No.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

REPUBLIC OF NICARAGUA
MINISTRY OF AGRICULTURE, LIVESTOCK AND FORESTRY (MAG-FOR)

THE STUDY
ON
AGRICULTURAL DEVELOPMENT
FOR
THE REGION II AND IV IN THE PACIFIC COAST
IN
THE REPUBLIC OF NICARAGUA

FINAL REPORT
(FEASIBILITY STUDY)

JUNE, 2000

PACIFIC CONSULTANTS INTERNATIONAL
ASIA AIR SURVEY CO., LTD.

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Currency (May, 2000)		
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C$1	=	0.08US$
US$1	=	107.6Yen

PREFACE

In response to the request from the Government of the Republic of Nicaragua, the Government of Japan decided to conduct the Study on Agricultural Development for the Region II and IV in the Pacific Coast in the Republic of Nicaragua and entrusted the Study to Japan International Cooperation Agency (JICA).

JICA sent to the Republic of Nicaragua the Study Team headed by Mr. Takashi Fujita, Pacific Consultants International, six times between August 1997 and May 2000. In the course of the implementation of the Study, JICA submitted in October 1998 the Master Plan Report relevant to the Study, in response to the request of the Government of the Republic of Nicaragua.

The Study Team held discussions with the officials concerned of the Government of the Republic of Nicaragua and conducted field survey in the Study Area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Nicaragua for their close cooperation extended to the Study.

June, 2000

Kimio Fujita
President
Japan International Cooperation Agency

Mr. Kimio Fujita
President
Japan International Cooperation Agency

Dear Sirs,

Letter of Transmittal

We are pleased to submit the Final Report of the Feasibility Study succeeded to the Master Plan for "THE STUDY ON AGRICULTURAL DEVELOPMENT FOR THE REGION II AND IV IN PACIFIC COAST IN THE REPUBLIC OF NICARAGUA".

The report contains the formulation of the feasibility study for the agricultural development mainly from the view point of supporting small farmers in the Study Area, which has been made taking into account of the advices and recommendation of the officials of public organizations of the Government of Japan including your agency as well as reflecting the comments of the Nicaraguan counterpart agency presented during the course of the discussions on the Draft Final Report of the Feasibility Study.

The Regions II and IV are the main agricultural and livestock areas of the country, well known as cultivation areas of exporting products, such as coffee, sesame, sugarcane besides livestock production. Despite this fact, these are the zones where both poor and wealthy sectors of the population are living within the same geographical space; the majority of low-resources farmers are living an impoverished life. The reasons for poverty in the Regions can be thought to be the result of a combined bad influences of factors such as low level of agricultural technology, lack of effective access to finance, lack of production infrastructure, farmers' tradition to rely mainly on other means rather than themselves, etc. However, it is also a fact that these areas have favorable potentials such as the fact of being traditional agricultural zones, having good climatic conditions and soils suitable for agriculture, high labor potential and accessibility to the capital city. The main aim of the Study is to lift the development constrains by utilizing these development potentials.

In this report, we have formulated the Agricultural Development Model Plan as a project to support small farmers that the Government of Nicaragua ought to foster during the subsequent years, on the basis of the results obtained in the Pilot Study which

was implemented in parallel with the Feasibility Study. Furthermore, we have also prepared separately an extension set that will help as a tool during technical assistance and extension to the small producers when the projects are to be implemented. We wish that these projects should come into use effectively for the formulation of the agricultural development plan from now onward in the Republic of Nicaragua.

We wish to take this opportunity to express our sincere gratitude to the officials of your agency and Ministry of Foreign Affairs and Ministry of Agriculture, Forestry and Fisheries of the Government of Japan for their valuable advises and recommendations for our Feasibility Study. We are also grateful to the officials of the Ministry of Agriculture, Livestock and Forestry and other public organizations of the Government of Nicaragua involved in the Feasibility Study.

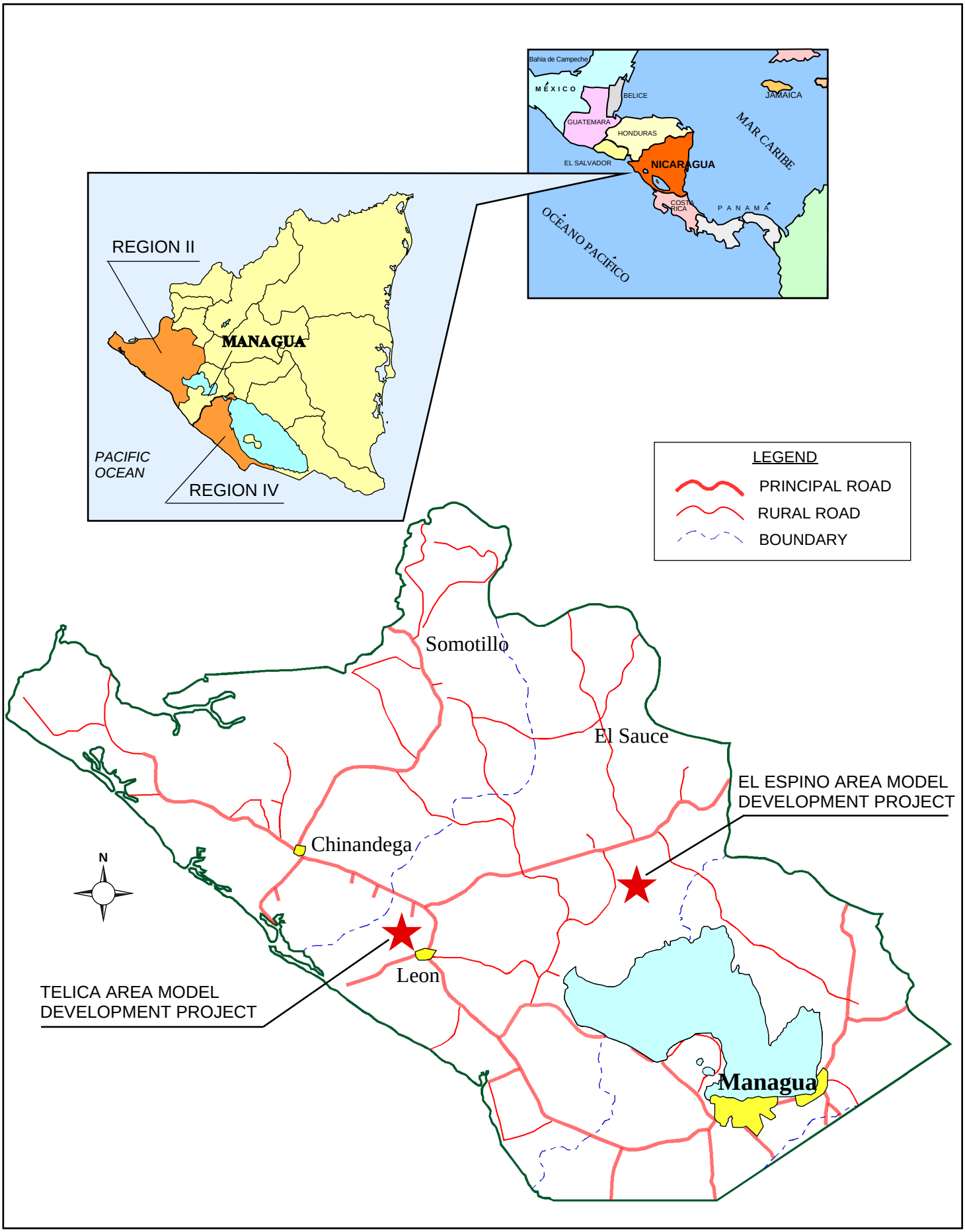
Cordially yours

June 2000

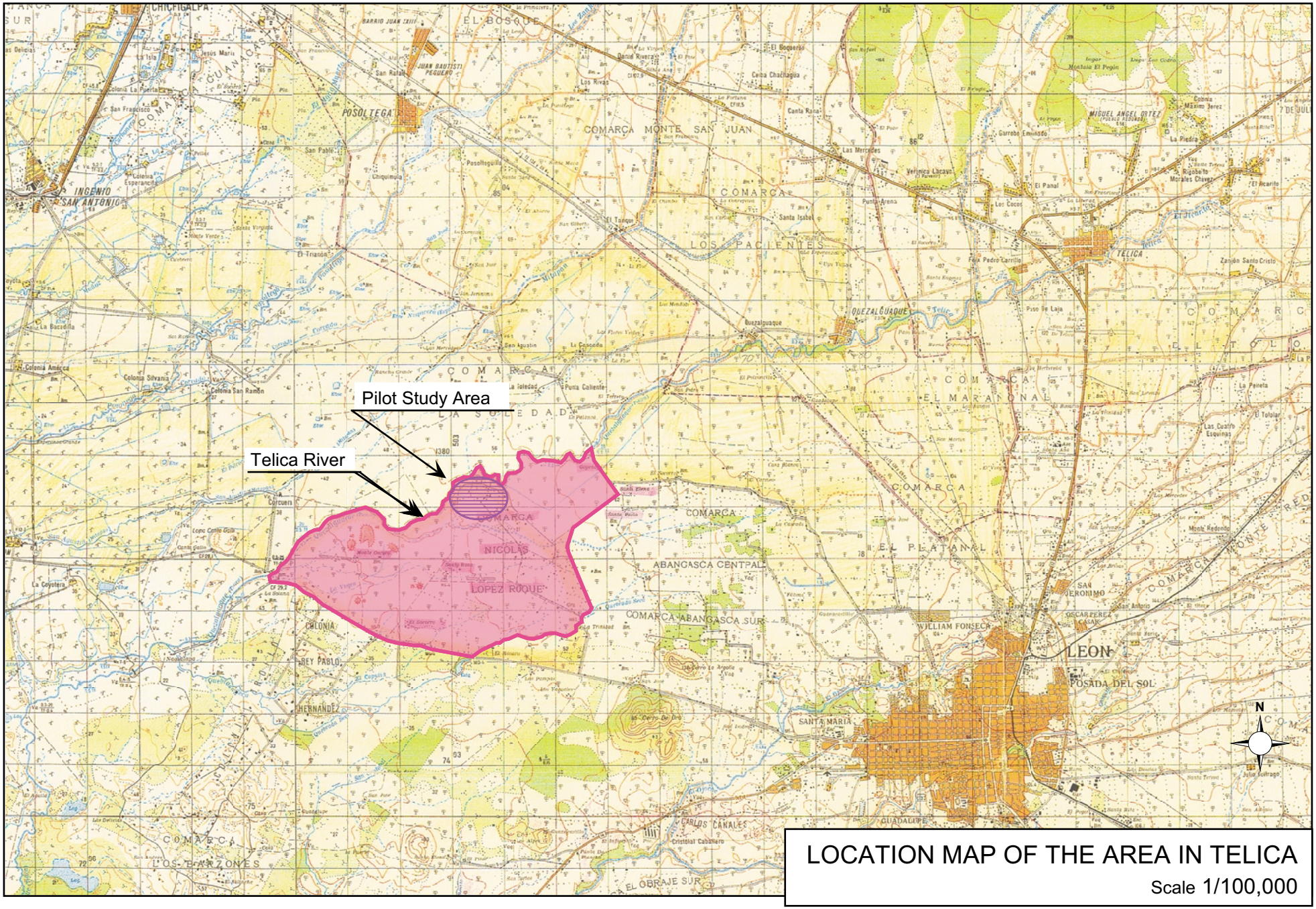
藤田 孝

Takashi Fujita, Team leader
THE STUDY ON AGRICULTURAL DEVELOIPMENT FOR THE REGION II AND IV IN THE PACIFIC COAST IN THE REPUBLIC OF NICARAGUA

MAPS AND PHOTOS

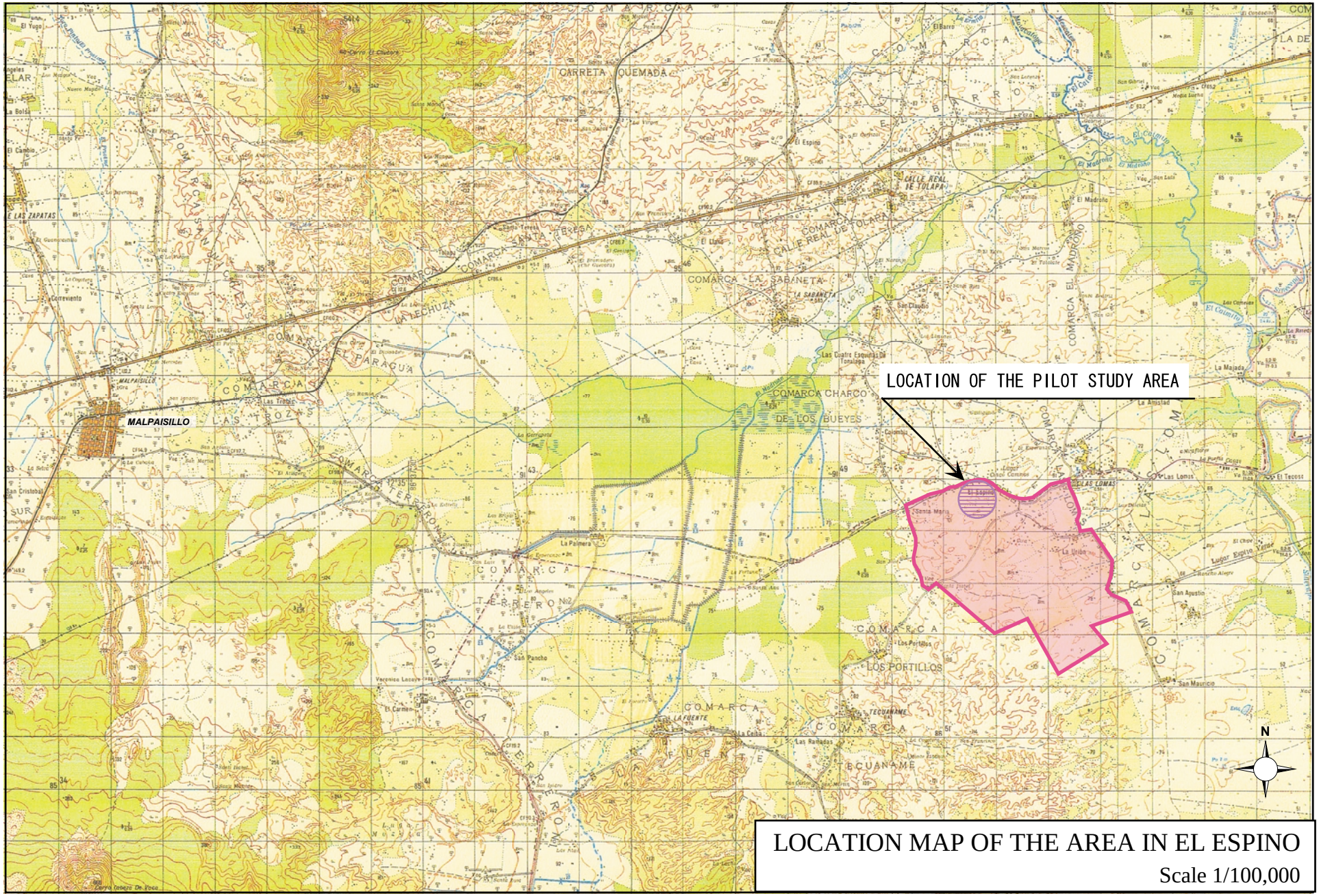


LOCATION MAP OF THE STUDY AREA



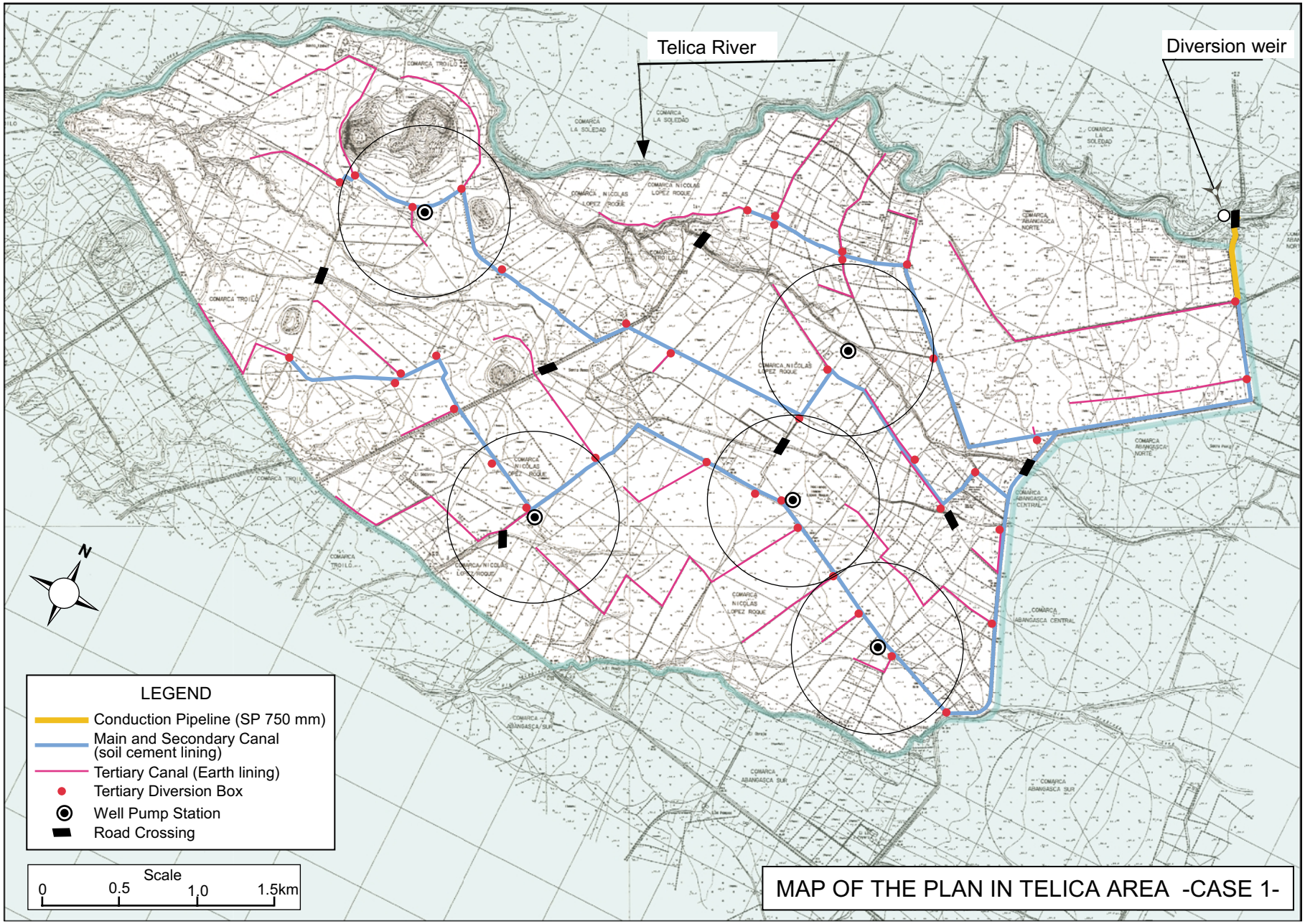
LOCATION MAP OF THE AREA IN TELICA

Scale 1/100,000



LOCATION MAP OF THE AREA IN EL ESPINO

Scale 1/100,000


Telica River
Diversion weir
N
LEGEND
Conduction Pipeline (SP 750 mm)
Main and Secondary Canal (soil cement lining)
Tertiary Canal (Earth lining)
Tertiary Diversion Box
Well Pump Station
Road Crossing
Scale
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0.5
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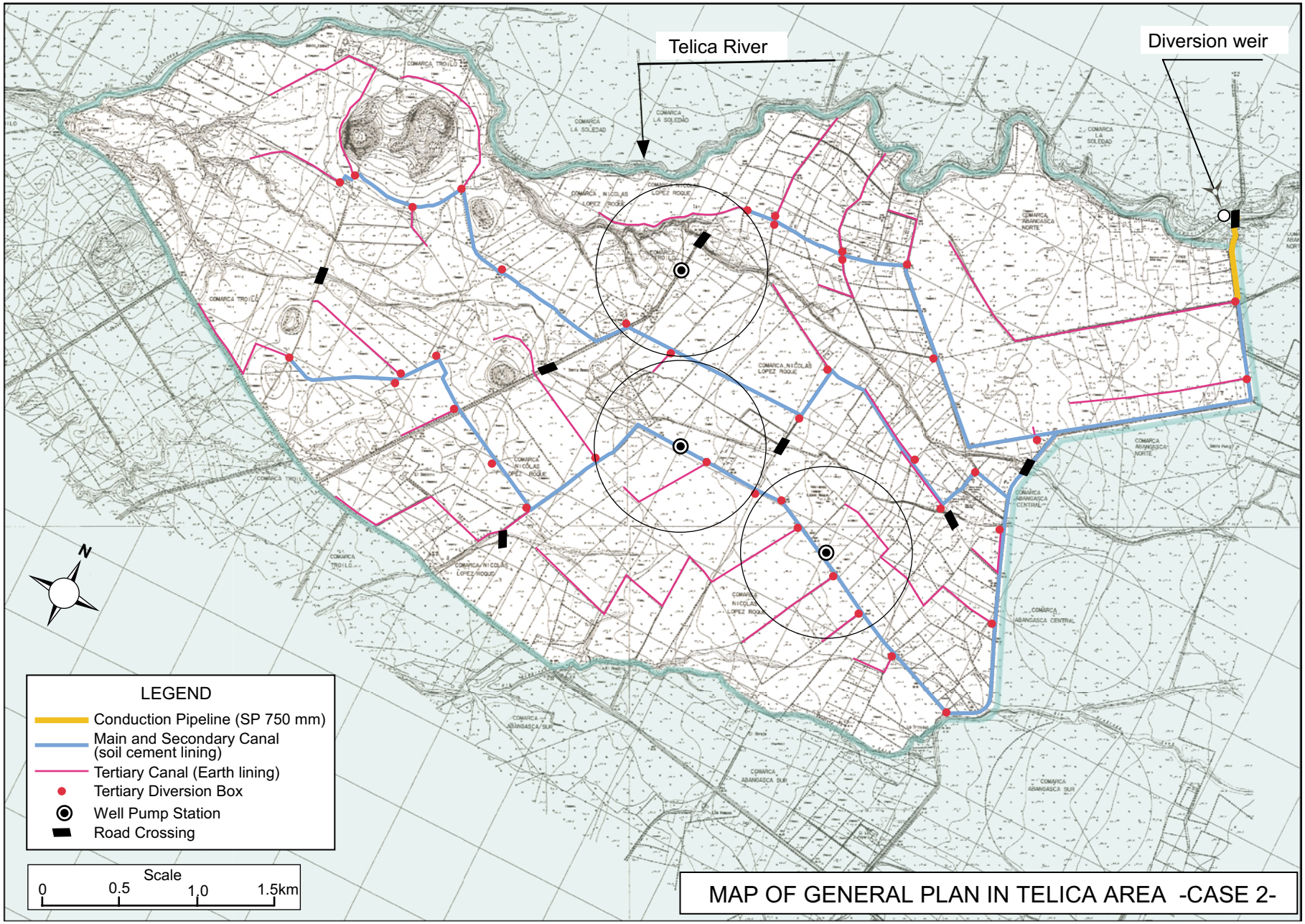
1.5km
MAP OF THE PLAN IN TELICA AREA -CASE 1-


Telica River
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Well Pump Station
Road Crossing
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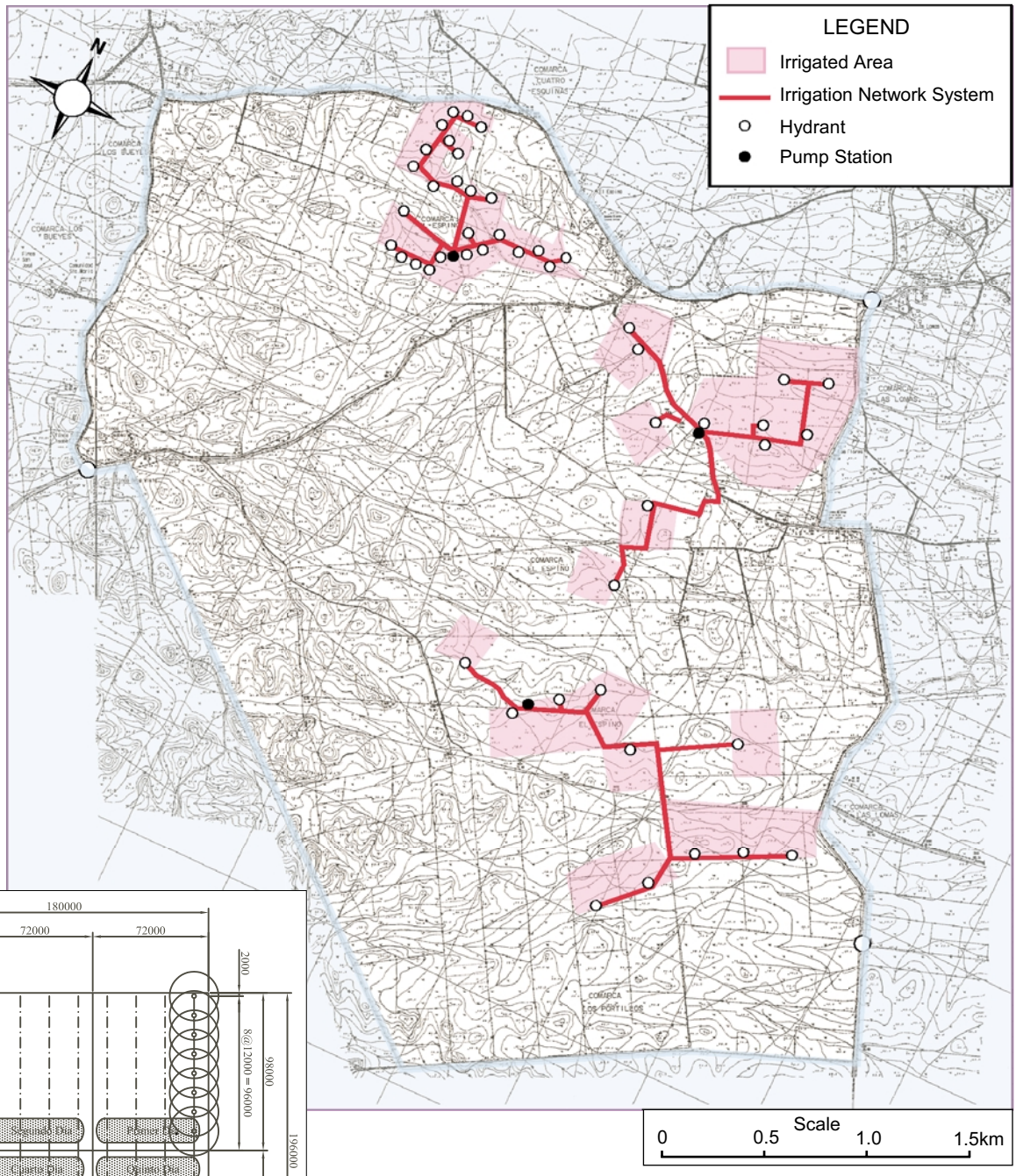
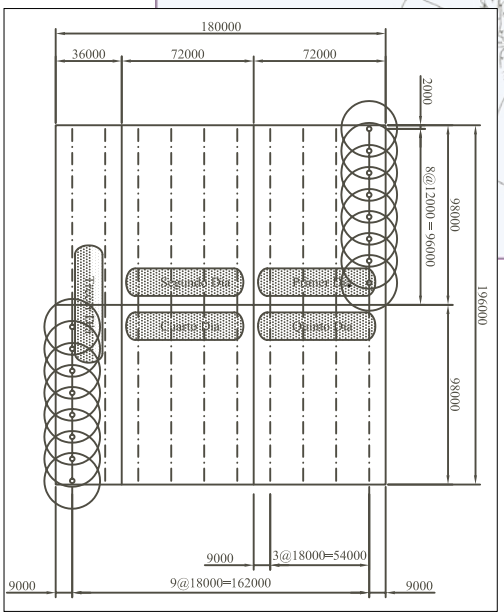
MAP OF GENERAL PLAN IN TELICA AREA -CASE 2-





MAP OF GENERAL PLAN OF THE PROJECT IN EL ESPINO AREA

Telica Area:
Workshop for Rapid Rural Appraisal

El Espino Area:
Workshop for Project Cycle Management

Telica Area:
Training to farmers by INTA

Area de El Espino:
Training to farmers by MAG-FOR

Photo 1

Telica Area:
Total loss of maize due to attack of Hurricane Mitch just before harvest (the cottage is for pumping facilities)

El Espino Area:
Training to farmers on measuring of land inclination grade

Telica Area:
Plawing by animal power in the field for maize

El Espino Area:
Plowing by Disk Plow

Photo 2

Telica Area:
Production of Cabbage before the loss due to attack by Plupella

El Espino Area:
Harvest of maize

Telica Area:
Packing of harvested sweet pepper

El Espino Area:
Harvest of watermelon

Photo 3

SUMMARY

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I. INTRODUCTION

1.1 Background

The agricultural sector of the Republic of Nicaragua represents 25% of the Gross National Product (GNP), 65% of exports and more than 40% of the employment in the country. Therefore, the Government of Nicaragua emphasis within the National Development Program the increase of the agricultural production and the reduction of poverty levels, giving high importance to the reactivation of the agricultural productivity but the results expected by the government have not been reached so far.

Regions II and IV are traditionally agricultural centers of Nicaragua being large producers of coffee, sugar cane, and meat, which are the main export products. In spite of this, many poor farmers live in those regions who do not possess enough economic resources; then poverty and richness live together in this zone.

Under these circumstances, in December of 1995, the Government of Nicaragua requested the Government of Japan help to extend its assistance in the elaboration of an agricultural development project destined to Regions II and IV where the potential for agricultural development is very high within the regions located in the Pacific Coast.

1.2 Contents of the Report

The present Report gathers the results of "the Pilot Study and Revision of the Feasibility Study based on the results of the Pilot Study", which followed the Master Plan Study (M/P, from August, 1997 to March, 1998), which had as objective the selection of the priority projects and the Feasibility Study of the priority projects and selection of the project areas of the Pilot Study (from March, 1998 to October, 1998). Feasibility study is for the Model Agriculture Development Areas of Telica and El Espino.

II PILOT STUDY

2.1 Objectives of the Pilot Study

The Pilot Study (P/S) was carried out from October, 1998 to May, 2000 with the objective to increase the precision of the F/S through the specific organization of farmers in the objective areas of the F/S and to demonstrate feasibility of the plan elaborated within the framework of the Study. At the same time, it establishes the guidelines of the development plan in case similar projects are carried out in Nicaragua. This Study was executed in the two selected areas, with an extension of 20 to 30 hectares, respectively.

El Espino is characterized because the average size of the agricultural land in each property is 4 times larger than the properties of Telica, but regarding market accessibility, land classification, access to irrigation water, etc., El Espino is under less favorable conditions than Telica. In spite of the reduced area, the agricultural land in Telica is more fertile and has good water availability for irrigation, besides having a

more favorable accessibility to the markets. However, even though it has been the focus of support from different NGOs, it has not established its autonomy so far.

2.2 Participants in the Pilot Study

The participants for the P/S are divided into three (3) groups. The first is formed by farmers who established the farmers ' association in the objective areas and who carried out the agricultural production, the second is formed by the administrative institutions, i.e., MAG-FOR and INTA and the third one by the JICA Study Team. Direct participants from MAG-FOR and INTA were technicians of Region II (Leon) and an outline for the required support for both institutions in Managua, has been established.

2.3 Selection of the Participants

The number of parcels participating was defined as approximately fifteen (15) families per area, which was estimated as the suitable number to monitor the standard operation of the farmers' association in charge of the collective handling of the irrigation facilities, gathering activities and collective shipment, etc. The time limitation was also taken into consideration, as well as the limited number of technicians available from the Nicaraguan counterpart and the Japanese Study Team. The complete selection process is described as follows.

- El Espino:
There are 57 properties in El Espino. The participants were selected among those who were willing to participate in the P/S, first they were interviewed to know their way of thinking regarding agriculture, own land availability, family labor force, distance from the house to the site, etc. At the end, 14 families were selected. It should be noted that the three landowners in the P/S site were included from the beginning as participants. It was determined to divide their lands into 14 irrigation blocks and to sign a lease contract with the other participants. The land required for the access roads on the proposed sites to construct the wells was entrusted to MAG-FOR.

- Telica:
Since there were already wells in this district and rural associations are using them, it was decided to select them as participants of the P/S. This was also done to see the difference with El Espino where a new farmers' association had been formed. Farmers group users of the well not subject to intervention from other support organizations where selected from the four existing wells, whose irrigation system and organization are under operation.

2.4 Guidelines for the Pilot Study

The objective of the P/S is to increase the income of the farmers, then by this, it will increase the autonomous development of the small-scale farmers. During the approximate 18 months duration of the P/S, it was aimed to change the environment surrounding the small-scale farmers: from a situation where they did not have anything, up to having a certain perspective toward the future. This is how the contents of the three steps of the study were defined:

Stages	Periods (crops)	Description
First Stage: Beginning of P/S	Launching stage for P/S: from the beginning of P/S to the first cultivation of corn and vegetables.	Prepare the menu of P/S for MAG-FOR, INTA, farmers and Study Team; establish rural organizations, agricultural credit system, clarify divisions of responsibilities, etc.
Second Stage: Initiative of Counterparts	Cultivation of upland rice	Execution of P/S through the meticulous advice to the farmers by MAG-FOR, INTA and Study Team Members.
Third Stage Initiative of farmers organizations	Second cultivation of corn and vegetables	Execution of P/S by the farmers' initiative while MAG-FOR, INTA and Study Team are in charge of the required consulting and advice.

The P/S consisted mainly on the priority topics defined in the Agricultural Development Model: "Improvement of agricultural technology", "Improvement of the productive infrastructure", "Support for commercialization", "Access to agricultural credit", and the "Rural Associations", which are the promoting entities of the previous programs. In addition to the above items, the organizational capability of the officials of MAG-FOR and INTA will be monitored, as well as the inter-institutional coordination, since they are the executing entity of the P/S for the project of improvement of the small and medium-scale farmers in Nicaragua.

2.5 Investments for the Pilot Study

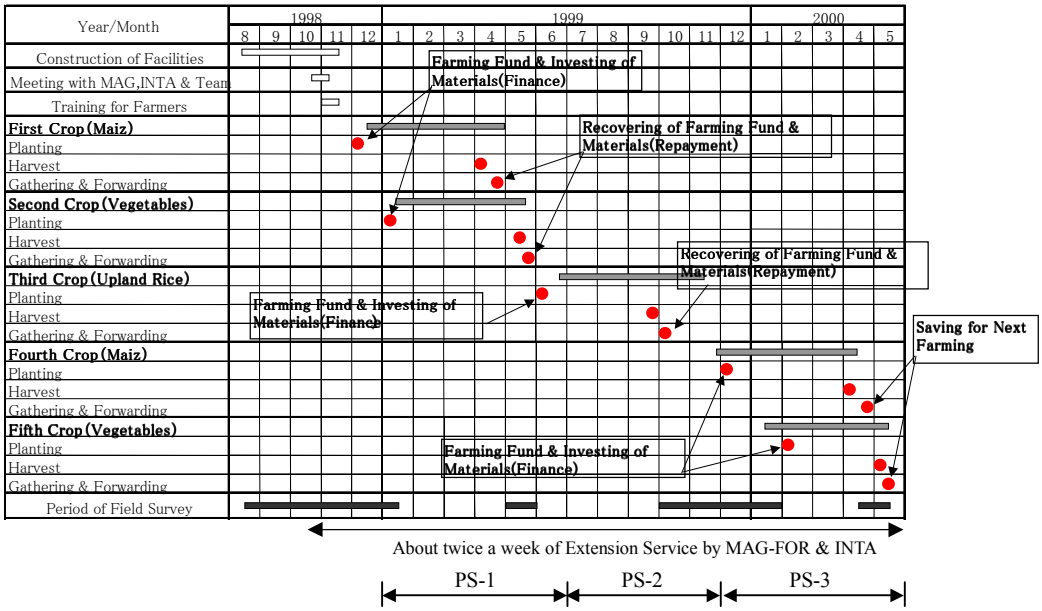
Responsability	Personal	Equipment	Facilities
Japan	Total : 23M/M (4persons)	Credit fund : C$475,000 Transportation	Irrigation facilities
Nicaragua	MAG-FOR : 3 persons INTA : 3 persons	Transportation	

2.6 Contents of the Pilot Study

The plans related to the P/S were elaborated according to the basic guidelines of the Agricultural Development Model. These plans, which constitute the pillars of the Agricultural Development Model, are as follows: 1) Plan for Systematizing Rural Organization, 2) Formulation Plan for the Cultivation Pattern 3) Irrigation Plan, and 4) Processing and Commercialization Plan.

2.7 Monitoring Plan

Monitoring the achievements and problems of the P/S plans will take place, based on the schedule of the cropping pattern of property administration which is showed as follows:



2.8 Items for the Evaluation of the Pilot Study

Just as it is indicated in the PDM, the P/S was designed as follows: the proposed activities are carried out using the investments (personnel and materials, including the resources), that facilitate proposed results and thus achieving the objective.Therefore, the evaluation should also be designed around the "objective", "investments", "activities" and "results" as outlined below.

1. Achieving the objective :	a) Achieving the objective of the Project. b) Obtaining results. c) Cause-effect relationshipof the results and objective of the Project
2. Efficiency :	Efficiency of the investments
3. Impact :	a) Expected or forecasted impact. b) Unexpected / unforeseen impact.
4. Relevance :	a) Relevance of the objective and results. b) Coherence with the need of the beneficiaries. d) Relevance of the plan of activities.
5. Economic Development :	a) Financial point of view. b) Technical point of view. c) Management point of view

2.9 Objective of the Evaluation

The Draft Final Report (1) submitted in October, 1998 will be reviewed according to the results of the P/S in order to prove the effectiveness of the Project, and the Draft Final Report (2) will be prepared.

2.10 Achieving Goals

1) Achieving the Project Goals

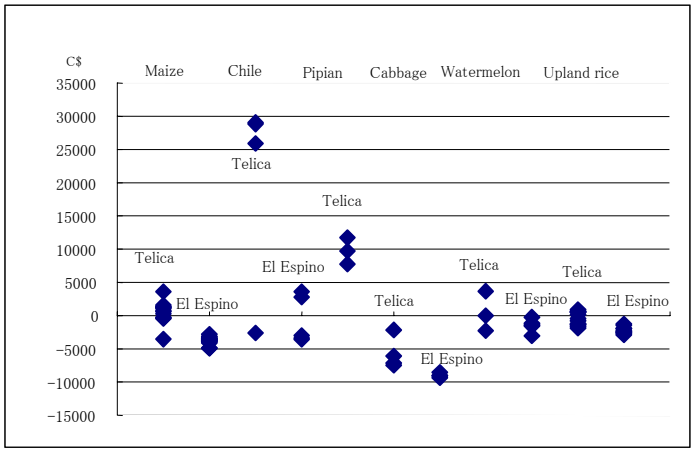
a. Achievement

The objective of the Project is "to increase the agricultural income" and the objective of the evaluation indicators is "to obtain the proposed agricultural income".

The total profit before the P/S had been -C$2,538, far from reaching the proposed amount of C$17,262, not being able to even cover the costs. If the data is observed according to the items, only the vegetables show profit, due to the high profit obtained by the bell pepper growers, while more than half of the growers had a negative profit. The actual cost of cultivation was approximately 23% lower than the proposed cost and therefore, in this aspect the objective was reached. On the other hand, the gross profit was hardly close to 42% of the proposed gain.

(Unit: C$)

Item	Area	Cost		Gross Income		Profit	
	Mz	Plan	Executed	Plan	Executed	Plan	Executed
Corn	1.4	7,887	7,316	10,080	4,271	2,193	-3,045
Vegetables	0.6	6,034	3,184	10,637	5,000	4,603	1,816
Upland rice	2.0	13,534	10,703	24,000	9,394	10,466	-1,309
Total	4.0	27,455	21,203	44,717	18,665	17,262	-2,538



As for the outcome according to the area, El Espino stands out for its low profitability, where none of the items has produced any profit and at the property level, only two growers earned profits by growing bell peppers. Telica, on the other side, has generated a profit in all the items, except for upland rice. Bell pepper in particular, has been extremely profitable, in as much as three out of the four properties earned a profit of about C$20,000. Although upland rice has not been profitable, more than half of the properties registered a surplus, which leads to think that if there had not been a drop in the prices, most of the properties would have enjoyed a profit.

b. Evaluation

The causes for the lack of profit were that it was up against a proposed gross income of C$44,717, the actual income has only been C$18,665 which hardly corresponds to 42% of the proposed income. This situation is mainly owed to the low achievement of the two proposed results for the Project ("making the rural organizations operational" and "to carry out intensive cultivation", referred to further on) which was translated as a low yield, to which the damages due to natural disasters should be added, as well as the confusion in the rice and vegetable market. With exception of the low yield of each crop, the other causes can be interpreted as external conditions of P/S.

Regarding the operation of the rural organizations, it cannot be said that the organizations formed in Telica and in El Espino have started to work. It is true that in the aspects of collective purchasing and in the use of agricultural credit, the organizations have accomplished their task. But if we consider that there are two indispensable factors for the activities of the organizations, the "right" and the "obligation", both the collective purchasing and the use of the credit correspond to the

right, and if the organizations were not able to "fulfill their obligations" including the operation and maintenance of the irrigation facilities by the farmers, then in general terms, the organizations did not carry out their functions fully.

If an evaluation is performed according to the areas, the profits at El Espino have been substantially inferior to those of Telica. Both areas have been subject to similar cultivation plans, support systems, quantitative and qualitative investments, and activities, and one cannot say that there were large differences in investments and activities of P/S, only very insignificant. This means that the main causes have been the lack of experiences and initiative of the participating farmers, the low fertility and the steep slope of the cultivating fields, the bad accessibility to the markets, amongst others, which as a whole prevented from generating high earnings in El Espino.

As for Telica, it is envisaged that the agricultural income will be increased once the external conditions have been improved (market recovery, etc.), and through the revision of the activities and investments plans of the P/S. In the case of El Espino, it is difficult to increase the agricultural income in the present framework of P/S without correcting the problems mentioned above.

2) Achieving results

Regarding corn, it has been possible to obtain a yield that is more than twice of the current yield. In the case of the upland rice in Telica, the growth has been 93%, that is to say lower than the current one, but this was mainly owed to the lack of experience from the participating producers in P/S, in the cultivation of this crop.

Except for the upland rice in Telica, the proposed yield was not obtained in any of the items. The items with the largest difference among the proposed and the actual yield, were the corn in El Espino and the vegetables in both areas. The main causes were the unexpected confusion in the cabbage market and the propagation of diseases and plagues, a technical advice problem, and the farmers' lack of techniques to cultivate in both areas. If the situation is analyzed for each area, the low productivity of the lands in the case of El Espino.

3) Cause and effect relationship of the results and objective of the Project

The items, in which the production cost was higher than the selling price, were cabbage from Telica, and most of the items from El Espino. All this leads us to think that the goal for the Project in this P/S has not been reached. The main causes were the reduced production against the proposed yield, and other external factors such as the abrupt drop in the prices of the agricultural products, the generation of natural disasters, etc. that had direct impact on the agricultural income. Multiple internal problems of the growers' organizations were also perceived that did not contribute to the achievement of the objective.

On the other hand, there are also some positive factors such as reduction in the acquisition cost of materials through collective purchasing, and comparatively larger production compared to the one they had before and even though this does not reflect an income increment, it offers conditions to continue increasing the agricultural rent once the favorable external conditions are given.

2.11 Yield

a. Suitability of the investment of human resources

- Amount of human resources and season -

In the same way, the technicians from MAG-FOR were responsible of the rural organizations, providing advice through the opportune visits to the sites with a frequency of up to four times a week in the peak season. The extension services of INTA in other areas usually consist on one visit a week, and in the NGO projects of these areas the visits are made with the same frequency. Therefore, two visits a week in the case of the current P/S was considered appropriate if the examples of other projects are taken into account. Also the personnel assignment is considered adequate since it designates a permanent and exclusive person for two areas under one person responsible for the P/S from each institution.

- Quality of the human resources -

The intention of this P/S was to implement a new agricultural system, different from the ones being practiced up to now by the small-scale farmers in Nicaragua. This posed the need for the C/P both from INTA and MAG-FOR, to develop the skills of extension workers incorporating new elements. Although it is true that the extension methodology worked during the stay of the Study Team, many problems occurred during their absence.

b. Suitability of the investment of materials and resources

- Resources to administrate the properties -

At the beginning of the P/S a fund for agricultural resources with approximately C$400,000 had been created. However, because of the low refund rate, an additional C$70,000 had to be added to the fund before starting the third plantation of corn and vegetables. Besides the low yield of these items, the main cause for the deficit was that the fast increase of imports has overturned the rice market, temporarily disabling the farmers to sell their products.

- Irrigation Facilities -

New irrigation facilities were built in El Espino, and the existing ones in Telica were repaired. There is still water leakage from a section of pipes at the irrigation facilities in Telica affected by the floods and obsolete, but it continues to irrigate the area according to the plan.

-Means of transportation-

The C/P personnel use the motorcycles to access both areas. The gasoline shortage up to P/S-2 had prevented to offer the extension service in a constant rhythm, but this situation has been later solved. On the other hand, the trip of 60 km from Leon to El Espino by motorcycle takes around 2.5 hours one way, also constituting a restrictive factor for the extension activities.

c. Administration and management

- Resources to administrate the properties -

A NGO has been put in charge of the administration of the agricultural resources,

informing the balance to the Study Team. Up to now there has not been any problem with this system.

-Irrigation Facilities-

The mishaps on the irrigation facilities in Telica are very frequent. However, the main cause is the obsolescence of the structures, and not the wrong handling of the farmers. In El Espino, the operation and maintenance are not as good as in Telica, and although up to now there has not been a fatal structural damage, a breakage in the electric system (batteries, etc.) was detected. In this area the fuel was stolen and a double lock had to be put in the warehouse where the fuel is stored. Also, some producers borrowed fuel from others without previous consultation.

2.12 Impact

1) Expected impact

Since the objective of the Project was not accomplished, the impact on the overall objective was insignificant and could not be perceived.

2) Unexpected impact

There were some farmers who violated the regulations of the organization intolerably. They were expelled by the decision of the assembly of producers. And a delicate change is perceived in the human relationship of the area.

2.13 Relevance

1) Relevance of the objectives and results

The objective of the Project "to increase the agricultural income" has been defined in such a way that it is inline with the focus of the National Plan of Development (1996-2000), the support of the Government policies in Nicaragua which is to combat the poverty through the reactivation of agricultural production.

At this moment, the Central Government is continuing its investment and efforts to reach the political objective of fighting poverty, but due to the limitation of the fiscal resources it can only implement some projects. Within this context, the present Project (plan) is conceived as an integrated plan to fight against poverty and its importance is fully recognized inside the Government of Nicaragua.

2) Coherence with the necessities of the beneficiaries

The farmers who are beneficiaries always want to increase their income, but they do not know what to do because of lack of information. The small-scale farmers due to the lack of technical and economic capacity cannot escape from poverty. For this reason, the present Project has as an objective to increase the income of the small-scale farmers offering a complete menu of activities and is considered coherent with the necessities of the beneficiaries.

3) Suitability of the plans

The two big components of the P/S are the farmers' organization and the improvement

of the cultivation techniques. To increase the agricultural income of the small-scale farmers, it is necessary to organize them in order to improve their agricultural technical capacity so that they can begin the intensive cultivation. The efforts at group level and not as individuals, simultaneously, would multiply the effects. Next, the suitability of the rural organization is evaluated and the materialization of the intensive cultivation.

- Farmers' organization -

The P/S has established the support framework from the creation up to the administration of rural organizations, which as a plan has high suitability. Nonetheless, the intent of achieving the gathering and collective shipment was an activity that the members should have begun once the organization was able to make an influence in the market, distribute the earnings, and strengthen the small-scale farmers, and the intent is considered to have been premature at this time.

- Materialization of the intensive cultivation-

The P/S has intended to give technical support to the beneficiaries in the cultivation practices, at the same time it is implementing the irrigation facilities, which as a plan is considered ideal. However, the necessity to improve some aspects of extension of the cultivation techniques is recognized, since a breach between the density or the real technical level and the demand for the plan of activities of the P/S has frequently detected.

2.14 Autonomous Development

1) Financial point of view

During the execution of the P/S there were two important external factors that caused a great reduction of the agricultural income. The income reduction of the small-scale farmers with a small economic capacity influences directly on the reduction of the agricultural credit fund. Indeed, the fund resources from the P/S were also scarce at times. Another factor preventing the achievement of the proposed increase is the lack of the technical capacity for farmers as well as for the organizations of C/P. If the P/S intends to keep maintaining the same framework and the current technical capacity, it would be necessary to continue injecting resources to the agricultural credit fund, and financially, it should be recognized that this present framework would barely guarantee the autonomous development of the farmers.

2) Technical point of view

The agricultural capacity of the beneficiaries has been strengthened through the P/S, likewise the support service from the C/P to the farmers. However, it cannot be said that the technical level is enough to achieve an autonomous development, and it should continue offering further technical support.

3) Organizational point of view

Each Nicaraguan part has his inherent problems, since the rural organizations have not yet achieved their autonomy and they require support for the following years. As for MAG-FOR and INTA, it cannot be said that there is a good coordination among the technical personnel between the Leon office and its respective headquarters in Managua. Indeed, during the P/S, many times the Study Team had to be in charge of coordinating the activities with the respective headquarters, and one of the tasks for the future is to

improve the flow of information from the Leon office to the Managua offices.

2.15 Summary of the Evaluation Results

1) Rural Organization

The small-scale farmers of the Project Area have three large limitations: the financial capacity, technical level and the size of the agricultural lands. It is impossible for them to overcome these obstacles and achieve development, if they try to approach the task individually. On the other hand, the support institutions to the farmers such as MAG-FOR and INTA also have limitations in terms of human resources, budget, technical level, etc. In these circumstances, in order for the support organizations to offer an effective extension service, and for the small-scale farmers to accept the services they need, it becomes indispensable to create and strengthen the rural organizations as receiving entities of the services. However, just as it was evidenced in the P/S, among the small-scale farmers there are factors that block the formation and the normal development of the organization functions.

The small-scale farmers are ambitious to achieve an autonomous development: The beneficiaries were those who were previously working at plantations and factories. Since in this scheme the employees were forced to obey their employer's orders, this population got used to receiving orders and not acting on own initiative.

The small-scale farmers do not want to pay their debts: The beneficiaries of the Sandinista Agrarian Reformation, were the former workers of the plantations and factories, with little knowledge of agriculture. The resources, materials and agricultural equipment that were lent to them up to now in large quantities has hardly been returned in their entirety.

Dominance of individualism to protect their own interests: Usually, a member of society learns the rules of a collective life. However, many Nicaraguan small-scale farmers are atomized, having the feeling of not belonging to any rural community.

The plan for agricultural development in an area that presents this type of limiting factors, requires to take into account the following aspects in relation with the formation and functional invigoration of the rural organizations:

a) The farmers should decide the plan even if this process could be slow. If the technicians of the support organizations take the initiative, when the results are not good, the beneficiaries tend to attribute the responsibility to whoever took the initiative.

b) In order for the members to learn the social rules, it is necessary to define the activities to be developed when creating an organization, and at the same time, define the regulations that the members should obey and comply. This whole process should be assumed by the initiative of the participating farmers.

c) With the purpose of motivating the debtors to return the debt, it is necessary to take their properties as mortgage, etc. Although this is merely nominal, it can confirm the will of the participating producers of “stepping out of poverty, even having to risk the mortgage”.

d) For the selection of the project areas, priority should be given to the socially mature

communities. It would be especially convenient to have capable leaders who are able to control or who are really controlling the inhabitants of the community.

2) Cultivation

The process of the plan elaboration for the present P/S consisted of the following: under the initiative of the JICA Study Team and in consultation with the C/P personnel of MAG-FOR and INTA, the detailed plan of the P/S was elaborated for both areas based on the plan of F/S. In this process of deciding the details of the plan, the will of the participating producers of the P/S has not been fully reflected, but rather the Study Team and the supporting organizations who will not be the ones cultivating the lands elaborated and presented the plan, which was subjected to small adjustments to define the framework of the tasks for the participating farmers. Through the execution of the P/S, which was started within this framework, the following facts related with the cultivation and extension were manifested.

Selection of new crops and the capacity of the farmers: The new items to be introduced were selected through an integrated analysis of the results from the technical study of individual properties carried out during the F/S, as well as the information obtained by exemplary farmers, supporting organizations, NGOs, distributors of agricultural inputs and other related informants. However, all the farmers were familiarized with the cultivation technique of corn (basic grain), as opposed to upland rice, where there was no previous experience in its production and the one on vegetables was limited (only cultivated in kitchen gardens). Consequently, the technical level of the farmers was not enough to begin the production by their own initiative, and except for the corn, they have had to be totally dependent on the technical assistance of the extension workers.

Technical level and the service method of the support organizations: From the new crops introduced through the P/S, cabbage was the only item that the office of INTA-A1 did not have experimental data of cultivation in the savanna area of the Pacific Coast. On the rest of the crops, the institution already had technical experiences such as organization, through field demonstrations or on experimental vegetable gardens. However, during the development of the P/S a series of diverse problems regarding technical assistance took place. Behind these problems there is a series of causes that are related to one another, such as the lack of experience of extension specialists, who were in charge, the deficiency of the complete technical assistance system from the extension workers of INTA A-1 up to the upper management, the standardized extension system through the method of T&V to contact the farmers, the lack of coordination among the supporting organizations (MAG-FOR and INTA), and the passive behavior of the farmers.

These two points suggest important problems in the elaboration process of the future plans for agricultural development, having to carry out a careful analysis in the elaboration phase so that the project guarantees the autonomous development of the farmers.

a) The main characters of the implementation of an agricultural plan (introduction of new crops and new techniques, determination of the planting surface, etc.) are the own beneficiaries. A plan elaborated by a third party for the entire service area, without fully taking into account the background and actual conditions around the administration of each benefited property and applying standardized approaches can cause negative reactions from the farmers. Therefore, it is necessary to study in the

initial phase a methodology of regional agricultural planning which includes the individual cropping plans for each benefit elaborated around the traditional crops, and which simultaneously can awaken the initiative of the farmers.

b) The support services for the beneficiaries should be planned systematically taking into account the natural and social conditions of the service area, the agricultural experiences of the beneficiaries, and the conditional characteristics of their properties. Concretely, it is necessary to study the system of a flexible agricultural credit that can respond to the needs of each benefited property, the creation of demonstrative fields that will serve as incentive for the farmers, a practice system in the properties so that the farmers can be empowered through developing the exchange of information among the farmers, and the study of a systematic training plan for the farmers.

2.16 Improvement through the Pilot Study

There were multiple activities that could not be carried out in the initial stage of the Project, and which the respective members were gradually assuming appropriately by experience.

Characters	Activities	Previous problems	Improvement
Farmers	Collective purchase (agrochemicals and fertilizers)	The purchase was made coordinating with the agricultural credit. The farmers knew the warehouses but they could not make the purchase by themselves since they did not know how to present an estimate nor the payment conditions.	Through experience, the farmers were acquiring knowledge on the mechanisms for the agricultural credit, and now they can make their own purchases.
	Collective purchase (gasoline and services)	Previously, the farmers could not contract the sale and purchase of gasoline because the transaction was through a credit, hence the first purchase required the support of a third party.	The farmers are already qualified to make purchases on their own without the need of the support from C/P, except for when a serious problem arises.
	Crop	For lack of experiences, the behavior of the farmers was very passive, depending too much of the extension workers.	The producers are relatively more active after P/S-1. The difference of the aggressiveness of the participants was reflected in the intensity of the cultivation control and, therefore, in the yield.
C/P	Purchase of goods and services	Initially, a purchase process was adopted designed by the Study Team and C/P that linked the purchase with the credit. However, the support to the farmers regarding this topic has not been sufficient because of time limitations, etc.	Presently, a high-priority support is provided.
	Technical assistance in the crops	A great communication breach existed between the supporting organizations and the beneficiaries regarding the service of technical assistance in cultivation.	In the P/S-2, when compared to P/S-1, there was less dissatisfaction from the farmers regarding technical support, and the communication among both parties was also improved.
	Selling the crop	The participating producers insisted on marketing their products individually, and very seldom the necessary quantity of crop for the commercialization in big lots would be met.	The C/P can look for and propose the favorable commercialization routes for the farmers. However, the proposal not always guarantees the expected results.
	Payment of the debts	At the beginning the C/P personnel did not have a deep knowledge on the cost-benefit relation, agricultural credit procedures, etc. which hindered them to carry out the necessary analyses.	Now they are qualified to calculate and analyze the amount of the debt that the farmers can return from the earnings obtained in the sale of products.

2.17 Items for feedback in the Feasibility Study

The problems that were detected through the execution of the P/S and the items for feedback in F/S are as follows:

(1) Rural organization

- They were accustomed to receive orders but not to act on their own initiative, therefore it is necessary to make them understand in the initial stage of formation, the incentives and the objectives of the rural organization, as well as the activities to be developed.
- When forming an organization, it is necessary to define the activities to be developed, and at the same time, define the regulations that the members should obey and comply.
- When the project is started, it is difficult to have the farmers act on their own initiative, requiring the support of C/P and Study Team in the procedures, for example, of purchasing materials and equipment.

(2) Cultivation techniques for the producers

- It is not pertinent to introduce new crops for those farmers without any agricultural experience, because it is very risky, except when the supporting organizations have demonstrative cultivation data and only if they have considered feasible to offer enough technical assistance. It is necessary to make a new revision of the crops to be introduced.

(3) Extension on the cultivation techniques

- Technical extension demands a series of requirements, from the frequent contact with the farmers, to the technical capacity of the extension specialists. Therefore, from now on, it is necessary to establish a new framework regarding extension on cultivation techniques incorporating other support methods, besides INTA's services, for example, through NGOs, training of leaders, etc. and to promote mutual technical cooperation amongst farmers.
- It is not pertinent to introduce new crops when the support organisms lack demonstrative data since it is very risky, except for when the agricultural beneficiaries have enough techniques to introduce them.
- In the case of beginning the cultivation of new crops, it is necessary to study a method to extend the pertinent techniques through the creation of demonstration fields for the farmers so they can see the difference between the conventional and the improved method, and at the same time analyze the techniques accumulated by the supporting organizations, and if they are non-existent they should supplement somehow.
- At the initial stage of the Project, it is necessary to outline the importance and the meaning of keeping the control records of the cultivation, to carry out OJT to the beneficiaries so that they are qualified to fill out the formats appropriately.
- The organizations of C/P are qualified in calculating the volume of the equipment and materials to be invested on, according to the cultivation plan, but the support should be extended through the experts or through the preliminary training carried out when implementing a project.
- It is necessary to execute a systematic training plan oriented to the farmers according to their needs.

(4) Irrigation facilities

- When building the irrigation facilities, it is necessary to demand the farmers to assume the cost and to take consciousness that it belongs to them.
- It is important to carry out the training of the farmers in preventive and periodic maintenance in such a way that the users can assume its adequate operation and maintenance.

(5) Distribution of goods

- The gathering and collective shipment are activities that the own farmers should begin once they have been able to influence the market, distribute the earnings, and have strengthened the small-scale farmers, and it is important not to incorporate this component at the initial phase of the execution of the project.

(6) Agricultural loans

- The agricultural credit was structured in such a way that the beneficiaries cannot use the loan for objectives other than the requested. The future projects should also adopt the same procedure, financing objectives, and other basic elements adopted in this P/S.
- To obtain the agricultural credit it is necessary to subscribe the corresponding contract ahead of time. During this stage the beneficiaries require support because it is difficult for them to understand the exact details of the contract. Also concerning the refund of the debts, it is extremely important to have the support of C/P in the initial phase of the project. However, the C/P lacks deep knowledge of the mechanism of the system, which poses the need to extend the support through experts or to carry out the preliminary training at the moment of implementing the project.
- The procedures usually take a long time and the farmers cannot respond quickly to the urgent needs. On the other hand, the fund created in this P/S did not cover the needs of labor recruiting and the properties without which enough labor family could not fully take care of the cultivation works. For the future, it is necessary to create a flexible fund that can also respond to these needs.
- In the initial stage of the project, the agricultural income is usually lower than the proposed because neither the farmers nor the support organizations are familiarized with the new agricultural system. The fund for agricultural credit should be planned with enough flexibility so it can respond to these contingencies.
- In order to motivate the debtors to pay the loan, it is necessary to take their properties as mortgage, etc.

III TELICA AREA MODEL DEVELOPMENT PROJECT

Outline of F/S Study at Telica Area Model Development Project is described as follows:

3.1 Natural Conditions

Topography, and Geology	Almost in the center of the basin, a quaternary volcano intrudes and raises along the fault
Soil	Loamy sand to clayey soil.
Meteorology	The annual mean rainfall is 1,494mm, and the annual rainfall pattern is different between the rainy season and dry season. Also, one of the characteristics of the rainfall pattern in this area is the frequent occurrence of successive no-rain days during the rainy season, called “Canicula”

Hydrology	A spring is the Telica river's water source, with a steady flow without much fluctuation between rainy and dry season. Therefore available water discharge volume at the proposed intake point is 0.6m^3/sec.
Groundwater	The critical pumping volume was estimated as 52.281/sec (3.14m^3/min).

3.2 Socioeconomic Conditions

Number of Agricultural Families	Total population of farming families is 250 and total area of land holdings is 1642.5Mz (6.6Mz per family). Land holding size of less than 10 Mz represent 67% of the total area and 89% of the total amount of properties.
Economic Activities	Agricultural household income is comprised of sales of agricultural products (including products of family farming and small domestic animals), works away from home, and day labors, in which the portion earned by dairy products to the total household income is large.
Land Use	Upland: 1,136Mz(53.0%), Paddy: 40Mz(1.9%), Tempate: 478Mz(22.3%), Grassland: 194Mz(9.1%), Wasteland: 37Mz(1.7%), Forestarea: 139Mz(6.5%), Residence: 63Mz(2.9%), Road/Canal: 56Mz(2.6%), Total 2,142.9Mz(1,500ha) Tempate is a permanent tree crop, containing oil in its seed, and the strained leaves after extracting oil is used as a processing material for stock feed. Tempate cultivation has been started since 1993, but at present it is in dispute between growers and project implementing organization.
Farm Management and Extension	**Cultivated crop：** ① Basic Grains：Maize, upland and paddy rice, sorghum, mung bean, cowpeas ② Traditional crop：Sugarcane ③ Non-traditional crops：Soybean, sesame, tempate (Jatropha carcus L), plantain, bell pepper, pipian (Cucurbita pepo), watermelon, cassava (Manihot esculenta L. Crantz), mango, cashew nut etc. **Present Cropping Pattern：** Under rainfed farming system, the dominant cultivated crops are centered on the second cropping season called as "Postorera" and less cropped in the first cropping season "Primera" due to unstable and short rainy period. The cultivated crop is dominantly basic grains, comprising of 70 % of the entire arable land and relatively progressed in crop diversification because of fertile soils and located in the outskirts of Leon city **Cropping Acreage and Crop Production：** The basic grains like rice, frijol, maize and sorghum occupy 75% of the whole cropping acreage and soybean, sesame, sugarcane are cultivated at 19.3%, 3.7%, and 2.4% of total cropped area respectively. **Farming Practice in the Study Area：** The prevailing farming practice among the small and medium-scale farmers in the Study Area is shown below. Farm operations such as cutting grass, plowing, and harrowing are entirely managed by tractor or animal traction power via custom hired system, and sowing operation is also done in combination of seeding device and tractor or animal traction power. A source of tractor or animal traction power is supplied from large-scale farmer or agriculture cooperatives. **Agriculture Extension：** Agricultural Extension Activity by INTA：ATPM(90farms)、ATP1(90farms)、ATP2(40farms) **Major private organizations that support farmers：**Techno Serve、CARE etc.
Marketing	Telica Area is located near Leon City, which is the most adjacent market and has a good traffic condition and it is easy to use public transportation such as bus and truck. As a result, the farmers seldom go to the markets in Leon to sell their products, especially fresh products such as vegetables and milk. However, there are many cases where the farmers sell their products especially grains, to the brokers who come to Telica. **Grains (maize, sorghum, rice):** Farmers sell rice just as paddy after drying, except that they bring and ask polishing of paddy to rice millers in Leon for their consumption. **Sesame:** About 100% of the producers sell the produce to brokers who offer the highest price. **Soybean:** There is not much contract cultivation and most of the producers sell their products to brokers. **Vegetables and fruits:** There are cases that farmers sell them in the markets of Leon, in addition to selling them to the broker. **Markets in Leon City:** In Leon City, there are four markets managed by Municipality Office. ① Subtiava : Registered Traders 66persons,nearest to Telica Area ② Terminal : Registered Traders 545persons ③ Station: Registered Traders 1,034persons ④ Central : Registered Traders 329＋150（outside）persons

Farm Economy	Annual household expenditure was estimated at C$30,234 on average. Annual expenditure on food was estimated as C$19,350 accounting for 64% of the total household cash income. The agricultural and livestock production-related expenditures (inputs, fertilizers, agrochemicals, etc.) represented 15% (C$4,535) of total expenditures; transport expenses 9% (C$2,721); clothing expenses 5% (C$1,512); health-related expenses 4% (C$1,209); education expenses 2% (C$605); and other expenses 1% (C$302).
Agrarian Society and Gender	**Family, marriage, and dwelling house:** Family members per household are about 5 or 6 people, and as for family type, many nuclear families are observed. **Education:** There are four elementary schools and about 400 students in the Study area. Only 40 % are able to graduate from the elementary schools. **Health Care:** 2 clinics are in the Study area **Gender:** divisions of labor based on gender is observed in the Study area. Men work in the fields and women are in charge of house duties, such as sweeping, laundry, cooking, raising children, family farming and taking care of livestock.
Agrarian Organization	There are some Organizations, but do not function effectively. **Agrarian Associations :** there are three organizations, established in 1965, 1983 and 1987 respectively and 201 persons belong to them. **Subtiaba Agricultural & Livestock Cooperative Union(UCAIS):** This union is established by integration of 16 cooperatives and has a total of 1,199 members (998 cooperative and 200 individual members).
Infrastructure	**Access Road:** The local road which leads to Colonia El Polvón from Leon is unpaved one. The boundary is in the southern part of the Area and this road borders each other. The road condition isn't good but in the case of rainfall, a vehicle can pass. **Rural Road:** The total length is about 38 km. A lot of roads are rough and they need surface treatment. However, there are not many sections where passage is hindered in case of the rainfall. Since no bridge available in the river crossing place (10-20m width) in eight places, vehicles can not pass these places in the rainy season. **Electricity and Communication:** A power transmission line is installed in this Area as the power source of the pump for irrigation but electricity isn't supplied to each home. There is no telephone in the area. **Potable Water**: A shallow well (about 10m depth) is installed in each home and generally, a hand-pump is used. These wells are never dried up even in the dry season.
Environment	**Inhabitation:** The majority of inhabitation of this area is indigenous, called Sutiapa. There are no conflicts between inhabitation of this area. **Health and Sanitation:** This area is Malaria protected area, but there has not been a break out of other endemic and epidemic diseases. **Forestry:** They afforested many places ,but production of fuel wood for living is supplied about only 50% of the demand of the area. The insufficient 50% is cut down out of area. **Water Quality:** The result of analysis does not detect presence of any agrochemical, so ground water of this area can be used for irrigation.

3.3 Potentials and Constraints for Development

Potentials for Development	**Land:** The zones present a plain topography and fertile soils, and are known as the main agricultural production zone in Nicaragua. **Water Resources:** The district has abundant groundwater resources and it is possible to bring this water up easily in great amount at a relatively small depth. On the other hand, the Telica river which runs at the district limit still has some available water that can be used for development purposes. **Other Development Potentials:** Telica, located close to the city of Leon also presents a favorite markets. Therefore, it has advantages in introducing several crops to be supplied to that city. Furthermore, due to the execution of an immigration project 20 years ago, the infrastructure improvement cost is lower in this district comparing with other districts.
Constraints for the Development	**Insufficient Funds for the Agricultural Activity:** The farmers in this District are constrained by the non availability of new credit for the acquisition of agricultural machinery and hiring of workers. **Scarcity of Agricultural Machinery:** In this district, there are no organizations lending agricultural machinery. Besides that, the maintenance cost of such machinery is too high and the farmers themselves cannot purchase it. This is one of the causes for the low agricultural production. **Lack of Agricultural Materials:** Besides the lack of economic resources by the farmers, their organizations are not well organized as for to purchase the materials collectively. Another problem is that the agricultural materials prices are too high due to the intervention of middlemen. These are the main reasons for the lack of agricultural materials.

	Low Selling Prices of Agricultural Products: This situation occurs because they can not wait for the prices to rise due to the following reasons; lack of storehouses to keep the products, lack of utilization of market information, lack of proper transportation means, necessity to obtain money in cash as soon as possible.

3.4 Basic Guidelines of the Agricultural Development Model

Taking advantage of the potentials for the development that Telica has because of "Nearness to the city", a plan has been elaborated based on the following:

(1) Improvement of Productive Infrastructure at a Short Term and Establishment of the Guidance for its Management
(2) Improved Agricultural Technology Based on an Effective Cultivation Plan
(3) Agricultural Credit Accessible to Small and Medium-Scale Producers
(4) Collection and Selling of Products at a Group Level through the Apprenticeship of New Agricultural Techniques for Commercialization
(5) Sustainable Development of the Environment Protection
(6) Formation and Management of the Farmers' Organization

3.5 Land Use Plan

The basic concept to formulate a land use plan is premised on how to improve farmer's life along with conservation of natural environment. Therefore, selecting suitable farmland for crop production, and necessary amount of crop harvest for the people is secured by producing a maximum yield with an intensive farming method.

(1) Planting trees should be carried out along the river bank, boundary of the arable land, and the roads.
(2) From the viewpoint of preserving the existing forest, it should be kept out of deforestation and managed by planting trees as a source of firewood supply.
(3) The field of Tempate is in dispute at present, a land use plan should be examined with two cases such as " excluding Tempate field" and "including Tempate field".
(4) An expansion of residential area caused by population increase (2.6 % per year) is considered of securing 24 Mz.
(5) Grass land is basically maintained in status quo by increasing the annual fodder production and some part of the grass land is diverted to the future residential area.
(6) A cropping intensity of 65 % at present should be expanded by improving land productivity and labor productivity with introduction of irrigated agriculture.
(7) The existing paddy field should be in status quo.

3.6 Farm Management Plan

Basic Policy of Farming	(1) Production system is directed from self-support oriented basic grain production to market oriented farming system. (2) Transition to crop-diversification process should be started from improvement of crop productivity for the prevailing crops and should gradually introduce vegetable crops as well as cash crops by training the beneficiaries to get an eagerness and receptive capacity with OJT period. (3) With establishment of self-supply system by improving labor and land productivity from present extensive farming, the system of farming practice toward market-oriented farming is introduced. (4) New farm management plan is examined in order to secure a stable farm-income and enable the farmers to work in their own farm through the year without off-farm activity, by introducing irrigation technology that replaces the rainfed-oriented farming system (5) In order to exploit agro-environmental resources effectively, sustainable farming is directed by taking the measures of soil conservation, agronomic method to build soil fertility, and a farming system to expand farming scale is premised.
Proposed Cropping Pattern	**Target Crops:** The major target crops selected for the Study Area are maize, sorghum, upland rice, soybean, cassava, and vegetables. The reasons for the selection are as follows; ・ Maize is one of the important staple food, but has not accomplished the self-sufficiency level. ・ Sorghum plays an important role as a fodder source for agriculture with livestock raising and thus it should be kept as before. ・ Upland rice is an important principle food crop among the basic grains, however rice is imported every year. ・ Soybean whose international price is relatively stable is one of the fair profitable crops whose production can be easily mechanized in its farm operation system through a custom hired system, and should be introduced with the purpose of rotation crop as well. ・ Cassava is one of recommended crops via the crop diversification strategy, and its processing facility is completed in the surrounding area. Further, cassava is technically easy to cultivate with a high profit, and it should be extended as an export crop.

	・Watermelon, bell pepper, and pipian, which have a steady demand in the market are introduced. The farmers are highly concerned about the crops, which bring in a good profit supported by the large consuming city.

Cropping Pattern: The beneficiaries are classified into 2 classes, such as Type A : above 10 Mz landholder and Type B: less than 10 Mz land holder and further, while formulating cropping pattern, 2 cases are taken into account such as without Tempate field area and with Tempate field area, considering the future diversification to arable land as follows.

Without Tempate field				Including Tempate field			
Crop Intensity (%)			Net Income (C$)	Crop Intensity (%)			Net Income (C$)
Total	A	B		Total	A	B	
181.0	163.9	189.5	8.15 millons	176.2	156.8	183.2	10.55 millons
CI results in 3 times more than that of the present				The acreage of vegetable crop is status quo to avoid oversupply to market.			

Cropping Plan for the model farm household by farm household type:

Manegement of tempate	① Without Tempate field		② Including Tempate field	
Type	A	B	Tipe	A
Cultivated Area	14.5Mz/family	3.5Mz/Family	16.5Mz/Family	5.4Mz/Family
Main Crops	Maize, Sorghum, Upland Rice, Cassava, and Bell Pepper	Maize, Sorghum, Upland Rice, and Bell Pepper	Maize, Sorghum, Upland Rice, Cassava, and Bell Pepper	Maize, Sorghum, Upland Rice, and Bell Pepper
Annual CI	188.8%	200 %	171.2 %	186.9 %
Net Benefit	C$93000	C$29000	C$97000	C$40000

Proposed crop Yield (after 5 years)

Crops	Present	Without P. (qq/M)	With P. (qq/M)	Crops	Present	Without Project	With Project
Maize	40	42.0	80	W.Melon	-	-	200u
Upland rice	63	66.2	80	B.pepper	-	-	375bags
Sorghum	20	21.0	65	Pipian	-	-	2500doz.
Soybean	30	31.5	45	Cassava	-	-	125bags

Proposed crop production (5 year after)

Without Tempate field					Including Tempate field				
Crop	Cultivated Area (Mz)	Ratio (%)	Yield (qq/Mz)	Production (qq)	Cultivated Area (Mz)	Ratio (%)	Yield (qq/Mz)	Production (qq)	
Maize (Irrig.)	868.1	40.4	80	69,448	1,577.8	73.5	80	126,224	
Upland rice	740.0	34.5	80	59,220	740.0	34.5	80	59,200	
Sorghum	52.0	2.4	65	3,380	85.0	4.0	65	5,525	
Soybean	116.4	5.4	45	5,238	159.2	7.4	45	7,164	
Water Melon	55.0	2.6	200un.	11,000	55.0	2.6	200un.	11,000	
Bell Pepper	90.0	4.2	375bags	33,750	90.0	4.2	375bags	33,750	
Pipian	25.0	1.2	2500doz.	62,500	25.0	1.2	2500doz.	62,500	
Cassava	120.0	5.6	125bags	15,000	120.0	5.6	125bags	15,000	
TOTAL	2,146.3	100.0			2,146.3	100.0			

3.7 Irrigation Facilities Development Plan

In the irrigation plan of the Study area, both the Telica River and groundwater can be proposed as water sources. In case of the groundwater, deep wells like the existing ones shall be constructed within its potential, which covers about 60% of all irrigable farmlands in the area. On the other hand, the annual cost of operation and maintenance and construction cost per hectare for the use of the river water is cheaper than for the groundwater use. Therefore, river water flowing near the benefited area should be maximum utilized and the groundwater shall be used as supplementary water.

	Land Use Classification	Present	Case 1	Case 2
Irrigation Area	Dry field	37.5	798.3	798.3
	Paddy field	27.8	27.8	-
	Tempate	-	334.6	-
	Total	65.3	1,160.7	798.3
Selection of Water Intake Point	It is desired that the irrigation water is conveyed by gravity to the beneficiary area from the river. However, topographic and geological survey revealed that the method of taking water by gravity compels to a combination of a lower height of the weir and to a deeper head work and it is unable to irrigate the whole area by gravity. Therefore, the pumping station is planned close to the northern end of the Study Area.			

Irrigation Facilities	Irrigation Method		furrow irrigation		
	Alternatives		Case 1		Case 2
	Irrigation Area		1,160 ha		798.3 ha
	Intake Facilities	Headwork	Type	fix dam, floating (with Fish passing)	Same as case1
		Pumping plant	Type Designed pumping volume Quantity Conducting canals	Rotating and aspirating pump, simple stage with horizontal axe 0.3m^3/sec 3 units iron tubes: D 750mm, length: 1,100m	Same as case1
	Installation of supple-mentary source	Deep well	No of wells Diameter of wells Length of wells Volume of designed pumping	5 wells 300mm 70m 120 l/sec	3 wells Same as case1 Same as case1 Same as case1
	Irrigation canal	Main canal	Type, Length	Lined 4,670m	Same as case1
		Secondary Canal	Type, Length	Lined 13,940m	Same as case1
		Tertiary Canal	Type, Length	Unlined 13,940m	Same as case1
		Gates	Main Simple	2 149	2 110

3.8 Agrarian Organization Strengthening Plan

Formation of Organization	It is necessary to take into account this reality for the formation of an organization and to form groups of 10 to 20 properties that are located along the same side of the channel. This way, fifteen to twelve rural groups would be formed in the whole area and each one of these groups will develop the activities of a rural organization in the initial stage of the plan. On the long term, it is expected that these groups of farmers will mature, strengthening in cooperative bond with other groups, to finally form a rural organization that covers the entire area. The institutional support for the farmers' organization should be established on this view. However, concerning the administration and operation of the irrigation facilities, from the beginning it requires an organization that would act in the entire area.
Functions of Organization	Three main activities will be attributed to the rural organizations. **Collective purchasing:** The objective of the collective purchase is to reduce the unit cost of purchased goods by ordering in large volumes. **Collective gathering and forwarding activities:** It is necessary to have sufficient maturity, and it would not be realistic to demand organization to have this kind of capacity from the beginning of the Plan. The administration of properties will be done at an individual level in each rural group only at the beginning and as the farmers recognize their needs, they will start to gather the agricultural products in a collective manner. **Operation and management of irrigation facilities:** The control of the irrigation water in the terminals will be carried out by each group of farmers. Since the requirement of irrigation water varies according to the crop, each rural group will know the items and area of each member's crop, to be able to distribute the required water equally in each parcel. According to the intake plan, the person in charge of controlling the water will operate the water intake of each rural group.

3.9 Agricultural Credit Plan

Basic focus on fund for the agricultural loan	The small and medium-scale farmers who are the beneficiaries of the Plan for the Agricultural Development Model do not have enough own resources at the moment, therefore, they depend almost completely on the agricultural credit in the initial stage of the project. Also, it is necessary to take into account that initially it will be difficult to get enough production because of the lack of technical level among the producers. Therefore, for the first year of the project only 50% of the proposed yield is expected and on the fifth year onwards 100% will be achieved. The amount not collected (unrecoverable debt) of each property will be taken as a long term loan, forcing the debtors to pay in a planned manner up to the fifth year when the administration of each property will already have been stabilized.

Credit Mechanism	The credit system must be managed under the premise that the farmers understand and agree the mechanism. The executing organizations of the project or the NGOs in charge of administering the resources will instruct the requesting farmers of the most adequate method to manage the resources and financing. The farmers should participate actively in the training organized by the executing organizations of the project or by NGOs and be completely responsible for the use of the loan system.

3.10 Executing Plan of the Project

Cost of the Project (US$1,000)		Case 1 Irrigation area: 1,160.7 ha No. of beneficiaries: 250 properties	Case 2 Irrigation area: 798.3 ha No. of beneficiaries: 250 properties
	Construction works	2,777.9	2,483.1
	Indirect Cost	1,279.2	1,144.2
	Total Cost of the Project	4,057.1	3,627.3
	Cost per ha.	3.5	4.5
	Cost per beneficiary	16.2	14.5

3.11 Economic Evaluation

(Discount Rate：15%)	Case	EIRR(%)	C/B	NPV(US$1,000)
	Tempate	18.3	1.25	875
	Tempate	16.2	1.08	280
Revenue and Expense Analysis of the Properties	• In case of the initial investment for the implementation of the irrigation facilities has been C $10,000 and C $2,700, the analysis provided good results. However, the surplus on the twentieth year in both cases has been higher than the reinvestment requirement. Still when the resources are reserved for reinvestment on the twentieth year, the farmers will be able to enjoy enough resources to improve their living standard. • If the beneficiaries had to finance the entire implementation cost of the irrigation facilities, the corresponding debt would be paid in 13 or 16 years depending on the case. However, the surplus on the twentieth year is lower than the reinvestment requirement, and the farmers will not be able to enjoy the remaining resources to improve their living standard.			

IV EL ESPINO AREA MODEL DEVELOPMENT PROJECT

Outline of F/S Study at Telica Area Model Development Project is described as follows:

4.1 Natural Conditions

Topography, Geology	Tertiary system, which is the basement of the area, forms gentle basin, and on the top of the system lies quarternary diluvium and volcanic sedimentary layer to form low and gently undulating platform.
Soil	The soil distribution is of franc loamy soils and heavy loamy soils at a depth of 10 to 20 cm from the surface soil
Meteorology	The annual rainfall pattern is divided into rainy season and dry season. One of the characteristics of the rainfall pattern in this area is the frequent occurrence of successive no-rain days during the rainy season, called “Canicula” The annual mean rainfall is 1,179mm (Malpaisillo).
Hydrogeology	The results of pumping test： Existing well (74.282m above msl): 66.35 l/s (3.98 m^3/min) New well (78.606m above msl): 52.28 l/s (3.14 m^3/m)

4.2 Socio-economic Conditions

Number of Agricultural Families	The total farm families are 57, The beneficiary area is 1,351.3Mz. The farmers with a landholding size of 5 to 50Mz are 47, which is equal to 81%; and the number of farming families with less than 5.0Mz land holding size is 6; and more than 50Mz is 5.
Economic Activities	The income of El Espino village are obtained through family farming, the sales of agricultural products (including products from the kitchen garden and small domestic animals), the works in the property (selling their labor force), in other words, the persons in the area live from agriculture.

Land Use	Cultivated land: 647Mz(47.2%), Orchard: 11Mz(0.8%), Unused land, 56Mz(4.1%), Grassland: 520Mz(37.9%), Waste land: 67Mz(4.9%), Forest: 44Mz(3.2%), Settlement: 20Mz(1.4%), Road/Channels: 6Mz(0.5%), Total: 1,373Mz(960ha)
Land Classification	II：218Mz(15.9%)、III：473Mz(34.5%)、IV：587Mz(42.8%)、VI：18Mz(1.3%)、VII：77Mz(5.6%)
Farm Management and Extension	**Cultivated Crops:** ①Basic Grains：Maize, Sorghum ②Non-traditional Crop：Sesame, Vegetables(for kitchen garden), Jicaro(Crecentia alata) **Present Cropping Pattern：**The first cropping season-"Primera" has a high risk of poor harvest due to a short rainy period interacted with unstable rainfall pattern, thus planted in small acreage, and the 2nd cropping season - "Postorera" following to a short dry spell so-called "Canicula" is a primary cropping season. **Cropping Acreage and Production：**Sesame, a cash crop occupies almost 60 % over the whole cropping acreage followed by maize (24%), and sorghum (16%). **Farming Practice：**Farm operations like cutting grass before sowing, plowing and harrowing are dominantly managed by tractor or animal traction power via custom hired service. However, timely plowing operation after rain is apt to be delayed due to limited number of implements for custom hired service and due to a blood relation, that is to say, the thinner the relation to the implement owner, the more delayed. **Agriculture Extension：**El Espino area is actually not included in the extension net work serviced by INTA
Marketing	The transportation condition in El Espino Area is worse than in Telica and the accessibility to Leon City as the adjacent market is bad, as it must take about 8 km to the adjacent national highway, where public transportation such as bus and truck can be used. Most of products are sold to brokers who comes to purchase them and even the farmers who go to the markets of Leon permanently are few. As a result, the market information that farmers can obtain is mostly from brokers.
Farm Economy	Annual household expenditure was estimated at C$7,454 on average in the El Espino area. Annual expenditure on food was estimated as C$4,770 accounting for 66% of the total household cash income. The agricultural and livestock production-related expenditures (inputs, fertilizers, agrochemicals, etc.) represented 16% (C$1,118) of total expenditures; transport expenses represented 9% (C$671); clothing expenses represented 5% (C$373); health-related expenses represented 4% (C$298); education expenses represented 2% (C$149); and other expenses represent 1% (C$75).
Agrarian Society and Gender	**Family, marriage and house：**The average number of family members in El Espino is 8, and 6 of them are children. Usually it is common for children to become independent of their parents and keep houses for themselves at the age of 20 or so. **Education：**The educational level is generally low, and there are about 30 % of uneducated peasants over the age 15, about 30 % of dropouts from the elementary school, and the rest 30 % are graduated from the elementary school or above. **Health Care：**There is a health care center as public medical institution in the neighboring Las Lomas village. A male nurse and a female nurse works at this center, but there is no doctor. **Gender：**The division of labor based on the gender is observed. Men work only in the fields. On the other hand, women are mainly in charge of several house duties such as sweeping, laundry, cooking and raising children. They are also in charge of kitchen gardening and taking care of small domestic products. **Activities of NGOs：**Centro de Mujeres "Xochilt Acalt", Save The Children, etc.
Agrarian Institutions	There are two Agrarian Institution but activities carried are normal, nothing notable **Agricultural Association：**In the study area, there are three agricultural associations. At present, main functions of the agricultural association are seen in the following three points; finding financing agencies, solving any common problems among members, and cropping and management of tempate. However since no credits toward each agricultural association has been carried out for several years, the substantial functions of agricultural associations are to solve any common problems among members, and crop and manage tempate. **Community Development Committee：**The activities carried are normal, nothing notable, to mention some of them are: road repair, production of forestry nursery, vegetable production, well facility and latrines for public use.
Infraestructures	**Access Road：**The El Espino Area is located about 60 km of the northeast from the León City. The access road to the area branches from the rout 26 (León-Matagalpa, Asphalt pavement) and the distance to the area is about 8.5 km. **Rural Road：**The present road conditions of these roads are very bad in a lot of sections, and so the traffic hindrance has occurred in the rainy season.

	Electricity and Communication：Power transmission line is already constructed in the area but there is not a single house which is supplied at present. But, the electricity plan is supplied of December 1998 stipulates electricity to be supplied to each house. There is no telephone facility in the area. **Potable Water：**Water supply facilities aren't established in this area but a shallow well (about 10m depth) is installed in each home and a handpump is used generally. These wells are never dried up even in the dry season.
Environment	**Inhabitation：**This region was settled by immigrants who moved into this area about 100 years ago. **Health and Sanitation：**This area is Malaria protected area, but other endemic and epidemic diseases are not breaking out. **Forestry：**Forest exists only along the tributary of the Rio Sinecapa. All of fuel wood for living is supplied out of area. **Water Quality：**The result of water quality analysis dose not detect presence of any agrochemical, so ground water of this area can be used for irrigation.

4.3 Potentials and Constraints for Development

Potentials for Development	**Land：**The farmers have an average of 23.7 Mz of agricultural land each, which is equivalent to two times the average in Region II. **Water Resources：**It is possible to perforate 8 wells for the whole district, which makes possible the irrigation of 430 Mz, i.e., 7.5 Mz per farmer. **Other Potentials：**Around the district, there are no places where job opportunities could be created, except the agricultural sector. Therefore, there will be a good supply of labor force for the development of intensive agriculture under irrigation in the neighboring districts besides the fact that it will be possible to extend efficiently the effects of development towards this district as well.
Constraints for Development	**Insufficient Cultivated Area：**The lack of funds to hire labor force and to use agricultural machinery or draft animals are the reasons for the impossibility to increase the cultivated area, despite the existence of large agricultural areas, causing a low agricultural production. **Rainfed Agriculture：**Due to the lack of funds to establish the irrigation system, this district's agriculture depends on the rainfall regime, which is one of the reasons for the low agricultural production. **Low Fertility：**The farms located in slope land are always under erosion risk and the farmers do not know how efficient the soil maintenance can be, and even if they are aware of the importance of such maintenance they don't have enough funds for such purpose, due amongst other things to the low fertility of the soil. **Improved Seeds：**Due to lack of knowledge about quality seeds, which results in a low agricultural production. **Damages due to Plagues：**There are many plagues in this district. However, the farmers cannot take proper measures to combat them due to lack of funds to purchase insecticides, this fact is also causing the low agricultural production. **Low Quality of Agricultural Products：**The quality control of agricultural products is improper due to lack of proper storehouses. Their quality is also low because of the lack of proper cultivation technology by the farmers once they do not receive agricultural technology extension services. As a consequence, the prices of these products are too low. **Lack of Market Information：**Due to the lack of access to the market information, the farmers do not know the real prices of the agricultural products, thus they offer their products at a low price. **Selling through Middlemen：**The farmers have to ask for credit from the middlemen. This is also factors for the low price of their products. **Bad market accessibility：**The markets are far and the roads are not good, also that the public transportation means are not even developed. All this is translated as a disadvantage for the accessibility to the markets. **Property title for land：**Some farmers are not under conditions of receiving more credit because their properties have already been given as mortgage to the middlemen or banks. **Property title for land：**Some farmers are not under conditions of receiving more credit because their properties have already been given as mortgage to the middlemen or banks. **Rural organization：**The farmers are not accustomed to work collectively to reach a common objective, and also, they already have a series of negative factors as those described above, so it will require a long time to form and maintain a rural organization and able to develop activities by their own initiative. **Services of institutional support：**However, at the moment it takes a long time 2.5 hours to arrive to this area by motorcycle from the regional office, which hinders providing meticulous support services.

4.4 Basic Guidelines for the Agricultural Development

The following items are proposed to be the basic guidelines for the development.

(1) Improvement of the Productive Infrastructure at a Short Term and Establishment of the Guidance for its Management.
①Around 25Mz of irrigated fields shall be distributed to the farmers in the first stage.②The land renting method shall be adopted in the first stage.③As a result of the before mentioned method, the participant farmers will have a rented parcel being cultivated under irrigation and other own parcels being cultivated under rainfed conditions only.
(2) Improve the agricultural techniques of the properties under a plan of effective cultivation.
(3) Agricultural credit available for the small and medium-scale farmers.
(4) Start of the Environmental Recovery.
(5) Support in the learning of the methodology of administration of properties guided to the market to carry out the gathering and collective shipment in future.
(6) Creation and Management of the Farmers' Organization.

4.5 Land Use Plan

The basic concept to formulate a land use plan in this study area is premised on how to improve farmer's life with conservation of natural environment.

(1) Finding out a countermeasure to control soil erosion is very important area from the viewpoint of conservation of the agro-environmental resources.
(2) From a viewpoint of preserving the existing forest, it should be kept without cutting, and the land use ranked above IV class which is used as arable land at present should be diverted to forest or grassland use in order to prevent soil erosion.
(3) The current grassland of 520.8 Mz is basically kept in status quo and some of them ranked as I to II classes is diverted to arable land and the rest is kept as it is.
(4) An expansion of residential area caused by population increase (2.6 % per year) is considered of securing 8 Mz more in 2015.
(5) Shortage of fodder crop during the dry season can be solved by feeding livestock on rice straws as an alternative fodder crop.

4.6 Farm Management Plan

Guideline for the Elaboration of the Farm Management Plan	(1) The selection of the new crops to be produced will be made trying to convert the current system of extensive production mainly of basic grains of self-support, to an agricultural system oriented to the market through crop diversification and a larger value added to the agricultural products. (2) The diversification process of the crops will have a medium and long-term vision, beginning with increasing the productivity of the traditional crops. (3) A farm management plan that allows to pass from seasonal production (depends on rainwater) to permanent production through irrigation implementation that will allow to continue producing even during the dry season. (4) The priority of the cultivation land without irrigation will be dedicated to the production of cash crops that can only be produced with rainwater, as for example, sesame. (5) In order to guarantee a sustainable agricultural development, it is intended to establish an administration system of properties of the "reproduction in progressive scale" type. Concretely, the leguminous crop will be introduced since they contribute to conserve the soil and to maintain their productivity guaranteeing the sustainability of the agricultural natural resources.
Proposed Cropping System	**Target Crops：** The major target crops selected for the Study Area are maize, sorghum, upland rice, mung bean (Vigna radiata) and vegetables (watermelon, bell pepper). ・Maize is one of the important staple food crops in Nicaragua, while yield of maize is obliged to be poor level due to harsh natural condition, which makes them difficult to support themselves. ・Upland rice is also an important principle food crop in Nicaragua; however, the inhabitant procures rice because of its inability to grow under harsh natural condition, thus it is introduced to secure self-support at first. ・Sesame holds an important position as a cash crop, which can be only grown under rainfed condition, thus it is continuously cultivated in the rainfed area. ・Sorghum plays an important role as a fodder source for agriculture with livestock raising and thus it should be kept as before. ・Mung bean is a heat tolerant crop which can be easily grown in El Espino's hot dry weather condition, and also utilized as an alternative for frijol bean, while plant residue can be used as an alternative source of fodder crop during the dry season, thus it is introduced. ・As lasting vegetable crop like Watermelon, bell pepper are introduced.

Proposed Cropping System:

It is intended to develop intensive agriculture with irrigation in flat agricultural land of high productivity, under the lease modality, attributing 2.5Mz to each property. The cultivation plan for the 142.5Mz required in the execution of the plan and of the seasonal cultivation lands is indicated. The cultivation intensity according to this plan will be of 200% in areas under irrigation, 100% in areas without irrigation, with an average of 128% on the whole, and the agricultural net gain is estimated to be about C $835,000.

Crops	El Espino Area				Model Area			
	Area		Production	Net Profit	Area		Production	Net Profit
	Mz	%	(qq)	(C$)	Mz	%	(qq)	(C$)
Sorghum	109	17	981	62,228	1.9	17	17	1,085
Sesame	256	39	1,665	279,258	4.5	40	29	4,906
Maize(Irrigated)	78	12	4,650	83,700	1.0	9	60	1,080
Maize(AC)	17	3	1,020	65,727	0.3	3	18	1,160
Upland rice	120	18	4,800	442,740	2.0	18	80	7,379
Sesame(Irrigated)	6	1	66	6,701	0.2	2	2	244
Water Melon	25	4	3,750	59,233	0.5	4	75	1,185
Mung bean	40	6	800	91,248	1.0	9	20	2,281
Total	650	100		834,924	11.4	100		14,829

Proposed crop Yield (after 5 years)

Crops	Present prod. (qq/M)	Without P. (qq/M)	With P. (qq/M)	Crops	Present prod. (qq/M)	Without Project	With Project
Maize	8	8	60	Up. rice	-	-	60
Sorghum	9	9	9	M.bean	-	-	20
Sesame	9	9	9	W.Melon	-	-	120 doz.
Sesame (Irrig.)	-	-	12				

Proposed crop production (after 5 years)

Crop	Cultivation Area(Mz)	Culutiv. Rate(%)	Production (qq)	Crop	Cultiv. Area(Mz)	Culutiv. Rate(%)	Production(qq)
Maize	94.5	4.2	5,670	W. Melon	25.0	2.2	3,750
Up.rice	120.0	20.6	7,200	Sorghum	109.0	16.8	981
M.bean	40.0	6.6	800	Sesame	231.6	39.4	1,505.4
				Total	620.1	100.0	

4.7 Irrigation Facilities Implementation Plan

Plan for Irrigation Source	The volume of water source and the water requirement of the crops decide the irrigable area.
Irrigable Area	Eight (8) wells can be perforated in their region, including the two existing wells. Based on the topography and present land use pattern about 99.75 ha can be brought under irrigation (inclusive of that under present wells)

Irrigation Facilities Plan

Facility	Item	Contents	Remark
Water Source	No. of water source: Intake volume Diameter of wells Depth of well Pump type	3 wells (one existing) 42 l/sec – 53 l/sec 300mm 97.5m, 103.6m, 100.0m turbo pump of multiple stages and vertical axe	Existing: 2 Newly: 1 Diameter: 200mm
Installation of water supply	Length of pipes: Type of tubes: Diameter of tubes: Accessories	5.8 km (for 2 places) PVC 200 - 75mm Water control Valve: 33 Air Valve: 12 Discharge Valve: 12 Water feeding: 33	
Terminal Installations	Block Area: Data of the Block: Interval of feeder: Length of transporter tubes: No. of sprinklers:	5 blocks (per 2 farmers) 196.0m x 180.0 m 12.0m x 18.0m 96.0m 8 sprinklers	

4.8 Plan to Strengthen the Rural Organization

Formation of the Association	Multiple forms of structuring the rural organizations are conceived so that they carry out the attributed functions fully, according to the conditions of each rural group and the formulation conditions.
Functions of Organization	The following are the main activities in a rural organization: **Collective purchase:** The collective purchase is the acquisition of the consumption articles related with the agricultural production whose objective is, by means of a larger order, to reduce the unit price of the goods to acquire. **Collective gathering and shipping:** The collective collection and forwarding are important activities, which influence the function of production organization in an agricultural association. It is not just collecting and forwarding. Agencies to sell are chosen based on the production estimation from the production plan and the analysis of the market information, and the sales contract, the sales, and the control and the management of sales money are carried out. **Operation and management of irrigation water:** The management of irrigation water is carried out based on the cropping plan of members. As for the unit cost of irrigation water (in this case per Mz.) is calculated as the operation cost of irrigation facilities divided by the total irrigated area.

4.9 Plan for Agricultural Credit

Plan for Credit Fund	The system for the agricultural credit will be the same as described for Telica. However, it is necessary to take into account that the farmers of this area have only had the experience of administering its property with the resources of the agricultural credit during P/S, and that there were more farmers here than Telica who refused to return the debt. Since it can be forecasted that the NGO dealing with agricultural credits will have its office in the city of León, it will be more difficult to maintain a closer communication with the population of El Espino than Telica. For this reason, the executing organization for the project should offer a strong support to the farmers for the canalization procedures and refund of credits.

4.10 Execution Plan for the Project

Project Cost (US$1,000)		Irrigation Area： 99.75 ha, No. of benefited families：43 families
	Construction Works（Irrigation Facilities）	561.3
	Variable Costs	190.9
	Project Cost	752.2
	Project Cost per hectare.	7.5
	Project Cost per beneficiay	17.5

4.11 Economic Evaluation

(Discount ratio：15%)	EIRR(%)	B/C	NPV (US$1,000)
	9.1	0.72	-293
Income-Expenditure Analysis	・The beneficiaries should contribute C$10,000 and C$5,000, respectively, for the construction of the irrigation facilities as initial investment, the analysis showed good results. However, the surplus in the 20th year is lower than that required for reinvestment in both cases. It is also difficult to destine the entire surplus for reinvestment, and it is necessary to make more efforts to increase the value added of the products not only in the production base but also in commercialization. ・If the beneficiaries had to cover the entire implementation cost of the irrigation facilities, there would not be any surplus at the 20th year. On the other hand, the initial investment should be as small as possible because when it is too high, it can have adverse effects on the administration of the properties.		

V AGRICULTURAL DEVELOPMENT MODEL PLAN

5.1 Introduction

The agricultural development model plan implemented in Telica and El Espino were two of the four plans, elaborated in a Master Plan for Agricultural Development The development model has an integrated approach that aims to: 1) increase the agricultural

productivity; 2) support farmers' organizations; 3) increase the added value of the crops, etc. These plans were proposed to be implemented at an early stage in order to strengthen the capacity of the implementing agencies of the project and to motivate the small scale farmers and, in the long term, expect that the positive effects of the plans have a ripple effect to the neighboring areas.

After the Master Plan (M/P) and the F/S, a draft of the development plan was elaborated for both areas; based on this draft, a Pilot Study (P/S) was carried out by selecting certain zones and number of farms in order to increase the practical effects of the Plan. As the study was being implemented, the technical level of the small scale farmers concerning farm management, locational characteristics of the zones, executing capacity of the institutions, were being recognized, it was felt that there was a need for a more feasible plan to substitute the two agricultural development model plans that were implemented.

There are a great number of zones in the regions of the Pacific Coast of Nicaragua that show natural and social conditions suitable for the implementation of the Development Model Plan. Concrete policies for the selection of priority areas of the Development Model Plan are presented, as well as methods for their implementation.

5.2 Background of the Development Model Plan

The productivity of the small and medium scale farmers of Nicaragua is low and this is one of the major factors that do not allow to raise their living standards. The reasons why the productivity of the small and medium scale farmers productivity is low, are mainly "instability of the natural conditions" and "lack of institutional support", and the following four other factors: ① Low level of agricultural technology, ② Lack of production infrastructure, ③ Inadequate market administration, and ④ Difficult access to agricultural credit. Within these factors, the most important is the low level of the technology.

The root of these constraints is in "⑤ Bad operation of the farmers' organization". This is because the four constraints above mentioned can be solved if there is an agricultural organization which would propose objectives following its own initiative (i.e., improve the living conditions of the members of the organization). There is not a good farmers' organization because in the small and medium scale farmers, "⑥ There is no thought or action coming by their own impulse".

5.3 Objective of the Agricultural Development Model

To increase the agricultural income level of the small and medium scale farmers, it is required to carry out effective policies to the "formation of farmers' organizations and their activities" and to the "improvement of the farmers' technical capability in crop cultivation". Also, the "improvement of the infrastructure for production" and "establishment of a credit system" are included as these are two main components for increasing the agricultural income of the targeted population, in such a way that the Project will have an integrated approach for the solution of the constraining factors.

It is difficult to expect that the small and medium farmers act by their own will in the initial stage of the Project, and this is the reason why the supporting organizations must provide them a strong support. However, as the Project progress on, and the agricultural incomes are being increased, the farmers will understand the incentives of the Project,

as week as the essence of the activities of the farmers' organizations, and in this way, they will start to act on their own volition, forming true farmers' organizations able enough to develop by themselves.

In this Project, three objectives are proposed to reduce poverty among the small and medium scale farmers. The first one is to improve the living conditions of the targeted population in the Project Area. For this purpose, it is necessary to successfully implement three components: "supporting system for the farmers (farmers' organization) to complement the lack of appropriate agricultural technology of the small and medium scale farmers; "irrigation facilities" that are infrastructure to carry out agricultural activities on an intensive basis, and; "agricultural credit system" to complement the lack of economic resources of the beneficiaries. These three components are mutually complementary, and the absence of any of them could represent a severe constraint to the Project.

The second objective is to "accumulate enough technical skills" and "strengthen the advisory capabilities" of the executing agencies of the Project. In the first stage of the Project, it is necessary to simultaneously implement a supporting system to complement the technical weakness of the extension workers.

The third objective is to apply the experiences accumulated during the process of providing assistance to the small and medium scale farmers through the execution of the Agricultural Development Model Project. The guidelines for agricultural development and management are different according to the conditions of the different zones in the country, as well as the natural conditions. Because of this factor, it is necessary to implement the programs according to the needs of each zone, taking the farmers' organizations as a central axis.

5.4 Strategy for the Development Model Plan

(1) Project Formulation

It is proposed to provide integral support to the small scale farmers in order to increase their agricultural income. However, the protagonist of the Project must be the farmer themselves, and the intensity of their motivations is the key for the Project to fully show its expected results. With this motive, it is important to support those farmers who understand and fully recognize the conditions of their farms; the incentives provided by the Project must be clearly explained to these farmers using a participatory approach. Also, the monitoring plans for specific crops to be cultivated within the Project must be elaborated by the farmers' own initiative.

(2) Concept for Improvement of the Facilities

The "improvement of the infrastructure for production purposes" must include adequate facilities with a futuristic perspective, because it represents a huge initial investment for the small and medium scale farmers who are still not familiar with cultivation practices under irrigation. Therefore, the size of the facilities will be defined basically considering a appropriate cropping area which will secure adequate income level for the farmers, taking into account the farm management system and the availability of water and soil resources. Also, it is important to define the appropriate irrigation surface which will make it possible to carry out a stable and intensive agriculture, and in this way, improve the living conditions of those who are vulnerable to fall into poverty with the lowest unit cost (per farm) for the facilities.

At present, the average size of the agricultural land owned by each one of the small and medium scale farmers in Region II is 11.1 Mz (approx. 8 ha), and in some cases this land is distributed in various places. Rainfed agriculture is being practiced except in some cases. Based on this situation, if the irrigation facilities were introduced, with a common source, the cost of the improvement would be too much high. Therefore, in the Development Model, 20 to 30 small and medium scale farmers get together in a group and rent agricultural lands with better soil and natural conditions, and each farmers receives 2 to 3 Mz that will allow the farmer to get enough income. By doing this, the cost of improvement of the facilities will be minimized.

(3) Effect on other zones

The governmental institutions which will carry out the Development Model Plan are MAG-FOR and INTA. They will have to work taking into consideration the need to achieve an effect all through the country. These accumulated experiences will be very valuable in the future and these must be compiled in a manual for the development of the small and medium scale farmers of Nicaragua.

5.5 Development Model Plan

5.5.1 Flow of the Development Model Plan

The Development Model Plan could be divided into three stages: preparatory stage carried out by the farmers, preparatory stage of the supporting systems, and the execution stage. The preparations of the farmers consist of the organization of the beneficiaries and the participatory elaboration of the plans; the preparations of the new systems consist of the establishment of the irrigation facilities and the credit and supporting systems for the farmers. Finally, the execution stage for the farm management using all the provided tools.

Basically, the Project is conceived aiming for the small and medium scale farmers to increase their agricultural income through their own efforts; however, this will not be possible without them receiving any support. Therefore, it will be shown in which way the administrative entities must support, motivate and advice the small and medium scale farmers. Also, in the P/S it was evident that the supporting institutions are not capable enough to provide the required support to the farmers needed by the Development Model, and it is, therefore, necessary to provide assistance to these institutions too. The kind of support needed by these institutions is shown in the figure.

The general framework of the Development Model Plan is proposed together with the required items to be fulfilled for a smooth development of the Project. However, the specific crops that will be cultivated by the farmers must be decided by their own farmers' organizations. Also, the type and supporting method to be provided must be defined by the supporting institutions themselves based on the request of the farmers' organizations.

Selection & location through the screening and detailed study

The executing agencies of the development model are MAG-FOR and INTA. It is probable that the technical staff of the regional offices will have to implement the plan in practice, but the number of the staff at the MAG-FOR office in Region II is limited.

From the experiences of the P/S, it is concluded that it is necessary to start the works with no more than five zones per year at the beginning. The general framework of the projects is defined as follows:

- Basically, each group to receive institutional support will include 15 to 20 farms.
- Each target farm will have an area of about 2 to 3 Mz. Fundamentally, mini-irrigation systems will be implemented using ground water.
- Therefore, each project will be carried out by a farmers' organization covering 15 to 20 households with an irrigation area of 30 to 60 Mz.
- The projects will be executed in Region II, within and outside the area of the P/S.
- The establishment and investment for facilities, agricultural credit, etc., will be executed after the farmers' organizations to administer them have been created.

The selection of the areas where the projects will be implemented, based on the screening and detailed studies, will be the responsibility of the Nicaraguan governmental institutions: MAG-FOR and INTA. However, because the success of the Plan is based on this selection, the participation of the experts in the selection process will be needed; they will have to jointly work with the Government of Nicaragua. Below, the concrete conditions to be met in the areas where the Plan will be implemented, are shown.

① Groups of small and medium scale farmers who understand and agree with the objective of the Development Model.

The attitude of the beneficiaries (small and medium scale farmers) towards the Plan will affect its development. Therefore, the Development Model Plan must be executed in an area where there are groups of small and medium scale farmers who agree with the objective and methodology of the Plan.

② Availability of enough water resources for irrigation purposes

The irrigable area by each well increases proportionally to the well's capacity. The construction cost per each surface unit is also reduced when the irrigable area is bigger. Also, when the water table level is deep, the cultivation cost is increased. However, in those zones where there are abundant water resources from rivers or springs that guarantee the stable supply of irrigation water, higher priority will be given to the use of waters from the river because the cost of the works is lower than the alternative of constructing wells.

③ Availability of clustered cultivation lands with good quality

It is desirable for effective irrigation facilities to select a zone where cultivation fields of good quality are concentrated. Therefore, it is necessary to select zones where there are more than 30 Mz of cultivation lands of good quality.

④ Establishment of an adequate linkage of land renting

In the case that the land renting system is adopted, about twenty farmers must subscribe the renting contract with a few landowners. Therefore, it is necessary to select a zone where it is possible to reach a full agreement on renting between landowners and the farmers renting the land.

⑤ Good access to the market

Even when it would be possible to implement the intensive agriculture and high yield cash crops are produced, the selling price would still be low if there is no good access to the markets. Therefore, it is necessary to select the zones which are near to big consumers' markets.

(1) Selection method of the candidate areas for the implementation of the Agricultural Development Model

Basically, no more than five areas will be selected per year. For the definition of the project's areas, the candidate areas will be selected following the steps being described below, and after determining the priorities through the screening process, the detailed study for the areas with higher priority will be carried out in order to evaluate the feasibility of the project.

From March to May 1999, MAG-FOR and the experts from JICA carried out a joint study on the damages caused by the hurricane Mitch, by which a total of 55 areas in the departments of León and Chinandega with a high potential for development of mini-irrigation systems were identified. These areas, in general terms, satisfy the requisites of selection mentioned before, and are being considered as "candidate areas for the Agricultural Development Model".

During the screening. besides collecting the basic information such as weather conditions, water resources, location conditions, etc., a field recognizance will be carried out as well as simple interviews to collect the general information of the zones. The aspects to be investigated in this process are:

- Social conditions that fit the framework for the agricultural development model
- Water sources for irrigation
- Grouped farms with soils of good quality
- Possibility of land renting
- Market accessibility

The results of the screening will be evaluated using the checking list and by the detailed study in the five areas with the highest priority to verify if the execution of the project is feasible. The detailed study is carried out with the objective of identifying the awareness and willingness of the farmers and the present social problems. At the same time, it will be verified whether there are other factors that constraints the development model. Therefore, the development study will consist of mainly investigating the following eight aspects:

- Willingness of the farmers (hopes and perspectives for the future)
- Attitude of the farmers towards agriculture
- Structure of the communal society and the role of the communal organizations
- Identification of the leader of the community and his role
- Presence or absence of conflicts among communities or within the community
- Existence of the custom of renting farms and its respective method
- Size and distribution of the farms
- Existence of mortgages

Based on the results of the detailed study, a final verification of the requisites

established for the Agricultural Development Model will be made and the candidate areas will be defined. However, it must be noted that even during this stage the fact that the areas have been defined does not necessarily means that the project will be initiated. The decision will be made after the plan has been elaborated with a participatory scheme and approved by the top management of the project.

To be able to finalize the screening in one month and also the detailed study in one month, a leader who completely knows about the plan will be selected together with two full time assistants. These three persons, besides selecting the areas, will play a primordial role in the implementation of the plan.

(2) Method for screening and evaluation of the definition of the priority areas

The process includes the interviews, field study and analysis of the existing data and information. In order to not to reflect the subjectivity of the screener on the results, it is necessary to carry out the verification among various persons. The information of the screening will be summarized in the checking list and the assessment will be made assigning points that will be added up at the end. Then, the candidate areas will be ranked staring from the ones that obtained the highest number of points and a priority order is defined. The evaluation will be made at three levels. The areas that show even one item in the lowest level must be discarded from the list of the candidate areas.

(3) Method of the detailed study

The requisites that must satisfy the areas cover different aspects. The most important requisite is the willingness of the farmers and social condition that are aspects that can not be easily shown in a social study carried out in the conventional way. To verify whether these areas are suitable or not for the Agricultural Development Model, it is necessary to carry out a Rapid Rural Assessment (RRA) that is a method that allows to know the social characteristics of a zone in a short time. To carry out the social study by applying the RRA it is required to have the assistance of an expert at least at the initial phase of the implementation.

To minimize the distortion of the collected data, it is recommended to form a team of five experts in the agricultural development model (experts in farmers' organizations, rural society, irrigation, technical extension workers from MAG-FOR and INTA, etc.). A team must include more than three experts of different specialties, and the participation of the MAG-FOR staff is indispensable in order to carry out the on-the-job-training; this is because from the second year the project will be carried out only by the staff from MAG-FOR.

Activities of the farmers	Institutional Support	Assistance to the supporting institutions
A: Fulfilling of the organization's requirements		
• Actively participate in the analysis of the problems • Actively participate in the analysis of the objectives to solve the problems. • Understand the scope and incentives of the Plan • Define the required activities and division of responsibilities • Define the strategies to achieve the responsibilities	• Select and organize the meeting place and the participating farmers. • Provide the necessary instruments and advice the farmers in the participatory diagnosis of the actual conditions. • Explain the components of the Plan and its usefulness for the solution of the problems (make them understand the incentives for the creation of the farmers'	The experiences in the participatory development methodology of the Nicaraguan institutions (MAG-FOR and INTA) are few and it is required the participation of experts able to handle such methodology.

• Provide the land to MAG-FOR for the installation of the pumps	organizations).	

- Clear definition of the incentives and duties -

To make the farmers assume the main role in the project, it is necessary that they must have a clear idea of the incentives offered by the project and the duties that must be carried out to perform the activities.

<Procedures to help the farmers to understand the incentives of the project> (1) Understand the participatory methodology To make the national small scale farmers to get rid off this dependence, it is necessary that they assume the protagonist role in the development of agriculture. The participatory planning is considered as an optimal method for awakening the initiative of the farmers and make them overcome their present situation. (2) Identify and understand the problems within the group and analyze the problems together It will be discussed with the farmers about the main factors that constrain the agricultural development and systematically analyze the causes that for such problems. (3) Analyze the means to solve the problems - Analyze the objectives In this process, the methods to solve the problems are studied in a global way, using the logical framework.	<Procedures for establishment of the duties> (1) Define the required actions for the solution of the problems and the division of the responsibilities This definition of responsibilities by the farmers themselves becomes a process of crucial importance to make them aware of the fact that they are the protagonists of the project, which puts forward the need of minimizing the institutional intervention notwithstanding how slow the process may be. (2) Define the strategies for the fulfillment of the duties-Clearly define the "duties" of the farmers The fact that they have identified the causes of the problems and taken care of carrying out the activities to solve them, implies that they have assumed the responsibility of implementing such actions. The internal rules of the group define the way how an individual who has not fulfilled his duties will have to assume his responsibility.

B: Study of the contents of the Plan

• Define the crop varieties • Train the key farmers in the most progressive farms. • Select the cultivation fields and define the renting system.	• Coordinate the general framework of the present Plan with the needs of the farmers. • Exhibit the crops varieties making comparisons of the agricultural techniques of the farmers and the required techniques for the cultivation of each proposed variety • Coordinate the training in the farms. • Provide support in the subscription of the rent agreement.	For the understanding of the components of the Plan it is required to carry out the participatory methodology and requires provision of technical assistance to the institutions on this aspect. Also, to increase the practical effect of the components, it is necessary to have the participation of the experts.

C. Establishment of the supporting systems-1: -Supporting system-

The support to the farmers in this phase refers to the support for the farms' management which includes all activities from crop preparation, harvesting and sale; it also includes the elaboration of the cultivation plan for the next season.

Guidelines for the support to the farmers' organizations (farm management) (1) The definitive execution plan must be decided by the farmers themselves even if the process is slow. (2) The definition of the surface of the parcels within the rent system must be made by a supporting institution that guarantees the equity and neutrality of the process. (3) At least during the initial stage of the Project, it is required to provide support for purchasing inputs and machinery, etc. (4) It is necessary in the initial stage of the Project to emphasize the importance and meaning of taking records of the crops for control purposes. (5) It is necessary to provide training to the farmers on preventive periodic maintenance of the irrigation facilities. (6) To obtain the agricultural credit, the beneficiaries require the support in this stage.	Support for the cultivation activities (1) The definitive execution plan must be decided by the farmers themselves even if the process is slow. (2) Elaborate a cropping plan that awakens the initiative of the farmers. (3) It is not pertinent to introduce new crops for those for which the supporting organizations do not have any data, except when the beneficiaries have adequate cultivation techniques for their introduction. (4) In the case of initiating the production of new crops, the extension of the pertinent techniques will be made through the creation of demonstration farms to show to the farmers the difference between the conventional and improved methods. (5) A systematic training plan oriented towards the farmers according to their needs will be executed.

C. Establishment of supporting systems-2: -Implementation of mini-irrigation systems-

For the implementation of the irrigation systems, the beneficiaries must assume a determined cost. It is necessary to reach an agreement through the farmers' organizations and, in this way, guarantee the establishment of an adequate operation and maintenance system.

C. Establishment of supporting systems-3: -Establishment of the agricultural credit system-		
- Requisites for the creation of the agricultural credit Beneficiaries: Farmers to be subject of the Plan (80 farmers per year, with a total of more or less 400 farmers) Objectives: Inputs (seeds, fertilizers, agro-chemicals, etc.), rental services, hiring of labor, etc. Executing agency: NGO Management and administration: Organization for the administration of the Project Conditions of the credit: Interest: 6% (inflation rate) + 3% (commission) = 9% annual Collateral: own assets Repayment: in cash Repayment delay: only accepted when the debtor cannot pay due to adverse climate or market conditions, etc.	-Procedures for the loan and repayment of the agricultural credit- (1) At the moment of granting the loan: ・Loan will subscribe a contract defining the maximum amount, period, and the objectives of the agricultural credit. ・In case of requesting the credit for buying goods and services, the farmers can get them by using a letter of payment issued by the financing entity. ・In the case of requesting the credit to buy fuel for the irrigation facilities, the farmers' organizations subscribe a payment contract for credit with a determined gas station. (2) At the moment of the repayment: ・The amount that each farm can repay is determined based on the gross profits and the cost of living until the next selling season of the harvested crops. ・The farmers ask for an extension of the deadline for repayment if the amount that they can repay do not cover the outstanding debt. ・An examination is carried out to see whether the extension of the repayment period is justified. ・If the request is found to be justified, it is decided to accept an extension of the repayment periods until the farm management has reach an adequate stability. ・If the request is found not to be enough justified, the farmers' organization will be questioned and will be asked to repay the debt. ・If they do not want to repay the debt, then the mortgaged collateral will be taken or other measures will be adopted.	
D: Preparations for cultivation		
• Elaborate the farm management plan (size of the farm, crops to be cultivated, harvesting and forwarding, etc.). • On-farm training of the key farmers. • Select and define the fields and cultivation method.	• Provide support in the elaboration of the farm management plan. • Coordinate the on-farm training. • Provide support in the processing of the agricultural credit. • Provide support in the collective purchase of services and inputs. • Provide technical assistance for the cultivation (ploughing, etc.). • Execute the definition of the parcels.	The elaboration of the farm management plan must be a "bottom-up" process. Therefore, it is necessary to carry out the assistance to the supporting organizations by the agricultural experts who know this methodology.
E: Cultivation		
• Put into practice the collective management system for crops cultivation through the farmers' organizations(Technical assistance for cropping among farms under the guidance of the leaders) • Fertilization control • Plagues and diseases control • Management of the irrigation facilities	It is necessary in a way to cover the lack of experience of the administrative staff, to ask for the cooperation of a NGO that are familiar with the "bottom-up" methodology and mutually complement the know-how about the cultivation techniques that the different institutions and supporting entities have in order to motivate the farmers.	The technical assistance to these supporting institutions is necessary in the initial stage of the Project when they still do not have enough experiences accumulated.
F: Harvest and sales		
• To know the market and producers' prices • To know the volume of production according to the sales items • Carry out the collective negotiation with the intermediaries. • Define the crops to be processed • To negotiate the service fees with the processing firms • Execute the collective processing	• Provide support for the definition of the sales plan through meetings with the farmers. • Provide information and explanations about the prices of the crops. Estimate the volume of production for each crop. • Provide information about the processing firms and the services fees. • Provide support in the gathering and forwarding of the products processed collectively.	An internal consensus within the farmers' organizations, in a participatory process is indispensable. The supporting institutions that have few experiences in this process will also require of an external assistance.

G: Repayment of debts		
• To know the gross profits. • To know the amount of the outstanding debt. • Make a project of the living expenses. • Make the necessary procedures if it is impossible to repay the whole outstanding debt. • Repay the debt.	• To know the gross profits of sales for each farm. • To know the outstanding debt for each farm. • Evaluate the requests • Control the repayment process of each farm.	It is required the participation of the experts who will advice the administrative institutions in a way to complement their lack of experience at the initial stage of the Project.
H: Elaboration of the next cultivation plan		
Once the cultivation of the corresponding season is finished, all the members must participate in the evaluation of the processes from the preparation of the cultivation until the forwarding and sale of the crops under the guidance of the leader in order to share the experiences and formulate the guidelines for the elaboration of the next cultivation plan.	For the farmers who do not have much experience, the evaluation to be made at the end of the cultivation period becomes a efficient way to develop their own skills, because the administrative institutions will point out the identified problems motivating the farmers to incorporate the improvements in the next cultivation cycle.	

5.5.2 Plan for execution of the Project

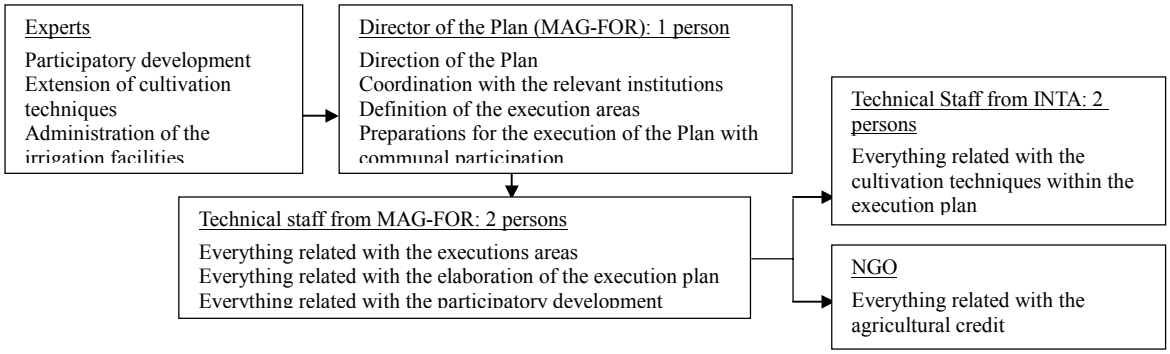
The Project is divided in two broad stages: ① stage of the formation of the organizations and the establishment of the supporting systems for the benefited farmers could execute the Project, and ② stage in which the farmers manage their farms with the support of the executing institutions of the Project.

	Stage ①	Stage ②
Tasks to be performed	- Selection of the location - Fulfilling the organizational requirements - Organization of the farmers by themselves - Preparations for the execution of the Project - Establishment of the supporting systems	- Crop preparations - Cultivation - Harvesting and selling - Distribution of the profits - Repayment of debts - Elaboration of the next cultivation plan

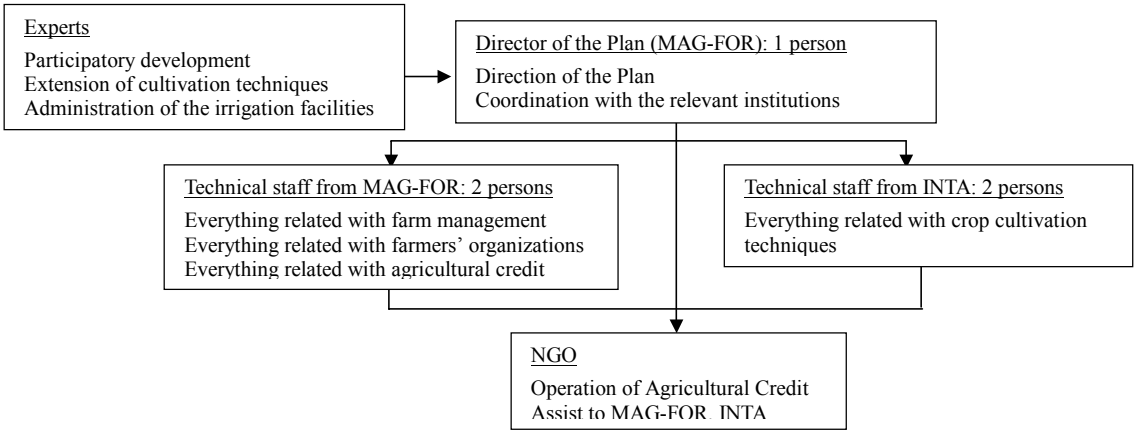
(1) Execution system for the Project

The division of responsibilities will be basically as follows: MAG-FOR will take care to provide support in everything related with the farmers' organizations; INTA will do the same with everything related with cultivation, and the NGO with the agricultural credit. However, if each component works independently, the supporting effect will be limited, and, therefore, the services must be coordinated to achieve a synergetic effect. And it is required to have the participation of experts in the participatory development and in crop/farm management.

Stage ① corresponds to the definition of the framework of the Project, which consists of establishing a mechanism and framework of the administrative services. This will be the responsibility of the governmental institutions. Because the creation of the farmers' organizations is the main objective in this stage, the main institution to participate will be MAG-FOR. However, it also requires the timely intervention of the NGOs to take advantage of the many experiences that they have in agricultural development.



Stage ② corresponds to the support to the activities related to cultivation and the farm management. The latter could be divided into the support to the activities of the farmers' organizations and agricultural credit. In the execution system of the Project, a director of the project will be chosen among the staff of the MAG-FOR who will assume the coordination and general direction of the Project. The number of the staff required will be two from MAG-FOR and two from INTA, both must be permanent staff and with exclusive dedication to the Project, assuming that they will make two visits per week to each zone of the Project; because a technical staff could cover up to two zones, if it is proposed to cover four zones per year. The administration of the agricultural credit will be given to the NGO that has been providing this service so far.



(2) Execution Plan of the Project

With different kinds of supporting menu, if the actual conditions of the Government of Nicaragua are taken into account, the number of zones in which the Plan could be executed would not be more than five per year. As a goal for each zone, it is being planned to offer one year of support in stage ① and five years in stage ②, getting a total of six years of support, by which it is expected to achieve a level of development of the farms good enough for them to offer their crops in the market and grow by themselves. Initially, the development of five zones in one year is assumed, representing 25 zones in five years. Because the development of each zone requires a total of six years of support, the duration of the Plan will be a total of ten years.

(3) Estimated cost of the Project

The cost of the Project includes the implementation cost of the irrigation facilities, funds for agricultural credit and the operation costs of the supporting organizations. However,

within this last item, the staff expenses of MAG-FOR or INTA are not included.

Implementation cost of the irrigation costs

The cost for implementation of the irrigation facilities varies depending of the area to be irrigated, the topographic conditions, and the depth of the water table. For estimation purposes, it has been assumed that an area of about 40 Mz will be irrigated under conditions similar to those proposed for El Espino.

Items	Amount (Thousand US$)	Remarks
Construction cost: Wells' perforation, Installation of pumps, Pipes, Sprinklers sets, Rural roads	222	Wells with a 100m depth, Pumps and engines
Administrative expenditures, etc.	71	32% of the costs of the works
Total improvement of the irrigation facilities	293	
Cost of the Project for each hectare	10.5	40Mz=28ha

Requirements of the funds for agricultural credit

By assuming that a zone under the Development Model is 40 Mz and that the Plan will be implemented in five zones per year, the total area would be 200 Mz. Taking as a reference the requirement of resources for farm administration of the Development Model for Telica, the requirement for the funds is estimated to be C$2,360,000 per year. By assuming that the Plan will be implemented in five zones per year, during five years, and if a repayment rate of the initial credit is 50%, and a repayment rate of 100% after five years, the necessary amount required in the first year is C$2,360 and will increase gradually, until the fifth year when a maximum of C$5,310,000 is reached.

Expenditures for activities of the supporting organizations

Here are included the direct administrative office costs, fuel for vehicles, etc. An estimation of the annual budget required for each item is as follows; Office expenditures: C$ 58,000, Fuel for vehicles: C$36,000, Others: C$20,000, Total: C$114,000.

5.6 Evaluation of the Plan

According to the balance, at the third year the farms will have a surplus, and by the fifth year, the debt will be totally repaid. From the sixth year a surplus of C$11,700 is expected; this surplus becomes C$55,100 and C$171,000, by the tenth and twentieth year, respectively. At the twentieth year, the farmers that own a parcel of 2.5 Mz will need about C$2,000,000 to renovate the facilities.

VI CONCLUSIONS AND RECOMMENDATIONS

Based on the results obtained in the studies of the Feasibility Study (F/S) of the agricultural development model plan in Telica and El Espino, and a Pilot Study (P/S) implemented for a more feasible plan to substitute the two F/S studies, the recommendations mentioned below are presented.

6.1 Conclusions

From this point of view, as projects for supporting the small and medium scale farmers in Nicaragua, the Agricultural Development Model must be implemented as it is easier

to implement and, after the supporting institutions have accumulated enough experiences, then the agricultural development model plans for Telica and El Espino should be implemented.

6.2 Recommendations

(1) Agricultural Development Model Plan for the Telica Area

Telica has been selected as a priority area and due to its favorable social and natural conditions, it is an area where a project can easily generate the benefits, which will be reflected in the good results shown by the economic evaluation. Also, from the point of view of the beneficiaries, it is an area that has a great development potential due to the presence of numerous small and medium scale farms. However, because of the great number of the small and medium scale farmers in this zone, it makes difficult to be served by the supporting institutions due to their limited resources. Therefore, it is strongly recommended to carry out the development project in a relatively near future, but before doing so, it is proposed to implement the development model described in Chapter 5 and raise the efficiency of the institutional support.

(2) Agricultural Development Model for the El Espino Area

El Espino natural (soil productivity, etc.) and social conditions makes it a typical Nicaraguan rural area where small and medium scale farmers predominate. The increase of the agricultural income level of the population in these areas, without doubt, will contribute to pull the small and medium scale farmers out of their poverty condition. However, the support required to overcome all the constraining factors that this area faces and to achieve the self-development of the community is very intense, besides the fact that the success of the project assumes a certain degree of maturity of markets and socioeconomic conditions of the whole country. Therefore, it is recommended that El Espino and other areas facing similar unfavorable conditions must be considered as candidate areas for the last stages of the agricultural development model.

(3) Implementation of the Agricultural Development Model Plan

The Agricultural Development Model Plan proposes to limit the scale of development and select the prioritized areas that offer good conditions in terms of soils, water resources, markets, etc. in order to secure determined agricultural productivity, and commercialize the crops under fair conditions. The selection of these areas must be implemented under the initiative of public institutions like MAG-FOR, INTA, etc. so that they could get a sense of ownership of the projects and encourage the farmers to participate in the projects.

The Agricultural Development Model Plan must be a participatory process inviting the beneficiaries to take part in each stage of the development process, from the selection of the areas of the project to the management of the farms. This is to make them to become aware that they are the real implementors of the project, and at the same time, that they need to help the supporting institutions in correctly identifying the true needs of the beneficiaries. The public institutions have been providing support to the small and medium scale farmers for many years, but it must be admitted that they still do not have enough number of technical staff who know about the methodology of participatory development, making it necessary to request the technical assistance from the donors.

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LIST OF ABBREVIATIONS

ABBREVIATIONS

Public Organizations of Nicaragua

DGIAP	General Directorate for Information and Support to Farmer
ENABAS	Nicaraguan Enterprise of Organization for the Nations
INTA	Nicaraguan Institute for Agricultural Technology
MAG-FOR	Ministry of Agriculture and Livestock and Forestry
MARENA	Ministry of Environment and Natural Resources

International Organization

JICA	Japan International Cooperation Agency
NGO	Non-Governmental Organization

Currency

C$	Nicaragua currency unit C$1.0 = US$0.08 (May, 2000)
US$	US$1.0 = C$107.6（May, 2000）

Measurement

Mz	1.0 Mz = 0.701 ha
ha	1.0 ha = 1.42 Mz
qq	1.0 qq = 46 kg
gal	1.0 Gallon = 3.785 Litter

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 Background

The agricultural sector of the Republic of Nicaragua represents 25% of the Gross National Product (GNP), 65% of exports and more than 40% of the employment in the country. Therefore, the Government of Nicaragua puts high emphasis on the increase of the agricultural production and decreasing the poverty levels through the National Development Program, giving more importance to the reactivation of the agricultural productivity. However, 71% of the Nicaraguan population still suffers from poverty, meaning that the expected results have not been reached.

Regions II and IV are traditionally agricultural centers of Nicaragua, being big producers of coffee, sugar cane, and meat, which are the main export products. In spite of this, many poor farmers live in those regions who do not possess enough economic resources; in those areas poverty and wealth live together.

Under these circumstances, in December of 1995, the Government of Nicaragua requested the Government of Japan for help in formulating an agricultural development project dedicated to the Regions II and IV where the potential for agricultural development is very high within the regions located along the Pacific Coast.

The Study is composed of three phases as indicated below. The present Report compiles the results of "the Pilot Study and Revision of the Feasibility Study based on the results of the Pilot Study", which followed the Master Plan Study (M/P, from August of 1997 to March of 1998), which had the objectives of the selection of the priority projects and the Feasibility Study of the priority projects and selection of the project areas of the Pilot Study (from March of 1998 to October). The reports for the Study on the Agricultural Development in the Regions II and IV on the Pacific Coast of the Republic of Nicaragua (M/P Report) and Strengthening Project for the Seeds Center (Final Report for F/S), were already submitted to the Government of Nicaragua in October, 1998 and in January, 1999, respectively.

Phase	Studies	Objective	Period	Submitted Reports
Phase I	Master Plan Study (M/P)	Selection of priority projects	From August 1997 to March 1998	Study on Agricultural Development for the Region II and IV in the Pacific Coast in the Republic of Nicaragua (P/M Report): October 1998
Phase II	Feasibility Study (F/S)	Feasibility study of the priority projects and the selection of the project areas for the pilot study (P/S)	From March 1998 to October 1998	Draft Final Report on the Study on Agricultural Development for the Region II and IV in the Pacific Coast in the Republic of Nicaragua (Feasibility Study): October 1998 Strengthening Project for Seed Center (Final Report for F/S): January 1999
Phase III	Pilot Study and Revision of F/S	Pilot study and revision of F/S based on the results of the pilot study	From October 1998 to June 2000	Monitoring Report for Pilot Study (1), (2), (3) and (4): from January 1999 to May 2000 Areas of Telica and El Espino (Final Report for F/A): June 2000

1.2 Objectives of the Study

The objectives of the Study are as follows:

(1) Carry out the Feasibility Study for the three selected projects through the results of the M/P Study concerning the agricultural development project which puts emphasis on the support for the small-scale farmers in Regions II and IV located on the coast of the Pacific Ocean.

(2) To promote the farmers' association Pilot Study area to show the validity of the Agricultural Development Project implemented with the participation of the farmers' associations.

(3) To carry out the technological transfer to the Nicaraguan counterparts concerning the methodology and planning guidelines to be applied for the formulation of the Project.

1.3 Selection Process of the Target Areas of the Study

In the M/P Study, the following 23 projects were formulated: Development Models (4 projects), Irrigation (3), Roads Rehabilitation (1), Seeds Production (1), Experimental Farm (1), Strengthening of Extension Services (1), Livestock (2), Commercialization (1), Agricultural Credit (1), Farmers Organizations (4) and Environmental Protection (3).

As these 23 projects are interrelated with an aim to improve the living conditions of the small and medium scale farmers and hence, it can be said that all of them are important. However, those deemed to be urgent must be executed first, as they will become the foundation of the regional development. Therefore, the following criteria was formulated in order to select those with a high priority:

1. The project must be the foundation for the development of the region
2. The project must improve the living conditions of the small and medium scale farmers
3. The project must take short time for implementation
4. The project must have direct effects in the short term
5. The project must provide immediate benefits to the small and medium scale farmers
6. The project must be worth itself even if considered separately
7. The project must be worth for feasibility study
8. The project must contribute to the improvement of the skills and abilities of the executing organizations
9. The project must be implemented at a lower economic cost

Based on the above-mentioned criteria, three (3) top priority projects were selected. The feasibility study for these projects is considered to be the first step towards the implementation of the Master Plan. The selected areas were those included in Regions II and IV as the Master Plan covers those regions.

Name of the Project	Summary of the Project
Telica Development Model Project (Region II)	Formulation of the Master Plan and its implementation for integrated development, which includes the improvement of the irrigation system using the Telica rivers as a water source.
El Espino Development Model Project (Region II)	Formulation of the Master Plan and its implementation for integrated development, which includes the improvement of the irrigation system using the newly dug wells as water sources.
Supporting Project for CESASUR (Region IV)	Strengthening of the existing Seeds Center in charge of production, selection and inspection of improved seeds for basic grains and vegetables.

From these three projects, the Supporting Project for CESASUR, contrary to the other two remaining did not require a follow up study, and it needed to be executed with urgency, hence it was carried out separately from the other two development model projects and the report was submitted in January, 1999.

1.4 Study Areas

The development model projects will be implemented in the Telica and El Espino areas, which belong to Region II; the supporting project for CESASUR belongs to Region IV. The Telica area is situated about 10 km from the city of León and has not only a good access to that markets but also has flat and fertile lands suitable for agriculture. Ground water is the actual source for irrigation. The project will utilize surface water from the Telica River as a source of irrigation water.

The El Espino area is located about 8 km from the main road that joins Telica with El Jicaral. This area has topography characterized by a smooth relief and is threatened by soil erosion caused by deforestation. The area has three irrigation wells but they do not have pumps so irrigation can not be carried out. The project will contribute for the agricultural development in the area by reintroducing the irrigation system by means of newly constructed wells.

For the P/S, an area of 20 to 30 ha was selected in Telica and in El Espino, respectively, where the P/S activities were carried out during 18 months with the participation of the organized farmers, organisations of the C/P and the Study Team.

1.5 Scope of the Study

The main topics of investigation for the present Study are those indicated in Table 1-1 and the scope covers from the execution of the P/S in four stages, its monitoring, the preparation of the Draft Final Report for the F/S based on the results of the previous studies and the preparation of the Final Report based on the revision of its draft.

Table 1-1 The Main Topics of Investigation

Year	Process			Item for Study
1998	Phase I	Field Study 1	Preparation of the Study / Meetings	Explanation and consultation meetings on the Inception Report
				Meetings on technological transfer and guidelines on training and elaboration of program for technological transfer
			Master Plan Study	Collection and compilation of existing data and information and review of related projects
				Field study (analysis of actual conditions)
				Farmers' conditions study (through sub-contract)
				Water quality analysis (through sub-contract)
				Study of the development potential and constraints
				Integrated approach on the basic development concepts
				Execution of Initial Environmental Examination
				Discussion and setting up of selection criteria for priority projects
				Discussion and preparation of Progress Report
		Works in Japan 1	Arrangement of results of study in Nicaragua / Preparation of Report	Arrangement of the results of the Phase I Field Study
				Analysis and arrangement of the results of the Field Study of Phase I
				Formulation of Master Plan
				Preparation of Draft of Master Plan Report
1999	Phase II	Field Study 2	Study on the Priority Projects	Topographic survey
				Explanation and discussion on the Draft of the Master Plan Report
				Detailed study of the priority projects
				Decision on the priority projects
				Selection of the Pilot Study areas
				Discussion and elaboration of the Progress Report
		Works in Japan 2	Arrangement of the results of the Field Study	Report on the results of the Phase II Field Study
				Analysis and arrangement of results of the Phase II Field Study
				Preparation of the priority projects
				Agricultural development project for the Pilot Study areas
				Evaluation of the project and recommendations
				Preparation of the Master Plan Report and Draft of the Final Report
	Phase III	Field Study 3	Presentation of the Report and Start of the Pilot Study	Explanation of the Draft of the Final Report and the projects of the Pilot Study
				Execution of the projects of the Pilot Study-1
				Explanation and discussion on the Monitoring Report-1
2000		Field Study 4	Pilot Study	Execution of the projects of the Pilot Study-2
				Explanation and discussion on the Monitoring Report-2
		Field Study 5		Execution of the projects of the Pilot Study-3
				Explanation and discussion on the Monitoring Report-3
		Works in Japan 3	Elaboration of the Draft Final Report	Recapitulación del Estudio Piloto (1)
				Preparation of the Draft Final Report
		Field Study 9	Termination of the Pilot Study	Explanation of the Draft Final Report
				Execution of the projects of the Pilot Study-4
				Analysis, arrangement and discussion of Pilot Study
				Organization of the Seminar
		Works in Japan 5	Elaboration of the Final Report	Reflejar en el Borrador del Informe Final los Resultados del Estudio Piloto y los Comentarios Finales del Gobierno Nicaragüense
				Elaboration and presentation of the Final Report

CHAPTER 2

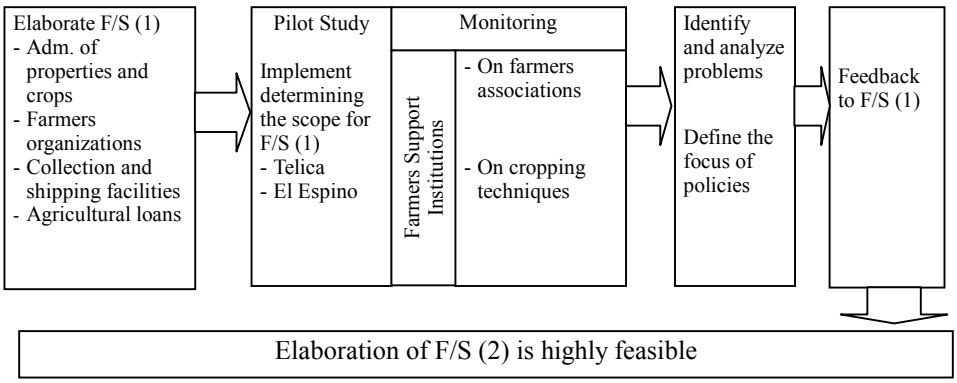
PILOT STUDY

CHAPTER 2 PILOT STUDY

2.1 Objectives of the Pilot Study

Through the elaboration of the Agricultural Development Master Plan with priority to support Small-scale Farmers for the regions II and IV, carried out from August 1997 to March, 1998, Project for the Agricultural Development Model in El Espino and Telica was considered as the priority project for the Feasibility Study (F/S). From March to October, 1998, the F/S was carried out in these two areas. Later on, the Pilot Study (P/S) was carried out from October, 1998 to May, 2000 with the objective to increase the precision of the F/S, through the concrete organization of the farmers in these two areas and to demonstrate the Project for the Agricultural Development Model. At the same time, it establishes the guidelines of the development plan in case similar projects are carried out in Nicaragua. This Study was executed in the two selected areas, with an extension of 20 to 30 hectares, respectively.

El Espino is characterized because the average area of the agricultural land in each property is four times larger than the properties of Telica, but regarding market accessibility, land classification, access to irrigation water, etc., El Espino is under less favorable conditions than Telica. In spite of smaller area, the agricultural land in Telica is more fertile and has good water availability for irrigation, besides having a more favorable accessibility to the markets. However, even though it has been the focus of support from different NGOs, up to now it has not been able to establish its autonomy. These two areas are not atypical in the Nicaraguan Pacific Coast region, representing districts with relatively high (Telica) and low (El Espino) potential for agricultural development. (For further details on the current conditions for both areas, see "Current Conditions of the Areas" in the Agricultural Development Model Chapter).



2.2 Generalities of the Plan for the Pilot Study

2.2.1 Participants in the Pilot Study

The participants for the P/S are divided into three (3) groups. The first is constituted by the farmers who will form the farmer's association in the objective areas and will carry out the agricultural production, the second is formed by the administration institutions, i.e., MAG-FOR and INTA and the third one by the JICA Study Team.

The number of participating properties was defined as approximately fifteen (15) families per area, which was estimated as the suitable number to monitor the standard operation of the farmers association in charge of the collective handling of the irrigation facilities, gathering

activities and collective shipment, etc. The time limitation was also taken into consideration, as well as the limited number of technicians available from the Nicaraguan counterpart organizations and the Japanese Study Team. The complete selection process is described as follows. It should be noted that the selection of the objective Study Areas and the participating farmers was a parallel process and the results are shown in section 2.2.2.

- El Espino: There are 57 properties in El Espino. The participants were selected from those who were willing to participate in the P/S, they were first interviewed to know their way of thinking regarding agriculture, own land availability, family labor force, distance from the house to the site, etc. At the end, 14 families were selected. It should be remembered that the three landowners in the P/S site were included from the beginning as participants. It was determined to divide their lands in 14 irrigation blocks and to sign a lease contract with the other participants. The land required for the access roads on the proposed sites to construct the wells would be offered to MAG-FOR.

- Telica: Since there were already wells in this district and rural associations using them, it was decided to select them as participants of the P/S. This was also done to see the difference with El Espino where a new farmers' association had been formed. From the four existing wells, two are subject to the intervention from other support organizations, therefore the rural users' groups for the two remaining wells were taken into consideration. From these two, one was operating the irrigation system and the association, while the other one was damaged requiring a high repairing cost for the P/S. Taking into account this economic factor, as well as the coherence with El Espino, it was decided to select the peasants from the rural user group of the first well. These are 13 properties.

When proceeding to organize the selected farmers, a seminar was conducted for the counterpart members of MAG-FOR, who were in charge of the topic. The seminar lasted for two weeks, and it consisted on analyzing the functions of the rural association, a structure in accordance with each function, and the formation process of organizations. Later on, the officials of MAG-FOR visited El Espino and Telica, and explained to the local population the advantages and functions of being organized, through some debates, the organizational structure and the role of the participating farmers were defined. In this manner, the rural associations, which would become the P/S promoting entities, were formed.

It should be remembered that there were changes in the membership during the course of time.

Some farmers who could not adapt to the collective activities were excluded of the association, and others who were interested in participating joined. This way, in the phase P/S-2 they were 10 participating properties in El Espino, and 13 in Telica, and at the end there were 9 and 13 properties in El Espino and Telica, respectively.

Considering that the officials of MAG-FOR and INTA of Region II (Leon) are the ones in charge of P/S, an outline for the required support for both institutions in Managua, has been established.

2.2.2 Selection of the Objective Area in the Pilot Study

The objective area for the P/S in Telica was selected from the benefited areas of the existing irrigation systems. The criterion for the selection was the presence of an existing association of small-scale farmers, the possibility of using the existing irrigation facilities efficiently, the absence of other international support organisms, amongst others.

The objective area for the P/S in El Espino, on the other hand, was selected through the application of the following selection approach, mainly due to the lack of an exiting irrigation system and rural association.

- Area where the agricultural land for the small-scale farmers is concentrated;
- Area where the predominant land use is agriculture;
- Area with good accessibility so it can show the best effect as a demonstration field (along a road); and
- Area where farmers are united by common territorial ties.

2.2.3 Guidelines for the Pilot Study

The objective of the P/S is to increase the income of the farmers, and by doing this it will increase the autonomous development of the small-scale farmers. During the 18 months of duration the P/S, the aim was to change the environment surrounding the small-scale farmers: from a situation where they did not have anything, up to having a certain perspective toward the future. This is how the contents of the three steps of the study were defined:

Fist Stage	Launching stage for P/S: from the beginning of P/S to the first cultivation of corn and vegetables. Elaboration of instructions for MAG-FOR, INTA, Farmers and Study Team: this work includes the establishment of rural associations, the system of agricultural loans, clarification of the division of responsibilities, etc.
Second Stage	Initiative Stage for counterpart: cultivation of upland rice Execution of P/S through the meticulous advice to the farmers by MAG-FOR, INTA and Study Team experts.
Third Stage	Initiative Stage for rural associations (second cultivation of corn and vegetables) Execution of P/S by the farmers' initiative while MAG-FOR, INTA and Study Team are in charge of the required consulting and advice.

The P/S consisted mainly on the priority topics defined in the Agricultural Development Model: "Improvement of agricultural technology", "Improvement of the productive infrastructure", "Support for commercialization", "Access to agricultural credit" and the "Rural Associations", which are the promoting entities of the previous programs. Furthermore, in order to deeply understand the natural conditions of the two Study areas, the water level monitoring of the wells, which is the source for irrigation, was carried out.

In addition to the above items, the organizational capability of the officials of MAG-FOR and INTA was monitored, as well as the inter-institutional coordination, since they are the executing entity of the P/S for the project of improvement of the small and medium-scale farmers in Nicaragua.

2.2.4 Content of the Pilot Study

The plans related to the P/S were elaborated according to the basic guidelines of the Agricultural Development Model. These plans, which constitute the pillars of the Agricultural Development Model, are as follows: 1) Plan for Systematizing Rural Organization, 2) Formulation Plan for the Cultivation Pattern 3) Irrigation Plan, and 4) Processing and Commercialization Plan.

Table 2-1 shows a summary of each plan.

Table 2-1 Summary of Plans for P/S

Items	Telica	El Espino
1. Plan for Systematizing Rural Organization		
Activities and structure of rural associations	- Organize farmers in order to carry out intensive agriculture. - The association will be established by the collective work of the farmers, counterpart organizations and Study Team, through the diagnosis of the present situation of the farmers, analysis, elaboration and execution of the farmers' own initiative plan. - The activities will include: a) collection and collective shipping b) collective purchasing (inputs), and c) operation and maintenance of irrigation facilities.	
2. Formulation Plan for the Cultivation Pattern		
Selection of new crops and its basis	Corn and four vegetables were selected (watermelon, cabbage, pipian and bell pepper). In addition to the three vegetable crops proposed by the Study Team (watermelon, cabbage and bell pepper), pipian was proposed by the counterparts and added. - Corn: It is a major staple food, important for the population and it has market demand. The farmers of the area are familiar with the planting techniques and it is easy to be introduced. - Upland rice: It is a staple food for the population and is highly profitable. It is also feasible for the technical level of the farmers, who show a lot of interest in growing it. - Vegetables: Each selected crop has a high market demand and is profitable. The farmers have experience in planting the crops in their kitchen garden, except for cabbage, thus guaranteeing the technical feasibility of the introduction. Its demand is also high due to the closeness of large consumer markets, such as León and Chinandega. The farmers show a deep interest in starting this crop.	Upland rice, corn and three vegetable crops were selected (watermelon, cabbage y bell pepper). - Corn: Besides the reasons mentioned on the left, corn was selected to establish a base for self-supply in their own agricultural lands. - Upland rice: Besides the reasons mentioned on the left, the purpose is to establish a base for self-supply in their own agricultural land and to commercialize the excess after having polished it. - Vegetables: The three crops mentioned previously have a high market demand, and are also profitable. With the exception of cabbage, the farmers have experience in planting the other crops in their kitchen garden, guaranteeing the technical feasibility of the introduction. The area is approximately one hour away from Leon and Managua, which guarantees the potential as a production area after securing the means of access.
Cultivation Pattern	There were two harvests per year with an intensity of 200%. The farmers selected by their own will three out of the four alternative vegetable crops. Fist corn cropping: November 1997 First vegetable cropping: January 1998 First upland rice cropping: July 1998 Second corn cropping: November 1998 Second vegetable cropping: January 2000	

<table>
<tr><th>Items</th><th>Telica</th><th>El Espino</th></tr>
<tr><td>Proposed Method of Cultivation</td><td colspan="2">With the purpose of achieving an intensive cultivation, the irrigation system is introduced, which consist of underground water pumping. It is also necessary to introduce improved seeds and improved cultivation techniques for each item, and to carry out the rationalization of works in accordance with the new cultivation system, trying to carry out each work appropriately. The proposed method of cultivation was formulated according to the following guidelines, based on the conventional method in the areas of P/S:
1) As for the plowing and harrowing of soil, the system of contracting services will continue to be adopted and strengthened. The same system will be applied for tillage, with the use of animal force or tractors where it becomes possible to carry out a controlled operation.
2) The irrigation will be made by a sprinkler method. The irrigation rate will be 100% during dry season, while during rainy season it will be only complementary.
3) Furrow preparation, planting, weeding, fertilization, application of agrochemicals, harvesting, drying of the crop, transportation and other works will be made by means of contracting animal force or machinery, insofar as possible, and the rest will be made by human labor.
Telica: The harvest of upland rice will be made by renting the combined harvesters (provided by 2KR, of Japan). Poles, an organism, will commercialize the rice after the polishing.
El Espino: The upland rice will be harvested by human force, and the polishing will be made in the nearby facilities.
4) The labor force of the proposed cultivation system will consist basically of the family labor force.
5) Cabbages and bell pepper will be planted in a green house and transplanted, while the two remaining vegetable crops will be cultivated by direct planting.</td></tr>
<tr><td>Production Plan</td><td>For each property
<table>
<tr><th rowspan="2">Crop</th><th colspan="2">Area</th><th rowspan="2">Unit Yield (qq/Mz)</th><th rowspan="2">Total Prod. (qq)</th><th rowspan="2">Net Profit (C$)</th></tr>
<tr><th>Mz</th><th>%</th></tr>
<tr><td>Corn</td><td>20</td><td>38.5</td><td>80.0</td><td>2,240</td><td>6,667.4</td></tr>
<tr><td>Upland rice</td><td>26</td><td>50.0</td><td>50.0</td><td>1,820</td><td>14,755.0</td></tr>
<tr><td>Pipian</td><td>06</td><td>11.5</td><td>2,500.0</td><td>21,000</td><td>3,563.6</td></tr>
<tr><td>Water-melon</td><td>06</td><td>11.5</td><td>200.0</td><td>1,680</td><td>3,221.6</td></tr>
<tr><td>Bell Pepper</td><td>06</td><td>11.5</td><td>375.0</td><td>3,150</td><td>5,279.4</td></tr>
<tr><td>Cabbage</td><td>06</td><td>11.5</td><td>18,000.0</td><td>151,200</td><td>10,195.4</td></tr>
<tr><td>Total</td><td>52</td><td>100</td><td></td><td></td><td>43,682.3</td></tr>
</table>
Profit according to the combination of basic grains and vegetable:
Unit: C$
<table>
<tr><th>Combi-nation</th><th>Cost of Prod.</th><th>Gross Profit</th><th>Net Profit</th></tr>
<tr><td>A: Basic grains + cabbage</td><td>30,182</td><td>61,800</td><td>31,618</td></tr>
<tr><td>B: Basic grains + bell pepper</td><td>30,148</td><td>56,850</td><td>26,702</td></tr>
<tr><td>C: Basic grain + pipian</td><td>30,738</td><td>53,100</td><td>22,362</td></tr>
<tr><td>D: Basic grain +water-melon</td><td>30,808</td><td>52,800</td><td>21,992</td></tr>
</table>
Source: JICA Study Team</td><td>For each property
<table>
<tr><th rowspan="2">Crop</th><th colspan="2">Area</th><th rowspan="2">Unit Yield (qq/Mz)</th><th rowspan="2">Total Prod. (qq)</th><th rowspan="2">Net Profit (C$)</th></tr>
<tr><th>Mz</th><th>%</th></tr>
<tr><td>Corn</td><td>15</td><td>35.7</td><td>80.0</td><td>1,120</td><td>5,000.6</td></tr>
<tr><td>Upland rice</td><td>21</td><td>50.0</td><td>50.0</td><td>700</td><td>12,776.6</td></tr>
<tr><td>Pipian</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Water-melon</td><td>06</td><td>14.3</td><td>200.0</td><td>2,800</td><td>3,221.6</td></tr>
<tr><td>Bell Pepper</td><td>06</td><td>14.3</td><td>375.0</td><td>5,250</td><td>5,279.4</td></tr>
<tr><td>Cabbage</td><td>06</td><td>14.3</td><td>18,000.0</td><td>252,00</td><td>10,195.4</td></tr>
<tr><td>Total</td><td>42</td><td>100</td><td></td><td></td><td>36,473.5</td></tr>
</table>
Profit according to the combination of basic grains and vegetable:
Unit: C$
<table>
<tr><th>Combi-nation</th><th>Cost of Prod.</th><th>Gross Profit</th><th>Net Profit</th></tr>
<tr><td>A: Basic grains + cabbage</td><td>24,223</td><td>52,200</td><td>27,977</td></tr>
<tr><td>B: Basic grains + bell pepper</td><td>24,193</td><td>47,250</td><td>23,057</td></tr>
<tr><td>C: Basic grain +water-melon</td><td>22,201</td><td>43,200</td><td>20,999</td></tr>
</table>
Source: JICA Study Team</td></tr>
</table>

3. Irrigation Plan		
Irrigation Area	31.57ha (45.12Mz)	21.49ha (30.7Mz)
Methods	Sprinkler	
Irrigation Plan	- Spacing of sprinklers: 12m×18m - Mean discharge: 32.2 l/min - Operating pressure: 3.16 Kg/cm^2 - Irrigation intensity: 8.94 mm/hr - Irrigation time:4 .8 hr (peak) - Frequency per day: 4/day (peak) - Interval: 5 days	Same as left column
4. Processing and Commercialization Plan		
Use of Market Information	The cultivation of the vegetables will be carried out for the crops selected by each farmer. For this effect market information will be used, by way of selecting the crop of larger profitability and taking into account other conditions.	
Collective gathering and shipping of crops	The gathering and collective shipping provide an added value to the products. However, since the products and the cash go through the agricultural association, it is important to maintain equity in the organization and credibility from the producers. For this reason, it is considered difficult to carry out the gathering and collective shipping from the beginning of P/S, but rather this modality should be put into practice once the Study has entered into a stable stage. Only rice will be processed and commercialized, and since gathering and collective shipping brings great advantages, it should be done first. On the other hand, basic grains and other items that can adjust to the shipping season will be commercialized in the best period, in terms of price, using the market information.	

2.3 Monitoring Plan

2.3.1 Schedule of the Pilot Study

Monitoring the achievements and problems of the P/S plans was carried out based on the schedule of the cropping pattern, and property administration which is showed as follows:

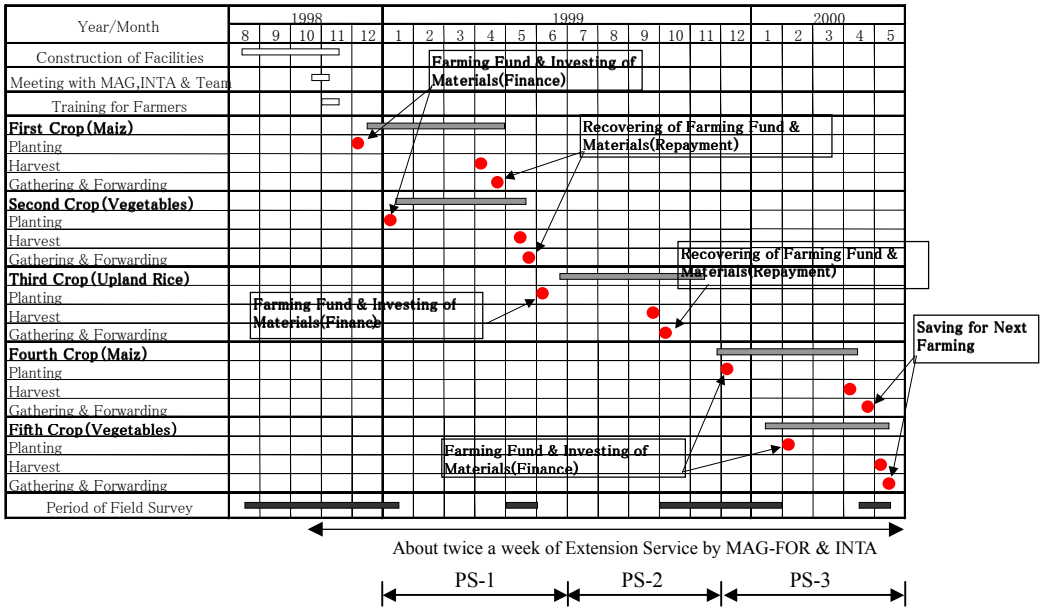


Figure 2-1 Schedule for Monitoring for P/S

The detailed monitoring plan has been elaborated in the initial stage of the third phase of the study in Nicaragua by the participating farmers of P/S, personnel of counterpart organizations and the Study Team, following the PCM (Project Cycle Management) Method.

2.3.2 Preparation of PDM (Project Design Matrix)

In order to evaluate the P/S, a new PDM was prepared, taking into account the contents of the execution of P/S untill now, reviewing the PDM prepared at the beginning of P/S (Table 2-2). The objectives, results, activities, etc. are planned according to the matrix. The monitoring items coincide with the ones in the PDM and the evaluation was done for each one of them.

Table 2-2 MDP of the Activities in the Pilot Study

Narrative Summary of the Project	Indicators	Means to Gather Data	Assumed Conditions
OVERALL OBJECTIVE Improve the living standard of the farm families	Savings, increase in education level and health		
OBJECTIVES OF THE PROJECT Increaseed income of farm families	Obtain the proposed agricultural income	Purchasing records of equipment and materials and sales, M/R (Monitoring Register)	There will not be a reduction of price in the products
RESULTS: 1. Making the rural organizations operational	Collective purchasing of inputs by the farmers, taking advantage of the agricultural credit system by the farmers.	Registry of collections and shipping (by property), activity registers of M/R	No occurrence of natural disasters. No climatic instability. No disease or uncontrolled plagues.
2. Intensive cultivation	Registry of operation and maintenance of the irrigation installations by farmer. Collective gathering and shipping by farmers. Democratic administration of the associations by the farmers. Achieve the projected yield through P/S.	Registry or operation and maintenance of installations, M/R Cash books of the organisms of agricultural credit, M/R M/R Registry of collection and shipping (by property)	
ACTIVITIES:	INPUTS		
1-1. Support from C/P to the rural associations. 1-2. Support from C/P to channel the credit contract between the farmers and the agricultural loan organisms. 1-3. According to the cultivation program, purchase the necessary equipment for the rural associations (collective purchasing). 1-4. Preparation and execution of the plan for operation and maintenance of the irrigation facilities by the farmers, with the support of C/P. 1-5. Preparation and execution of the shipping plan of the products by the rural associations, with the support of C/P.	<Japan> Personnel: Leader 3 M/M Adm. of properties and extension: 8 M/M Farmer's associations: 6 M/M Meteorology and Hydrology: 6 M/M	<Nicaragua> Personnel: MAG-FOR: 3 persons INTA: 6 persons	The farmers of the area will not oppose to the execution of the Project. No drastic mechanical damage will occur in the irrigation facilities.

2-1. Preparation of the cultivation plan according to the season, by C/P with the advice of the farmers. 2-2. Preparation, correction and execution of the guidelines for cultivation according to crops by C/P. 2-3. Calculation by C/P of the volume of equipment and materials to be invested on according to the cultivation plan. 2-4. Preparation by C/P of the training plan for farmers. 2-5. Implementation of training for farmers by C/P. 2-6. Technical support by C/P through the visits to the P/S site, twice a week. 2-7. Registration of activities for the farm management, by the farmers with the support of C/P. 2-8. Eliminate the remaining of the vegetables from the field by the farmers with the support of C/P. 2-9. Classification of the parcels, by the farmers with the support of C/P. 2-10. Irrigation before sowing, by the farmers, with the support of C/P. 2-11. Plowing of the fields, by the farmers with the support of C/P. 2-12. Sowing by the farmers, with the support of C/P (corn, vegetables, upland rice). 2-13. Greenhouse for vegetables plantlets by the farmers, with the support of C/P. 2-14. Transplant vegetables by the farmers, with the support of C/P. 2-15. Cultivation control by farmers, with the support of C/P. 2-16. Harvest by the farmers, with the support of C/P (in the case of rice, hulling, drying and polishing are included).	Equipment: Fund for required farmer's credit according to the administration plan of the properties (C$475,000) At beginning of P/S-1: C$395,000 At beginning of P/S-3: C$80,000 Transportation means necessary for the implementation of P/S, etc. Facilities: Irrigation facilities necessary for the execution of the P/S	Equipment: Transportation means necessary for the execution of P/S, etc. Facilities: None in particular	

2.4 Results of the Evaluation

2.4.1 Objective of the Evaluation

The Draft Final Report (1) submitted in October, 1998 was reviewed according to the results of the P/S in order to prove the effectiveness of the Project, and the Draft Final Report (2) will be prepared. The P/S is finished by May 2000, and although it is true that it has not yet been completed, the activities have culminated at least once up to now, considering that the fundamental problems of the execution of the P/S have been identified almost completely.

2.4.2 Items for the Evaluation of the Pilot Study

Just as indicated in the PDM (Table 2-2), the P/S was designed as follows: the proposed activities are carried out using the investments (personnel and materials, including the resources), which facilitated to the proposed results and thus achieving the objective.

Therefore, the evaluation should also be designed around the "objective", "investments", "activities" and "results". This is how the items and the contents of the evaluation were defined as shown in Table 2-3. In so far, the evaluation was made based on the results of P/S-2 (up to

March 2000), and included the analysis of P/S-3, including the corn and vegetable planting.

Table 2-3 Evaluation Design

Evaluation Items			Study Items	Means of Obtaining Information for the Evaluation
1. Achieving the objective	1-1	Achieving the objective of the Project	Up to what degree has the Project achieved its objectives?	Registers of purchases and sales, M/R
	1-2	Obtaining results	Were the rural associations able to be formed?	Register of activities and M/R
			Are the rural associations working?	Register of activities and M/R
			Has intensive cultivation taken place?	Register of activities and M/R
	1-3	Relationship cause-effect of the results and objective of the Project	How has achieving the formation of the rural organizations contributed (or prevented) to reach the Project objective?	Register of activities, M/R and minutes
			How has achieving the functions of the rural organizations contributed (or prevented) to reach the Project objective?	Register of activities, M/R and minutes
			How has achieving intensive cultivation contributed (or prevented to reach the Project objective?	Register of activities and M/R

Evaluation Items			Study Items	Means of Obtaining Information for the Evaluation
2. Efficiency	2	Efficiency of the investments	Has the investment of personnel been adequate quantitatively and qualitatively?	Register of activities and M/R
			Has the investment of materials (including resources) been adequate quantitatively and qualitatively?	Register of activities and M/R
			Has the operation and management been adequate so the investment can conduct to properly achieving the results?	Register of activities and minutes of periodical meetings
			Were the achieved results sufficient to justify the magnitude of the investments?	Register of activities and M/R

Evaluation Items			Study Items	Means of Obtaining Information for the Evaluation
3. Impact	3-1	Expected or forecasted impact	How much larger has the impact of the Project execution been against overall goal?	Register of activities and M/R
	3-2	Unexpected /unforeseen impact	Did the execution of the Project have any initial unexpected or unforeseen positive or negative impact?	Register of activities and M/R

Evaluation Items			Study Items	Means of Obtaining Information for the Evaluation
4. Relevance	4-1	Relevance of the objective and results	Is the overall goal, Project objective and results still valid as defined initially?	Register of activities and M/R
	4-2	Coherence with the need of the beneficiaries	Does the defined objective still respond to the needs of the beneficiaries at this moment?	Register of activities and M/R
	4-3	Relevance of the plan of activities	Have the plans been completely relevant?	Register of activities and M/R
			Has the capability of the C/P and the number of staff for the execution of the activities been sufficient?	Register of activities and M/R
			Has the capability and the number of farmers been enough for the execution of the activities?	Register of activities and M/R

Evaluation Items			Study Items	Means of Obtaining Information for the Evaluation
5. Economic Development	5-1	Financial point of view	Has the financial base which warranties the continuity of the P/S activities after finalizing the Project been secured?	Register of activities, M/R, INTA and MAG-FOR reports
			Will the farmers be able to continue the P/S with a loan from the financial institutions after finalizing the Project?	Register of activities and M/R
	5-2.	Technical point of view	Is it possible to continue the Project with the technical level of C/P?	Register of activities and M/R
			Do the farmers have enough technical knowledge to continue the production activities on their own?	Register of activities and M/R
	5-3	Management point of view	Is it possible to continue the Project between the P/S organizations and the rural organizations after finalizing the Project?	Register of activities and M/R

2.4.3 Results of the Evaluation

2.4.3.1 Achieving the Goals

(1) Achieving the Project Goals

a. Achievement

The objective of the Project as indicated in the PDM is "to increase the agricultural income" and the objective of the evaluation indicators is "to obtain the proposed agricultural income". At the moment, the participating farmers carry out agriculture mainly for self-supply and the objective is to reach the proposed yield according to the items indicated in Table 2-4, through the plan for intensive cultivation.

The total profit before the P/S had been -C$2,538, far from reaching the proposed amount of C$17,262, not being able to even cover the costs. If the data is observed according to the items, only the vegetables show profit, due to the high profit obtained by the bell pepper growers, while more than half of the growers had a negative profit. The actual cost of cultivation was approximately 23% lower than the proposed cost and therefore, in this aspect the objective was reached. On the other hand, the gross profit was hardly close to 42% of the proposed gain. As it was indicated in the predicted property income and expenses in Appendix 1, a surplus of C$9,662 had been planned as the balance of a representative property when concluding P/S-2 (November, 1999), which is the end of the harvest and selling period for rice.

However, the actual balance at the conclusion of P/S-2, showed a deficit of C$10,416. Similarly, a surplus was planned at the conclusion of P/S-1 (April, 1999), by the end of the harvesting and selling season of the first cultivation of corn and vegetable, but in fact a deficit was generated here, too. This was owed to the increased production cost of corn, vegetables and upland rice on both stages of P/S; therefore the cost was greater than the income, which translated as a constant increment of debts. Table 2-4 shows the proposed and actual income and expenses of a representative property during P/S, according to each item. In this case, a representative property is understood as one with 2Mz of farming land, 1.4Mz for the cultivation of corn and 0.6Mz for vegetables in P/S-1, and in the P/S-2 upland rice planted in 2.0Mz.

Table 2-4 Income and Expenses for Representative Properties according to Item - P/S

(Unit: C$)

Item	Area	Cost		Gross Income		Profit	
	Mz	Plan	Executed	Plan	Executed	Plan	Executed
Corn	1.4	7,887	7,316	10,080	4,271	2,193	-3,045
Vegetables	0.6	6,034	3,184	10,637	5,000	4,603	1,816
Upland rice	2.0	13,534	10,703	24,000	9,394	10,466	-1,309
Total	4.0	27,455	21,203	44,717	18,665	17,262	-2,538

As for the outcome according to the area, El Espino stands out for its low profitability, where none of the items has produced any profit and at the property level, only two growers earned profits by growing bell peppers. Telica, on the other side, has generated a profit in all the items, except for upland rice. Bell pepper in particular, has been extremely profitable, in as much as three out of the four properties earned a profit of about C$20,000. Although upland rice has not been profitable, more than half of the properties registered a surplus, which leads to think that if there had not been a drop in the prices, most of the properties would have enjoyed a profit. The balance of properties according to areas in Appendix 1 indicates that the amount of the debts of the producers in Telica have experienced a constant reduction in the selling season of the crops, which does not occur in El Espino, where on the contrary, the total amount of debt is increasing each month because the growers have to obtain another credit for the following season. Table 2-5 shows the actual income and expense of a representative property according to each item. In this case, a representative property means that it has 2Mz of cultivated land, 1.4Mz of corn and 0.6Mz of vegetables in P/S-1, and 2.0Mz of upland rice in P/S-2. Also, Figure 2-2 shows the distribution of income and expenses of the properties according to items.

Table 2-5 Income and Expenses for Representative Properties according to Area

(Unit: C$)

Item	Area	Cost		Gross Profit		Profit	
	(Mz)	Telica	El Espino	Telica	El Espino	Telica	El Espino
Corn	1.40	6,063	6,543	6,944	1,349	881	-5,194
Vegetables	0.60	2,915	3,466	12,860	1,489	9,945	-1,977
Upland rice	2.00	8,936	10,588	8,077	6,208	-859	-4,380
Total	4.00	17,914	20,597	27,881	9,046	9,967	-11,551

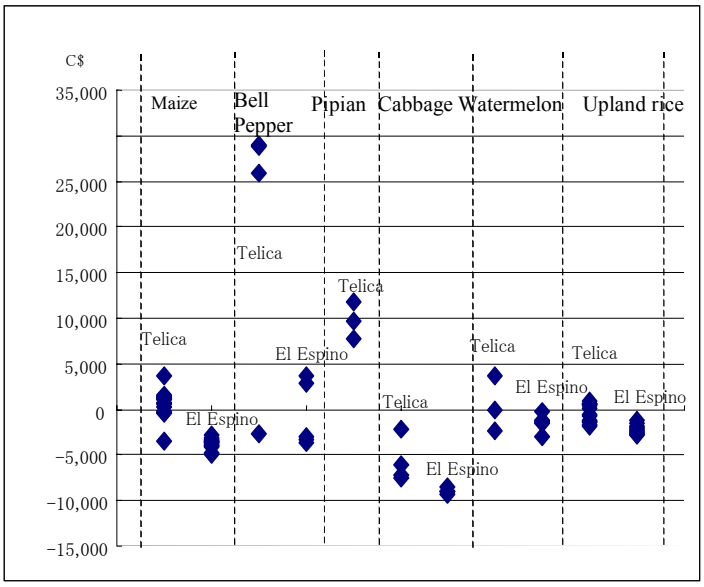


Figure 2-2 Achieved Profit according to Item and Zone

b. Evaluation

The causes for the lack of profit were that it was up against a proposed gross income of C$44,717, the actual income has only been C$18,665 which hardly corresponds to 42% of the proposed income. This situation is mainly owed to the low achievement of the two proposed results for the Project ("making the rural organizations operational" and "to carry out intensive cultivation", referred to further on) which was translated as a low yield, to which the occurance of natural disasters should be added, as well as the confusion in the rice and vegetable market. With exception of the low yield of each crop, the other causes can be interpreted as external conditions of P/S. Therefore, with the purpose to achieve the objective within the P/S framework and to increase the yield of each crop, discarding the external conditions, the analysis should be made deeper through feedback toward the P/S. On the other hand, the cost has been lower than the one proposed and this can be appreciated as a result of the efforts of reducing the cost inside the P/S.

Regarding the operation of the rural organizations, it cannot be said that the organizations formed in Telica and in El Espino have started to work. This is evident because it has not been possible to carry out the operation and maintenance of the irrigation facilities (only in Telica), neither the gathering collective shipment. It is true that in the aspects of collective purchasing and in the use of agricultural credit, the organizations have accomplished their task. But if we consider that there are two indispensable factors for the activities of the organizations, the "right" and the "obligation", both the collective purchasing and the use of the credit correspond to the right, and if the organizations were not able to "fulfill their obligations" including the operation and maintenance of the irrigation facilities by the farmers, then in general terms, the organizations did not carry out their functions fully.

If an evaluation is performed according to the areas, the profits at El Espino have been substantially inferior to those of Telica. Both areas have been subject to similar cultivation plans, support systems, quantitative and qualitative investments, and activities, and one cannot say that there were large differences in investments and activities of P/S, only very insignificant. This means that the main causes have been the lack of experiences and initiative of the participating farmers, the low fertility and the steep slope of the cultivating fields, the bad accessibility to the markets, amongst others, which as a whole prevented from generating high earnings in El Espino.

As for Telica, it is envisaged that the agricultural income will be increased once the external conditions have been improved (market recovery, etc.), and through the revision of the activities and investments plans of the P/S. The market price of rice has been less than 70% of the normal price. If the normal price had stayed the same, the profit of the upland rice would have been high, too. In the case of El Espino, it is difficult to increase the agricultural income in the present framework of P/S without correcting the problems mentioned above.

(2) Achieving results

The proposed results in the PDM were two: "making the rural organizations operational" and "to carry out intensive cultivation". The evaluation of the achievement of these two aspects is shown as follows:

-Making the rural organizations operational-

The evaluation indicators for this article were four: 1) Collective purchasing of the inputs by the farmers; 2) Use of the agricultural credit system by the farmers; 3) Operation and maintenance

of the irrigation facilities by the farmers, and; 4) Gathering and collective shipment by the farmers.

1) Collective purchasing of the inputs by the farmers

From the five evaluation indicators related with the rural organizations, the collective purchase of equipment and materials has been the indicator with the best results. The most important reason for this achievement was that the farmers do not have their own resources and they can only depend on the credit from agricultural financial organizations to obtain them to manage their property, but the requirement to obtain the credit was to carry out collective purchasing. Up to now three collective purchases were done: the first one had a strong support from the P/S and the Study Team, and the initiative of the producers has not been low. However, starting from the second purchase, they themselves assumed the entirety of the process. Even assumed the procedures for the financing contract of a private financial organizations (CEPRODEL), with the support of C/P. Although it is true that C/P and the Study Team should intervene up to a certain degree in the selection of the equipment to be purchased or in the price negotiation, it can be said that almost all the activities are carried out properly by the producers. This support from C/P to the farmers has facilitated the understanding of the procedures for collective purchasing, as well as for the use of the private credit system. In this sense, the initially proposed objective on the function of the rural organizations concerning the collective purchasing has been achieved.

2) Use of the agricultural credit system by the farmers

The administration of the agricultural credit was the responsibility of an NGO "CEPRODEL" that offers its services in the objective areas of P/S. The financing was only channeled for: 1) the purchase of equipment and agricultural materials, 2) expense for the contracting of agricultural services, and 3) expenses for fuel for the well pumps. A mechanism was established so that the resource for property managing is transferred directly from CEPRODEL to the suppliers, without having the farmers having to handle the cash. The financing requirements were the following:

Interest:	24% annual (2% monthly)
Period of loan:	6 months
Mortgage:	The products that are the object of the financing.

The procedure for the use of the obtained resources consisted of the following: the farmers request the warehouse for an estimate, and after obtaining the approval of the Study Team, C/P and CEPRODEL, they take a letter of payment to the corresponding warehouse for the amount sent by CEPRODEL, and finally they get the equipment and purchased materials. The advantage of this system is that the farmers cannot misuse the resources, and the disadvantage is that the procedures require time, preventing the beneficiary to respond to urgent necessities. This prevents the farmers who do not have enough resources from P/S, to have an appropriate control, for example, of diseases and plagues that need a treatment in an early stage. For this reason, in the Study Team's opinion, a fund of C$20,000 has been created for temporary loans. This fund can be used immediately, according to the decision of the Study Team or the C/P, then the beneficiaries will take care of the official procedures after having used the resources, and the loan is reimbursed to the fund through CEPRODEL.

To obtain the resources for property administration from a financial organization for agricultural credit, it is required to sign a contract between the farmer and the financial organization. In this case, it is very difficult for the farmers to understand the details of the contract document, and they need support. In the P/S it was necessary to take these steps immediately after the damages from hurricane Mitch occurred. At that time, the contract was signed between the farmers and the financial organization with the leadership of the Study Team. On the other hand, regularly

the obtaining of credits and the reimbursement of loans to the financial organisms is usually a difficult task to be assumed by the farmers, therefore the advice of C/P is indispensable.

The repayment of the loan gets more complicated when it is done through the rural association, because it requires an internal handling of resources, which constitutes a complicated step for the current capacity of the farmers. This also requires establishing a mutual trust relationship among the members. At such instance, in the P/S, the farmers manifested the desire to make the refund on an individual level. This also reflects their desire not to be controlled by a third person regarding their earnings. Also, the Study Team assumed that the obtained earnings differed from one property to another, and that the internal procedure of the calculation of the resources at this time is still complex for the capacity of the organization. Therefore, it was decided that the refund of the loan will be made at an individual level, and not through the group responsibility of the rural organization. However, the control of C/P was considered necessary, since when the entire right of refund of resources is attributed to an individual, some beneficiaries will not fulfill their obligation of reimbursement. In any event, there was the case of some farmers who absolutely refused to return the loan.

The system of agricultural credit was taken advantage of ambitiously, but the reimbursement has not been constant, which leads to think that the farmers have not taken appropriate advantage of the agricultural credit as a sustainable system. The main reason of the high requirement of the loan was that the farmers do not have the resources to assume the cost of acquisition of the inputs. As for the payment, the loan amounts not returned by P/S-1 and 2 were C$323,990 which translates to a low rate of refund of 40%. Among the causes for this situation were the low yield, the drop in the market prices of the agricultural products and other external conditions. The reimbursed amount for each item is lower than 50% of the amount proposed initially. If the data is analyzed according to each area, in Telica the amount reimbursed was C$147,225 and the amount borrowed in P/S-1 and 2 added to a total of C$229,634, with a refund rate of 64%. In El Espino on the other side, the loans granted between P/S-1 and 2 was C$302,020, of which only C$60,439 were returned, in other words, hardly 20%.

Table 2-6 Loans Granted to the Properties and Payment Status

Unit: C$

Areas	P/S-1			P/S-2		
	Credit	Paid	Balance	Credit	Paid	Balance
Telica	116,649	84,750	-31,899	112,985	62,475	-50,510
El Espino	169,676	27,271	-142,405	132,344	33,168	-99,176
Total of both areas	286,325	112,021	-174,304	245,329	95,643	-149,686

Table 2-7 shows a summary of the gross agricultural income and the amount of reimbursement for the agricultural loan according to each area. When comparing the gross income and the amount paid, it is observed that the gross income is not used entirely to refund the loan, and between the gross income and the amount returned there is a total balance of C$59,945 both for P/S-1 and 2. This conclusion was arrived at by analyzing the consolidated data of each area, but if one observes each property individually, only the farmers who obtained a good sale returned the entire amount of the loan, while those did not, returned it partially. On the other hand, the producers need at least C$500 monthly to subsist, and when the gross income does not allow a margin, it is impossible to return the complete amount. The area where there is a large difference between the amount returned and the gross income is Telica in the P/S-1. This is mainly owed to the bell pepper growers who enjoyed a very high gross income, in contrast with the cabbage growers who did not have any.

Table 2-7 Gross Agricultural Income and Reimbursement of Loans

Unit: C$

Areas	P/S-1			P/S-2		
	Gross Income	Amount Reimbursed	Balance	Gross Income	Amount Reimbursed	Balance
Telica	178,931	84,750	-94,181	89,250	62,475	-26,775
El Espino	44,159	27,271	-16,888	66,338	33,168	-33,170
Total of both areas	223,090	112,021	-111,069	155,588	95,643	-59,945

The procedures to obtain a contract for an agricultural credit and to reimburse the loans will continue requiring the support of C/P since it will be difficult for the farmers to assume them on their own. However, it cannot be said that the C/P personnel knows the mechanism of the system deeply either, which raises the need to extend the support through the experts or to carry out the preliminary training at the moment of implementing the Project.

3) Operation and maintenance of the irrigation facilities by the farmers

There is a great difference between Telica and El Espino concerning the capacity for operation and maintenance of the irrigation facilities. As it was indicated previously, the population of Telica was previously using the existing wells for irrigation at the beginning of the P/S, El Espino had to start from the installation of new wells. This implies that the population of Telica already had knowledge and experience regarding irrigation facilities, while El Espino had none. In spite that during the P/S numerous operation and maintenance problems of the irrigation facilities took place in both areas, the type of problems were very different from one another. A brief review is presented for each area:

- Telica

Since the population had previous experience in managing these facilities, there were hardly any serious problems in Telica. There were only numerous mechanical damages in the motor during the operation season due to the obsolescence of the facilities and to unexpected accidents. Regarding the administration of the organization, it was detected that some lands not included in the Plan were also being irrigated therefore the irrigation interval was longer than the proposed, affecting negatively the growth of the crop.

- El Espino

The problems identified in El Espino in connection to the operation of the irrigation facilities were structural (imbalance of the irrigation water volume, due to the use of different kinds of sprinklers) and mechanical problems of the generator for the motor, mainly because of human causes. These problems are classified into two types:

The first one is the lack of technique to operate the facilities. The inadequate handling of the operator caused ignition mishaps, battery breakage, fuel, filter, etc.

The second problem is the non-compliance of the irrigation plan, robbery of motor oil, inadequate control of the fuel, etc. All this is translated into the lack of cooperation spirit, which is an indispensable element in the administration of an organization. Due to these problems, the irrigation interval was prolonged too much, and even though they were able to harvest the crop, the impact on it was serious.

With the previously exposed, it can be concluded that in Telica, although some problems were detected in the operation of the facilities mainly due to its obsolescence, it was possible to reach the predetermined results concerning the operation and maintenance of the irrigation facilities. Meanwhile, in El Espino it is difficult to say that the appropriate operation and maintenance of

the facilities was achieved. There was a lack of the pertinent techniques and cooperative spirit of some producers (it should be noted that this situation in El Espino was corrected later on, through the substitution of participants who were uncooperative or had little initiative in the productive activities). It would be convenient to continue the support through the experts or to carry out the preliminary training at the moment of implementing the project.

4) Gathering and collective shipment by the farmers.

The gathering and collective shipment could only be carried out for rice in El Espino, and not for the other crops because the rice needs to be processed and the merchants prefer to carry out the transactions in big volumes. The main causes were the opposition from the farmers basically to carry out the gathering and collective shipment because they would not have the control of the resources and because the vegetables could not be sent to the market in large amounts.

Essentially, the gathering and collective shipment were carried out to reach certain benefits that are difficult to achieve individually, but this assumes that each producer has a high level of agricultural administration. In this sense, we can conclude that it is still early to implant this modality, except for the rice, which requires processing and where the merit of the gathering and collective shipment is quite clear.

Items	Gathering and collective shipment
Corn	Gathering and collective shipment was carried out partially for the consumption of fresh corn
Upland rice	Telica: It was not possible El Espino: It was possible for the total volume
Vegetables	It was not possible

-Intensive Cultivation will Take Place-

The evaluation is carried out by comparing the proposed and the actual yield as well as each one of the activities carried out to materialize intensive agriculture.

- Proposed Yield

(1) Achievement

The produced items for Telica and El Espino are limited, and the current yield is also differed. The following table indicates the yield for each item, proposed in the P/S and the actual yield reached by the implementation of the P/S.

Items		Actual (qq/Mz)		Proposed (qq/Mz)	Results of P/S (qq/Mz)	
		Telica	El Espino	Both areas	Telica	El Espino
Corn		19	8	56	46.30	19.77
Upland rice		63	-	56	58.40	42.10
Vegetables	Cabbage (unit)	-	-	12600	0	0
	Bell pepper (bag)	-	-	263	112	107
	Water-melon (dozen)	-	-	140	57	43
	Pipian	-	-	1750	1193	-

(*1: The data for the actual yield was obtained from the Office of Region II de MAG-FOR)
(*2: The projected yield for the Draft of F/S is defined as 70%)

(2) Evaluation

Regarding corn, it has been possible to obtain a yield that is more than twice of the current yield. In the case of the upland rice in Telica, the growth has been 93%, that is to say lower than the current one, but this was mainly owed to the lack of experience from the participating producers in P/S, in the cultivation of this crop.

Except for the upland rice in Telica, the proposed yield was not obtained in any of the items. The items with the largest difference among the proposed and the actual yield, were the corn in El Espino and the vegetables in both areas. The main causes were the unexpected confusion in the cabbage market and the propagation of diseases and plagues, a technical advice problem, and the farmers' lack of techniques to cultivate in both areas. If the situation is analyzed for each area, the sedimentation runoff from the floods onto the cultivation fields took place immediately before the P/S in the case of Telica, and the low productivity of the lands in the case of El Espino.

In general, the achievement of the proposed goals has been reduced. To increase the yield towards the goals, it is necessary to revise the current framework of the P/S, reanalyze the technical capacity of the farmers as well as of C/P and make a new evaluation of the content of activities.

Items		Increase (%) towards the actual yield		Achievement (%)	
		Telica	El Espino	Telica	El Espino
Corn		244	247	83	35
Upland rice		93	-	104	75
Vegetables	Cabbage (unit)	-	-	0	0
	Bell Pepper (bag)	-	-	43	41
	Water-melon (dozen)	-	-	41	31
	Pipian (dozen)	-	-	68	-

- Evaluation of each activity

A. Preparing the cultivation plan according to the season by C/P in consultation with the farmers

The plan for the first corn and vegetable cropping has been elaborated under the leadership of the Study Team, since the officials of C/P had to be in charge of the restoration of the hurricane Mitch damages. On the other hand, the second plan and subsequent cropping were elaborated in a combined work between C/P and the farmers, undergoing small readjustments by the Study Team. It should be mentioned that the cultivation plans become more and more precise.

B. Preparation, correction and execution of the guidelines for the crops, according to harvests by C/P

The guidelines were prepared based on the draft elaborated by the Study Team, which was subject to deliberations between the C/P personnel from INTA taking into account the environment of agricultural production, habitual techniques on both areas of the P/S, and the techniques recommended by INTA. During this process, the measures for the problems taking place during the execution of the P/S were incorporated appropriately in the guidelines, such as the low productivity of the lands

in El Espino, physiologic disorder of the vegetable cultivation, transplant procedures, etc. The C/P personnel from INTA carried out this modification work through the discussions with the Study Team, but a strong initiative was not observed in finding the solution of the problems. As for the cultivation guidelines, except for the need of analyzing the suitable volume of herbicide to be applied in some areas, are considered adequate. The proposed activities were carried out, although neither the initiative from the support entity was perceived nor the sense of responsibility from the farmers taking charge of the entirety of the project.

C. Calculation of the volume of equipment and materials to be invested according to the cultivation plan, by C/P

In the process of determining the guidelines for cropping, the required inputs were determined for each unit area (unit requirement). In P/S-1, because of lack of time, the Study Team was in charge of calculating the requirement of seeds, fertilizers, agrochemicals and materials. For P/S-2, the C/P personnel from INTA calculated the requirement of the inputs for corn and vegetables, based on the experiences of P/S-1. The C/P is qualified to calculate the volume of required inputs according to the cultivation plan, but it is recommended to extend assistance through the experts or previous training in the initial stage of the project.

D. Preparation of the plan for the farmers' training, by C/P

The C/P personnel assumed the analysis of the topics for the training oriented towards the participating producers based on the cultivation plan according to cycles, as well as the preparation of materials including the guidelines for the cultivation techniques and the execution of the training. Except for the previous training during the P/S-1, the C/P personnel from INTA took the initiative of carrying out the training and the practices in the cultivation fields through the on-the-job training (OJT). However, because of lack of preparation time, the training executed during the cultivation season was not on the topics and content in accordance with the technical level of farmers. Therefore, it is necessary to elaborate a properly structured training plan, fully taking into account the background and technical experience of the participating farmers in the initial phase of the project.

E. Execution of the farmers' training, by C/P

The preliminary training is given to the farmers immediately before the planting, the preparation and the execution for P/S-1 were assumed by the Study Team, and later on by C/P, at the beginning of P/S-2. The expert technical personnel carried out the practices in the cultivation fields during the plantation season. The farmers with less experience in the improved technology only listened and followed what it was said, without an active exchange of questions and answers.

The support entity, therefore, should study in the planning phase an effective methodology of training, incorporating the OJT (on-the-job training) factor on the structured topics, fully knowing the agricultural experience of the participating producers.

F. Technical support by C/P through the visits to the sites of P/S, twice a week

In accordance with the participating producers, the P/S was started with the predisposition that the C/P personnel will carry out two visits to the project sites to offer technical assistance. However, this was not accomplished, the visits were done only once a week, at different hours, staying only for a short time, which was reflected in the dissatisfied participating producers. The extension method was the T&V type recommended by the World Bank and adopted by INTA, which consists in the extensionists giving instructions to the representatives or leaders of the rural organizations who in turn transmit them to the members of their groups. This modality does not facilitate a flowing communication among the farmers who also showed dissatisfaction in this regard.

The C/P personnel has complete knowledge of the fundamental technology on basic grains on the level required to satisfy the farmers. However, since their experience in horticultural cropping is limited, it lead to the emission of mistaken instructions or preventing a timely assistance in unforeseen occurrences.

In the extension service, an important factor is the establishment of a trust relationship between the extensionists and the farmers, and to wake up their sense of responsibility and initiative. However, it cannot be said that in the P/S this type of extension service was provided. Among the causes is the time limitation of the C/P personnel, who had to fulfill the conventional extension service and the activities of the P/S, to which the lack of support as an organization is added. Therefore, to further implement the project, it is required to establish a solid system from the executing organization. At the same time, it is necessary to propose a new support mechanism for the farmers, incorporating the complementary participation of the government organization and the NGOs, in the training of the rural leaders in the cultivation topic.

G. Registry of works for crop management done by the farmers, with the support of C/P

It was agreed with C/P that the participating farmers would keep recordings of the materials and invested labor force, as well as of the control works carried out, and that the extensionists would transcribe them to the format distributed to the farmers for analyzing revenues and expenses, according to crops. After P/S-1, the producers who continued during P/S-2 to keep careful records were three in El Espino, and in Telica, all the properties except for one. The effects of the extensionists assistance from INTA in El Espino were insignificant. One can think that the causes could be the inadequate methodology of assistance on the part of the support entity, and the lack of conscience on the importance of these registrations, as well as illiteracy on the part of the farmers.

Therefore, it is necessary in the initial stage of the project, to outline the importance and meaning of keeping these records, to carry out OJT to the beneficiaries so that they are qualified in filling appropriately the formats in the early phase. Also, it is necessary to create the incentive for the practice explaining that it can facilitate them to channel a credit.

H. Elimination of the vegetable remains in the cultivation field, by the farmers with the support of C/P

During P/S-1 the crop was late because of the hurricane damages and the Study Team and the C/P had to instruct to the farmers to carry out the work in the least possible

time. In P/S-2 they were instructed to cultivate the land with the use of the disk plow after harvesting the upland rice, to reduce the hay in the cultivation fields in order to increase its productive capacity. A participating farmer of El Espino absolutely opposed to this instruction saying that he would not plow the field before the livestock would finish grazing. Therefore, it was decided to burn the hay and then to carry out the plowing, because the hay should be clear off before the beginning of the following plantation. Also in Telica, due to the delay of the crop, it was decided to burn the vegetable remains first, incorporating them into the land, since there was not enough time for them to be clear off naturally.

The dispute with some farmers reflects the lack of complete consent on the contents of the project through the extension service and at the time of creating the rural organization. This creates the necessity to strengthen the capacity of the extensionists, and to deepen the understanding of each of the farmers on the incentives of the project, its objectives and activities at the moment of forming the rural organizations.

I. Land ordinance by the farmers with the support of the C/P

The arrangement of the parcels was finished, although the C/P personnel carried out this work. The parcels in El Espino are defined for each farmer in the modality of a lease and therefore it was necessary to carry out the plot classification. On the other hand, in Telica it was also necessary to define the extent of each parcel to calculate the amount of credit for each property, since the agricultural loan is granted to a rural organization of the area. Initially, a topographical map of scale 1:2500 was used, but its data did not match with the actual area of each plot and a survey had to be done in the presence of each farmer.

This work should be carried out when creating a rural organization, by the organization of C/P that guarantees justness and neutrality, trusted by the farmers, since it impacts directly on the income of each property.

J. Preliminary irrigation for the farmers, with the support of C/P

The P/S intends to carry out three croppings, two of them during the dry season. The preliminary irrigation constitutes an extremely important job since it promotes the mixing of the seeds with the soil thus facilitating its germination. The sowing is done after raking and leveling the land. This activity was carried out in the form proposed initially, except in El Espino where there was a shortage of fuel in the sowing stage of the upland rice during P/S-2. However, although it is true that during P/S no serious problems occurred, the irrigation facilities presented structural damages either due to its obsolescence or because of lack of maintenance. It is important to carry out the training of the farmers in preventive and periodic maintenance in such a way that they can assume themselves the appropriate operation and maintenance. In the case of starting a project with an irrigation system using underground water, it is indispensable to carry out the training so that the beneficiaries fully assume the responsibility of maintaining the facilities.

K. Sowing by the farmers, with the support of the C/P (corn, vegetables, upland rice)

Regarding sowing, the expected results were not obtained. In the P/S-1, corn sowing in Telica was made mechanically with the use of tractors, while in El Espino, at the request of the farmers, it was carried out manually after making furrows with animal

force. The use of animal force neither guarantees the uniformity nor the efficiency of work, and since it required a longer time, it overlapped with the season of the preliminary irrigation. The soil covering was made using the conventional method, and because of the heterogeneity in soil water content in the soil, this was not done uniformly in some furrows. The germination rate of water-melon was low due to the depth of the seed, the soil entered into the holes during irrigation, and it was necessary to carry out a complementary sowing. As for cabbage, the germination was relatively uniform. The opposite happened with bell pepper due to the lack of the soil bed preparation and germination control. The causes other than the lack of the farmers' experience, were the lack of a meticulous service from C/P who could not offer the farmers a positive or negative judgment of the work performed by the farmers, causing a lack of uniformity in the row interval and plant density.

The technical assistance should not be solely verbal, because the farmers would have a difficult time to understand the extended instructions. It is indispensable to carry out the OJT in the field, applying a vision and methodology that would facilitate the understanding of the beneficiaries. Therefore, it is necessary to propose a new mechanism incorporating the services of NGOs, training the farming leaders' in cultivation aspects, etc.

L. Greenhouses for nursery of vegetables by the farmers, with the support of C/P

The crops for the greenhouses are cabbage and bell pepper. The watering in the seedbeds began with the use of drums and watering cans. The biggest problem that took place with the cabbage was the weed control, plagues and diseases. The extension workers could not offer an adequate technical assistance particularly in the control of Plutella xylostella (Linnaeus) for lack of knowledge on the seasonal variation of proliferation. The bell pepper germination has not been uniform, and an additional seedbed had to be prepared. The Study Team advised to cover the seedbeds with vegetable remains so that the germination would be uniform. The degree of weed control in the seedbeds differed according to the properties. Because of the lack of experience of the extension workers from INTA in horticultural cropping, it was not possible to provide a technically satisfactory training through OJT.

M. Vegetable transplanting by the farmers, with the support of C/P

The method of transplanting for cabbages imparted by INTA, was different to the guidelines elaborated at the beginning of the cultivation, and many plants wilted because of the damage suffered during transplanting. The same method was also imparted for bell pepper, but some properties carried out an appropriate transplanting obeying the guidelines, the same as for cabbage. These instructions were not given by the extension workers but by the experts, and in the future, when a new crop is introduced, it is necessary to analyze the techniques accumulated in the support organization, and if they do not exist, they should be supplemented somehow.

N. Crop cultivation by the farmers, with the support of C/P

Regarding corn, there was no problem since the farmers of both areas have enough experience with this crop, as well as INTA has enough accumulated techniques in basic grains. As for the horticultural crops, the extension workers lost the trust of the beneficiaries as a result of mistaken instructions. The producers did not complete the

proposed guidelines, plus there was a lack of manpower too, and on the whole it caused a low yield of crops. In summary, in the control of horticultural crops, the results were not satisfactory because of the lack of training of the extension workers from INTA and for the lack of experience from the farmers. As for the corn, on the contrary, the results were satisfactory because both the extension workers and the farmers had enough knowledge and experience, likewise in the case of the upland rice the control was adapted thanks to the accumulation of techniques from INTA.

For future projects, when a new crop is introduced and the support organism lacks demonstrative data, it would be advisable to discard it if experienced growers do not exist, because it is too risky. On the other hand, it is necessary to take into account the fact that the farmers do not want to obey the instructions of the extension workers from INTA, there is also ignorance of the relationship between suitable works and yield increase, so when introducing new items, it is necessary to create a demonstration field so the farmers can see the difference between the conventional and improved methods.

O. Harvest by the farmers, with the support of C/P (in the case of rice, it includes dehusking, drying and polishing).

The tasks related to the corn harvest did not present any major problems in the areas. As for pipian in Telica, this crop requires of a lot of manpower since the harvest period is very short and the commercial value of the products depends on its freshness. Some properties, due to the lack of family manpower, were forced to abandon a great part of their crop. The upland rice was harvested with the use of the harvesters in both areas, and in El Espino there was a high rate of loss because they used a universal type equipment, very obsolete, and were not able to adjust the speed appropriately. In general, it cannot be said that the crop was satisfactory, including the judging of the crop maturity. Therefore, in the future it is necessary to carry out a comprehensive evaluation of the maturity of the crops, reserve enough manpower ahead of time and have good quality agricultural equipment with enough anticipation in order to reduce crop losses.

(3) Cause and effect relationship of the results and objective of the Project

The items, in which the production cost was higher than the selling price, were cabbage from Telica, and most of the items from El Espino. All this leads us to think that the goal for the Project in this P/S has not been reached. The main causes were the reduced production against the proposed yield, and other external factors such as the abrupt drop in the prices of the agricultural products, natural disasters, etc. that impacted directly on the low agricultural income. Multiple internal problems of the growers' organizations were also perceived that did not contribute to the achievement of the objective.

On the other hand, there are also some positive factors such as the reduction of the acquisition cost of materials through the collective purchasing, and the comparatively larger production compared to the one they had before and even though this does not reflect an income increment, it offers conditions to continue increasing the agricultural rent once the favorable external conditions are given.

2.4.3.2 Yield

In this section the quantitative and qualitative suitability of the investments is evaluated in function of the objective and the results of the Project, with the exception of the investment of

human resources from Japan, since this is considered a preliminary requirement.

(1) Suitability of the investment of human resources

- Amount of human resources and season -
Three technicians participated from MAG-FOR and also three from INTA for the P/S, adding to a total of six people. Besides participating in the P/S, all of them were at the same time performing their regular job. The INTA technicians were in charge of the extension, carrying out two visits per week to the respective areas to offer technical assistance on cultivation. In the same way, the technicians from MAG-FOR were responsible of the rural organizations, providing advice through the opportune visits to the sites with a frequency of up to four times a week in the peak season. The extension services of INTA in other areas usually consist on one visit a week, and in the NGO projects of these areas the visits are made with the same frequency. Therefore, two visits a week in the case of the current P/S was considered appropriate if the examples of other projects are taken into account. Also the personnel assignment is considered adequate since it consisted of designating a permanent and exclusive person for two areas under one person responsible for the P/S from each institution.

Because of the flood damages caused by the hurricane Mitch right before the execution of the P/S, the officials of MAG-FOR and INTA were seriously prevented in participating in the preparation phase of the activities plan and in the mechanism for the agricultural credit at the beginning of the P/S, and the Study Team had to assume these tasks. This fact was translated in the delay of the C/P in understanding the methodology of work.

- Quality of the human resources -
The intention of this P/S was to implement a new agricultural system, different from the ones being practiced up to now by the small-scale farmers in Nicaragua. This posed the need for the C/P both from INTA and MAG-FOR, to develop extensionist incorporating new elements. Although it is true that the methodology worked during the stay of the Study Team, many problems occurred during their absence.

(2) Suitability of the investment of materials and resources

- Resources to administrate the properties -
At the beginning of the P/S a fund for agricultural resources in the amount of approximately C$400,000 had been created. However, because of the low refund rate, an additional C$70,000 had to be added to the fund before starting the third plantation of corn and vegetables. Besides the low yield of these items, the main cause for the deficit was that the fast increase of imports has overturned the rice market, temporarily disabling the farmers to sell their products.

- Irrigation Facilities -
New irrigation facilities were built in El Espino, and the existing ones in Telica were repaired. There is still water leakage from a section of pipes at the irrigation facilities in Telica affected by the floods and obsolete, but it continues to irrigate the area according to the plan.

-Means of transportation-
The C/P personnel use the motorcycles to access both areas. The gasoline shortage up to P/S-2 had prevented to offer the extension service in a constant rhythm, but this situation has been solved up to date. On the other hand, from Leon to El Espino, the distance is about 60 km in a straight line, and the trip by motorcycle takes around 2.5 hours one way, also constituting a restrictive factor for the activities.

(3) Administration and management

- Resources to administrate the properties -
A NGO has been put in charge of the administration of the agricultural resources, informing the balance to the Study Team. Up to now there has not been any problem with this system. However, the procedures usually take a long time and one cannot respond quickly to the urgent necessities, for example, when a proliferation of a plague or disease is detected. On the other hand, this fund has not covered the necessities of manpower recruiting, and the properties that did not have enough family labor force were not able to carry out the cultivation works fully. It will be necessary to create a contingency fund in the future, which can also respond in a more flexible manner to these necessities.

-Irrigation Facilities-
The mishaps on the irrigation facilities in Telica are very frequent. However, the main cause is the obsolescence of the structures, and not the wrong handling of the farmers. In El Espino, the operation and maintenance are not as good as in Telica, and although up to now there has not been a fatal structural damage, a breakage in the electric system (batteries, etc.) was detected. In this area the fuel was stolen and a double lock had to be put in the warehouse where the fuel is stored. Also, some producers borrowed fuel from others without previous consultation.

2.4.4 Impact

(1) Expected impact

Since the objective of the Project was not accomplished, the impact on the overall objective was insignificant and could not be perceived.

(2) Unexpected impact

There were some farmers who violated the regulations of the organization intolerably. They were expelled by the decision of the assembly of producers. And a delicate change is perceived in the human relationship of the area.

2.4.5 Relevance

(1) Relevance of the objectives and results

The objective of the Project "to increase the agricultural income" has been defined in such a way that it coincides with the focus of the National Plan of Development (1996-2000), the support of the Government policies in Nicaragua which is to combat the poverty through the reactivation of agricultural production.

At this moment, the Central Government invests through large efforts to reach the political objective of fighting poverty, but due to the limitation of the fiscal resources it can only implement some projects. Within this context, the present Project (plan) is conceived as an integrated plan to fight against poverty and its importance is fully recognized by the Government of Nicaragua.

(2) Coherence with the necessities of the beneficiaries

The farmers who are beneficiaries always want to increase their income, but they do not know what to do because of lack of information. The small-scale farmers due to the lack of technical

and economic capacity cannot escape from poverty. For this reason, the present Project has as an objective to increase the income of the small-scale farmers offering a complete menu of activities and is considered coherent with the necessities of the beneficiaries.

(3) Suitability of the plans

The two big components of the P/S are the farmers' organization and the improvement of the cultivation techniques. To increase the agricultural income of the small-scale farmers, it is necessary to organize them in order to improve their agricultural technical capacity so they can begin the intensive cultivation. The efforts at group level and not as individuals, simultaneously, would multiply the effects. Next, the suitability of the rural organization is evaluated and the materialization of the intensive cultivation. The evaluation also covers the observation task of the phreatic level of the well that constitutes the source of irrigation water in the nearest domestic well and was carried out parallel with the P/S.

- Farmers' organization

The small-scale farmers in Nicaragua, in general, work individually and their organizational knot is not very strong. This is a hindrance from benefiting from the few support programs that the Government is promoting at the moment. Also, it is a difficult task for each one of the farmers working independently to market relatively less quantity of produces from their small land holdings. Also the non-organized farmer has difficult access to the agricultural credit. All of these are concrete problems taking place when the small-scale farmers work by themselves, clearly reflecting the necessities to be organized. The fundamental objective of the organization is to strengthen small-scale farmers, and to prepare a base for their autonomous development through the shared information and mutual help amongst the members. Therefore, there is a need to organize farmers not only in this P/S but also in order for small Nicaraguan farmers to achieve a sustainable development.

It would be ideal that the farmers would take self-initiative to organize themselves. However, this is difficult, almost impossible for the small-scale Nicaraguan farmers to understand the incentives and the necessities of to be organized. A minimum support at least, is necessary in the motivation and creation phase of the organizations, as well as for the activities that begin after the creation. The P/S has established the support framework from the creation up to the administration of rural organizations, which as a plan has high suitability. Nonetheless, the intent of achieving the gathering and collective shipment was an activity that the members should have begun once the organization was able to settle an influence in the market, distribute the earnings, and strengthen the small-scale farmers, and the intent is considered to have been premature at this time.

- Materialization of the intensive cultivation

The production of the small Nicaraguan properties is basically for self-support and the cultivation is extensive with a low yield. Its access to the production resources is limited in comparison with the large and medium-scale farmers, making extremely difficult its transition toward production attending the market demand. In order to increase the income of the small-scale farmers and fight poverty, it requires to increase the productivity of the available lands, and to dedicate them to the cultivation of the demanded products for the market. For this task, it is indispensable to achieve intensive cultivation, through the improvement of the technical capacity and the productive infrastructures. The P/S has intended to give technical support to the beneficiaries in the cultivation topic, at the same time it is implementing the irrigation facilities, which as a plan is considered ideal. However, the necessity to improve some aspects of extension of the cultivation techniques is recognized, since a breach between the density or

the real technical level and the demand by the plan of activities of the P/S has frequently detected.

With the purpose of increasing the agricultural income, horticultural crops with relatively high profitability were selected. However, it was not possible to obtain the profitable yield of cabbage because of the failure to control the plagues. This item has been incorporated in the P/S because there was information that it was being cultivated in other areas, but the conclusion is that it has not been an appropriate item for the technical level of the farmers and extension workers. There should be a new analysis and selection of the crops to be introduced.

The P/S for the farming beneficiaries had been an intention of beginning a new form of property administration, and it turned out to be absolutely necessary to offer them the institutional technical support. Initially, in the framework of the P/S, this task was assigned in its entirety to the extension workers of INTA. However, technical extension demands a series of requirements going from the frequent contact with the farmers, up to the technical capacity of the extension workers. Therefore, from now on, besides the services of INTA, it will be necessary to incorporate another guideline of support through an NGO, training of leaders, etc. and to promote the mutual technical support among the farmers.

- Phreatic water level

The variation of the phreatic level in all the observed wells was within the proposed realm, and the plan of irrigation facilities did not generate any big problems in the surrounding areas. The irrigation well of El Espino registered a drop in the level of water of approx. 20 m during the pumping operation in the dry season. Since the plan had forecasted an approx. drop of 20 m during the pumping operation of maximum efficiency, it concludes that the results were good. The closest well for domestic use in this area is about 600 m on a straight line from the irrigation well, and no impact was observed here. The variation of the phreatic level in Telica has been extremely reduced: a maximum of approx. 4 m during the dry season which is lower to the predicted 6 m for the pumping operation of maximum efficiency. This is because in the P/S only half of the capacity of the available wells is being used. The closest well for domestic use in this area is about 200 m on a straight line from the irrigation well, and the variation of the phreatic level has been insignificant, in the order of 60 cm.

2.4.6 Autonomous Development

(1) Financial point of view

During the execution of the P/S there were two important external factors that caused a great reduction of the agricultural income. The income reduction of the small-scale farmers with a small economic capacity influences directly on the reduction of the agricultural credit fund. Indeed, the fund resources from the P/S were also scarce at times. Another factor preventing the achievement of the proposed increase is the lack of the technical capacity from farmers as well as from the organization of C/P. If the P/S intends to keep maintaining the same framework and the current technical capacity, it would be necessary to continue injecting resources to the agricultural credit fund, and financially, it should be recognized that this present framework would barely guarantee the autonomous development of the farmers.

(2) Technical point of view

The agricultural capacity of the beneficiaries has been strengthened through the P/S, likewise the support service from the C/P to the farmers. However, it cannot be said that the technical

level is enough to achieve an autonomous development, and it should continue offering further technical support.

(3) Organizational point of view

The P/S was executed with the participation of four actors: from the Nicaraguan side are the rural organizations, and MAG-FOR and INTA, which are the support institutions, and from the Japanese side is the Study Team. Each Nicaraguan part has his inherent problems, since the rural organizations have not yet achieved their autonomy and they require support for the following years. As for MAG-FOR and INTA, it cannot be said that there is a good coordination among the technical personnel between the Leon office and its respective headquarters in Managua. Indeed, during the P/S, many times the Study Team had to be in charge of coordinating the activities with the respective headquarters, and one of the tasks for the future is to improve the flow of information from the Leon office to the Managua offices. On the other hand, it is perceived that the priority of the P/S in the offices of Leon both in MAG-FOR and INTA, is not clearly defined, reflected in the fact that the technical personnel assigned for the P/S was affected by having to complete other tasks. For this reason, it is considered necessary to strengthen even more the technical support to the personnel assigned to the P/S, in the institutional environment.

2.4.7 Summary of the Evaluation Results

2.4.7.1 Rural Organization

The following facts were evidenced in connection with the rural organizations through the P/S:

The small-scale farmers of the Project Area have three large limitations: the financial capacity, technical level and the acreage of the agricultural lands. It is impossible for them to overcome these obstacles and achieve development, if they try to approach the task individually. On the other hand, the support institutions to the farmers such as MAG-FOR and INTA also have limitations in terms of human resources, budget, technical level, etc. In these circumstances, in order for the support organisms to offer an effective extension service, and for the small-scale farmers to accept the services they need, it becomes indispensable to create and strengthen the rural organizations as receiving entities of the services.

Besides the above mentioned, these organizations also play an important role in achieving the development of the area and overcoming the problem of the fragmentation of lands arising from the increase in population. However, just as it was evidenced in the P/S, among the small-scale farmers there are factors that block the formation and the normal development of the organization functions.

The small-scale farmers are ambitious to achieve an autonomous development: During the Sandinista Government and up to now, numerous international organizations and NGOs have been cooperating in the development of the small-scale farmers. The beneficiaries were those who were previously working at plantations and factories. Since in this scheme the employees were forced to obey their employer's orders, this population got used to receiving orders and not acting with own initiative.

The small-scale farmers do not want to pay their debts: The beneficiaries of the Sandinista Agrarian Reformation, were the former workers of the plantations and factories, with little knowledge of agriculture. The resources, materials and agricultural equipment that were lent to them up to now in large quantities has hardly been returned in their entirety. It is said that this

individualistic mentality of not paying the debt, not even the remaining or surplus, has its origin in the experiences of the Sandinista Government's period.

Dominance of individualism to protect their own interests: This means that many people do not live in an environment of collective life, in sociological terms. Usually, a member of society learns the rules of a collective life. However, many Nicaraguan small-scale farmers are atomized, not belonging to any rural community. Such is the case of El Espino, where the farmers are not aware of the social rules, and therefore they cannot comply with them. On the other hand, in the case of Telica, a social organization is being developed (although still immature), and relatively few problems took place on the organizational activities.

The plan for agricultural development in an area that presents this type of limiting factors, requires to take into account the following aspects in relation with the formation and functional invigoration of the rural organizations:

a) The farmers should decide the plan even if this process could be slow. If the technicians of the support organisms take the initiative, when the results are not good, the beneficiaries tend to attribute the responsibility to whoever took the initiative. The attitude of "thinking, making an effort and taking responsibility oneself of the results" is indispensable for the farmers that work at an individual level.

b) In order for the members to learn the social rules, it is necessary to define the activities to be developed when creating an organization, and at the same time, define the regulations that the members should obey and comply. This whole process should be assumed by the initiative of the participating farmers.

c) With the purpose of motivating the debtors to return the debt, it is necessary to take as mortgage their properties, etc. Although this is merely nominal, it can confirm the will of the participating producers of "stepping out of poverty, even having to risk the mortgage".

d) For the selection of the project areas, priority should be given to the socially mature communities. It would be especially convenient to have capable leaders who are able to control or who are really controlling the inhabitants of the community.

2.4.7.2 Cultivation

The process of the plan elaboration for the present P/S consisted on the following: under the initiative of the JICA Study Team and consulting the C/P personnel of MAG-FOR and INTA, the detailed plan of the P/S was elaborated for both areas based on the plan of F/S. In this process of deciding the details of the plan, the will of the participating producers of the P/S has not been fully reflected, but rather the Study Team and the support organizations who will not be the ones cultivating the lands elaborated and presented the plan, which was subjected to small adjustments to define the framework of the tasks for the participating farmers. Through the execution of the P/S, which was started within this framework, the following facts related with the cultivation and extension were manifested.

Selection of new crops and the capacity of the farmers: The new items to be introduced were selected through an integrated analysis of the results from the technical study of individual properties carried out during the F/S, as well as the information obtained by exemplary farmers, support organisms, NGOs, distributors of agricultural inputs and other related informants. However, all the farmers were familiarized with the cultivation technique of corn (basic grain),

as opposed to upland rice, where there was no previous experience in its production and the one on vegetables was limited (only cultivated in kitchen gardens). Consequently, the technical level of the farmers was not enough to begin the production by their own initiative, and except for the corn, they have had to be totally dependent on the technical assistance of the extensionists.

Technical level and the service method of the support organizations: From the new crops introduced through the P/S, cabbage was the only item that the office of INTA-A1 did not have experimental data of cultivation in the savanna area of the Pacific Coast. On the rest of the crops, the institution already had technical experiences such as organization, through field demonstrations or on experimental vegetable gardens. However, during the development of the P/S a series of diverse problems regarding technical assistance took place. Behind these problems there is a series of causes that are related to one another, such as the lack of experienced of extension workers that were in charge, the deficiency of the complete technical assistance system from the extension workers of INTA A-1 up to the upper management, the standardized extension system through the method of T&V to contact the farmers, the lack of coordination among the support organizations (MAG-FOR and INTA), and the passive behavior of the farmers.

These two points suggest important problems in the elaboration process of the future plans for agricultural development, having to carry out a careful analysis in the elaboration phase so that the project guarantees the autonomous development of the farmers.

a) The main characters of the implementation of an agricultural plan (introduction of new crops and new techniques, determination of the planting area, etc.) are the own beneficiaries. A plan elaborated by a third party for the entire service area, without fully taking into account the background and actual conditions around the administration of each benefited property and applying standardized approaches can cause negative reactions from the farmers. Therefore, it is necessary to study in the initial phase a methodology of regional agricultural planning which includes the individual cropping plans for each benefit elaborated around the traditional crops, and which simultaneously can awaken the initiative of the farmers.

b) The support services for the beneficiaries should be planned systematically taking into account the natural and social conditions of the service area, the agricultural experiences of the beneficiaries, and the situation of their properties. Concretely, it is necessary to study the system of a flexible agricultural credit that can respond to the needs of each benefited property, the creation of demonstrative fields that will serve as incentive for the farmers, a practice system in the properties so that the farmers can be empowered through developing the exchange of information among farmers, and the study of a systematic training plan for the farmers. The administrative institutions should offer the support services attributing priority to the activities of information exchange among farmers, and to their strengthening.

c) Also, a support system that could extend the services was mentioned previously in the above paragraph b) and requires to be studied.

2.4.7.3 Problems which were improved through the Pilot Study

It has been 15 months since the P/S began so far, during this period three sowings and two harvests took place. The counterpart organizations (MAG-FOR and INTA) and the farmers should have completed their respective roles attributed within the framework of the P/S. There were multiple activities that could not be carried out in the initial stage of the Project, and which

the respective members were gradually assuming appropriately by experience.

Characters	Activities	Previous problems	Improvement
Farmers	Collective purchase (agrochemicals and fertilizers)	The purchase was made coordinating with the agricultural credit. The farmers knew the warehouses but they could not make the purchase by themselves since they did not know how to present an estimate nor the payment conditions. Since their level of cropping was not the one that the P/S demanded, they did not know what type of inputs to purchase	Through experience, the farmers were acquiring knowledge on the mechanisms for the agricultural credit, and now they can make their own purchases. However, they continue to need the support of C/P, since they still ignore the type of inputs that they should buy. However, it is perceived that they will eventually know ahead of time the inputs required in the routine agricultural works of their own crop.
	Collective purchase (gasoline and services)	Previously, the farmers could not contract the sale and purchase of gasoline because the transaction was through a credit, hence the first purchase required the support of a third party.	The farmers are already qualified to make purchases on their own without the need of the support from C/P, except for when a serious problem arises.
	Crop	For lack of experiences, the behavior of the farmers was very passive, depending too much of the extension workers.	The producers are relatively more active after P/S-1. The difference of the aggressiveness of the participants was reflected in the intensity of the cultivation control and, therefore, in the yield.
C/P	Purchase of goods and services	Initially, a purchase process was adopted designed by the Study Team and C/P that linked the purchase with the credit. However, the support to the farmers regarding this topic has not been sufficient because of time limitations, etc.	Presently, a high-priority support is provided.
	Technical assistance in the crops	A great communication breach existed between the support organizations and the beneficiaries regarding the service of technical assistance in cultivation.	In the P/S-2, when compared to P/S-1, there was less dissatisfaction from the farmers regarding technical support, and the communication among both parties was also improved.
	Selling the crop	The participating producers insisted on marketing their products individually, and very seldom the necessary quantity of crop for the commercialization in big lots would be met.	The C/P can look for and propose the favorable commercialization routes for the farmers. However, the proposal not always guarantees the expected results.
	Payment of the debts	At the beginning the C/P personnel didn't have a deep knowledge on the cost-benefit relation, agricultural credit procedures, etc. which hindered them to carry out the necessary analyses.	Now they are qualified to calculate and analyze the amount of the debt that the farmers can return from the earnings obtained in the sale of products.

2.4.7.4 Items for feedback in the Feasibility Study

The problems that were detected through the execution of the P/S and the items for feedback in F/S are as follows:

(1) Regarding rural organization

- The farmers had not fully understood the content of the Project at the moment when the rural organizations were formed. They were accustomed to receive orders but not to act on their own initiative, therefore it is necessary to make them understand in the initial stage of formation, the incentives and the objectives of the rural organization, as well as the activities to be developed.
- When forming an organization, it is necessary to define the activities to be developed, and at the same time, define the regulations that the members should obey and comply.

- When the project is starting, it is difficult to have the farmers act on their own initiative, requiring the support of C/P and Study Team in the procedures, for example, of purchasing materials and equipment.

(2) Regarding the cultivation techniques for the producers

- It is not pertinent to introduce new crops for those farmers without any agricultural experience, because it is very risky, except when the support organizations have demonstrative cultivation data and only if they have considered feasible to offer enough technical assistance. It is necessary to make a new revision of the crops to be introduced.

(3) Regarding extension on the cultivation techniques

- Technical extension demands a series of requirements, from the frequent contact with the farmers, to the technical capacity of the extension workers. Therefore, from now on, it is necessary to establish a new framework regarding extension on cultivation techniques incorporating other support methods, besides INTA's services, for example, through NGOs, training of leaders, etc. and to promote mutual technical cooperation amongst farmers.
- It is not pertinent to introduce new crops when the support organisms lack demonstrative data since it is very risky, except for when the agricultural beneficiaries have enough techniques to introduce them.
- In the case of beginning the production of new crops, it is necessary to study a method to extend the pertinent techniques through the creation of demonstration fields for the farmers so they can see the difference between the conventional and the improved method, and at the same time analyze the techniques accumulated in the support organisms, and if they are non-existent they should supplement somehow.
- At the initial stage of the Project, it is necessary to outline the importance and the meaning of keeping the control records of the cultivation, to carry out OJT to the beneficiaries so that they are qualified to fill out the formats appropriately. Also, practice should be empowered, explaining to them that this can facilitate them to channel a credit.
- The organisms of C/P are qualified in calculating the volume of the equipment and materials to be invested on, according to the cultivation plan, but the support should be extended through the experts or through the preliminary training carried out when implementing a project.
- It is necessary to execute a systematic training plan oriented to the farmers according to their needs.

(4) Regarding the irrigation facilities

- When building the irrigation facilities, it is necessary to demand to the farmers to assume the cost and to take consciousness that it belongs to them.
- It is important to carry out the training of the farmers in preventive and periodic maintenance in such a way that the users can assume its adequate operation and maintenance. It is necessary to train the farmers in the initial stage of the project so that they fully assume the responsibility of maintaining the facilities.

(5) Regarding the distribution of goods

- The gathering and collective shipment are activities that the own farmers should begin once they have been able to influence the market, distributed the earnings, and have strengthened the small-scale farmers, and it is important not to incorporate this component at the initial phase of the execution of the project.

(6) Regarding the agricultural loans

- The agricultural credit was structured in such a way that the beneficiaries cannot use the loan for objectives other than the requested. The procedure has been complex for the farmers, but it was possible to avoid the problems of inadequate use of the granted resources. Therefore, the future projects should also adopt the same procedure, financing objectives, and other basic elements adopted in this P/S.
- To obtain the agricultural credit it is necessary to subscribe the corresponding contract ahead of time. During this stage the beneficiaries require support because it is difficult for them to understand the exact details of the contract. Also concerning the refund of the debts, it is extremely important to have the support of C/P in the initial phase of the project. However, the C/P lacks deep knowledge of the mechanism of the system, which poses the need to extend the support through experts or to carry out the preliminary training at the moment of implementing the project.
- The procedures usually take a long time and the farmer cannot respond quickly to the urgent needs. On the other hand, the fund created in this P/S did not cover the needs of labor recruiting and the properties without enough labor family could not fully take care of the cultivation works. For the future, it is necessary to create a flexible fund that can also respond to these needs.
- In the initial stage of the project, the agricultural income is usually lower than the proposed because neither the farmers nor the support organisms are familiarized with the new agricultural system. Natural disasters and the unfavorable conditions of the market can also affect income. The fund for agricultural credit should be planned with enough flexibility so it can respond to these contingencies.
- In order to motivate the debtors to pay the loan, it is necessary to take as mortgage the properties, etc.

(7) Regarding the Project in general

- The attitude of "thinking, making an effort and taking responsibility oneself of the results" is indispensable for the farmers that work at an individual level and therefore, the definitive plan of execution should be decided by the farmers themselves even though this process is slow.
- In the initial stage of the project, a specific cultivation plan for each beneficiary should be elaborated around the conventional crops, which at the same time would awaken the initiative of the farmers.
- It is necessary for the support entities to take conscience and full sense of responsibility that they are in charge of the entirety of the project. In the initial stage, it also requires to provide cooperation through experts to the technicians of C/P of INTA and MAG-FOR who offer extension services.
- The C/P personnel should offer the extension service and at the same time to fulfill the tasks of the P/S. It is necessary to recognize that time was extremely limited and the organizational support was not enough. It is necessary to propose a new support mechanism for the farmers incorporating the complementary participation of the government organizations and the NGOs.

- The definition of the area of the parcels for lease, is a task that impacts directly on the income of each property, and therefore, it should be carried out when creating a rural organization, by the organization of C/P guaranteeing the justness and neutrality, trusted by the farmers.
- The C/P personnel uses motorcycles to access the service areas that are usually far away taking a long time to reach. For example, in the case of the present P/S, it takes 2.5 hours to arrive to El Espino. This also constitutes a limiting factor for the activities, so the use of automobiles should be made possible.
- The accessibility of El Espino to the markets is very bad and regardless of how much production of new items takes place, the crop cannot be commercialized at the expected price. Under these conditions, one cannot expect a great impact of the project on the fight against poverty, considering pertinent to hope for the market conditions to change before executing the project. If in any event it were executed, it is necessary to improve the soil quality previously in order to increase its productivity.

Telica Area (1/4)

	Activities	Specific Activities	Evaluation (EP-I)	Evaluation (EP-II)	Evaluation (EP-III)	Remarks
1-1.	Support of P/C to the workshops held for formation of farmers' organizations	Participation of P/C in the workshops held for formation of farmers' organizations.	Good	Good	Good	
		To call and organize farmers' meetings under the initiative of P/C.	Good	Good	Good	
		Explanation of the basic functions of a farmers' organization and the need for and acheievement of a consensus.	Good	Good	Good	
		Explanation of the advantages of the groupal activities and the need for and achievement of a consensus.	Regular	Regular	Regular	The P/C staff that took part oin the training explained to the farmers participating in the P/S about the functions of the framers' organization. Through the P/S, the farmers understood the advantages of working together for collective purchase of equipment and materials and the management of the irrigation facilities. However, concerning the recollection and collective fowarding, the disadvantages were greater than the advantages, and the farmers tend to not to trust each other, specially on money matters. Then, the farmers did not participate.
		Formation of farmers' organizations shaping them according to the characteristics of each community.	Deficient	Deficient	Deficient	In the P/S, a model structure for the farmers' organization was studied and analyzed during the training of the P/C staff. Because an organization adopts an structure according to the needs of each farmers' group. The formation of an organization with a model structure created the impression among the participating farmers that this was something"imposed from the outside".
1-2.	Support from P/C to chanel the credit contract between the farmers and the organiztions in charge of granting agricultural credit.	Explanation by the P/C about the advantages of the credit method to the farmers.	Good	Good	Good	
		Obtaining the price quotations of equipment and materials to be purchased by the farmers.	Deficient	Good	Good	
		Negotiation by the farmers on the equipment and materials to be purchased.	Deficient	Regular	Regular	The farmers' organization of Telica made the price negotiation of equipment and materials to be purchased through their representatives. The farmers sometimes needed the support of the P/C to negotiate with the owner of the store.
		Correct following of all the procedures by the farmers and subcription of the financing contract.	Deficient	Good	Good	
		Cancellation of debts by the farmers under a organizational framework.	Deficient	Deficient	Deficient	In Telica, the repayment of the debt has been done by the farmers on an individual basis and the same mode was adopted in the P/S, and it was not possible to work it out through the farmers' organization.
1-3.	According to the cultivation plan, purchase of the required equipment by the farmers' organizations (collective purchase).	Preparation of the cultivation plan under the P/C	Deficient	Deficient	Deficient	The cultivation plan in the P/S has been mainly elaborated by the Study Team because the study period was short, about one year only.
		Preparation of the plan for equipment and materials according to the farm management plan under the initiative of the P/C.	Deficient	Deficient	Deficient	As in the item above, the purchase plan for equipment and materials has been mainly done by the Study Team.
		Purchase of the equipment and materials following the purchase plan by the farmers.	Deficient	Good	Good	
		Transport of equipment and materials purchased through the farmers' organization.	Deficient	Good	Good	
		Distribution of equipment and materials purchased to the farmers' organization	Regular	Good	Good	
		Achieve a democratic management of the organization concerning the activities related to the collective purchase.	Regular	Good	Good	
1-4.	Preparation and execution of the operation and maintenance plan for the irrigation facilities by the farmers with the support of the P/C.	Preparation of the management plan for the irrigation facilities under the initiative of the P/C.	Deficient	Deficient	Deficient	In Telica, the irrigation plan has been elaborated by the Study Team taking into consideration the irrigation method that had been adopted in the past.
		Purchase of the fuel according to the management plan for the facilities.	Good	Good	Good	
		Irrigating according to the management plan for the facilities.	Regular	Good	Good	
		Carrying out the maintenance of the facilities according to the management plan for the facilities.	Regular	Regular	Good	

Telica Area (2/4)

	Activities	Specific Activities	Evaluation (EP-I)	Evaluation (EP-II)	Evaluation (EP-III)	Remarks
		Democratic administration of the organization concerning the management of the irrigation facilities.	Good	Good	Good	In Telica, the farmers already had experience with irrigated agriculture before the P/S, and that is why the could manage the irrigation facilities within a democratic framework.
1-5.	Preparation and execution of the fowarding plan of the agricultural products by the farmers' organizations with the support of the P/C.	Forecast of the crops under the initiative of the P/C.	Regular	Regular	Regular	A crop forecast was done with the assistance of the P/C, but it was not accurate.
		Preparation of the recollection plan and fowarding of the agricultural products by the farmers based on the forecast.	Deficient	Regular	Deficient	The farmers could intervene in the process of fowarding and processing the rice. However, the support of the P/C was always necessary. Concerning the sale of the vegetables, because the farmers sold the production to the interemediaries on an individual basis, the plan for collective recollection was not necessary.
		Study and definition of the commercialization chanels based on the forecast.	Regular	Regular	Regular	For the study and definition of the buyer of the products, the farmers needed the advice of the the P/C. In the P/S, they investigated by themselves which was the most convenient commercialization chanel . However, this was not based on how much they could actually harvest and, therefore, sell.
		Subceiption of the sale/buy contract of the crops between the farmers' organization and the buyers.	Regular	Regular	Good	
		Recollection and fowarding of the agricultural products through the farmers' organization.	Deficient	Regular	Deficient	The recollection and fowarding of the agricultural products through the farmers' organization has been done for only one part of the rice production but not for vegetables. This is because vegetables, compared to maize or rice, are difficult to recollect in big bundles once at a time. Vegetables need to be recollected several times per week and their wide variety makes the task even harder.
		Custody of the the sales' proceeds in an pre-established bank account.	Regular	Regular	Good	The rice has been sold at the far level after it has been polished, and that is the reason why the sale through the farmers' organization could not be controlled by using a single common bank account. The sale has been controlled by farmers on an individual basis, who cancelled their debts through the accountant of the organization. The repayment rate has been good.
		Calculation of the production cost per farm through the management and accounting section of the farmers' organization under the initiative of the P/C.	Deficient	Deficient	Deficient	The calculation of the production cost has been completely done by the P/C. At present, it is still difficult to expect that the farmers could do the calculation by themselves and it is necessary to provide support for this purpose.
		Calculation of the income and expenditures per farm made by the management and accounting section of the farmers' organization.	Deficient	Deficient	Deficient	Idem
		Distribution of the profits/dividends to each farm based on the calculated income and expenditures.	Deficient	Deficient	Deficient	The sale was done on an individual basis. Therefore, there was no profit or dividends distribution.
		Cancellation of debts based on the calculated income and expenditures.	Deficient	Deficient	Deficient	The sale was done on an individual basis. Therefore, the cancellation of the debts was not done through the organization.
		Democratric administration of the organization concerning the recollection and fowarding of the agriultural products.	Deficient	Deficient	Deficient	Concerning the cash management, including the sales, unfortunately it was not possible to achieve a democratic administratation. The reason why this problem occurred was that there was a lack of rules for the administration of the organization by the participants.
2-1.	Preparation of the cultivation plan according to the seasons by the P/C in consultation with the farmers.	Final definition of the crops to be cultivated by the P/C in consultation with the farmers.	Deficient	Deficient	Good	The crops to be cultivated had been established by the Study Team during the F/S at the moment of elaborating the basic plan for cultivation for the P/S for Telica.
		Final definition of the cultivation surface by crops by the P/C in concultation with the farmers.	Good	Good	Good	
2-2.	Preparation, correction and execution of the guidelines for cultivation according to crops by the P/C.	Preparation of the cultivation guidelines by crop by the P/C.	Deficient	Deficient	Regular	The basis for the guidelines for cultivation had been elaborated under the initiative of the Study Team. However, the guidelines for the P/S 3 were elaborated by the P/C introducing the ayote as a new crop.
		Revision and correction of the cultivation guidelines by crops by the P/C according to the existing knowledge and available experiences.	Regular	Regular	Regular	The modification of the guidelines for cultivation has been done by the P/C under the advice of the Study Team.

Telica Area (3/4)

	Activities	Specific Activities	Evaluation (EP-I)	Evaluation (EP-II)	Evaluation (EP-III)	Remarks
2-3.	Calculation of the volume of equipment and materials to invest according to the cultivation plan by P/C.	Calculation by the P/C of the equipment and materials requirements based on the cultivation plan.	Deficient	Good	Good	
2-4.	Preparation of the training plan of the farmers by the P/C.	Analysis of the topics and contents of the preliminar training by the P/C.	Deficient	Good	Good	
		Planning by P/C of the on-the-job training during the cultivation period.	Good	Good	Good	
2-5.	Execution of the training plan by the P/C.	Carrying out the preliminary training under the initiative of the P/C.	Deficient	Good	Good	
		Carrying out the preliminary training in the field by the P/C for each cultivation cycle.	Good	Good	Good	
2-6.	Provision of technical support by visits to the sites of the P/S twice a week by the P/C.	Two weekly visits to the P/S sites by the P/C.	Deficient	Deficient	Deficient	This was due to problems such as accident of the extension officer, participation in training courses, illeneses of the INTA staff, etc.
		Creation of a bond of trust between the farmers and the P/C through the technical assistance.	Regular	Regular	Regular	The error in diagnosing the growth of vegetables or on the instructions given about the management methods has created mistrust on the farmers' side.
		Obtaining the support of all the farmers by the participatory approach applied by the P/C.	Deficient	Deficient	Regular	The adopted method of Training and Visist (TV) has not allowed to keep a smooth communication between the P/C and the farmers, which resulted in discontent among the farmers.
2-7.	Recording of the works involved in crops management by the the farmers with the support of the P/C.	Advisory services by the P/C to the farmers to correctly record the activities for crop management.	Regular	Regular	Regular	The P/C staff did not succeed in making the farmers understand the importance of keeping a record of the activities carried out for farm management.
		Recording of the the farming works according to each crop and cultivation cycle by the farmers.	Regular	Regular	Regular	All the farmers, except one, keep records.
		Transcription by the P/C of the records made by the farmers in a pre-established income and expenditures format.	Deficient	Deficient	Deficient	The handwriting of the farmers is sometimes difficult to read and the extension officers do not have enough time to try to descipher what is written.
2-8.	Eliminate the vegetation leftover from the cultivation fields by the farmers with the support of the P/C.	Issuing of the instructions by the P/C to the farmers about the management of the vegetation leftover previous to the planning of the following cultivation cycle.	Regular	Regular	Regular	There was a gap between what the P/C staff said and what the farmers understood, and the information has not been spread enough.
		Elimination of the leftover from the farms by the farmers under the supervision of the the P/C.	Good	Regular	Regular	About this aspect, the information provided by the P/C was also not spread well enough and the farmers had to look for information by themselves.
2-9.	Carry out the demarcation of the land by the farmers with the support of the P/C.	Advisory services by the P/C to the farmers in a harmonious environment following the instructions issued by the P/C.	Good	Good	Good	
		Demarcation of the farms by the farmers in a harmonious environment following the instructions issued by the P/C.	Good	Regular	Good	
2-10.	Carry out the irrigation previous to the sowing by the farmerfs with the support of the P/C.	Advising to the farmers following the the cultivation plan.	Good		Good	
		Preliminar irrigation by the farmers within a cooperative scheme for the cultivation plan during the dry season.	Good		Good	
		Adequate management of the irrigation facilities by the farmers including the operation and maintenance in order to keep them permanently fit.	Regular	Regular	Regular	The facilities were obsolete and were not receiving adequate maintenance.
2-11.	Carry out the ploughing by the farmers with the support of the P/C.	Rent of tractors by the farmers with the advice of the P/C.	Regular	Good	Good	
		Coordination with the farmers and the supplier of the rental service about the level of work required , putting emphasis on the supervision in the field of the ploughing works.	Regular	Regular	Regular	Even though it is true that it was necessary to carry out a deep ploughing, there was no adequate supervision of the works and the staff of the P/C were not present on the days those works were carried out.

Telica Area (4/4)

	Activities	Specific Activities	Evaluation (EP-I)	Evaluation (EP-II)	Evaluation (EP-III)	Remarks
2-12.	Sowing by the farmers with the support of the P/C (maize, vegetables, rice)	Adequate sowing of the maize by the farmers under the supervision of the P/C.	Good		Good	
		Adequate sowing of the rice by the farmers under the supervision of the P/C.		Regular		The depth of the cultivation and the distance between the rice stalks have not been indicated in the guidelines for cultivation. A low rate of germination was observed.
		Dorect adequate sowing of the vegetables by the farmers under the supervision of the P/C.	Regular		Regular	The distance of planting the stalks and the depth of cultivation for watermelon have been different from those indicated in the guidelines for cultivation and germination was low.
		Adequate sowing of the transplanted plants by the farmers under the supervision of the P/C.	Regular		Good	Due to the lack of adequate mulch to avoid dryness on the surface around the transplanted plant, after the sowing of the chiltoma, the germination was not been uniform.
2-13.	Carry out the cultivation of the transplanted plants by the farmers with the support of the P/C.	Cleaning of the shrubs of thetransplanted plants under the supervision of the P/C.	Regular		Good	A difference in real availability of family labor and what is needed to achieve the expected production levels has been detected. There was not an adequate number of family members to work in a proper way.
		Plague and diseases control under the supervision of the P/C.	Regular		Good	It has not been possible to control the proliferation of the Plutella xylostella affecting cabbages. The reason is because the staff of the P/C did not have enough knowledge about the seasonal variation of the proliferation of this plage. Therefore, it was difficult to issue adequate instructions.
2-14.	Carry out the transplant of the vegetables by the farmers with the support of the P/C.	Adequate advising by the P/C to the farmers about the transplant.	Deficient		Good	The instructions of the P/C consisted in uprroting thetransplanted plants and submerge the roots in a chemical solution and carry out the transplant in the final cultivation field. This has lead to the withering of a high percentage of the plants.
		Adequate transplant by the farmers under the supervision of the P/C.	Regular		Good	The experimented farmers carried out the transplant by using a shovel without following the issued instructions. They avoided the damage to their plants.
2-15.	Carry out the control of cultivation practices by the farmer with the support of P/C.	Adequate technical assistance by the P/C to the farmers on cultivation of basic grains: maize.	Good			
		Adequate technical assistance by the P/C to the farmers on the cultivation of basic grains: rice.		Regular		The application of herbicides provoqued the phytotoxicity. This affected the level of production and, therefore, the revenues.
		Adequate technical assistance by the P/C to the farmers on the cultivation of vegetables: cabbage.	Deficient		–	INTA-1 did not have experience in the cultivation of cabbage and that is why they could not control the Plutella xylostella (Linnaeus) which destryed the whole crop.
		Adequate technical assistance by the P/C to the farmers on the cultivation of vegetables: watermelon.	Regular		Regular	The rottening of the fruit was caused by a lack of Ca, It was not possible to make the farmers fully understand the contribution of an adequate crop management to the increase of income. The farmers reacted very slowly and rthis affected their income level at the end.
		Adequate technical assistance by the P/C to the farmers on the cultivation of vegetables: chiltoma.	Regular		Regular	The rottening of the fruit was caused by a lack of Ca. Because the staff of the P/C could not provide a correct diagnosis, the farmers had to solve the problem by consulting with the owner of the store that sold them agricultural inputs. This created mistrust among the farmers on the technical capabilities of the staff of the P/C.
		Adequate technical assistance by the P/C to the farmers on the cultivation of vegetables: pipian.	Good		Regular	The prolifferation of the afido and white fly has provoqued a disease in the plants and affected the income received by the farmers.
2-16.	To carry out the harvesting by the farmers with the support of the P/C (in case of rice, it includes unhusking, drying and polishing)	Adequate technical assistance by the P/C to the farmers on timely harvesting and adequate methodology for harvesting maize.	Good		Good	
		Adequate technical assistance by the P/C to the farmers on timely harvesting and adequate methodology for harvesting rice.		Regular		The staff of the P/C were not present on the harvesting day decided by the farmers in accordance with the guidelines. This problem delayed the hiring of the harvester and, therefore, the harvesting di not took place at the optimal time.
		Adequate technical assistance by the P/C to the farmers on timely harvesting and adequate methodology for harvesting vegetables.	Good		Good	

El Espino Area (1/4)

	Activities	Specific Activities	Evaluation (PS-I)	Evaluation (PS-II)	Evaluation (PS-III)	Remarks
1-1.	Support of P/C to the workshops held for formation of farmers' organizations	Participation of P/C in the workshops held for formation of farmers' organizations.	Good	Good	Good	
		To call and organize farmers' meetings under the initiative of P/C.	Good	Good	Good	
		Explanation of the basic functions of a farmers' organization and the need for and acheievement of a consensus.	Good	Good	Good	
		Explanation of the advantages of the groupal activities and the need for and achievement of a consensus.	Deficient	Regular	Regular	The staff of the P/C that participated in the training, explained to the participating farmers of the P/S about the functions of the farmers' organization. However, it can not be a 100% sure that the farmers fully understood the activities of the organization, One of the factors that impede the understanding by the farmers ins the predominance of individualism (or, rather, selfishness).
		Formation of farmers' organizations shaping them according to the characteristics of each community.	Deficient	Deficient	Deficient	In the E/P model structure of farmers organization was analyzed and determined during the training of C/P personnel. Because an organization would take a structure in accordance with the requirements of each farmers groups, the formation of an organization with model structure had facilitated percepption from the part of participated farmers in such manner as "something imposed from outside".
1-2.	Support from P/C to chanel the credit contract between the farmers and the organiztions in charge of granting agricultural credit.	Explanation by the P/C about the advantages of the credit method to the farmers.	Good	Good	Good	
		Obtaining the price quotations of equipment and materials to be purchased by the farmers.	Deficient	Regular	Regular	Price quotations could not be obtained as expected because the store selling the inputs was located in Leon City and it is far from El Espino. The farmers did not wanted to cover the transportation cost.
		Negotiation by the farmers on the equipment and materials to be purchased.	Deficient	Deficient	Deficient	Concerning the purchase of the equipment and materials, the farmers of this zone had to depend too much on the P/C. As indicated before, this was mainly caused because the zone is located far from the market, but the organizational deficiency was another main cause.
		Correct following of all the procedures by the farmers and subcription of the financing contract.	Deficient	Regular	Good	
		Cancellation of debts by the farmers under a organizational framework.	Deficient	Regular	Deficient	Some farmers tried to ommercialize their products on an individual basis, like in the case of rice, but did not succeded because of the resistance put forward by the P/C and the tax office. Because the sale was made through the organization, the organization could control the sales (even though partially), and the repayment. The vegetables were wholly sold on a individual basis, and there has bee no repayment through the organization.
1-3.	According to the cultivation plan, purchase of the required equipment by the farmers' organizations (collective purchase).	Preparation of the cultivation plan under the P/C	Deficient	Deficient	Deficient	The cultivation plan in the P/S has been mainly elaborated by the Study Team because the study period was short, about one year only.
		Preparation of the plan for equipment and materials according to the farm management plan under the initiative of the P/C.	Deficient	Deficient	Deficient	As in the item above, the purchase plan for equipment and materials has been mainly done by the Study Team.
		Purchase of the equipment and materials following the purchase plan by the farmers.	Deficient	Regular	Regular	For the purchase of the equipment and materials, the farmers still needed the support of the P/C even in the P/S 2 because of the deficiency of the working of the organization and the distance from the market. During the P/S3, the farmers could purchase the materials almost by themselves but still continued to have the support from the Study Team to get the price quotations, etc.
		Transport of equipment and materials purchased through the farmers' organization.	Deficient	Good	Good	
		Distribute the equipment and materials purchased by the farmers' organization.	Regular	Good	Good	
		Achieve a democratic management of the organization concerning the activities related to the collective purchase.	Regular	Regular	Regular	The farmers did not wanted to cooperate with the person in charge of making the purchase (in spite of being asked). There was a deficieny in the way how the organization was managed.
1-4.	Preparation and execution of the operation and maintenance plan for the irrigation facilities by the farmers with the support of the P/C.	Preparation of the management plan for the irrigation facilities under the initiative of the P/C.	Deficient	Deficient	Deficient	The irrigation plan had to be elaborated mainly by the Study Team because the P/C still did not have enough experience and capacity to make it; the topography of El Espino was also difficult.

El Espino Area (2/4)

	Activities	Specific Activities	Evaluation (PS-I)	Evaluación (PS-II)	Evaluation (PS-III)	Remarks
		Purchase of the fuel according to the management plan for the facilities.	Good	Good	Good	
		Irrigating according to the management plan for the facilities.	Regular	Regular	Regular	The farmer who had caused problems due to his selfishness during the P/S1 was expelled, but even in the P/S2, there were instances of stealing of fuel, not meeting the complementary irrigation schedule, etc. Therefore, it is concluded that the plan for the irrigation facilities was not met. In the same way, in the P/S3, the farmers did not want to irrigate their lands during the nights and, therfore, the proposed interval for irrigation of 5 days was prolongued to 8 days.
		Carrying out the maintenance of the facilities according to the management plan for the facilities.	Regular	Regular	Regular	Idem
		Democratic administration of the organization concerning the management of the irrigation facilities.	Deficient	Regular	Regular	In El Espino, it can not be said that the management of the irrigation facilities was carried out in a democratic way. In the P/S2, the situation was improvded after substituting the members, but even then this was not enough. In the P/S3, a farmer took out the tip of the sprinklers and to find a solution to this problem, many meetings were held but without finding a solution.
1-5.	Preparation and execution of the fowarding plan of the agricultural products by the farmers' organizations with the support of the P/C.	Forecast of the crops under the initiative of the P/C.	Regular	Regular	Regular	A crop forecast was done with the assistance of the P/C, but it was not accurate.
		Preparation of the recollection plan and fowarding of the agricultural products by the farmers based on the forecast.	Deficient	Deficient	Deficient	The farmers had to go and ask the P/C for support for fowarding of the products.
		Study and definition of the commercialization chanels based on the forecast.	Regular	Regular	Good	In the P/S1 and P/S2, the farmers required the support of the P/C for the study and definition of the commercialization chanel.
		Subceiption of the sale/buy contract of the crops between the farmers' organization and the buyers.	Regular	Regular	Good	Idem
		Recollection and fowarding of the agricultural products through the farmers' organization.	Deficient	Good	Deficient	The farmers strongly resisted carrying out the collective sale of the products through the farmers' organization. It was not possible to carry out the collective sale of the vegetables because the harvesting period is long and it was difficult to collect bvegetables in large amounts in one turn.
		Custody of the the sales' proceeds in an pre-established bank account.	Deficient	Regular	Deficient	In the P/S 2 a sales control was carried out through the farmers' organization, but a semi-imposed control had to be carried out by the P/C. In the P/S 3, the farmers had cancelled their individual debts, and it is necessary to keep on providing support on this topic.
		Calculation of the production cost per farm through the management and accounting section of the farmers' organization under the initiative of the P/C.	Deficient	Deficient	Deficient	The calculation of the production cost has been completely done by the P/C. At present, it is still difficult to expect that the farmers could do the calculation by themselves and it is necessary to provide support for this purpose.
		Calculation of the income and expenditures per farm made by the management and accounting section of the farmers' organization.	Deficient	Deficient	Deficient	Idem
		Distribution of the profits/dividends to each farm based on the calculated income and expenditures.	Deficient	Regular	Deficient	The sale was done on an individual basis. Therefore, there was no profit or dividends distribution.
		Cancellation of debts based on the calculated income and expenditures.	Deficient	Regular	Regular	The repayment rate has not been high enough.
		Democratric administration of the organization concerning the recollection and fowarding of the agriultural products.	Deficient	Deficient	Deficient	As mentioned before, in the P/S 2 it was possible to carry out the collective sale of the crops but in a semi-imposed way and not in a very democratic way. Some of the farmers at El Espino showed a fatal weakness that was that they put more importance to their individual interest rathet tham of the others or of the organization.
2-1.	Preparation of the cultivation plan according to the seasons by the P/C in consultation with the farmers.	Final definition of the crops to be cultivated by the P/C in consultation with the farmers.	Deficient	Deficient	Good	The crops to be cultivated had been established by the Study Team during the F/S at the moment of elaborating the basic plan for cultivation for the P/S for Telica.
		Final definition of the cultivation surface by crops by the P/C in concultation with the farmers.	Good	Good	Good	
2-2.	Preparation, correction and execution of the guidelines for cultivation according to crops by the P/C.	Preparation of the cultivation guidelines by crop by the P/C.	Deficient	Deficient	Deficient	The base of the guidelines has been elaborated under the initiative of the Study Team.

El Espino Area (3/4)

	Activities	Specific Activities	Evaluation (PS-I)	Evaluación (PS-II)	Evaluation (PS-III)	Remarks
		Revision and correction of the cultivation guidelines by crops by the P/C according to the existing knowledge and available experiences.	Regular	Regular	Regular	The modification of the guidelines for cultivation has been done by the P/C under the advice of the Study Team.
2-3.	Calculation of the volume of equipment and materials to invest according to the cultivation plan by P/C.	Calculation by the P/C of the equipment and materials requirements based on the cultivation plan.	Deficient	Good	Good	
2-4.	Preparation of the training plan of the farmers by the P/C.	Analysis of the topics and contents of the preliminar training by the P/C.	Deficient	Good	Good	
		Planning by P/C of the on-the-job training during the cultivation period.	Good	Good	Good	
2-5.	Execution of the training plan by the P/C.	Carrying out the preliminary training under the initiative of the P/C.	Deficient	Good	Good	
		Carrying out the preliminary training in the field by the P/C for each cultivation cycle.	Good	Good	Good	
2-6.	Provision of technical support by visits to the sites of the P/S twice a week by the P/C.	Two weekly visits to the P/S sites by the P/C.	Deficient	Deficient	Deficient	This was because of a lack of fuel for the motorcyles of the extension officers, participation in training courses by the INTA staff, illness, etc.
		Creation of a bond of trust between the farmers and the P/C through the technical assistance.	Regular	Regular	Regular	The error in diagnosing the growth of vegetables or on the instructions given about the management methods has created mistrust on the farmers' side.
		Obtaining the support of all the farmers by the participatory approach applied by the P/C.	Deficient	Deficient	Deficient	The adopted method of Training and Visist (TV) has not allowed to keep a smooth communication between the P/C and the farmers, which resulted in discontent among the farmers.
2-7.	Recording of the works involved in crops manageement by the farmers with the support of the P/C.	Advisory services by the P/C to the farmers to correctly record the activities for crop management.	Regular	Regular	Regular	The P/C staff did not succeed in making the farmers understand the importance of keeping a record of the activities carried out for farm management.
		Recording of the the farming works according to each crop and cultivation cycle by the farmers.	Regular	Regular	Regular	Out of the ten farms, only three farms made a record of the agricultural works carried out within them. This low percentage is mostly due to illiteracy.
		Transcription by the P/C of the records made by the farmers in a pre-established income and expenditures format.	Deficient	Deficient	Deficient	The handwriting of the farmers is sometimes difficult to read and the extension officers do not have enough time to try to descipher what is written.
2-8.	Eliminate the vegetation leftover from the cultivation fields by the farmers with the support of the P/C.	Issuing of the instructions by the P/C to the farmers about the management of the vegetation leftover previous to the planning of the following cultivation cycle.	Regular	Regular	Regular	There was a gap between what the P/C staff said and what the farmers understood, and the information has not been spread enough.
		Elimination of the leftover from the farms by the farmers under the supervision of the the P/C.	Good	Regular	Regular	About this aspect, the information provided by the P/C was also not spread well enough and the farmers had to look for information by themselves.
2-9.	Carry out the demarcation of the land by the farmers with the support of the P/C.	Advisory services by the P/C to the farmers in a harmonious environment following the instructions issued by the P/C.	Good	Good	Good	
		Demarcation of the farms by the farmers in a harmonious environment following the instructions issued by the P/C.	Good	Good	Good	
2-10.	Carry out the irrigation previous to the sowing by the farmers with the support of the P/C.	Advisory services of C/P to the farmers following the the cultivation plan.	Good	Good	Good	
		Preliminar irrigation by the farmers within a cooperative scheme for the cultivation plan during the dry season.	Good		Good	
		Adequate management of the irrigation facilities by the farmers including the operation and maintenance in order to keep them permanently fit.	Regular	Regular	Regular	The farmers could not carry out the operation and maintenace of the facilities.

El Espino Area (4/4)

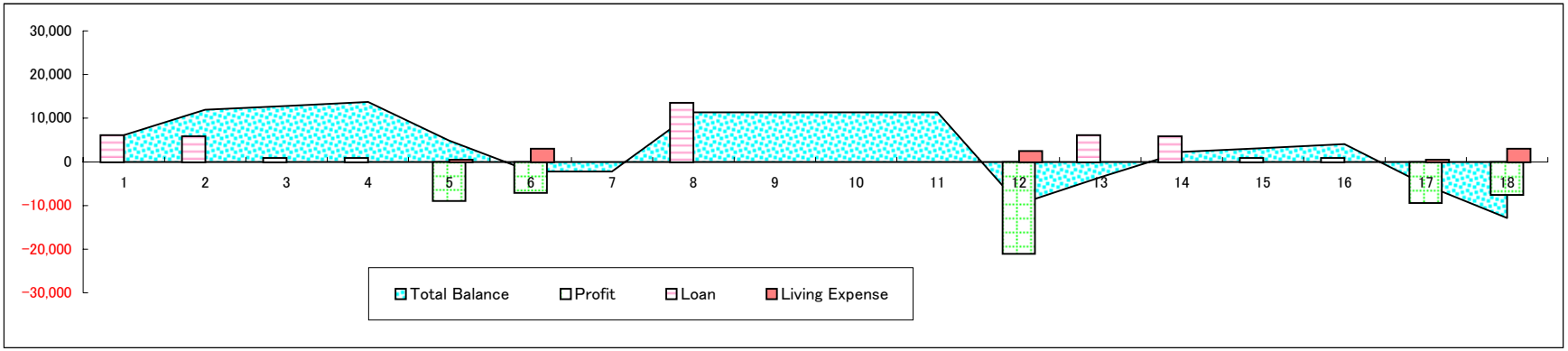
	Activities	Specific Activities	Evaluation (PS-I)	Evaluation (PS-II)	Evaluation (PS-III)	Remarks
2-11.	Carry out the ploughing by the farmers with the support of the P/C.	Rent of tractors by the farmers with the advice of the P/C.	Regular	Good	Good	
		Coordination with the farmers and the supplier of the rental service about the level of work required , putting emphasis on the supervision in the field of the ploughing works.	Regular	Regular	Regular	Even though it is true that it was necessary to carry out a deep ploughing, there was no adequate supervision of the works and the staff of the P/C were not present on the days those works were carried out.
2-12.	Sowing by the farmers with the support of the P/C (maiz, vegetation, rice).	Adequate sowing of the maize by the farmers under the supervision of the P/C.	Good		Good	
		Adequate sowing of the rice by the farmers under the supervision of the P/C.		Good		
		Adequate direct sowing of the vegetables by the farmers under the supervision of the P/C.	Regular		Regular	The distance for plantation and sowing depth for the watermelon were different from those indicated by the cultivation guidelines; as a consequence, there was a low rate of germination. The farmers had not read the guidelines very carefully and the technical staff of INTSA did not provided adequate instruction.
		Adequate sowing to the nursery bed by the farmers under the supervision of the P/C.	Regular		-	Because of lack of ennoough mulch for eliminating the dry of the surface of nursery bed, after sowing of chiltoma, the germination was not uniform.
2-13.	Carry out the cultivation of the transplanted plant by the farmers with the support of the P/C.	Cleaning of the shrubs of the transplanted plant under the supervision of the P/C.	Regular		-	A difference in real availability of family labor and what is needed to achieve the expected production levels has been detected. There was not an adequate number of family members to work in a proper way.
		Control of the insects and diseases under the supervision of the P/C	Regular		-	It has not been possible to control the proliferation of the Plutella xylostella affecting cabbages. The reason is because the staff of the P/C did not have enough knowledge about the seasonal variation of the proliferation of this plage. Therefore, it was difficult to issue adequate instructions.
2-14.	Carry out the cultivation of the transplanted plant by the farmers with the support of the P/C.	Adequate advising by the P/C to the farmers about the transplant.	Deficient		-	The instructions of the P/C consisted in uprroting the transplanted plants and submerge the roots in a chemical solution and carry out the transplant in the final cultivation field. This has lead to the withering of a high percentage of the plants.
		Adequate transplant by the farmers under the supervision of the P/C.	Regular		-	The experimented farmers carried out the transplant by using a shovel without following the issued instructions. They avoided the damage to their plants.
2-15.	Carry out the control of cultivation practices by the farmer with the suppport of P/C	Adequate technical assistance by the P/C to the farmers on cultivation of basic grains: maize.	Good		Good	
		Adequate technical assistance by the P/C to the farmers on the cultivation of basic grains: rice.		Regular		The application of herbicides provoqued the phytotoxicity. This affected the level of production and, therefore, the revenues.
		Adequate technical assistance by the P/C to the farmers on the cultivation of vegetables: cabbage.	Deficient		-	INTA-1 did not have experience in the cultivation of cabbage and that is why they could not control the Plutella xylostella (Linnaeus) which destryed the whole crop.
		Adequate technical assistance by the P/C to the farmers on the cultivation of vegetables: watermelon.	Regular		Regular	The rottening of the fruit was caused by a lack of Ca, It was not possible to make the farmers fully understand the contribution of an adequate crop management to the increase of income. The farmers reacted very slowly and rthis affected their income level at the end.
		Adequate technical assistance by the P/C to the farmers on the cultivation of vegetables: chiltoma.	Regular		-	The rottening of the fruit was caused by a lack of Ca. Because the staff of the P/C could not provide a correct diagnosis, the farmers had to solve the problem by consulting with the owner of the store that sold them agricultural inputs. This created mistrust among the farmers on the technical capabilities of the staff of the P/C.
2-16.	Carry out the harvesting by the farmers with the support of the P/C (in case of rice, it includes unhuskiing, drying and polishing).	Adequate technical assistance by the P/C to the farmers on timely harvesting and adequate methodology for harvesting maize.	Good		Good	
		Adequate technical assistance by the P/C to the farmers on timely harvesting and adequate methodology for harvesting rice.		Regular		Because the combine which was used was a general tipe and obsolescent model, loss in harvest was caused. The P/C only observe workmanship, but does not interfere to negotiate with who provide seervices of harvest, for improvement of the situation.
		Adequate technical assistance by the P/C to the farmers on timely harvesting and adequate methodology for harvesting vegetables.	Good		Good	

Plan of armer Economic at the Pilot Study (Total Farmland 2.0Mz: Maize 1.4Mz, Vegitable 0.6Mz, Rice2.0Mz)

（単位：C$)

Year/Month		98/12	99/1	99/2	99/3	99/4	99/5	99/6	99/7	99/8	99/9	99/10	99/11	99/12	00/1	00/2	00/3	00/4	00/5
Vegitale																			
	Out		4,973												4,973				
	Income						10,537												10,537
Rice																			
	Out								12,650										
	Income												24,000						
Maize																			
	Out	5,412												5,412					
	Income					10,080												10,080	
Pump Operation	Out	680	884	884	884	204			884					680	884	884	884	204	
Living expense		0	0	0	0	500	500	0	0	0	0	0	500	0	0	0	0	500	500
Monthly Balance		-6,092	-5,857	-884	-884	9,376	10,037	0	-13,534	0	0	0	23,500	-6,092	-5,857	-884	-884	9,376	10,037
Total Balance		-6,092	-11,949	-12,833	-13,717	-4,341	5,696	5,696	-7,838	-7,838	-7,838	-7,838	15,662	9,570	3,713	2,829	1,945	11,321	21,358
Monthly Loan		6,092	5,857	884	884				13,534					6,092	5,857	884	884		
Deposit for Living Expense						500	3,000						2,500					0	2,500
Repayment for Loan						8,876	7,037						21,000					9,376	7,537
Loan Balance		6,092	11,949	12,833	13,717	4,841	-2,196	-2,196	11,338	11,338	11,338	11,338	-9,662	-3,570	2,287	3,171	4,055	-5,321	-12,858

Monthly Loan	6,092	5,857	884	884	0	0	0	13,534	0	0	0	0	6,092	5,857	884	884	0	0
Deposit for Living Expense	0	0	0	0	500	3,000	0	0	0	0	0	2,500	0	0	0	0	500	3,000
Repayment for Loan	0	0	0	0	-8,876	-7,037	0	0	0	0	0	-21,000	0	0	0	0	-9,376	-7,537
Loan Balance	6,092	11,949	12,833	13,717	4,841	-2,196	-2,196	11,338	11,338	11,338	11,338	-9,662	-3,570	2,287	3,171	4,055	-5,321	-12,858

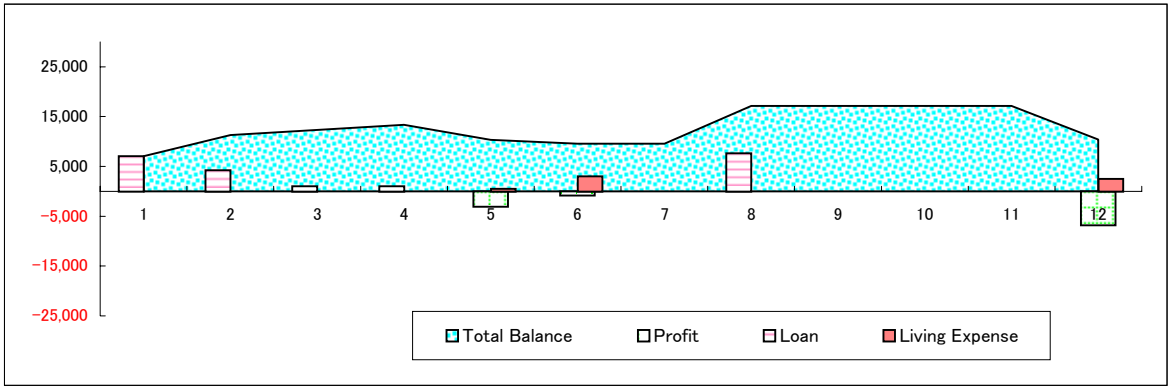


Result of Farmer Economic at the Pilot Study (Total Farmland 2.0Mz: Maize 1.4Mz, Vegitable 0.6Mz, Rice2.0Mz)

（単位：C$)

Year/Month		98/12	99/1	99/2	99/3	99/4	99/5	99/6	99/7	99/8	99/9	99/10	99/11	99/12	00/1	00/2	00/3	00/4	00/5
Vegitale																			
	Out		3,218																
	Income						4,301												
Rice																			
	Out								7,160										
	Income												9,754						
Maize																			
	Out	6,338																	
	Income					4,301													
Pump Operation	Out	715	1,022	1,022	1,022	307			468										
Living expense		0	0	0	0	500	500	0	0	0	0	0	500						
Monthly Balance		-7,053	-4,240	-1,022	-1,022	3,494	3,801	0	-7,628	0	0	0	9,254						
Total Balance		-7,053	-11,293	-12,315	-13,337	-9,843	-6,042	-6,042	-13,670	-13,670	-13,670	-13,670	-4,416						
Monthly Loan		7,053	4,240	1,022	1,022				7,628										
Deposit for Living Expense						500	3,000						2,500						
Repayment for Loan						2,994	801						6,754						
Loan Balance		7,053	11,293	12,315	13,337	10,343	9,542	9,542	17,170	17,170	17,170	17,170	10,416						

Monthly Loan	7,053	4,240	1,022	1,022	0	0	0	7,628	0	0	0	0
Deposit for Living Expense	0	0	0	0	500	3,000	0	0	0	0	0	2,500
Repayment for Loan	0	0	0	0	-2,994	-801	0	0	0	0	0	-6,754
Loan Balance	7,053	11,293	12,315	13,337	10,343	9,542	9,542	17,170	17,170	17,170	17,170	10,416

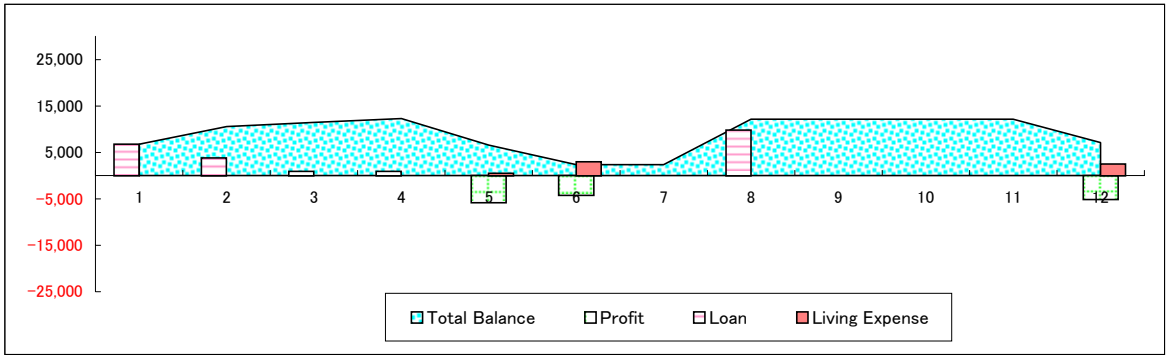


Result of Farmers Economic at Telica Area (Total Farmland 2.0Mz: Maize 1.4Mz, Vegitable 0.6Mz, Rice2.0Mz)

(単位：C$)

Year/Month		98/12	99/1	99/2	99/3	99/4	99/5	99/6	99/7	99/8	99/9	99/10	99/11	99/12	00/1	00/2	00/3	00/4	00/5
Vegitale																			
	Out		2,915																
	Income						7,716												
Rice																			
	Out								8,936										
	Income												8,077						
Maize																			
	Out	6,063																	
	Income					6,944													
Pump Operation	Out	680	884	884	884	204			884										
Living expense		0	0	0	0	500	500	0	0	0	0	0	500	0	0	0	0		
Monthly Balance		-6,743	-3,799	-884	-884	6,240	7,216	0	-9,820	0	0	0	7,577	0	0	0	0	0	0
Total Balance		-6,743	-10,542	-11,426	-12,310	-6,070	1,146	1,146	-8,674	-8,674	-8,674	-8,674	-1,097						
Monthly Loan		6,743	3,799	884	884				9,820										
Deposit for Living Expense						500	3,000						2,500						
Repayment for Loan						5,740	4,216						5,077						
Loan Balance		6,743	10,542	11,426	12,310	6,570	2,354	2,354	12,174	12,174	12,174	12,174	7,097						

Monthly Loan	6,743	3,799	884	884	0	0	0	9,820	0	0	0	0
Deposit for Living Expense	0	0	0	0	500	3,000	0	0	0	0	0	2,500
Repayment for Loan	0	0	0	0	-5,740	-4,216	0	0	0	0	0	-5,077
Loan Balance	6,743	10,542	11,426	12,310	6,570	2,354	2,354	12,174	12,174	12,174	12,174	7,097

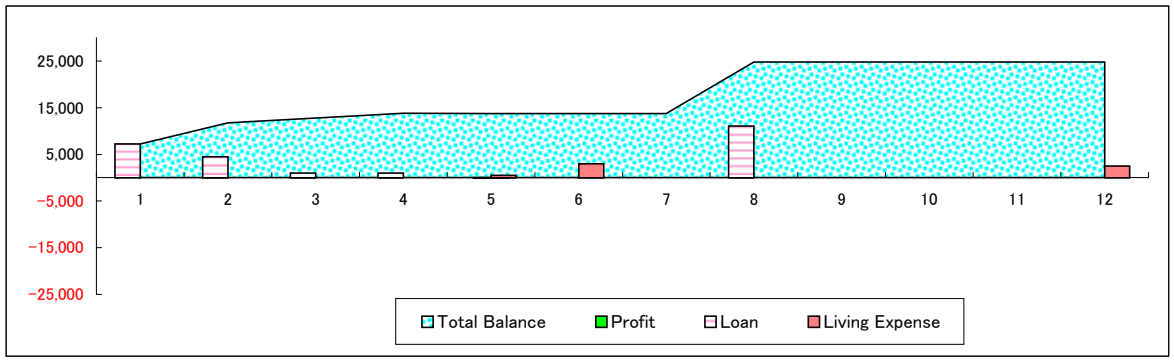


Result of Farmers Economic at El Espino Area (Total Farmland 2.0Mz: Maize 1.4Mz, Vegitable 0.6Mz, Rice2.0Mz)

(単位：C$)

Year/Month		98/12	99/1	99/2	99/3	99/4	99/5	99/6	99/7	99/8	99/9	99/10	99/11	99/12	00/1	00/2	00/3	00/4	00/5
Vegitale																			
	Out		3,466																
	Income						1,489												
Rice																			
	Out								10,588										
	Income												6,208						
Maize																			
	Out	6,543																	
	Income					1,349													
Pump Operation	Out	715	1,022	1,022	1,022	307			468										
Living expense		0	0	0	0	500	500	0	0	0	0	0	500						
Monthly Balance		-7,258	-4,488	-1,022	-1,022	542	989	0	-11,056	0	0	0	5,708						
Total Balance		-7,258	-11,746	-12,768	-13,790	-13,248	-12,259	-12,259	-23,315	-23,315	-23,315	-23,315	-17,607						
Monthly Loan		7,258	4,488	1,022	1,022				11,056										
Deposit for Living Expense						500	3,000						2,500						
Repayment for Loan						42	-2,011						3,208						
Loan Balance		7,258	11,746	12,768	13,790	13,748	15,759	15,759	26,815	26,815	26,815	26,815	23,607						

Monthly Loan	7,258	4,488	1,022	1,022	0	0	0	11,056	0	0	0	0
Deposit for Living Expense	0	0	0	0	500	3,000	0	0	0	0	0	2,500
Repayment for Loan	0	0	0	0	-42	0	0	0	0	0	0	0
Loan Balance	7,258	11,746	12,768	13,790	13,748	13,748	13,748	24,804	24,804	24,804	24,804	24,804



CHAPTER 3

TELICA AREA AGRICULTURAL MODEL DEVELOPMENT PROJECT

CHAPTER 3 TELICA AREA AGRICULTURAL MODEL DEVELOPMENT PROJECT

3.1 Natural Conditions of the Project Area

3.1.1 Topography, Geology and Soil

(1) Topography, and Geology

Telica area is located in the Region II and is closer to the Pacific Coast rather than to the center of the region. The area is classified as low land with an elevation of less than 200 meters. In the northeastern part of the area, there are volcanoes and great lift valley. Elevation of the area is less than 100 meters and has a gentle slope. On the northern side of the area, flat terrain of less than 200 meters of elevation and 5 - 20 km width is spreading to the northwestern direction. The eastern part of this flat area is facing Lake Managua and huge marsh area is lying near the border of Honduras.

To the north of this plain lies a mountain area of 100 - 800 meters of elevation with steeper slope. In the mountains, there are 10 volcanoes whose elevations range from 600 to 1,600 meters. Around the Telica area, a tertiary system, which is the basement of the area, forms a gentle basin and on top of the tertiary system, quaternary diluvium and volcanic sedimentary layers ride to form a flat platform.

Almost in the center of the basin, a quaternary volcano intrudes and raises along the fault, which runs from northwest to southeast direction to form a group of volcanoes raising in the midst of the plain. Ground water occurs in diluvium. Ground water level is shallow, ranging between 4 - 6 meters in the Telica area.

(2) Soil

Using the existing soil map of 1:50,000 scale, the soil series in the Telica area are identified, and the areas under each series are measured by using a planimeter. According to USDA classification, most of the soils in the area are classified as Inceptisol. This soil map also includes the land classification. The data regarding the analysis of soil chemical properties are already available for the area of Comarca Abangasca and further estimation on the soil properties was made using these data. Most of the land in this area are almost flat and the soil texture ranges from loamy sand to clayey soil. Although there were two volcanic eruptions after 1990 in Cerro Negro Volcano, the depth of volcanic ashes is less than 10 cm.

3.1.2 Meteorology and Hydrology

(1) Meteorology

1) Rainfall

The rainfall data were collected at the Leon Meteorological observatory, which is located in the neighborhood of this study area. The daily rainfall data were collected data for 38-years period from 1956 to 1997 (four years data (1979-1982) were omitted). The annual mean rainfall is 1,494mm, the annual maximum rainfall during 42 years is 2,802mm, which was recorded in 1960 and the annual minimum rainfall is 339mm which was recorded in 1976. Annual total rainfall of below 1000mm or above 2000 mm were found for 6 years for each of these two cases, and the annual total rainfall varies year by year.

The annual rainfall pattern is different between the rainy season and dry season. 98% of the annual rainfall concentrates during June to November. Also, one of the characteristics of the rainfall pattern in this area is the frequent occurrence of successive no-rain days during the rainy season, called "Canicula", which causes a serious damage to farm products.

Table 3.1.1 Monthly Mean Precipitation (unit: mm)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Precipitation	0	0	3	18	166	247	108	178	335	338	95	6	1494

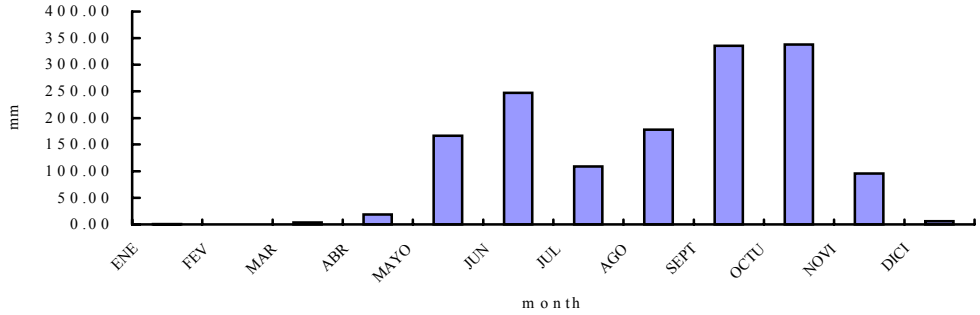


Fig.: Monthly Mean Precipitation Pattern

2) Hurricane Mitch

Hurricane Mitch battered Center and South America during the second half of October, 1998 and it has been one of the strongest hurricanes in the Twentieth Century. The precipitation in Leon from the 21st to the 31st of October reached 1,110.4 mm and produced large quantities of sediment runoff on the 29th and 30th due to landslides and flooding of the rivers. The producers of Telica were seriously affected because the disaster destroyed the cultivation that was about to be harvested.

Table 3.1.2 Precipitation in Leon during Hurricane Mitch (mm)

Days	21	22	23	24	25	26	27	28	29	30	31	TOTAL
	2.0	15.8	15.7	20.6	22.9	87.0	71.1	164.7	276.8	289.6	144.2	1,110.4

3) Other Meteorological Parameters

The other meteorological data were also collected at the Leon Meteorological Station, and compared with the precipitation observation period, the data on the other meteorological aspects is not as abundant. Monthly mean data of sunshine hours, wind velocity and direction were collected for 17 year period (1980 to 1996), and other monthly parameters were collected for 23 year period (1974 to 1996).

The annual mean temperature is 27.3°C, the minimum is 26.1°C recorded in November and the maximum is 29.4°C recorded in April. The annual fluctuation of temperature is only 3.3°C and there is only very slight variation in the monthly mean temperature. The absolute maximum temperature recorded is 40.0°C and the absolute minimum temperature is 16.5°C.

The annual mean relative humidity is 75.8%. The average of relative humidity during dry season

(December to April) is 67%, and during rainy season (May to November) is 82%. The pattern of monthly mean relative humidity shows high humidity values in rainy season and low humidity values in dry season.

The annual total evaporation is 2,032mm. The pattern of monthly total evaporation shows a high volume in rainy season and a low volume in dry season, as same as monthly fluctuation pattern of the relative humidity.

The annual mean wind velocity is 1.9m/sec. The monthly maximum wind velocity is recorded in February, and it slowly decreases to November. The wind direction is approximately east through out the year.

Table 3.1.3 Monthly Meteorological Data

PARAMETER	Unit	JAN	FEB.	MAR	APR.	MAY	JUN.	JUL.	AGO.	SEP.	OCT.	NOV.	DEC.	MED.
Temperature, average	°C	27.0	28.0	28.8	29.4	27.9	27.2	27.4	27.1	26.2	26.1	26.1	26.4	27.3
Average max. temperature	°C	33.9	34.9	35.6	36.2	34.4	32.7	33.3	33.3	31.8	31.5	32.1	33.0	33.6
Average min. temperature	°C	20.2	21.3	22.7	24.0	24.0	23.2	22.6	22.5	22.4	22.0	21.1	20.0	22.2
Abs. max. temperature	°C	38.0	38.4	39.6	40.0	39.4	37.4	38.0	37.8	38.0	35.2	36.6	37.3	40.0
Abs. min. temperature	°C	17.2	18.6	19.6	21.3	22.0	21.3	20.5	20.5	20.9	20.3	18.8	17.1	16.5
Relative humidity	%	67.6	63.7	65.3	66.6	76.1	82.6	77.5	81.3	86.7	87.0	81.7	73.1	75.8
Min. relative humidity	%	31.1	28.1	28.6	28.3	33.5	42.6	39.8	41.4	47.1	48.1	44.2	34.9	38.3
Max. relative humidity	%	97.6	97.5	98.5	98.6	98.3	99.3	99.2	99.4	99.6	99.5	99.6	99.1	99.2
Evaporation	mm	213.9	240.6	270.1	245.0	164.2	122.4	158.3	151.6	106.1	101.2	119.7	172.7	2031.6
Sunshine hours	hr	265.2	264.2	291.8	249.7	189.2	172.3	186.2	188.9	174.0	199.6	215.2	235.1	217.6
Wind velocity, h= 8	m/sec	2.3	2.6	2.4	2.2	1.9	1.7	2.0	1.7	1.6	1.7	1.4	1.9	1.9
Wind direction	Direc.	E	NE	E	E	E	SE	E	E	SE	SE	NE	NE	E
Cloudiness	Octas	3.3	3.3	3.3	4.1	5.0	5.5	5.2	5.3	5.5	5.1	4.5	3.8	4.4

(2) Hydrology

The Telica River flows along the northern part of the Telica Area. The river system of Telica River is shown in Figure B-3 (Annex). This river presents the following characteristics: the river mouth has a catchment area of 285km^2. The characteristics of this river is the same as other rivers located at the Pacific Coast in Nicaragua, a narrow catchment area, the river length is short, a spring is the river water source, with a steady flow without much fluctuation between rainy and dry season. Discharge measurement of this river has not been made, and hence daily discharge was measured at two points during this study period (November 1997 to May 1998). One of the measuring points is located at the road crossing point at end of Northeast Telica area and the an other measuring point is located at the Comarca Quezalguaqe (approximately 3 km upper stream of Northeast Telica area). The monthly mean discharge of these two points is shown below.

Table 3.1.4: Monthly River Discharge of Telica River

Month	Location	Velocity (m/sec)	Discharge (m^3/sec)	Location	Velocity (m/sec)	Discharge (m^3/sec)
NOV.	Upper	0.50	0.94	Lower	0.494	1.463
DEC.		0.49	0.91		0.453	1.300
JAN.		0.46	0.78		0.426	1.246
FEB.		0.44	0.73		0.505	1.464
MAR.		0.42	0.78		0.525	1.611
APR.		0.37	0.66		0.535	1.686
MAY.		0.51	0.98		0.615	2.085

The catchment area of the upper measuring point is approximately 130km^2, and the lower is approximately 148km^2. The distance between these two points is 3 km, without any tributary flowing into River Telica. But there is a large difference in the river discharge of the two points of 1.87 times between upper and lower point, because of a lot of springs, which run along the river. Those springs were confirmed in this study period. And there is also a big difference of specific discharges between these two points. The river characteristics at the two observation points are shown below.

Table 3.1.5: River Characteristics at Two Observation Points

Month	Upper Point		Lower Point	
	Runoff Percentage	Specific Discharge	Runoff Percentage	Specific Discharge
	%	1/sec/km^2	%	1/sec/km^2
Nov.	20	7.25	27	9.88
Dec.	299	6.99	375	8.78
Jan.	3527	6.03	4926	8.42
Feb.	8661	5.65	15157	9.89
Mar	465	5.96	849	10.89
Apr	71	5.09	159	11.39
May	12	7.52	23	14.09

Note: Runoff percentage value is the result of comparing it with precipitation (average of 38 years) from the meteorological observation station in Leon and it is used as reference only, since rainfall observant year and river discharge observant year were not consistent

(3) Available Water

Available water sources for farming in this area are rainfall, discharge of Telica River and ground water. This paragraph will cover rainfall and river discharge and underground water will be discussed further on.

1) Rainfall

Probability analysis was carried out, based on the annual mean rainfall record at Leon meteorological observation station. The results are shown below and the monthly precipitation pattern is shown in Figure B-5 (Annex).

Table 3.1.6 24hr-Max Rainfall for Probability Analysis of Exceedance at LEON Station

(unit : mm)

Return Period	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
50	0.2	0.1	1.7	9.4	84.4	125.2	55.1	90.3	169.7	171.1	48.3	3.2	756.4
20	0.3	0.1	2.0	10.7	95.8	142.1	62.5	102.5	192.7	194.3	54.8	3.6	859.0
10	0.3	0.1	2.2	12.0	107.2	159.1	70.0	114.8	215.8	217.5	61.4	4.0	961.6
5	0.3	0.1	2.5	13.7	122.9	182.4	80.3	131.6	247.4	249.4	70.4	4.6	1102.5
2	0.4	0.2	3.3	17.8	159.7	237.0	104.3	171.0	321.4	324.0	91.4	6.0	1432.2

2) River Water

The data on river discharge is available only for a period of 7 months, which was the data measured during this study period. The river discharge-measurement was made from November to May. In this period, the monthly discharge is generally scarce and normally there is fluctuation through out the year in Nicaragua. However discharge of the Telica River was stable through out the year comparing with other rivers, because of the greater part of this river discharge flow from many springs along the river. Also characteristics of this river based on the hearing form inhabitants living around the river were 1) river discharge is stable through out the year, 2) the yearly river discharge does not have much fluctuation. The Telica River is considered as a reliable

water resource from the above conditions. Available water of the Telica river which can be assumed from monthly mean discharge and other conditions that volume is 0.66m^3 at the upper measurement point and 1.25m^3 at the lower measurement point.

The regulations of river maintenance discharge were not established in Nicaragua. But necessary flow volume of subsistence for aquatic animals are kept. And utilization plan of river discharge must be planed considering the intake water volume (water right) at lower part of the river. Four intake facilities were installed at the lower part, which were proposed in this study at the Telica river, and the total intake water volume of these facilities is estimated as 0.93m^3/sec. Therefore available water discharge volume at proposed intake of this study is 0.6m^3/sec. This water volume is 50% of the river discharge, which was analyzed based on discharge measurement of this study. Intake volume of each facility and river discharge before and after intake river water are mentioned in the tables shown below.

Table3.1.7 Location and Intake Volume for each Facility

Intake	Intake Volume (m^3/sec)	Location	Facility	Catchment Area (km^2)
No1	0.02	About 2km upper stream from road cross point at Comarca Toroilo	Pump	174
No2	0.03	Nearby road cross point at Comarca Toroilo	Pump	183
No3	0.57	About 1km down stream from Nagualapa	Head Work	213
No4	0.32	About 3km down stream from Nagualapa	Head Work	217
Proposed	0.60	About 1.5km down stream from Quezalguaque	-	140

Table 3.1.8 River Discharge

Intake	River Discharge Before Intake Water (m^3/sec)	River Discharge After Intake Water (m^3/sec)
No1	1.47	0.85
No2	1.54	0.90
No3	1.79	0.58
No4	1.83	0.30
Proposed	1.18	0.58

(4) Flood Volume

1) 24-Hour Maximum Rainfall

Probability analysis of 24hr Maximum Rainfall was carried out, based on 38 years daily rainfall data at the Leon Meteorological Station. The results are shown below. As a reference, daily precipitation (24 hours) of the Hurricane Mitch corresponds to a return period of 100 years.

Table 3.1.9 Probability Analysis of 24hr Maximum Rainfall

Return Period		24hr-Max Rainfall
	(%)	(mm)
200	0.5	331.08
100	1	297.60
50	2	264.89
20	5	222.43
10	10	190.45
5	20	157.82
2	50	110.15

2) Flood Discharge Volume at the Telica River

Flood discharge volume at the Telica River was analyzed by the Rational Method, based on the results of probability analysis of 24hr maximum rainfall. The results are shown below.

Table 3.1.10 Flood Discharge Volume at Telica River

Return Period (year)	24hr Max. Rainfall (mm)	Flood Volume (m^3/sec)	Specific Discharge (m^3/sec/km^2)
200	331.08	799.02	5.71
100	297.60	702.16	5.02
50	264.89	609.74	4.36
20	222.43	493.37	3.52

The Rational Analysis Method was used and the runoff coefficient is 0.7, and the time of flood concentration coefficient is 350.

3) Field Drainage Volume

Field drainage volume in this area was analyzed by the Rational Method, based on result of probability analysis of 24hr maximum rainfall. The results are shown below.

Table 3.1.11 Field Drainage Volume for unit Area

Return Period	24hr Max. Rainfall		Drainage Volume(m^3/sec)				
	(%)	(mm)	5ha	10ha	50ha	100ha	500ha
50	2	264.9	0.63	1.14	4.62	8.42	33.96
20	5	222.4	0.51	0.93	3.74	6.81	27.48
10	10	190.5	0.42	0.77	3.09	5.64	22.76
5	20	157.8	0.33	0.61	2.46	4.49	18.13
2	50	110.2	0.22	0.39	1.59	2.91	11.72

3.1.3 Hydrogeology

(1) Outline

In the northern part of the area, Telica River is running in a westward direction. The river flows into the Pacific Ocean. Most of the rivers in the Region II have riverbed water and in addition to that, due to geological and soil characteristics, a large portion of the precipitation permeates into the ground rather than running off over the surface. Therefore, both specific discharge and rate of runoff show a low value and the difference in runoff in dry and wet season is large.

Rivers which flow into the Pacific Ocean, such as Telica River, are short and have a small watershed because mountains are close to the coast. However, sources of these rivers are spring water and fluctuation in annual runoff is small.

Geological structure in the Telica area is summarized as follows:

High permeability quaternary system lies on aquiclude and therefore it is having a high rate of groundwater recharge. Presently, water for domestic, irrigation and industrial use comes from ground water. Ground water is the most important water source in the Pacific Coast in Nicaragua. Pumping volume of existing wells is 0.01 - 0.1m^3/sec and the ground water potential of Telica area is estimated to be more than 0.011m^3/sec/km^2. However, this is on the condition that the density of well is one for every km^2. Existing wells are located almost at this density. A drop on the pumping volume is expected if well density increases.

(2) Hydrological Analysis

Step-up pumping test was conducted by using existing well PP-T3. The critical pumping volume was estimated as 52.281/sec (3.14m^3/min).

(3) Geological structure of water intake

Different sounding surveys were conducted on both banks of the Telica River to study the geological structure and to confirm the existence and bedrock depth. Core samples were collected and physical tests were done.

Basement of this area is tuff (TOBA VOLCANICA) and this was confirmed by the sounding survey. It was found that the tuff had N value of more than 50 and the thickness of the system was 11.65 meters (SQ-2). Therefore, it is assumed that this tuff system can be used as a good rock base.

3.2 Socioeconomic Conditions in the Study Area

3.2.1 Location, Administrative Division, Agricultural Population

The Telica project area is located in the Region II of Nicaragua at about 12km from Leon city and a part is included in the administrative division of Leon city. Telica area includes the communities of Nicolas Lopezu Roque, Abangasca Norte, and Troilo and Lopezu Roque community is situated at the center of the project area.

Total population of farming families is 250 and farming population in each community is shown below:

Community	Number of Farming Families
Nicolas Lopezu Roque	143
Abangasca Norte	26
Troilo	80
Total	250

The area of land holdings according to size is shown in the following table. The properties of less than 10 Mz represent 67% of the total surface and 89% of the total amount of properties.

Present Condition of Landholding in the Project Area

Area	No. of families	Area (Mz)	Area (ha)	Area Ratio (%)	Ratio of number of families (%)
Below 3.0Mz	80	202.5	141.8	12.33	31.17
3 ~ 5.0Mz	60	285.0	199.5	17.35	24.28
5 ~ 10.0Mz	84	611.5	428.1	37.23	34.01
10 ~ 30.0Mz	24	438.0	306.6	26.67	9.72
30 ~ 50.0Mz	1	33.0	23.1	2.01	0.41
50 ~ 100.0Mz	1	72.5	50.8	4.41	0.41
Above 100Mz	0	0	0	0	0
Total	250	1,642.5	1,149.9	100.00	100.00

3.2.2 Economic Activities

A flow of goods in the area of Telica is shown in the figure 3.2.2. Compared with the area of El Espino, Telica is different in terms of more varieties of agricultural products. Furthermore more accessibility of agricultural technical assistance and credits are seen only in the area of Telica. Agricultural household income is summed up from sales of agricultural products (including products of family farming and small domestic animals), works away from home, and day labors, in which the portion earned by dairy products to the total household income is large. The fact that people are engaged in making and selling milk products, working away from home and day labors is reflected in the difficulty of living only from the main occupation, agriculture. On the other hand, reflecting the fact mentioned above, the remittance from children has become an important income source in this area, too. (see Annex diagram of agricultural household's income and expenditure). However, according to the fact that all male residents above age 15 answered as cultivators as their main occupation, it can be said that an important industry in the study area is agriculture.

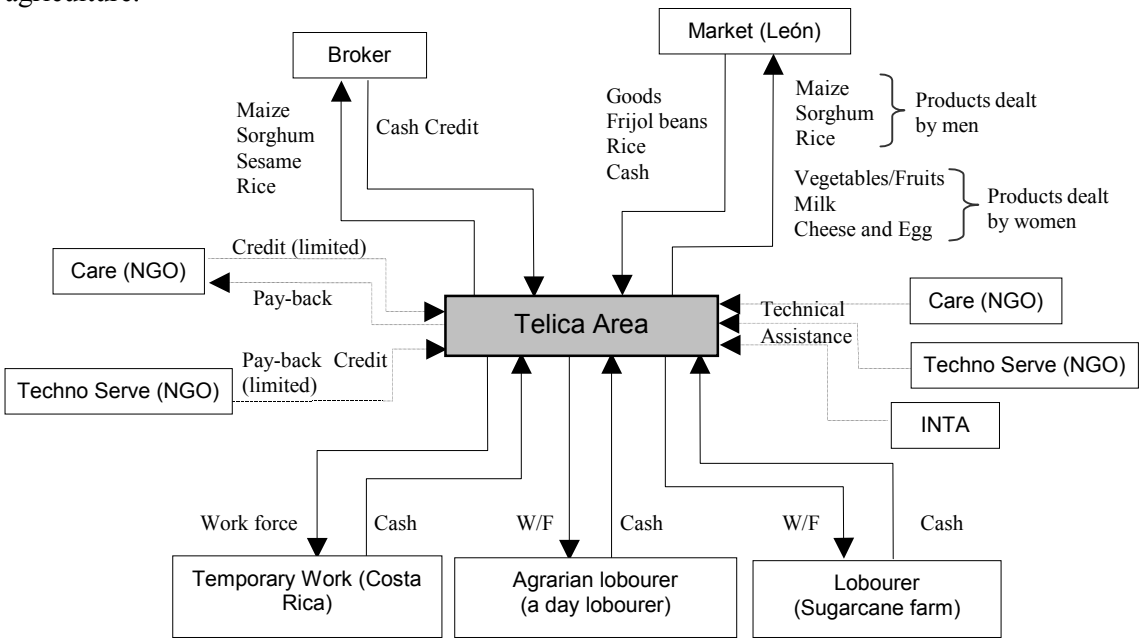


Figure 3.2.2 Flow of goods in Telica Area

Main agricultural products in the area of Telica are maize, sorghum, sesame, vegetables, and fruits. Maize, sorghum and rice are sold to brokers depending on their sales prices, but all sesame is sold to brokers. All other agricultural products except sesame are sold in markets in Leon city, too.

3.2.3 Land Use

Summarizing the result of present land use condition in Telica Area (See Table shown below), there are 8 kinds of land use conditions such as upland field, paddy field, Tempate field, grassland, waste land, forest, residential area and roads/canal, and 93 % of the area is used as arable land, grassland, permanent crop and forest area. Irrigated rice field by pumping groundwater occupies 1.9%. The arable land is mainly cultivated with basic grains such as maize, sorghum, beans, and partially with sugarcane as well. Vegetables are cultivated mainly for self-consumption in a small scale and its surplus is sent for sale. Fruit crop is planted in farmyard for self-consumption, while Tempate crop (to be mentioned later) occupying 22.3 % of the area.

Present Land Use Conditions in Telica Area (Unit : Mz)

Land Use	Block						Total	%
	I	II	III	IV	V	VI		
Upland	184.4	157.9	162.5	142.5	449.5	63.1	1140.0	53.1
Paddy	0.0	0.0	0.0	22.6	0.0	17.4	40.0	1.9
Tempate	137.8	0.0	18.8	174.2	63.5	83.4	477.8	22.3
Grass land	0.0	31.7	20.4	45.6	65.7	30.7	194.1	9.0
Waste land	2.4	0.0	3.0	27.0	0.0	4.7	37.1	1.7
Forest area	9.0	27.4	8.4	35.7	42.6	15.9	138.9	6.5
Residence	7.9	13.7	8.6	8.3	20.8	3.3	62.5	2.9
Road/Canal	7.0	6.3	6.7	14.3	16.1	5.9	56.3	2.8
Total	328.4	237.0	228.5	470.1	658.3	224.3	2146.7	100.0

Source: JICA Study Team based on Aerial Photo and ground checks.

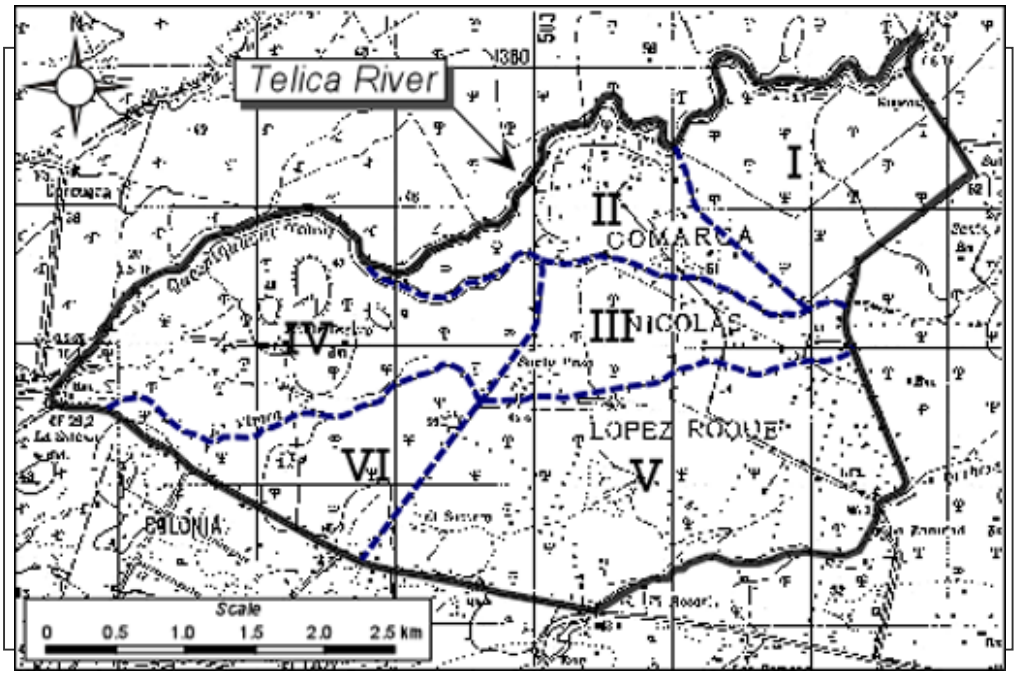


Fig. 3.2.2 Study Area Division

3.2.4 Farm Management and Extension

(1) Farming Type

Crop diversification in the Study Area has progressed, and major farming type prevailing in Telica Area is comprised of 7 types as shown below.

Major Production System in the Telica Area

Type	Production System
A	Maize + Sorghum + Vegetables
B	Rice + Vegetables
C	Maize + Vegetables
D	Maize + Sorghum + Sesame + Vegetables
E	Soybean + Vegetables
F	Livestock (15-20 heads) + Maize + Sorghum + Vegetables
G	Livestock + Vegetables

(2) Cultivated Crop

The main crops cultivated in Telica Area are mentioned below.

1) Basic grains
Maize, upland and paddy rice, sorghum, mung bean, cowpeas

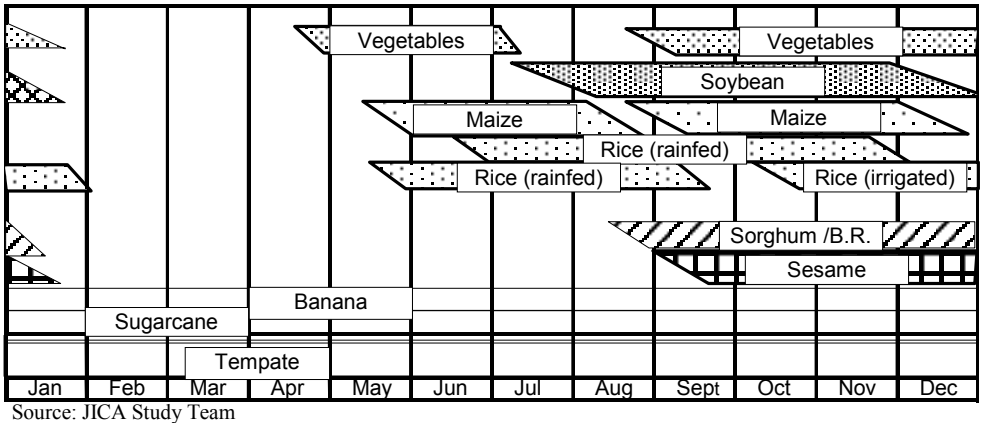
2) Traditional crop
Sugarcane

3) Nontraditional crops
Soybean, sesame, tempate (Jatropha carcus L), plantain, bell pepper, pipian (Cucurbita pepo), watermelon, cassava (Manihot esculenta L. Crantz), mango, cashew nut and so on.

Tempate is a permanent tree crop, containing oil in the seed which can drive a diesel engine, and the strained leaves after extracting oil is used as a processing source for stock feed. Tempate cultivation has been started since 1993, but at present it is in dispute between growers and project implementing organization because of economically not feasible situation due to the extremely poor yield level. Nontraditional crops like fruit and vegetable crops are cultivated with a purpose of sale of the surplus, if generated a surplus from self-consumption and there are no fruit growers in full scale.

(3) Present Cropping Pattern

Cropping pattern in the Study Area is dominantly based on rainfall, but partially irrigation farming for rice and maize by pumping the groundwater prevails with a progress of crop diversification. The present cropping pattern noted from a hearing survey in the study area is shown below.



Source: JICA Study Team

Fig. 3.2.3 Present Cropping Pattern in Telica Area

Under rainfed farming system, the dominant cultivated crops are centered on the second cropping season called as “Postorera” and less cropped in the first cropping season “Primera” due to unstable and short rainy cropping season. The cultivated crop is dominantly basic grains, comprising 70 % of the entire arable land and relatively well progressed in crop diversification because of fertile soils and located in the outskirts of Leon city. Frijol beans, one of important principle food crops in Nicaragua can not be physiologically grown due to hot dry weather

condition.

(4) Cropping Acreage and Crop Production

Cropping acreage and its production in the Study Area is shown below. This data collected by DARIAP/MAG-FOR was revised in terms of area devoted to rice cultivation, in accordance with the result of individual farmer's interview survey.

Table 3.2.5 Agricultural Production in Telica Area

Crop	Sown (Mz)	%	Lost (Mz)	Area (Mz)	Yield (QQ/Mz)	Production (QQ)
Rice (rainfed)	319.5	29.3	315	4.5	63	283.5
Rice (irrigated)	89	8.2	-	89	96	854.4
Frijol	15	1.4	-	15	15	22.5
Sesame	40	3.7	-	40	6.5	26.0
Cana*	26	2.4	-	26	30	78.0
Soybean	210	19.3	-	210	40	840.0
Maize	240	22.0	-	240	19	456.0
Sorghum	150	13.8	-	150	20	300.0
Total (Mz)	1,089.5	100.0	315	774.5		
Total area (Mz)	2,145.3					
Crop Intensity (CI) %	50.8					

Source: DRIAP/MAG-FOR modified by JICA Study Team
Note: Yield of sugarcane is based on unit of t/Mz

The basic grains like rice, frijol, maize and sorghum occupy 75 % of the whole cropping acreage and soybean, sesame, sugarcane are cultivated at 19.3%, 3.7%, and 2.4 % respectively. The irrigable area is only 8.2 % generated from a pooled irrigation rice farming of 89 Mz of the cropping area. Upland rice faces a critical limiting factor caused by unstable rainfall pattern, which resulted in 98.5 % of unharvested land. The present crop intensity results in 65.8 % statistically but is supposed to be more because of some crop like permanent crop is not collected in the agro-census.

(5) Farming Practice in the Study Area

The farming practice among the small and medium-scale farmers prevailing in the Study Area is shown below. Farm operations such as cutting grass, plowing, and harrowing are entirely managed by tractor or animal traction power via custom hired system, and sowing operation is also done in combination of seeding device and tractor or animal traction power. A source of Tractor or animal traction power is supplied from large-scale farmer or agriculture cooperatives. Renewing improved seeds like maize, rice, sorghum and sesame prevails in the Study Area on every 2 to 3 years. Applying compound fertilizer is also common and many farmers spray agro-chemicals like insecticide and herbicide if budget for input is available.

Farming Practice Prevailing in Telica Area

Farm Operation	Ratio depending on Mano Vuelta (%)	No of CW employed (head/FH)	Wage (C$/day/Head)	Kind of Input or CW	Charge of custom hired (C$/Mz)
Field Preparation	0				
Plowing	100			Tractor	160
Harrowing	100			Tractor	70
Sowing	100	4	20	Tractor	70
				Animal	120
Inter-tilling	30			Tractor	70
				Animal	120
Fertilizer appl.	0				
Weeding	100		20	6 heads/Mz	
Agro-chemical spray	100	1	35	shoulder type sprayer	
Harvesting	100		20	,R heads/Mz	
Transportation	100			Truck	5C$/QQ

Fuente: JICA Study Team Remark: CW refers to caual worker.

(6) Agriculture Extension

There are many organizations including official and private sectors to carry out farmer's supporting activity in the Study Area. Farmers supporting activities of the major implementing organizations are described below.

1) Agricultural Extension Activity by INTA

One extension worker from Leon Office is assigned to Comarca-Troilo and Abangasca Central areas in the Study Area, and works for ATPM and ATP1 groups. ATP2 group is shouldered by a private company, SETAGRO. S.A., which has been contracted with INTA and the 23 farm households of the Aristidez Sanchez Cooperatives belongs to the ATP2 group. Each class of extension activity is shown below.

Extension Activity by INTA

Area	Class	No. of Farmers Group	No. of Farm
Troilo	ATP M		50
	ATP 1	3	50
Sub total			100
Abangasca Norte	ATP 2	1	23
Bangasca Central	ATP M		40
	ATP 1	2	40
Sub total			80

Source: JICA Study Team

ATPM, one of the INTA extension classes is formally called as ATPB, and the extension program is same as before; namely, field day, demonstration farm, seminar and so on. ATP1 class shares a portion of extension cost with INTA and pay C$10/month which is used as running cost for INTA's office and extension workers. Actual extension activity by INTA is managed by visiting the farmers group every 2 weeks for consultation, and by organizing seminars for the special subject groups such as livestock, upland crop, horticultural crop.

INTA and SETAGRO.S.A have no credit lines for the beneficiaries, and they cope with farmers financing business to tie up with PROTIERA, which is a World Bank financing project. In Troilo area, INTA ties up with PROCATEPA (Programa de Capacitacion y Asistencia Tecnica a las Mujeres Productoras) financed by NORAD and distributes small domestic animals, hand pump, vegetable seeds and fruit tree seedlings to the female headed household in the Study Area.

2) Major private organizations to support farmers

1. Techno Serve

Techno Serve is one of the international non-governmental organization sponsored by IDB and carry out the farmer's supporting activity under the strategic program such as farmer's training, crop production, marketing, farmers financing, crop diversification and land tenure. In Telica area, Techno Serve implements their project-PROCADAE via UCAIS, a cooperative union in order to increase sustainable income generation for the small-medium scale farmers.

On the other hand, Techno Serve has constructed a 2.75 Mz irrigated demonstration farm by sprinkler method in Nicolas Lopez and from the second half of 1998 was supposed to start the program such as nursery for fruit and afforestation seedlings, demonstration of new horticultural crops and training of farmers from late this year.

The target group aided by Techno serve requires the following conditions.

- should have access to irrigation source
- should have a legal document for land registration
- should have own farm land within a range of 5 - 35 Mz
- should be a full time farmer
- should have no debt
- should be a member of existing farmers' organization

2. CARE

CARE is one of the international NGO sponsored by Canadian government and USAID, and has started farmer's supporting program since 1984 in Telica Area. CARE has implemented two projects, i.e, SAS (Seguridad Alimentaria Sostenible) and PAS (Proyecto Agrícola Sostenible). The former project SAS, has been carried out since June, 1995 by assigning a technical specialist in Telica Area and started a 3 years project in this June. This project comprises of the components such as crop diversification, soil/water conservation, organic fertilizer/home-made agro-chemicals, farmer's training, gender and farmer's financing business, and was executed over the 3 Comarca in Telica Area. The farmer's credit is implemented by establishing a revolving fund based on the financial source obtained from Canadian government. Financing condition should meet the requirement that an applicant should be a less than 3 Mz land holder and should attend the training seminar organized by CARE. After termination of the SAS project, a farmer's organization – La Union brought up by CARE will take over the supporting activity.

3. CEPAD (Council of Evangelical Churches of Nicaragua)

CEPAD is a Christian-oriented NGO, having an office in Leon with 7 staff including 2 technicians. CEPAD is working since 1975 in Leon Department and has supported Comarca-Troilo area involving approximately 60 farm households. Their dominant activity comprises the 3 components like farmer's training program, fostering farmer's organization (CDC: Community Development Committee), and farmer's financing. Examination of financing to the farmers' applicant is judged by the CDC comprised of 5 women.

4. FOUNDATION PRODE-MUJER

FOUNDATION PRODE-MUJER, is a non-religious NGO having an office in Leon and has a staff of 10 that includes 3 technicians. It is sponsored by Spain, Netherlands and EC as budget source. FOUNDATION PRODE-MUJER has begun the supporting activity to 15 farm households in Comarca-Troilo area in Telica since June 1997. Their activity comprises of four components such as farmer's financing, individual and group training, dissemination of cooking

pan by solar energy use, and production of organic fertilizer for sale. The budget source for credit amounts to 40,000 dollars, and the applicant is financed up to US$100 per each application as the upper limit under the condition to attend the prerequisite seminar.

3.2.5 Marketing

Telica Area is located near Leon City, which is the most adjacent market and has a good traffic condition and it is easy to use public transportation such as bus and truck. As a result, the farmers seldom go to the markets in Leon to sell their products, especially fresh products such as vegetables and milk. However, there are many cases where the farmers sell their products especially grains, to the brokers who come to Telica.

(1) Farmers' Marketing Conditions

a) Grains (maize, sorghum, rice)

Farmers sell grains mainly to brokers who come to their farm gates; otherwise they bring and sell grains in markets in Leon. In the case of selling their products in markets in Leon, farmers transport their products in bags using public transportation, paying C5/qq. as a transportation fee. Farmers know how the selling prices of their products fluctuates from their past experience. Then farmers tend to sell the necessary amount of the product for the cost needed for immediate life just after harvesting, store the rest and wait the time for selling watching the market price. Their longest storage period is about five months after harvesting.

Market information resource that can be obtained is very limited which includes mainly brokers coming to their places and the neighboring farmers. Farmers sell rice just as paddy after drying, except that they bring and ask polishing of paddy to rice millers in Leon for their consumption. Polishing charge is C20/qq. and it becomes C18/qq for polishing more than 100qq.

b) Sesame

Almost 100% of the producers sell the produce to brokers. They sell them to a person who offer the highest price among the brokers coming to their places. Some farmers might have dealt with about 20 brokers in a season.

c) Soybean

There is not much contract cultivation and most of the producers sell their products to brokers. It is utilized as an animal feed material in addition to oil manufacture material.

d) Vegetables and fruits

There are cases that farmers sell them in the markets of Leon, in addition to selling them to the brokers who come to their places. These sales are the role of the women and they gather and put their products in a basket and/or a bag and bring them to Leon by public bus or truck.

There are some women who procure the products from neighboring producers in addition to their own products and sell them in Leon. They go to markets in Leon frequently, the most often is every day excepting Saturday and Sunday, and they even have clientele. As they do not have registration in market, as well as merchant registration, they carry out sales by using a proper vacant area in market and paying C2/day to the market manager.

(2) Agro-processing facility

There is a terminal elevator (drying facility and 6 corrugated silos, storage capacity 4,000

qq./silo) in the area that belongs to ENABAS. The mechanical part of the facility such as a dryer (LSU type) and bucket elevators are broken, since it has been left for many years without operation. It is judged that repair is very difficult and economical efficiency is extremely low to use it after the repair.

(3) Markets in Leon City

In Leon City, there are four markets managed by Municipality Office where farmers from both the Study Areas sell their products except selling them to brokers.

The outline is as follows:

a) Subtiava Market : Registered Traders: 66

This market is located besides a terminal bus station in the west of Leon City and is the smallest among four markets. And it is the entrance to Leon City for the products coming from the background area in the west from this market including the study areas. Also, this market is a transaction place of marine products in Leon City, because it is nearer to the sea and the terminal to a beach town called Poneloiya.

As there are small volumes of grains, vegetables and fruits marketed here, it can be seen that the traders come from Central Market and purchase the products from farmers and take them back and sell them in the Central Market.

b) Terminal Market : Registered traders: 545

The market is located at the edge of easter side of Leon City and adjoining a long distance terminal bus station. And the products from east/north/south such as Chinandega, Chichigalpa, Managua, Matagalpa, Malpaisillo are traded here. Accordingly, this market is relatively characterized as a wholesale market and various kinds of commodities are handled. This market is the main entrance to the commodities from distant areas for Leon City accompanying the exit to such remote areas for the local products.

c) Station Market Registered traders: 1,034

It is the biggest Market in the City having more than 1,000 registered traders, and the entrance of the products in the background after east from Subtiava market. Various commodities are dealt here, and vegetables and fruits share 30%, grains share 25% and dairy products and meat are also sold. Both transactions of wholesale and retail are coexist here. Accordingly, some wholesalers in this market procure their selling commodities from Mayoreo Market in Managua and there are some overlapped functions with Terminal market.

There are two kinds of onion and cabbage, one from Sebaco area and the other from Mayoreo Market after importing from Guatemala with some practical demarcation of marketing.

d) Central Market : Registered Traders : 329(in building), 150(in the open)

The building was renewed with the aid of Spain recently. It is the characteristic of the market that most of the transactions are retail transactions, and almost all kinds of commodities are handled in this market.

e) Outline of distribution channel

The outline of general distribution channels of commodities in Leon City mentioned above is shown in Fig-3.2.3.

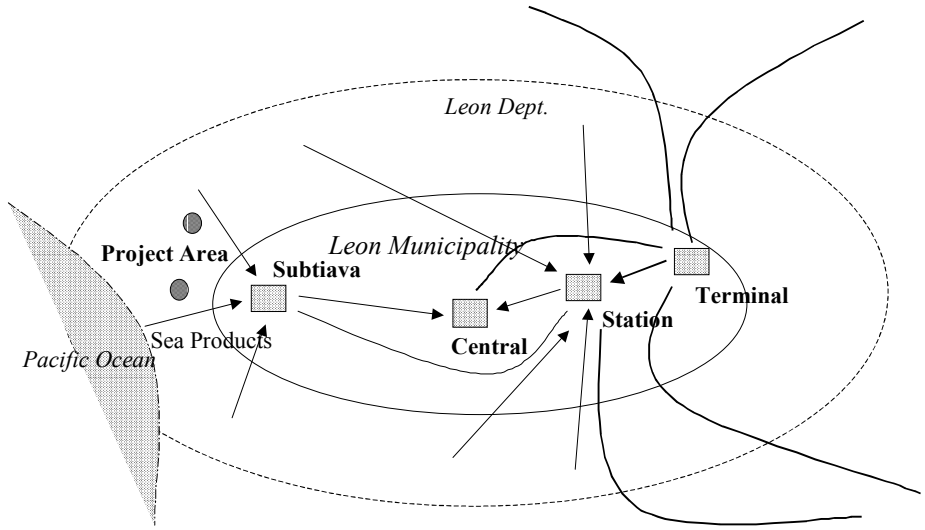


Figure 3.2.3 Outline of Distribution Channels in Leon City

f) Leon Municipality Office

The four markets are managed and controlled by Dept. of Commerce and Marketing, Municipality Service Bureau, Municipality Office in Leon. The manpower of the department has a staff of 49, including 42 field workers such as garbage collectors, tax collectors, guardsmen and 7 workers in the head office.

Municipality Office only carries out operation control of markets, and does not intervene in actual trading activities in markets such as promotion of fairness of transaction and promotion of effective trading through supplying market information.

(4) Market condition of sesame

Sesame is one of the major trading products in both survey areas. The market condition of sesame is mentioned below, based on the information obtained from brokers, and a processing and export company.

a) Distribution channel

The distribution channel of sesame is divided to two channels as shown in the following figure. The one has a broker between a producer and a processing and export company as a final receiver and the other is a direct channel between the two.

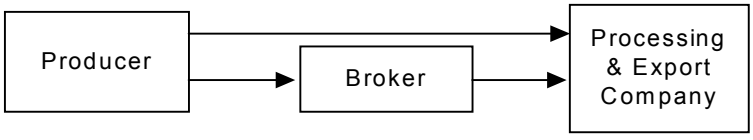


Figure Distribution Channel of Sesame

Direct channel to processing and export company

CONAGRA, one of the processing and export companies, is carrying out a direct purchase from the producers through their own regional offices aiming at the stability of the management by stable procurement of sesame. As CONAGRA's share of procurement volume is expected to be about 25% for the year '97 / '98, the distribution ratio in this route is conceivable as less than 25%

against whole distribution volume.

Channel through broker
All quantity of sesame other than that mentioned above is distributed via brokers. The capacity of brokers differs from a private merchant to a company scale. There are five to six big brokers with company scale in the area from Leon to Chinandega.

Most of the distribution volume in this channel is the condition that brokers go to the producer's place and buy their products, and producer seldom come to the office of a broker and sell the product. In this case a broker purchases it at the price adding a transportation fare.

b) Processing and export companies and brokers
There are six local processing and export companies and two Guatemalan companies purchasing sesame in the area. About 80% of the brokers are in exclusive relation with each processing and export company and the rest 20% are selling to multi-processing and export companies freely.

The joint purchasing of the Guatemalan companies exerts a big influence on the purchase volume of the local processing and export companies. The change such as bankruptcy and new mergers have occurred in local processing and export companies and a stable distribution system of sesame is not yet established in Nicaragua.

It is expected that the unstable condition is unavoidable on the price and distribution structure even in the future, affected by market condition such as production in Guatemala and international market, as long as Nicaraguan government would not take appropriate measures for intervention.

In spite of the unstable market condition mentioned above, the procurement interest of the companies and brokers is very high at present, and there is no problem for immediate increase of sesame production.

c) Price and quality
Farmgate price
Farm gate price fluctuated between C$250 to 350/qq. in March, high price period, in '97/'98. However, it rose suddenly and substantially from C$200 to C$400 in '96/'97, because of Guatemala companies' participation as explained before.

According to the explanation of a processing and export company, the export price is US $58 to 60/qq. in early this year (US $47 to 48 at the last survey time on November '97).

Quality and price
A broker explained that they reduce the procurement price by the mixed rate of small and big impurities and spot colored kernels when they procure sesame from farmers, after they eliminate and calculate impurities using a sieve and also calculate spot colored kernels by soaking and mixing with caustic soda solution (dark spots remain on a surface of kernel even after bleaching with caustic soda solution).

However, it is difficult to think that these analyses are carried out at the time of purchase on the farmer's place. Actually brokers carry out the presentation of the purchase price by their experienced judgment seeing the quality of sesame. Accordingly as for the farmer's selling price, a cheaper trend is seen than the above price as a purchase price.

In this regard, farmers may raise their selling price by producing better quality of sesame. However, some broker explained that it is difficult for farmers to get qualified sesame seeds and also difficult to diffuse it with expensive price (C$100/qq.).

(5) Market information issued by MAG-FOR

DGIAP of MAG-FOR has been issuing the market information such as monthly and weekly reports already, collecting and processing market information while utilizing the network with each regional branch office.

Also, MAG-FOR branch office in Leon which cover the survey area dispatch an investigator to the Station Market once every week and carry out the survey of wholesale and retail prices of various kinds of products, and arrange survey cooperation staff to each production area and collect the selling prices of farmers.

The MAG-FOR branch office is issuing various market information reports independently, in addition to reporting the survey results on a telephone to DGIAP headquarter of Managua. These documents are gathered with the publication issued by DGIAP headquarter and are offered to the person who comes to the office, in addition to being sent to banks, agencies of education, regional governments, NGOs, various kinds groups etc. in the area. However, it was not recognized that this information was utilized with farmers or farmer groups in the survey area during the survey period. The regular published materials, which can be received at MAG-FOR branch office in Leon, are listed below:

<u>Materials issued by DGIAP headquarter</u>	
1) “Agropecuriario y Desarrollo”	Monthly
2) Reporte Semanal	Weekly
3) Monitor Agropecuriario	Weekly
<u>Materials issued by DGIAP in Leon</u>	
1) Wholesales Price	Weekly
2) Retail Price	Weekly
3) Precios de Insumos Agropecuarios	Monthly
4) Precios de Productos	Monthly
5) Tarifa de Servicios	Quarterly
6) Tarifa de Transporte	Quarterly

3.2.6 Farm Economy

In the Telica area, an average family size was estimated at 5.5 members. Age of family head was 49 years old on average, who got primary education of 2.1 years on average. The farm size is approximately 6.6 Mzs. The main crops are maize, sorghum, paddy, sesame, fruits, and vegetables. After deducting the amounts used for self-consumption, the surplus production is sold mainly in the markets of Leon City. In the case of the sesame, the whole production is bought by traders.

An annual household income was estimated at C$34,752 on average in the Telica area. It includes sales of crops cultivated, livestock products and off-farm income (small-scale side business, temporal employment at factories within the region or abroad, etc.) It must be noted that those households involved in livestock-related activities usually have a higher level of income coming from cattle raising activities and sales of milk and cheese products. Concerning crops, the most

profitable crop is paddy, even though its cultivation is not so extended; other profitable crops are vegetables and fruits. It has been estimated that 77% of the household income is generated by crop cultivation and sales; the remaining 23% comes from livestock-related activities and off-farm activities.

Annual household expenditure was estimated at C$9,978 on average in the Telica area. Annual expenditure on food was estimated as C$6,733 accounting for 64% of the total household cash income. The agricultural and livestock production-related expenditures (inputs, fertilizers, agrochemicals, etc.) represented 15% (C$1,578) of total expenditures; transport expenses represented 9% (C$947); clothing expenses represented 5% (C$526); health-related expenses represented 4% (C$421); education expenses represented 2% (C$210); and other expenses represented 1% (C$105).

As it can be seen from the data shown above, food expenses had a great share of total expenditures; it can be implied that the income level is not high enough to allow the small and medium scale farmers to have resources to use for other expenditure items, mainly production-related expenditures. If the level of income increases, it will be possible for them to use more funds to improve both production and living conditions.

Summary of Farm Economy

Item	Number	Share (%)
Average Landholding Size	6.6 Mzs	
Average Number of Household Members	5.5 persons	
Gross Income (C$)	10,520	100
a) Agriculture-related sources	8,100	77
b) Livestock and off-farm sources	2,240	23
Gross Expenditures (C$)	9,978	
a) Food	6,733	64
b) Production-related	1,578	15
c) Transport	947	9
d) Clothing	526	5
e) Health-related	421	4
f) Education	210	2
g) Others	105	1

3.2.7 Agrarian Society and Gender

(1) Family, marriage, and dwelling house

There are 250 households in the Telica area. In this area, since most houses are built next to agricultural land, generally houses are dispersed.

Family members per household are about 5 or 6 people, and as for family type, many nuclear families are observed. Usually children become independent of their parents and keep house for themselves when they get married. In the case with economic difficulties, there are some cases living with parents. It is often observed setting up a house near to parents house, but neither paternal nor maternal social rules are observed as for places of houses.

Though, houses of inhabitants are slightly different from each other depending on their economic conditions, most of the houses are generally about 4m-by-4m square. Majority of houses is

wooden walled, coconut leaf-roofed or tin-roofed (tile-roofed for economic favored households) and earth-floored. Number of rooms is one or two and the same room is used as both the living room and the bedroom.

(2) Education

There are four elementary schools and about 400 students in the Study Area. Only 40 % are able to graduate from the elementary schools. The main reason of dropout is farming and helping household duties, and the economic reasons followed next. In this region, studying at junior high school is very rare (only 1 person in the previous year), and high transportation cost[1] to the Leon city, the place where junior high school located, is considered as another reason. The educational level in Telica Area is slightly better than that in El Espino, and 10 % are uneducated, a little more than 40% are dropping out of elementary schools, and another more than 40 % are graduated from elementary school or above.

(3) Health Care

The comarca Nicolás López Roque has one clinic, and Troilo area has the other clinic, and total 2 clinics are in the Study Area. The clinic in the comarca Nicolás López Roque was re-built last year and its renewed clinic has a consulting room, a pharmacy, and a treatment room. A doctor and a nurse commute from Leon City everyday and work only from 6:30 a.m. to 2:30 p.m. due lack of transportation means.

Most widely observed diseases in the Study Area are Acute Respiratory Infection and diarrhea. Nowadays skin disease is also observed. Parasitic disease is not popular. In average, about 20 patients or so per day visit the clinic.

(4) Gender

As same as the case of El Espino, divisions of labor based on gender is observed in the Study Area. Men work in the fields and women are in charge of house duties, such as sweeping, laundry, cooking, raising children, family farming and taking care of livestock. In this area, breeding cows are widely observed, the related jobs such as the care of cows, milking, selling milk and making and selling cheese are taken care by women.

The situation regarding activities per day and accessibility and control pattern of resources is similar to the situation of El Espino. Compared to hours engaged in cultivation by men, generally working hours of women are longer. As for the accessibility and control pattern of resources (the right of decision), contrary to the fact that men have access to the productive resources (land), products and capital and the right of decision regarding the sales of main products and the usage of capital, women only can gain access to productive resources but do not have the right of decision regarding the sales and the usage of capital. Similar to the situation of El Espino, what women can control is limited to products from family farming and small livestock such as chickens and eggs.

[1] The transportation cost to Leon city is 8 Cordoba to make a around trip. Normally, it is difficult to pay this transportation cost for agricultural households that do not have constant income.

3.2.8 Agrarian Organization

(1) Agrarian Associations

There are three agrarian cooperatives in the area, which are: Nicolás López Roque Cooperative, Jerónimo Rafael Guzmán Cooperative and Aristidez Sánchez Vázquez Cooperative to have been established since 1965, 1983 and 1987, respectively. Members belonging to these associations are more than 200 people (87, 90 and 24 members each).

The prevailing main functions of agrarian cooperatives are: to look for financing agencies, to solve the common problems of members and to manage Tempate (excluding Nicolás López Roque). However, since no credits are offered in these days, therefore, the function of cooperative is concentrated on the last two functions.

The structure of agrarian cooperatives mentioned above is shown in the diagram below.

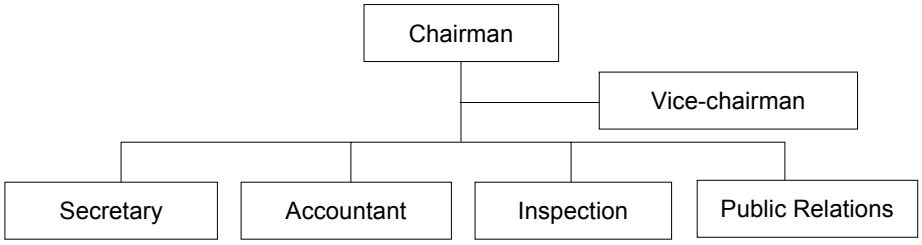


Fig. 3.2.5 Organization of Cooperatives in the area

The chairman of agrarian cooperative is in charge of any administrative aspect and the vice-chairman supports and substitutes the chairman in case of his absence. The accountant collects and manage membership (C$5 = US$ 0.5)[2] and the secretary takes note the discussions of each meeting. The public relations officer informs every necessary matters to the members, who are elected through voting to be held every 2 years.

(2) Subtiava Indigenous Agrarian Cooperatives Union: UCAIS

This union consists of 16 agrarian cooperatives located in the regions of Abangasca toward Pacific coasts. The chairman of the Nicolás López Roque takes the role of the president of the UCAIS at the same time. This cooperative comprised\s every cooperatives in the area mentioned before, and the total number of members reaches 1,198 persons. According to the president of UCAIS, the union has the following functions:

- Training: To plan seminars for making exchange of opinions of every cooperatives nationwide.
- Financing: The UCAIS has access to credits of banks. Therefore, their members have possibility to receive finance through UCAIS.
- Planning of activities: Investigation will be conducted for introduction of non-traditional products based on marketing information and natural conditions.
- Marketing
- Collective acquisition of inputs: The UCAIS purchases a great volume of inputs with lower prices and sell them to their members.
- Support to debtors: To render legal support to debtors and to make explanation on reason of delay in repayment to banks.

3.2.9 Infrastructure

(1) Social Infrastructure

1) Roads and Transportation

a) Access Road to the Project Area

The Telica Project Area is located at about 12 km west of the Leon City. The local road which leads to Colonia El Polvón from Leon is constructed. The boundary is in the southern part of the Area and this road borders each other. This road is not paved and the road condition is not good but in the case of rainfall, a vehicle can pass. The road width is 8-25 m.

b) Rural Road

The main roads in the Area branch from above-mentioned local road and lead to main colonies in the Area. The width of these roads is about 6-10 m and the total length is about 38 km. Since these roads are not paved and road maintenance is not done, a lot of roads are rough. Therefore, the proper treatment of road surface is necessary. However, there are not many sections where passage is hindered in case of the rainfall. Since the bridge isn't installed in the river crossing place (10-20m width) in eight places, the vehicle cannot pass these places in the rainy season. The simple bridges must be constructed in these places.

c) Transportation

The bus comes into the area from Leon several times on one day. Moreover, many light trucks carry goods and people. There is much passage of the bus on the local road where located in the southern part in the Area and most of the habitants in the Area use these buses.

2) Electricity and Communication

A power transmission line is installed in this Area as the power source of the pump for irrigation but electricity is not supplied to each home. There is no telephone in the area.

3) Medical Care and Education

Details are described in the Clause of the Farmhouse investigation.

4) Potable Water

Water supply facilities are not established in this area but a shallow well (about 10m depth) is installed in each home and generally, a hand-pump is used. These wells are never dried up even in the dry season.

(2) Rural Infrastructures

1) Irrigation Facilities

Existing large-scale irrigation facilities in the Area are as follows.

Existing Irrigation Facilities

Facility	Location	Area irrigated (Mz)	No. of members (Nos.)	Water Source	Power Source	Present Condition
Pump Station 1	Central Part	Field 27	10	Deep well	Diesel Engine 75Ps	Operating
Pump Station 2	"	Field 27	9	"	Diesel Engine 75Ps	No operating
Pump Station 3	"	Field 42	15	"	Electric Motor 100Ps	"
Pump Station 4	"	Field 40	17	"	Diesel Engine 100Ps	Operating
Paddy Field 1	Western Part	Rice 16	1	"	Diesel Engine 60Ps	"
Paddy Field 2	"	Rice 12	1	"	Diesel Engine 60Ps	"
Paddy Field 3	"	Rice 30	1	Telica river	Diesel Engine 45Ps x 2	"
Total		164	52			

Source: MAG-FOR, JICA Study Team

Among the above mentioned facilities, the benefited area of the paddy field 3 pumping station is out of the Project Area. The 2 pumping stations are not used at present. The cause is insufficiency of the operating capital. Besides, there are several farmers who pump up water from the small stream or the shallow well with the small pump to irrigate less than 1 ha of farmland. Totaling, the ratio of the irrigated area in the Study Area is about 14%.

2) Agricultural Land

The field lot of this Area is big generally and the short side of one lot is equal to or more than about 50 m. Because Manzana (Mz, 100 x 100 Vara = 0.7ha) is used for a unit of the field lot, the length of each side of the lot is the multiple of 100Vara (83.8m) generally.

3) Farm Road

The farm road in the area has the road width of about 6-10 m and the total length is about 38 km. There are many sections where road surface is rough since the maintenance work is not done and these farm roads should be rehabilitated in the future. However, there are not many sections where passage is hindered in case of the rainfall. Also, since there are eight places of small stream crossing (the 10-20 m width) which does not have a bridge and causes the traffic fault in the rainy season, it is necessary to construct simple bridges.

Farm roads are well arranged in the Area, and the agricultural machinery and the small trucks can get to most of the farms. The road width of these farm roads is 3-4 m and cars can not pass each other, but since there is little traffic in the farmland, this is not a problem.

4) Water for Livestock

About 15 heads of large-sized livestock (mainly cattle) are raised in this Area. Most of the livestock are grazed at the pasture or the field after harvest. The source of water for livestock is generally a shallow well dug around the stable or the small stream.

3.2.10 Environment

(1) Environmental Condition in Project Area

1) Social environment

a) Inhabitation

The majority of inhabitation of this area is indigenous, called Sutiapa. There are a few people who moved into this area. There are no conflicts between inhabitation of this area. Population

composition and economic activity has not been transformed in recent years.

b) Health and Sanitation

This area is Malaria protected area, but there has not been a break out of other endemic and epidemic diseases. Agrochemicals are used during farm work, however farmers do not use appropriate protective material during fumigation. Therefore a slight outbreak was suffered to farmers in this area, but there has not been a serious injury yet.

c) Cultural Property

There are no existing precious and important cultural heritage properties.

2) Natural Environment

a) Biological and Ecological

There are no endangered species in areas such as the wetlands (ponds, swamps, and marshes) do not fall under category stipulated in the Ramsar Treaty. However aquatic organization exist in the Rio Telica, it is necessary to protect these organization.

b) Topography, geology and soil

The area has flat topography and geology made up sandy loams and loam. The farmland occupied more than 50% of the total land use of this area. There are no soil erosion or other obstructions.

c) Forestry

Forest occupied 6.5% of land use in the area. Forest exists along the tributary of the Rio Telica, also afforested along the road and farmland. But production of fuel wood for living supply about only 50% of the demand of the area. The insufficient 50% is cut down out of area. Accordingly nursery production project was planed supported by MARENA and NGOs, but this project has not been implemented yet.

(2) Water Quality

1) Objective of the survey

Large-scale cotton growing had been managed in the Region II, including the Study Area. Much agrochemicals were used for the cultivation of cotton, which stay behind in the soil and ground water. Therefore water quality analysis was used for analyzing the suitability of ground water quality for irrigation.

2) Survey point and date

The water quality analysis expected homogeneity about residual agrochemicals in the ground water of all the wells in the area. Water was sampled two times in a 10 days interval, which improved the precision of analyzes.

Sampling Well	Third well of Telica area
Sampling Data	May/5/1998 (1^{st} time), June/1/1998 (2^{nd} time)

3) Result of analysis

The values of the Panama's environmental standards that are utilized in Central America were utilized in this study on water quality analysis. At present, MARENA, which is the organization in charge for such control, is still preparing the national standard. The result of analysis does not detect presence of any harmful agrochemical, so ground water of this area can be used for irrigation.

Agrochemical	1st Time	2nd Time	Standard
Organic-chlorine			
HCB			0.0082
HCH			0.0108
LINDANO			0.0126
ALDRIN			0.0189
OXICLORDANO			0.0274
HEPTACLOROEP		no	0.0270
PP'DDE			0.0392
DIELDRIN			0.0471
PP'TDE			0.0783
PP'DDT			0.0909
Organic-phosphoric pesticides			
DICLORVOS			1.5255
DIAZINON			1.5642
RONNEL			2.2737
CLORPIRIFOS			1.8793
MALATHION		no	4.6890
ETHILPARATHION			2.0350
ETHION			3.2274
CARBOFENOTION			6.4746

3.3 Potentials and Constraints for Development

3.3.1 Potentials for Development

(1) Land

The zones of the region II, located along the Pacific Coast, present a plain topography and fertile soils, and are known as the main agricultural production zone in Nicaragua. The district of Telica is located within this zone and in its surroundings several types of irrigation based agriculture are carried out.

However, the agricultural land of each farmer is in average 6.6 Mz, equivalent to almost half the average in the whole Region II, which is 11.1 Mz, and around 55% of the farmers in this district have less than 5 Mz. The majority of this agricultural land cannot been efficiently utilized, although the total cultivated area, with good natural conditions, can be increased by means of the introduction of an irrigation system.

(2) Hydraulic Resources

The district of Telica presents abundant groundwater resources and it is possible to bring this water up easily and in great amount with a relatively small depth. As a matter of fact, in some places of the district this groundwater is already utilized. At the time when cotton was intensively cultivated, the utilization of groundwater was even larger. On the other hand, the Telica river which runs at the district limit still has available water for development purposes which allows its utilization for irrigation. In this manner, Telica is characterized for having a high potential on water resources within the region.

(3) Other Development Potentials

The district of Telica also presents other good conditions such as location. It is located close to the city of León, which is the second biggest city in Nicaragua. Therefore, it presents advantages in introducing, besides the basic grains, several crops to be supplied to that city.

Furthermore, due to the execution of an immigration project 20 years ago, the roads still present good conditions and the green areas are properly maintained, which means that the infrastructure improvement cost is lower in this district comparing with other districts. In this manner, it offers an ideal environment for small and medium scale farmers regarding infrastructure supply.

3.3.2 Constraints for the Development

The main factors for the low level of life conditions of the Telica district farmers are presented as follows;

(1) Insufficient Funds for the Agricultural Activity

The farmers in this District are suffering from the impossibility of obtaining new credit for the acquisition of agricultural machinery and hiring of workers. This is because the interest rates are too high, besides the fact that they do not have goods to mortgage and there are still debts to be paid, among other factors. The existence of debts is because they could not obtain the expected agricultural production due to the unstable meteorological conditions and the insufficiency of the irrigation system. As for the mortgage problem, one of the reasons for this situation is that the registration of land is lacking an improvement.

(2) Lack of Water for Agricultural Purposes

The proportion of agricultural land being cultivated under irrigation corresponds to 14%, the rest remaining without irrigation system. The non irrigated area presents the following problems; impossibility of cultivation in the whole area due to unstable rainfall pattern, impossibility of creating job opportunities, low level of cultivation methods leading to a low agricultural production. The delay in improving the irrigation system is due to the fact that the small farmers can not improve it with their own funds, once the initial investment is too high. In this aspect, the lack of support by the Nicaraguan Government also contributes to worsen the problem. Another reason for the impossibility of increasing the cultivated area is that a large portion of the agricultural land is being utilized for the cultivation of Tempate.

(3) Insufficient Agricultural Guidance

The farmers lack sufficient guidance about agricultural technology, which is one of the reasons for the low agricultural productivity. There are several reasons for this situation such as lack of interest in receiving governmental support, low capacity to pay for the technical instruction, and lack of a technical extension system due to scarce economic resources of the Government.

(4) Scarcity of Agricultural Machinery

In this district, there are no organizations lending agricultural machinery. Besides that, the maintenance cost of such machinery is too high and the farmers themselves can not purchase it. This situation represents one of the causes for the low agricultural production. Therefore, the main reasons for the scarcity of agricultural machinery are weak farmers' organizations, too

expensive spare parts, and insufficient access to credit.

(5) Lack of Agricultural Materials

Besides the lack of economic resources by the farmers, their organizations are not well organized as for to purchase the materials collectively. Another problem is that the agricultural materials prices are too high due to the intervention of middlemen. These are the main reasons for the lack of agricultural materials which also a contributing factor for low agricultural production.

(6) Low Selling Prices of Agricultural Products

The farmers are obliged to sell their products at too low prices, this fact being the main reason for their low income. This situation occurs because they can not wait for the prices to rise due to the following reasons; lack of storehouses to keep the products, lack of utilization of market information, lack of proper transportation means, necessity to obtain money in cash as soon as possible.

3.4 Basic Guidelines of the Agricultural Development Model by Area

The Telica Study area is located near the city of Leon, the second biggest city in Nicaragua. It covers a portion of the flatland at the left side of the Telica River, a zone with a high agricultural potential. Green areas are abundant in this zone and its good natural conditions made possible to gather many small farmers. In spite of this, since these small farmers cultivate according to the rainy season, their production is unstable.

On the other hand, there are many farmers carrying out two activities at the same time, and the income from agriculture is secondary. This is due to the fact that they live near the urban areas and their cultivable areas are small. Even when their agricultural land is larger, their cultivated area is small because of the lack of economic resources and labor force, the cultivated crops are sold at low prices, there is a lack of cultivation technology, the rainfall regime is unstable, etc. Therefore, these farmers cannot count only on the income of the agricultural activity.

The objective of the agricultural development model is to be able to fulfill these needs and, at the same time, making good use of the potential for local development pretends to eliminate the constraints for the development. As for the Tempate, which is cultivated in this zone, at present this issue is under lawsuit, thus the results can not be foreseen. Therefore, the area will be considered with the actual conditions, without any variation, although in relation to the planned infrastructure, the alternative of change of the cultivation items will also be studied. The following items are proposed to be the basic guidelines for the development;

(1) Improvement of Productive Infrastructure at a Short Term and Establishment of the Guidance for its Management

The idea is to make possible the increase of a continuous production of each of the small farmers through the introduction of the minimum necessary irrigation facilities required. Since the irrigation source will be a combination of superficial water and wells, it is necessary to provide a good orientation to the farmers as well as to strengthen the small and medium-scale farmers' organization in order to attain an efficient management and O&M of this irrigation system.

(2) Increase of the Agricultural Technology Based on an Effective Technical Assistance

The cultivation plan to raise profitability in production is based on the combination of basic grains and the commercial crops of high profitability. It is intended to gather small and medium-scale farmers in an organized way aiming at easing their access to the extension services rendered by governmental institutions such as MAG-FOR and INTA, besides the NGOs.

(3) Agricultural Credit Accessible to Small and Medium-Scale Producers

Rural organizations will be created as the receptive bodies for the loans and a new credit system will be established accessible to small and medium-scale farmers within the framework of the development model.

(4) Collection and Selling of Products at a Group Level through the Apprenticeship of New Agricultural Techniques for Commercialization

Initially, the current modality of selling the products to the intermediary and/or bringing in small lots to the market independently from the properties will be maintained. However for the future, a new gathering modality and collective shipment by means of grouping the small and medium-scale farmers in order to elevate the profitability will be incorporated. In order to accomplish this, the meetings of the farmers will be used to explain to them the new challenge of giving a larger added value to their crops by means of gathering and collective shipment.

(5) Continuous Development of the Environment Protection

This area still count with large green areas and the reforestation is being carried out. In order to protect the environment, it is necessary to create a farmers' organization which can carry out the reforestation activities in a continuous way.

(6) Creation and Management of the Farmers' Organization

A farmers' organization will be created to be the basis for the continuous development of several activities, based on the good interaction of its members.

3.5 Land Use Plan

The basic concept to formulate a land use plan in this Study Area is premised on how to improve farmer's life with conservation of natural environment. Therefore, selecting suitable farmland for crop production, and necessary amount of crop harvest for the people is secured by producing a maximum yield with an intensive farming method.

Meanwhile, under the imperative necessity of preserving the unsuitable farming land and forest areas as before from the viewpoint of natural environmental conservation, a land use plan was formulated based on the following direction.

1) Telica area is dominant with flat landscape with a thick plowing layer, less problem soils, and soil erosion problems because of less sloppy area, and planting trees should be carried out along the river bank and boundary among the arable land, and the roads.
2) From the viewpoint of preserving the existing forest, it should be kept without destruction and managed by planting trees as a source of firewood supply.

3) The field of Tempate (*Jatoropha carcus L*) is in dispute at present, and most of the Tempate growers want to remove them, and a land use plan should be examined with two cases such as " excluding Tempate field" and "including Tempate field".
4) An expansion of residential area caused by population increase (2.6 % per year) is considered of securing 24 Mz more in 2015.
5) Grass land is basically maintained in status quo by increasing the annual fodder production and some part of the grass land is diverted to the future residential area, while rice straw, a byproduct of upland rice can be used as an alternative fodder source during the dry season.
6) A cropping intensity of 65 % at present should be expanded by improving land productivity and labor productivity with introduction of irrigation farming.
7) The existing paddy field should be in status quo.

Under this direction, the land use plan for the study area was formulated as shown below;

Present Land Use and Future Land Use Plan in Telica Area Unit: ha

Land Use	Actual	Potentials for development			
		With tempate		tempate (present)	
		Rainfed	Irrigated	Rainfed	Irrigated
Upland field	795.2	0	798.3	0	798.3
Rainfed land	27.8	0	27.8	0	27.8
Tempate	334.6	0	334.6	334.6	0
Grass land	135.9	135.9	0	135.9	0
Waste land	26.0	-	-	-	-
Forest	97.3	-	-	-	-
Total	1,416.8	135.9	1,160.7	470.5	826.1

After implementation of the plan, the existing rainfed farmland can be double-cropped by introducing irrigation technology.

3.6 Proposed Farm Management Plan

3.6.1 Basic Concept for Formulating Farm Management Plan

The farmland in this area is potentially productive but is put in the condition that the small-medium scale farmers could not exercise in full-scale due to limited accessibility for the means to improve a productivity. Thus it is considered as a top priority that a rich rural life would be established by developing its potentiality from agronomic view and promoting an income improvement of the small-medium scale farmers, and the proposed farm management plan is formulated based on the policy described below.

(1) The target crop is examined based on a direction to seek for a market-oriented agriculture with crop-diversification by increasing value-added of agro-products from current basic grain-oriented production system for self-sufficiency.

(2) Transition to crop-diversification process should be initiated from improvement of crop productivity for the prevailing crop under medium-long term range, while cash crop like vegetables should be gradually introduced by training the beneficiaries to get an eagerness and receptive capacity under OJT period.

(3) With establishment of self-supply system by improving land and labor productivity from present extensive farming system, introducing a possible farming system from present

beneficiary's skill is examined with aiming for market-oriented agriculture.

(4) New farm management plan shall be examined in order to secure a stable agro-income and be possible to work in owned- farm through the year without off-farm activity by introducing irrigation technology from the rainfed-oriented farming system.

(5) In order to seek for a sustainable farming with an effective use of agro-environmental resources, a farming system which enable sustainability of natural resources is premised by introducing a reduced agro-chemical use, leguminous crop to build soil fertility, and protection methods of soil erosion.

3.6.2 Proposed Cropping System

The cropping system for the Study Area was formulated based on the basic concept stated in 3.6.1.

(1) Target Crops

The major target crops selected for the Study Area are maize, sorghum, upland rice, soybean, cassava and vegetables. The reasons for the selection are as follows;

Maize:
Maize is one of the important staple food crops not only in the Study Area but also in Nicaragua with special contemplation among the farmers, but has not accomplished to support themselves yet, and it is to be imported every year.

Sorghum:
Sorghum plays an important role as a fodder source for agriculture with livestock raising system among the small to medium-scale farmers, and thus it should be kept as before.

Upland rice:
Upland rice is an important principle food crop among the basic grains not only in the Study Area but also in Nicaragua; however, rice is imported every year. Thus self-support of rice is one of important policies in Nicaragua.

Soybean:
Soybean whose international price is relatively stable is one of the fair profitable crops which can be easily mechanized in its farm operation system through a custom hired system, and should be introduced with the purpose of rotation crop as well.

Yucca
Yucca is one of recommended crop via the crop diversification strategy, and its processing facility is completed in the surrounding area. Further, yucca is technically easy to cultivate with a high profit, and it should be extended as an export crop.

Vegetables:
Watermelon, bell pepper, cabbage and pipian, which have a steady demand in the market are introduced. The farmers in the Study Area are highly concerned about the crops, which bring in a good profit supported by the large consuming city like Leon and Chinandega, located in the outskirts of the Study Area.

(2) Proposed Cropping System

The proposed cropping system is designed using linear programming (LP) model to maximize the profit, based on the maximum use of available family labor, land and water resources under consideration of the natural and socioeconomic conditions in the Study Area. Formulating the plan, a profit coefficient of each target crop, technical coefficient of labor and land use, kind of constraints and its quantity are set as mentioned below.

1) Profit Coefficient

Concerning the profitability of each target crop, production cost and profit are fixed as follows, based on the cost estimated document issued by the National Bank as a standard for financing business, the information of official and NGO's farmer's supporting organizations, agrochemical suppliers, local market and the result of farmer's interview survey in the Study Area.

Profit Co-efficient of the Target Crop in Telica Unit: C$/Mz

Cost Item	Supplemental irrigation	Irrigation			Supplemental Irrigation				Irrigation
	Upland rice (Rainy season)	Bell Pepper	Watermelon	Pipian	Cassava	Soybean	Sorghum	maize (rainy season)	Maize (Dry season)
Custom hired charge	380.0	520.0	520.0	370.0	490.0	700.0	430.0	430.0	380.0
Labor charge	975.0	2787.5	1895.0	1750.0	1100.0	232.5	900.0	700.0	700.0
Transportation	165.0	50.0	50.0	50.0	185.0	20.0	25.0	25.0	25.0
Seed & fertilizer	1174.0	1155.0	1194.0	828.0	576.0	501.0	482.5	564.0	564.0
Agro-chemicals	1352.5	2961.8	1475.0	1664.0	135.0	707.8	510.0	990.0	990.0
Harvesting & others	1269.3	1486.0	506.0	1008.0	935.0	562.0	709.5	647.0	647.0
Irrigation cost	1009.7	986.3	986.3	886.3	252.4	300.0	261.2	504.9	1009.0
Depreciation	5.4	4.4	4.4	4.4	5.4	5.4	5.4	5.4	5.4
Total cost(C$)	6330.9	9951.0	6630.7	6560.7	3678.8	3028.7	3323.6	3866.3	4320.4
Yield(/Mz)	80.0	375.0	200.0	2500.0	125.0	45.0	65.0	80.0	80.0
Farm gate price	240.0	50.0	60.0	5.0	60.0	120.0	85.0	90.0	90.0
Gross income(C$)	12720.0	18750.0	12000.0	12500.0	7500.0	5400.0	5525.0	7200.0	7200.0
Net income(C$)	6389.1	8799.0	5369.3	5939.3	3826.6	2371.3	2201.4	3333.8	2879.6
B/C ratio(%)	100.9	88.4	81.0	90.5	104.0	78.3	66.2	86.2	66.7

2) Labor force and Land Resource Constraints

The pre-fixed condition to formulate a farm management plan is set by classifying the beneficiaries into 2 classes, such as Type A : 10 Mz landholder and Type B: less than 10 Mz land holder. Further, while formulating cropping pattern, 2 cases are taken into account such as without Tempate field area and with Tempate field area, considering the future diversification to arable land as follows.

① Pre-fixed condition of the Study Area

Prefixed Condition to formulate farm management plan in Telica Area (without Tempate

Farmer's Class	No of FH	Arable land Area(Mz)	Available labor/FH	Working hours/day	Pooled Working Hours/FH/M	Monthly Total Working Hours/area	Maize for self-support	Sorghum for self-support (Status in quo)	Employed Casual worker	Cropping of Vegetables
A Type≧10Mz)	26	377.7	3.7	7	621.6	16,161	5 Mz	8Mz	・Family labor + casual worker ・15 C$/Head/Day	Cropping area of 3 vegetables a cassava is at least 10% of t arable land.
B Type≦10Mz)	221	763.7	3.7	7	621.6	137,373	40 Mz	44Mz	・Family labor	Cropping area of 3 vegetables a cassava is at least 10% of t arable land.
Total	247	1141.4				153,534	45 Mz	52Mz		

Source : JICA Study

Prefixed Condition to formulate farm management plan in Telica Area (with Tempate

Farmer's Class	No of FH	Arable land Area(Mz)	Available labor/FH	Working hours/day	Pooled Working Hours/FH/M	Monthly Total Working Hours/area	Maize for self-support	Sorghum for self-support (Status in quo)	Employed Casual worker	Cropping of Vegetables
A Type≧10Mz)	26	428.1	3.7	7	621.6	16,161	5 Mz	8Mz	・Family labor + casual worker ・15 C$/Head/Day	Cropping area of 3 vegetables a cassava is at least 10% of t arable land.
B Type≦10Mz)	221	1191.8	3.7	7	621.6	137,373	40 Mz	44Mz	・Family labor + casual worker ・15 C$/Head/Day	Cropping area of 3 vegetables a cassava is at least 10% of t arable land.
Total	247	1619.9				153,534	45 Mz	52Mz		

② Restricted Condition of model farm household by the farm household type in the Study Area

Planting acreage for self-supporting of maize and sorghum was fixed in accordance with the per capita consumption amount presented by INTA, and a current planting area of sorghum for livestock feed (See Annex). Meanwhile, the targeted vegetable crop was examined in terms of cropping area under consideration of the marketing factor. Under consideration of various constraints, the cropping pattern formulated with cropping area per each case is shown below.

Prefixed condition of the model farm household to formulate farm management plan in Telica Area (Without Tempate field)

Individual Farmer's Class	No of FH	Arable land Area/FH (Mz)	Available labor/FH	Working hours/day	Pooled Working Hours/FH/M	Maize for self-support	Sorghum for self-support (Status in quo)	Employed Casual worker	Cropping Limitation of Vegetables
A Type	26	14.5	3.7 人	7	621.6	0.2 Mz	0.3Mz	・Family labor + casual worker ・15 C$/Head/Day	Cropping area of 3 vegetables and cassava is at least 10% of the arable land.
B Type	221	3.5	3.7 人	7	621.6	0.2	0.2	・Family labor	Cropping area of 3 vegetables and cassava is at least 10% of the arable land.

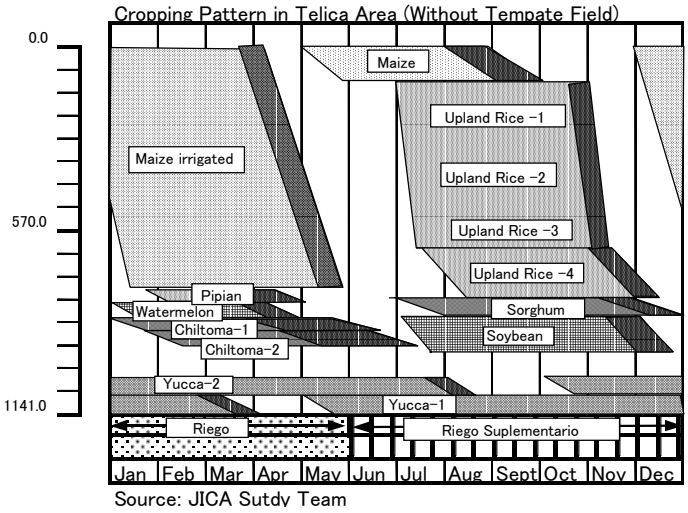
Source：JICA Study Team

Prefixed condition of the model farm household to formulate farm management plan in Telica Area (With Tempate field)

Individual Farmer's Class	No of FH	Arable land Area/FH (Mz)	Available labor/FH	Working hours/day	Pooled Working Hours/FH/M	Maize for self-support	Sorghum for self-support (Status in quo)	Employed Casual worker	Cropping Limitation of Vegetables
A Type	26	16.5	3.7 人	7	621.6	0.19 Mz	0.3Mz	・Family labor + casual worker ・15 C$/Head/Day	Cropping area of 3 vegetables and cassava is at least 10% of the arable land.
B Type	221	5.4	3.7 人	7	621.6	0.18 Mz	0.2Mz	・Family labor + casual worker ・15 C$/Head/Day	Cropping area of 3 vegetables and cassava is at least 10% of the arable land.

Source：JICA Study Team

③ The Case without Tempate field



Source: JICA Sutdy Team

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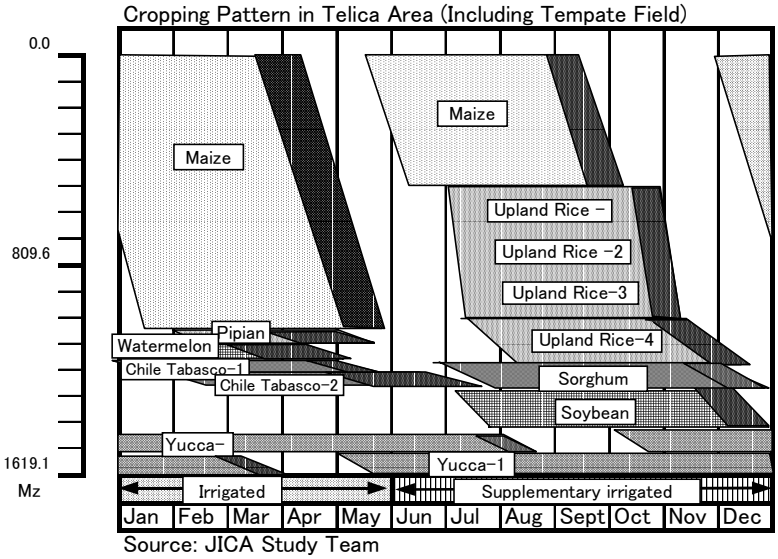
Crop Production Plan in Telica Area(Without Tempate Field] CI(%)= 181.0

Cultivo	A type FH (Mz)	B type FH (Mz)	Total (Mz)	%	Rendimient (QQ/Mz)	Produccion Total	Precio (C$/qq)	Total Ingreso	Costo de produccion	Sub total (C$) costo	Net de Ingreso
Maiz con riego	186.4	568.7	755.1	36.5	80	60408	90	5436720	4315.7	3258785.1	2177934.9
Maiz invierno	24.7	43.3	68.0	3.3	80	5440	90	489600	3866.0	262888.0	226712.0
Maiz por AC	5.0	40.0	45.0	2.2	80	3600		0	3866.0	173970.0	-173970.0
Sorgo por AC	8.0	44.0	52.0	2.5	65	3380		0	3323.6	172827.2	-172827.2
Arroz invierno-1	65.0	120.0	185.0	9.0	50	9250	240	2220000	6330.9	1171216.5	1048783.5
Arroz invierno-2	65.0	120.0	185.0	9.0	50	9250	240	2220000	6330.9	1171216.5	1048783.5
Arroz invierno-3	65.0	120.0	185.0	9.0	50	9250	240	2220000	6330.9	1171216.5	1048783.5
Arroz invierno-3	65.0	120.0	185.0	9.0	50	9250	240	2220000	6330.9	1171216.5	1048783.5
Soya	40.0	76.4	116.4	5.6	45	5238	120	628560	3028.7	352540.7	276019.3
Yucca 1**	20.0	40.0	60.0	2.9	125	7500	60	450000	3678.8	220728.0	229272.0
Yucca 2**	20.0	40.0	60.0	2.9	125	7500	50	375000	3678.8	220728.0	154272.0
Pipian*	10.0	15.0	25.0	1.2	2500	62500	5	312500	6560.7	164017.5	148482.5
Sandia*	15.0	40.0	55.0	2.7	200	11000	60	660000	6630.7	364688.5	295311.5
Chiltoma 1**	15.0	30.0	45.0	2.2	375	16875	50	843750	9951.0	447795.0	395955.0
Chiltoma 2**	15.0	30.0	45.0	2.2	375	16875	50	843750	9951.0	447795.0	395955.0
Sub total	619.1	1447.4	2066.5	100.0				18919880.0		10771629.0	8148251.1
Area (Mz)	377.7	763.7		la unidad de produccion: * doc, ** sacos, ninguno asterisco 'QQ'							
Crop Intensity(%)	163.9	189.5									

Both A and B types are similar double cropping systems but B type results in more cropping acreage than that of A type. The CI of this pattern results in 181% as a whole while the A type above 10 Mz land holder becomes 163.9% and 189 % for the B type under 10 Mz land holder, respectively, and approximately a little less than 3 times of the present CI. The cropping pattern yields C$8,150,000 of the net income in the Study Area.

④ The Case with Tempate Field



Source: JICA Study Team

Net Ingresso: 10551989.6

Crop Production Plan in Telica Area(With Tempate Field] CI(%)= 176.2

Cultivo	A type FH (Mz)	B type FH (Mz)	Total (Mz)	%	Rendimient (QQ/Mz)	Produccion total(QQ)	Precio (C$/qq)	Total Ingreso	Costo de produccion	Sub total (C$) costo	Net de Ingreso
Maiz con riego	188.3	874.7	1063.0	37.3	80	85038.4	90	7653456.0	4315.7	4587502.8	3065953.2
Maiz por inviern	41.2	428.6	469.8	16.5	80	37584.0	90	3382560.0	3866.0	1816246.8	1566313.2
Maiz por AC	5.0	40.0	45.0	1.6	80	3600.0			3866.0	173970.0	-173970.0
Sorgo por vendc	33.9	0	33.9	1.2	65	2203.5	85	187297.5	3323.6	112670.0	74627.5
Sorgo por AC	8.0	44.0	52.0	1.8	65	3380.0			3323.6	172827.2	-172827.2
Arroz invierno-1	65.0	120.0	185.0	6.5	50	9250.0	240	2220000.0	6330.9	1171216.5	1048783.5
Arroz invierno-2	65.0	120.0	185.0	6.5	50	9250.0	240	2220000.0	6330.9	1171216.5	1048783.5
Arroz invierno-3	65.0	120.0	185.0	6.5	50	9250.0	240	2220000.0	6330.9	1171216.5	1048783.5
Arroz invierno-3	65.0	120.0	185.0	6.5	50	9250.0	240	2220000.0	6330.9	1171216.5	1048783.5
Soya	40.0	119.2	159.2	5.6	45	7164.0	120	859680.0	3028.7	482169.0	377511.0
Yucca 1**	20.0	40.0	60.0	2.1	125	7500.0	60	450000.0	3678.8	220728.0	229272.0
Yucca 2**	20.0	40.0	60.0	2.1	125	7500.0	50	375000.0	3678.8	220728.0	154272.0
Pipian*	10.0	15.0	25.0	0.9	2500	62500.0	5	312500.0	6560.7	164017.5	148482.5
Sandia*	15.0	40.0	55.0	1.9	200	11000.0	60	660000.0	6630.7	364688.5	295311.5
Chiltoma 1**	15.0	30.0	45.0	1.6	375	16875.0	50	843750.0	9951.0	447795.0	395955.0
Chiltoma 2**	15.0	30.0	45.0	1.6	375	16875.0	50	843750.0	9951.0	447795.0	395955.0
Sub total	671.4	2181.5	2852.9	100.0				24447993.5		13896003.9	10551989.6
Farm Land (Mz)	428.1	1191.8									
Crop Intensity(%	156.8	183.0									

la unidad de produccion: * doc, ** sacos, ninguno asterisco 'QQ'

Both A and B types are similar cropping but the addition of cropping acreage is originated from an increase of the basic grain which requires less labor force compared to the case excluding Tempate field under condition of labor limitation. Vegetable should be status quo to avoid oversupply to the market. Therefore, in spite of pre-fixing condition of 20 % more labor force increase, a crop intensity is reduced to 156.8 % for the A type, 183.2 % for the B type, and 176.3 % for the whole area, respectively. This cropping pattern yields 10,550,000 C$ of the net income in the Study Area.

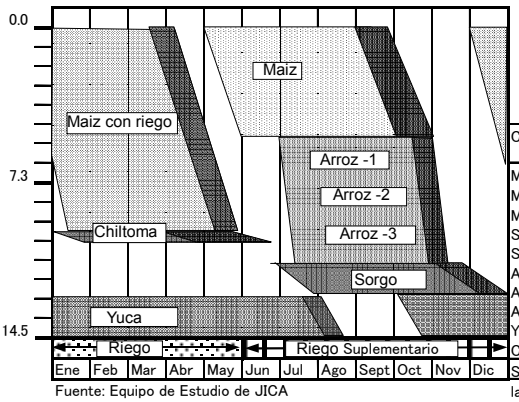
⑤ Cropping Plan for the model farm household by the farm household type (Without Tempate field)

Next, the model cropping pattern for the two types of the farmer's class prevailing in the Telica Study Area is presented below. Target crop and its proportional cropping acreage were

formulated based on the factor of possessed land acreage, family labor size and employed casual workers under the prefixed condition stated at the beginning. The target crop should be selected from the cropping pattern of the Study Area based on farming scale, ability and experience of each individual farmer, and consequently CI and income varies with the selected crops.

a. Model Farmer A Type

Cropping Pattern of Model Farmer A Type in Telica



Net Ingresso 93060.7
CI(%)= 188.8

Cultivo	Mz	%	Rendimient (QQ/Mz)	Produccion Total	Precio (C$/qq)	Total Ingreso	Costo de produccion	Sub total (C$) costo	Net de Ingreso
Maiz con riego	11.3	42.9	80	900.0	90	81000	4315.7	48551.6	32448.4
Maiz invierno	5.0	18.9	80	396.8	90	35712	3866.0	19175.4	16536.6
Maiz por AC	0.2	0.8	80	16.0		0	3866.0	773.2	-773.2
Sorgo invierno	1.0	4.0	65	67.6	85	5746	3323.6	3456.5	2289.5
Sorgo por AC	0.3	1.1	65	19.5		0	3323.6	997.1	-997.1
Arroz invierno-1	2.0	7.6	50	100.0	240	24000	6330.9	12661.8	11338.2
Arroz invierno-2	2.0	7.6	50	100.0	240	24000	6330.9	12661.8	11338.2
Arroz invierno-3	2.0	7.6	50	100.0	240	24000	6330.9	12661.8	11338.2
Yucca *	2.0	7.6	125	250.0	50	12500	3678.8	7357.6	5142.4
Chiltoma *	0.5	1.9	375	187.5	50	9375	9951.0	4975.5	4399.5
Sub total	26.3	100.0				216333.0		123272.3	93060.7

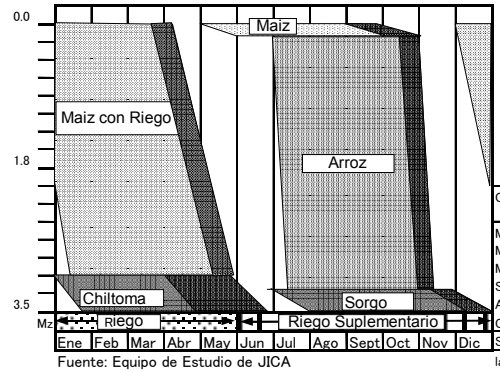
Fuente: Equipo de Estudio de JICA

la unidad de produccion: * sacos, ninguno asterisco 'QQ'

The model farmer A type has 14.5 Mz of arable land and cultivates mainly maize, sorghum, upland rice, cassava and chiltoma. The dry season is irrigated 100 % and supplemental irrigation for the rainy season. Casual worker should be employed in accordance with need under prefixed condition of 20 % more labor force increase on the family labor, and the annual CI results in 188.8 % with C$93,000 of agriculture net income.

b. Model Farmer B Type

Cropping Pattern of Model Farmer B Type in Telica



Net Ingresso: 28955.2
CI(%)= 200.0

Cultivo	Mz	%	Rendimient (QQ/Mz)	Produccion Total	Precio (C$/qq)	Total Ingreso	Costo de produccion	Sub total (C$) costo	Net de Ingreso
Maiz con riego	3.0	42.9	80	240	90	21600	4315.7	12947.1	8652.9
Maiz invierno	0.1	1.4	80	8	90	720	3866.0	386.6	333.4
Maiz por AC	0.2	2.9	80	16		0	3866.0	773.2	-773.2
Sorgo por AC	0.2	2.9	65	13		0	3323.6	664.7	-664.7
Arroz invierno	3.0	42.9	50	150	240	36000	6330.9	18992.7	17007.3
Chiltoma *	0.5	7.1	375	187.5	50	9375	9951.0	4975.5	4399.5
Sub total	7.0	100.0				67695.0		38739.8	28955.2

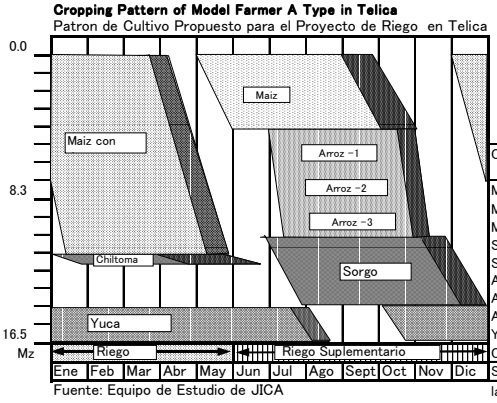
Fuente: Equipo de Estudio de JICA

la unidad de produccion: * sacos, ninguno asterisco 'QQ'

Model farmer B type has only 3.5 Mz /farm household and cultivates with mainly maize, sorghum, upland rice and chiltoma. Irrigation scheme is similar with Type A in both cropping seasons but it is possible to manage within a family labor force and generate C$29,000 of agriculture net profit with 200 % of the annual CI.

⑥ Cropping Plan for the model farm house by each farmer's class (With Tempate field)

a. Model Farmer A Type



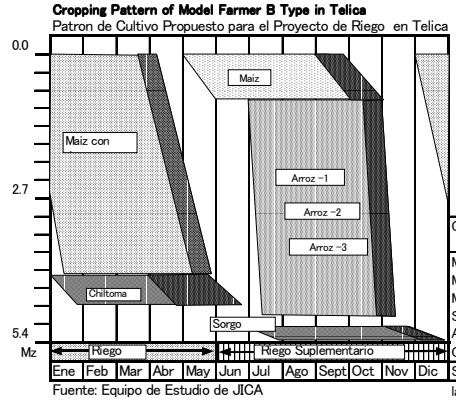
Net Ingressc 96648.0
CI(%)= 171.2

Cultivo	Mz	%	Rendimien (QQ/Mz)	Produccion Total	Precio (C$/qq)	Total Ingreso	Costo de produccion	Sub total (C$) costo	Net de Ingreso
Maiz con riego	11.3	39.8	80	900.0	90	81000	4315.7	48551.6	32448.4
Maiz invierno	4.2	15.0	80	339.2	90	30528	3866.0	16391.8	14136.2
Maiz por AC	0.2	0.7	80	16.0			3866.0	773.2	−773.2
Sorgo invierno	3.8	13.3	65	244.4	85	20774	3323.6	12496.7	8277.3
Sorgo por AC	0.3	1.1	65	19.5			3323.6	997.1	−997.1
Arroz invierno-1	2.0	7.1	50	100.0	240	24000	6330.9	12661.8	11338.2
Arroz invierno-2	2.0	7.1	50	100.0	240	24000	6330.9	12661.8	11338.2
Arroz invierno-3	2.0	7.1	50	100.0	240	24000	6330.9	12661.8	11338.2
Yucca	2.0	7.1	125	250.0	50	12500	3678.8	7357.6	5142.4
Chiltoma *	0.5	1.8	375	187.5	50	9375	9951.0	4975.5	4399.5
Sub total	28.3	100.0				226177.0		129529.0	96648.0

la unidad de produccion: * sacos, ninguno asterisco 'QQ'

Model farmer A type still increases to 16.5 Mz/farm household and cultivates mainly maize, sorghum, upland rice, cassava and chiltoma same as ⑤a. Irrigation scheme is same as the previous model with pre-fixed condition of 20 % more labor force to a family labor in accordance with labor requirement. The annual CI decreases a little to 171.2% and generates C$97,000 of agriculture net profit.

b. Model Farmer B type



Net Ingressc 40391.4
CI(%)= 186.9

Cultivo	Mz	%	Rendimien (QQ/Mz)	Produccion Total	Precio (C$/qq)	Total Ingreso	Costo de produccion	Sub total (C$) costo	Net de Ingreso
Maiz con riego	4.2	41.5	80	335.2	90	30168	4315.7	18082.8	12085.2
Maiz invierno	0.9	8.9	80	72.0	90	6480	3866.0	3479.4	3000.6
Maiz por AC	0.2	2.0	80	16.0		0	3866.0	773.2	−773.2
Sorgo por AC	0.3	3.0	65	19.5		0	3323.6	997.1	−997.1
Arroz invierno	4.0	39.6	50	200.0	240	48000	6330.9	25323.6	22676.4
Chiltoma *	0.5	5.0	375	187.5	50	9375	9951.0	4975.5	4399.5
Sub total	10.1	100.0				94023.0		53631.6	40391.4

la unidad de produccion: * sacos, ninguno asterisco 'QQ'

Model farmer B type including Tempate field has 5.4 Mz of the arable land /farm household and cultivates mainly maize, sorghum, upland rice and chiltoma. Irrigation scheme is carried out same as Model A type and it is possible to manage within family labor force through the year. The CI decreases relatively to ⑤-b and 186.9% but increases C$40,000 as an agriculture net profit.

(2) Proposed Farming Practice

In order to exhibit an agricultural potential and accomplish a high productivity, introduction of irrigation farming is essential for stabilization of crop production due to unstable rainfall, one of natural constraints. On the other hand, it is absolutely necessary to bring in the improved seeds and farming practice, efficient farm operation based on a proposed cultural technique, timely farm operation, systematic harvesting and shipping on the produce, and so on. The proposed

farming system was formulated based on the farming practice prevailing in the Study Area under the following direction.

1) The Study Area has poor content of soil organic matter and soil nitrogen, and been composed of compacted soil, thus breaking hardpan layer should be done at the beginning of the rainy season on every 3 years while crop residue should be incorporated into soil as much as possible in order to improve soil physical-chemical properties.

2) A current custom hired system for plowing and harrowing operations is continuously strengthened and possible operation such as inter-tiling is managed via custom hired system by using tractor or animal traction power.

3) Sprinkler and furrow irrigation methods are applied 100 % during the dry season and supplemented during the rainy season.

4) Animal traction power as well as mechanized power is applied to manage various farm operations such as ridging, ditching, sowing, weeding, fertilizer application, chemical spray, harvesting, drying the harvest, and transportation as much as possible. If not, it is manually managed.

5) Soybean is cultivated with a consignment operation system via a custom hired system. A harvesting operation of upland rice is managed by combine via custom hired system and the paddy rice is processed into white rice by the producer and sold.

6) Necessary labor force for the proposed farming practice is mainly managed by the family labor, and supplemental labor force will be recruited in the Study Area and its surrounding area, up to 20 % more to a present labor force during the season.

Further details in the farming practice of each crop should be refereed to the Annex.

(4) Labor Forces

Examining a feasibility of the formulated cropping pattern based on the proposed farming practice, a difference between the required labors and available family labors was examined in each model farm household in the Study Area.

1) Case of without Tempate field

Below table shows a result of the difference between required labor and available labor for the cropping pattern. In the A type farm household (FH), a necessary annual pooled labor force is 7785.7 hours (1122.2 man-day per FH) to the 7452 hours (1065.6 man-day per FH), available family labor, which implies 822.9 hours (117.6 man-day) short annually and equivalent to 11 % of the annual available family labor per FH. Examining the labor force per each month, the only time family labor can cope with June and November. But the rest of the months generate 124 hours (17.7 man-day per FH) short at peak during August and March. This short of help can be compensated by a surplus labor force generated from the B type FHs. Meanwhile, the arable land of the B type is a quarter of the A type and annual labor requirement per household is 3580.6 hours (557.2 man-day per FH), half of the type A. Thus it is well managed by the family labor through the year.

Difference of Labor Requirement on the Proposed Model Farmer's Farming Plan (Without Tempate Field)

Kind of Labor Force	FH Type	Monthly Labor Requirment												Total
		5	6	7	8	9	10	11	12	1	2	3	4	／Y／FH
Available Family Labor Cap/Month		621.0	621.0	621.0	621.0	621.0	621.0	621.0	621.0	621.0	621.0	621.0	621.0	7452.0
Employed casual worker Cap/Month	A Type	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	1488.0
	B Type	–	–	–	–	–	–	–	–	–	–	–	–	
Family Labor Operational Hours/M ①	A Type	621.0	361.5	621.0	621.0	621.0	621.0	391.3	621.0	621.0	621.0	621.0	621.0	6962.8
Casual Worker Operational Hours/M ②		6.8	0.0	41.6	124.0	80.3	17.9	0.0	113.2	99.0	100.6	124.0	115.5	822.9
Total ①+②		627.8	361.5	662.6	745.0	701.3	638.9	391.3	734.2	720.0	721.6	745.0	736.5	7785.7
Family Labor Operational Hours/M ①	B Type	124.0	112.0	399.0	310.0	297.0	263.0	40.6	336.0	294.0	429.0	497.0	479.0	3580.6

Source :JICA Study Team　　Unit:(Hours/Month/FH)

2) Case of including Tempate Field

The table shown below indicates the result of the difference between required labor and available labor for the cropping pattern. In the A type FH, a necessary annual pooled labor force is 7,947 hours (1135.3 man-day per FH) to the available 7,452 hours (1065.6 man-day per FH), which annually causes 495 hours (70.7 man-day) shortage, an equivalent to 6.6 % of the annual available family labor per FH. Examining the labor force per each month, the only family labor can cope with May and June, but rest of the months generates 122.2 hours (17.5 man-day per FH) deficiency at peak during July. Meanwhile, the B type results in no labor short, and generates surplus labor force each month. This extra labor force can be applied to the A type, and be managed within the Study Area.

Difference of Labor Requirement on the Proposed Model Farmer's Farming Plan (With Tempate Field)

Kind of Labor Force	FH Type	Monthly Labor Requirment												Total
		5	6	7	8	9	10	11	12	1	2	3	4	／Y／FH
Available Family Labor Cap/Month		621.0	621.0	621.0	621.0	621.0	621.0	621.0	621.0	621.0	621.0	621.0	621.0	7452.0
Employed casual worker Cap/Month	A Type	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	1488.0
	B Type	–	–	–	–	–	–	–	–	–	–	–	–	
Family Labor Operational Hours/M ①	A Type	573.0	310.5	621.0	621.0	621.0	621.0	621.0	621.0	621.0	621.0	621.0	621.0	7093.5
Casual Worker Operational Hours/M ②		0.0	0.0	122.2	121.5	87.1	39.7	46.2	113.2	99.0	100.6	8.5	115.5	853.5
Total ①+②		573.0	310.5	743.2	742.5	708.1	660.7	667.2	734.2	720.0	721.6	629.5	736.5	7947.0
Family Labor Operational Hours/M ①	B Type	214.0	77.0	581.0	487.9	481.6	352.8	60.9	469.7	567.0	521.7	122.5	590.0	4526.1

Source : JICA Study Team　　Unit:(Hours/Month/FH)

(5) Yield Projection and Production

By implementing the plan, the farming practice will be improved with strengthening of farmers supporting system as well as introducing of irrigation farming, thus a yield increase is expected. Projected yield per each crop is estimated as shown below.

Projected yield after 5 years

Crop	Present (QQ/Mz)	Without project (QQ/Mz)	With project (QQ/Mz)
Maize	40	42.0	80
Upland Rice	63	66.2	80
Sorghum	20	21.0	65
Soy bean	30	31.5	45
Water melon*	–	–	200
Sweet Pepper**	–	–	375
Pipian*	–	–	2500
Cassava**	–	–	125

Remark : Unit No mark＝QQ/Mz、*=Dozen、**=Bag,
Upland rice is based on paddy rice basis.

The crop yield will be reached to the target yield level 5 years after commencement of the project. In case of without project, a yield level was projected as one (1) percent increase per year with farmer's self-effort as well as a substantial extension activity.

The annual crop production in the irrigation development area after starting the project will be estimated as follows under the projected yield aforementioned.

Crop Production Plan in the Irrigation Development Area

[Without Tempate Field]

Crop	Cropping Area (Mz)	Ratio (%)	Yield (QQ/Mz)	Production (QQ)
Maize	868.1	40.4	80	69,448
Upland Rice	740.0	34.5	80	59,200
Sorghum	52.0	2.4	65	3,380
Soy bean	116.4	5.4	45	5,238
Water melon*	55.0	2.6	200	11,000
Sweet pepper**	90.0	4.2	375	33,750
Pipian*	25.0	1.2	2500	62,500
Cassava**	120.0	5.6	125	15,000
	2146.3	100.0		

[With Tempate Field]

Crop	Cropping Area (Mz)	Ratio (%)	Yield (QQ/Mz)	Production (QQ)
Maize	1577.8	73.5	80	126,224
Upland Rice	740.0	34.5	80	59,200
Sorghum	85.0	4.0	65	5,525
Soy bean	159.2	7.4	45	7,164
Water melon*	55.0	2.6	200	11,000
Sweet pepper**	90.0	4.2	375	33,750
Pipian*	25.0	1.2	2500	62,500
Cassava**	120.0	5.6	125	15,000
	2146.3	100.0		

Remark: unit No mark＝QQ/Mz、*= Dozen、**=Bag, Upland rice is based on paddy rice basis.(qq/Mz)

3.6.3 Necessary condition of the Crop husbandry/Extension Supporting Activity

The aforementioned cropping plan is predicted to reach the goal 5 years after commencement of the project under establishment of agriculture infrastructure. In order to involve the beneficiary well in the project goal, farmer's supporting system provided by the government is vital factor. As the beneficiary is the major body to implement the project, how to involve the beneficiary positively in the project is a keystone of farmer's supporting activity headed by the governmental organization. Moreover, supporting activity via on-the-job-training is indispensable until the beneficiary stand on their own legs to carry out an intensive farming. Therefore, the strategy of farmer's supporting activity for the crop husbandry/extension sector is described below.

(1) Implementation of systematic training program to the beneficiary

The supporting side should formulate the extension program by examining the subject in the target area elaborately during the project preparation stage as below:

1) Seize the natural and socio-economic environmental condition of the target area, as well as prevailing farming practice of the beneficiary and their farming experience thoroughly.
2) Identify what kinds of problems are existed and how is the method to solve them.

And it is important that empowering the beneficiary via systematic training program based on the beneficiary's standing level should be proceeded.

(2) Establishment of the demonstration farm in the target area

Demonstration of cultivating target crop with improved farming practice in the target area is considered as the most effective method to convince the beneficiary because of verifying new farming system with target crop in their same condition. That is to say, verification of the on-farm trial is applied to the source for extension program, and further it promotes a leadership of the beneficiary who is in charge of taking care of demonstration farm. Moreover, a systematic

OJT-oriented training program is enabled based on the demonstration farm.

(3) Establishment of farmers training program in the advanced farmers area

Guidance of new crop and improved farming practice by extension worker is not sufficient for the beneficiary who has less experience to be convinced. Mastering the farming practice required for the target crop is really tough without experience via OJT systematically. Therefore, it is necessary for the supporting side to set up the agricultural training program in the advanced farming area and to recruit farm household which can accept agricultural trainee in order to raise the beneficiary's interest and eagerness for the proposed farming plan. This farmer's agricultural training program in the advanced farming area could generate a big incentive to the beneficiary in terms of leaning advanced farming practice, sense of farm management, rural society of the training area, and marketing process from cultivation to sale.

Supporting system of farming practice and others (finance, marketing and farm management etc) in the proposed farming plan is principally taken by MAG-FOR and INTA. In case of difficulty to provide full-time staff and form special team for the project implementation in the governmental organizations, it is proposed that promising NGOs are recruited under umbrella of governmental organizations to promote a reciprocal help of supporting system between the governmental organizations and NGOs. In this case, the T & V system provoked by the IBRD which is applied to INTA system has both good points and bad points, and from the viewpoint of promoting an inter-communication between the beneficiary and supporting side, a cooperation with the NGOs is proposed. Further, presiding over the staff involved in supporting the project is taken by the MAG-FOR regional office in order to make necessary decision rapidly in accordance with progress of the project.

3.7 Irrigation Facilities Development Plan

In the irrigation plan of the Study Area, both the Telica River and groundwater can be proposed as water source. In case of the groundwater, deep wells like the existing ones shall be constructed within its potential, which covers about 60% of all irrigable farmlands in the area.

The farmlands in the Telica area are classified as superior, and the scale of the farmland per farmhouse is rather smaller than other areas. From this point of view, if there is a river suitable for irrigation, the irrigable area should be developed as larg as possible by utilizing it at maximum. On the other hand, the annual cost of operation and maintenance and construction cost per hectare for the use of the river water is cheaper than for the groundwater use. In addition to that, pumping of large quantity of groundwater might affect the adjacent areas.

Concerning the farmers' organizations, both systems are similar from the view point of final users of the irrigation system. However, the groundwater use is superior to the river use once it is easier to fulfill the farmers' request due to the fact that the irrigation unit using groundwater is rather smaller. However, there is no difference as for collective gathering, forwarding and purchasing because the farmers' organizations are stratified as one unit.

Synthesizing the above mentioned points, the utilization of the river water, which flows near the study area, is the most orthodox and economical method.

3.7.1 Irrigation Area

The irrigation areas of Telica Area are as follows based on the land use plan.

Case 1: Containing Tempate and Paddy rice: 1,160.7 ha
Case 2: Not containing Tempate and Paddy rice: 798.3 ha

Table 3.7.1 Irrigation Area in the Telica Area Unit: ha

Land Use Classification	Present	Case 1	Case 2
Dry field	798.3	798.3	798.3
Paddy field	27.8	27.8	-
Tempate	334.6	334.6	-
Total	1,419.9	1,419.9	798.3

3.7.2 Irrigation Water Source

(1) Main Water Source

The main water source for the irrigation in this Area is surface water of the Telica River (Rio Telica). The surface water of the Telica River is available through the year. But, because there exist no observation data on the flow rate observation was implemented at the Quezalguaque spot near the intended head work place from September 1997 by the JICA Study Team. The observed flow rate is presented in the clause 3.1.2 (meteorology and hydrology).

The possible amount of intake water is estimated after deducting 10% as the river maintenance water from the flow rate that was calculated from the observation. The possible amount of intake water of each month to be estimated is shown in the following table. The existing water use of the Telica lower reach from the water intake point was investigated. As a result, it is confirmed that this amount of water intake will not affect the present water use of the lower reach (clause 3.1.2).

Possible amount of water intake at the Quezalguaque point of the Telica River(m^3/sec)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Amount of water intake	0.71	0.66	0.70	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.85	0.82

(2) Selection of Water Intake Point

It is desired that the irrigation water is conveyed by gravity to the beneficiary area from the river. Therefore, water intake point is selected taking into consideration the following conditions; 1) it must be in an altitude which allows conveyance of the water to the uplands in the Area, and 2) the construction conditions.

The Telica River is flowing through a deep hollow in a flat land. Starting from the central part of the Study Area, both sides of the upper stream of the Telica River are cliffs and most of the sections of the cliffs reach to a height of 25 m. In order to select the headwork construction site, field investigation over about 5 km, upper stream of the Telica River from the Study Area. The main investigation items are as follows.

1) The condition of the cliffs on both sides
2) The difficulty for carrying-in construction machines
3) The difficulty of the construction site security

4) The conditions of the riverbed
5) The plane shape of the river
6) The existing water use

The survey around the possible intake point, showed that the height of both sides of cliff is about 25m. In case of taking water by gravity in such circumstances, the adopted method shall make the height of the weir as high as possible, results in high elevation of the canal headwork. However, geological survey shows that the morphology characteristics around the site is highly permeable and the infiltration rate is regarded as dangerous as well as the backwater against the upper stream in case of flood. Therefore, the method of taking water by gravity at this point compels to a combination of a lower height of the weir and to a deeper head work. The length of the canal is about 3km and its depth is about 20m at the intake point and 3 to 4m near the beneficiary area. That is to say, as there is no suitable site that can allow the irrigation of all irrigable area by gravity, lifting water from about 5 meters is necessary to irrigate around 210 hectares of the Abaungasta Norte area and irrigation by gravity can be possible for around 950 hectares, 1.7 km farther downstream.

With the above-mentioned conditions, the alternative in which steady surface water is pumped up was studied together. The conditions of the water intake spot by pumping are as follows.

1) As near to the beneficiary area as possible
2) Less difference in altitude within the beneficiary area
3) Good conditions for the construction works

From this viewpoint, the location where the Telica River is close to the northern end of the Study Area was selected (Fig. 3.7.1, 2). The conditions of this spot are as follows.

- The riverbed altitude of the intended water intake place is 44.9 m above mean sea level and of the northern end area is 59 m above mean sea level. Therefore, the altitude difference of both areas is comparatively small.
- The access to the site is easy, because there is an existing road.
- Because there is about 10m shore of the river and the cliff allows, it is convenient to construct facilities.
- There are no facilities using river water at the downstream nearby.
- The construction site is situated on the straight line part of the river.
- The geological feature of the riverbed of the construction site is formed of rough sand with gravel but the foundation ground is judged as good.
- The construction site touches the Study Area very closely.

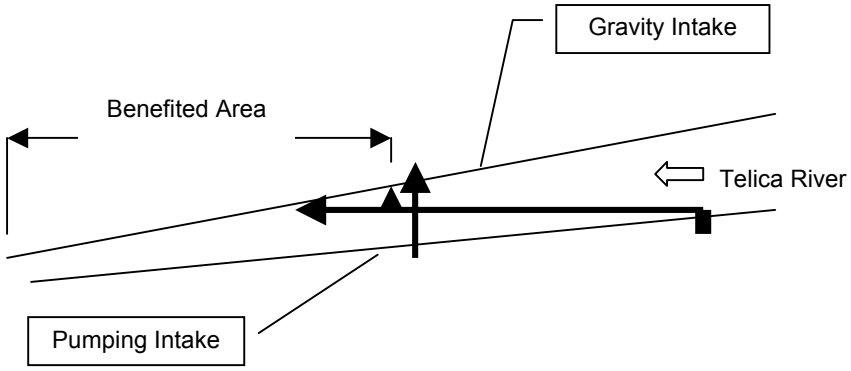
These two alternatives can be featured as follows:

Table 3.7.3 Comparative Analysis of the Intake System

	Gravity intake	Pumping intake
Construction cost of head work (US$ million)	4.59	0.71
Percentage of headwork to the total construction cost (%)	44	18
Annual Maintenance cost (during 50 years) (US$ million)	0.02 (1.15)	0.04 (2.08)
Renewal cost of facilities (US$ million/50years)	1.4	1.2
EIRR(%)	8.7	21.2
Others	Non-complete gravity irrigation	-

The cost of the gravity intake system is 6.5 times of the pumping one, and the percentages of head work to the total construction cost are 44% for the former, and 18% for the latter. Although there is a merit that the maintenance cost of the gravity intake is about half of the pumping intake, this merit is too small compared with the weight of the construction cost. Values of EIRR were finally calculated in 21.4% for the pumping intake and 8.7% for the gravity intake. The gravity intake method is very effective when there is a relatively large quantity of intake water and the benefited area balanced with it and consequently the percentage of the head work to the total construction cost goes down. However, the headwork of the Study Area cannot show its rightful effect because it is too large and partially requires pumping.

Based on the above considerations, the pumping intake method shall be adopted to the following study.



(3) Supplementary Water Source

The water from the intake (the pump station) on the Telica river only is insufficient for the irrigation of the Area at the peak period. The shortage of water is as follows.

Case 1 : Jan. – Apr. ; 0.60 m3/s
Case 2 : Feb. – Apr.; 0.33 m3/s

Therefore, supplementary water source is necessary and deep wells will be perforated as a supplementary water source.

When excavating a well to about 70-m depth, the optimum capacity of the deep well is estimated to be $0.12m^3/s$, as calculated from the pumping data of a test well that was implemented in the Telica Area in this Study (section 3.1.3). Accordingly, the following wells are planed as the supplementary water source for the irrigation.

Case 1 : five (5) wells
Case 2 : three (3) wells

The supplementary water from the wells will be used from their joining in the canal water drawn from the to be constructed pumping station. The wells are drilled in the neighborhood of the area where the lack of water for irrigation will appear by the discharge calculation of the canals. But each well is situated taking into consideration the influence area of the deep wells. The selected well position based on the above conditions is shown in the water distribution chart.

(4) Supplementary Water Supplying

The well must be operated to correspond with the shortage of water, checking the intake water volume in the pump station, the estimated amounts of use in the terminals and the flow rate of each main canal. Since these will be open channels, this will easily generate an invalid discharge. It is necessary to pay attention to this.

3.7.3 Irrigation Method

(1) Irrigation Method

The soil in this Area are predominantly loamy and also the farmlands are comparatively flat, therefore, either furrow irrigation or sprinkler irrigation method can be adopted. The water source of irrigation in this Area is surface water and irrigation water is supplied to each farm field by open canals. The altitude of the water source is about 50 m above sea level and the altitude of the benefited area is 40-50 m above sea level. Therefore, even in the lowest farmland in the benefited area, the water head is low. Even if a pipeline is used for transporting water, an enough water head to operate the sprinkler without a pump is not possible. Therefore, in this Area, the proper irrigation method is furrow irrigation, considering the land characteristics and the economic condition of farmers.

The crops that will be planted in this Area are rice, soybean and cabbage etc., and these crops are suitable for any irrigation method. The facilities needed for sprinkler irrigation are as follows requiring a high construction cost.

1) Pump facilities to pressurize the irrigation water to the required pressure (about 3.5 kg/cm^2) to operate the sprinkler
2) Pipeline from the pump to the farm field
3) Farm reservoir to adjust a time lag between the intake time and the irrigation time

Also, because the operation of pump, the running cost is expensive. This is uneconomic for the crops that don't adopt the sprinkler irrigation and there is a need to unify the planted crops.

Because of these conditions, furrow irrigation is recommended for this area. In case a sprinkler system is introduced in the future, if the mentioned facilities were constructed it is possible to change the furrows irrigation to the sprinkler method, even if it requires an investment.

(2) Irrigation Canal

In this Study Area, there are many areas, which have equal to or less than 1% of gentle inclinations and few areas, which have an opposite inclination. Therefore, as a principle, a pipeline with high construction cost is not used and open canal with a low construction expense is adopted.

Because this area is divided into three blocks by two small streams, the main canals is arranged in each block which was divided in these streams and irrigation water is supplied to each farm by the secondary canals which branch from the main canal. The canals are constructed at the high part of the irrigation blocks taking into account the convenience of the irrigation works, basically, also, canals are arranged nearby existing roads as far as it is possible taking into account of the maintenance of canals. The arrangement of the main and secondary canals is the same as in the general plan.

(3) Criteria of Furrow Irrigation

1) Reasonable Field Ditch Discharge

The reasonable field ditch discharge is the maximum discharge water in the range that does not generate soil erosion. When making irrigation water reach the end of the farm field with the maximum inflow, the overflow from the end of the farm field occurs. To prevent this phenomenon, little farm inflow must be applied. The change of the inflow should be frequently done. However, there is a problem of shortage of the labor for this irrigation operations and actually, the farmer can not implement this work equal to or more than twice.

The field ditch discharge is designed according to the following standard.

Table 3.7.4 Maximum Field Ditch Discharge in case of a furrow gradient of 1%

Soil	Field ditch discharge (l/sec)	Field ditch discharge (l/min)
Volcanic ash soil	0.8	48.0
Sandy soil	0.9	54.0
Loamy soil	0.8	48.0
Clay loam soil	0.6	36.0

Source: Design Criteria, MAFF

Because the soil in the Area is loamy soil almost, the maximum field ditch discharge rate of 0.8 l/s is adopted. When the gradient of the furrow is other than 1%, the flow rate is revised as per the following coefficient.

Furrow gradient (%)	0.5	1.0	1.5	2.0	2.5	3.0
Revision coefficient	1.2	1.0	0.9	0.9	0.8	0.8

2) Length of Furrow

The maximum allowable length of a furrow is the length which water can reach without soil erosion. The bigger the field ditch discharge is, and the smallest the intake-rate of the soil, the more long the furrow is. Referring to the data of another projects which is shown in the table below, the furrow length of 100m is adopted in this Area because the soil is loamy and water requirements of one irrigation work is about 40-50 mm.

Table 3.7.6 Maximum Allowable Furrow Length

Soil	Water requirements (mm)	Maximum allowable furrow length (m)
Sandy soil	16	4
Volcanic ash soil	44	29
Sandy loam soil	34	36
Loamy soil	38	99
Clay loam soil	44	121

Source: Design Criteria, MAFF

3) Furrow Width

When doing the furrow irrigation, the furrow width must be set as the root zone depth of the crops to contain in the saturation area which are made by the irrigation water which soaked to the both side soils. The furrow width is regulated by the kind of soil, that is, generally, in order of volcanic ash soil, clay loam soil, loamy soil, sandy soil, it is possible to take furrow width widely. In this Area, it is estimated that the limit of furrow width is 70-80 cm judging from the soil condition.

4) Rotation Block of Irrigation

The irrigation is practiced as the follow-on system on already decided rotation block. The area of the one rotation block is as follows.

In case of the water requirement of 7.35mm/day (in the peak season) and five days irrigation interval, the necessary irrigation water for once irrigation work is 565.4m^3/ha. On the other hand, because a field ditch discharge with 48 l/min is adopted, the flow rate which flows in to the 1.0 ha farm field is 0.08 m^3/sec in case of the furrow width of about 1 m. Therefore, about 2 hours are necessary to irrigate the proposed water volume. When an irrigation work is executed, the irrigation water is flowed in a furrow space in order because it is difficult to irrigate the farm field at once. The irrigation time for each furrow is estimated at 1 hour. Therefore, the necessary time to irrigate the farm field of 1.0 ha is estimated to be 3 hours.

The total irrigation time of 24 hours per day is convenient, because irrigation water is supplied to the farm field from the intake facility through a day. However, since the furrow irrigation work in night is difficult, maximum irrigation time of 18 hours is adopted in a day. Therefore, the area of the 1 rotation block is 6 ha.

5) Leveling Work of Field

To furrow irrigation, the gradient of the farm field must be uniform. The construction machinery must level the farm field that is not flat but in this Area, most of the farm fields are flat and there are few farm fields that need the leveling work.

6) Cultivating Method

At present, hardly the ridge plowing is done in the farm fields in this Area. Generally, after plowing a farm field, sowing is done, but the cultivating method with the ridge plowing must be adopted because the furrow irrigation is introduced in this project.

3.7.4 Water Requirement

(1) Evapotranspiration (ETo)

The evapotranspiration is calculated with the Penman Formula by use of the data of the nearest weather observatory (Leon). The estimated evapotranspiration (ETo) of the crop is as follows (Annex H).

Table 3.7.7 Evapotranspiration (ETo) Unit: mm/day

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eto	5.65	7.08	7.35	6.76	5.47	4.85	5.33	5.15	4.46	4.35	4.36	4.82

(2) Unit Water Requirement

The monthly water requirement for irrigation is estimated in the following conditions.

ETo:	The value which was estimated above.
Precipitation:	The precipitation of the probability in 5 years that have been gotten by processing a rainfall data of the León weather observatory.
Crops:	The crops to be irrigated are described in Clause 3.6.
Cropping Pattern:	The proposed cropping pattern is shown in Clause 3.6.
Irrigation Efficiency:	Conveyance Efficiency: 85% (Open canal)
Application Efficiency:	65% (Furrow irrigation)
Irrigation Efficiency:	55.3%

Estimated monthly water requirement according to month and crop using the above-mentioned conditions is shown in Annex I: Table I.T.3.

(3) Irrigation Area

The total irrigation area is as follows:

Case 1 : 1,160.7ha
Case 2 : 798.3ha

The planted area (area under irrigation) of each crop is the same as annex I: Table I.T.2.

(4) Water Requirement

The monthly water requirement that was estimated based on the planted area of every crop and the proposed cropping pattern is as follows (Annex I: Table I.T.2).

Table 3.7.8 Monthly water requirement Unit: m^3/Sec

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Case - 1	0.6	1.09	1.20	0.99	0.16	0.00	0.26	0.17	0.00	0.00	0.26	0.05
Case - 2	0.41	0.83	0.93	0.75	0.14	0.00	0.25	0.14	0.00	0.00	0.24	0.04

3.7.5 Design of the Irrigation Facilities

(1) Intake Facilities

1) Water Intake System

The elevation system through pumping based on the water source plan shall be adopted. The river condition in the site where the pumping plant is planned to be constructed present a remarkable difference of the flowing and level of the water during flooding and normal seasons as shown in the following table. For an example during normal season the level of the water is 0.39 m, being the suitable depth of 0.3 m approximately. The superficial layer of the base is formed by fine sands originated from quicksand, which would sediment inside of the pumping intakes all preventing the proper performance of the facility regardless of the season.

Besides, pumps shall have low NPSH value considering that the suction charge is more than 4.0m, this types are always expensive. Considering these reasons headwork shall be installed in this pumping plant in order to ensure the level of the intake water (absorption level), then, a mixed water intake system by headwork and pumping system shall be established. The headwork shall be located down the river after the pumping plants in a place where both structure may be completely controlled considering necessary for the operation and maintenance.

Table 3.7.9 River Conditions in the Intake Site

	Flood in a return period of 50 years	Normal Waterlevel	Difference
Flow (m^3/sec.)	609.74	1.25	608.49
Depth of Water	4.53	0.39	4.14

2) Headwork and Pumps

a) Type of Headwork

The purpose and functions of headwork of this project are based on the low installation cost, to insure the minimum necessary operation level of the pumping plant and avoid a negative impact

of the aquatic population (ecosystem) in the Telica river. Therefore, headwork of this project is composed of a fix dam of 21 m high with a margin of 2 m wide for passing of fishes. The backwater level shall be increased in 1.0 m, the minimum necessary level for the pipe intake. Besides, a gate type sand wood extractor shall be installed in the intake mouth of the left margin of the river.

As a consequence of the basic study elaborated in the site 2.9 km upstream is expected that concrete works of the headwork, site shall present the value N lower than 20, decreasing only 2.0 m from the base that requires substitution of the original soil by high qualified soils. Concrete works of the headwork shall be floating type.

Upstream from the headwork there is an access road (8 m wide), however, the counterflow from the dam shall affect it. Then, a reinforced concrete bridge shall be constructed in order to avoid transit of this road.

b) Pumping Plants

i) Necessary Pumping Volume

The balance between the available quantity of the Telica River and the maximum annual extraction volume foreseen decides the design pumping volume. The available quantity of the Telica River established by the water source plan is 0.6 m^3/sec and the monthly requirement of the Study Area is shown in the following table. According to the below table a lack of water is expected from January to April for the case 1 and from February to April in the second case.

Therefore, 0.6 m^3/sec is considered as pumping volume of this project.

Table 3.7.10 Necessary Pumping Volume by month unit: l/sec

	Month	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Case 1	Necessary Pumping Volume	717.59	1154.16	1204.15	991.25	131.76	0	288.62	180.07	0	0	164.5	59.52
	Pumping Volume	600.00	600.00	600.00	600.00	131.76	0	288.62	180.07	0	0	164.5	59.52
	Difference	-111.59	-554.16	-604.15	-391.25	468.24	0	311.38	419.93	600	600	435.5	540.48
Case 2	Necessary Pumping Volume	527.65	894.08	934.03	751.2	111.77	0	278.61	150.08	0	0	144.51	49.51
	Pumping Volume	527.65	600.00	600.00	600.00	111.77	0	278.61	150.08	0	0	144.51	49.51
	Difference	72.35	-294.08	-334.03	-151.2	488.23	0	321.39	449.92	600	600	455.49	550.49

ii) Number of Pumps

The number of pumps to be installed is based on the requirement of irrigation per month. However, in case a pump with equivalent capacity to the pump according to the month is installed, there will be problems in the operation, repairing and control of parts. Based on this situation, this project shall supply 2 pumps with the similar water level (0.3 m3/sec./unit) and other as backup (0.3 m^3/sec/unit), a total of 3 pumps. And the pumping volume according to the month is the same shown in the above table.

iii) Type of Pump and Water source

- Water Supply

The superficial water stemmed by the headwork shall be conducted to feeders through artesa type collector tubes and shall be located in a place protected from the designed flooding designs, E.L 49.43. The structure of that feeder shall be box type and the inside shall be 3.0m x 3.6m with a

height of 5.83 m considering the quantity and capacity of the pumps to be installed. Regarding the sand extraction tank, this shall not be natural discharge type considering that the Telica River is an excavated river with a depth of 4.53m during flood period. Therefore, floating sands shall sediment in the feeder which shall be discharged through a sand-discharging pump.

- Type of Pumps

The conditions of the structure headwork and conducting facilities (receptor tubes artesa type and feeder) and conditions of the pump are as shown in the below table. Pumps are rotary and aspiration type, simple stage with horizontal axe. Water shall be discharged through steel pipes (1,100m length and diameter: 75 cm), to the distribution tank (1.5m x 1.5m x 2.0m) and conducted to the principal canals.

Table 3.7.11 Pump Types

Item	Data	Remark
Minimum aspiration level	E.L 45.7m	
High of the pumping plant	E.L 49.5m	
Maximum aspiration charge	4.3m	Losses in the tube were considered
Water level in discharge	E.L 61.25m	
Total elevation	20.0m	

iv) Primary Engine Type

The electricity energy supply in the project area shall be considered as unstable, then the primary engine shall be diesel and the connection between the engine and the pump shall be through a speed reducer in order to avoid loses during the transmission of energy. The necessary power of the engine shall be 140 Hp.

v) Pumping Plant Shelter

A protection shelter for pumps, motors and accessories shall be constructed. The size shall be 4.6m x 7.0m with 6.0m high, considering a place for the devices and resting zone for operators.

(2) Complementary Water Intake Facility

i) Plan to Locate the Supplementary Source

The complementary requirement of water requested to the supplementary source is calculated from the difference between the superficial water and the irrigation requirement.

A difference in the complementary requirement and in the times of the fields described in the below table is presented in the comparative cases 1 and 2 due the variation of the quantity of crops in each parcel.

Table 3.7.12 Result of the Irrigation Requirement Balance according to the principal canal

Month	Superficial Walter	Case 1						Case 2					
		CS1-1	CP2	CS3	CS4	Total	Dif.	CS1-1	CP2	CS3	CS4	Total	Dif
Jan	600.00	121.68	73.62	222.65	299.64	717.59	-117.59	77.55	73.62	141.19	237.29	527.65	72.35
Feb	600.00	185.73	124.77	353.72	489.94	1154.16	-554.16	128.02	124.77	239.22	402.07	894.08	-294.08
Mar	600.00	194.33	130.35	368.48	510.99	1204.15	-604.15	133.74	130.35	249.92	420.03	934.03	-334.03
Apr	600.00	162.37	104.82	305.84	418.22	991.25	-391.25	107.56	104.82	200.99	337.83	751.2	-151.2
May	600.00	16	15.6	41.13	59.03	131.76	468.24	16	15.6	29.91	50.26	111.77	488.23
Jun	600.00	0	0	0	0	0	600	0	0	0	0	0	600
Jul	600.00	39.89	38.89	80.17	129.67	288.62	311.38	39.89	38.89	74.55	125.28	278.61	321.39
Aug	600.00	21.49	20.95	56.99	80.64	180.07	419.93	21.49	20.95	40.16	67.48	150.08	449.92
Sep	600.00	0	0	0	0	0	600	0	0	0	0	0	600
Oct	600.00	0	0	0	0	0	600	0	0	0	0	0	600
Nov	600.00	20.69	20.15	49.89	73.77	164.5		133.73	130.35	249.92	420.03	934.03	
Dec	600.00	7.09	6.91	18.85	26.67	59.52	540.48	7.09	6.91	13.23	22.28	49.51	550.49
Maximum of the year		194.33	130.35	368.48	510.99	1204.15		133.73	130.35	249.92	420.03	934.03	
Ave. of the year		64.11	44.67	124.81	1740.48	407.64		45.84	44.67	85.65	143.96	320.12	

Selection of the site for the installation of the complementary water intake work shall be decided according to the following conditions in order to avoid interruption of water supply even during the highest consumption period and to perform a suitable distribution of water in each irrigation block.

- Do not stop the water flow of the canals even during the high consumption period and supply the service during the whole year.
- Transport adequately the irrigation requirement to the fields located downstream and provide the service in necessary areas.
- Consider the influence area of each well considering that shall be installed many of them.

Considering the pumping test is estimated 120 l/sec the available volume of each pump. According to these results are established the quantity of wells to be installed and the quantity of canal water to be supplied as shown in the below table. The installation points of wells are shown in the Figure: Irrigation Canal Systems.

Table 3.7.13 Flow Distribution according to the Canal Unit: l/sec

Name of the Canal	Case 1			Case 2		
	Number of Wells	Quantity of use of groundwater	SurfaceWaters	Number of Wells	Quantity of use of groundwater	Surface waters
CS-1	0	0.00	194.33	0	0	133.73
CP-2	0	0.00	130.35	0	0	130.35
CS-3	2	241.16	127.32	1	107.47	142.45
CS-4	3	362.99	148.00	2	226.56	193.47
Total	5	604.00	600.00	3	334.03	600.00

ii) Data of the Complementary Source Facility

According to the result of the pumping test developed in the existing wells, data of the complementary source installation are decided as described in the table shown below. The type of primary engine shall be diesel type due the unstable supply of electrical energy in the area.

Table 3.7.14 Data of Supplementary Intake Facilities

Item	Data
Well	Diameter: 12 inches Length: 70m Volume of designed pumping: 12 l/sec
Type of the pump	Type: Turbo pump with vertical axe and multiple stages for deep wells Total Elevation: 60m
Primary engine	Type: Motor Power: 140 Hp
Shelter of the pumping plant	Type: Fiber-concrete structure Dimension: 3.1W x 2.6B x 2.5H
Flow Regulator	Type: partial opened canal

As already mentioned in the complementary source location plan, the duration of the pumping operation and the supplementary requirement are from January to April and 117.6 to 604.15 l/sec in case 1; and from February to April and 51.2 a 334.1 l/sec in case 2. This demonstrates the water control needs for each canal to be executed with a flowing regulator provided in each pump.

(3) Water canals

i) Canal Location Plans

The water distribution system established for the areas to be irrigated is divided into 4 blocks for

the three communities and three braking that cross the area. The system is formed by three type of canals; primary, secondary and tertiary, the last to transport water to the fields with a size of 10 ha (15 blocks).

In the moment to decide a direction of the principal and secondary canals shall basically considered that shall cross in straight angle with the bordering lines. However the agriculture activities of the area are almost established, fact that should be considered according to the land use and maintenance being necessary for the establishment of other roads along the existing ones. The length of each irrigation canals and the density according to the case are the same described in the below table. Unless there is a difference between case 1 and 2 due to the mixed crops along the canal, they shall have the same length in both cases.

Table 3.7.15 Canal Density in the Project Area

Canal	Case 1		Case 2		Remarks
	Length of canal (m)	Density of canal (m/ha)	Length of canal (m)	Density of canal (m/ha)	
Principal	4,670	5.7	4.670	5.8	Lined Canal
Secondary	13,940	16.9	13,940	17.5	Lined Canal
Third	18,490	22.4	18,490	23.2	Lined Canal
Total	37,100	44.9	37,100	46.5	

ii) Type of Canals

Lined canals shall be adopted in principal and secondary canals in order to insure the transport of water to tertiary and parcel canals. Structure of lining shall be divided in to three classifications as in the table shown below table. However, in Nicaragua the three coat concrete type are mainly adopted for agriculture canals, then the coated canals proposed in this project shall follow the regulation of Nicaragua with the exception of the tertiary canals that shall be unlined.

Table 3.7.16 Specifications According to the Type of Canal

	Reinforced Concrete Canals	Masonry Canal	Soil-concrete Canals
Resistance	High	Medium	Low
Thickness of the coat	10cm	25cm	10cm
Unit cost of the material	C$832.83/$m^3$	C$728.52/$m^3$	C$396.40/$m^3$

iii) Diversion Facilities

The diversion facilities are provided at principal gates that conduct the river water to the canals and simple gates for the tertiary canals and parcel irrigation. In the water transportation system of this project, groundwater shall be used besides surface sources of the river during the high irrigation periods, especially in places with need of canal water in order to balance the water, the suitable distribution of superficial water shall be very important, then a gate with door system in the principal gates for the control of flowing shall be installed and also partially opened canals for measuring of flows. Suitable control and contention of water is necessary in tertiary canals and simple gates in order to maintain the water requirement of the system. One gate for each 10 ha of the terminal fields shall be provided with simple doors.

(4) List of the Installation Data

In the following table the summary of the irrigation installation plan is shown for comparative cases, 1 and 2. The facilities to be provided shall have the same level, however there is a difference of cost due to the quantity of work to be developed in each field for each case. Case 2 is more economical than case 1.

Table 3.7.17 Facility Data

	Comparison	Case 1	Case2	Remark
	Irrigation Area	1160.7 ha	798.3 ha	
Intake Facilities	Headwork	Type: fix dam, floating Width of the dam: 21.0m Fish passing: 2.0m Connecting bridge: width: 8.0m Length: 20.0m	as in case 1	
	Pumping plant	Type: Rotating and aspirating pump, simple stage with horizontal axe Designed pumping Volume: 0.3m^3/seg. Quantity: 3 units Receipting tube artesa type: box drain: 1.5 m x 1.5m Feeder: 3.6mx 3.0mx5.83m Conducting canals: iron tubes: D 750mm, length: 1,100m	as in case 1	
Installation of complementary source	Deep well	No of wells: 5 wells Diameter of wells: 300mm Length of wells: 70m Volume of designed pumping:12 lt/ second Primary engine: 3.1x 2.6 x 2.5	No of wells: 3 wells Diameter of wells: 300mm Length of wells: 70m Volume of designed pumping:12 lt/ second Primary engine: 3.1x 2.6 x 2.5	
Irrigation canal	Main canal	Type: coated (soil-concrete) Length: 4,670m	as in case 1	
	Secondary Canal	Type: coated (soil-concrete) Length: 13,940m	as in case 1	
	Tertiary Canal	Type: coated (soil-concrete) Length: 18,490m	as in case 1	
	Gates	No of main gates:2 No of simple gates: 149	No of main gates:2 No of simple gates: 149	
Social Infrastructure Transversal Infrastructure		Installation place: 8	Same in the left side	Improvement of infrastructure

3.7.6 Operation and Maintenance Plan of the Irrigation Facilities

(1) Organization for the control of water

The association to be newly established shall carry out the control of the irrigation facilities of this area.

Refer 2. Function of the Association, Operation and Maintenance of irrigation water, etc of the Farmers Association Strengthening Plan.

(2) Contents of the water control

Operating and control of water is as follows:

1) Intake

- According to the planned quantity of water intake
- Supervision of the total intake
- Registration of data related to the water intake

2) Irrigation Canal

- Manage and revision of the canal intakes according to the transported design quantity.
- Supervision of all the canals
- Control of illegal intakes

3) Pumping Plans

- Manage according to the designed volume
- Make a daily control before operation of pumps and primary engine besides a yearly maintenance performed by a specialized firm.
- Daily revision of wells is not necessary, however service of specialized firm shall be required in case the estimated extraction volume can not be reached even if pumps and engines do not show normal signs.

4) Irrigation Work

- The water control association shall elaborate a weekly irrigation calendar, which shall be submitted to each farmer.
- Each benefited farmer shall irrigate in the days established in the calendar.
- The supervisor shall control the performance of the irrigation according to the established in the calendar and any case of not fulfillment shall be warned and instructed.

(3) Cost and Maintenance

1) Annual Operation Cost

The operation cost of the water control association is described as follows.

Table 3.7.19 Annual Expenses of the Water Control Association (Unit:US$1000)

Item	Annual Expenses	
	Case 1	Case 2
Labor	12.3	12.8
Operation Cost	36.0	28.5
Renovation of facilities cost	74.0	63.4
Total	122.3	104.7

2) Payment of the Farmers and Collecting Method

See 2. Function of the Association, Operation and Maintenance of Irrigation Water, etc of the Farmers Association Strengthening Plan.

3.8 Rural Infrastructure Improvement Plan

(1) Object Facilities of Improvement

The object of the rural infrastructure improvement in the Telica Area to implement in this project is the farm road which is the most necessary to forward farm products and to carry in agricultural materials. The contents of the improvement of farm road are the rehabilitation of the existing farm roads and the new construction of farm roads is not done. The farm roads to be improved are eight routes (total length of 19.7km) as shown in Fig.5.5.1. In these, the road lengths of 9.4 km are widened because the present road width is narrow. (for details refer to Annex H and Table H.T.1). Moreover, the simple bridges (the submerged type bridge) are newly constructed at the eight stream crossing places that are not installed with any bridge at present. The farm-road to each

farm is not included in the Improvement Plan, as these roads have been recently constructed in this Area.

(2) Rehabilitation Method

The main contents of the rehabilitation of the farm roads are the road grading and construction of the side ditch of the existing farm roads. The design road width of 6 m is adopted, taking into account the kinds of the vehicles to pass.

(3) Stream Crossing Work

The streams in the Telica Area are quite deep by the erosion in general (maximum: 4 m, minimum: 1.5 m). But because there is not water flow in the streams in the dry season, a submerged type bridge is adopted for the stream crossing structure, taking into consideration the economical condition. The standard section of the road rehabilitation is as in figure 3.7.1.

3.9 Agrarian Organization Strengthening Plan

3.9.1 Objectives of Organization Strengthening Plan

Because even though the main function is thought to receive credits according to the history of the associations' establishment, no credits are allocated to the associations at present, and it can be said that the associations are not functioning in their original sense (See Present Conditions.) Agricultural associations are production associations and, in other words, they are associations that have economic functions. The economic function is perceived as 'a way to gain access to resources that are not owned before' and according to this definition, it can be said no (economic) associations exists in this region since no accessibility to 'finance' and any other resources is observed.

On the other hand, the functions of organization as an agricultural association are not necessarily limited to 'the gain of access to financial resources'. The functions as a productive association are not limited to the gain of access to financial resources, but the even basic functions are widely seen as follows; the support for agricultural production, the management of production plan, the collection of products by organizations, the product cleaning, the product selection, forwarding, the purchase of consumer goods, the review and the decision about agencies to sell, the operation of selling and buying, and in addition the distribution of irrigation water and the management of irrigation facilities if irrigated. In order to work effectively, these activities should successfully interacted, and a body supporting this interaction is 'agrarian organizations' in this sense.

The objective of this preparation plan is to establish the back born for agricultural activities through the preparation of agricultural associations as economic organizations in this region where no access to resources are observed.

3.9.2 Organization Formation

In Telica there are two cooperatives formed during the period of the Sandinista Government, but at the moment their operations are suspended. Since some time ago, it has been receiving large amounts of subsidy and support, dependence toward the support institutions persists among the members of these cooperatives, therefore it would not be possible to take advantage of these organizations as promoting bodies for the Plan for the Development Model in Telica. On the other

hand, since a rural organization covering the whole area does not yet exist, it becomes necessary to form an organization that serves as a promoting body of the development model.

Presently, the agriculture of Telica is developed predominantly by the farmers who work individually. It is necessary to take into account this reality for the formation of an organization and to form groups of 10 to 20 properties that are located alongside the same side of the channel. This way, several rural groups would be formed in Telica and each one of these groups will develop the activities of a rural organization in the initial stage of the plan. On the long term, it is expected that these groups of farmers will mature, strengthening in cooperative bond with other groups, to finally form a rural organization that covers the entirety of the area. The institutional support for the farmers ' organization should establish on this view. However, concerning the administration and operation of the irrigation facilities, from the beginning it requires an organization that would act in the entirety of the area.

3.9.3 Organization Functions

Three main activities will be attributed to the rural organizations and they are: (1) collective purchasing (mainly consumer goods), (2) collection gathering and shipping, and (3) cooperation and management of irrigation facilities.

A rural organization is an entity that executes the production activities ambitiously, including production reactivation, improvement of efficiency and stabilization of the agricultural production, gathering and rational shipment of the agricultural products minimizing the post-harvest loss, search of routes for a more profitable commercialization, etc. In summary, it is an active organization that has access to multiple resources. However, it is not possible to hope such organizations are formed from one day to another, they should begin with group activities that are relatively easy, where the farmers who are accustomed to work individually, can participate at once, and at the same time, can quickly perceive the beneficial effects, i.e., the collective purchasing. As for the gathering and collective shipping, these activities will be introduced once the farmers have understood the advantages of working in this modality. In any event, it is necessary that the support and institutional advice should be offered so that in the future, the gathering and collective shipment is carried out on the whole area.

The three basic functions of a rural organization are described as follows:

(1) Collective purchasing

The collective purchasing is the activity to purchase consumer goods mainly related to agricultural production. The objective of the collective purchase is to reduce the unit cost of purchased goods by ordering in large volumes. Purchased items and volumes are determined by the acquisition plan prepared by the management section of the association, based on the plans presented by each farmer. Such section will also be in charge of the selection of suppliers, ordering, buying-in and distributions.

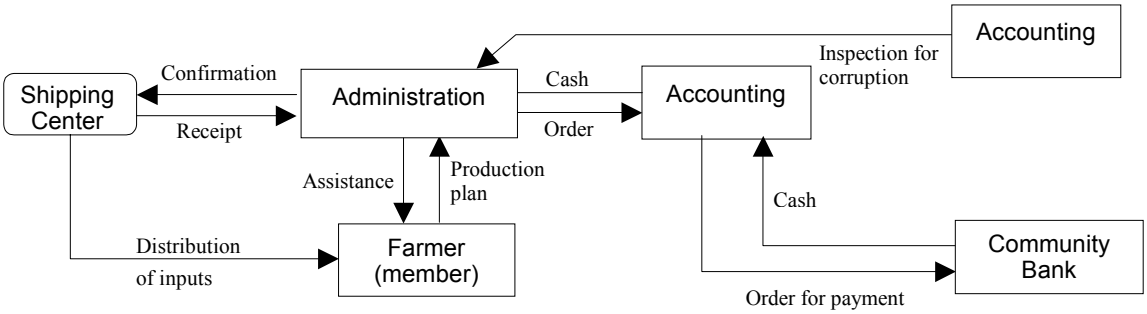
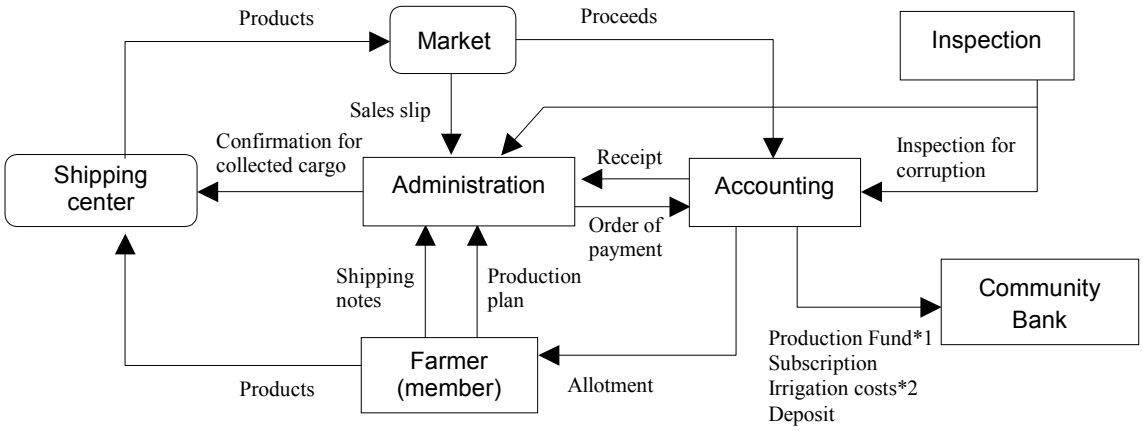


Figure 3.9.1 Collective Purchasing

(2) Collective gathering and forwarding activities

The collective collection and forwarding is the important activity, which influences the function of production organization as an agricultural association. This does not consist only on collecting and forwarding, but are based on the production estimation from the production plan and the analysis of the market information, and the contract, marketing, and the control and the management of profit. Sales management in turn will include the calculation and control of the earnings from the sale of agricultural crops, cost of input for the next cultivation, cost of operation and maintenance of the irrigation systems, reserves for construction and renovation of irrigation installation, cooperative costs, etc.

Nonetheless, in order for an organization to accomplish all the functions mentioned above, it is necessary to have sufficient maturity, and it would not be realistic to demand organization to have this kind of capacity from the beginning of the Plan. The administration of properties will be done at an individual level in each rural group only at the beginning and as the farmers recognize their needs, they will start to gather the agricultural products in a collective manner.
A flow chart of the goods in the organization regarding to the collective gathering and forwarding activities is shown below.



*1 The production funds include the cost of inputs, seeds, rental fee for machinery, fee for temporal lobourer, etc.
*2 The irrigation costs include the cost of fuel, of the maintenance, of renewal charge, etc.

Figure 3.9.2 Collective Gathering and Shipping

(3) Operation and management of irrigation facilities

The control of the irrigation water in the terminals will be carried out by each group of farmers. Since the requirement of irrigation water varies according to the crop, each rural group will know the items and acreage of each member's crop, to be able to distribute the water required in each parcel. Presently the Plan for the Model Development, besides using the canal water, also uses underground water to supplement the lacking and therefore the cost of irrigation water is high.

The data on the type and the cultivation area should be given ahead of time to the respective association for water control, and the cost of irrigation water will be financed by each rural group. For this, the person responsible for the control will divide the total cost of water by the total irrigation area, and based on the cost per unit area (in this case, Mz), the amount each property has to pay is calculated. The farmers pay the accountant of the rural group the cost, who transfers the amount to the water control association on behalf of the group. Also, according to the intake plan, the person in charge of controlling the water will operate the water intake of each rural group (or verifies if the taking is made appropriately). The irrigation cost will include the operation cost and maintenance of the canal irrigation system from intake and channels maintenance, and of the well irrigation system from fuel, maintenance and renovation of the facilities.

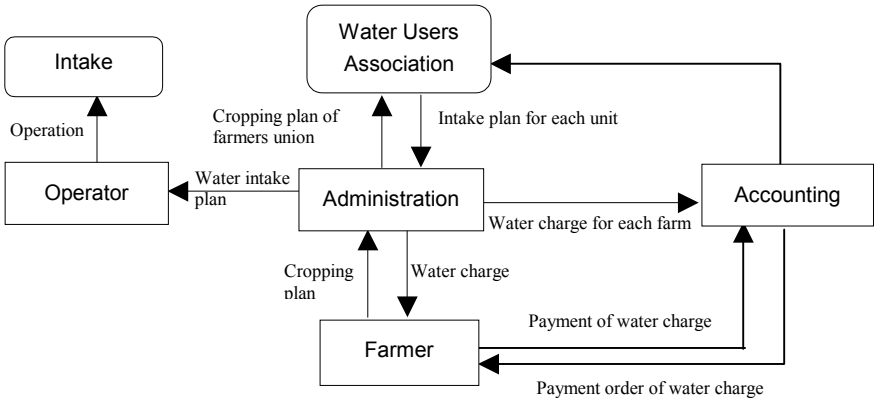


Figure 3.9.3 Operation and Maintenance of Irrigation Facilities

As it was indicated previously, the watering system in Telica consists on taking river water and supplement the lack with underground water, therefore the association blocks that are located upstream need to pump the missing volume downstream. This means that for the operation of the whole irrigation system it is required that the farmers will carry out the works not necessarily related to themselves or their group, but for the rest. Since the volume to be pumped varies according to the cropping pattern and the irrigated area, it is required to create a high level Committee for the Control of Irrigation Water to be in charge of the integrated handling of the irrigation water.

At the moment, three cooperatives exist in Telica and as indicated previously, they have suspended their operation. These are: "Nicolás López Roque", "Aristídez Sánchez Vázquez" and "Jerómino Rafael Guzmán". The high level Committee for the Control of Irrigation Water will take advantage of the operation of these cooperatives.

The crops to be produced and the plantation surface will be defined through the coordination of the high level Committee for the Control of Irrigation Water. The functions of this entity are the

readjustment of the cultivation area of each rural group, and the readjustment for the fair distribution of the irrigation water in three areas.

- Include the cultivation plans presented by each rural group and estimate the requirement for irrigation water.
- Elaborate the plan for the distribution of irrigation water to the parcels of each cooperative trying to avoid any differences of distributed volume taking place among the three areas.

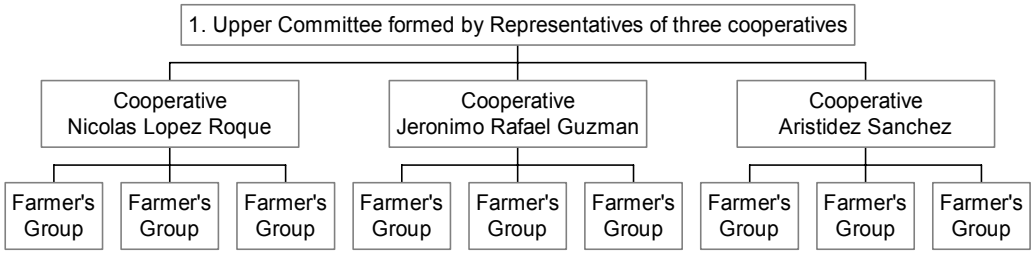


Figure 3.9.4 Organizational Structure of the Superior Committee for the Control of Irrigation Water

3.9.4 Structure of the Organization

Multiple forms of structuring rural organizations are conceived so that they can carry out the attributed functions fully, according to the conditions of each rural group and the formulation conditions. Although it is certain that the definitive configuration of the organization is decided by each rural group on agreement with their respective needs. In this section, an organization model was conceived so it can perform the functions described above.

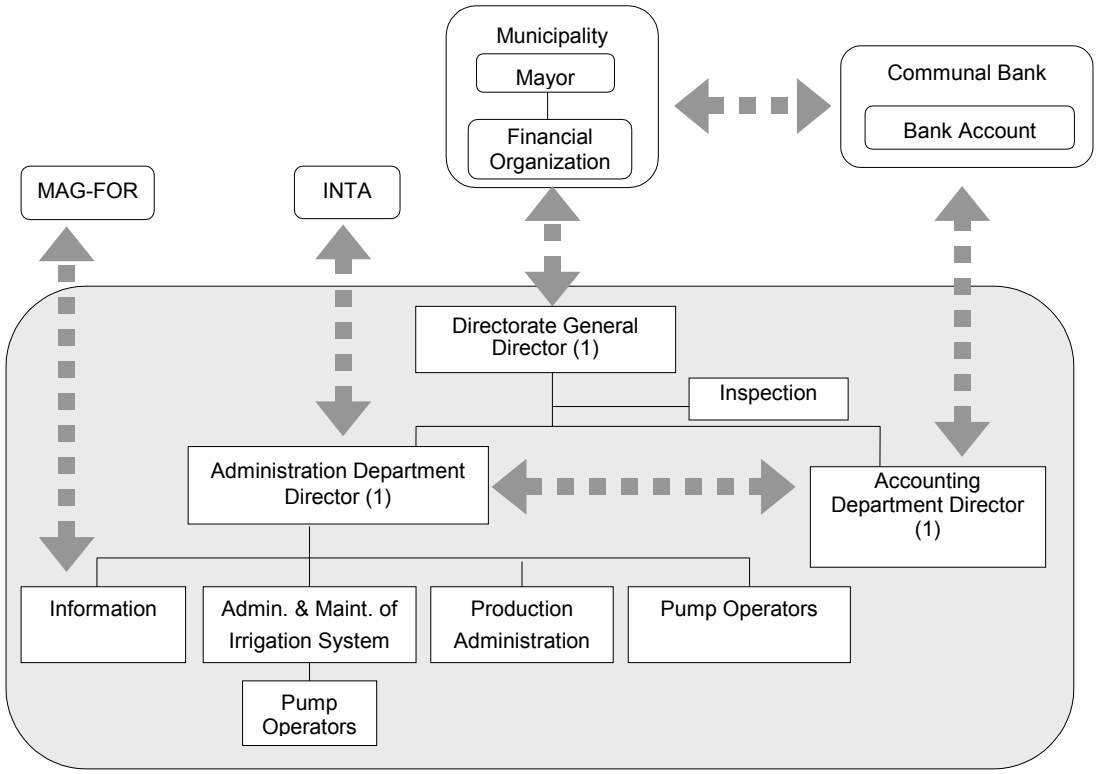


Figure 3.9.5 Configuration of the Rural Groups (Model)

3.10 Marketing

If the degree of conscience according to the evaluation of the P/S and the current system of distribution of goods is taken into account, it is considered that it is still premature to carry out the gathering and collective shipment or the processing of agricultural products. However, since this working manner is useful to give a higher value added to the products, it would be necessary from now on to outline the mechanism and incentive of these works through the rural meetings hoping to reach a degree of maturity enough for the rural organizations and to find a transformed market environment in the future.

The activities related with the commercialization of the agricultural products at this time will be carried out by each rural organization. However, since the number of properties in this area is high (250 families), currently the activities will be grouped for each rural organization unit.

3.10.1 Outline of Development Plan

So as to increase an aggregated value of the products in the marketing stage, two methods have been conceived: "To carry out negotiation in collective way, even though sale of products is done at individual level" and "To carry out processing in collective way in view of achievement of cost saving.

(1) Collective negotiation for sale prices

At the moment, the agricultural products are sold to the middlemen who arrive to the area, choosing the one that offered the most favorable price. Presently, it is still difficult to transform this scheme for the farmers even when they have outside support. Therefore, initially it will try to strengthen the current scheme through a collective negotiation of prices. Concretely, information of the producer and market prices are gathered to empower the negotiating capacity collectively, at the same time offering the products in larger lots, which also favors the middlemen, as it tries to increase the price of the producer.

- To know the producer's prices of the goods
- To know the market prices of agricultural products
- To negotiate the prices collectively with the middlemen

The information on the prices of agricultural products should be provided timely to the farmers by MAG-FOR. Those who have leftover resources from the credit refund or own resources can adjust to the sale season depending on the evolution of the market prices. However, it is necessary to take into account that knowing exactly the optimum season for selling is extremely difficult, since it is necessary to see the evolution of the market prices and also the country's economic situation, tendency of international trade, etc. making a complete analysis of different factors. Therefore, it is necessary to take a definite decision with the advice of MAG-FOR and INTA.

(2) Processing of agricultural products

The cost of the refined rice decreases when the processing volume increases. The same can be said with the transportation cost up to the processing plant. Therefore, in the case of the rice the collective processing will be made with the purpose of reducing the costs.

3.10.2 Importance of market information

Market information should not only be used for searching the seller who offers the best advantage at the present. The information that was processed and accumulated can give many suggestions as the result of the transactions of the agricultural products that are repeated every season, every year. It can provide an important material for considering a cultivation plan such as which crop can be cultivated and when they can sell to get a better profit. Also market information in a wide sense includes even the information about agricultural inputs such as fertilizer and agricultural chemicals, besides machinery application service. Such information helps them take measures for the reduction of production costs in order to improve the level of profitability.

As a result of the use of the information, the focus and the farmers' way of thinking will change to a market oriented mentality and towards a commercial production that they can manage by themselves. All of this works, along as the market information is properly used.

Therefore, market information should not be limited to be applied for the commercialization activities but it should rather be used for each activity carried out by the farmer's group. Moreover, it is conceivable that the mutual coordination through the information among the various activity fields in the group should be established as a management system similar to the one in a private company.

3.10.3 Plan to Intensify Commercialization in the Future

In the future it is intended to carry out gathering and collective shipping of agricultural products. These will be shipped to big cities (Managua, Leon and Chinandega) because of the market scale. Another advantage offered by gathering and collective shipping is that the earnings go through the organization and they in turn can carry out the steps of refunding the debts in representation of each farmer. The scheme will consist on implementing the processing center and collection, incorporating all the processing procedure for the products coming from the properties near the project area. For more details of the commercialization plan and processing, refer to the ANNEX.

3.11 Agricultural Credit Plan

The final objective of the credit program is to make the farmers depend less and less on the program and to become self-sufficient. This objective will be reached only through an organized effort made by the farmers themselves. The credit program will be a reason for them to get organized as the credit will be granted only to those farmers who are organized as groups. Through the credit program they will not only learn how to administer and pay the credit but also will learn to create their own source of resources, it means, by saving through the program.

The farmers participating in the Plan for the Development Model will benefit from an integrated support service that includes the systematic technical assistance, implementation of the production infrastructures, etc., and this way, they can increase their agricultural revenue. Therefore, as a general rule, the credit will only be granted to the members of the rural organizations under this plan. This basic principle will motivate other farmers to form rural organizations as the receiving body of similar plans in other fields.

The basic items for the credit program are the following:

(1) Basic focus for the small and medium-scale farmers

- The financing will be granted to the participating rural organizations in the development model. However, the debts will be financed by the same beneficiaries that have purchased the goods and services with the loan. This decision is based on the need to avoid the undue appropriation of the resources, and because the small and medium-scale farmers have not wanted to be responsible for the other farmer's debts.
- To channel the financing, the properties and the livestock will be given as mortgage.
- The channeled loans will be destined to the property administration of the small and medium-scale farmers to execute the activities contemplated in the Plan for the Model Development (acquisition of inputs such as fertilizers, agrochemicals, etc., fuel and lubricants necessary to operate the irrigation facilities, transportation of the agricultural products, rent and labor recruiting).
- The acquisition of goods and services will be made transferring the money from the NGO responsible for the loan to the corresponding supplier so that the resources and checks are not handled directly by the farmers.
- The debts contracted by the purchase of the goods and services will be exactly distributed among the beneficiaries according to the consumed volume and surface of the lots.
- The beneficiaries should be organized appropriately in a way such that work is coordinated manner, with a NGO or Cooperative administering the funds of the loans.
- The beneficiaries should accept the technical attendance financed by the credit program. The technical assistance will not include only assistance in terms of the production but also in terms of the administration of the loan.
- The debts will be reimbursed by each farmer individually.

(2) Basic focus for fund for the agricultural loan

The small and medium-scale farmers who are the beneficiaries of the Plan for the Agricultural Development Model do not have enough own resources at the moment, therefore, they depend almost completely on the agricultural credit in the initial stage of the project. Also, it is necessary to take into account that initially it will be difficult to get enough production because of the lack of technical level on the producers. Therefore, for the first year of the project only 50% of the proposed yield is expected and on the fifth year 100% will be achieved. For this reason, it is necessary to take into account that the first year there will be a rate of no reimbursement so there should be enough reserves to cover the fund. The amount not collected (unrecoverable debt) of each property will be taken as a long term loan, forcing the debtors to pay in a planned manner up to the fifth year when the administration of each property will already have been stabilized. However, those farmers who do not want to return the debt although they are in a condition to do so, will be expropriated of the properties given as mortgage.

The fund reserve is considered as C$5,440,000 taking into account that at the moment the farmers do not have sufficient resources of their own and that they should cover almost entirely the resources required to administer their properties with the loan.

The fund resources will be transferred from the Government to the organization executing the project and from this to the NGO who will be in charge of administering them. The NGO will grant the loans to the rural organizations that will receive at the same time the technical assistance service, control, gathering and shipping according to the established plan.

(3) Credit Mechanism

The credit system must be managed under the premise that the farmers understand and agree the mechanism. The executing organizations of the project or the NGOs in charge of administering the resources will instruct the requesting farmers of the most adequate method to manage the resources and financing. The farmers should participate actively in the training organized by the executing organizations of the project or by NGOs and be completely responsible for the us of the loan system.

The rules of the credit system must be written down in a Manual for Credit Operations. The Regulations Manual must include, in principle, the following items:

- Objectives of the credit system
- Legal status of the credit system
- Procedures for the approval of loans
- Specific conditions, if any, for loans granted to clients (i.e., women) or special purpose agriculture
- Delimitation of activities acceptable for financing through the credit system
- Type of guarantees or collateral
- Financial conditions: rate of interest, repayment periods, grace period, monetary charges on overdue payments, etc.
- Sanctions and controls
- Calculation system for the interest payment amount
- Maximum and minimum amounts for loans
- Disbursement systems
- Repayment systems
- Formalization procedures for the loans
- Saving conditions
- Administrative costs
- Financial reserves
- Composition of the credit committee within the farmers' group
- Faculties of the credit committee

3.12 Execution Plan of the Project

3.12.1 Executing Plan of the Project

This area is characterized for its large rural population. Although it is true that the intention is to organize the farmers and form cooperatives, the basic unit of activities will be similar to the organizational unit proposed in Chapter V Plan for the Agricultural Development Model.

Also as for the procedures of the project development, the execution plan, including the executing agencies, etc. the same criteria described in Chapter V will be applied.

3.12.2 Implementation Plan of the infrastructures

Executing Organization for the Project

In the Republic of Nicaragua none of the institutions have enough experience on the detailed design, supervision of the construction works and operation and maintenance of the agricultural facilities under the irrigation system. Although PNDR is in charge of some programs related with

the improvement of agricultural infrastructure, they are of a small scale, not as large and high cost as the one in the district of Telica.

It is better if an institution that will be the nucleus in promoting the projects of the agricultural development in the future will be in charge of the execution. On the other hand, MAG-FOR mentions the promotion of irrigation as one of its basic political concepts, for this it should prepare an execution system of the irrigation works and accumulate the related experiences. Also, MAG-FOR was incorporated to the project from the basic study phase and this project can be used as a case study. However, in case MAG-FOR is the executing organization for the project, it should have the support of INTA and the municipalities, in the agricultural technology aspect as well as in the regional development aspect, respectively. And above all, it should establish an association that will benefit the farmers themselves, with which the construction of the necessary facilities is supported and an operation and maintenance system of the built facilities is prepared.

The works that the executing organization has to carry out will be different in the case of implementing the project with own funds from Nicaragua or with a foreign financial cooperation. In the first case, MAG-FOR should follow the following process: a) carry out topographical surveys and soil analysis, elaborate the tendering documents, request the environmental impact evaluation from MARENA, hire a consultant to be in charge of the execution design, which involves the tendering evaluation, supervision of the construction works; b) conclude the construction contract of facilities through an international tendering; c) take responsibility on the operation and maintenance of the built facilities under the project in cooperation with the farmers' associations. In the second case, MAG-FOR will support in the Nicaraguan legal aspect such as the expropriation of necessary lands, compensation of crops so that the project under the foreign cooperation is always advancing properly. The following is mentioned based on the first case.

Executing Plan for the Project

MAG-FOR, together with the hired consultant, shall carry out all phases from the detail design to the supervision of the works. It is important to develop an environmental impact study and approval of MARENA before the beginning of the works. The consultant shall cooperate with the execution organization of the project on technical issues. The construction works shall be executed by constructor(s) in block hiring form. The necessary construction machinery shall be prepared by the contractor(s) as well as the construction materials to be obtained in local and foreign markets.

① Budget Measures

The project expenses, excepting the one that may be covered by the Government of Nicaragua, shall be covered by loans from international banks

② Constructions Works

The contract (s) shall be carried out by a contractor selected by international tender

③ Project Administration Office

The project administration office shall be established in a place within the project area, easy that have access. This office may be used as operation and maintenance office of the facilities constructed by the project after completion of the works.

④ Consultant

The consultant, according to the contract, offers to the executing organization the technical services including the detail design, elaboration of tender documents, evaluation of tender

and supervision of the construction work, etc

⑤ Execution Plan for the Works

The construction works shall be finished in 2 years, however, the detail design for the construction works and the tender works shall take almost a year, and one year and a half for credit processing and consultant contract, then four years and a half is approximately needed until the completion of the works.

	1st year	2nd year	3rd year	4th year	5th year
Credit Processing					
Consultant Hiring					
Detail Design					
Tender					
Construction Works					

3.12.3 Estimated Cost for the Implementation of Infrastructures

(1) Calculation Conditions

The project cost will include the cost of the construction works, necessary land expropriation cost, general and technical administrative expenses, and contingency cost. The calculation conditions are presented as follows:

- As for the costs of materials, personnel, equipment and machinery for the construction and machinery use, they shall be calculated based on the real prices in Nicaragua. However, the construction unit price shall be added by 20% of the original prices, in order to consider the expenses and benefits of the constructors.
- The unit price is divided into foreign and local currency. As for the unit price expressed in local currency, it shall be utilized for basic materials such as aggregates and for the personnel expenses. As for the foreign currency, the C.I.F. in Managua will be considered for construction materials, equipment and machinery.
- For the exchange rate, the average between October 1997 until May 1998, which is US$ 1.00 = C$ 10.22 Cordobas, shall be adopted.
- For the reserve included in the construction works cost, 10% of the total cost of civil works shall be considered.
- For the general administrative expenses, 25% of the cost of the construction works shall be calculated
- For the technical administrative expenses, 7% of the cost of the construction works shall be calculated.
- For the reserve, 10% of the project cost shall be considered.
- The prices reserve shall not be considered in the total project cost.

(2) Estimated Cost for the Implementation of Infrastructure

1) Calculation Conditions of the Cost

The project cost shall be calculated for the following cases based on the irrigation plan:

Facilities to be Introduced	Case1	Case 2	Remark
Irrigation Area			798.3 ha
Paddy Fields and Tempate		X	362.4 ha

2) Project Cost

The expenses of the 4 items and the project total cost according to the case are calculated based on the above mentioned conditions, and the results are presented in the following table.

There is a difference of US$295,000 between the construction cost and the total cost of the project in the cases 1 and 2. This difference is due to the topographic factors because of the difference in irrigation area. In other words, it is due to the variation of the work volume due to the channel slope.

Total Cost of the Project Unit: US$ 1,000

Items	Case 1 Irrigation area: 1,160.7 ha No. of beneficiaries: 275 properties			Case 2 Irrigation area: 798.3 ha No. of beneficiaries: 275 properties		
	Local Currency	Foreign Currency	Total	Local Currency	Foreign Currency	Total
Construction works	859.8	1,918.1	2,777.9	711.5	1,771.6	2,483.1
**Irrigation facilities*	*(850.8)*	*(1,770.9)*	*(2,621.7)*	*(702.5)*	*(1,624.4)*	*(2,326.9)*
Road improvement	*(9.0)*	*(147.2)*	*(156.2)*	*(9.0)*	*(147.2)*	*(156.2)*
Land Acquisition	21.2	0.0	21.2	19.6	0.0	19.6
Administrative Expenses	215.0	479.6	694.6	177.9	442.9	620.8
Technical Administration	60.2	134.3	194.5	49.9	124.1	174.0
Contingencies	115.7	253.2	368.9	95.9	233.9	329.8
Total Cost of the Project	1,271.9	2,785.2	4,057.1	1,054.8	2,572.5	3,627.3
	(31.3%)	(68.7%)	(100%)	(29.1%)	(70.9%)	(100%)
Cost per ha.			3.5			4.5
Cost per beneficiary			14.8			13.2

Note: The cost of the preparation works and the temporary works are included in the implementation cost of the irrigation facilities.

3.13 Methodology for the Economic Evaluation

3.13.1 General Methodological Considerations

Economic evaluation of the proposed agricultural projects based on economic cost and benefit is a guideline of assessing their economic viability. Economic benefit is estimated as a difference of net benefits between with-project condition and without-project condition in the areas influenced by the proposed projects. In the case of irrigation projects, the benefits are estimated as the difference between net value of crop production under irrigated condition and net value of crop production under present condition.

Economic cost differs from financial cost in the sense of value judgment since the former is valued at real shadow price and the latter is a resource cost valued at market prices. The project costs are estimated on the basis of the market prices. Thus, to estimate the economic costs of the proposed projects, the financial costs have to be converted using conceivable adjustment methods.

In estimating the economic cost and benefit, the following criteria and assumptions are applied to convert the financial values of the proposed project cost and benefit to the economic ones. The reference of “Pautas Metodologicas de Preinversion” by MEDE gives an important guideline for economic evaluation. The following factors are considered.

Item	Description	
Standard Conversion Factor (SCF)	0.85	
Shadow Wage Rate	Skilled Worker	1.00
	Unskilled Worker	0.70
Shadow Foreign Exchange	1.15 of the prevailing exchange rate	
Evaluation period	Economic life	50 years
Timing of benefit accruing	After the completion of the project. The matured benefit is attained in four years later after the completion of construction works.	
Price Level	Cost and benefits of the project were set at the beginning of June, 1998. The prevailing exchange rate is C$10.22 per US$ at the official rate.	
Social discount rate	15%	

3.13.2 Economic Benefit

The market prices for the crops were gathered through market information obtained by the JICA Study Team and by MAG-FOR. In economic analysis, however, the crops are evaluated not with market prices but with economic prices. In terms of tradable crops, the economic prices are estimated applying international prices. To estimate economic farm-gate prices of crops, the international prices have to be modified in consideration of distribution activities between international market and farm-gate in the project areas. The economic prices of non-tradable crops such as vegetables and fruits are converted from market prices to economic prices through applying the Standard Conversion Factor (SCF) of 0.85.

Present crop budgets are based on the present farming practices, and are assumed to be pursued in the future in the case of without-project condition. Proposed crop budgets are based on recommended farming practices, and are prepared for with-project condition after introduction of the proposed irrigation projects.

For economic evaluation, economic prices are applied to crop values, input materials and labor costs, applying the conversion criteria mentioned above. The following table includes both financial and economic crop budgets under without-project and with-project conditions. The crop budgets have been calculated for two cases:

Without-project Condition

Crops	Financial Budget (C$/Mz)	Economic Budget (US$/Mz)
Upland Rice (Winter)	4,143	616
Upland Rice (Summer)	5,897	910
Beans	2,505	834
Sesame	854	215
Sugarcane	1,840	231
Soybean	3,553	621
Maize	250	119
Sorghum	195	62

With-project Condition

Crops	Financial Budget (C$/Mz)	Economic Budget (US$/Mz)
Upland Rice (Winter)	6,520	1,153
Bell Pepper	8,801	1,062
Watermelon	5,370	700
Pipian	5,940	721
Yucca	3,822	478
Soybean	2,370	572
Sorghum	195	62
Maize (Winter)	3,097	675
Maize (Summer)	2,782	625

Incremental irrigation benefit of the project is estimated as a difference of net production values between with-project and without-project conditions in the future. The net production values under with-project and without-project conditions are calculated as a difference between gross income and production costs.

The following benefits are expected for the two cases (with and without "Tempate" areas):

Case	Projected Area (Mz)	Total Benefit (US$1000)	Benefit per Mz (US$/Mz)
With "Tempate	2,066.5	523.1	253
Without "Tempate"	2,852.9	1,013.6	355

3.13.3 Economic Cost

The following table shows the construction cost (shown as financial cost) which is estimated based on market prices and economic cost. The construction cost was calculated for the two cases, with Tempate and without Tempate.

(Unit: US$1000)

Case	Financial Cost	Economic Cost
With "Tempate"	3,697	3,377
Without "Tempate"	3,176	2,455

The operation and maintenance (O&M) cost is annually required during the economic life of the respective projects in conformity with management of the schemes. The O&M cost is also given by making adjustment to economic prices. The O&M cost is assumed as in the following table based on section 3.7.5 Operation and Maintenance Plan. The renewal cost of the facilities is equivalent to 20% of direct construction costs; renewal will take place every 20 years after the initial construction year.

Case	Operation and Maintenance Cost
With "Tempate"	4.5% of the cost of main works
Without Tempate	4.5% of the cost of main works

3.13.4 Economic Viability

The economic efficiency, examined by EIRR, B/C and NPV, is summarized in the table below. Hence, present values of cost and benefit for B/C and NPV are discounted at 15%. As shown in

the Table, all indexes show that the project is feasible for all examined cases.

Case	EIRR (%)	B/C	NPV (US$1000)
With "Tempate"	18.3	1.25	875
With "Tempate"	16.2	1.08	280

3.13.5 Sensitivity Analysis

A sensitivity analysis has been carried for the project for each of the following situation:

a) 10% decrease of benefits
b) 10% increase of costs
c) 2 years delay in the achievement of benefits

The results of the analysis are shown below:

Unit : %

Case	With "Tempate"			Without "Tempate"		
	EIRR	B/C	NPV	EIRR	B/C	NPV
Benefits (10% Decrease)	16.5	1.15	823	17.2	1.14	786
Costs (10% Increase)	17.6	1.21	898	17.3	1.16	835
Generation of benefits after 2 Years	14.4	1.03	69	13.5	1.01	14

3.13.6 Revenue and Expense Analysis in the Properties

The properties in Telica were classified into Type A and B (refer to section 3.6 "Proposed Crop System". Here an income and expense analysis is made on each type of property in the model.

(1) Model for the revenue and expense analysis for properties

According to the administration plans of the properties and the implementation of facilities on the Plan for the Agricultural Development Model in Telica, the following is an analysis on the forecast of revenues and expenses of the properties. First, the basis of the analysis are defined.

a) Revenues
The revenues of a property will constitute the earnings from selling the agricultural products harvested in the cultivation fields subject to the Plan. The prices of the agricultural products are the financial prices of the economic evaluation.

b) Expenses
The expenses include the living cost and the cost of agricultural production. The latter does not include the family labor. The living cost is estimated as C$ 8.400/year, which is the average in this area.

c) Debts
The debt will be calculated in current value, and it is only included in the commission cost from the bank at 3% per year.

d) Implementation Cost of Facilities
From the project cost allotted to Telica, the implementation cost of facilities will be the initial investment. The cost is considered as follows:

Properties type A with tempate: C$ 1,056,000
Properties type B with tempate: C$ 346,000
Properties type A without tempate: C$ 725,000
Properties type B without tempate: C$ 175,000

(Unit: thousand of C$)

Calculation Basis	With Tempate		Without Tempate	
	Type A	Type B	Type A	Type B
1. Revenue				
With irrigation (revenue in June)	90.4	39.5	90.4	31.0
Without irrigation (in December)	135.8	54.5	126.0	36.7
2. Expenses				
Yearly living expenses	8.4	8.4	8.4	8.4
Yearly property expenses	130.3	54.0	128.2	39.0
3. Loans				
Commission	3%/year	3%/year	3%/year	3%/year
4. Cost of facilities (per property)	1,056	346	725	175

(2) Definition of Cases for Analysis

The analysis of property revenues and expenses provides very varied results when different contribution percentages from the properties are applied in the implementation cost of facilities. Therefore, the following cases were defined for the analysis:

Case	Conditions
1	Contribution of beneficiaries: - Property Type A C$10,000 - Property Type B C$2,700
2	Total contribution of the beneficiaries

(3) Results of Analysis

As reference indicators of the analysis, the following summary shows the amount of the surplus accumulated on the tenth and twentieth year, as well as the year when the balance of the credit would be annulled (accumulated deficit). For Case 1, considering that the contribution amount of the beneficiary is relatively small, the contribution amount is included in the first year credit. For Case 2, since the contribution amount is high, it will be paid on a long-term basis until the administration of the properties has stabilized (after it begins to generate surplus). In the following table the detailed results of the analysis are shown.

(Unit: C$1,000)

Case	Accumulated Surplus		End of payment of the accumulated debt (year)
	Tenth Year	Twentieth Year	
1			
Type A with tempate	565	1,418	4
Type B with tempate	192	499	4
Type A without tempate	543	1,363	4
Type B without tempate	112	308	5
2			
Type A with tempate	0	372	16
Type B with tempate	0	153	16
Type A without tempate	0	648	13
Type B without tempate	0	133	14

Table Farm Economy (1/4)

Telica With Tenpate A Type Farmer
case-1 Intial Cost C$10,000 for farmer

(Unit：C$1,000)

	0	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
		6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
Contents of Out Flow																																							
Intial Cost	10																																						
Farming Cost																																							
Input		53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0
Maintenance			0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8
TOTAL		53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8
Living Expense																																							
Living Expense		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Other		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Sub-Total		53.5	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0
Contents of Income																																							
Profit																																							
Irrigation		45.2	0.0	56.5	0.0	67.8	0.0	79.1	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0
Rain Fed		0.0	67.9	0.0	84.9	0.0	101.9	0.0	118.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8
Sub-Total		45.2	67.9	56.5	84.9	67.8	101.9	79.1	118.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8
Loan																																							
Loan	10	63.5	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0
Commission		1.0	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2
Repaymentable		45.2	67.9	56.5	84.9	67.8	101.9	79.1	118.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8
Act.Repayment		45.2	67.9	56.5	84.9	67.8	101.9	62.9	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3
Loan Balance		-19.3	-33.6	-35.8	-33.1	-23.9	-4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farmers Economic Balance		-19.3	-14.4	-2.1	2.6	9.2	19.6	20.5	36.6	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5
Total Balance		-19.3	-33.6	-35.8	-33.1	-23.9	-4.3	16.1	52.7	84.5	138.0	169.8	223.4	255.2	308.7	340.5	394.0	425.8	479.4	511.2	564.7	596.5	650.0	681.8	735.4	767.2	820.7	852.5	906.0	937.8	991.4	1023.1	1076.7	1108.5	1162.0	1193.8	1247.4	1279.1	1332.7	1364.5	1418.0

Telica With Tenpate A Type Farmer
case-1 Intial Cost C$2,700 for farmer

(Unit：C$1,000)

	0	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
		6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
Contents of Out Flow																																							
Intial Cost	2.7																																						
Farming Cost																																							
Input		23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6
Maintenance			0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3
TOTAL		23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9
Living Expense																																							
Living Expense		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Other		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Sub-Total		23.1	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1
Contents of Income																																							
Profit																																							
Irrigation		19.8	0.0	24.7	0.0	29.7	0.0	34.6	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0
Rain Fed		0.0	27.2	0.0	34.1	0.0	40.9	0.0	47.7	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5
Sub-Total		19.8	27.2	24.7	34.1	29.7	40.9	34.6	47.7	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5
Loan																																							
Loan	2.7	25.8	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1
Commission		0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5
Repaymentable		19.8	27.2	24.7	34.1	29.7	40.9	34.6	47.7	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5
Act.Repayment		19.8	27.2	24.7	34.1	29.7	40.9	34.6	40.7	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6
Loan Balance		-6.4	-14.7	-17.7	-19.2	-17.2	-12.0	-5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farmers Economic Balance		-6.4	-8.4	-3.0	-1.5	2.0	5.3	6.9	12.1	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9
Total Balance		-6.4	-14.7	-17.7	-19.2	-17.2	-12.0	-5.1	7.0	18.9	37.8	49.7	68.5	80.4	99.3	111.2	130.0	141.9	160.8	172.7	191.6	203.4	222.3	234.2	253.1	264.9	283.8	295.7	314.6	326.5	345.3	357.2	376.1	388.0	406.9	418.7	437.6	449.5	468.4	480.2	499.1

Table Farm Economy (2/4)

Telica Without Tenpate A Type Farmer
case-2 Intial Cost C$10,000 for farmer

(Unit：C$1,000)

	0	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
		6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
Contents of Out Flow																																									
Intial Cost	10																																								
Farming Cost																																									
Input		53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7
Maintenance			0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7	
TOTAL		53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5
Living Expense																																									
Living Expense		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Other		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Sub-Total		53.5	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7
Contents of Income																																									
Profit																																									
Irrigation		45.2	0.0	56.5	0.0	67.8	0.0	79.1	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0
Rain Fed		0.0	63.0	0.0	78.7	0.0	94.5	0.0	110.2	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0
Sub-Total		45.2	63.0	56.5	78.7	67.8	94.5	79.1	110.2	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0
Loan																																									
Loan	10	63.5	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7
Commission		1.0	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1
Repaymentable		45.2	63.0	56.5	78.7	67.8	94.5	79.1	110.2	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0
Act.Repayment		45.2	63.0	56.5	78.7	67.8	94.5	62.0	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8
Loan Balance		-19.3	-32.1	-34.2	-31.3	-22.1	-3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farmers Economic Balance		-19.3	-12.8	-2.1	2.9	9.2	18.7	20.5	34.4	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2
Total Balance		-19.3	-32.1	-34.2	-31.3	-22.1	-3.4	17.0	51.5	83.2	133.4	165.2	215.3	247.1	297.3	329.1	379.2	411.0	461.1	492.9	543.1	574.9	625.0	656.8	707.0	738.7	788.9	820.7	870.8	902.6	952.8	984.6	1034.7	1066.5	1116.7	1148.4	1198.6	1230.4	1280.5	1312.3	1362.5

Telica With Tenpate A Type Farmer
case-2 Intial Cost C$2,700 for farmer

(Unit：C$1,000)

	0	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
		6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
Contents of Out Flow																																									
Intial Cost	2.7																																								
Farming Cost																																									
Input		17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8
Maintenance			0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3	
TOTAL		17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1
Living Expense																																									
Living Expense		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Other		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Sub-Total		17.9	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3
Contents of Income																																									
Profit																																									
Irrigation		15.5	0.0	19.4	0.0	23.2	0.0	27.1	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0
Rain Fed		0.0	18.4	0.0	23.0	0.0	27.5	0.0	32.1	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7
Sub-Total		15.5	18.4	19.4	23.0	23.2	27.5	27.1	32.1	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7
Loan																																									
Loan	2.7	20.6	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3
Commission		0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4
Repaymentable		15.5	18.4	19.4	23.0	23.2	27.5	27.1	32.1	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7
Act.Repayment		15.5	18.4	19.4	23.0	23.2	27.5	27.1	32.1	27.4	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7
Loan Balance		-5.4	-12.8	-15.9	-18.6	-17.8	-16.0	-11.4	-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farmers Economic Balance		-5.4	-7.3	-3.1	-2.7	0.8	1.8	4.6	6.4	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0
Total Balance		-5.4	-12.8	-15.9	-18.6	-17.8	-16.0	-11.4	-4.9	3.6	14.6	23.1	34.2	42.7	53.7	62.2	73.3	81.8	92.8	101.3	112.3	120.9	131.9	140.4	151.4	159.9	171.0	179.5	190.5	199.0	210.1	218.6	229.6	238.1	249.1	257.7	268.7	277.2	288.2	296.8	307.8

Table Farm Economy (3/4)

Telica With Tenpate A Type Farmer
case-2 Intial Cost C$1,056,000 for farmer

(Unit：C$1,000)

	0	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
		6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
Contents of Out Flow																																									
Intial Cost	1,056																																								
Farming Cost																																									
Input		53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0	53.5	76.0
Maintenance			0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8		0.8
TOTAL		53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8	53.5	76.8
Living Expense																																									
Living Expense		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Other		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Sub-Total		53.5	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0
Contents of Income																																									
Profit																																									
Irrigation		45.2	0.0	56.5	0.0	67.8	0.0	79.1	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0
Rain Fed		0.0	67.9	0.0	84.9	0.0	101.9	0.0	118.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8	0.0	135.8
Sub-Total		45.2	67.9	56.5	84.9	67.8	101.9	79.1	118.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8
Loan																																									
Loan		53.5	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0	57.7	81.0
Commission		0.8	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2
Repaymentable		45.2	67.9	56.5	84.9	67.8	101.9	79.1	118.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8	90.4	135.8
Act.Repayment		45.2	67.9	56.5	84.9	67.8	101.9	52.8	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3	58.6	82.3
Loan Balance		-9.1	-23.5	-25.6	-23.0	-13.8	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farmers Economic Balance		-9.1	-14.4	-2.1	2.6	9.2	19.6	20.5	36.6	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5
Total Balance		-9.1	-23.5	-25.6	-23.0	-13.8	5.8	26.3	62.9	94.6	148.2	180.0	233.5	265.3	318.9	350.6	404.2	436.0	489.5	521.3	574.9	606.6	660.2	692.0	745.5	777.3	830.9	862.6	916.2	948.0	1001.5	1033.3	1086.8	1118.6	1172.2	1204.0	1257.5	1289.3	1342.8	1374.6	1428.2
Loan for Intial Cost																																									
Repayment		0.0	0.0	0.0	0.0	0.0	5.8	20.5	36.6	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5	31.8	22.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Balance	1,056	1056.0	1056.0	1056.0	1056.0	1056.0	1050.2	1029.7	993.1	961.4	907.8	876.0	822.5	790.7	737.1	705.4	651.8	620.0	566.5	534.7	481.1	449.4	395.8	364.0	310.5	278.7	225.1	193.4	139.8	108.0	54.5	22.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Balance After Repayment		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.8	31.8	53.5	31.8	53.5	31.8	53.5	31.8	53.5
Total Balance		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.8	62.6	116.2	148.0	201.5	233.3	286.8	318.6	372.2

Telica With Tenpate B Type Farmer
case-2 Intial Cost C$346,000 for farmer

(Unit：C$1,000)

	0	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
		6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
Contents of Out Flow																																									
Intial Cost	346																																								
Farming Cost																																									
Input		23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6	23.1	30.6
Maintenance			0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3
TOTAL		23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9	23.1	30.9
Living Expense																																									
Living Expense		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Other		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Sub-Total		23.1	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1
Contents of Income																																									
Profit																																									
Irrigation		19.8	0.0	24.7	0.0	29.7	0.0	34.6	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0	39.5	0.0
Rain Fed		0.0	27.2	0.0	34.1	0.0	40.9	0.0	47.7	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5	0.0	54.5
Sub-Total		19.8	27.2	24.7	34.1	29.7	40.9	34.6	47.7	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5
Loan																																									
Loan	2.7	25.8	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1	27.3	35.1
Commission		0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5
Repaymentable		19.8	27.2	24.7	34.1	29.7	40.9	34.6	47.7	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5	39.5	54.5
Act.Repayment		19.8	27.2	24.7	34.1	29.7	40.9	34.6	40.7	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6	27.7	35.6
Loan Balance		-6.4	-14.7	-17.7	-19.2	-17.2	-12.0	-5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farmers Economic Balance		-6.4	-8.4	-3.0	-1.5	2.0	5.3	6.9	12.1	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9
Total Balance		-6.4	-14.7	-17.7	-19.2	-17.2	-12.0	-5.1	7.0	18.9	37.8	49.7	68.5	80.4	99.3	111.2	130.0	141.9	160.8	172.7	191.6	203.4	222.3	234.2	253.1	264.9	283.8	295.7	314.6	326.5	345.3	357.2	376.1	388.0	406.9	418.7	437.6	449.5	468.4	480.2	499.1
Loan for Intial Cost																																									
Repayment		0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Balance	346	346.0	346.0	346.0	346.0	346.0	346.0	346.0	339.0	327.1	308.2	296.3	277.5	265.6	246.7	234.8	216.0	204.1	185.2	173.3	154.4	142.6	123.7	111.8	92.9	81.1	62.2	50.3	31.4	19.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Balance After Repayment		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.2	18.9	11.9	18.9	11.9	18.9	11.9	18.9	11.9	18.9
Total Balance		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.2	30.1	41.9	60.8	72.7	91.6	103.4	122.3	134.2	153.1

Table Farm Economy (4/4)

Telica Without Tenpate A Type Farmer
case-2 Intial Cost C$725,000 for farmer

(Unit：C$1,000)

	0	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
		6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
Contents of Out Flow																																									
Intial Cost	725																																								
Farming Cost																																									
Input		53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7	53.5	69.7
Maintenance			0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7		0.7	
TOTAL		53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5	53.5	70.5
Living Expense																																									
Living Expense		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Other		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Sub-Total		53.5	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7
Contents of Income																																									
Profit																																									
Irrigation		45.2	0.0	56.5	0.0	67.8	0.0	79.1	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0	90.4	0.0
Rain Fed		0.0	63.0	0.0	78.7	0.0	94.5	0.0	110.2	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0	0.0	126.0
Sub-Total		45.2	63.0	56.5	78.7	67.8	94.5	79.1	110.2	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0
Loan																																									
Loan		53.5	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7	57.7	74.7
Commission		0.8	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1
Repaymentable		45.2	63.0	56.5	78.7	67.8	94.5	79.1	110.2	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0	90.4	126.0
Act.Repayment		45.2	63.0	56.5	78.7	67.8	94.5	51.9	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8	58.6	75.8
Loan Balance		-9.1	-22.0	-24.1	-21.2	-12.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farmers Economic Balance		-9.1	-12.8	-2.1	2.9	9.2	18.7	20.5	34.4	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2
Total Balance		-9.1	-22.0	-24.1	-21.2	-12.0	6.7	27.2	61.6	93.4	143.5	175.3	225.5	257.3	307.4	339.2	389.4	421.1	471.3	503.1	553.2	585.0	635.2	667.0	717.1	748.9	799.1	830.8	881.0	912.8	962.9	994.7	1044.9	1076.7	1126.8	1158.6	1208.7	1240.5	1290.7	1322.5	1372.6
Loan for Intial Cost																																									
Repayment		0.0	0.0	0.0	0.0	0.0	6.7	20.5	34.4	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Balance	725	725.0	725.0	725.0	725.0	725.0	718.3	697.8	663.4	631.6	581.5	549.7	499.5	467.7	417.6	385.8	335.6	303.9	253.7	221.9	171.8	140.0	89.8	58.0	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Balance After Repayment		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.9	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2	31.8	50.2
Total Balance		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.9	74.0	105.8	156.0	187.8	237.9	269.7	319.9	351.6	401.8	433.6	483.7	515.5	565.7	597.5	647.6

Telica Without Tenpate B Type Farmer
case-2 Intial Cost C$175,000 for farmer

(Unit：C$1,000)

	0	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
		6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
Contents of Out Flow																																									
Intial Cost	175																																								
Farming Cost																																									
Input		17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8	17.9	20.8
Maintenance			0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3		0.3	
TOTAL		17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1	17.9	21.1
Living Expense																																									
Living Expense		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Other		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Sub-Total		17.9	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3
Contents of Income																																									
Profit																																									
Irrigation		15.5	0.0	19.4	0.0	23.2	0.0	27.1	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0	31.0	0.0
Rain Fed		0.0	18.4	0.0	23.0	0.0	27.5	0.0	32.1	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7	0.0	36.7
Sub-Total		15.5	18.4	19.4	23.0	23.2	27.5	27.1	32.1	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7
Loan																																									
Loan	2.7	20.6	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3	22.1	25.3
Commission		0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4
Repaymentable		15.5	18.4	19.4	23.0	23.2	27.5	27.1	32.1	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7	31.0	36.7
Act.Repayment		15.5	18.4	19.4	23.0	23.2	27.5	27.1	32.1	27.4	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7	22.5	25.7
Loan Balance		-5.4	-12.8	-15.9	-18.6	-17.8	-16.0	-11.4	-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farmers Economic Balance		-5.4	-7.3	-3.1	-2.7	0.8	1.8	4.6	6.4	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0
Total Balance		-5.4	-12.8	-15.9	-18.6	-17.8	-16.0	-11.4	-4.9	3.6	14.6	23.1	34.2	42.7	53.7	62.2	73.3	81.8	92.8	101.3	112.3	120.9	131.9	140.4	151.4	159.9	171.0	179.5	190.5	199.0	210.1	218.6	229.6	238.1	249.1	257.7	268.7	277.2	288.2	296.8	307.8
Loan for Intial Cost																																									
Repayment		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Balance	175	175.0	175.0	175.0	175.0	175.0	175.0	175.0	175.0	171.4	160.4	151.9	140.8	132.3	121.3	112.8	101.7	93.2	82.2	73.7	62.7	54.1	43.1	34.6	23.6	15.1	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Balance After Repayment		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0	8.5	11.0
Total Balance		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	15.5	24.1	35.1	43.6	54.6	63.2	74.2	82.7	93.7	102.2	113.3	121.8	132.8

(4) Revenue and Expense Analysis of the Properties

From the analysis results, the most important items in the forecast of revenues and expenses in the Plan for the Agricultural Development Model are the following ones:

- In Case 1, the contribution from the beneficiaries to the initial investment for the implementation of the irrigation facilities has been C $10,000 and C $2,700, the analysis provided good results. However, the surplus on the twentieth year in both cases has been higher than the reinvestment requirement. Still when the resources are reserved for reinvestment on the twentieth year, the farmers will be able to enjoy enough resources to improve their living standard.

- If the beneficiaries had to finance the entirety of the implementation cost of the irrigation facilities, the corresponding debt would be paid in 13 or 16 years depending on the case. However, the surplus on the twentieth year is lower to the reinvestment requirement, and the farmers will not be able to enjoy the remaining to improve their living standard.

3.13.7 Impacts

(1) Foreign Exchange Saving

Domestic crop production in Nicaragua is not sufficient to meet the demands of the present food consumption, and the deficit is supplemented by imports. With project implementation, the production of basic grains in the project sites will increase several times more than that under without-project condition. Accordingly, the increment of basic grain production will contribute to the savings of foreign exchange.

(2) Increase in Employment Opportunity

Employment opportunities for the local people will be increased during the construction works of the projects, which will have a favorable impact on the national economy. Furthermore, employees will be able to gain more experience and technical skills in various working fields. These benefits would be applied to the future development of Nicaragua.

In addition to the above construction works, other employment opportunities will be created through farming practices after completion of the projects.

(3) Inequality of Income Distribution and Redistribution Policy

After completion of the proposed projects, the people in the project areas can get the fruits of development. The living standard of the people in the project areas will be improved because their family income will increase in proportion to the rise of farming production. The better the proposed projects go on, the bigger the difference will be in farm income between inside the areas of the projects and outside the projects. Although it works as an incentive to increasing the agricultural productivity, an inequality of income distribution is important and serious in order to attain more equitable distribution of the fruits of development. In the case of selection of redistribution policy, the real disparity should be taken into consideration not only in the agricultural sector but also among the ptjer economic sectors. In addition to taxation system, social welfare, intervention policy in market mechanism, etc., as a redistribution policy by the public sector, it is also important to stimulate activities of the private sector. Business enterprises

can invest to productive factories by utilization of private savings, which come from surplus income of consumers, and produce goods and services to consumers. Moreover, activation of private economic sector stimulates the market mechanism and creates new labor market. Thus, the fruits of development could be redistributed to the people by this market power from the long term point of view.

3.14 Environmental Impact Assessment

The contents of the project was analyzed by MARENA and, as a result, both this institution and the Environment Expert of the Study Team considered that the environmental impact evaluation (EIA) should be carried out. However, the validity period of the EIA in Nicaragua is of 3 years, while the beginning of the project execution is foreseen for 2003. Therefore, in this study, the EIA will not be executed through the official process. It is necessary that, before the beginning of the project, the EIA is carried out by MARENA and MAG-FOR, the project executing agency. It is worthy to point out that, in consultative meetings with MARENA, both parties understood that it shall be given due consideration to the adjustment of the water use rights and to the analysis of the social environment, once this project will be developed at a medium scale.

In the present item, the effects the project can cause and its environmental protection plan will be cleared up, before the execution of the EIA.

3.14.1 Conditions of the Environmental Impact Assessment

(1) Contents of the Project

This project is composed of the following aspects: the strengthening of productive facilities, support to agricultural extension, commercialization of agricultural products, farmer's organization, and credit for the farmers. It is considered that among the components, those that will affect the environment are: 1) water intake facilities, 2) irrigation canals, and 3) farmers' organization. Other components such as the rehabilitation of local roads and the construction of the agricultural products gathering and forwarding plant will improve the actual conditions, not causing any negative effects to the environment. The main facilities which were planned in the projects are presented as follows:

Facility Name	Description
Headworks	Type: fixed dike Dike height: 1.0 m, Dike width: 23.0 m Fish way: stepped
Pumping plant	Type of pump: centrifugal pump No. of pumps: 3 units
Main canal	Total length: 16,900 m Type: coated on three sides by cement-soil
Well	Depth: 70 m Pumping volume: 119.5 l/sec/pump No. of wells: maximum of 5 wells

(2) Natural Conditions of the Project District

As shown in the location map, the Telica district is located close to the city of Leon and its topography is relatively plain. At the extreme north of the district, the Telica River runs. The trees in this district are reasonably conserved due to the fact that the district's farmers are mainly small

and medium-scale ones. For more details about the present situation of the district see "3.1: Natural Conditions of the Study Area" and "3.2: Socio economic conditions of the District object of the Study Area"

(3) Influence of the Project

As for the influence of the project, two separate areas can be considered; the area "within the district" and the area "downstream to the intake facilities in the Telica River, which is outside the district". A summary of the negative environmental effects which can be caused by the project is presented as follows.

Project Reach of Influence	Negative Environmental Effects	Affected Population
Within the district	• Increase of the income gap. • Damages to the population caused by pesticides. • Diffusion of epidemic. • Sedimentation of land and mud in the intake facilities. • Alteration in the flow and level of groundwater	• No. of farmer families: 250 • Population: around 1,400 persons
Outside the district 1. Around the district	• Diffusion of epidemic.	• Several undefined persons living around the district.
2. Telica river	• Control of the water use rights.	• There are 4 intake facilities at downstream

3.14.2 Environmental Impact Evaluation

The project execution shall have impact on the district environment in the 7 aspects mentioned in the previous table. In the following items, the environmental impacts are organized according to the check list prepared by Japan International Cooperation Agency.

(1) Impact on the Social Environment

The three items that will affect the social environment are described hereinafter. The remaining items are not considered to cause any impact.

a. Increase of the income gap

Under the project execution, the income generated by the agricultural activity is foreseen to increase. Nevertheless, the income of each farmer depends on the size of possessed agricultural land, the reason why there will be differences from the very beginning. In spite of this, almost all the district inhabitants are landowners and beneficiaries of the project. That means that there will be no differences between beneficiaries and non-beneficiaries.

Due to this possessed land size difference, which varies between less than 3 Mz and more than 5 Mz, it is foreseen an increase of the income gap. However, this difference is already being shaping up due to the historic and social aspects along time, therefore it is not adequate to mention it in this environmental impact evaluation. In spite of this, with respect to the water use cost and to the farmers' organization cost, which will be once more established with the project execution, it is necessary to charge the farmers equitably according to each farmer's income.

b. Change in the social structure due to systematization

The farmers' systematization will be the base of the project, being very important for its success. In the Project Area is the "confederation of agricultural cooperatives of the Sutiapa indigenous

community" is functioning along with three other cooperatives in each district. This confederation has its jurisdiction over a very large area, to which the Project Area also comes under.

In establishing a new organization, farmers' association, there is the possibility of the generation of the following impact; destruction of traditional organizations, disharmony among the inhabitants, creation of non-effective organizations, etc. For this reason, the new organization, the farmers' association shall be formed respecting the intentions of the beneficiary farmers of the project, the existing systems and customs, and renewing the three already existing cooperatives.

c. Readjustment of the water use rights

In the Telica River, there are already four intake facilities downstream to the place where it is proposed to install a new one by this project. Taking into consideration this fact, in the item 3.1.2: Meteorology and Hydrology, it was an available amount of water intake in this place estimated so that it will not affect the already existing intake facilities. Nevertheless, the river water discharge volume will be reduced proportionally to the amount of the new intake facility. Therefore, this situation shall be exhaustively explained to the four existing intake facilities executors and the water use rights shall be readjusted before the start of the project execution.

(2) Impacts on Sanitation and Hygiene

The following two items are foreseen to generate impacts in the sanitation and hygiene of the district. The remaining items are not considered to cause such impacts.

a. Increase of the use of pesticides

By improving the irrigation facilities and introducing modern agriculture methods, it is foreseen the increase of the use of pesticides. For this reason, it is necessary to utilize confirmed safe pesticides, and to reeducate the farmers about the proper method for the use of the pesticides. Furthermore, it is also necessary to constantly monitor residual pesticides in groundwater, as this is also utilized for domestic use in the district.

b. Diffusion of epidemic

Due to the improvement and the construction of irrigation canals, there is the risk of creating favourable conditions for the formation of mosquitoes' habitat, which can cause malaria. In considering the shape of the canals, there are no ways to avoid the generation of such mosquitoes. Therefore, it is necessary to periodically carry out the vigilance on their generation and their extermination.

(3) Damages and Destruction of Ruins and Cultural Patrimony

There are neither important ruins nor cultural patrimony in the district object of the project and its surroundings.

(4) Impacts in the Ecosystem

No item that can strongly affect the wildlife and the district ecosystem is observed. However, the construction of the dam for the water intake will obstruct the river flow and shall affect the aquatic life. In order to affect them as less as possible, the dam will be supplied with a fish way.

(5) Impacts to the Land and Soils

It is considered that there are no items that shall strongly affect the land and soils. However, there is a risk of reducing the soil fertility due to the residual pesticides and the continuous cultivation. Therefore, it is necessary to the prohibit the use of high residual pesticides in the production program and a cultivation system, so that interest fertility of the soils is maintained.

(6) Impacts on the Hydrology and Water Quality

The following two items are foreseen to generate impacts in the hydrology and water quality of the district. The remaining items are not considered to cause great impacts worthy to mention.

a. Sedimentation of land and mud in the water intake facilities

In order to take Telica river water, it is planned to install headworks. Besides that, it is also planned to install sand cleaning gates at them, which requires a proper management for their good operation, and at the same time, to avoid an excessive sedimentation. It is necessary to open such gates not only periodically but also after an inundation, whenever necessary.

b. Changes in the groundwater flow and level

The use of groundwater as suplementary source for irrigation is programmed in this project. Under this theory, the water extraction will be carried out in a maximum of five wells. In the project, it was established the pumping volume to allow the use of this water in a sustainable way, thus it shall avoid the extraction water beyond the established volume. Furthermore, it is very important to continuously observe and measure the well water level, since it is very difficult to predict the behavior of such water and it is a very important resource for the district, which is also being used by the people as drinkable water.

3.14.3 Plan for Environment Protection

(1) Plan for Environment Protection

a. Monitoring of the groundwater level

In order to observe the variation of the district groundwater level, it is necessary to monitor such level. In the execution of this monitoring, the water level indicators, the places where this monitoring shall be carried out and the frequency of monitoring shall be established.

As for the groundwater level rates, there is no existing data collected through a continuous measurement. It is necessary to carry out its measurement in a specific well, at least starting one year before the project execution in order to evaluate the data obtained by this monitoring.

b. Monitoring of the water quality

In order to observe the contamination of the groundwater level in the Study Area, it is necessary to monitor its water quality. In the execution of this monitoring, the water quality indicators, the places where this monitoring shall be carried out and the frequency of monitoring shall be established.

The groundwater is used for both domestic and irrigation purposes. However, as water contamination indicators, the standards for drinkable water shall be adopted since they are strict in order to prevent serious damages for the human health.

c. Places and frequency of monitoring

Selecting some wells (more than two places), it is possible to carry out the monitoring of

groundwater level and quality. For the observation of the water level, it is convenient to carry out this observation twice a month for a good understanding of the variations caused by the period, elapse of the years and extraction for irrigation. For the observation of the water quality, not so many observations are necessary once it is groundwater, thus twice a year is enough.

(2) Reforestation Plan

All the farmers in the district utilize firewood as domestic combustible. Half of the consumed firewood comes from residential areas located 18 km far at the countryside and the other half is provided by the Telica district itself. Comparing with other districts in Nicaragua, there are lots of trees in this district yet, even though it can not produce all the necessary combustible (firewood). In order to increase the production of firewood and to reduce the deforestation, it is necessary to go for afforestation programs.

(3) River Water Monitoring Plan

The river discharge data which was utilized for the adjustment of water use rights in this study are those of the dry period, when the discharge is smaller. Nevertheless, they represent seven months within this study period. In the execution of the EIA, more reliable and continuous data shall be utilized, in order to execute a detailed study. For this purpose, it is necessary to start again the observation of the discharge. After the completion of the project, this observation shall be continued in order to accumulate basic data, which will be useful in the future when the restructuring of the water use rights is to be carried out.

CHAPTER 4

EL ESPINO AREA AGRICULTURAL MODEL DEVELOPMENT PROJECT

CHAPTER 4 EL ESPINO AREA AGRICULTURAL MODEL DEVELOPMENT PROJECT

4.1 Natural Conditions of the Project Area

4.1.1 Topography, Geology and Soil

(1) Topography and Geology

El Espino area is located to the southeast of the center of Area 2 and closer to the Managua Lake. The area consists of low hills with the elevation of less than 200 meters. The area is separated from the Pacific Ocean volcanoes and is situated on the edge of the great fault.

The Project area is situated on the eastern edge of a flat area formed by a collapsing old calderas and comprises of hills of 80 - 120 meters elevation. This topography is considered to be caused by potential small faults.

Tertiary system, which is the basement of the area, forms gentle basin, and on top the system lies quaternary diluvium and volcanic sedimentary layer to form low and gently undulating platform.

Almost in the center of the basin structure, quaternary volcano intrudes and rises along the fault which runs from northwest to southeast direction to form a group of volcanoes raising in the midst of the plain. Shallow groundwater exists in diluvium with a depth ranging from 15 to 25 meters from the ground surface.

(2) Soil

The topography of the land in this area is characterized by gentle undulations in most part of the area. According to the outline of the soil study carried out through the excavations in the plateau and lower lands, the soil distribution is of franc loamy soils and heavy loamy soils at a depth of 10 to 20 cm from the surface soil which is formed by arable land of 1-10 cm thick with a great degree of compaction. Lower, vegetative roots cannot be seen.

4.1.2 Meteorology

(1) Meteorology

1) Rainfall

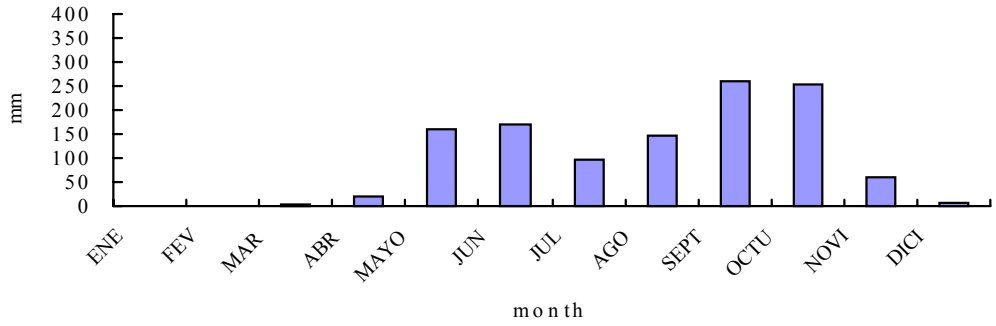
The rainfall data were collected at the Malpaisillo precipitation observatory, which is located in the neighborhood of this Study Area. The daily rainfall data were collected for 25-years period from 1963 to 1990 (three years data (1981,1982,1987) were omitted). The annual mean rainfall is 1,179mm, the annual maximum rainfall in 25 years is 1,641mm, recorded in 1973 and the annual minimum rainfall is 752mm recorded in 1967. The annual total rainfall was below 1000mm in 8 years, and more than 1,500mm in 2years, and varies from year to year. The monthly average rainfall data of 38 years is shown in Table B-6 (Annex) and the monthly precipitation pattern in Figure B-6 (Annex).

The annual rainfall pattern is divided into the rainy season and dry season. The monthly rainfall rate is shown is Figure B-7 (Annex). 97% of annual rainfall is concentrated from June to November. Also, one of the characteristics of the rainfall pattern in this area is the frequent

occurrence of successive no-rain days during the rainy season, called “Canicula”, which causes serious damage to farm products.

Table 4.1.1 Monthly Mean Precipitation (Unit : :mm)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Precipitation	0	1	2	20	161	169	98	148	259	253	61	7	1179



2) Other Meteorological Parameters

Except for the precipitation data, all the other meteorological data was obtained from the Leon Meteorological Station. To analize the climatological conditions of the region, it is necessary to depend on the Leon meteorological station, consider the distance to the area, types of data and the observation period.

The following table shows as monthly average of temperature, relative humidity, evaporation, cloudiness for 23 years (from 1974 to 1996) and the sunshine hours, wind velocity and direction, for 17 years (1980 to 1996).

Table 4.1.2 Monthly Meteorological Data

Parameter	Unit	JAN.	FEB.	MAR	APR.	MAY	JUN.	JUL.	AUG	SEP.	OCT.	NOV	DEC.	Average/ TOTAL
Temperature, average	℃	27.0	28.0	28.8	29.4	27.9	27.2	27.4	27.1	26.2	26.1	26.1	26.4	27.3
Average Max. Temperature	℃	33.9	34.9	35.6	36.2	34.4	32.7	33.3	33.3	31.8	31.5	32.1	33.0	33.6
Average Min. Temperature	℃	20.2	21.3	22.7	24.0	24.0	23.2	22.6	22.5	22.4	22.0	21.1	20.0	22.2
Abs. Max. Temperature	℃	38.0	38.4	39.6	40.0	39.4	37.4	38.0	37.8	38.0	35.2	36.6	37.3	40.0
Abs. Min. Temperature	℃	17.2	18.6	19.6	21.3	22.0	21.3	20.5	20.5	20.9	20.3	18.8	17.1	16.5
Relative Humidity	%	67.6	63.7	65.3	66.6	76.1	82.6	77.5	81.3	86.7	87.0	81.7	73.1	75.8
Min. Relative Humidity	%	31.1	28.1	28.6	28.3	33.5	42.6	39.8	41.4	47.1	48.1	44.2	34.9	38.3
Max. Relative Humidity	%	97.6	97.5	98.5	98.6	98.3	99.3	99.2	99.4	99.6	99.5	99.6	99.1	99.2
Eveporation	mm	213.9	240.6	270.1	245.0	164.2	122.4	158.3	151.6	106.1	101.2	119.7	172.7	2031.6
Sunshine Hours	Hr	265.2	264.2	291.8	249.7	189.2	172.3	186.2	188.9	174.0	199.6	215.2	235.1	217.6
Wind Velocity, h= 8 m	m/sec	2.3	2.6	2.4	2.2	1.9	1.7	2.0	1.7	1.6	1.7	1.4	1.9	1.9
Wind Direction		E	NE	E	E	E	SE	E	E	SE	SE	NE	NE	E
Cloudiness	Octas	3.3	3.3	3.3	4.1	5.0	5.5	5.2	5.3	5.5	5.1	4.5	3.8	4.4

(2) Available Water Resources

Available water sources for farming in this area are rainfall and ground water. Rainfall pattern is discussed here while the ground water sources are discussed elsewhere.

Based on the annual precipitation data for 25 years obtained from the Malpaisillo Meteorological Station, the return period analysis was made as shown in the following table and the rainfall pattern is shown in Table B-8 (Annex).

Table 4.1.3 Analysis of the Period of Return of the Annual Average Rainfall

Return Period	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
50	0.1	0.7	1.0	11.3	90.3	95.1	54.7	83.0	145.5	142.5	34.2	3.7	662.1
20	0.1	0.8	1.2	12.7	100.7	106.1	61.1	92.6	162.3	159.0	38.1	4.2	738.8
10	0.1	0.8	1.3	14.0	111.1	116.9	67.3	102.1	178.9	175.2	42.0	4.6	814.3
5	0.2	0.9	1.4	15.7	124.9	131.6	75.8	114.9	201.3	197.1	47.3	5.1	916.3
2	0.2	1.2	1.8	19.7	156.6	164.9	94.9	144.0	252.2	247.0	59.2	6.5	1148.2

(3) Flood Volume

1) 24-hour Maximum Rainfall

Based on the Daily rainfall data from the Malpaisillo Meteorological Station, the Return Period was estimated by Probability Analysis as shown in the following table. The maximum daily precipitation for 25 years is shown in Table B-7 (Annex).

Table 4.1.4 Maximum Precipitation for 24 Hours, According to the Return Period

Return Period	(%)	Maximum Precipitation for 24 Hours (mm)
100	1	306.73
50	2	265.02
20	5	212.84
10	10	175.16
5	20	138.36
2	50	88.10

2) Field Drainage Volume

Field drainage volume in this area was analyzed by the Rational Method, based on result of probability analysis of 24hr maximum rainfall. The rainfall volume that has been used in the result from the return period study was applied to the maximum precipitation for 24 hours.

The values used in the Rational analysis method are:

Table 4.1.5 Field Drainage Volume for unit Area

Return Period		24hr Max. Rainfall	Drainage Volume (m^3/sec)				
	(%)	(mm)	5ha	10ha	50ha	100ha	500ha
50	2	264.9	0.63	1.14	4.62	8.42	33.98
20	5	222.4	0.48	0.88	3.54	6.46	26.05
10	10	190.5	0.38	0.69	2.80	5.10	20.57
5	20	157.8	0.29	0.52	2.10	3.83	15.45
2	50	110.2	0.17	0.30	1.22	2.22	8.94

4.1.3 Hydrogeology

(1) Outline

In this area there are no rivers and hence irrigation systems which use surface water cannot be

expected. Most of the rivers in the surrounding area have riverbed water. In addition to that, most of the precipitation permeate into the soil rather than running off over the ground surface because of the geological conditions of volcanic origin and soil characteristics, and therefore both specific discharge and run off rate show low value and the difference between the runoff in dry and rainy seasons is large.

Geologically, quaternary diluvium of good permeability lies on top of the aquiclude system. And because of this geological structure the groundwater recharge rate in this area is high.

Private wells for daily domestic use exist for almost every two households in the area. Back in 1970s three irrigation wells were constructed and groundwater irrigation was being conducted. However, these three wells have been abandoned and are not in use now. Groundwater potential of this area is expected to be more than $0.011 m^3/sec/km^2$ and even in existing well pumping capacity is 0.05 m^3/sec. However, this is based on the assumption that density of the wells is one well for every one km^2 and if the density of well increases, pumping capacity will drop.

In order to identify the development potential of the underground water the pumping tents were carried out in the existing wells and in the new one (drilled for P/S) to verify the pumping capacity.

(2) Hydrological Analysis

Pumping test was conducted in the existing well and in the newly constructed well. The results are shown below.

Existing well (74.282m above msl): 66.35 l/s (3.98 m^3/min)
New well (78.606m above msl): 52.28 l/s (3.14 m^3/m)

4.2 Socio-economic Conditions in the Study Area

4.2.1 Location, Administrative division and Agricultural Population

El Espino Area is located at about 60km northeast of Leon city and falls within the administrative boundary of Malpaisillo. It includes two communities such as El Espino and Las Lomas. Almost all of the El Espino community is included in the Study Area, where as only 1/3rd of Las Lomas is included in the Study Area.

The total population is approx. 500 including 57 farm families. The number of farm families in each department is shown below.

Table 4.2.1 Number of agricultural Families

Community	Farm families
El Espino	35
Las Lomas	22
Total	57

The landholding size according to the area is shown in the following table:

Table 4.2.2. Actual land holding size (Mz)

	Farm Family	Area (Mz)	Area (ha)	Area Ratio (%)	Ratio of No. of Family (%)
Below 3.0Mz	4	5.76	4.03	0.43	7.02
3-5.0Mz	2	9.27	6.49	0.69	3.51
5-10.0Mz	12	100.08	70.06	7.41	21.05
10-30.0Mz	18	343.14	240.20	25.39	31.58
30-50.0Mz	16	547.37	383.16	40.50	28.07
50-100.0Mz	5	345.69	241.98	25.58	8.77
Above 100Mz	0	0	0	0	0
Total	57	1,351.31	945.92	100.00	100.00

Source: JICA Study Team

As it can be noted from the above table, among the total 57 farm families, the farmers with a landholding size of 5 to 50Mz are 47, which is equal to 81%, and the number of farming families with less than 5.0Mz land holding size is 6 and more than 50Mz is 5.

4.2.2 Economic Activities

The distribution of goods in the El Espino area is shown in the following figure. As clearly seen from the diagram, the incomes of El Espino village are obtained through family farming, the sales of agricultural products (including products from the kitchen garden and small domestic animals), the works in the property (selling their labor force), in other words, the persons in the area live from agriculture. This is supported by the fact that all adult males under the social survey except students consider themselves as cultivators. According to the result of the agricultural household's income and expenditure survey, it is also revealed that remittances from children become an important income source in quite a few cases. (See Annex diagram of agricultural household's income and expenditure).

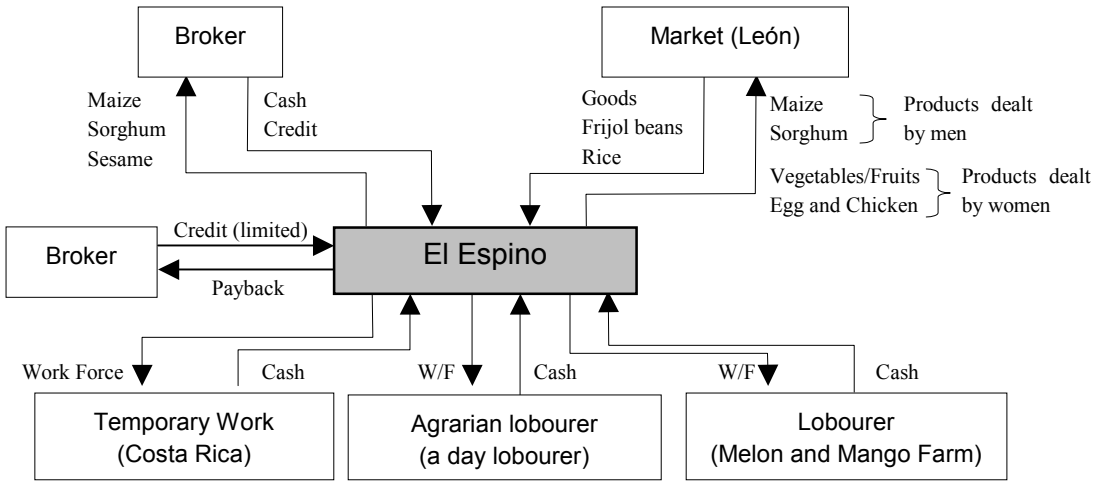


Figure 4.2.1 Movement of Services and Goods in El Espino

4.2.3 Land Use

El Espino area is predominantly a gentle mountainous area and has inclined landscape. Summarizing the present land use in El Espino area, the 88 % of the project area, 1,374.2 Mz is used as arable land, grassland and forest use (See below table). The arable land is dominantly cultivated with the rainfed crops such as maize, sorghum and sesame. The forest area, occupying

3.2 % has been diminishing due to cutting firewood, and generates partially soil erosion problems in the area. Further, about 40% of the whole project area is used as grassland for livestock grazing.

Concerning tree crops, Jicaro of which fruit is used as fodder and materials for refreshing is partially cultivated in small scale.

Table 4.2.3. Actual Land Use

Use	Area (ha)	Area (Mz)	Percentage (%)
Cultivated land	453.1	647.3	47.2
Orchard	7.9	11.3	0.8
Unused land	38.9	55.6	4.1
Grassland	364.2	520.3	37.9
Waste land	47.0	67.1	4.9
Forest	30.5	43.6	3.2
Settlements	13.9	19.9	1.4
Roads/Channels	4.5	6.4	0.5
Total	960.0	1,372.5	100.0

Examining the present land use from the view point of land classification, the land use which needs special attention or is not suitable for arable land occupies 33.8 % over the 647.9 Mz upland field (Table 4.1.1). In other words, the land, which should be originally used as forest or grassland use is currently, used as arable land, and causes soil erosion problems.

Table 4.2.3 Land Surface according to Classes

Class	Area (ha)	Area (Mz)	Percentage (%)
II	152.3	217.7	15.9
III	330.8	472.9	34.5
IV	410.7	587.2	42.8
VI	12.5	17.9	1.3
VII	53.7	76.8	5.6
Total	960.0	1,372.5	100.0

Source: JICA Study Team

4.2.4 Farm Management and Extension

(1) Farming Type

The farming type prevailing in the Study Area is only one type of maize + sorghum + sesame + livestock (large and small animals) in combination of both El Espino and Las Lomas Comarca. Maize and sorghum are cultivated for self-consumption purpose including livestock feed, while sesame is cultivated as a cash crop. Most of the farmers in the Study Area raises few domestic animals like cattle, horse, pig or chicken which plays an important role in food security, animal traction power or acquisition of animal products like milk or meat. Further, most of the farmers makes a livelihood by working away from the farm such as FRUTEX or MANGOSA,SA which are plantation farms to export melon and mango fruits, or a neighboring country-Costa Rica. Background of this rural life style is derived from low land productivity caused by ample slope landscape related to unstable rainfall pattern.

(2) Cultivated Crop

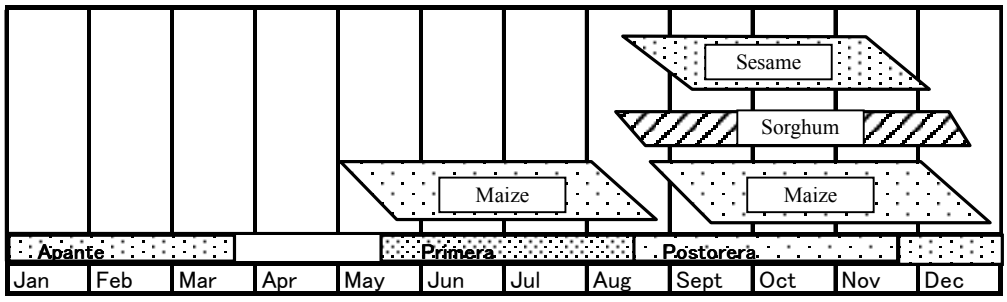
Dominant crops cultivated in El Espino area comprise of the three major crops with little vegetable as follows;

1) Basic Grains
Maize, sorghum

2) Nontraditional crop
Sesame, vegetables (for kitchen garden), Jicaro (Crecentia alata)

(3) Present Cropping Pattern

Cropping pattern in El Espino centers on only rainfed farming. The first cropping season-"Primera" has a high risk of poor harvest due to a short rainy period interacted with unstable rainfall pattern, thus planted in small acreage, and the 2nd cropping season - "Postorera" following to a short dry spell so-called "Canicula" is a primary cropping season. Cultivated crops are maize, sorghum and sesame, and its cropping pattern is as follows;



Source: JICA Study Team

Figure 4.2.2. Present Cultivation Pattern

Frijol beans, one of the major staple food crops is physiologically impossible to cultivate here because of hot dry weather condition. Some vegetables like bell pepper, cucumber and pipian are planted for self-consumption in backyard garden with well irrigation method.

(4) Cropping Acreage and Production

The table shown below indicates 97/98 census of cropping acreage, yield and production in the Study Area collected by DARIAP.

Table 4.2.4 Agricultural Production in El Espino Area (Cycle 97/98)

Crop	Sowing area	%	Lost area (Mz)	Harvest	Yield (QQ/Mz)	Production
Sesame	364.1	59.7	10.0	353.5	6.0	2184.3
Maize	148.4	24.3	74.0	74.4	8.0	595.2
Sorghum(red)	41.7	6.8	23.3	18.4	9.0	166.0
Sorghum(white)	55.2	9.1	4.0	51.2	9.0	461.0
Total for sowing	609.3	100.0	111.3	497.6		3763.1
Total Area	1372.5					
Crop Intensity(%)	44.4					

Source: DARIAP census revised by JICA Study Team

The figures in the Table are the revised information collected in Comarca-basis into acreage proportional allotment in Caserió basis because of only Caserió Las Lomas included in the Study Area.

Sesame, a cash crop occupies almost 60 % of the whole cropping acreage followed by maize, and sorghum. The resultant CI is 44.4 %. The harvesting lost area due to unstable rainfall under rain-fed condition amounts to 18.2 % and is usually occurs in every year.

(5) Farming Practice

The prevailing farming practice among the small-medium scale farmers in El Espino is shown in the following table.

Table 4.2.5 Crop Management Technology Prevailing in El Espino Area

Farm Operation	Ratio of FH depending on employing & custom hired system (%)		Averaged employing CW (Head/FH)		Averaged wage (C$/Day/Head)	Kinds of input	Charge of custom hired (C$/Mz/Time)	No. of Plowing /harrowing times
Farmers scale	10Mz<	10Mz>	10Mz<	10Mz>				
Field preparation	100	50	2	10	20			
Plowing	100		2			Tractor Animal	150 50	1 3
Harrowing	100	100	1	1		Tractor	75	3
Sowing	100	100	4	5	20	Tractor Animal		
Inter-tilling	100		1			Animal	50	1
Fertilizer Appl.	100	50	2	4	20			
Weeding	100	50	2	10	20			
Agro-chemical spray	100	50	2	4	35	Shoulder type sprayer		
Harvesting	100	100	3 to 7	10	20			
Transportation			-			Ox-cart		

Source: JICA Study Team

Farm operations like cutting grass before sowing, plowing and harrowing are dominantly managed by tractor or animal traction power via custom hired service. However, timely plowing operation after rain is apt to be delayed due to limited number of implements for custom hired service and due to a blood relation, that is to say, the thinner the relation to the implement owner, the more delayed.

The seeds are used from their own product every year and seldom renewed. Fertilizer and agro-chemicals are only used when they have budget in reserve and no use for self-consumption purpose for the basic grains. Sesame is cultivated with fertilizer and chemical inputs because of available credit source, but usually influenced by unstable rainfall.

(6) Agriculture Extension

The organizations carrying out farmer's supporting activity in the Study Area consists of four organizations such as INTA, MAG-FOR, UNAG and Spanish NGO, summarized below but the official organizations including INTA are generally sluggish.

1) INTA, UNAG and MAG-FOR

El Espino area is actually not included in the extension net work serviced by INTA and broadly fallen in the category of ATPM, which is supported in a way of the farmer's monthly training seminar organized by the official organizations at Municipial Office in Malpisillo. For this seminars, the member of the village development committee in El Espino usually takes part in and presents the findings of the seminar at the community meeting, and which is the only one way to obtain new knowledge for the villagers. The reason behind this situation is derived from a low agricultural potential under harsh natural condition and the difficulty to exhibit an effect of the extension activity-oriented to the soft program based on the farmers training program. Meanwhile, the three farm households have become a member of the ATP2 class since the end of last year and assisted by the SETAGRO., S.A., a private company contracted with INTA.

2) Spanish NGO

This NGO, with the project office in Malpisillo and extend its activity to El Espino Area by carrying out health care service, extension of kitchen garden, and distribution of small domestic animals like goats and cattle to the female beneficiaries as a target group. In order to extend kitchen garden among the villagers, irrigating kitchen garden by well is promoted by installing a hand pump.

(7) Post Harvest Storage

In accordance with the result from the farmer's interview survey in the Study Area, 80 % of the farmers stores basic grains in the drums and the rest of the farmers uses nylon bag which are heaped in the house. Sesame is not stored except for the next year's seed stock because of selling the harvest immediately after screening the impurities.

Table 4.2.6 Storage Method for Grains (%) in El Espino

	Nylon bag	Drums
Maize	20	80
Sorghum	20	80

Soruce: JICA Study Team

4.2.5 Marketing

The transportation condition in El Espino Area is worse than in Telica and the accessibility to Leon City as the adjacent market is bad, as it must take about 8 km to the adjacent national highway, where public transportation such as bus and truck can be used.

(1) Farmer's marketing condition

As the access to markets is extremely difficult, various farm products that intends to be sold to the markets of Leon is not seen in this area and the production concentrates on sesame, maize and sorghum.

Most of products are sold to brokers who comes to purchase them and even the farmers who go to the markets of Leon permanently are few. As a result, the market information that farmers can obtain is mostly from brokers.

(2) Agro-processing facility

There is a small flour mill in Las Lomas and a milling machine was introduced in 1992.

The outline of operation is as follows:

Processing amount:	7 - 10qq./month
Processing grains and distribution:	Maize 60%, Sorghum 20%, Coffee 15%, Soya bean 5%
Milling charge:	Maize C$32/qq., Others C$20/qq.

The production of mixed feed is carried out in addition to the above grain milling business. Only 5qq./month is produced now, as the price of materials goes up too much and the profit can not be expected this year, although 10qq./day was produced last year.

Mixed contents:	Maize, Sorghum, Semolina, Salt, and Vitamin additives, Maize (sometimes)
Selling price:	C$100/qq.

As shown above, this business has not reached to the profitable base.

(3) Other conditions

The conditions for marketing of products in the Area such as condition of the markets in Leon City and of sesame distribution channel are already mentioned in section 3.2.5.

4.2.6 Farm Economy

In the El Espino area, an average family size was estimated as 8 members. The farm size is approximately 23.7 Mzs. (actual cultivated area is around 10 Mzs) The main crops are maize, sorghum, and sesame; livestock activities are also an income source. In the case of the sesame, the whole production is bought by traders.

An annual household income was estimated at C$34,752 on average in the El Espino area. It includes sales of crops cultivated, livestock products and off-farm income (small-scale side business, temporary employment within the region or abroad, etc.) Off-farm income and sales of animals are an important source of income as the agricultural production conditions are not so good compared to those in Telica.

Based on the results of the RRA and the PCM and field surveys carried out by the JICA Study Team, it has been estimated that about 41% of total income is generated by agricultural-related activities while 59% comes from off-farm and livestock-related activities.

Annual household expenditure was estimated at C$7,454 on average in the El Espino area. Annual expenditure on food was estimated as C$4,770 accounting for 66% of the total household cash income. The agricultural and livestock production-related expenditures (inputs, fertilizers, agrochemicals, etc.) represented 16% (C$1,118) of total expenditures; transport expenses represented 9% (C$671); clothing expenses represented 5% (C$373); health-related expenses represented 4% (C$298); education expenses represented 2% (C$149); and other expenses represent 1% (C$75).

As can be seen from the above data, food expenses had a great share of total expenditures; it can be implied that the income level is not high enough to allow the small and medium scale farmers to have resources to use for other expenditure items, mainly production-related expenditures. If the level of income increases, it will be possible for them to use more funds to improve both

production and living conditions.

Table 4.2.7 Farm Economy Summary

Item		Share (%)
Average Landholding Size	22.7Mzs	
Average Number of Household Members	8 persons	
Gross Income (C$)	7,454	
a) Agriculture-related sources	3,056	41
b) Livestock and off-farm sources	4,398	59
Gross Expenditures (C$)	7,454	
a) Food	4,770	66
b) Production-related	1,118	16
c) Transport	671	3
d) Clothing	373	9
e) Health-related	298	2
f) Education	149	3
g) Others	75	1

4.2.7 Agrarian Society and Gender

(1) Family, marriage and house

More than half of 57 households in El the area of Espino gathered in the area called El Espino, and the rest are dispersed in the area. Most of them are related through the kinship relationship, and the arrangement of houses is highly influenced by this kinship relationship.

The average number of family members in El Espino is 8, and 6 of them are children. Usually it is common for children to become independent of their parents and keep houses for themselves at the age of 20 or so. However it is often observed the cases of living with parents even after 20 years old due to the economic difficulties.

As for the marriage type, the half just live together and only the other half are ‘married’ religiously and officially. It seems that joining of both sexes are moderately lenient and sometimes both males and females experienced the several living-ins.

(2) Education

There is an elementary school in El Espino. Two teachers (who live in El Espino village) teach about 40 to 50 students at two classrooms of the elementary school. In this elementary school, students study up to the 4th grade, and from 5th grade they have to go to an elementary school in Las Lomas, a kilometer away. A junior high school is 10-kilometer away from the village.

Though there is the trend of the increasing rate of school attendance, the majority is compelled to leave school for economic and social reasons, and the rate of elementary school graduation is not high. The educational level is generally low, and there are about 30 % of uneducated peasants over the age 15, about 30 % of dropouts from the elementary school, and the rest 30 % or so are graduated from the elementary school or above. (But no one has high level education other than the junior high school education.)

(3) Health Care

There is a health care center as public medical institution in the neighbor Las Lomas village. A male nurse and a female nurse works at this center, but there is no doctor. If sufficient treatments are not provided in this center, patients have to go to another health care center located in Malpaisillo town, 30-km away from the village. Medicines, especially antibiotics, are tend to be in short. If there is no medicines in the center, it prescribes for a patient and he/she is supposed to go to a pharmacy and buy medicines. However, in most cases villagers can not buy them because of the economic difficulties.

In addition, there is a clinic managed by Spanish NGO in a community named La Unión. It is a clinic for women and some activities such as medical examinations of cervical cancer, family planning (contraception), the arrangement of salpingectomy operations and the sex education for the youth are carried out.

(4) Gender

Not only in El Espino as the Study Area but also in this region, the division of labor based on the gender is observed. Men work only in the fields and do not do other jobs except a few necessary miscellaneous ones. On the other hand, women are mainly in charge of several house duties such as sweeping, laundry, cooking and raising children. They are also in charge of kitchen gardening and taking care of small domestic products. In addition, for many cases, women work in the fields during the farming season. As for the daily activities, since women are busy with various works from the morning to just before going to bed, contrary to men working only in the fields, generally women's activity hours are longer than men's.

As for the accessibility and control pattern (the right of decision), men have access to productive resources (land in the case of El Espino) and the right of decision about sales of main products and ways to use incomes. On the contrary, women only have access to productive resources and products, but no rights about sales of main products and how to use incomes. What women can control is limited to products from the kitchen gardening (most of them are self-consumed) and small livestock such as chickens and eggs.

(5) Activities of NGOs

Xochilt Acalt Womens' Center

Spanish NGO introduced in the section of the health care is promoting the activities of this center and it has a project office in Malpaisillo town. Four main activities are (1) providing the health care service for women, (2) promoting kitchen gardening, (3) the goat distribution program and (4) the cow distribution program. Through these activities, women's' voluntary formation of organizations are promoted.

Save the Children

The activities have just started since last July. At present, it is formed by 10 volunteer women. Main activities of this NGO are to improve the nutritious conditions of children under age 3 and mothers. Concretely, they find malnourished and under-nourished children by measuring the weight and height of children under age 3, and distribute food to them and their mothers.

4.2.8 Agrarian Institutions

(1) Agricultural Association

In the Study Area, there are three agricultural associations, namely Nicolás López Roque agricultural association, Jerónimo Rafael Gusmán agricultural association, and Aristídez Sánchez Vázquez agricultural association. They are established in 1965, 1983, and 1987 respectively, and the present members are summed up to 201 persons (87 persons, 90 persons and 24 persons respectively).

At present, main functions of the agricultural association are seen in the following three points; finding financing agencies, solving any common problems among members, and cropping and management of tempate. However since no credits toward each agricultural association has been carried out for several years, the substantial functions of agricultural associations are to solve any common problems among members, and crop and manage tempate. The diagram of agricultural association's structure is presented below.

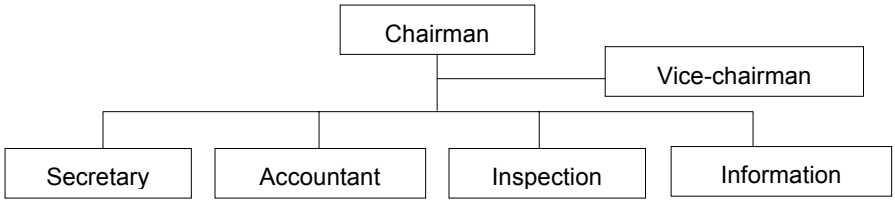


Figure 4.2.3 Composition of the cooperative en the area of El Espino

A chairman of agricultural association is in charge of all business regarding management of the association. A vice-chairman supports the chairman, and place chairman's business in the case of the chairman's absence. An accounting committee is in charge of collecting membership fees (5 Córdoba per month = 0.5 $) and management. A secretary is in charge of recording general meetings of members, and a public information committee is dealing with notifying about the associations to the members. Committee members are elected by association members. The term of service is two-years.

(2) Community Development Committee

The Development Committee of the region of El Espino is formed by 5 members. They have been selected by voting and then the Mayor designates them. In this sense, it is official , nevertheless, the members are volunteers and do not receive any remuneration. The jurisdiction for the Development Committee is the entire region and it includes the people who do not belong to the cooperative and/or who are not working in agriculture. The activities carried are normal, nothing notable, mentioning some of them are: road repair, production of forestry nursery, vegetable production, well facility and latrines for public use.

4.2.9 Infrastructure

1) Social Infrastructure

a) Access Road to the Project Area

The El Espino Area is located in about 60 km of the northeast from the León City. The access road to the area branches from the rout 26 (León-Matagalpa, Asphalt pavement) and the distance to the area are about 8.5 km. The width of this road was about 8 m originally; however, the

existing road width becomes about 20 m, because the vehicles pass the site of the roadside when the surface of the road is rough. The existing conditions of the road are very bad, especially, the vehicles become not able to pass frequently because water filled potholes on the road after the rainfall.

It is because road maintenance is not done that the road condition is bad, but basically, it is caused by the bad structure of the road. That is, side ditches isn't constructed though a road is constructed to the lower position than the agricultural land or the pasture on both sides of the road. Therefore, because the road becomes a drain by the rainfall, big accumulations of water are caused in the hollows. Therefore, the construction of the side ditches and the processing of drainage are necessary.

The access road branches from the national road 26 and crosses El Madroño River with about 8m width at about 1 km from the intersection. But, no bridge is available. The people and the vehicles can cross the river when there is little water flow in the river, but when there is much water on the river, traffics are blocked off. Therefore, a simple bridge (e.g. the submerged bridge) should be constructed. The road crosses small streams (there is no water flow in the dry season) in 10 places. Concrete pipes (600-1,000mm diameter) are installed in the crossing places. However, they are not functioning well at present as they are damaged or filled up with earth and sand. For above-mentioned reasons, to prevent the destruction of the road and to prevent flooding on the road, these crossing places must be rehabilitated.

b) Rural road

In the Study Area, two rural roads branch from the access road. One is about 7.5km long that approximately surrounds the Area and another is the about 4-km which runs through the Area (Fig.4.7.2). The width of these roads is about 5-7 m. However, according to the above-described reason, there are sections, where the road width is about 20 m. The present road conditions of these roads are very bad in a lot of sections according to the reason mentioned above 1), and because the traffic hindrance has occurred in the rainy season, these roads should be repaired. But, because there is not much traffic in the Area at present, the road conditions of the road where the drainage water does not flow into are kept being good, comparatively. Rehabilitation of these crossing facilities is necessary because the laid concrete pipes are damaged.

Such roads cross some ravines (without water in the dry season) in seven places where the concrete pipes are buried. They are broken and are not presently in operation and in need of repair.

c) Means of transportation

The bus passes the road outside this area several times per day but there is not a single bus that enters in the area. The habitant who lives in this area must go to the national road in about 8.5km distance either by walking or bicycle to take a bus.

2) Electricity and Communication

The power transmission line is constructed into the area but there is no house with electricity supply. But, in May 1998, the electricity plans to be supplied to each house. There is no telephone facility in the area.

3) Medical care and Education

Details are described in the Clause of the Farmhouse investigation.

4) Potable Water

Water supply facilities are not established in this area but a shallow well (about 10m to 30m depth) is installed in each home and a handpump is used generally. These wells are never dried up even in the dry season.

(2) Rural Infrastructures

1) Irrigation Facilities

The irrigation facilities in the Area are three wells as shown in the following but are not used at present.

Table 4.2.8 Existing Irrigation Facilities (Deep Wells)

Facility	Location	Depth of Well	Water Level	Pumping Facilities	Diameter of Casing (mm)	Discharge Volume (m^3/min)	Present Condition
Well No.1	Center area	Buried	"	None	300	"	impossible to use
Well No.2	"	89m	-13.0m	"	300	3.03	possible to use
Well No.3	"	103m	-13.5m	"	300	About 3.0	"

Source : JICA Study Team

The 1st well is buried and it is impossible to use but the other two wells are usable. In this Study, a pumping test was executed to confirm the water capacity of the well No.2. The water capacity of the table above is the result and the water capacity of the well No.3 is estimated approximately similar to the well No.2. There are no irrigation facilities in this Area and the irrigation percentage of the agricultural land is zero.

2) Agricultural Land

The field lot of this Area is generally big and the short side of one lot is equal to or more than about 50 m. Because Manzana (Mz, 100×100 Vara: 0.7ha) is used for a unit of the field lot, the length of each side of the lot is the multiple of 100Vara (83.8m). The cultivated lands are relatively well consolidated but the other land is not consolidated and these lands are used for pastures almost. The whole area is ups and downs loosely but partially there is land with strong gradient. These lands with strong gradient aren't used at present.

3) Farm Roads

There is only one farm road of about 4 km length in the Study Area excluding the roads that are seen around the Area. The road width of this unpaved farm road is about 6 m. There are many sections where road surface is rough because a maintenance work is not done and there are many sections where passage is hindered in case of the rainfall. This farm road should be rehabilitated in the future.

There are few farm roads extended to individual farmland. The agricultural machinery and the light truck must pass farmlands or pastures to enter a farmland. So, it is necessary to construct farm roads in the future.

4) Water for Livestock

About 20 head of large-sized livestock (mainly cattle) are raised in this Area. Most of the livestock are grazed at the pasture or the field after harvest. The source of water for livestock is generally shallow well to have dug around the stable or the small stream.

4.2.10 Environment

(1) Environmental Condition in Project Area

1) Social environment

a) Inhabitation

This region was settled by immigrants who moved into this area about 100 years ago. Since there have been no immigrants recently, there are no conflicts between inhabitants of this area. Population composition and economic activity were not surveyed in recent years.

b) Health and Sanitation

This area is Malaria protected area, but other endemic and epidemic diseases are not breaking out. Agrochemical is used during farm work, however farmer dose not use protective material. Therefore outbreak of slight injury was suffered to farmers in this area, but no serious injury was reported.

c) Cultural Property

There exist no precious and important cultural heritage properties.

2) Natural Environment

a) Biological and Ecological Ecosystem

There are no endangered species in the area as the wetlands (ponds, swamps, and marshes) do not fall under category stipulated in the Ramsar Treaty. However, since aquatic organisms exist in the Rio Telica, it is necessary to protect these organisms.

b) Topography, geology and soil

The area has flat topography and geology made up sandy loam and loam. The farmland occupied approximately 50% of total land use ratio of this area. Soil erosion occurred same part of the area.

c) Forestry

Forest occupied 3.2% of land use of the area. Forest exists only along tributary of the River Sinecapa. All of fuel wood for living is supplied out of area. Accordingly forestation project that plant 2000 trees was carried out in 1996, and planed same project that plant 7,500 trees in this year.

(2) Water Quality

1) Objective of the survey

Large-scale cotton growing had been managed in the Region II, including the Study Area. Much agrochemical is used for cultivation of cotton, and stay behind for soil and ground water. Therefore water quality analysis was made to access the suitability of ground water for irrigation.

2) Survey point and date

The water quality could be expected to be uniform in residual agrochemical in all the wells of the area. Waters are sampled two times in 10 days interval improve the precision of analyzes.

Sampling Well	Second well of El Espino area
Sampling Data	Jun/9/1998 (1st time), Jun/19/1998 (2nd time)

3) Result of analysis

The values of the Panama's environmental standards that are utilized in Central America, were utilized in this water quality analysis study. At present, MARENA, which is the organization in charge for such control, is still preparing the national standard. The result of analysis dose not detects the presence of any agrochemical, so ground water of this area can be used for irrigation.

Table 4.2.9 Results of the Water Quality Analysis

Agrochemical	1st Time	2nd Time	Standard
Organic-chlorine			
HCB	None detected		0.0082
HCH			0.0108
LINDANO			0.0126
ALDRIN			0.0189
OXICLORDANO			0.0274
HEPTACLOROEP			0.0270
PP'DDE			0.0392
DIELDRIN			0.0471
PP'TDE			0.0783
PP'DDT			0.0909
Organic-phosphoric pesticides			
DICLORVOS	None detected		1.5255
DIAZINON			1.5642
RONNEL			2.2737
CLORPIRIFOS			1.8793
MALATHION			4.6890
ETHILPARATHION			2.0350
ETHION			3.2274
CARBOFENOTION			6.4746

4.3 Potentials and Constraints for Development

4.3.1 Potentials for Development

(1) Land

In the whole district, the farmers have an average of 23.7 Mz of agricultural land, which is equivalent to two times the average in Region II. The district is located at 70 to 100 m of the sea level, generally presenting a smooth gradient topography although in some places there are strong ones hindering the utilization of irrigation. There are also some areas not conductive for agriculture due to soil conditions. Even considering these improper areas, the average sized of farmland is 18 Mz per farmer. Therefore, it can be considered that there is enough land for development, as the places not suit for irrigation can still be utilized as pastures.

(2) Water Resources

In the surroundings of the district, there are no rivers which can be used as irrigation source, the reason why the groundwater is the main source for domestic and agricultural purposes. Another disadvantage is that this district is located at a high location in relation to the sea level, which causes the groundwater to be in a too low level. Even though, it is possible to perforate 8 wells in the entire district, which makes possible the irrigation of 430 Mz, i.e., 7.5 Mz by farmer. In this

district, although the price of water is high, there is potential to develop the agricultural activity.

(3) Other Potentials

Around the district, there are no places where job opportunities could be created, except the agricultural sector. Therefore, there will be a good supply of labor force for the development of intensive agriculture under irrigation in the neighboring districts besides the fact that it will be possible to extend efficiently the effects of development towards this district as well.

4.3.2 Constraints for Development

The main reasons for the low standards of living conditions of the farmers in this district are as follows:

(1) Insufficient Cultivated Area

The lack of funds to hire labor force and to use agricultural machinery or draft animals are the reasons for the impossibility to increase the cultivated area, despite the existence of large agricultural areas, causing a low agricultural production. The impossibility to properly prepare the cultivation leads the farmers to a situation in which they cannot ask for credit.

(2) Rainfalled Agriculture

Due to the lack of funds to establish the irrigation system, this district's agriculture depends on the rainfall regime, which is one of the reasons for the low agricultural production.

(3) Low Fertility

The farms located in strong gradient land are, always under erosion risk and the farmers do not know how efficient soil maintenance can be, and even if they are aware of the importance of such maintenance they do not have enough funds for such purpose. Therefore, no soil conservation measures are taken up. Furthermore, also in the cultivation of agricultural land, no proper methods are adopted to prevent soil erosion due to unfamiliarity with these methods.

This situation is causing the low soil productivity, which causes the low agricultural production. In the P/S conducted this time, the corn yield which is a predominant crop cultivated every year, the yield is less than half of Telica, due amongst other things to the low fertility of the soil.

(4) Improved Seeds

Due to lack of knowledge about improved seeds, they are not being produced in the district or in its surroundings, which results in a low agricultural production once good quality seeds are not utilized for sowing.

(5) Damages due to Plagues

There are many plagues in this district. However, the farmers cannot take proper measures to combat them due to lack of funds to purchase insecticides, this fact also cause the low agricultural production.

(6) Low Quality of Agricultural Products

The quality control of agricultural products is improper due to the lack of proper storehouses. Their quality is also low because of the lack of proper cultivation technology by the farmers once they do not receive agricultural technology extension services. As a consequence, the prices of these products are too low, reducing the income of the farmers.

(7) Lack of Market Information

Due to lack of access to the market information, the farmers do not know the real prices of the

agricultural products, thus they offer their products at a low price.

(8) Selling through Middlemen

The farmers have to ask for credit for the middlemen and also depend on them to sell their products once they do not have means to send their products collectively, since there are no farmers associations available. These are also factors for the low price of their products.

(9) Bad market accessibility

The markets are far and the roads are not good, also that the public transportation means are not even developed. All this is translated as a disadvantage for the accessibility to the markets.

(10) Property title for land

Some farmers are not under conditions of receiving more credit because their properties have already been given as mortgage to the middlemen or banks. To carry out the project of construction of mini-irrigation systems, it is necessary to subscribe the lease contracts among the participating farmers, or to offer the lands to MAG-FOR for the construction of communal facilities such as pumping stations. If the lands have already been taken by mortgage, it will be impossible to carry out these procedures, and therefore the project cannot be executed.

(11) Rural organization

To promote the agricultural development in this area, it is indispensable to organize the farmers for example, to give operation and maintenance to the irrigation facilities. However, the farmers are not accustomed to work collectively to reach a common objective, and also, they already have a series of negative factors as those described above, so it will require a long time to form and maintain a rural organization in order to able to develop activities by their own initiative.

(12) Services of institutional support

The services of institutional support constitute an important factor to promote the agricultural development in this area, through the extension of administration techniques of the properties, agricultural credit, etc. However, at the moment it takes a long time 2.5 hours to arrive to this area by motorcycle from the regional office, which hinders providing meticulous support services.

4.4 Basic Guidelines for the Agricultural Development Model by Area

At present, the agriculture in this area is mainly based on the cultivation of maize and sorghum for self-consumption and sesame as cash crop. However, the productivity is low mainly due to the following reasons; unstable rainfall regime, land devastation due to uncontrolled deforestation, long distances to purchase consumption goods, lack of access to credit, etc.

In the P/S more resources were invested, economic as well as labor, of what is used to invest in Nicaragua in the implementation of the irrigation facilities, financing and technical assistance for the administration of properties, with the purpose of increasing the revenues of the farmers. However, it was not possible to change the curve of agricultural revenues upward during the approximate 18 months that the project lasted. The possibility that this situation will be improved in the following years even continuing the same investments is quite low. It can be concluded that the causes are not only that the phreatic level is excessively deep and that this impacts in the cost of operation of the irrigating facilities, but rather other existing problems exist whose solution require of more time. They are:

1. Low fertility of the agricultural lands,
2. The farmers' limitations to maintain a rural organization or to improve the

administration techniques of the properties,
3. Bad accessibility to the markets.

The problem No. 1 can be solved by means of integrated policies on erosion control through the planned reforestation, soil improvement, implementation of drainage channels, etc. Meanwhile, problems No. 2 and 3 should be solved as the living standard and the education of the Nicaraguan population improves.

Therefore, to promote the development of this area requires to solve these problems previously, the development priority of this area is reduced. In any case, due to the Plan for the Agricultural Development Model in El Espino forms an integrated part of Chapter 5: Plan for the Agricultural Development Model" the following guidelines are mentioned for the development of this area.

The objective of this development model is to fulfill the farmers' needs, and at the same time to increase the cultivation area, possible due to the large land ownership, and aiming at the elimination of restraining factors for the development. Furthermore, this zone is characterized by having several areas with strong gradient and different agricultural production conditions according to the land classification, therefore it is necessary to establish a development plan based on the proper use of the land. The following items are proposed to be the basic guidelines for the development:

(1) Improvement of the Productive Infrastructure at a Short Term and Establishment of the Guidance for its Management

The idea is to make possible the increase of a continuous production of each of the small farmers through the introduction of the minimum necessary irrigation facilities, drainage facilities and roads. It is necessary to strengthen the small-scale farmers' organization in order to attain an efficient management and O&M of the irrigation facilities, and that each farmer is sufficiently able to carry out this activity by himself.

1) Around 25Mz of irrigated fields shall be distributed to the farmers in a first stage.
According to the results of P/S, 2.5 Mz can be irrigated with the labor force available in each property. Since there are 57 properties, the total irrigation area is calculated at 142.5Mz (99.75 ha).

2) The land renting method shall be adopted in the first stage.
The irrigation facilities including the well shall be centralized in parcels of land, which offer the best advantages within the project influence area in order to save funds as well as to maximize the utilization of facilities. The beneficiary farmers shall share a limited number of parcels. Therefore, due to this restriction, the farmers shall rent those parcels, which offer the best irrigation conditions for the project.

3) As a result of the before mentioned method, the participant farmers will have a rented parcel being cultivated under irrigation and other own parcels being cultivated under rainy conditions only.
The water demand for the proposed irrigation area can be covered by three wells, even if up to eight wells can be installed in the area, it is calculated on the bases of the exploitable volume of underground water. These three wells will be distributed strategically taking into account thee classifications of agricultural land, road accessibility, boundaries of agricultural lands, etc.

(2) Improve the agricultural techniques of the properties under a plan of effective cultivation

To elaborate a cultivation plan able to increase the profitability through the combination of the basic grains for self-support with the cultivation on rented lands under irrigated agriculture. Meanwhile, the rainfed lands will be dedicated to the extensive production of the basic grains during the rainy season.

To group the small and medium-scale farmers so that they have better access to the services of technical extension from government institutions such as INTA, MAG-FOR, etc., as well as of the NGOs.

(3) Agricultural credit available for the small and medium -scale farmers

To form the rural organizations as receiving entities of credit, and to create a new credit system according to the Agricultural Development Model and that it is available for the small and medium-scale farmers.

(4) Start of the Environmental Conservation

The idea is to plant trees along the roads, around the parcels and houses in order to avoid the worsening of environmental conditions and to foster its recovery, and at the same time, to develop a sustainable agricultural production. Highly utilizable trees will be planted, such as those used for firewood and charcoal, high quality trees, fruit trees, etc. In order to implement this reforestation activity in a continuous way, it is necessary to create an adequate farmers' organization.

(5) Support in the learning of the methodology of administration of properties guided to the market to carry out the gathering and collective shipment in future

Initially, the current outline of selling the agricultural products to the middlemen or in the market in small lots for each property. However, in the long run it is intended to group the small and medium-scale farmers to implement the new gathering and collective shipment modality with the purpose of increasing the earnings. For this effect, it is necessary to explain in the rural meetings the outline of gathering and collective shipment that will allow to increase the added value of the goods.

(6) Creation and Management of the Farmers' Organization

A farmers' organization will be created to be the basis for the continuous development of several activities, based on the good interaction of its members.

4.5 Land Use Plan

The basic concept to formulate a land use plan in this Study Area is premised on how to improve farmer's life with conservation of natural environment. Therefore, selecting suitable farmland for crop production, and a necessary amount of crop harvest to meet the food demand is secured by producing a maximum yield using an intensive farming method.

Meanwhile, under the imperative necessity of preserving the unsuitable land and forest areas

from the viewpoint of natural environmental conservation, a land use plan was formulated based on the following direction (See the Annex).

1) El Espino area is abundant with gentle rise and fall, and rich in inclined landscape with a thin plowing layer, thus soil erosion problems have been generated. Therefore, finding out a countermeasure to soil erosion is very important from the viewpoint of conservation of the agro-environmental resources.

2) From the viewpoint of preserving the existing forest, it should be kept without cutting, and the land use ranked above IV class which is presently used as arable land should be diverted to forest or grassland use in order to protect soil erosion. Further, promoting reforestation under imperative necessity of supplying firewood, a silvo-pastoral land use should be applied. On the other hand, the 65 Mz of currently used as arable as well as grasslands above 15 degree inclination should be diverted to forest use by reforestation.

3) The current grassland of 520.8 Mz is basically kept in status quo and some of them ranked as I to II classes is diverted to arable land and the rest is as it is. Meanwhile, the present arable land above IV class should be shifted to grassland use in combination with sivo-pastral land use by planting trees as much as possible.

4) An expansion of residential area caused by population increase (2.6 % per year) is considered by securing 8 Mz more in 2015.

5) Shortage of fodder crop during the dry season can be solved by feeding livestock on rice straws as an alternative fodder crop.

Based on the above direction, the land use plan for the Study Area is formulated as below.

Present Land Use and Future Land Use Plan in El Espino

Land Use	Present (Mz)	%	Future (Mz)	%
Irrigable land	0.0	0.0	355.0	25.8
Rainfed land	647.9	47.1	153.0	11.1
Tree crop	11.3	0.8	11.3	0.8
Unused land	55.6	4.0	55.6	4.0
Grassland	520.8	37.9	562.5	40.9
Waste land	67.2	4.9	67.2	4.9
Forest	43.6	3.2	133.8	9.7
Residential area	19.9	1.4	27.9	2.0
Road/Canal	7.9	0.6	7.9	0.6
Total	1374.2	100.0	1374.2	100.0

Source: Estimated figure based on the aerial photo and ground truth by the JICA Study Team

4.6 Farm Management Plan

4.6.1 Basic Concept for formulating the Farm Management Plan

This Study Area is exposed to a series of limitations such as the long distance to the markets, low land productivity, uncertainty of the precipitation pattern that restricts the type of crops under rain-fed condition. All this is translated in a production environment that makes the farmers to carry out the production for self-support difficult. To leave this situation, the farm management plan is elaborated with the following guidelines:

(1) The target crop is examined based on a direction to seek for a market-oriented agriculture with crop-diversification by increasing value-added agro-products from current basic grain-oriented production system for self-sufficiency.

(2) Transition to crop-diversification process should be initiated from improvement of crop productivity for the prevailing crop under medium-long term range, and cash crop like vegetables should be gradually introduced by training the beneficiaries to get an eagerness and receptive capacity under OJT period.

(3) New farm management plan shall be examined in order to secure a stable agro-income, and be possible to work in owned- farm through the year without off-farm activity by introducing irrigation technology to change the rainfed oriented farming system

(4) The farmland out of irrigable area is mainly cultivated with profitable cash crop such as sesame which grow under the rainfed condition.

(5) In order to seek for a sustainable farming with an effective use of agro-environmental resources, a farming system which enable natural resources to renew is premised by introducing a reduced agro-chemical use, leguminous crop to build soil fertility, and protection methods of soil erosion.

4.6.2 Proposed Cropping System

The cropping system for the Study Area was formulated based on the basic concept stated in 4.6.1

(1) Target Crops

The major target crops selected for the Study Area were maize, sorghum, upland rice, mung bean (*Vigna radiata*) and watermelon. The reason for selection is as follows:

Maize:
Maize is one of the important staple food crops not only in the Study Area but also in Nicaragua; however self-support has not been accomplished within the Study Area yet, thus it is selected to secure self-support within the area.

Upland rice:
Upland rice is also an important principle food crop in Nicaragua; however, the beneficiary procures rice because of unable to grow under a harsh natural condition, thus it is introduced to secure self-support at first and the surplus is sold by adding value of the harvest via polishing process.

Sesame:
Sesame holds an important position as a cash crop, which can be only grown under harsh rain-fed condition, thus it is continuously cultivated in the rain-fed area.

Sorghum:
Sorghum plays an important role as a fodder crop for agriculture with livestock raising system in the Study Area, and also used as a supplemental crop in case of emergency, thus it should be in status quo.

Mung bean:
Mung bean is a heat tolerant crop which can be easily grown in El Espino's hot dry weather condition, and also utilized as an alternative for frijol bean, while plant residue can be used as an alternative source of fodder crop during the dry season, thus it is introduced.

Vegetables:
As a vegetable crop, water melon which is one of long-duration crop with high demand is introduced. Technically, most of the beneficiaries have experience to cultivate them in their kitchen garden in a small scale, and are high demand within the Study Area with high concerned about the said crops for the beneficiary.

(2) Proposed Cropping System

The proposed cropping system has been designed via linear programming method to maximize a profit, based on maximum use of available family labor resources, available land resources and water resources under the consideration of natural and socio-economic conditions in the Study Area. Formulating the plan, co-efficient of profit on the target crops, technical co-efficient of labor, and constraints of land use and cropping with its amount are set as shown below.

1) Profit Coefficient

Concerning the profitability of each target crop, production cost and profit are fixed as below, based on the cost estimated document issued by the National Bank as a standard for financing business, the information of official and NGO's farmer's supporting organizations, agro-input suppliers, local market and the result of farmer's interview survey in El Espino Study Area.

Profit Co-efficient of the Target Crop in El Espino — Unit: C$/Mz

Cost Item	Supplemental Irrigation			Irrigation			Rainfed Farming		
	Upland rice	Maize	Sesame	Maize	Watermelon	Mung bean	Sesame	Sorghum	Maize
Custom hired charge	380.0	430.0	540.0	380.0	520.0	480.0	210.0	260.0	200.0
Labor charge	975.0	700.0	300.0	700.0	1895.0	710.0	112.0	77.4	90.8
Transportation	165.0	25.0	25.0	25.0	50.0	15.0	5.0	5.0	5.0
Seed & fertilizer	1174.0	564.0	536.0	564.0	1194.0	312.0	222.0	50.0	70.0
Agro-chemicals	1352.5	990.0	248.3	990.0	1475.0	619.4	70.0	0.0	0.0
Harvesting & others	979.3	647.0	637.0	647.0	506.0	277.0	165.0	178.5	79.5
Irrigation cost	884.7	504.9	330.0	1009.0	986.3	300.0	0.0	0.0	0.0
Depreciation	5.4	5.4	5.4	5.4	4.4	5.4	0.0	0.0	0.0
Total cost(C$)	5915.9	3866.3	2621.7	4320.4	6630.7	2718.8	990.0	570.9	470.8
Yield(/Mz)	60.0	60.0	12.0	60.0	150.0	20.0	6.5	9.0	8.0
Farm gate price	240.0	90.0	320.0	90.0	60.0	250.0	320.0	85.0	90.0
Gross income(C$)	9000.0	5400.0	3840.0	5400.0	9000.0	5000.0	2080.0	765.0	720.0
Net income(C$)	3084.1	1533.8	1218.3	1079.6	2369.3	2281.2	1090.0	194.1	249.3
B/C ratio(%)	52.1	39.7	46.5	25.0	35.7	83.9	110.1	34.0	52.9

Souce: JICA Study Team Remark: Gross income of rice is based on a price of the polished rice.
Remark:Production unit= QQ/Mz=rice、mung bean、sesame、soybean、maize、 dozen:pipian、watermelon

2) Labor and Land Resource Constraints

Based on the field survey result, the pre-fixed condition to formulate the farm management plans of the F/S area for stage-I and of an averaged farm household in the Study Are is set as follows.

① Pre-fixed condition of Study Area

Prefixed Condition to formulate farm management plan in El Espino Area

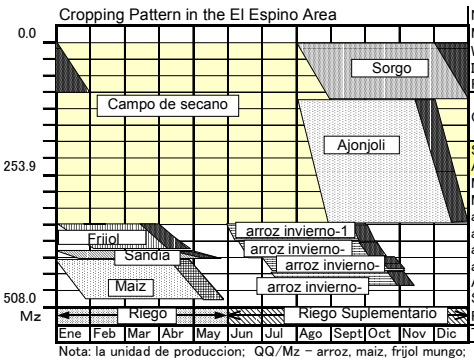
Farmer's Class	No of FH	Available labor/FH	Pooled Working Hours/FH/M	Arable land Area(Mz)	Irrigable area (Mz)	Rainfed Area (Mz)	Monthly Total Working Hours/area	Maize for self-support	Sorghum for self-support (Status in quo)	Employed Casual worker	Remark
Averaged Farm Household	57	3.4	571.2	507.7	142.5	365.2	32558.4	14	109	Family Labor	Leveling of harvesting period Crop diversification Imporoving Land/Labor productivity Introduction of leguminous crop to buid soil fertility

Prefixed condition of the model farm household to formulate farm management plan in El Espino Area

Farmer's Class	No of FH	Available labor/FH	Pooled Working Hours/FH/M	Arable land Area/FH (Mz)	Irrigable area/FH (Mz)	Rainfed Area/FH (Mz)	Maize for self-support	Sorghum for self-support (Status in quo)	Employed Casual worker	Remark
Averaged Farm Household	57	3.4	571.2	8.9	2.5	6.4	0.25	1.9	Family Labor	Leveling of harvesting period Crop diversification Imporoving Land/Labor productivity Introduction of leguminous crop to buid soil fertility

Source: JICA Study Team

Planting area for self-support of maize and sorghum was fixed in accordance with per capita consumption of cereals in a year presented by INTA, and a current planting area of sorghum for livestock feed (See the Annex). As for the target vegetable crop, water melon was selected because of its easiness to sell within the Study Area which is located far from large consuming area such as Leon and Managua. Under the pre-fixed condition, the cropping pattern for the F/S area is shown as follows:



Net Ingreso = 834924.0
Mean ingreso/FH = 14647.8 C$/FH/Year
Whole area CI = 128.0 %
Irrigable area CI = 200.0 %
Rainfed area CI = 100.0 %
No of Beneficiaries = 57 CI(%)= 128.0

Cultivo	Mz	%	Rend. QQ/Mz	Produccion Total	Precio Product (C$)	Total Ingreso (C$)	costo de produccion (C$)	Sub total costo (C$)	Net de Ingreso (C$)
Sorgo secano	109.0	16.8	9.0	981.0			570.9	62228.1	-62228.1
Ajonjoli secano	256.2	39.4	6.5	1665.3	320.0	532896.0	990.0	253638.0	279258.0
Maiz con riego	77.5	11.9	60.0	4650.0	90.0	418500.0	4320.0	334800.0	83700.0
Maiz por AC	17.0	2.6	60.0	1020.0			3866.3	65727.1	-65727.1
arroz invierno-1	30.0	4.6	40.0	1200.0	240.0	288000.0	5910.5	177315.0	110685.0
arroz invierno-2	30.0	4.6	40.0	1200.0	240.0	288000.0	5910.5	177315.0	110685.0
arroz invierno-3	30.0	4.6	40.0	1200.0	240.0	288000.0	5910.5	177315.0	110685.0
arroz invierno-4	30.0	4.6	40.0	1200.0	240.0	288000.0	5910.5	177315.0	110685.0
Ajonjoli	5.5	0.8	12.0	66.0	320.0	21120.0	2621.7	14419.4	6700.7
Sandia	25.0	3.8	150.0	3750.0	60.0	225000.0	6630.7	165767.5	59232.5
Frijole mongo	40.0	6.2	20.0	800.0	250.0	200000.0	2718.8	108752.0	91248.0
Total	650.2	100.0				2549516.0		1714592.1	834924.0

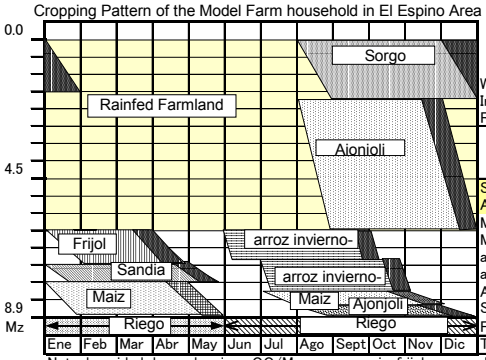
Nota: la unidad de produccion; QQ/Mz = arroz, maiz, frijol mungo; Doc/Mz = sandia; rendimient de arroz = arroz oro

It is intended to develop an intensive agriculture with irrigation in flat agricultural land of high productivity, under the lease modality, allotting 2.5Mz to each farm household. The proposed cropping plan of the 142.5 Mz and the rest of the rain-fed farmland required for the plan is shown in the figure.

The shaded parts in the figure correspond to the rainfed farmland. Mung bean should be cultivated every three years by rotation in the irrigation fields. Meanwhile, the rainfed arable lands will be devoted to sorghum production for keeping status quo because of its important as a livestock feed, and also to sesame production as a cash crop.
In this cropping pattern, the CI results in 200 % in the irrigable area, 100 % for the rain-fed arable land, and 128 % for the whole area, and generates around C$ 835,000 of net profit.

② Cropping Pattern for the model farm household

The following figure shows the cropping plan of the model farm household, representative in the F/S area of El Espino. This plan was elaborated based on the arable land per farm household, and available family labor force under the pre-fixed condition. The target crop for cultivation should be selected from the general cropping pattern for the Study Area, according to farming scale, capacity and experience of each beneficiary. The crop intensity and profit vary with conditions selected by each beneficiary.



Whole area CI = 128.1 %
Irrigable area CI = 200.0 %
Rainfed area CI = 100.0 %
Ingreso/FH: 14828.9 C$
CI(%)= 128.1

Cultivo	Mz	%	Rend. QQ/Mz	Produccion Total	Precio Product (C$)	Total Ingreso (C$)	costo de produccion (C$)	Sub total costo (C$)	Net de Ingreso (C$)
Sorgo secano	1.9	16.7	9.0	17.1			570.9	1084.7	-1085
Ajonjoli secano	4.5	39.5	6.5	29.3	320.0	9360.0	990.0	4455.0	4905
Maiz con riego	1.0	8.8	60.0	60.0	90.0	5400.0	4320.0	4320.0	1080
Maiz por AC	0.3	2.6	60.0	18.0			3866.3	1159.9	-1160
arroz invierno-1	1.0	8.8	40.0	40.0	240.0	9600.0	5910.5	5910.5	3689.5
arroz invierno-2	1.0	8.8	40.0	40.0	240.0	9600.0	5910.5	5910.5	3689.5
Ajonjoli	0.2	1.8	12.0	2.4	320.0	768.0	2621.7	524.3	243.7
Sandia	0.5	4.4	150.0	75.0	60.0	4500.0	6630.7	3315.4	1184.7
Frijol mongo	1.0	8.8	20.0	20.0	250.0	5000.0	2718.8	2718.8	2281.2
Total	11.4	100.0				44228.0		29399.1	14828.9

Nota: la unidad de produccion; QQ/Mz = arroz, maiz, frijol mungo; Doc/Mz = sandia; Rendimient por arroz = arroz oro

The averaged farm household in the Study Area has an arable area of 8.9Mz more than that in Telica, but it is located far from large consuming area and is put under the condition of harsh natural and socio-economic environment with unreliable rainfall pattern. Around 30 % of the arable land is irrigable which is mainly cultivated with double cropping of maize, upland rice, sesame, water melon and mung bean, while in the rain-fed area, sorghum and sesame are cultivated. Irrigation will be made 100% during the dry season, while in the rainy season supplementary irrigation will be provided. This plan could be managed within the family labor force through the year. The annual CI will be 128.1% for the whole area and of 200% in irrigable area, and generates about C $14800 of agricultural net profit.

(3) Proposed Farming Practice

Improving productivity is intended by constructing irrigation infrastructure to develop a potential of agriculture production in this Study Area which is exposed to harsh natural condition.

Thus, it is absolutely necessary to bring in the improved seeds, improved farming practice, communal maintenance and management system for the irrigation facility associated with the proposed cropping pattern. Also, training of farmer's organization for a systematic procurement of agro-inputs and harvesting-shipping of the produce corresponded to a market-oriented agriculture are required.

In order to improve the level of farming practice in the Study Area, the proposed farming practice has been formulated by incorporating advanced practices on a prevailing farming practice in the Study Area under the direction mentioned below.

a. As mentioned in the chapter of present conditions, the farm land includes gentle slope with shallow plowing layer which has been formed with hardpan layer, thus breaking hardpan layer on every three year is required at the onset of the rainy season, with a measure of incorporating crop residue generated in the field to improve physiochemical aspect of the soils.

b. As surface soil erosion will take place in the rainy season, agronomic countermeasures such as making furrow along to contour line, making levee, and planting promising grass species should be practiced to protect surface soil from erosion.

c. Current custom hired system for plowing and harrowing operations is continuously strengthened and possible operations such as inter-tiling is managed via custom hired system by tractor or animal traction power.

d. Sprinkler and furrow irrigation methods are applied 100 % during the dry season and are

supplemented during the rainy season.

e. Animal traction power as well as mechanized power is applied to manage various farm operations such as ridging, ditching, sowing, weeding, fertilizer application, chemical spray, harvesting, drying the harvest, and transportation as much as possible. If not, it is manually managed.

f. Necessary labor force for the proposed farming practice in the irrigable 142. 5 Mz of the first phase F/S area is mainly managed by the family labor force. Meanwhile, the rain-fed farm land is managed basically by the family labor force with prevailing farming practice.

g. The paddy rice is sold with value addition by processing into white rice, and of which polish process is practiced in the rice-mills within the surrounding area.

Further details in the farming practice of each crop should be refereed to the Annex.

(4) Labor Force

Examining the feasibility of the formulated cropping pattern, a difference between the required labor force and available family labor force was examined (See below table).

Difference of Labor Requirement on the Proposed Model Farmer's Farming Plan

	Monthly Labor Requirment												Total
	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	／Y／FH
Available Family Labor Cap/Month ①	571.2	571.2	571.2	571.2	571.2	571.2	571.2	571.2	571.2	571.2	571.2	571.2	6854.4
Family Labor Operational Hours/M②	119.0	119.0	243.0	466.8	505.8	306.9	487.9	161.7	336.0	319.5	256.5	234.0	3556.1
Difference ①－②	452.2	452.2	328.2	104.4	65.4	264.3	83.3	409.5	235.2	251.7	314.7	337.2	3298.3

Source:JICA Study Team Unit:(Hours/Month/FH)

The required labor force in the plan of the model farm household is 3556.1 hrs/FH/year (508 man-days). Since available family labor force is 6854.4 hours per year (979 man-days/FH), the propose model plan can be managed throughout the year within the family labor force, as can be seen in the above table.

(5) Yield Projection and Crop Production Plan

By implementing the first phase of F/S plan, the farming practice of the beneficiary will be improved with strengthening of farmers supporting system as well as introducing irrigated farming, thus a yield increase is expected. Projected yield per each crop is estimated as follows.

Crop	Present (QQ/Mz)	Without Project (QQ/Mz)	With Project (QQ/Mz)
Maize	8.0	8.0	60.0
Sorghum**	9.0	9.0	9.0
Sesame**	6.5	6.5	6.5
Sesame (intensive)	-	-	12.0
Upland Rice	-	-	60.0
Mung bean	-	-	20.0
Water melon*	-	-	150.0

Remark: Unit; No mark = QQ/Mz, * = Dozen, ** = yield under rainfed farming (QQ/Mz)
Upland rice is based on paddy rice basis

The crop yield will be reached to the target yield level 5 years after commencement of the project. In case of without project, a yield level is projected as it is because of harsh natural condition. Annual crop production in the irrigated area after starting the project, it is estimated as follows under the yield projection aforementioned.

Crop Production Plan in El Espino Area

Crops	Phase I of F/S			
	Yield (QQ/Mz)	Cultivation Area (Mz)	Cultivation Rate (%)	Production (QQ)
Maize	60	94.5	4.2	5670
Upland rice**	60	120.0	20.6	7200
Mung Bean	20	40.0	6.6	800
Watermelon *	150	25.0	2.2	3750
Sorghum (rain-fed)	9	109.0	16.8	981
Sesame (rain-fed)	6.5	231.6	39.4	1505.4
		620.1	100.0	

Note: Units without symbol: QQ/Mz, *: dozen, **: paddy rice

4.6.3 Requirements for the Extension Service in Cultivation

This Study Area is less advantageous area compared to Telica area because it is located far from the major markets with unreliable rainfall pattern and landscape of many gentle slope. In order to reactivate this disadvantageous area, a project effect gradually emerges when strong institutional support and independent attitude of the beneficiary are combined. As for the requirements needed for the service of institutional support, refer to the chapter corresponding to Telica.

4.7 Irrigation Facilities Implementation Plan

4.7.1 Plan for Irrigation Source

(1) Water Source

The ground water is adopted as the source for the irrigation water, because there is a lack of surface water that can be used for irrigation, in and around this Area. The ground water is pumped up from deep wells that are drilled and the possible quantity to install depends on the influence area of each well. The boring and pumping tests were carried out in this Study to obtain the data on the influence area and optimum capacity of the deep wells. As a result, the radius of the influence area of the well is estimated to be 500m. Therefore, each well must be installed at least 500 m apart. Moreover, the farmhouses in the Area have shallow wells (the average depth of about 10 m) for drinking water. So, the excavating position of new deep wells must be considered so they do not have any influence on these wells.

(2) Optimum Capacity of Deep Wells

As the results of the pumping tests on the existing well and the newly drilled well, their optimum capacity is estimated as follows

Optimum capacity of the existing well No.2: $2.52m^3$/min (42 l/s)
Optimum capacity of newly drilled well: $3.18m^3$/min (53 l/s)

(3) Layout of New Wells

The layout of the new wells is decided by the following conditions.

1) Each well shall not interfere with each other, the interval of each well is secured by 500 m at least.
2) Each well shall not influence the shallow wells for drinking water at each farmhouse, the new wells are separated 500 m minimum from these wells.
3) The new well will be installed in the zone where there is much farmland suited for cultivation according to the land classification.
4) Taking into account the installation of the new irrigation wells outside of the Area in the future, the position of the new well in this Area will be selected.
5) The well positions that can irrigate farmland of one colony will be selected as far as possible from another one for a smooth operation and management.

Applying the above criteria, it is defined that eight (8) wells can be perforated in their region, including the two existing wells.

4.7.2 Irrigable Area

The volume of water source and the water requirement of the crops decide the irrigable area. In this Area, eight wells can be installed as mentioned above. The irrigable area in this Area is determined, from the optimum capacity of one well and the water requirement for irrigation (the system volume).

The location of the farmlands that will be irrigated by one well is selected taking into consideration the optimum capacity of the well, the landform, the land use plan and so on. In this Study, the irrigable areas of each well are selected by the following conditions:

1. The irrigable area will be widely chosen as far as possible to improve a cost performance, within the range of the optimum capacity of the well.
2. The high rank farmland in the land classification is primarily chosen.
3. The farmlands are chosen for pipeline length to be minimized for a smooth operation and maintenance and to reduce the cost of the facilities.
4. The labor force and the possible acreage under cultivation of the farmhouse are taken into consideration.
5. The farmlands are chosen so the irrigable area of each farmer is equal.
6. Farmland that is as much concentrated as possible is chosen for the smooth irrigation work.

It is very difficult to select the irrigation farmland to meet all of the above-mentioned conditions. The irrigation farmland of each well was selected studying the topographical maps, the landholding maps and the land classification maps, and the result is shown in the following table. The locations of the irrigation farmland are shown in the table.

Table 4.7.1 Irrigation Areas according to each Well (Pumping Plan)

Well	Type	Irrigable Area (ha)	
		Stage I	Stage 2
E-1	Existing	24.5	27.0
E-2	Newly installed		27.0
E-3	Newly installed		27.0
E-4	Newly installed		27.0
E-5	Existing	36.75	37.8
E-6	Newly installed		27.0
L-1	Newly installed	38.5	37.8
L-2	Newly installed		37.8
Total		99.75	248.40

4.7.3 Basic Concept for the Irrigation Plan

(1) Irrigation Method

It is possible to apply both the furrow irrigation and sprinkler irrigation systems as the irrigation method because the soil is clay-loam soil for most part in this Area. But the furrow irrigation is profitable from the construction costs aspect. However, because the farm field slopes gradually (average gradient of 3-12%), the suitable area for furrow irrigation is limited. On the other hand, the combination of two irrigation methods in the farmland supplied from one well becomes a problem, from the management aspect of irrigation work and the aspect of farmer's feelings. The spray irrigation using sprinklers is adopted from these conditions (Annex H) as the irrigation method of this Area. The medium pressure type sprinkler (operation pressure of about 3.5kg/cm^2) which suits the above crops is adopted, and the portable type sprinkler-set is introduced.

(2) Water Requirement

1) Evapo-transpiration (Eto)

The evapo-transpiration is calculated with the Penman Formula by the use of the data of the León and Malpaisillo weather observatory. The estimated evapo-transpiration (ETo) of the crop is as follows (Annex H shows the calculation process).

Table 4.7.2 Evapotranspiration of crops (ETo) Unit: mm/day

	ENE.	FEB.	MAR	ABR.	MAY	JUN.	JUL.	AGO	SEP.	OCT.	NOV	DEC.
ETo	5.65	7.08	7.35	6.76	5.47	4.85	5.33	5.15	4.46	4.35	4.36	4.82

(3) Unit Water Requirement

The monthly water requirement for irrigation is estimated in the following conditions.

ETo:	The value was estimated as above.
Precipitation:	The precipitation probability is 5 years and was obtained by processing the rainfall data from the León and Malpaisillo weather observatory.
Crops:	The crops to be irrigated are vegetables, sesame, maize, sorghum and upland rice.
Cropping Pattern:	The proposed cropping pattern is shown in 2.3.1.
Irrigation Efficiency:	Conveyance Efficiency: 90% (Pipeline)
Application Efficiency:	85% (Sprinkler irrigation, high temperature region)
Irrigation Efficiency:	76.5%

The estimated monthly water requirement using the above-mentioned conditions is as follows (Annex H).

Table 4.7.3 Estimated monthly unit water requirement Unit:m^3/sec /ha

	JAN.	FEB.	MAR	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
Requirement	0.41	0.82	0.76	0.88	0.04	0.05	0.25	0.23	0.00	0.00	0.18	0.19

4.7.4 Basic Concept of the Irrigation Facilities Strengthening

According to the Master Plan for Development, agricultural land will be grouped and an area of 2.5Mz (1.75 ha) will be under irrigation in each property. As mentioned in item (1): the irrigation plan of this region shall be based on the sprinkler irrigation system.

4.7.5 Irrigation Facilities Plan

(1) Adequate Sprinkler System in the Terminal fields

The irrigation area per farmer shall be of 2.5 Mz that is very small compared with the agriculture lands of each farmer. However, the cost and operation condition shall be changed according to the distribution of sprinklers (especially the pipelines). Therefore, the selection of suitable sprinkler equipment for the terminal fields shall be promoted.

① Basic Items of the Sprinkler Irrigation System

- Equipment Data
  Movable sprinkler shall be utilized within this plan considering the advantage for repairing and maintenance and also taking into account that this equipment is well known in Nicaragua.
  Basic data of these sprinklers are shown as follows:

Table 4.7.4 Sprinkler Data

Item	Material	Specification	Remark
Sprinkler head	Cast iron	#30 Leinhard product	
Transmission	Aluminum	Diameter: 75mm	Availability of tubes
pipe		Length: 6.0m	100 bars (83.8m)

- Intensity of Irrigation
  Intensity of irrigation varies according to the slope and quality of soil in the agriculture parcel where the irrigation system is to be developed. The allowable irrigation intensity is shown in the following table. In this system the slopes of the agriculture lands are limited to 5% considering the operation specification of this system. Besides, the soil of the region is classified as the clayey type and the allowable irrigation intensity is set at 10 mm, considering the safety factor.

Table 4.7.5 Allowable Irrigation Intensity unit: mm/hour

Topographic Slope (%)	Sandy	Franc	Clayey
1 – 5	18.00	12.00	5.00
6 – 8	16.20	10.44	4.05
9 – 12	15.48	9.60	3.50
30 – 20	14.76	9.96	3.10
More than 20	13.50	7.20	2.35

- Duration of Sprinkler operation
  Generally, the operation time during the high irrigation period in cultivated lands is between 18 to 20 hours considering the operation conditions. The operation time and the equipment time are in inverse relation, and then sprinkling duration shall be 20 hours per day, taking into account the equipment cost. Considering the operation and equipment cost, the parcels shall be formed in a block of 5 Mz (3.5 ha) for every 2 benefited farmers. Transportation time is not considered because 2 sprinkler sets are provided for each block.

- Irrigation Interval
  The irrigation shall be executed by shifts according to the established order. The shift interval (day's interval) is decided taking into account the water retention capacity of the soil. As mentioned in the above paragraph, soil of this region is clayey, therefore water retention of the soil is considered high and sprinkler problem is not expected. Then, interval of days taking into account the irrigation intensity, duration of sprinkler use and operation per day is set at 5 days. During the low requirement period the water use shall be reduced, in this case quantity of sprinkler shall be reduced according to duration, however the interval shall be fixed independently of the season.

② Arrangement of Sprinklers

Sprinklers are arranged according to the length of the tubes. There are three combinations of distance between sprinklers 12m x 12m, 12m x 18 m and 18m x 18m.
Besides, the movable pipes are straight and they are changed according to the topography of the parcel. Then, considering these reasons, the cost of the sprinkler installation varies according to the blocks.

Comparing the agricultural lands owned by the farmers with the irrigation area within the plan, these are considered small. Pipes shall be straight and combined in order to reach the irrigated area. According to this background, arrangement of sprinkles shall be decided through the economical evaluation and the combination of agricultural lands and arrangement of sprinklers. The result of this analysis is shown as follows (see annex H for the table with the results from the analysis).

According to the P/S, there are wells in this area to cover the demand for the 14 properties. Therefore, in this plan, the required deep wells for the remaining 43 properties which is equal to two wells with a capacity of 53 l/sec shall be introduced, there is 1 existing well to be rehabilitated and 1 new.

Table 4.7.6 Data for the Facilities Plan

Well capacity	42 lt/sec.	53 lt/sec.	Remarks
Field size	196 m x 180 m 5Mz (3.5 ha)	196 m x 180 m 5Mz (3.5 ha)	
Irrigated area per day	1.0 blocks (0.7 ha)	1.0 blocks (0.7 ha)	
Interval of days	5 days	5 days	
Gross irrigation requirement	36.75 mm	36.75 mm	
Application Efficiency	85%	85%	
Total demand of irrigation water	43.24 mm	43.24 mm	
Transportation frequency	4 times /day	4 times/day	
Duration of irrigation	20 hours	20 hours	High season
Arrangement of sprinkler	12 m x 18 m	12 m x 18 m	
Discharge/unit	31.67 l/m	31.67 l/m	

Well capacity	42 lt/sec.	53 lt/sec.	Remarks
Sprinkler diameter	31.2 m	31.2 m	
Discharge pressure	3.0kg/ cm^2	3.0kg/ cm^2	
Pipe length	96.0 m (16 pipes)	96.0 m (16 pipes)	
No. of sprinklers /Set	8 sprinklers	8 sprinklers	
Irrigation intensity	8.8 mm	8.8 mm	
Volume of the system	253.36 l/m	253.36 l/m	
No. of blocks	8	11	
No. of farmers	16	22	

(2) Water Supply Facility

The area has a soft undulated topography with an altitude difference of 2 to 10 m, that impedes the use of opened canals (depending on the location of the well). This condition forces to adopt an underground piping system, for conveying the irrigation water.

The water supply system is based in the rented form, so the areas with suitable conditions for agricultural activities and a tree system shall be selected. The location of each block shall make possible the exchange of information among farmers while they are working in their fields. The length of the tubes shall not be too long from the viewpoint of the costs.

① Specification of the conveyance structures

- Depth of underground pipes
  The pipes shall be of hard polyvinyl chloral (PVC) considering that the pressure to be applied is low (less than 10 kg/ cm^2). Pipelines shall have to be laid at a minimum of 1.0m underground depth in the case they are under roads and under agricultural parcels considering the transport of tractors and trucks. A sand base shall be applied on the installation of the pipes so they are not damaged by gravel.

- Pipes accessories
  The following devices shall be installed as pipes accessories:

Tube peg:	For connecting the sprinkler line and shall be installed in the benefited farmers areas with a distance of 72 m, the diameter shall be 75 mm, the same value of the transporter tube.
Water control valve:	They shall be installed in the principal derivation points of the tubes for emergency cases. The diameter of the valve shall depend on the tubes meeting in the connection points.
Air Valve:	They shall be placed in the convex part in order to protect the interior of tubes, eliminating the accumulated air. However, due to the small size of this conduction, simple air valve of 25mm diameter at the discharge mouth will be used.
Drainage Equipment:	They shall be placed in the lowest part of the conduction line for drainage of pipe water. A control valve of 50 mm shall be utilized.
Control Equipment:	A flow meter (instant and accumulative) shall be installed as control equipment and a pressure control valve in the discharge tube of the pump).

(3) Water Source Facilities

1) Data of wells

The necessary quantity of water source to be installed shall be three (one is already established). The structural data such as screen length and pumping volume shall change according to the topographic conditions. Due to this, continuous and instant pumping tests were executed in both wells, the new one and the existing well. The availability of water as the result of this analysis is described as follows:

Table 4.7.7 Data of Wells

No of wells	District	Intake Volume (l/sec.)	Height of the well installation	Diameter of the well	Depth of the well	Condition
E-1	El Espino	42	78.606	300mm	97.5	Existing
E-5	El Espino	53	74.282	300mm	103.6	Existing
L-1*	Las Lomas	53	77.400	300mm	100.0	New

Remarks: Wells data with * sign are value estimated in the pumping test
The unit of the height for installation of wells is E.L.
Regarding location of wells please refer to figure 4.7.1.

2) Pumping Volume

Sprinkler irrigation system shall be applied in this region and the data of each irrigation source is described in the following table.

Table 4.7.8 Data for the Water Source Facilities

No. of Wells	Required Volume (l/min.)	Irrigation Area (ha)	No. of Blocks	No. of Farmers
E-1		24.50	14	14
E-5	*3,167	36.75	10.5	21
L-1	*3,167	38.5	11	22
Total		99.75	35.5	57

Remark: The pumping volume with the symbol * is for stage1 and 2

3) Pumps

a) Type of pumps

Water motor-pump and turbo-pump of two stages with vertical axes are suitable for deep wells. The first is used with an electrical source and the second with electricity and motor. The second alternative shall be used for this region considering they are widely used in Nicaragua.

b) Total elevation of the pump

The total elevation of the pump shall be the addition of the total level of the water, the sprinkler pressure, the difference of the see level and the discharge lost by friction inside the pipe. The total elevation is composed by the real elevation (50%), the necessary discharge in the terminal fields (30%) and the discharge lost in tubes and pumps (20%), and although the establishment of the total discharge is difficult, the total elevation of the pump shall be set for the first stage between 100 and 130m.

c) Motor

Pumps of this program shall be propelled by diesel. Bisel gear (bevel) shall be used instead of a belt in order to reduce loses of transmission power in the connection between the engine and the pump.

d) Specification of the pump

According to the above mentioned considerations the following specification has been set.

Table 4.7.9 List of Pump Specification

Pump	Type of Pump	Diameter mm	Discharge m^3/min.	Total elevation m	Power Hp
E-1	Turbo-pump of multiple stage with vertical axes	20	1,970	100	100
E-5	Ditto	20	3,096.6	122.5	130
L-1	Ditto	20	3,096.6	92.36	95

4) Pumping Plant Shelter

A shelter of 3m x 3m with a height of 2.5m shall be constructed in order to protect the pump (main body is in the water), motor and accessories. The structure will have walls made of fine blocks and the roof will be of slate.

5) Pump Control Method

The method that supplies directly the pressured water from the pump to the sprinklers located in the field shall be used in this area. Automatic stopping and starting of pumps are convenient according to the quantity of water to be used. However, in this case, it is necessary to have a pressure tank, an elevated deposit tank and other equipment, but is expensive. Beside, the automatic pump requires an advanced technique for operation and maintenance. Considering the above, it will be difficult to adopt them in this region.

Therefore, the manual control pump shall be adopted, at the beginning of the irrigation the operator shall start the motor and the water will start going up and when the irrigation is finished the motor is stopped daily. In this way the programmed water supply shall be developed but shall present some inconvenience in the moment of changing the water use quantity and because of moving the sprinkler on the field or by the topography. For this, a fixed method to regulate the discharge should be prepared. In this region the following methods will be adopted.

- The manometer shall be installed in the discharge tube as well as the flow meter and the pressure regulator.
- The irrigation association shall elaborate a weekly irrigation program, adjusting to the crops being cultivated and based on this, the duration of the period of operation for the pump will be decided. The irrigation program shall be executed by the control operator and not only the weekly programs will be described but also the schedule for the next week and the estimated irrigation hours. This program shall be submitted to the operator and beneficiary farmers.
- Based on the program, the operator of the pump will manage the pump and the farmers receiving the irrigation will in turn take care of the irrigation.
- The pump operator shall always confirm the performance of the irrigation during the moving of the sprinklers. The operator shall make a round visit to all parcels in case some problems on the flow and pressure arise and shall warn the farmers who do not follow the program.
- During the low flow use the pressure shall be balanced by controlling the quantity of revolutions.
- The pressure regulator valve avoids high pressure in the pipes but in case of a long use the pump and motor may be damaged.

By adopting above measures, the farmers will not be overloaded with the irrigation works, and the pump operator will be working during the whole operation of the system.

(4) Summary of Facilities

Summary of the general data for the facilities are shown in the following table:

Table 4.7.10 General Data for Facilities

Facility	Detail	Description	Remark
Installation of water source	Nº of water source:	3 wells (one existing)	
	No. of pumps:	turbo pump of multiple stages and vertical axe	
	Shed:	3.0 x 3.0 x 2.5 (height)	
	Type of structure:	Covered roof	
Installation of water supply	Length of pipes:	5.8 km (for 2 places) PVC	
	Type of tubes:	200 – 75mm	
	Diameter of tubes:	Water control Valve: 33	
	Accessories	Air Valve: 12	
		Discharge Valve: 12	
		Water feeding: 33	
Terminal Installations	Block Area:	5 blocks (per 2 farmers)	P. 53 l/sec.
	Data of the Block:	-196.0m x 180.0 m	P. 42 l/sec.
	Interval of feeder:	12.0m x 18.0m	P. 53 l/sec.
	Length of transporter tubes:	96.0m	
	No. of sprinklers:	8 sprinklers	

4.7.6 Operation and Maintenance Plan of the Irrigation Facilities

(1) Operation and Maintenance of irrigation water

The Water Control Section of the Association to be established by the Farmers Association Strengthening Plan shall carry out operation and maintenance of the irrigation facilities. Regarding the administration method please see item 4.9.2. (3); Operation and Maintenance of Irrigation Water.

Regarding the schedule of the association please refer item 4.9.3. Structure of the Association

(2) Components of the water control

1) Pumps and wells

The maintenance and operation method of each pumping plant shall be as follows:

- The Water Control Section of the association shall elaborate a monthly program for the operation of pumps based on the cultivation plan presented by each farmer, then the monthly program shall be submitted to the pump operator and interested farmers.
- According to the Program, farmers shall perform irrigation according to the program of the pump operator and also according to the assigned shift.
- The pump operator shall supervise one by one the irrigated area, and in case some of the farmers do not fulfill the established program, he shall first be warned. The flow control (regulation and pressure) shall be developed when the use of water is low.
- Pumps and motors shall be daily checked before operation of the system and a maintenance once a year to be carried out by a specialized firm.
- Wells generally do not need a periodical revision, however they shall be checked in case the extraction volume of water is lower than expected by a specialized company.

2) Installation of Water Supply

A staff member of the Irrigators Association shall supervise from time to time a circular verification of pipes and valves. In case of water loss, repairing shall be immediately done by closing the closest water control valve or stopping the pump. Preparation of pipes and joints for repairing parts is necessary.

3) Installation of Sprinklers

The original owner of the sprinkler shall be the Irrigators Association, however they shall be always used by farmers, then the verifying and checking shall be carried out by the farmers and repairing shall be executed by the association under the request of farmers. The common damages of the system are braking of the rubber joints in the aluminum pipes indicating maintenance need.

(3) Irrigation Works

Each farmer shall develop the irrigation work as previously planned. The influence area (agricultural lands) shall be basically decided by the capacity of an irrigator set. The farmer shall not irrigate outside the established area.

Irrigation water shall be regulated in order to reduce the irrigation hours in periods with low water requirement. The Irrigators Association shall establish watering time and the irrigation requirement in the manual to be elaborated for reference.

(4) Operation Cost and Maintenance

1) Annul Operation Cost

The annual expenses of the Irrigation users are described as follows:

Table 4.7.12 Annual Expenses of the Irrigation Users

Unit: US$1,000

Item	Annual Expenses
1. Labor Cost	1.0
2. Operation Expenses	21.0
Subtotal	22.0
3. Cost of renovation of facilities	25.4
Total	47.4

2) Payment from Farmers and Collecting Method

The above mentioned expenses shall be charged to the benefited farmers according to their land extension. The cost per unit area shall be US$760/Mz and US$647/Mz in Stage 1 and 2. Payment shall be done as follows: after harvest, the product shall be commercialized through the association, where the irrigation cost shall be directly reduced from the incomes and the remaining shall be given to the corresponding farmers.

4.8 Plan to Strengthen the Rural Organization

4.8.1 Objectives for the Strengthening of Rural Organizations

When observing the steps for the formulation of agricultural cooperatives of the project area, one can tell that these organizations were created to receive loans. Nonetheless, these have not been

and still are not valid any more in the search to access credits; in other words, it can be said that the associations are not functioning in reality (See Present Conditions). Agricultural associations are production associations and, in other words, they are associations, which have economic functions. The economic function is perceived as "a way to gain access to resources that are not own by oneself" and according to this definition, it can be said that no (economic) associations exists in this region since no accessibility to 'finance' and any other resources is observed.

On the other hand, the functions of organization as an agricultural association are not necessarily limited to "the gaining access to financial resources". The functions of a productive association are not limited to gaining access to financial resources, but basic functions are widely seen as follows: support for agricultural production, management of production plan, collection of products by organizations, product cleaning, product selection, shipping, purchase of consumer goods, the review and decision about agencies to sell to, the operation of selling and buying, and in addition the distribution of irrigation water and the management of irrigation facilities if irrigated. In order to work effectively, these activities should successfully interact and a body supporting this interaction is an 'agrarian organizations' in this sense.

The objective of this preparation plan is to establish the backbone for agricultural activities through the preparation of agricultural associations as economic organizations in this region where no access to resources is observed.

4.8.2 Formation of the Association

In El Espino there were some cooperatives formed during the Sandinista Government, which were dissolved at the beginning of the nineties, distributing the lands among the farmers. Therefore, at the moment there is no rural organization in this area that can serve as the promoting entity for the Plan of Agricultural Development Model in El Espino. However, to carry out this plan, it becomes indispensable to have an organization that serves as a base for the activities, and it is necessary to form a new organization of the development model.

At the moment, the agriculture of El Espino is developed predominantly by the farmers who work individually, as do most of the small and medium-scale farmers of Region II. It is necessary to take into account this reality for the formation of an organization, and to group 10 or 20 properties that make use of the same well. This way, several rural groups would be formed in El Espino, and each one of these groups will develop the activities of a rural organization in the initial stage of the plan.

The division of responsibilities inside each group or rural unit should be defined democratically through the own farmers. In the same way, the concrete activities of each function should also be decided in a participatiary way. It is necessary to prepare on writing the meaning of each activity, the benefits as well as the responsibilities and functions that each participating farmer has to fulfill. It should also define the internal regulations and the measures against non-fulfillment. Since it will be difficult for the farmers of El Espino to carry out these activities on their own initiative, it is necessary that the organisms of C/P offer support in the initial stage of the formation of the organization.

On the long run, it is expected that these groups of farmers will mature, strengthen in cooperation bond with other groups, to eventually form a rural organization that covers the entire area. The institutional support for the organization of the farmers should settle on this vision. However, concerning the administration and operation of the irrigation facilities, it requires from the beginning an organization that acts in the entire area.

4.8.3 Functions of Organization

The following are the main activities in a rural organization:

(1) Collective purchase (mainly consumer goods),
(2) Collective collection and shipping
(3) Operation and management of irrigation facilities.

The organization, in the context of this preparation plan, signifies the place for positive production activities aiming at the following: the vitalization of production activities, the achievement of efficient production, the stabilization of agricultural production, the smooth collection and forwarding of products with least post-harvest loss, finding and preserving agencies to sell with higher accretion. It is, in other words, the active organization with accessibility to several resources. It is not possible to expect that such organizations are formed overnight, having to start with the group activities which are relatively easy and where the farmers, used to working individually, can participate immediately and at the same time, can receive the beneficiary rewards fast, in other words, collective purchasing. As for collective gathering and shipping, these activities will be introduced once the farmers have understood the advantages of working under this modality. In any case, the institutional support and advice will be provided in order to carry out in the future the gathering and collective shipping at regional level.

The three main functions of the rural organization are described as follows:

(1) Collective Purchasing

The collective purchase is the acquisition of the consumption articles related with the agricultural production whose objective is, by means of a larger order, to reduce the unitary price of the goods to acquire. The articles and the quantity of goods will be determined by the prepared plan of acquisition by the control department of the association based on the plans presented by each farmer. And this department will also be in charge of the selection of suppliers, ordering, purchasing and distribution.

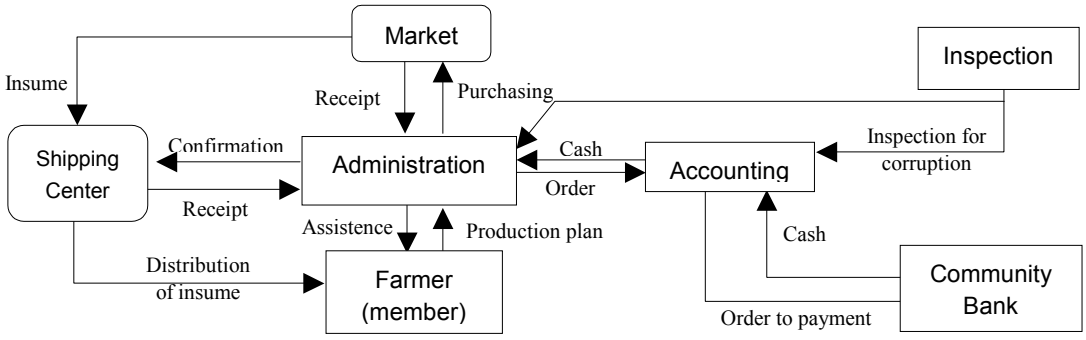


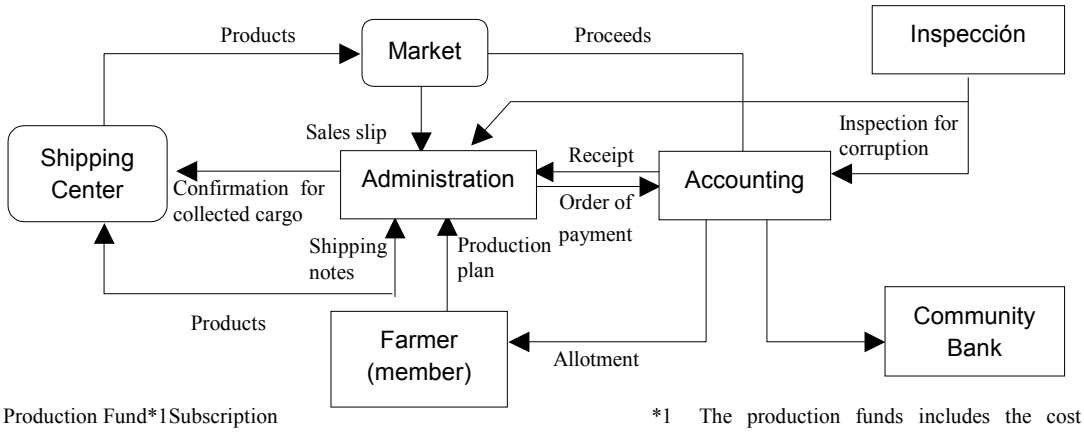
Figure 4.8.1 Collective purchasing

2) Collective gathering and shipping

The collective collection and forwarding are important activities, which influence the function of production organization in an agricultural association. It is not just collecting and forwarding. Agencies to sell to are chosen based on the production estimation from the production plan and

the analysis of the market information, and the sales contract, the sales, and the control and the management of sales amount of money are carried out. The management activity influences the functions of the whole organization because a part of the production sales amount of money is used as management funds. In other words, this amount consist of the cost of consumer goods for cultivation in the next period, the operation and management cost of agricultural water, the amount to accumulate as capital for the following irrigation, the association fees and other necessary expenses subtracted from the total amount of money from the sales, and is distributed among members as sales dividends.

A flow chart of goods in the organization regarding to the collective collection and forwarding activities is shown below.



*1 The production funds includes the cost of insume, seeds, rental fee for a machine, fee for temporal lobourer,etc.

*2 The irrigation costs includes the cost of fuel, of the maintenance, of renewal charge, etc.

Figure 4.8.2 Gathering and Collective Shipping

3) Operation and management of irrigation water

The management of irrigation water is carried out based on the cropping plan of members. As for the cost of irrigation water, the unit irrigation cost (in this case per Mz.) is calculated as the operation cost of irrigation facilities divided by the total irrigated area. First, each member's irrigation cost is calculated based on the size of irrigated land, and it is collected in advance by subtracting the calculated irrigation costs from their agricultural products' sales amount of money. The irrigation cost includes renewal fees of irrigation facilities, the maintenance and management cost (the repair cost) and the fuel cost (the electricity cost in the case of electric pumps).

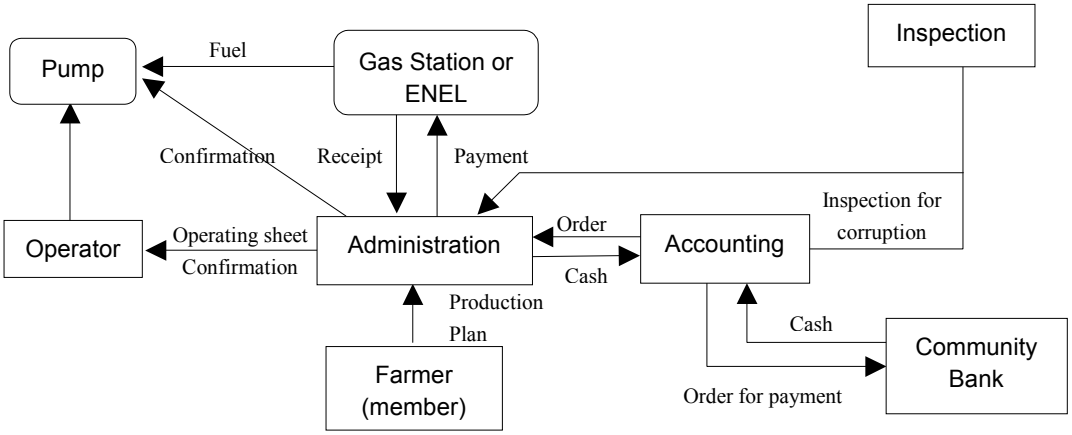


Figure 4.8.3 Operation and Maintenance of Irrigation Water

Since not only collection and forwarding activities but organization activities mentioned above act on the benefits of all association members, the corruption by personnel in charge of the association activities (especially in management section and accounting section) should be monitored carefully. Some countermeasures such as the setting up of a monitoring committee, the implementation of inspection, the disclosure of information and writing the articles of associations for the corruption prevention will be necessary.

4.8.4 Structure of the Organization

Multiple forms of structuring the rural organizations are conceived so that they carry out the attributed functions fully, according to the conditions of each rural group and the formulation conditions. Although it is certain that the definitive configuration of the organization is decided by each rural group according to their individual necessities. In this section, a conceived organization model is described which has the capability to carry out the above mentioned functions.

4.9 Marketing

If the degree of conscience according to the evaluation of the E/P and the current system of goods distribution are taken into account, it is considered that it is still premature to carry out the gathering and collective shipment or the processing of agricultural products. However, since this form of working is useful to give a larger value added to the products, it would be necessary from now on to outline the mechanism and the incentive of these works through the rural meetings hoping to reach a degree of enough maturity of the rural organizations and to find a transformed market environment in the future.

4.9.1 Plan for Commercialization of the Agricultural Products

To increase the value added of the agricultural products at this time in the commercialization phase, two methods are conceived: “to carry out the negotiation in a collective form although the sale is made at an individual level and to carry out the processing in a collective form to reduce the cost”.

(1) Collective negotiation of the sale prices

At the moment, the agricultural products are sold to the middlemen who arrive to the area, choosing the one that has offered the most favorable price. At this time it is difficult to transform

this scheme for the farmers when they have support from the outside. Therefore, initially it will be tried to strengthen the current outline through the collective negotiation of sale prices. Concretely, it is to gather the information on producer and market prices and empower the negotiating capacity in group, at the same time of offering the products in larger lots, which also favors the middlemen, to be able to elevate the producer price.

- To know the prices of the producer of the goods
- To know the market prices of the agricultural products
- To negotiate the prices collectively with the middlemen

The information on the prices of agricultural products should be provided on time by MAG-FOR to the farmers. Those that resource remnants from the credit refund or own resources, can adjust the sale season according to the evolution of the market prices. However, it is necessary to take into account that to know the best season for seeding is extremely difficult, since it is not only necessary to see the evolution of the market prices but also the economic situation of the country, tendency of the international trade, etc. making a complete analysis of different factors. Therefore, it is necessary to make a definite decision with the advice of MAG-FOR and INTA.

(2) Processing of agricultural products

The cost of the refined rice decreases when the processing volume gets larger. The same can be said with the transportation cost to the processing plant. Therefore, collective processing will be made for rice in order to reduce the costs.

4.9.2 Use of Market Information

The market information should not only be used to search for the buyer that offers more advantages. The information that was processed and accumulated can give many suggestions as a result of the transactions that are carried out with the agricultural products and transactions that are repeated each season and year. This can give important material to consider on the cultivation plan in such a way that a particular cultivation can be produced and sold with a larger profit. Also the market information, in a wide sense, apart from only being commercialization it includes the information on agricultural inputs (fertilizers and agro-chemical products) and services of agricultural machinery use. Such an information helps to adopt measures to reduce the production cost and to improve the level of revenues.

As a result of using the information, the focus and way of thinking of the farmers change toward a mentality guided towards the market and commercial production that can be administered by themselves. All this is provided if the market information is used well.

Therefore, the market information should not be limited to be applied for the commercialization activities but rather it should be used for each activity carried out by the group of farmers.

4.9.3 Plan to Strengthen Commercialization toward the Future

In the future it is intended to carry out the gathering and collective shipping of the agricultural products. These will be destined to the big cities (Managua, León and Chinandega) because of the scale of the market. Another advantage offered by the gathering and collective shipment is that the earnings go through the organization, and the organization can take the steps of refunding the debts in each farmer's representation. The outline will consist on implementing the processing and storage center and it will incorporate up to the processing process of the products coming

from the properties close to the project area. For more details of the commercialization and processing plan, see ANNEX.

4.10 Plan for Agricultural Credit

The system for the agricultural credit will be the same as described for Telica. However, it is necessary to take into account that the farmers of this area have only had the experience of administering its property with the resources of the agricultural credit during P/S, and that there were more farmers here than Telica who refused to return the debt. Since it can be forecasted that the NGO dealing with agricultural credits will have its office in the city of León, it will be more difficult to maintain a closer communication with the population of El Espino than Telica. For this reason, the executing organizations for the project should offer a strong support to the farmers for the canalization procedures and refund of credits.

The fund reserve is estimated at C $1,732,800 applying the same calculation bases as Telica.

4.11 Execution Plan for the Project

As for the procedures of the development of the project, execution plan, including the executing organizations, etc. the same approaches will be applied as described in Chapter 5: Plan for the Agricultural Development Model.

4.12 Project Total Cost

(1) Calculation Conditions

The conditions for the calculation of the Project cost for the district of El Espino, except the basic ones, are the following:

- For the fund reserve, which is included in the construction works cost, 5% of the total cost of the civil works shall be considered.
- For the general administrative costs, 15% of the cost of the construction works shall be calculated.
- For the technical administrative costs, 7% and 9% for the stages 1 and 2, respectively, shall be considered.
- For the material reserve, 10% of the project cost shall be considered.
- The prices reserve shall not be considered in this project.

(2) Cost of the Construction Works

1) Calculation Conditions

The project cost will be calculated according to the irrigation plan.

2) Project Cost

Based on the calculation costs mentioned above, the detail cost and total project cost are summarized in the following table:

Project Cost Unit: US$1,000

Cost Items	Irrigation Area: 99.75ha No. of benefited farmers: 43		
	Local Currency	Foreign Currency	Total
Construction works (irrigation facilities)	127.7	433.6	561.3
Land acquisition	0.1	0.0	0.1
Administrative expenses	19.2	65.0	84.2
Technical Administration	11.5	39.0	50.5
Contingencies	12.8	43.4	56.2
Project Cost	171.2	581.0	752.2
	(22.8%)	(77.2%)	(100%)
Project cost per hectare			7.5
Project Cost per beneficiary			17.5

Note: * The cost of the preparation costs and temporary works are included in the implementation costs of the irrigation facilities.

4.13 Economic Evaluation

The methodology applied for the evaluation is the same as in section 3.13

4.13.1 Economic Benefits

The following table includes both the financial and economic costs under the conditions without the project and with the project.

Without-project Condition

	Financial cost (C$/Mz)	Economic cost (US$/Mz)
Sesame	695	190
Maize	105	49
Sorghum	195	62

With-project Condition

	Financial cost (C$/Mz)	Economic cost (US$/Mz)
Rice (Winter)	3,084	153
Watermelon	2,369	700
Frijol	2,282	1,038
Sesame	1,090	254
Sorghum	195	62
Maize (Winter)	250	65
Maize (Summer)	1,534	692

Incremental irrigation benefit of the project is estimated as a difference of net production values between with-project and without-project conditions in the future. The net production values under with-project and without-project conditions are calculated as a difference between gross income and production costs.

The following benefits are expected:

Projected Area	Total Benefit (US$1000)	Benefit per Mz (US$/Mz)
650.2	210.0	323

4.13.2 Economic Cost

The following table shows the construction cost (shown as financial cost), which is estimated, based on market prices and economic cost. It has been converted applying the same methodology explained before.

(Unit: US$1000)

Financial Cost	Economic Cost
766	720

The operation and maintenance (O&M) cost is annually required during the economic life of the respective projects in conformity with management of the schemes. The O&M cost is also given by making adjustment to economic prices. The O&M cost is assumed as shown in following table based on 3.7.5 Operation and maintenance plan. The cost of renewal of the facilities is equivalent to 20% of direct construction costs; renewal will take place every 20 years after the initial construction year.

Operation and Maintenance Cost
14% of the cost of the main works

4.13.3 Economic Viability

The economic efficiency, examined by EIRR, B/C and NPV, is summarized in the table shown below. Hence, present values of cost and benefit for B/C and NPV are discounted at 15%.

EIRR (%)	B/C	NPV (US$1000)
9.1	0.72	-293

4.13.4 Sensitivity Analysis

A sensitivity analysis has been carried out for the project for each of the following situation:

a) 10% decrease of benefits
b) 10% increase of costs
c) 2 years delay in the achievement of benefits

The results of the analysis are shown below:

Cases	EIRR	B/C	NPV
10% Decrease of Benefits	7.4	0.65	-370
10% Increase of Costs	7.5	0.66	-399
Generation of Benefits after 2 Years	6.8	0.55	-480

The sensitivity analysis shows that the project is most sensible to the case with a 2 years delay.

4.13.5 Income-Expenditure Analysis

Se llevó a cabo el estudio sobre el balance de explotación agrícola con respecto a la puesta en marcha del desarrollo agrícola modelo. De las dos areas de objeto del Estudio, se elegió de área El Espinosa debido a su carácter general en término de desarrollo modelo.

(1) Model of the Income-Expenditure Analysis

Based on the plans for property administration and facility implementation of the Plan for the Agricultural Development Model in El Espino, the following forecast analysis is done.

a) Income

Income in a property is constituted only by the profit of the earnings from the sale of the agricultural products harvested in the cultivation fields subject to the Plan. The prices of the agricultural products are the financial prices of the economic evaluation.

b) Expenditures

Expenditures will be those related to living and production expenses. However, the expenditures for family labor for agricultural production will not be considered. The cost of living is estimated at C$6,400/year as the average of expenses in the region.

c) Credit Conditions

The debt will be calculated in the present value and it is only included in the bank commission cost which is 3% annum.

d) Cost of Improvement of Facilities

Within the investment amount for the El Espino, the implementation cost for the irrigation facilities will become the initial investment. The amount is C$147,000 per property.

Calculation Basis	Amount
1. Income	15.7 thousand córdobas per year
With irrigation (income in June)	28.6 thousand córdobas per year
Without irrigation (in December)	
2. Expenses	6.4 thousand córdobas per year
Yearly living expenses	29.6 thousand córdobas per year
3. Credits	
Commission	3%/year of the credit amount
4. Facilities Cost	147.0 thousand córdobas /property

(2) Establishment of the Analysis Cases

The income and expenditure analysis of the properties shows very varied results when different percentages of contribution from the properties in the facility implementation are applied. Therefore the following cases were defined for the analysis:

Cases	Conditions
1	Contribution of beneficiaries: C$10,000
2	Contribution of beneficiaries: C$5,000
3	Contribution of beneficiaries: C$147,000 (total)

(3) Results of the Analysis

As evaluation indexes, the surplus funds accumulated during a period of 10 years, 20 years are summarized in the following table, as well as the year when the credit balance would be canceled (accumulated deficit). For cases 1 and 2, considering that the amount of contribution of the beneficiary is relatively small, the amount of contribution is included in the first year credit. For case 3, since the amount of contribution is high, this will be paid on a long term period until the

property administration has been stabilized (after it starts to generate a surplus). The following table shows the results of the detail analysis:

(Amount: C$ 1,000)

Cases	Accumulated Surplus		End of the payment of the accumulated debt (year)	Remark
	10th Year	20th Year		
1	16.0	94.2	7	
2	21.1	99.3	7	
3	0.0	0.0		It is not possible to reimburse the facility credit in 20 years

(4) Income and Expenditures Evaluation

Based on the results of the analysis, the three most important items within the income and forecast expenditures evaluation are as follows:

- In Cases 1 and 2, where the beneficiaries should contribute C$10,000 and C$5,000, respectively, for the construction of the irrigation facilities as initial investment, the analysis showed good results. However, the surplus in the 20th year is lower than the required for reinvestment in both cases. It is also difficult to destine the entire surplus for reinvestment, and it is necessary to make more efforts to increase the value added of the products not only in the production base but also in commercialization.

- If the beneficiaries had to cover the entire implementation cost of the irrigation facilities, there would not be a surplus at the 20th year. On the other hand, the initial investment should be as small as possible because when it is too high, it can have adverse effects to the administration of the properties.

4.13.6 Indirect Benefits and Socioeconomic Impacts

(1) Foreign Exchange Saving

Domestic crop production in Nicaragua is not sufficient to meet present food consumption, and the deficit is supplemented by import. With the project implementation, the production of basic grains in the project sites will increase several times more than under without-project condition. Accordingly, the increment of basic grain production will contribute to the saving of foreign exchange.

(2) Increase in Employment Opportunity

Employment opportunities for the local people will be increased during the construction works of the projects, which will have a favorable impact on the national economy. Furthermore, employees will be able to gain more experience and technical skill in various working fields. These benefits would be applied to the future development of Nicaragua.

In addition to the above construction works, other employment opportunities will be created through farming practices after completion of the projects.

Farm Economy

El Espino
Case-1 Initial Cost C$10,000 for farmer

(Unit : C$1,000)

	0	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
		6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
Contents of Out Flow																																							
Initial Cost	10																																						
Farming Cost																																							
Input		10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5
Maintenance			0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1
TOTAL		10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7
Living Expense																																							
Living Expense		0.0	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Other		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		0.0	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Sub-total		10.9	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8
Contents of Income																																							
Profit																																							
Irrigation		7.8	0.0	9.8	0.0	11.8	0.0	13.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0
Rain fed		0.0	14.3	0.0	17.9	0.0	21.4	0.0	25.0	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6
Sub-total		7.8	14.3	9.8	17.9	11.8	21.4	13.7	25.0	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6
Loan																																							
Loan	10	20.9	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8
Commission		0.3	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3
Repaymentable		7.8	14.3	9.8	17.9	11.8	21.4	13.7	25.0	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6
Act. Repayment		7.8	14.3	9.8	17.9	11.8	21.4	13.7	25.0	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2
Loan Balance		-13.4	-21.2	-25.7	-30.0	-32.5	-33.2	-33.8	-30.9	-29.5	-23.1	-21.7	-15.3	-13.9	-7.5	-6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farmers Economic Balance		-13.4	-7.9	-4.5	-4.3	-2.5	-0.7	-0.5	2.8	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4
Total Balance		-13.4	-21.2	-25.7	-30.0	-32.5	-33.2	-33.8	-30.9	-29.5	-23.1	-21.7	-15.3	-13.9	-7.5	-6.1	0.3	1.8	8.2	9.6	16.0	17.4	23.8	25.2	31.6	33.0	39.4	40.9	47.3	48.7	55.1	56.5	62.9	64.3	70.7	72.1	78.5	80.0	86.4	87.8	94.2

El Espino
Case-2 Initial Cost C$5,000 for farmer

(Unit : C$1,000)

	0	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
		6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
Contents of Out Flow																																							
Initial Cost	5																																						
Farming Cost																																							
Input		10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5
Maintenance			0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1
TOTAL		10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7
Living Expense																																							
Living Expense		0.0	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Other		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		0.0	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Sub-total		10.9	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8
Contents of Income																																							
Profit																																							
Irrigation		7.8	0.0	9.8	0.0	11.8	0.0	13.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0
Rain fed		0.0	14.3	0.0	17.9	0.0	21.4	0.0	25.0	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6
Sub-total		7.8	14.3	9.8	17.9	11.8	21.4	13.7	25.0	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6
Loan																																							
Loan	5	15.9	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8
Commission		0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3
Repaymentable		7.8	14.3	9.8	17.9	11.8	21.4	13.7	25.0	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6
Act. Repayment		7.8	14.3	9.8	17.9	11.8	21.4	13.7	25.0	15.7	28.6	15.7	28.6	15.7	23.1	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2
Loan Balance		-8.3	-16.2	-20.6	-24.9	-27.4	-28.2	-28.7	-25.9	-24.5	-18.0	-16.6	-10.2	-8.8	-2.4	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farmers Economic Balance		-8.3	-7.9	-4.5	-4.3	-2.5	-0.7	-0.5	2.8	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4
Total Balance		-8.3	-16.2	-20.6	-24.9	-27.4	-28.2	-28.7	-25.9	-24.5	-18.0	-16.6	-10.2	-8.8	-2.4	-1.0	5.4	6.8	13.2	14.7	21.1	22.5	28.9	30.3	36.7	38.1	44.5	45.9	52.3	53.8	60.2	61.6	68.0	69.4	75.8	77.2	83.6	85.0	91.4	92.9	99.3

El Espino
Case-3 Initial Cost C$147,000 for farmer

(Unit : C$1,000)

	0	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
		6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
Contents of Out Flow																																							
Initial Cost	147																																						
Farming Cost																																							
Input		10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5	10.9	18.5
Maintenance			0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1
TOTAL		10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7	10.9	18.7
Living Expense																																							
Living Expense		0.0	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Other		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		0.0	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Sub-total		10.9	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8
Contents of Income																																							
Profit																																							
Irrigation		7.8	0.0	9.8	0.0	11.8	0.0	13.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0	15.7	0.0
Rain fed		0.0	14.3	0.0	17.9	0.0	21.4	0.0	25.0	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6	0.0	28.6
Sub-total		7.8	14.3	9.8	17.9	11.8	21.4	13.7	25.0	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6
Loan																																							
Loan		10.9	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8	14.0	21.8
Commission		0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3
Repaymentable		7.8	14.3	9.8	17.9	11.8	21.4	13.7	25.0	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6	15.7	28.6
Act. Repayment		7.8	14.3	9.8	17.9	11.8	21.4	13.7	25.0	15.7	28.6	15.7	28.6	15.7	25.9	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2	14.3	22.2
Loan Balance		-3.2	-11.1	-15.5	-19.8	-22.3	-23.1	-23.6	-20.8	-19.4	-13.0	-11.6	-5.1	-3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farmers Economic Balance		-3.2	-7.9	-4.5	-4.3	-2.5	-0.7	-0.5	2.8	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4
Total Balance		-3.2	-11.1	-15.5	-19.8	-22.3	-23.1	-23.6	-20.8	-19.4	-13.0	-11.6	-5.1	-3.7	2.7	4.1	10.5	11.9	18.3	19.7	26.1	27.5	34.0	35.4	41.8	43.2	49.6	51.0	57.4	58.8	65.2	66.6	73.1	74.5	80.9	82.3	88.7	90.1	96.5	97.9	104.3
Loan for Initial Cost																																							
Repayment		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-5.1	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4	1.4	6.4
Balance	147	147.0	147.0	147.0	147.0	147.0	147.0	147.0	147.0	147.0	147.0	147.0	152.1	150.7	144.3	142.9	136.5	135.1	128.7	127.3	120.9	119.5	113.0	111.6	105.2	103.8	97.4	96.0	89.6	88.2	81.8	80.4	73.9	72.5	66.1	64.7	58.3	56.9	50.5	49.1	42.7
Balance after Repayment		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Balance		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

(3) Inequality of Income Distribution and Redistribution Policy

After completion of the proposed projects, the people in the project areas can get the results of development. The living standard of the people in the project areas will be improved because their family income will increase in proportion to the rise of farming production. The better the proposed projects develop, the bigger becomes the difference in farm income between inside the areas of the projects and outside the projects. Although it works as an incentive to increase the agricultural productivity, an inequality of income distribution is important and serious in order to attain more equitable distribution of the fruits of development. In the case of the selection of redistribution policy, the real disparity should be taken into consideration not only in the agricultural sector but also among all other economic sectors. In addition to taxation system, social welfare, intervention policy in market mechanism, etc., as a redistribution policy by the public sector, it is also important to stimulate activities of the private sector. Business enterprises can invest to productive factories by utilization of private savings, which come from living surplus of consumers, and produce goods and services to consumers. Moreover, activation of the private economic sector stimulates the market mechanism and creates new labor markets. Thus, the fruits of development could be redistributed to the people by this market power from in the long run.

4.14 Environmental Impact Assessment

As a result of consultative meetings about the project contents with MARENA, both parties came to the agreement that the evaluation of the environmental impact (EIA) is not necessary for the following reasons: the development area is relatively small, the affected population is small, and the river water is not utilized. However, the project execution is foreseen to cause impacts on the area environment, and therefore the environmental impact will be cleared up before the execution of the project, as well as the environment protection plan.

4.14.1 Conditions of the Environmental Impact Assessment

(1) Contents of the Project

This project is composed of the following aspects; the strengthening of productive facilities, support to agricultural extension, commercialization of agricultural products, farmer's organization, and credit to the farmers. It is considered that among these components, those that will affect the environment are; 1) water intake facilities, 2) irrigation canals, and 3) farmers' organization. Other components such as the rehabilitation of local roads and the construction of the agricultural products collecting plant will improve the actual conditions, not causing any negative effects to the environment. The main facilities, which were planned in this project, are presented as follows:

Facility Name	Description
Main canal	Total length: 5,800 m
	Type: conduction tubes
Well	Depth: 100 m
	Pumping volume: 47.51 l/sec/pump
	No. of wells: 3 wells (1 existing, 2 new)

(2) Natural Conditions of the Project District

As shown in the location map, the El Espino district is located close to the city of Malpaisillo and its topography presents relieves. The number of trees in this district has being reduced

considerably due to excessive deforestation. For more details about the present situation of the district see section 4.1: Natural Conditions of the Project are and 4.2: Social and economic conditions of the Study Area.

(3) Scope of Project Influence

As for the reach of project influence, two separate areas can be considered: the area "within the district" and the area "outside the district". Nevertheless, there are no items in this project, which can affect the last area. A summary of the negative environmental effects that can be caused by the project is presented as follows.

Project Reach of Influence	Negative Environmental Effects	Affected Population
Within the district	• Increase of the income gap. • Changes in the social structure due to the systematization • Damages to the population caused by pesticides. • Alteration in the flow and level of groundwater	• No. of farmer families: 57 • Population: around 500 persons

4.14.2 Environmental Impact Assessment

The project execution should have adverse impact on the district environment in the seven aspects mentioned in the previous table. In the following items, the environmental impacts are organized according to the checking list prepared by Japan International Cooperation Agency.

(1) Impact on the Social Environment

Those items, which will affect the social environment, are the 3 described hereinafter. The remaining items are not considered to cause any impact.

a) Increase of the Income Gap

Under the project execution, the income generated by the agricultural activity is foreseen to increase. Nevertheless, the income of each farmer depends on the size of possessed agricultural land, the reason why there will be differences from the very beginning. In spite of this, almost all the district inhabitants are landowners and beneficiaries of the project. That means that there will be no differences between beneficiaries and non-beneficiaries.

Due to this possessed land size difference, which varies between less than 3 Mz and more than 5 Mz, the increase of the income gap is foreseen. However, this difference is already being shaped due to historic and social aspects along time, therefore it is not adequate to mention it in this environmental impact evaluation. In spite of this, with respect to the water use cost and to the farmers' organization cost, which will be once more established with the project execution, it is necessary to charge the farmers equitably according to each farmer's income.

b) Change in the Social Structure due to Systematization

The farmers' systematization will be the base of the project, being very important for its success. In establishing a new organization, farmers' association, there is the possibility of the generation of the following impact: destruction of traditional organizations, disharmony among the inhabitants, creation of non-effective organizations, etc. For this reason, a new organization, the farmers' association shall be formed respecting the intentions of the beneficiary farmers of the

project, the existing systems and customs, and renewing the three existing cooperatives.

(2) Impacts in Sanitation and Hygiene

The following is foreseen to generate impacts on the sanitation and hygiene of the district. The remaining items are not considered to cause such impacts.

a) Increase of the Use of Pesticides

In improving the irrigation facilities and introducing modern agriculture methods, the increase of the use of pesticides is foreseen. For this reason, it is necessary to utilize confirmed safe pesticides, and to reeducate the farmers about the proper method for the use of the pesticides. Furthermore, it is also necessary to constantly monitor residual pesticides in groundwater, as this is also utilized for domestic use in the district.

(3) Damages and Destruction of Ruins and Cultural Patrimony

There are neither important ruins nor cultural patrimony in the district object of the project and its surroundings.

(4) Impacts on the Ecosystem

No item which can strongly affect the beings and the district ecosystem is observed.

(5) Impacts to the Land and Soils

It is considered that there are no items, which shall strongly affect the land and soils. However, there is the risk of reducing the soil fertility due to the residual pesticides and the continuous cultivation. Therefore, it is necessary the prohibit the use of high residual percentage pesticides in the production program and a cultivation system, the maintain fertility of soils.

(6) Impacts on the Hydrology and Water Quality

The following item is foreseen to generate impacts on the hydrology and water quality of the district. The remaining items are not considered to cause great impacts worthy to mention.

a) Changes in the Groundwater Flow and Level

The use of groundwater as complementary source for irrigation is programmed in this project. Under this theory, the water extraction will be carried out in a maximum of three wells. In the project, the pumping volume was established to allow the use of this water in a sustainable way, thus it shall be avoided to extract water beyond the established volume. Furthermore, it is very important to continuously observe and measure the well water level, since it is very difficult to predict the behavior of such water and it is a very important resource for the district, which is also being used by the people as drinkable water.

4.14.3 Plan of Environment Protection

(1) Plan of Environment Protection

a) Monitoring of the Groundwater Level

In order to observe the variation of the district groundwater level, it is necessary to monitor such level. In case of monitoring the water level indicators, the places where this monitoring shall be

carried out and the frequency of monitoring shall be established.

As for the groundwater level rates, no data is collected through a continuous measurement until now. It is necessary to carry out its measurement definitely, at least for one year period before the project execution in order to evaluate the data obtained by this monitoring.

b) Monitoring of the Water Quality

In order to observe the contamination of the district groundwater level, it is necessary to monitor its water quality. In case of monitoring the water quality indicators, the places where this monitoring shall be carried out and the frequency of monitoring shall be established.

The groundwater is used for both domestic and irrigation purposes. However, as water contamination indicators, the standards for drinkable water shall be adopted since they are strict in order to prevent serious damages to human health.

c) Places and Frequency of Monitoring

By selecting some wells (more than 2 places) among the district wells, it is possible to carry out the monitoring of groundwater level and quality. For the observation of the water level, it is convenient to carry out this observation twice a month for a good understanding of the variations caused by the period, elapse of the years and extraction for irrigation. For the observation of the water quality, not so many observations are necessary as it is groundwater, thus twice a year is enough.

(2) Reforestation Plan

All the farmers in the district utilize firewood as domestic fuel. All the consumed firewood comes from colonies located 10 km far, at the countryside. In this district, there are no trees, which can be converted into firewood and charcoal due to the excessive deforestation. Hence, reforestation is necessary not only as a fuel source (firewood) but also to recuperate the natural conditions.

However, the tree rooting demand constant water supply. Since this district suffers from drought, the reforestation will be carried out around the irrigated agricultural land and at the sides of the ravines, and also in the pastures where drought resistant trees shall be planted.

CHAPTER 5

AGRICULTURAL DEVELOPMENT MODEL PLAN

CHAPTER 5 AGRICULTURAL DEVELOPMENT MODEL PLAN

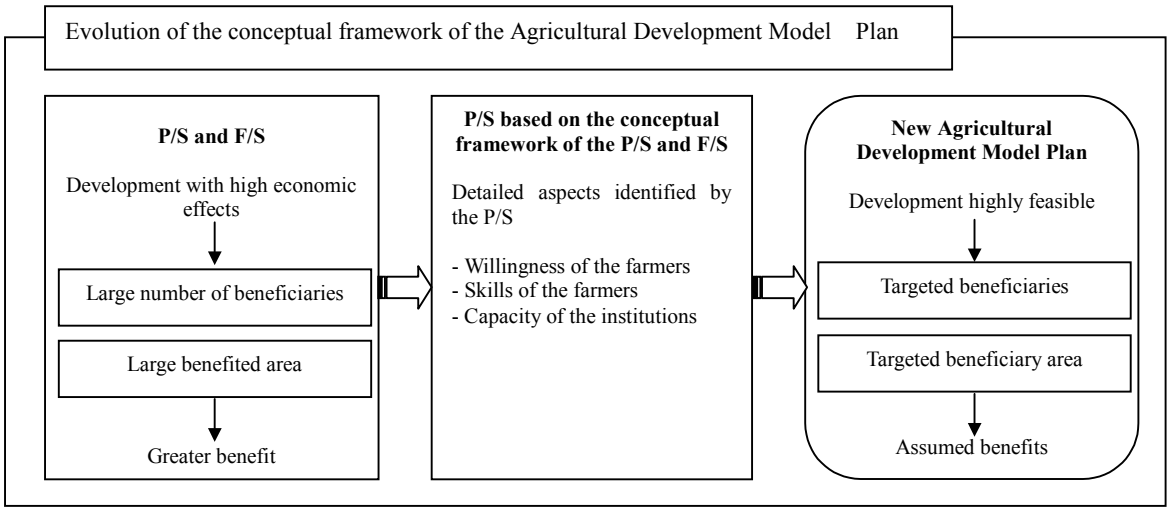
5.1 Introduction

A Master Plan for Agricultural Development was elaborated in October, 1998 giving priority support to the small scale farmers in Regions II and IV on the Pacific Coast of Nicaragua and four development model plans were proposed. The agricultural development model plan implemented in Telica and El Espino were two of the four plans. The development model has an integrated approach that aims to: 1) increase the agricultural productivity; 2) support farmers' organizations; 3) increase the added value of the crops, etc. These plans were proposed to be implemented at an early stage in order to strengthen the capacity of the implementing agencies of the project and to motivate the small scale farmers and, in the long term, expect that the positive effects of the plans have a ripple effect to the neighboring areas.

After the Master Plan (M/P) and the F/S, a draft of the development plan was elaborated for both areas; based on this draft, a Pilot Study (P/S) was carried out by selecting certain zones and number of farms in order to increase the practical effects of the Plan. In Chapter 2, the results of a pre-appraisal of the P/S are summarized. As the study was being implemented, the technical level of the small scale farmers concerning farm management, physical characteristics of the zones, executing capacity of the institutions, were being recognized. It was felt that there was a need for a more feasible plan to substitute the two agricultural development model plans that were implemented.

The technical evaluation of the Development Model Plan for Telica in the F/S showed good prospects. However, as shown in the F/S, the practical effects of the Plan can not be fully asserted if the crop cultivation techniques and the actual conditions of farmers' organizations are taken into account, as well as the capabilities of the Nicaraguan public institutions for implementing the projects. On the other hand, concerning the Agricultural Development Model Plan for El Espino, the economic evaluation did not give encouraging results due to the limited accessibility to the markets, the low fertility of the soils on the mountain slopes, etc. The results of the P/S in terms of achieving the objectives of the Project also supports the results of the economic evaluation. In short, in order for the Project to show a high impact on both zones, it is necessary to wait for the market conditions to change, to strengthen the basic skills of the farmers, and to improve the capabilities of the Nicaraguan public institutions for implementation of the projects.

However, there are a great number of zones in both regions of the Pacific Coast of Nicaragua that show natural and social conditions suitable for the implementation of the Development Model Plan. In this Chapter, concrete policies for the selection of priority areas of the Development Model Plan are presented, as well as methods for their implementation. At the same time, the philosophy and background of the plan for Telica and El Espino are presented by clearly defining the objective and strategies of the Development Model Plan.



5.2 Background of the Agricultural Development Model Plan

The productivity of the small and medium scale farmers of Nicaragua is low and this is one of the major factors that do not allow to raise their living standards. As discussed in the M/P, the reasons why the productivity of the small and medium scale farmers productivity is low, are multiple. Besides factors such as "instability of the natural conditions" and "lack of institutional support", the following four factors which have close relationship with the productive activities of the farmers are mentioned.

(1) Low level of agricultural technology
(2) Lack of production infrastructure
(3) Inadequate market administration
(4) Difficult access to agricultural credit

Within these factors, the most important is the low level of the technology; this is because even if other constraints are lifted, but the technical skills are not improved, the contribution of the farmers to the increase of the agricultural income will be minimal.

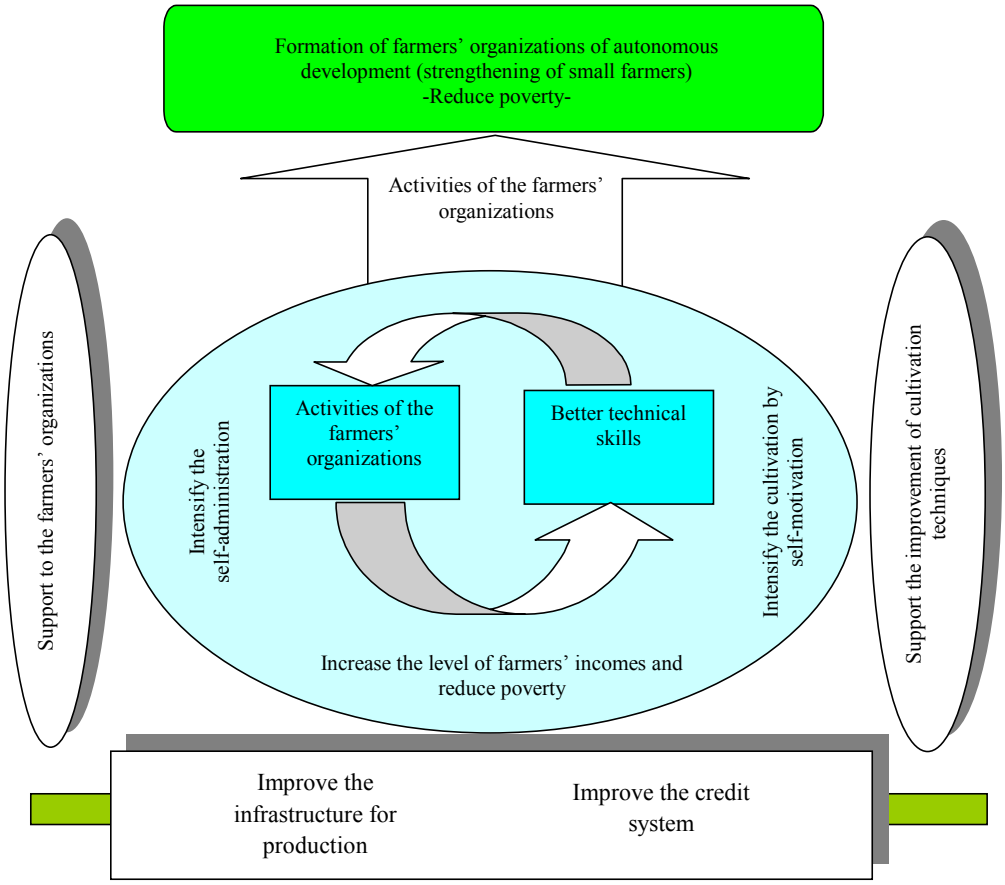
The root of these constraints is in "(5) Bad operation of the farmers' organization". This is because the four constraints above mentioned can be solved any if there is an agricultural organization which would propose objectives following its own initiative (i.e., improve the living conditions of the members of the organization). There is not a good farmers' organization because in the small and medium scale farmers, "(6) There is no thought or action coming by their own impulse".

5.3 Objective of the Agricultural Development Model Plan

To reduce poverty and increase the agricultural income level of the small and medium scale farmers, it is required to carry out effective policies concerning the constraining factors mentioned above. To find a solution to the main problems, it is necessary to assign a higher priority to the "formation of farmers' organizations and their activities" and to the "improvement of the technical capability for crops cultivation of the farmers". It would be impossible to expect that the small and medium scale farmers with an irrigation area of 30 to 60 Mz to take care of

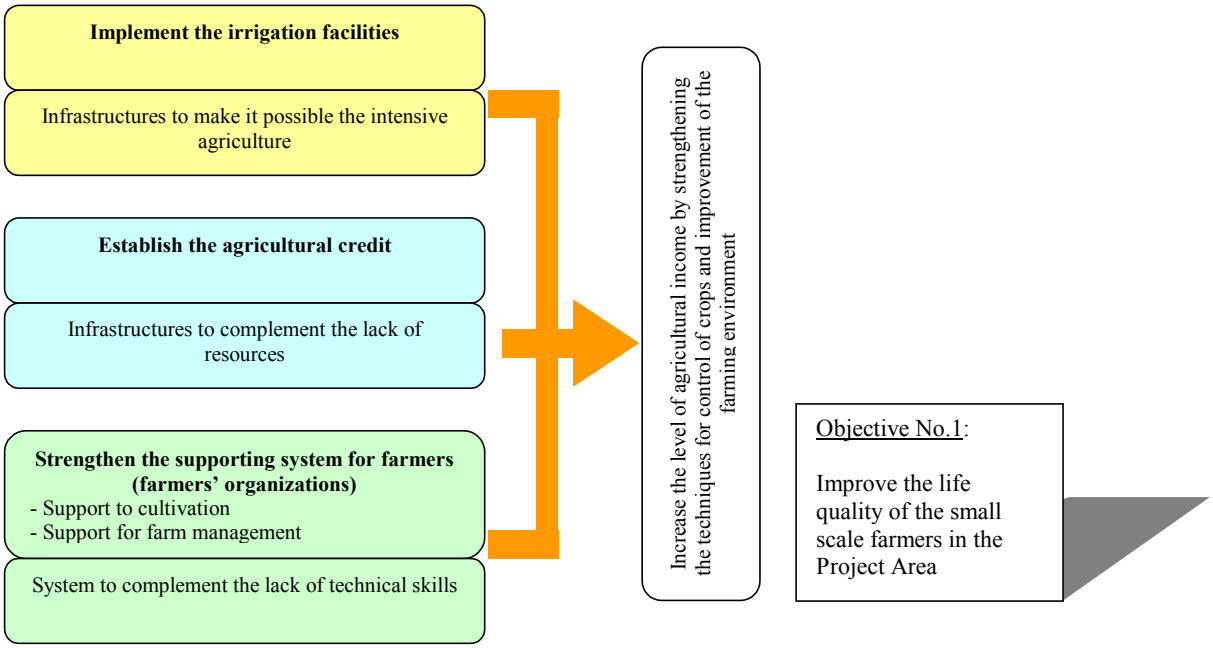
these top priority tasks by themselves, and this means that a mechanisms for "supporting the crop' cultivation technology" and "support to farmers' organizations" are required. Also, the "improvement of the infrastructure for production" and "establishment of a credit system" are included as these are two main components for increasing the agricultural income of the targeted population, in such a way that the Project will have an integrated approach to solve the constraining factors. It must be remembered that the "farms' management for a market-oriented agriculture", or in other words, the intensification of the marketing schemes of the agricultural producers will not be incorporated in this stage of the Project, taking into account the still insufficient skills of the small and medium scale farmers in Nicaragua and the capabilities of the supporting organizations, as well as the degree of maturity of the market. Therefore, this component will be incorporated by the own will of the farmers as a natural step of their strengthening process.

It is difficult to expect that the small and medium farmers act by their own will in the initial stage of the Project, and this is the reason why the supporting organizations must provide them a strong support. However, as the Project progress on, and the agricultural incomes are being increased, the farmers will understand the incentives of the Project, as week as the essence of the activities of the farmers' organizations, and in this way, they will start to act on their own volition, forming true farmers' organizations able enough to develop by themselves.

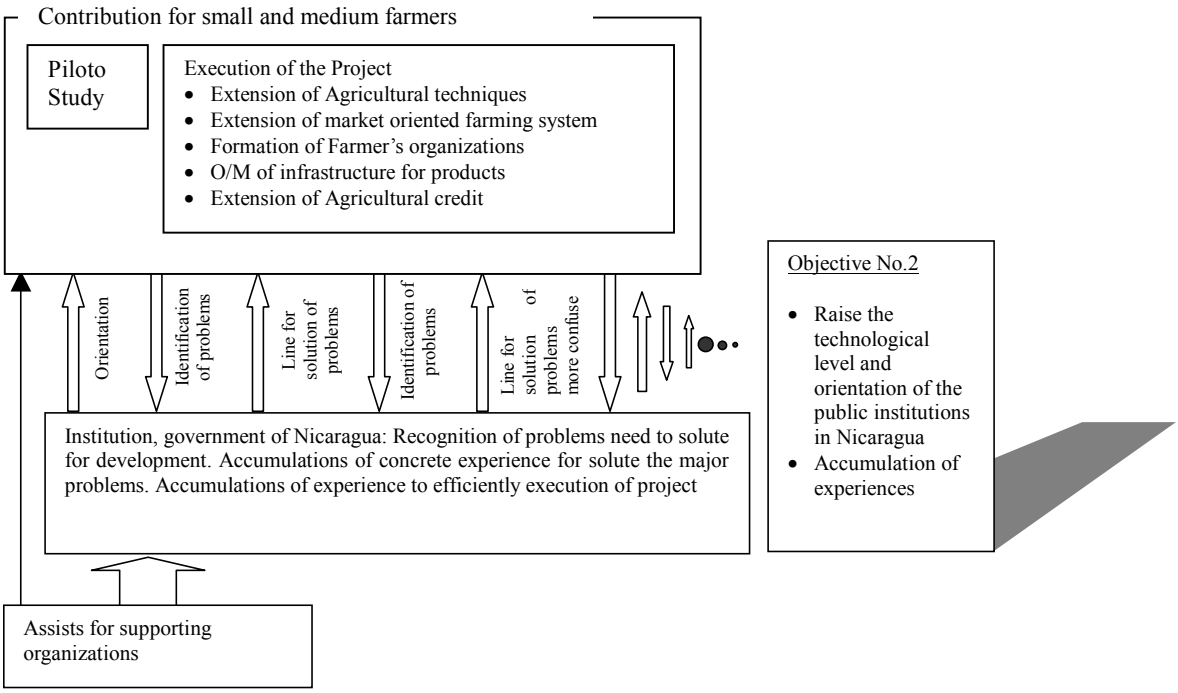


In this Project, three objectives are proposed to reduce poverty among the small and medium scale farmers. The first one is to improve the living conditions of the targeted population in the Project Area. For this purpose, it is necessary to successfully implement three component: "supporting system for the farmers (farmers' organization) to complement the lack of appropriate agricultural technology of the small and medium scale farmers; "irrigation facilities" that are infrastructure to

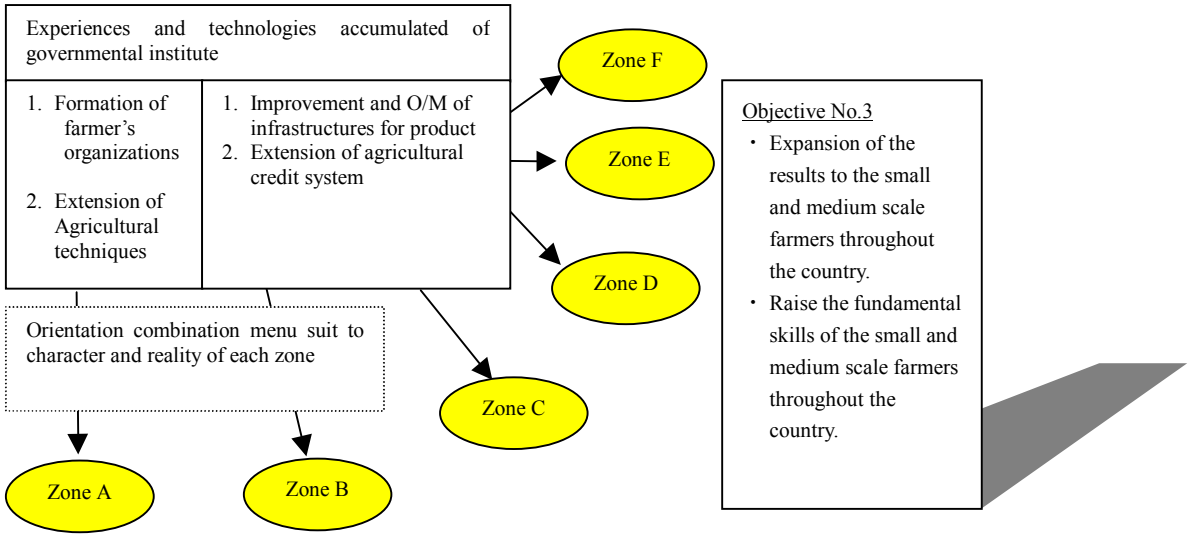
carry out agricultural activities on an intensive basis, and; "agricultural credit system" to complement the lack of economic resources of the beneficiaries. These three components are mutually complementary, and the absence of any of them could represent a severe constraint to the Project. As mentioned before, the increase of the agricultural income through these systems lead the farmers to become aware of the benefits of the Project and to encourage them to form a true farmers' organization.



The second objective is to "accumulate enough technical skills" and "strengthen the advisory capabilities" of the executing agencies of the Project. It can be thought that this objective already has started with the P/S of the present Project. As shown during the execution of the P/S, the technical skills of the extension workers of the government's institutions that provide support to the farmers are still in adequate, even though their skills are becoming stronger as the Project is being implemented through all its stages. One of the main causes of this lack of technical skills would be the lack of experience. In the first stage of the Project, it is necessary to simultaneously implement a supporting system to complement the technical capability of the extension workers.



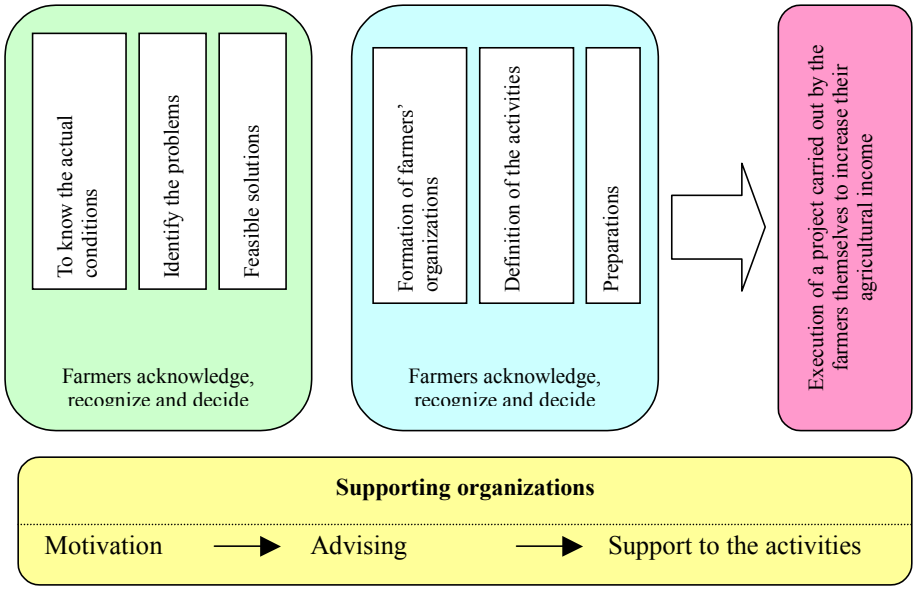
The third objective is to apply the experiences accumulated during the process of providing assistance to the small and medium scale farmers through the execution of the Agricultural Development Model Project. The guidelines for agricultural development and management are different according to the conditions of the different zones in the country, as well as the natural conditions. Because of this factor, it is necessary to implement the programs according to the needs of each zone, taking the farmers' organizations as a central axis. Also, as a final target, a sustainable development carried out by the small and medium scale farmers themselves is expected; this can be achieved only when the farmers' organization take firm and deep roots.



5.4 Strategy for the Agricultural Development Model Plan

5.4.1 Project Formulation

In the Development Model, it is proposed to provide integral support to the small scale farmers in order to increase their agricultural income. However, the protagonist of the Project must be the farmer themselves, and the intensity of their motivations is the key for the Project to fully show its expected results. With this motive, it is important to support those farmers who understand and fully recognize the conditions of their farms; the incentives provided by the Project must be clearly explained to these farmers using a participatory approach. Also, the monitoring plans for specific crops to be cultivated within the Project must be elaborated by the farmers' own initiative. However, if the actual potential of the targeted beneficiaries is taken into account, it would be very hard to ask these farmers to develop such activities without external help. Therefore, the supporting institutions must participate in the process of motivating and advising the beneficiaries, and provide timely and constant assistance through different activities.



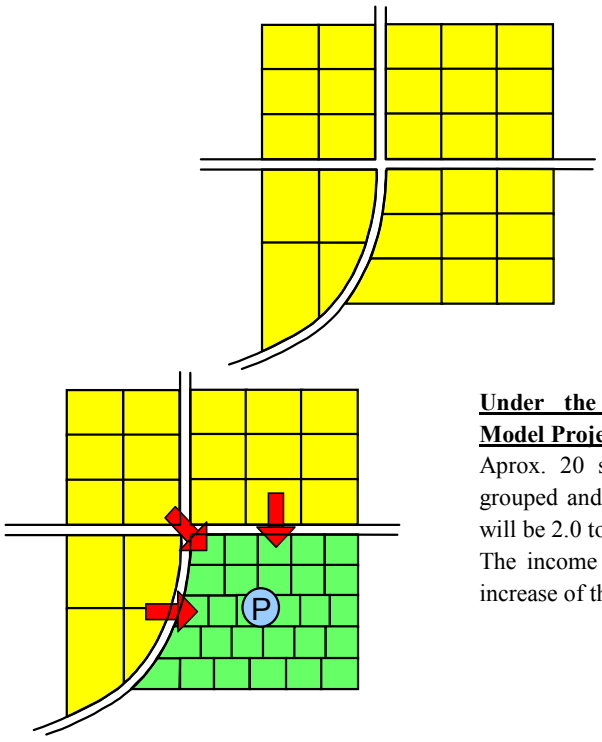
5.4.2 Concept for Improvement of the Facilities

The "improvement of the infrastructure for production purposes" must include adequate facilities with a futuristic perspective, because it represents a huge initial investment for the small and medium scale farmers who are still not familiar with cultivation practices under irrigation. The Development Model Plan aims to create the conditions for the farmers to achieve their own autonomous and sustainable development. Therefore, the size of the facilities will be defined basically considering adequate cropping area which will secure adequate income level for the farmers, taking into account the farm management system and the availability of water and soil resources. On the other hand, it must be considered that the attempt to promote the irrigation system through out the country will represent a huge investment concentrated in specific areas which will mean a disequilibrium from the national budget point of view. Therefore, it is important to define the appropriate irrigation surface which will make it possible to carry out a stable and intensive agriculture, and in this way, improve the living conditions of those who are vulnerable to fall into poverty with the lowest unit cost (per farm) for the facilities.

The type of construction of the facilities greatly vary according to the potential of the water resources, topography of the cropping fields, and other natural conditions of the zone. Due to the fact that the Pacific Coast of Nicaragua depends mainly on the ground water for irrigation, what follows is a proposal for the construction of the facilities considering these water resources. However, this approach will not be applied to those zones that have other water sources more economical than ground water and that, at the same time, guarantee a stable use.

- Concept for the Improvement of the Facilities Model under the Use of Underground Waters

At present, the average size of the agricultural land owned by each one of the small and medium scale farmers in Region II is 11.1 Mz (approx. 8 ha), and in some cases this land is distributed in various places. Rainfed agriculture is being practiced except in some cases. Based on this situation, if the irrigation facilities were introduced, with a common source, the cost of the improvement would be too much high. Therefore, in the Development Model, 20 to 30 small and medium scale farmers get together in a group and rent agricultural lands with better soil and natural conditions, and each farmers receives 2 to 3 Mz that will allow the farmer to get enough income. By doing this, the cost of improvement of the facilities will be minimized.



Existing Conditions:
- Average size of the agricultural area is 1.1 Mz.
- Rainfed cultivation
- Crops for self-consumption

Under the Implementation of the Development Model Project

Aprox. 20 small and medium scale farmers will be grouped and the average irrigable area for each farmer will be 2.0 to 3.0 Mz.

The income of the farmers will be improved with the increase of the agricultural production

5.4.3 Effect on other zones

The governmental institutions which will carry out the Development Model Plan are MAG-FOR and INTA. They will have to work taking into consideration the need to achieve the effect all throughout the country. These accumulated experiences will be very valuable in the future and these must be compiled in a manual for the development of the small and medium scale farmers of Nicaragua; the governmental institutions involved must organize and analyze the data and experiences for a better understanding and use for the benefit of the small and medium scale farmers.

5.5 Agricultural Development Model Plan

5.5.1 Flow of the Agricultural Development Model Plan

The Development Model Plan could be divided into three stages: preparatory stage carried out by the farmers, preparatory stage of the supporting systems, and the execution stage. The preparations of the farmers consist of formulating organizations of the beneficiaries and the participatory elaboration of the plans; the preparations of the new systems consist of the establishment of the irrigation facilities and the credit and supporting systems for the farmers. Finally, the execution stage for the farm management using all the provided tools. Each one of these three stages is subdivided into various activities,; the flow of these activities are shown in the figure 5.5.1 “Flow of the Development Model Plan”. The figure shows different activities to be carried out by the farmers (from “A” to “J”), except item “D” which is “Establishment of Supporting Systems”. All these activities require institutional support. What follows describe in detail the contents of each activity following the flow shown in the figure. Basically, the Project is conceived aiming for the small and medium scale farmers to increase their agricultural income through their own efforts; however, this will not be possible without them receiving any support. Therefore, it will be shown in which way the administrative entities must support, motivate and advice the small and medium scale farmers. Therefore, for each item it is shown what kind of activities must be carried out by the farmers, on one hand, and, on the other hand, what by the supporting institutions. Also, in the P/S it was evident that the supporting institutions are not capable enough to provide the required support to the farmers needed by the Development Model, and it is, therefore, necessary to provide assistance to these institutions too. The kind of support needed by these institutions is shown in the figure.

In this report, the general framework of the Development Model Plan is proposed together with the required items to be fulfilled for a smooth development of the Project. However, the specific and concrete crops that will be cultivated by the farmers must be decided by their own farmers’ organizations. Also, the type and supporting method to be provided must be defined by the supporting institutions themselves based on the request of the farmers’ organizations.

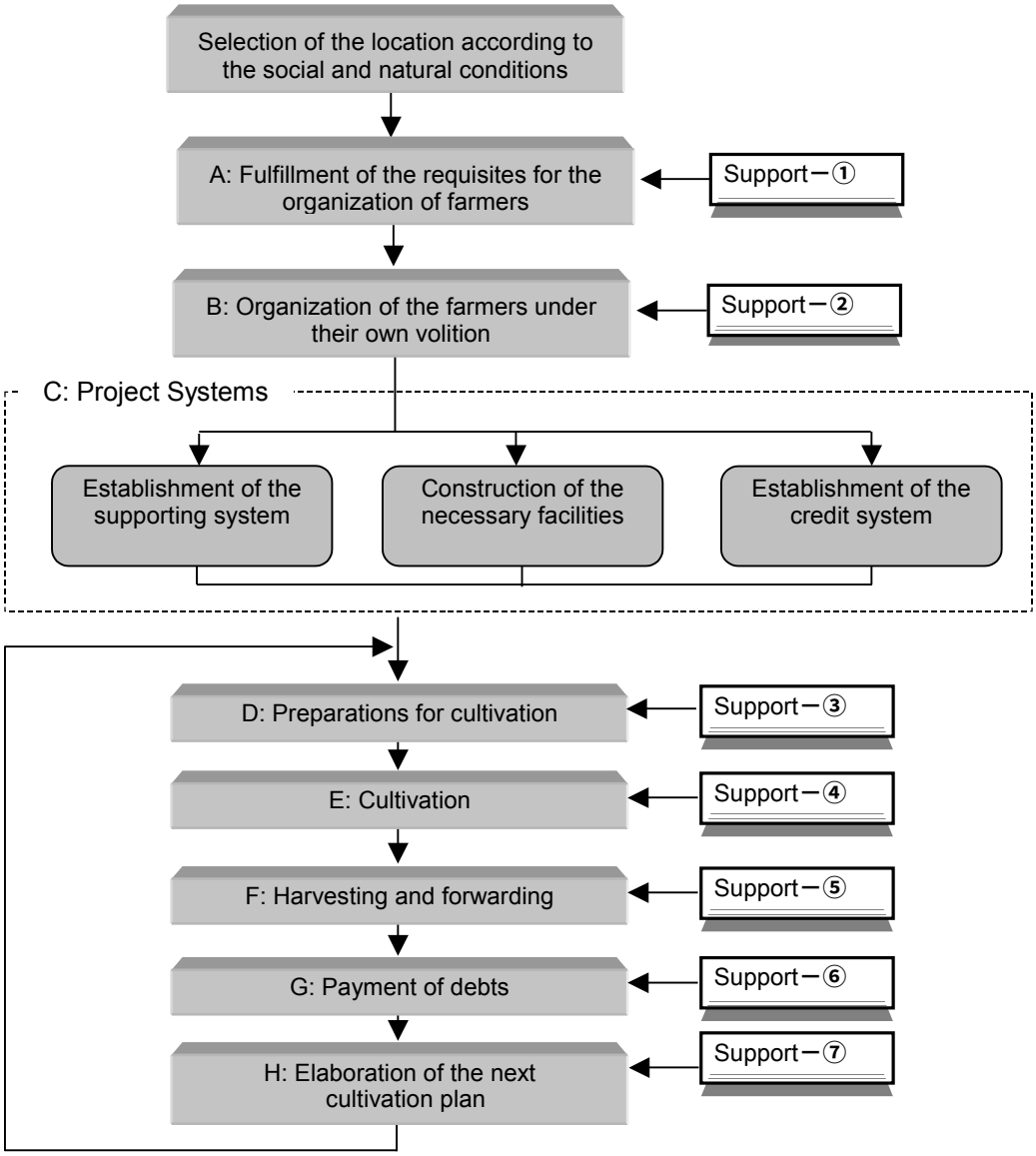


Fig. 5.5.1 Flow of the Model Development Plan

Selection of locations through the screening and detailed study

The executing agencies of the development model are MAG-FOR and INTA. It is probable that the technical staff of the regional offices will have to implement the plan in practice, but the number of the staff at the MAG-FOR office in Region II is limited. From the experiences of the P/S, it is concluded that it is necessary to start the works with no more than five zones per year at the beginning. The general framework of the projects is defined as follows:

- Basically, each group to receive institutional support will include 15 to 20 farms.
- Each target farm will have an area of about 2 to 3 Mz. Fundamentally, mini-irrigation systems will be implemented using derground water.
- Therefore, each project will be carried out by a farmers' organization covering 15 to 20 households with an irrigation area of 30 to 60 Mz.
- The projects will be executed in Region II, within and outside the area of the P/S.
- The establishment and investment for facilities, agricultural credit, etc., will be executed after

the farmers' organizations to administer them have been created.

The selection of the areas where the projects will be implemented, based on the screening and detailed studies, will be responsibility of the Nicaraguan governmental institutions: MAG-FOR and INTA. However, because the success of the Plan is based on this selection, the participation of the experts in the selection process will be needed; they will have to jointly work with the Government of Nicaragua. On the other hand, it must be also taken into consideration that there are NGOs who already are working in the region; these organizations must also participate in the Plan. However, the final decision concerning the location of the Plan in this stage is the responsibility of the Government of Nicaragua. The concrete conditions to be met in the areas where the Plan will be implemented, are shown below.

(1) Groups of small and medium scale farmers who understand and agree with the objective of the Development Model.

The attitude of the beneficiaries (small and medium scale farmers) towards the Plan will affect its development, because the Plan makes them its main protagonists, even though they have the institutional support for different activities. Therefore, the Development Model Plan must be executed in an area where there are groups of small and medium scale farmers who agree with the objective and methodology of the Plan.

(2) Availability of enough water resources for irrigation purposes

The irrigable area by each well increases proportionally to the well's capacity. The construction cost per unit area is also reduced when the irrigable area is bigger. Also, when the water table level is deep, the cultivation cost is increased. Therefore, it is desirable that the capacity of the well must be above 40l/sec and the level of the water table in the dry season must be to a depth below 40 mts. However, in those zones where there are abundant water resources from rivers or springs that guarantee the stable supply of irrigation water, higher priority will be given to the use of water from the river because the cost of the works is lower than the alternative of constructing wells.

(3) Availability of clustered cultivation lands with good quality

The Development Model Plan that uses underground water as a source is executed using the land renting system. Therefore, it is necessary to select a zone where more than 30 Mz of cultivated fields of good quality are concentrated. In the particular case of the Agricultural Development Model Plan that basically consists in taking the irrigation water from ground water sources, the majority of the projects should be implemented by renting the agricultural lands. Therefore, it is necessary to select zones where there are more than 30 Mz of cultivation lands of good quality.

(4) Establishment of an adequate linkage of land renting

In the case that the land renting system is adopted, more than ten farmers must subscribe the renting contract with a few landowners. In a relationship between landlord and rentee, in general, the landlord has the upper hand and if the contract does not have clear clauses, it could generate disputes concerning the lands during the execution of the Plan. Therefore, it is necessary to select a zone where it is possible to reach a full agreement on renting between landowners and the farmers renting the land.

(5) Good access to the market

Even when it would be possible to implement the intensive agriculture and high yield cash crops are produced, the selling price would still be low if there is no good access to the markets. In fact, if a comparison of the crop prices obtained in the P/S is made, the crops of Telica had better prices than El Espino because the area is closer to the bigger markets. Due to this fact, it is necessary to select the zones which are near to big consumers' markets.

1) Selection method of the candidate areas for the implementation of the Agricultural Development Model

Basically, no more than five areas will be selected per year. For the definition of the project areas, the candidate areas will be selected following the steps being described below. After determining the priorities through the screening process, the detailed study for the areas with higher priority will be carried out in order to evaluate the feasibility of the project.

From March to May 1999, MAG-FOR and the experts from JICA carried out a joint study on the damages caused by the hurricane Mitch, by which a total of 55 areas in the departments of León and Chinandega with a high potential for development of mini-irrigation systems were identified. These areas, in general terms, satisfy the requisites of selection mentioned before, and are being considered as "candidate areas for the Agricultural Development Model". If there are other important areas within the Region II beside the 55 already mentioned, they will be considered and subject to the screening process.

During the screening, besides collecting the basic information such as weather conditions, water resources, location, etc., a field recognizance will be carried out as well as simple interviews to collect the general information of the zones. The aspects to be investigated in this process are:

- Social conditions that fit the framework for the agricultural development model
- Water sources for irrigation
- Grouped farms with soils of good quality
- Possibility of land renting
- Market accessibility

The results of the screening will be evaluated by using the checking list and by the detailed study in the five areas with the highest priority to verify if the execution of the project is feasible. In any study made using the checking list, it is difficult to verify the "existence of the small and medium scale farmers that understand and agree with the objectives of the Agricultural Development Model" which is one of the requisites to be satisfied by the areas subject to this development scheme. For that reason, the detailed study will be carried out with the objective of identifying the awareness and willingness of the farmers and the present social problems. At the same time, it will be verified whether there are other factors that constraint the development model. Therefore, the development study will mainly investigate the following eight aspects:

- Willingness of the farmers (hopes and perspectives for the future)
- Attitude of the farmers towards agriculture
- Structure of the communal society and the role of the communal organizations
- Identification of the leader of the community and his role
- Presence or absence of conflicts among communities or within the community
- Existence of the custom of renting farms and its respective method
- Size and distribution of the farms

- Existence of mortgages

Based on the results of the detailed study, a final verification of the requisites established for the Agricultural Development Model will be made and the candidate areas will be defined. However, it must be noted that even during this stage the fact that the areas have been defined does not necessarily means that the project will be initiated. The decision will be made after the plan has been elaborated with a participatory scheme and approved by the higher authorities of the project.

To be able to finalize the screening in one month and also the detailed study in one month, a leader who completely knows about the plan will be selected together with two full time assistants. These three persons, besides selecting the areas, will play a primordial role in the implementation of the plan.

2) Method for screening and evaluation of the definition of the priority areas

The screening will be made using a checking list. As indicated before, the process includes interviews, field study and analysis of the existing data and information. In order to not to reflect the subjectivity of the screener on the results, it is necessary to carry out the verification among various persons. The information from the screening will be summarized in the checking list and the assessment will be made assigning points that will be added up at the end. Then, the candidate areas will be ranked starting from the ones that obtained the highest number of points and a priority order is defined.

The evaluation will be made at three levels. The areas that show even one item in the lowest level must be discarded from the list of the candidate areas. Of the three levels, the category "Good" will represent 3 points and the "Regular" will represent 1 point. The priority will be determined based on the total number of points gained. Also, the advantages of those areas that have abundant river or spring water that could be used for irrigation, must be considered as the irrigation facilities that will represent a lower construction cost compared to ground water sources. In the same way, it must be also considered the advantages of those areas that allow the execution of the project without the need of renting lands, because any problem related to land tenancy will be avoided. The areas that offer these advantages will have "extra" points and a higher priority. Other details of the evaluation method are available in the checking list.

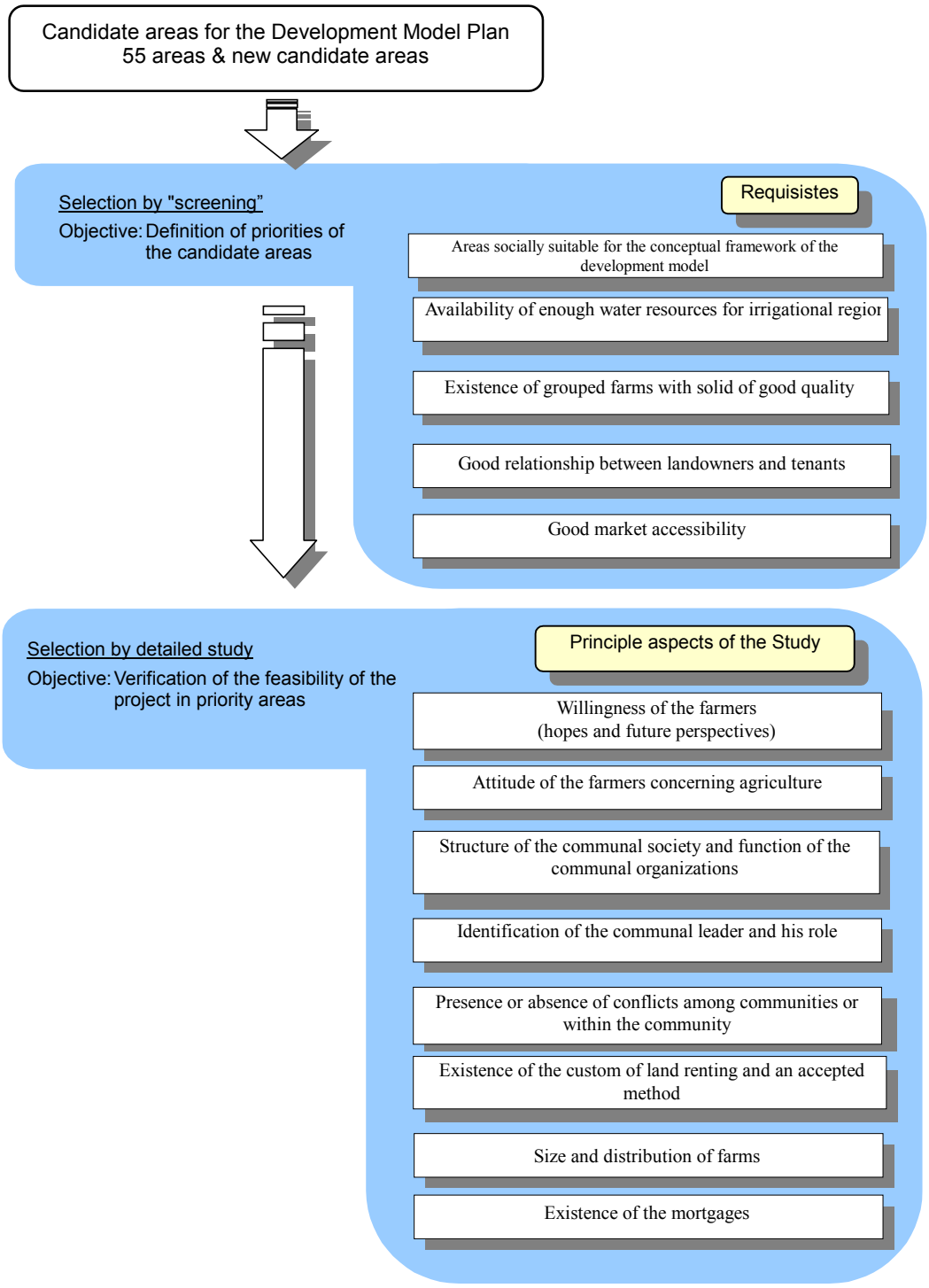
3) Method of the detailed study

The requisites that must satisfy the areas cover different aspects. The most important requisite is the willingness of the farmers and social condition that are aspects that can not be easily shown in a social study carried out in the conventional way. To verify if these areas are suitable or not for the Agricultural Development Model, it is necessary to carry out a Rapid Rural Assessment (RRA), a method that allows to know the social characteristics of a zone in a short time. To carry out the social study by applying the RRA it is required to have the assistance of an expert at least at the initial phase of the implementation.

The procedure of the detailed study consists first in defining the "conceptual framework" of the study covering all the requisites of the Agricultural Development Model Plan. Then, a guideline for the study will be elaborated according to the framework. In order to know the whole characteristics of the zone, different methods like interviews with key farmers, group discussion, etc. will be used; other methods like mapping, crop calendar for the area, decision trees, inputs flow, household structure diagram, income and expenses flowchart, etc., will be used. After collecting all the required information, the areas will be verified whether they

satisfy all the necessary requirements for the implementation of the plan.

To minimize the distortion of the collected data, it is recommended to form a team of five experts in the agricultural development model (experts in farmers' organizations, rural society, irrigation, technical extension workers from MAG-FOR and INTA, etc.) A team must include more than three experts of different specialties, and the participation of the MAG-FOR staff is indispensable in order to carry out the on-the-job-training; this is because from the second year the project will be carried out only by the staff from MAG-FOR.



List of the candidate areas for the Agricultural Development Model

Departments	No	Areas	Water Source	Existing Facilities	Farms (families)	Area (Mz.)	Crops
CHINANDEGA	1	COMARCA EL RAIZAL y COMARCA EL OJO DE AGUA	Ground Water		80	300	Corn, Sorghum, Sesame
	2	Sn. Benito Occidental	Ground Water		28	50	Pineapple, Fruit, Vegetables
	3	El Trapichon	River El Trapichon		30	150	Corn, Sorghum, Sesame
	4	COMARCA GRECIA No.4	Ground Water	2 Wells	20	150	Corn, Sorghum, Sesame
	5	Eliseo Carvojal	Ground Water	1 Well	12	60	Corn, Sorghum, Sesame
	6	Mauricio Abddalah	Ground Water		40	240	Corn, Rice, Banana
	7	San José	Ground Water	2 Wells	40	250	Sorghum, Corn, Rice, Banana
	8	Pancasan	Ground Water	1 Well/Lake	16	230	Corn, Banana, Rice, Vegetables
	9	COMARCA LA PICOTA	Ground Water		100	700	Corn, Sorghum, Sesame, Soya
	10	San Luiz	Ground Water		30	800	Rice, Corn, Sorghum, Vegetables
	11	COMARCA COSIGUINA	Ground Water		71	880	Sesame, Corn, Watermelon, Sorghum
	12	Caplin	Ground Water		50	400	Sesame, Corn, Watermelon
	13	COMARCA QUILACA	Ground Water		70	350	Corn, Sesame, Vegetables
	14	Com. Huispante	Ground Water		20	212	Corn, Vegetables
	15	CHICHIGALPA: La Laguna	Ground Water	1 Well	40	150	Rice, Soya, Corn, Sorghum
	16	CHICHIGALPA:COMARCA QUITANC SUR	Ground Water		45	360	Soya, Rice, Sesame, Cana
	17	CHICHIGALPA: Valle No.1 y No.2	Ground Water		43	80	Soya, Rice, Yuca, Corn
	18	POSOLTEGA: Filiberto Morales	Ground Water		15	200	Soya, Rice, Sorghum, Sesame
	19	POSOLTEGA: El Trianon	River Posoltega	3	68	680	Cana, Corn, Sesame, Rice, Soya
	20	POSOLTEGA: Chiquimula	River		35	150	Corn, Sorghum, Rice
	21	POSOLTEGA: Gilberto	Ground Water		18	40	Corn, Sorghum, Vegetables
	22	SOMOTILLO: Ceibas	River		60	400	Corn, Watermelon
	23	VILLANUEVA:RINCON GARCIA	Ground Water		40	70	Sesame, Corn, Soya, Sorghum
	24	VILLANUEVA: Canafistola	Ground Water		100	1,000	Sesame, Corn, Soya, Sorghum
	25	Israel	Ground Water		20	25	Corn, Sorghum, Rice
LEON	26	CHACARA SECA	Ground Water	1 Well	200	1,200	Corn, Sorghum, Yuca, Sesame
	27	San Carlos	El Ojoche River / Ground Water		20	100	Corn, Sorghum, Sesame
	28	QUEZALGUAQUE: Punta Arena	Ground Water		35	400	Soya, Corn
	29	QUEZALGUAQUE: Los Remedios	Ground Water		25	120	Soya, Corn, Sorghum
	30	TELICA:MIGUEL ANGEL ORTEZ	Ground Water		32	150	Soya, Corn, Sorghum
	31	TELICA: El Trabuco	Underground Water		34	60	Soya, Sorghum, Corn, Sesame

Checklist for the Screening of the Priority Areas (2/2)

Departments	No	Areas	Water Source	Existing Facilities	Farms (families)	Area (Mz.)	Crops
LEON	32	COMARCA SAGRADO CORAZON DE JESUS	Ground Water		25	100	Corn, Sorghum, Sesame
	33	OMAR TORRIJOS	Salinas Grandes River/ Ground Water	Pump	47	200	Corn, Sorghum
	34	Ojo de Aguas: Calle Daniel Amador	River		50	40	Sorghum, Corn, Vegetables
	35	Ojo de Aguas: La Pilas	River		80	15	Corn, Sorghum, Vegetables
	36	MALPAISILLO: San Carlos	Ground Water		60	250	Corn, Sorghum, Sesame
	37	MALPAISILLO: El Petén	Ground Water		50	300	Corn, Sorghum, Sesame
	38	MALPAISILLO: El Tigre y Yugo	Ground Water		25	100	Corn, Sorghum, Sesame
	39	MALPAISILLO: Valle Las Zapataz	Ground Water		30	400	Corn, Sorghum, Sesame
	40	MALPAISILLO: San Claudio	Ground Water		150	600	Corn, Sorghum, Sesame
	41	MALPAISILLO: El Espino	Ground Water		40	400	Sorghum, Sesame, Corn
	42	MALPALPAISILLO: Las Lomas	Ground Water		180	1,800	Sorghum, Sesame, Corn
	43	La JICARAL: Los Cerritos	Ground Water		60	500	Corn, Sorghum, Sesame
	44	LA JICARAL: La Plita	Ground Water		23	200	Sorghum, Sesame, Corn, Watermelon
	45	LA JICARAL : LOS ZALZALES	Ground Water		35	500	Sorghum, Sesame, Corn
	46	EL SAUCE: Los Tololos	Ground Water		60	250	Corn, Sorghum, Sesame
	47	EL SAUCE: COMARCA LOS LOROS	Ground Water		30	80	Corn, Sorghum, Sesame
	48	RÍO GRANDE: Salale	River Salala		80	600	Corn, Frijol
	49	RÍO GRANDE: El Campamento	Ground Water		40	150	Corn, Frijol
	50	RÍO GRANDE: Nacascolo	Ground Water		20	80	Corn, Frijol
	51	ACHUAPA: La Perla	Ground Water		20	100	Corn, Frijol
	52	LA PAZ CENTRO: Amatitan	Ground Water		20	600	Corn, Sorghum
	53	LA PAZ CENTRO: Santa Barbaras	Ground Water		17	230	Corn, Sorghum, Sesame
	54	LA PAZ CENTRO: COMARCA CHACARA	Ground Water		20	70	Corn, Sorghum
	55	NAGAROTE: San Gabriel	Ground Water		50	600	Corn, Sorghum, Vegetables

Checking list for the Screening of the Priority Areas (1/2)

1. Areas socially suitable for the development of the agricultural development model

Evaluation items	Evaluation		
	Good	Normal	Inadequate
A. No. of farmers willing to improve farm management.	More than half of population	Few	None
B. No. of farmers live in the surrounding area (in case of using the river water).	More than 30	More than 20	Less than 20
C. No. of small scale farmers live in the surrounding area (in case of using the river water).	More than 10	More than 5	Less than 5
D. The farmers can mortgage their land or houses to obtain agricultural credit.	They can		They can not
E. Conflict among the farmers.	No conflict		There is conflict
F. Leader recognized by local inhabitants.	There is	There is not	

2. Availability of enough water resources for irrigation

(1) When water is taken from underground sources

Evaluation items	Evaluation		
	Good	Normal	Inadequate
A. The capacity of the wells	60 l/sec or more	40 l/sec or more	Less than 40 l/sec
B. Depth of the watertable in the dry season	Watertable level during the dry season is 60m GL or less.	Watertable level during the dry season is between 40 to 60 m GL.	Watertable level during the dry season is above 60m GL.
C. Water quality for irrigation.	There is no problem according to the existing data and irrigation results in the zone.		There are problems according to the existing data and irrigation results in the zone.
D. Existence of irrigation wells (may not being used at present)	There are wells operating.	There are wells but they are not operating.	

(2) When water is taken from rivers

Evaluation Items	Evaluation		
	Good	Normal	Inadequate
A. The volume of exploitable water.	20 l/sec or more	10 l/sec or more	Less than 10 l/sec
B. Difference in altitude between the river and the farms	6m or less	Between 6 and 12m	12m or more
C. Water quality for irrigation.	There is no problem according to the existing data and irrigation results in the zone.		There are problems according to the existing data and irrigation results in the zone.

3. Existence of grouped farms with soils of good quality

Evaluation items	Evaluation		
	Good	Normal	Inadequate
A. Farm size	Each farm has more than 2 Mz.	If renting contracts are subscribed, then almost all farms will be about 2 Mz.	Even when renting contracts are subscribed the farms are less than 2 Mz..
B. Location of the farms	The irrigable farms are concentrated in an area of 1 km x 1 km.	The irrigable farms are concentrated in an area of 2 km x 2 km.	The irrigable farms are not concentrated in an area of 1 km x 1 km.
C. Productivity of the soils	The production is above the average for Region II of the Pacific Coast.	The production is similar to the average for Region II of the Pacific Coast.	The production is below the average for Region II of the Pacific Coast.
D. Topography	Soils are not affected by erosion.		Soils are dragged by the rains.
E. Rainfall pattern.	Impact of the “canicula” is relatively weak within the Region II.	Impact of the “canicula” is similar to other zones in Region II.	

Checking list for the screening of the priority areas (2/2)

4. Good relationship concerning landowners and tenants
(In case of renting lands)

Evaluation Items	Evaluation		
	Good	Normal	Inadequate
A. Farmers experience in the renting lands.	They are used to	They are not used to	

5. Good market accesibility

Evaluation Items	Evaluation		
	Good	Normal	Inadequate
A. Proximity to León, Chinandega or Managua.	Less than 30 minutes by car	Less than 1 hour by car	More than 1 hour by car
B. Road Accesibility	Is located along Highway #12.	Is located along paved highways.	

Evaluation method of the checking list

1. How to fill the checking list

- Concerning the sources for irrigation purposes, it must be selected between the underground water and river water and the data corresponding to the sources is filled up. If the two sources are usable, fundamentally the river water will be chosen as it is relatively more economical.
- The checking list will be filled up on a tentative basis, visiting the areas and carrying out interviews and field research. The study will be made by several people filling up the respective sheets.
- The final version of the checking list will be filled up in the office, in a working table by the people inolved in the field work. In this case, it is necessary to exhaustively discuss the topics so that the subjectivity of the persons are not reflected in the results.

2. How to make the evaluation

- The evaluation is made based on the points being added up. The category of "Good" will be equivalent to 3 points and 1 point the "Regular". Each number of points (3 and 1) will be multiplied by the number of corresponding items and the final result will be obtained.
- The category "Inadequate" will be determinant. If there is an item that received this qualification, the area receiving it must be discarded from the list.
- If the area has a river as water resource for irrigation purposes, it will get 3 points more because the cost of the initial investment will be lower.
- If the area offers the possibility of implementing the project without needing to rent the land, then it will get 9 additional points.

Example 1: An area that uses the water from the river for irrigation, offers the possibility of executing the project without needing to rent the land, and that has 6 items qualified as "Good" and 10 items with "Regular", would have the following classification: 3 + 9 + (3 points x 6 items) + (1 point x 10 items) = 40 points.
Example 2: An area that takes the water from wells and that needs to rent lands for the project, has 9 items classified as "Good" and 10 items with "Regular" will have the following classification: 0 + 0 + (3 points x 9 items) + (1 point x 10 items) = 37 points.

A: Fulfilling of the organization's requirements

-Activities of the farmers-

- Actively participate in the analysis of the problems
- Actively participate in the analysis of the objectives to solve the problems
- Understand the scope and incentives of the Plan
- Define the required activities and division of responsibilities
- Define the strategies to achieve the responsibilities
- Provide the land to MAG-FOR for the installation of the pumps

To achieve the sustainable development of the small scale farmers in Nicaragua, it is indispensable the active participation of the farmers themselves. In order to encourage them to act dynamically and under their own volition, the participatory development will be promoted. The type of development will be "bottom-up". The actions will be defined to analyze and solve the constraining development factors, the division of responsibilities for each activity, as well as the rules that guarantee the normal functioning of the operations. Through these activities, the farmers will understand the incentives of participating in the project, as well as the duties that must be complied with. On the other hand, the farmers must facilitate to MAG-FOR a land of 5m x 5m in the sites where the irrigation facilities (in particular, wells and pumps) will be constructed.

-Institutional Support-

- Select and organize the meeting place and the participating farmers.
- Provide the necessary instruments and advice the farmers in the participatory diagnosis of the actual conditions.
- Explain the components of the Plan and its usefulness for the solution of the problems (make them understand the incentives for the creation of the farmers' organizations).

The small scale farmers in Nicaragua are used to be told what they have to do, but not to think by themselves and to act under their own volition. On the other hand, it is also true that the individualism predominates among them. Under these circumstances, it is important to make them fully understand the incentives and objectives of the project at the moment of forming the farmers' groups. At that moment, they must define by themselves the activities to be carried out and the rules required for the achievement of such activities by the own members of the group.

The institutions must organize workshops within the participatory framework to make it easy for the farmers to understand the advantages of the project. These workshops must be organized following the methodology of participatory development.

-Assistance to the supporting institutions-

The experiences in the participatory development methodology of the Nicaraguan institutions (MAG-FOR and INTA) are few and it requires the participating of experts to handle such methodology.

-Clear definition of the incentives and duties-

To make the farmers assume the main role in the project, it is necessary that they must have a clear idea of the incentives offered by the project and the duties that must be carried out to perform the activities. This requires the identification of the actual problems and thoroughly understand in which way the development model project will contribute to solve them. Once they well understand the incentives, it will be easier to make them understand the duties that they must assume in order to make the incentives become true by administering the project. At this point, the institutions must provide a strong orientation so that the farmers think by themselves and understand the true notion of the words "incentive" and "duty", and not in a superficial way. The required procedures are presented below:

<Procedures to help the farmers to understand the incentives of the project>

① Understand the participatory methodology

A high number of small scale farmers in Nicaragua obtained their lands by the Agrarian Reform carried out by the Sandinista government. The beneficiaries, besides the land, received equipment and materials, as well as the resources for managing their farms. The next governments received support from the NGOs and cooperation organizations both national and international. This background have influenced the mentality of the actual small scale farmers who want to strongly depend on others but themselves. The studies made up to date confirm this conclusion.

To make the national small scale farmers to get rid of this dependence, it is necessary that they assume the protagonist role in the development of agriculture. The participatory planning is considered as an optimal method for awakening the initiative of the farmers and make them overcome their present constraints. This is achieved that make them understand that agriculture is an entrepreneurial activity which will make them put more efforts towards their self-development.

The first step that the supporting institutions must give in this phase is to fully understand the meaning of carrying out the participatory planning.

② Identify and understand the problems within the group and analyze the problems together

Once the institutions have identified the realities of the zones, together with the farmers, the next step is to share the difficulties that are faced by the farmers through the analysis of the problems. The clearing up of the real situation of the rural zone will highlight the problems that can be found in the zone. It will be discussed with the farmers about the main factors that constrain the agricultural development and systematically analyze the causes for such problems (using the logical framework). The participation of the supporting institutions in this process of analysis will allow to complement the limitation that the farmers have in analyzing the problem and to avoid the shallowness of the analysis (this is because the community can only see what is its surroundings and, even though it is true that the farmers have a certain knowledge and enough experiences within their action area, they do not know too much about what happens outside their area).

③ Analyze the means to solve the problems- Analyze the objectives-

The next step consists of analyzing the objectives in the workshops organized within the

participatory framework, in order to solve the problems analyzed incorporating the opinions and needs of the inhabitants. In this process, the methods to solve the problems are studied in a global way, using the logical framework. The protagonist of the debates must always be the farmers. The staff of the institutions must participate in the workshops as advisers in the process of analyzing the problems. The participation of the technical staff of the institutions will help the farmers to widen their scope of vision and enrich their knowledge. This point is very important in the sense of increasing the capacity of the farmers (strengthening).

It must also be remembered that the organization of the workshops for the analysis of the problems and objectives require the presence of a moderator who knows the use of the logical framework.

<Procedures for establishment of the duties>

① Define the required actions for the solution of the problems and the division of the responsibilities

The analysis of the objectives will highlight the means (actions) necessary for the solution of the problems. The next step will be the definition of the "who", "when" and "how" these actions will be carried out. At the moment of defining the responsibilities, it is necessary to take into account the predominance of individualism among the small scale farmers, and it will be incorporated in the activities related with the operation and maintenance of the irrigation facilities, getting agricultural credit, group purchase of materials, etc., in the initial stage of the project, while the activities of harvesting and forwarding of products will be incorporated after the organization has become matured enough.

This definition of responsibilities by the farmers themselves becomes a process of crucial importance to make them aware of the fact that they are the protagonists of the project, which puts forward the need of minimizing the institutional intervention notwithstanding how slow the process may be.

In this moment it will be let known to the beneficiaries that they must assume their corresponding share of the construction cost of the irrigation facilities and their agreement must be obtained.

② Define the strategies for the fulfillment of the duties- Clearly define the "duties" of the farmers

Once defined the division of the responsibilities, and the activities that each one must carry out, the internal rules of the group will be elaborated and these will rule the fulfillment of these activities. The rules will help to clarify the duties and responsibilities of the farmers. The fact that they have identified the causes of the problems and taken care of carrying out the activities to solve them, implies that they have assumed the responsibility of implementing such actions. The internal rules of the group define the way how an individual who has not fulfilled his duties will have to assume his responsibility. These measures will be defined by the participant farmers, and must be ratified by the institutions. Only when the inhabitants have defined realistic countermeasure by themselves, the project could be executed.

As basic rules required for the execution of the plan, the following can be considered.

These rules must also include internal sanctions, but because they must be defined by the farmers themselves at the moment of getting organized, under the guidance of MAG-FOR, they are not included here. The rules must cover all activities to be carried out by the organization. These are grouped in four categories at the initial stage of the project. They are: a) rules about the farmers' organization; b)agricultural credit; c)operation of the irrigation facilities, and; d)collective purchase. An example of the main clauses is given below:

① General rules about the farmers' organizations

Decision topics:	The topics to be defined by the farmers' organization include those who go from the definition of the leader of the organization, the persons in charge of each activity, collective activities of agricultural works, operation and maintenance of the irrigation facilities, agricultural credit, collective purchase, etc., to the sanctions to be applied internally to the members who did not fulfill their obligations.
Method of decision taking:	The decision must be taken in a farmers' assembly with participation of a determined number of members, following a democratic process for each discussed topic.
Responsibilities of the members:	All the members must respect the decisions taken at the assembly.
Cost contribution:	The members must assume the fair share towards covering the administrative costs of the organization. These include the cost of transportation, incidental expenses, etc.

② Rules about the agricultural credit

To take advantage of the agricultural credit, it is required to subscribe a separate contract with the credit institution. The rules for the repayment of the debt will be included in such contract, Therefore, here are presented the rules of the activities required to be fulfilled internally by the farmers' organization to channel the agricultural loans.

Communication:	It is required to periodically obtain from the financial organizations, the information required by the members, including the outstanding debt and transmit this information to the members.
Loan application:	It is required to carry out the procedures for loan application and subscription of the loan in representation of the members.
Collective purchase:	It is required to ask the credit organization for the purchase of equipment, in coordination of the person in charge of purchases.

③ Rules about the operation of the irrigation facilities

Irrigation of farms:	The members must operate the irrigation facilities (operate the sprinklers, etc.) according to the irrigation plan.

	Pump operation:	The operators of the pump must operate it according to the irrigation plan.
	Maintenance of the pump:	It is necessary to carry out periodic maintenance operations for pumps, engines, and other pumping equipment. In case of a failure, the workshop in charge of repairs must be contacted as soon as possible and request the repair service.
	Maintenance of the Sprinklers:	El mantenimiento de los juegos de aspersores debe ser asumido por todos los miembros. Además de la limpieza rutinaria, se requiere guardar los equipos en la bodega al finalizar la temporada de riego (inicio de la época de lluvia), echar lubricantes, reparar las fallas, etc.
④	Rules about collective purchase	
	Collecting price quotations:	It is required to ask and obtain prices quotations from various sellers that can offer fair prices for equipment and machinery with a guaranteed quality.
	Leasing contract:	It is required to subscribe a leasing contract with the seller who has offered the lowest price. Also, it is required to process the loan in coordination with the person in charge of financial matters.
	Transport:	It is required to make arrangements for transportation of the equipment and materials.
	Distribution of equipment and materials:	It is required to distribute the equipment and materials in a fair way among the members.

B: Study of the contents of the Plan

-Activities of the farmers-

- Define the crop varieties
- Elaborate the farm management plan including activities starting from the preparations for cultivation to cropping and forwarding to the market.
- Train the key farmers in the most progressive farms.
- Select the cultivation fields and define the renting system

The Plan is made by three components: advice in the farm management techniques, farmers' organization, etc.; implementation of the irrigation systems, and; implementation of the credit system. Their synergetic effect will be limited if they are implemented independently one from each other, Therefore, it is necessary that they must be implemented simultaneously in order to obtain greater benefits. The farmers must correctly understand the contents of each component and discuss and take decisions through their organizations.

Specially, due to the fact that its is proposed to implement the sprinkler irrigation taking the water from the wells, it is necessary to cluster the parcels. For that purpose, it is proposed to consolidate

the cultivation fields of the members of the farmers' organization by the land renting system. The renting of the lands must be made through a clearly defined process and subscribe the corresponding contract according to the existing laws.

Also, before implementing a concrete plan, the leaders and the key farmers (two or three in each zone) will support a training program of the On-the-job training in the most advanced farms which are carrying on a similar farm management plan.

-Institutional support-

- Coordinate the general framework of the present Plan with the needs of the farmers.
- Exhibit the crops varieties making comparisons of the agricultural techniques of the farmers and the required techniques for the cultivation of each proposed variety
- Coordinate the training in the farms.
- Provide support in the subscription of the rent agreement.

The institutional support will consist of making the farmers understand the needs of the components of the Plan through the farmers' organizations. However, this task must be a continuous process starting from the formation of the organizations. The farmers can not elaborate the farm management plans by themselves at the initial stage of the Plan and require the institutional support for the selection of the crops and in the elaboration of a coherent plan with the other farms in the zone.

Because in Nicaragua there is no in-farm-training system (from farmer to farmer), the institutions must coordinate the link among the farmers to be trained and the farms where the training will take place. Normally, a basic training cycle covers the stage going from the cultivation of a crop to its harvesting and selling. The farmers to be trained must freely provide the service in the farm where the training is going to take place, and in the farm they will receive the technical training, food and lodging, so to be mutually benefited. However, it is necessary provide an economic support to the farms by an amount around C$400 per month, considering the living expenses of the families of the farmers to be trained.

The renting of the lands must be based on legal and official procedures. Because the farmers do not know these procedures, it is required that the institutions should provide support on this aspect too. As the contribution of each farmer from an obtained rural credit is defined based on the surface of the parcels, the definition of the surface must be made, basically, by the administrative institutions.

-Assistance to the supporting institutions-

For the understanding of the components of the Plan it is required to carry out the participatory methodology and requires provision of technical assistance to the institutions on this aspect. Also, to increase the practical effect of the components, it is necessary to have the participation of the experts.

C: Establishment of the supporting systems-1

-Supporting system-

The support to the farmers in this phase does not refer to the assistance proceeding to the

execution of the Project, but the support for the farms' management which includes all activities from land preparation, harvesting and sale; it also includes the elaboration of the cultivation plan for the next season. The crucial point in the establishment of the supporting system is to make the personnel of the institutions aware of the need for them to take the total responsibility of the task of supporting the farmers within the framework of the present Plan. For that purpose, it is necessary to clarify the basic content of the supporting system, and the concrete activities must be decided among the people in charge of the execution phase. It is also necessary to carry out the technological transfer from the experts to the personnel of the Nicaraguan supporting institutions at the initial stage of each project.

The support to the farmers (farmers' organization) is divided, in general terms, into the technical assistance for crops and farm management, and the support to the farmers organizations. The Development Model Plan requires the farmers to manage the farms in a systematic way using the farmers' organizations. By doing this, the support for farm management and to the farmers' organizations can be done simultaneously. The topics related with the farmers' organizations will be the responsibility of MAG-FOR, while INTA will be in charge of the items related to cultivation techniques. It will be also useful to have the participation of the NGOs. About the role of the respective institutions and the coordination of the works, this will be dealt in the section describing the Execution Plan of the Project.

- Guidelines for the support to the farmers' organizations (farm management)

The support to the farmers' organizations (farm management) covers all topics related to agricultural management, except the cultivation techniques. The topics included, among others, are: collective purchase of inputs, operation and maintenance of the irrigation facilities, sale of the crops, processing for credit applications, and management of farmers' organizations within the framework of the Development Model Plan. Those aspects that require special attention at the moment of providing the support to the farmers are shown below. These have been identified during the P/S stage.

(1) The attitude of "think, work hard and take responsibility for the consequences" is indispensable for the farmers participating in the Project. The definitive execution plan must be decided by the farmers themselves even if the process is slow.
(2) The definition of the area of the parcels within the rent system is a task that will directly influence the income level of each farm. Therefore, this must be made at the moment of creating a farmers' organization by a supporting institution that guarantees the equity and neutrality of the process and that is trusted by the farmers.
(3) It is hard that the farmers act according to their own will at least during the initial stage of the Project, and it is required to provide support for purchasing inputs and machinery, etc.
(4) It is necessary in the initial stage of the Project to emphasize the importance and meaning of taking records of the crops for control purposes, and to carry out on-the-job training for the farmers so that they can work with recording formats.
(5) It is necessary to provide training to the farmers on preventive periodic maintenance for the irrigation facilities so that the users themselves can assume this task
(6) To obtain the agricultural credit it is necessary to subscribe beforehand the corresponding contract. The beneficiaries require the support in this stage because it is difficult for them to exactly understand the details of the contract. The same must be done at the moment of repaying the loan, etc.

- Support for the cultivation activities

The support for the cultivation activities will be made according to the Development Model Plan and will cover the definition of the crops, elaboration of the crop pattern, cultivation and

harvesting. Because the actual system used by INTA for extension of the cultivation techniques is not adequate enough, a combined methodology of T&V will be applied by incorporating the participation of the NGOs, training of farmers' leaders in order to improve the cultivation techniques within the framework of the farmers' organizations. Below are the aspects that require special consideration at the moment of providing support to the farmers. These are based on the experiences gained during the P/S phase.

(1) The attitude of "think, work hard and take responsibility for the consequences" is indispensable for the farmers participating in the Project. The definitive execution plan must be decided by the farmers themselves even if the process is slow.
(2) Elaborate a cropping plan that awakens the initiative of the farmers, respecting the cultivation plan elaborated by the farmers' organization.
(3) It is not pertinent to introduce new crops for those for which the supporting organizations do not have any data because it is too much risky, except when the beneficiaries have adequate cultivation techniques for their introduction.
(4) In the case of initiating the production of new crops, the extension of the pertinent techniques will be made through the creation of demonstration farms to show to the farmers the difference between the conventional and improved methods.
(5) A systematic training plan will be executed oriented towards the farmers according to their needs.

D: Establishment of supporting systems-2

-Implementation of mini-irrigation systems-

In case of getting free irrigation systems, the users usually are less conscious that these systems are part of their assets, and therefore, they do not give an appropriate operation and maintenance. Therefore, for the implementation of the irrigation systems, the beneficiaries must assume a determined cost. It is necessary to reach an agreement through the farmers' organizations and, in this way, guarantee the establishment of an adequate operation and maintenance system.

Based on the experiences of the P/S, the maximum requirement for irrigation water is 69 l/min/Mz. Therefore, to irrigate from 20 to 40 Mz with underground waters, it will required to wells with a capacity of 1,380 l/min to 2,760 l/min. The existing wells in Telica and El Espino have a capacity over 3,000 l/min, and, therefore, it is estimated that the wells built in the Region II could meet the requirements. In any case, it is necessary to make a verification of the capacity of the wells before implementing the projects.

	Problems of the irrigation systems identified through the P/S
Telica	- The engine (more than 20 years old) shows frequent mechanical problems - The pipes present frequent leaks from the joints onwards (pipes installed more than 20 years ago)
El Espino	- Problems created by the lack of awareness from the farmers

E: Establishment of the supporting systems-3

-Establishment of the agricultural credit system-

In case that the farmers manage their farms according to the framework established in the F/S, it is necessary to channel the agricultural credit to cover the lack of necessary economic resources.

For this motive, the agricultural credit becomes an indispensable component for the execution of the project and will be incorporated within the supporting plan for the farmers of the present Development Model Plan.

Because the Development Model Plan will start in the zones with relatively favorable topographic conditions and good access to the market, the same conditions found for the Development Model of Telica can be applied. In this way, the resources required for the proposed farm management are estimated to be C$11,800/Mz per year. Therefore, if the Development Model Plan is executed in five zones per year, with 40 Mz each (total 200 Mz), an amount of C$2,360,000 per year will be required.

In the P/S the proposed profit could not be achieved due to changes in the market conditions, supporting system, etc. The internal factors of the project, including the deficiencies of the supporting system can be solved, but not the external conditions such as a change in the market or the adverse natural conditions. In the case of floods, sudden drop of the market prices, etc., the farmers will not be able to repay the debts in the proposed way. Also, it must be taken into account that at the initial stage of the Development Model Plan, it is probable that the expected profit may not be realized. Therefore, the funds for agricultural credit must be planned with enough consideration to be able to respond to these contingencies.

In the P/S, there were some farmers who refused to pay their debts even though they had enough resources for repayment. To avoid the occurrence of such situations, it is necessary to mortgage some of their assets.

The administration of the agricultural credit will be assigned to a NGO which has been providing this service in this zone. As this NGO imposes an interest rate of 3% annual for each loan, in the present Plan the same interest rate will be applied.

Requisites for the creation of the agricultural credit

Items	Requisites
Beneficiaries	Farmers to be subject of the Plan (80 farmers per year, with a total of more or less 400 farmers)
Objectives	Inputs (seeds, fertilizers, agro-chemicals, etc.), rental services, hiring of labor, etc.
Executing agency	NGO
Management and administration	Organization for the administration of the Project.
Conditions of the credit	Interest: 6% (inflation rate) + 3% (commission) = 9% annual Collateral: own assets Repayment: in cash Repayment delay: only accepted when the debtor cannot pay due to adverse climate or market conditions, etc.

-Procedures for the loan and repayment of the agricultural credit-

To avoid the unjustified non-payment of debts, a series of rules must be made concerning the granting and repayment of the loans. The basic procedures are described below.

(1) At the moment of granting the loan:

- At the moment of granting the loan, the financing entity and the farmers' organization requesting the loan will subscribe a contract defining the maximum amount, period, and the

objectives of the agricultural credit.

- In order for the granted resources not to be directly transferred to the farmers, a flow of resources among the farmers, traders, and the financing entity will be established.
- In case of requesting the credit for buying goods and services, the procedures will be as follows: the farmers ask the commercial store for a price quotation for the goods and services they want to purchase and present it to the financial entity for its financing; then they take to the store a letter of payment issued by the financing entity and finally they get the goods and services purchased. The owner of the store receives from the financing entity the payment for the corresponding purchase in cash or by a check issued against the letter of payment issued for such amount.
- In the case of requesting the credit to buy fuel for the irrigation facilities, the procedures will be as follows: the farmers' organizations subscribe a payment contract for credit with a determined gas station; the financing entity will give to such station a payment certificate based on the contract mentioned above; the farmers' organizations every time they buy fuel, oil, etc., sign the corresponding receipt; and the owner of the gas station receives from the financing entity the payment for the corresponding amount in cash or by check against the signed receipts.

(2) At the moment of the repayment

- The amount that each farm can repay is determined based on the gross profits and the cost of living until the next selling season of the harvested crops.
- The farmers ask for an extension of the deadline for repayment if the amount they can repay do not cover the outstanding debt.
- An examination is carried out to see if the extension of the repayment period is justified.
- If the request is found to be justified, it is decided to accept an extension of the repayment periods until the farm management has reach an adequate stability.
- If the request is found not to be enough justified, the farmers' organization will be questioned and will be asked to repay the debt.
- If they do not want to repay the debt, then the mortgaged collateral will be taken or other measures will be adopted.

F: Preparations for cultivation

-Farmers-

- Elaborate the farm management plan (size of the farm, crops to be cultivated, harvesting and forwarding, etc.).
- Select and define the fields and cultivation method.

The members will elaborate the detailed plans for preparation of cultivation in order to achieve the goals of the respective farms through meetings among the farmers.

(1) Elaboration of the farm management plan

The farm management must contain the proposed objective, size of the farm, available family labor, agricultural experiences, hiring of non-family labor in the following way:

① Size of the farm:
Cultivated area, number of working members of the household, cultivated crops so far, agricultural experience, etc.

② Crops:
Crop varieties, cultivation area, cultivation seasons, nursery costs, agro-chemicals, hiring of labor, cost of renting of the machinery required to carry out the labors required by the plan, cultivation plan and irrigation costs, proposed profit, etc.

③ Harvesting and forwarding
The harvesting method for each crop, selection of the forwarding mode of the products (individual or collectively), concrete marketing routes, plan of revenues and expenditures that include the projected gross profits and the investment cost based on reasonable market prices, etc.

In the next page a copy of the format that covers items 1 to 3 above is presented.

1. Nombre del agricultor			Sexo		Edad	

2. Miembros de la familia edad: A ≦16, B = 16～60, C ≧ 61

Nombre	Relación con el jefe	Edad	Sexo	Labor familiar 1. Si 2. No	Nivel escolar	Año de experiencia

3. Tierra propia y resultados de cultivo en los últimos dos años (en tierra propia)

No. de lote	Mz	Propiedad de terreno *1)	Condición de tierra *2)	Antes de dos años			Antes de un año		
				Cultivo	Primera (qq/Mz)	Postrera (qq/Mz)	Cultivo	Primera (qq/Mz)	Postrera (qq/Mz)

Nota: Propiedad de terreno: *1) 1. Propietario; 2. Posesión colectiva; 3. Alquilado; 4. Hipotecado
Condición de terreno *2) 1. Tierra alta plana; 2. Con pendiente; 3. Tierra baja (area baja)

4. Plan de cultivo de nuevos rubros

Cultivo		Veriedad		Area de cultivo	Mz
Spoca de cultivo	1. Primera	2. Postrera		1. Con riego 2. Riego suplementario 3. Secano	

Costo y especif. de plantones	Cantidad /Mz	Precio unit.	Area de cultivo	Sub total
Semilla				
Fertilizante-1				
Fertilizante-2				
Fertilizante-3				
Total global			①	

El caso primero de riego

*** C$/mes/Mz x El número de meses para regar x Area de cultivo (Mz) = [ ] C$ ⑤

El segundo caso de riego

*** C$/días/Mz x tres días x área de cultivo (Mz) = [ ] C$ ⑥

Agro químico / specificación	Cantidad /Mz	Precio unit.	Area de cultivo	Sub total
Agro-químico-1				
Agro-químico-2				
Agro-químico-3				
Agro-químico-4				
Total			②	

Fondo de reserva para el manten. de facilidad de riego ⑦

Costo de terreno ⑧

Rendimiento propuesto:

Método de cosechar; 1. manual 2. cosechadora

El método de venta; 1. individual 2. colectivo

Canal de venta; 1. intermediario 2. corredor mercado 3. venta individual

Servicio contratado	pase /Mz	Precio unit.	Area de cultivo	Sub total
Gradeo				
Nivalación				
Siembra				
Aplicación de fertilizante				
Apl. de químico				
Cosecha				
Transportación				
Total global			③	

Perspectiva de balance

Ingreso bruto: el producto para la venta x precio unit. = [ ]C$ ⑨

Ingreso neto: ⑨-(①+②+③+④+⑤or⑥+⑦+⑧) = [ ]C$

Principales actividades técnicas a introducir

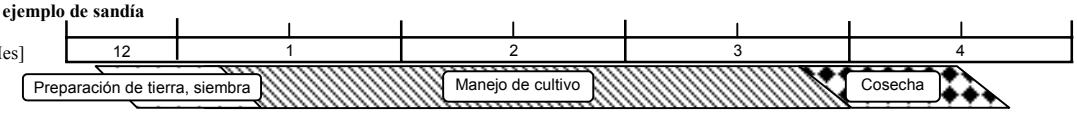
Referir al conjunto de extensión ejemplo de sandía

①Arado
②Gradeo
③Gradeo y nivelacion
④Pre-riego
⑤Hacer surcos (rayado)
⑥Abono basico
⑦Siembra
⑧Raleo de plantas
⑨Poda y areglo de guias
⑩Abono posterior-1
⑪Abono posterior-2
⑫Abono posterior-3
⑬Abono posterior-4
⑭Cosecha

Mano de obra	D/H /Mz	Precio unit.	Area de cultivo	Sub total
Operación agrícola-1				
Operación agrícola-2				
Operación agrícola-3				
Operación agrícola-4				
Total global			④	

5. Calendario de Cultivo

El ejemplo de sandía



Principales actividades técnicas: ①②③④ ⑤⑥⑦ ⑧ ⑩ ⑪ ⑫ ⑨ ⑬ ⑭

(2) On-farm training plan for key farmers

If new crops are proposed according to the farm management plan, the participant candidates will be selected through meetings with the farmers. They will be trained at farms with more advanced techniques. A training plan or on-the-job training will be elaborated, presented and discussed with the supporting organizations. In the training plan there must be recorded the name of the participants, the duration and location of the training, the type of crop, the tasks that must be performed during the training, and the role that the participants will have within the farmers' organizations once the training is over.

This training modality at the farms in the more advanced zones offers the following advantages:

1 Encourage the desire to cultivate and visualize good examples of new crops to be introduced.

2 The practices help to deepen the knowledge of the aspects that are difficult to acquire through lectures or exchange of information with the extension officers.

3 The participants can learn the entrepreneurship skills of the more advanced farmers.

4 The technical level of the farmers' organizations can be increased by sharing and exchanging the knowledge and information through the cultivation that is carried out around the participants of the training.

(3) Selection of cultivation fields and definition of the renting system

In case that it has been decided to implement the mini-irrigation facilities, the sprinkler irrigation method ground waters require that the parcels must be clustered in order to increase the irrigation efficiency. Therefore, it is necessary to discuss and define with the landowners the contents of the rent contract and present the draft to the supporting organizations.

-Institutional support-

- Provide support in the elaboration of the farm management plan.
- Coordinate the on-farm training.
- Provide support in the processing of the agricultural credit.
- Provide support in the collective purchase of services and inputs.
- Provide technical assistance for the cultivation (ploughing, etc.).
- Execute the definition of the parcels.

In the initial stage of the Project, it can not be expected that the farmers have enough skills to elaborate a plan. Therefore, it is necessary to provide them with institutional support through a on-the-job training until the farmers could understand the process and do it by themselves. Concerning the farm management plan, they will be given enough detailed advice about the requisites that the plan must fulfill as this is used as an instrument to channel credit. For the on-farm training, the zone where the training will take place will be decided based on the type of new crops that will be produced according to the farm management plan, and the necessary coordination will be made including the negotiations with the owners of the farms where the training will take place. On the other hand, the farmers will have to buy the inputs and services following the procedures to receive an agricultural credit. It is also required to provide a strong support on this aspect, because the farmers still do not know the procedures due to a lack of experience. The surface to be cultivated at each farm will be decided during the process of definition of the parcels. Because the cultivation are directly affects the amount to be received

through the agricultural credit, it is necessary that a supporting organization able to guarantee equity and neutrality should make the measurement of the parcels in front of the farmers.

-Assistance to the supporting institutions-

The elaboration of the farm management plan must be a "bottom-up" process. It means that the plan must be elaborated by the farmers who will implement it following their own judgment, under the auspices and support of the supporting organizations. Therefore, it is necessary to carry out the assistance to the supporting organizations by the agricultural experts who know this methodology.

G: Cultivation

-Activities of the farmers-

- Put into practice the collective management system for crops cultivation through the farmers' organizations
  (Technical assistance for cropping among farms under the guidance of the leaders)
- Fertilization control
- Plagues and diseases control
- Management of the irrigation facilities

The farmers will start the cultivation under the guidance of the leader following the elaborated farm management plan. It is important in this stage to keep the exchange of information and share it among the members of the farmers' organizations about the growth of the crops.

With the initiative of the leaders of the farmers' organizations o the farmers who participated in the on-farm training, the members must learn the techniques for crops control through visits to the cultivation fields of other members or conversations with extension workers to exchange information about the variations in the growth of the crops, proliferation of plagues and diseases, etc. In the same way, it is necessary to establish a scheme to request for the institutional support when there is an emergency, in the case, for example, when a plague and diseases occur and the farmers cannot control them. On the other hand, the farmers must elaborate through meetings with the farmers, a plan for the management of the irrigation facilities with the farm management plan, as well as selecting the people in charge.

-Assistance to the supporting institutions-

The awakening of the initiative of the farmers as protagonists of the agricultural activities and the support to the process of strengthening through the promotion of the exchange of information among the farmers, become the key of the institutional assistance. In this process, it is essential to keep a close contact with the farmers and provide them with services that they require. It is necessary in a way to cover the lack of experience of the administrative staff, to ask for the cooperation of a NGO that are familiar with the "bottom-up" methodology and mutually complement the know-how about the cultivation techniques that the different institutions and supporting entities have in order to motivate the farmers.

-Assistance to the supporting institutions-

The administrative institutions do not have enough accumulated experience about the technical support for the intensive management of the farms proposed in the Development Model Plan. On

the other hand, it is necessary to adequately manage the irrigation facilities and to know the season and optimal amount to apply of fertilizers and agro-chemicals, making it necessary the technical assistance to these supporting institutions in the initial stage of the Project when they still do not have enough experiences accumulated.

H: Harvest and sales

The crops will be sold basically to the intermediaries who periodically visit each farm. However, the negotiation of the prices will be made collectively in order to define higher prices through the increase of the volume of sales and the negotiation leverage. It is necessary at this point, to know beforehand the market prices of the crops and the producers' prices as a base for the negotiation, and avoid in this way, the commercialization of the crops at an unfairly low price. Rice and other crops require processing and this will be done collectively as the cost of milling decreases as the amount to be milled increases. This way also allows to reduce the transportation cost for rice.

-Activities of the farmers-

- To know the market and producers' prices
- To know the volume of production according to the sales items
- Carry out the collective negotiation with the intermediaries.
- Define the crops to be processed
- To negotiate the service fees with the processing firms
- Execute the collective processing

If it is true that the sale of the products must be made at the farm level, the negotiation of prices and processing must be totally made by the farmers' organizations. Before starting the activities, meetings with the farmers must be organized in order to reach a consensus among the members as well as defining the role to be played by each one of them.

-Institutional support-

- Provide support for the definition of the sales plan through meetings with the farmers
- Provide information and explanations about the prices of the crops Estimate the volume of production for each crop
- Provide information about the processing firms and the services fees
- Provide support in the gathering and forwarding of the products processed collectively.

At present, it is difficult to make the farmers to decide by themselves the sales method most favorable for them, making it necessary to provide enough support at the moment of elaborating the sales plan in the meetings with the farmers.

The information on the prices of the crops must be offered through the distribution of the bulletins that the MAG-OR is publishing on a periodical basis. However, to make the information more precise, it is necessary to carry out a study on the market prices prior to sending the information to the farmers. About the processing of the products, it is not enough to provide the farmers only with the data of the processing farms but they must be helped to make a more integral evaluation, for example, by explaining them that if the works are done mechanically, the processing losses would decrease and can obtain a higher profit in the long run.

As the farmers acquire greater skills, the negotiation of the prices must be realized by themselves

with the intermediaries and processing firms, minimizing as much as possible the intervention of the supporting institutions.

-Assistance to the supporting institutions-

For the definition of the guidelines for the execution of the forwarding plans is indispensable to have an internal consensus within the farmers' organizations, in a participatory process, as well as advising for such purpose. The supporting institutions that have few experiences in this process will also require an external assistance. Specially, in the initial stage of the Project, it is required to carry out an exhaustive check-out of the different information available in order to avoid any misunderstanding by the farmers. This could be done with the participation of the experts.

I: Repayment of debts

The non-repayment of debts of the loans means a contraction of the available funds and, therefore, does not make it possible to keep on offering the agricultural credit services. The farmers will not be able to manage their farms within the framework of the Development Model Plan without having an agricultural credit facility and, in the end, their income level will decrease. The loans granted under this Plan will be given to the farmers who, in turn must be the ones in charge of repaying them. About this point, it is important to carry out a strict and complete control in order to avoid the appearance of farmers who do not want to repay the loans even though they may have the resources to pay. Through the meeting with the farmers, these kind of farmers will be explained the importance of the agricultural credit and they will be also explained that the non-repayment of the debts would endanger the existence of the agricultural credit system itself. However, at the same time, it is necessary to explain, that the supporting organizations would consider the extension of the deadline for repayment if there are valid reasons, for example, due to lack of minimal resources for life subsistence or failed crops, etc.

-Activities of the farmers-

- To know the gross profits
- To know the amount of the outstanding debt
- Make a project of the living expenses
- Make the necessary procedures if it is impossible to repay the whole outstanding debt
- Repay the debt

The farmers define the amount of the debt to be repaid based on the gross profits from sales, and the living expenditures needed to be covered until the next season when they will get the profits from the next crop. If there is enough big gross profit, they could repay the whole outstanding debt. However, in those cases in which there is not enough production in the initial stage of the Project, when production has decreased due to natural disasters, or there has been a drop of international prices, etc., and the farmers find that they cannot repay the whole amount, then they should ask for an extension of the deadline to the supporting entities, who will approve the request.

-Institutional support-

- To know the gross profits of sales for each farm
- To know the outstanding debt for each farm
- Evaluate the requests
- Control the repayment process of each farm

The supporting organizations must explain to the farmers the importance of the agricultural credit and the repayment of debts. Because the topic of agricultural credit is closely related with the economic resources, it is very important that the organizations keep an attitude strictly neutral at the moment of providing assistance. They must also precisely know the conditions of each farm based on the outstanding debt, gross sales profits, etc., in order to provide them with adequate and timely advice about the repayment of the debt. If the supporting organizations see that it is impossible for the farmer to repay the total outstanding amount of the debt, then they will carry out a fair and overall evaluation of the request for an extension taking into consideration the selling conditions of the crops, living costs, etc.

-Assistance to the supporting institutions-

The repayment of the credit by the farmers must be evaluated correctly and in an integral way considering the mechanism of agricultural credit, the conditions of production and marketing, etc. For this motive, it is required the participation of the experts who will advice the administrative institutions in a way to complement their lack of experience at the initial stage of the Project.

J: Elaboration of the next cultivation plan

-Activities of the farmers-

Once the cultivation of the corresponding season is finished, the farmers will make an evaluation of the processes from the preparation of the cultivation until the forwarding and sale of the crops and will identify the good and bad aspects. These results will be accumulated under the form of techniques appropriate for farmers' organizations. This process must be made by meetings with the farmers with participation of the whole members, because the contents of the meetings will be used as a base for the formulation of the next cultivation plan. If the extension workers also participate in the evaluation meetings, they could help the farmers to better organize the problems and deepen their understanding. Therefore, all the members must participate in the evaluation under the guidance of the leader in order to share the experiences and formulate the guidelines for the elaboration of the next cultivation plan.

-Administration

For the farmers who do not have much experience, the evaluation to be made at the end of the cultivation period becomes a efficient way to develop their own skills, because the administrative institutions will point out the identified problems motivating the farmers to incorporate the improvements in the next cultivation cycle.

5.5.2 Plan for execution of the Project

The Project is divided into two broad stages: (1) from the selection of the project area until the formation of the farmers' organizations, and (2) the farms management. The items indicated in the flow of the Plan could be summarized as shown in the following table. There is a stage of the formation of the organizations and the establishment of the supporting systems for the benefited farmers could execute the Project and another stage in which the farmers manage their farms with the support of the executing institutions of the Project. Therefore, the executing organizations, the execution plan (schedule), and the estimated cost of the project will be also planned dividing them into these two stages.

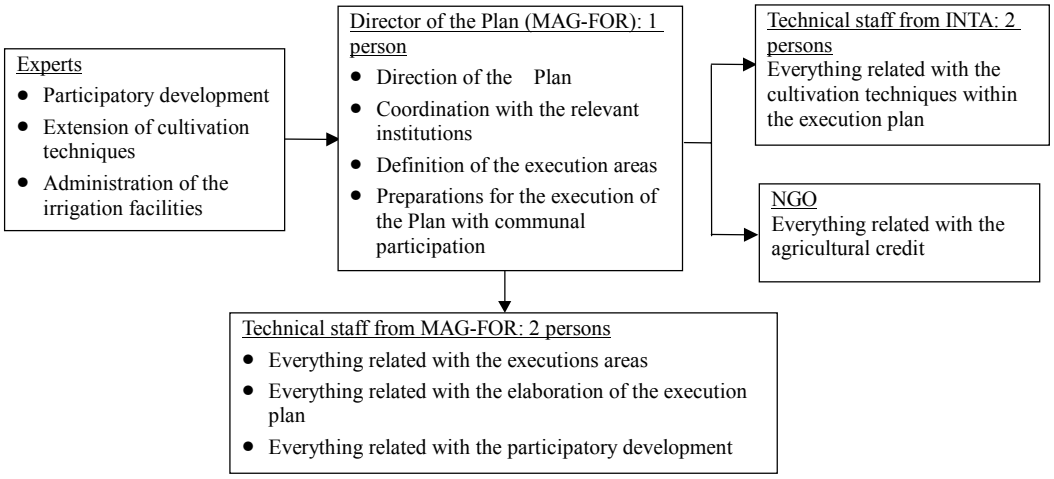
	Stage 1	Stage 2
Tasks to be performed	- Selection of the location - Fulfilling the organizational requirements - Organization of the farmers by themselves - Preparations for the execution of the Project - Establishment of the supporting systems	- Crop preparations - Cultivation - Harvesting and selling - Distribution of the profits - Repayment of debts - Elaboration of the next cultivation plan

(1) Execution system for the Project

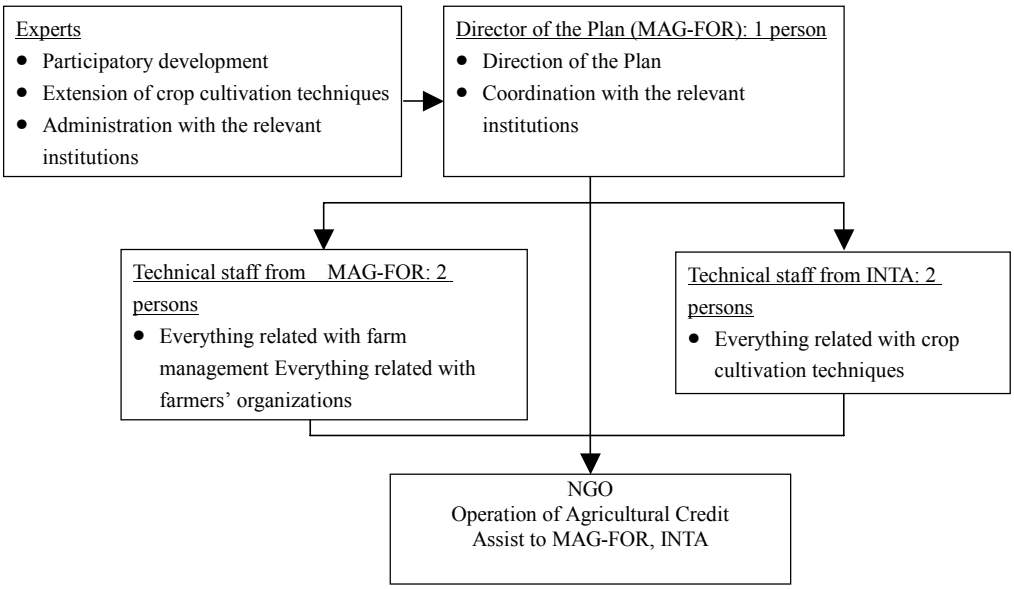
The Project will be executed by the Government of Nicaragua through MAG-FOR and INTA, and with the NGO that works in the area. The division of responsibilities will be basically as follows: MAG-FOR will take care to provide support in everything related with the farmers' organizations; INTA will do the same with everything related with cultivation, and the NGO with the agricultural credit. However, if each component works independently, the supporting effect will be limited, and, therefore, the services must be coordinated to achieve a synergetic effect. On the other hand, due to the fact that all these organizations still have few experiences in the execution of a integral plan for agricultural development, it is required to have the participation of experts in the participatory development and in crops' administration.

Stage (1) corresponds to the definition of the framework of the Project, which consists ofestablishing the mechanism and framework of the administrative services. This will be the responsibility of the governmental institutions. Because the creation of the farmers' organizations is the main objective at this stage, the main institution to participate will be MAG-FOR. However, it also requires the timely intervention of the NGOs (even though they are not public organizations) to take advantage of the many experiences they have in agricultural development. For the topics concerning the crops cultivation, the participation of INTA is required.

Description	Main organization	Supporting organization	Remarks
Selection of the Project areas	MAG-FOR	INTA Experts	The studies on the actual conditions for crops, etc., will be made by INTA
Fulfilling the organizational requirements	MAG-FOR	NGO Experts	The NGOs and the experts will provide support to the participatory development
Organization of the farmers under their own volition	MAG-FOR	NGO Experts	The NGOs and the experts will provide support to the participatory development
Preparations for the executing of the Project	MAG-FOR	INTA Experts	The tasks related with the cultivation, including the elaboration of the cultivation plan will be assumed by INTA
Establishment of the supporting systems	MAG-FOR	INTA NGO Experts	Elaborate the plan for each type of support and activities for each participant organization. MAG-FOR will take care of coordinating the different plans and programs.



Stage (2) corresponds to the implementation of the activities for farm management by the farmers. That is why the support will aimed mainly at the activities related to cultivation and the farm management. The latter could be divided into the support to the activities of the farmers' organizations and agricultural credit. In the execution system of the Project, a director of the project will be chosen among the staff of the MAG-FOR who will assume the coordination and general direction of the Project. The support to the farmers' organizations and farm management will be offered by MAG-FOR, while everything related to the extension of the cultivation techniques will be offered by INTA. The number of the staff required will be two staff from MAG-FOR and two from INTA, both must be permanent staff and with exclusive dedication to the Project. This requirement was estimated considering the capacity of the technical staff of each organization that took part in the P/S, and it was assumed that they will make two visits per week to each zone of the Project; because a technical staff could cover up to two zones, if it is proposed to cover four zones per year, then it will require two technical staff of each organization. The administration of the agricultural credit will be given to the NGO that has been providing this service so far. At the same time, the need to incorporate within the framework of the Development Model, the NGOs with rich experience will be studied; if they are incorporated, it will be necessary to clearly define the responsibilities of the respective institutions and entities.



(2) Execution Plan of the Project

The present plan consists of supporting the administration of 15 to 20 farms of each zone through its respective farmers' organization. It is well true that a, if a menu with different kinds of supports will be prepared, and the actual conditions of the Government of Nicaragua are taken into account, the number of zones in which the Plan could be executed would not be more than five per year. As a goal for each zone, it is being planned to offer one year of support in stage (1) and five years in stage (2), getting a total of six years of support, by which it is expected to achieve a level of development of the farms good enough for them to offer their crops in the market and grow by themselves. Initially, the development of five zones in one year is assumed, representing 25 zones in five years. Because the development of each zone requires a total of six years of support, the duration of the Plan will be a total of ten years.

Development schedule of each area under the Development Model

Year	1	2	3	4	5	6
1. Selection of the location						
2. Organization of the farmers						
3. Preparations for the execution of the Project						
4. Establishment of the supporting systems						
5. Support to the farm activities						

(3) Estimated cost of the Project

The cost of the Project includes the implementation cost of the irrigation facilities, funds for agricultural credit and the operation costs of the supporting organizations. However, within this last item, the staff expenses of MAG-FOR or INTA are not included.

- Implementation cost of the irrigation costs
  The cost for implementation of the irrigation facilities varies depending of the surface to be irrigated, the topographic conditions, and the depth of the water table. For estimation purposes, it has been assumed that an area of about 40 Mz will be irrigated under conditions similar to those proposed for El Espino.

Items	Amount (Thousand US$)	Remarks
Construction cost	222	
Wells' perforation	(60)	Wells with a 100m depth
Installation of pumps	(81)	Pumps and engines
Pipes	(60)	
Sprinklers sets	(15)	
Rural roads (access roads, etc.)	(6)	
Administrative expenditures	33	15% of the costs of the works
Operation and maintenance	16	7% of the costs of the works
Physical contingencies	22	10% of the costs of the works
Total improvement of the irrigation facilities	293	
Cost of the Project for each hectare	10.5	40Mz=28ha

・ Requirements of the funds for agricultural credit

By assuming that a zone under the Development Model is 40 Mz and that the Plan will be implemented in five zones per year, the total surface would be 200 Mz. Taking as a reference the requirement of resources for farm administration of the Development Model for Telica, the requirement for the funds is estimated to be C$2,360,000 per year. By assuming that the Plan will be implemented in five zones per year, during five years, and if a repayment rate of the initial credit is 50%. and a repayment rate of 100% after five years, the total requirement of the fund is as shown in the table below. It must be pointed out that in the column "Requirements of the fund" the necessary amount required to be added each year to the fund is shown. The resources required in the first year are C$2,360 and will increase gradually, until the fifth year when a maximum of C$5,310,000 is reached.

(Unit:C$1,000)

Year	Financing amount					Repayment amount	Requirements of the fund
	Areas for the first year	Areas for the second year	Areas for the third year	Areas for the fourth year	Areas for the fifth year		
First	2,360					1,180	2,360
Second	2,360	2,360				2,655	3,540
Third	2,360	2,360	2,360			4,425	4,425
Fourth	2,360	2,360	2,360	2,360		6,490	5,015
Fifth	2,360	2,360	2,360	2,360	2,360	8,850	5,310
Sixth	2,360	2,360	2,360	2,360	2,360	10,030	2,950
Seventh	2,360	2,360	2,360	2,360	2,360	10,915	1,770

・ Expenditures for activities of the supporting organizations

Here are included the direct administrative office costs, fuel for vehicles, etc. In the table below there is an estimation of the annual budget required for each item.

(Unit: C$)

Items	Expenditures		Total
	MAG-FOR	INTA	
Office expenditures	40,600	17,400	58,000
Services (energy, waters, etc.)	(8,400)	(3,600)	(12,000)
Office supplies	(16,800)	(7,200)	(24,000)
Communication	(12,000)	(8,400)	(3,600)
Others	(7,000)	(3,000)	(10,000)
Fuel for vehicles	25,200	10,800	36,000
Others	14,000	6,000	20,000
Total	798,000	34,200	114,000

(Nota: Para el desglose de los gastos, se tomaron en cuenta el número de personal encargado y el rol de las MAG-FOR e INTA, y se aplicaron los porcentajes de 70% para MAG-FOR y de 30% para INTA.

5.6 Evaluation of the Plan

The objective of the Development Model Plan gives a high priority to the contribution towards reduction of poverty among the small and medium scale farmers. For this reason, an evaluation has been made in such a way that the income of a model farms increases.

(1) Evaluation Criteria

	Conditions for the evaluation
Size of the parcels:	2.5Mz
Crops	same as Telica
Revenues/Expenditures:	same as Telica
Initial investment (irrigation facilities):	same as El Espino
Contribution of the beneficiaries of the initial investment	C$5,000

(2) Evaluation

According to the analysis of revenues and expenditures of the farms, the present Plan will contribute to improve the quality of life of the small and medium scale farmers in considerable way. According to the balance, at the third month the farms will have a superavit, and by the fifth year, the debt will be totally repaid. From the sixth year a superavit of C$11,700 is expected; this superavit becomes C$55,100 and C$171,000, by the tenth and twentieth year, respectively. At the twentieth year, the farmers who own a parcel of 2.5 Mz will need about C$2,000,000 to renovate the facilities. At that moment, the farmers will request for a new credit to cover the lack of resources. The interest and commission may vary greatly according to what amount of resources are available to those who make the loan request at that moment; the amount of the new debt will have impact on the farm management in the subsequent years. The superavit, therefore, must be allocated for improving the quality of life, but also it will be necessary to save in a planned way in order to have enough resources to renovate the facilities on the twentieth year.

Revenues and expenditures of the farms under the Development Model

Intial Cost C$5,000 for farmer (unit: C$1,000)

	0	1		2		3		4		5		6		7		8		9		10	
		6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
Contents of Out Flow																					
Intial Cost	5.0																				
Farming Cost																					
Input		12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9
Maintenance			0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1
TOTAL		12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0
Living Expense																					
Living Expense		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Other		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Sub-Total		12.8	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2
Contents of Income																					
Profit																					
Irrigation		11.1	0.0	13.8	0.0	16.6	0.0	19.4	0.0	22.1	0.0	22.1	0.0	22.1	0.0	22.1	0.0	22.1	0.0	22.1	0.0
Rain Fed		0.0	13.1	0.0	16.4	0.0	19.7	0.0	22.9	0.0	26.2	0.0	26.2	0.0	26.2	0.0	26.2	0.0	26.2	0.0	26.2
Sub-Total		11.1	13.1	13.8	16.4	16.6	19.7	19.4	22.9	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2
Loan																					
Loan	5.0	17.8	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2
Commission		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Repaymentable		11.1	13.1	13.8	16.4	16.6	19.7	19.4	22.9	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2
Act.Repayment		11.1	13.1	13.8	16.4	16.6	19.7	19.4	22.9	22.1	26.2	20.3	19.5	17.3	19.5	17.3	19.5	17.3	19.5	17.3	19.5
Loan Balance		-7.0	-13.3	-16.8	-19.8	-20.5	-20.3	-18.2	-14.7	-9.8	-3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farmers Economic Balance		-7.0	-6.3	-3.4	-3.1	-0.7	0.2	2.1	3.5	4.9	6.8	4.9	6.8	4.9	6.8	4.9	6.8	4.9	6.8	4.9	6.8
Total Balance		-7.0	-13.3	-16.8	-19.8	-20.5	-20.3	-18.2	-14.7	-9.8	-3.1	1.8	8.6	13.4	20.2	25.1	31.8	36.7	43.5	48.3	55.1

	11		12		13		14		15		16		17		18		19		20	
	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12	6	12
Contents of Out Flow																				
Intial Cost																				
Farming Cost																				
Input	12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9	12.8	14.9
Maintenance		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1
TOTAL	12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0	12.8	15.0
Living Expense																				
Living Expense	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Sub-Total	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2
Contents of Income																				
Profit																				
Irrigation	22.1	0.0	22.1	0.0	22.1	0.0	22.1	0.0	22.1	0.0	22.1	0.0	22.1	0.0	22.1	0.0	22.1	0.0	22.1	0.0
Rain Fed	0.0	26.2	0.0	26.2	0.0	26.2	0.0	26.2	0.0	26.2	0.0	26.2	0.0	26.2	0.0	26.2	0.0	26.2	0.0	26.2
Sub-Total	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2
Loan																				
Loan	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2	17.0	19.2
Commission	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Repaymentable	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2	22.1	26.2
Act.Repayment	17.3	19.5	17.3	19.5	17.3	19.5	17.3	19.5	17.3	19.5	17.3	19.5	17.3	19.5	17.3	19.5	17.3	19.5	17.3	19.5
Loan Balance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farmers Economic Balance	4.9	6.8	4.9	6.8	4.9	6.8	4.9	6.8	4.9	6.8	4.9	6.8	4.9	6.8	4.9	6.8	4.9	6.8	4.9	6.8
Total Balance	60.0	66.7	71.6	78.3	83.2	90.0	94.8	101.6	106.5	113.2	118.1	124.9	129.7	136.5	141.4	148.1	153.0	159.8	164.6	171.4

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS

In October 1998 the Master Plan for the Agricultural Development giving priority to the support to the small scale farmers of the Regions II and IV of the Pacific Coast in Nicaragua was elaborated. This document emphasized the importance of implementing as soon as possible the Agricultural Development Model Plan as top priority project. The objective of this recommendation was to increase the capacity of the executing agencies and to motivate the small scale farmers to execute of other projects, and, in this way, achieve a ripple impact on the surrounding areas. To secure the normal development of this project, the Pilot Study (P/S) was carried out in the areas, which were subject to the F/S during 18 months. Based on the results obtained in these studies, the recommendations mentioned below are presented.

6.1 Conclusions

The public institutions in Nicaragua as MAG-FOR and INTA have been playing a pivotal role in the support to the small and medium scale farmers and there is no doubt that the institutional efforts have contributed to the constant increase of the agricultural production of the area. However, it is also true that the constraints on human and financial resources of the two institutions limits the scope of influence of their support in geographical terms and population coverage.

The Agricultural Development Model Plan consists of providing an integral support to the small and medium scale farmers in Nicaragua who at present are in a poverty situation from which will be difficult to escape due to their lack of knowledge and material resources. The Nicaraguan institutions like MAG-FOR and INTA must play an important role in the implementation of the Plan, as they are the institutions which, together with the small scale farmers, join efforts in thinking what has to be done and how and, then, work all together to achieve the proposed objectives.

However, the fundamental principle of this support expected to be provided within this Agricultural Development Model Plan is the creation of a system where the producers learn to think, act by themselves and take responsibility of their own actions in order to increase their income levels. However, this concept requires to expand the framework of the service within which MAG-FOR and INTA have been providing their services and makes it necessary for these institutions to master the new execution methodology of the Agricultural Development Model Plan. Therefore, it is necessary to start with small projects and select zones that facilitate the provision of the services of these institutions at an adequate level; in other words, the zones where the productivity of the soils is high, enjoy of plenty irrigation water at a low cost, good accessibility to markets and have farmers with better skills. In this way, it is expected to assure the feasibility of these projects and, in the process, acquire the required experiences and techniques.

As agricultural development model plan in Telica and El Espino, an integrated project for support of the farmers was elaborated within the framework of the present Study. Its implementation will start from the presentation of the contents of this plan by the institutions to the farmers and organize those farmers who agree with the plan and want to participate in it. It means that for the case of El Espino, dissolve the present farmers' organization formed for the P/S, and create new organizations for the new three mini-irrigation systems. In the case of Telica, the project will start from the process of dividing the 250 farms in 10 to 20 groups for each terminal irrigation system, and to form new farmers' organizations. For El Espino, there is the need to strengthen the diffusion of technical services for farm management through INTA to overcome the problem of low agricultural productivity.

From this point of view, as projects for supporting the small and medium scale farmers in Nicaragua, the Agricultural Development Model described in Chapter 5 must be implemented as it is easier to implement and, after the supporting institutions have accumulated enough experiences, then the agricultural development model plans for Telica and El Espino should be implemented.

6.2 Recommendations

(1) Agricultural Development Model Plan for the Telica Area

Telica has been selected as a priority area and due to its favorable social and natural conditions, it is an area where a project can easily generate the benefits, which will be reflected in the good results shown by the economic evaluation. Also, from the point of view of the beneficiaries, it is an area that has a great development potential due to the presence of numerous small and medium scale farms. However, because of the great number of the small and medium scale farmers in this zone, it makes it difficult to be served by the supporting institutions due to their limited resources. Therefore, it is strongly recommended to carry out the development project in a relatively near future, but before doing so, it is proposed to implement the development model described in Chapter 5 and raise the efficiency of the institutional support.

At present, in Telica there are three wells besides the one used for the P/S. Of these three, one is being used and the other two are abandoned. This area is characterized by abundant underground water and good accessibility to the markets, becoming a priority zone or the agricultural development model proposed in Chapter 5. As an alternative, it is proposed to start the development of this area benefiting the farmers who are owners of the lands surrounding these wells during the first stage and, later in the second stage, promote a big development project using surface water as the main source.

(2) Agricultural Development Model of the El Espino Area

El Espino natural (soil productivity, etc.) and social conditions makes it a typical Nicaraguan rural area where small and medium scale farmers predominate. The increase of the agricultural income level of the population in these areas, without doubt, will contribute to pull the small and medium scale farmers out of their poverty condition. However, the support required to overcome all the constraining factors and to achieve the self-development of the community is very intense, besides the fact that the success of the project assumes a certain degree of maturity of markets and socioeconomic conditions of the whole country. Therefore, it is recommended that El Espino and other areas facing similar unfavorable conditions must be considered as candidate areas for the last stages of the agricultural development model.

When the P/S in El Espino started, the farms subject to the Study were property of the participating farmers, but now the land title of a part of the lands belongs to MAG-FOR. These farms have an irrigation system developed within the framework of the P/S and can be used as public demonstration or experimental farms managed by MAG-FOR in the future. As described before, this area is characterized by unfavorable natural and social conditions. There are also some surrounding areas similar conditions. The existence of experimental or demonstration farms supported by the technology provided by MAG-FOR or INTA to carry out the efforts oriented to increase the productivity or the soils or to introduce new crops will encourage the farmers not only from El Espino but those in neighboring areas to better manage their farms. Therefore, it is proposed to the Government of Nicaragua to create experimental demonstration fields in the farms used in the P/S

Among the farmers participating in the P/S there are some, even though not so many, who were

enthusiastic in promoting the development of the area. It is important that farmers' groups should be formed under the initiative of these farmers in order to increase the level of the farm management techniques learned through the P/S. MAG-FOR and INTA must provide advice to these farmers' groups, and support the efforts to increase the agricultural production through the activities carried out by the farmers under their own initiative. For example, with the objective of improving the low productivity soils, which is one of the main constraining factors, it is necessary to adopt long term measures that include reduction of weeds in the cultivation fields, reforestation in those places where drained water is concentrated or in the borderline of the farms in order to prevent soil erosion.

(3) For the implementation of the agricultural development model

The agricultural development model described in Chapter 5 proposes to limit the scale of development and select the prioritized areas that offer good conditions in terms of soils, water resources, markets, etc. in order to secure the achievement of a certain determined agricultural productivity, and commercialize the crops under fair conditions. The selection of these areas must be implemented under the initiative of public institutions like MAG-FOR, INTA, etc. so that they could get a sense of ownership of the projects and encourage the farmers to participate in the projects.

The Agricultural Development Model Plan must be a participatory process inviting the beneficiaries to take part in each stage of the development process, from the selection of the areas of the project to the management of the farms. This to make them to become aware that they are the real implementators of the project, and at the same time, that they need to help the supporting institutions in correctly identifying the true needs of the beneficiaries. The public institutions have been providing support to the small and medium scale farmers for many years, but it must be admitted that they still do not have enough number of technical staff who know about the methodology of participatory development, making it necessary to request the technical assistance from the donors.

The success of the development model heavily depends on the support given to the cultivation technique as well as to the participation of the beneficiaries. The small and medium scale farmers can improve their living standards using the profits obtained by selling the agricultural products; if this foundation can not be established, no project could succeed in spite of the support it is receiving. INTA has been providing extension services of agricultural techniques to the small and medium scale farmers and has good experience. However, the support required by the development model is beyond the framework of services used so far. Even though it is true that as the development model's implementation goes further, the institution will accumulate more experience, there is still an insufficient number of technical staff who master the techniques required by the Plan. Therefore, it is also necessary to request the donors' assistance on the topic of extension of cultivation techniques.

The concrete methodology for implementation of the projects of the agricultural development model has been presented in Chapter 5 "Agricultural Development Model Plan. To promote this Plan it is necessary to follow the steps listed below:

1) First stage: Selection of the target areas of the project

The selection of the target areas of the agricultural development model will be made under the initiative of MAG-FOR. The work will be based on the list of the "55 candidate areas for the development of the mini-irrigation" already studied, and it will also take into consideration the possibility of implementing part of the development plan for Telica at an earlier phase. The definition of the priorities will be made through the screening method using the check list

applying the following requirements:

(1) Existence of more than 15 small and medium scale farmers interested in promoting development under their own initiative
(2) Existence of a stable source of irrigation water
(3) Presence of grouped farms of 40 to 50 Mz
(4) Good accessibility to the markets

Defined the priority of the areas, the detailed study about the following aspects will be made and the feasibility of the project will be assessed. In this project the farmers will also have to participate in order to know the social aspects that could not been identified during the screening. Because the verification work requires a lot of time and human resources, it must be focused only on the target areas of the project.

(1) Willingness of the farmers (hopes and perspectives about the future)
(2) Attitude of the farmers concerning agriculture
(3) Structure of the communal society and the role of the communal organizations
(4) Identification of the leader of the community and his role.
(5) Presence or absence of conflicts among communities or within the community
(6) Existence of the custom of renting farms and its respective method
(7) Size and distribution of the farms
(8) Existence of mortgages

2) Second stage: Final confirmation of the execution areas and preparations

At the moment of forming the farmers' organizations for the P/S, a lot of care was put on hearing what the farmers wanted and about their needs. In spite of this, the impression that this action was imposed from above still lingers. Therefore, it is necessary to dedicate enough time to the formation of the farmers' organizations until they completely understand the incentives and duties of the project, because the success or failure of the project greatly depends on the fact that the incentives of the project are coherent with the needs of the beneficiaries, or if the farmers can or not assume the obligations of the actions required to materialize such incentives. For that purpose it is necessary that the institutions provide support to the farmers by facilitating the tools required for analysis of the problems and design of countermeasures, but the key of this process still in fact that the farmers must think and take decision by themselves. Besides the above mentioned fact, proceeding to the execution of the projects in the priority areas, it is necessary to satisfy the following conditions:

(1) Form new farmers' organizations and define the method of democratic management
(2) Carry out the legal procedures concerning land tenancy
    The owner of the irrigation facilities and the land where they are located must be MAG-FOR
    Subscribe the rent contract of the lands among the beneficiaries
(3) Subscribe the rent contract of the lands through the farmers' leader

3) Third stage: Establishment of the supporting systems

The different supporting systems must be established in the priority areas. In this stage it is important to plan the actions with the participation of the small and medium scale farmers who will benefit from the project in order to elaborate a plan that reflects their needs and, if possible, to make them participate in the implementation of the irrigation facilities.

(1) Planning of different supporting systems and calculation of the cost of the Plan

(2) Definition of the amount to be contributed by the beneficiaries
(3) Establishment of the supporting system for cultivation
(4) Establishment of the supporting system for farm management
(5) Implementation plan for the irrigation facilities
(6) Implementation plan for the agricultural credit

4) Execution of the plan: execution of the agricultural development model project

(1) Implementation and support to the cultivation practices in order to increase the agricultural income of the beneficiaries
(2) Implementation and support of the farm management practices in order to increase the agricultural income of the beneficiaries

ATTACHMENT-1

SCOPE OF WORK

MINUTES OF MEETING
ON
SCOPE OF WORK
FOR
THE STUDY
ON
AGRICULTURAL DEVELOPMENT
FOR
THE REGION 2 AND 4
IN
THE PACIFIC COAST
IN
THE REPUBLIC OF NICARAGUA

AGREED UPON BETWEEN
MINISTERIO DE AGRICULTURA Y GANADERIA
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Managua, 20 March, 1997

Dr. Horacio Jarquín Delgado
Vice Minister,
Ministerio de Agricultura y Ganadería
(MAG)

齋藤　登

Mr. Noboru Saito
Leader,
Preparatory Study Team,
Japan International Cooperation
Agency (JICA)

Ms. Isolda Frixione Miranda
Directora General Gestión Bilateral
Ministerio de Cooperación Externa
(MCE)

In response to the request of the Government of Nicaragua (hereinafter referred to as "GON"), the Government of Japan (hereinafter referred to as "GOJ") decided to dispatch through Japan International Cooperation Agency (hereinafter referred to as "JICA"), which is responsible for the implementation of technical cooperation programs of GOJ, the preparatory study team (hereinafter referred to as "the Team") headed by Mr. Noboru Saito, to Nicaragua from March 11th to March 27th, 1997 so as to discuss and exchange views on the study with Ministerio de Agricultura y Ganaderia (hereinafter referred to as "MAG"), and officials concerned of GON for the implementation of the study.

MAG and the Team mutually agreed to the Scope of Work for the Study on Agricultural Development for the Region 2 and 4 in the Pacific Coast in the Republic of Nicaragua (hereinafter referred to as "the Study").

The following minutes were prepared to confirm the main issues discussed and matters agreed upon by both sides in connection. The list of participants in a series of meetings is attached as ANNEX 1.

1 . Identifying the projects to conduct a Feasibility study are principally based on the following criteria, for example:

* To select area where the understanding for the necessity of the projects is deep among farmers and potential for organizing farmers is high.
* To select area where potential of agricultural development(water resources, soil, etc.) is high.
* To select area where condition of marketing is comparatively good and demonstration effect is high.
* To select area where possibility to diversify crops is high and conversion to non-traditional crops is expected in the near future from traditional crops.
* To select area where rehabilitation and construction of agricultural infrastructures(irrigation facilities, etc.) are urgently required.

2. For the smooth implementation of the Study, both sides agreed upon the necessity of establishing a Steering Committee for the Study. The Steering Committee will be formed comprising the following institutions:

Ministerio de Agricultura y Ganaderia (MAG) - coordinator
Ministerio del Ambiente y de los Recursos Maturales (MARENA)
Instituto Nicaraguense de Reforma Agraria (INRA)
Instituto Nicaraguense de Tecnologia Agraria (INTA)
Programa Nacional de Desarrollo Rural (PNDR)
Ministerio de Cooperacion Externa (MCE)
Embassy of Japan(EOJ) - observer

3. The work for topographic mapping will be conducted as a part of the study between Phase Ⅰ and Phase Ⅱ, which will take about five(5) months, in case it is considered as necessary.

4. The concept of the Pilot Study was discussed and agreed in principle based on the paper attached as ANNEX 2.
   The Nicaraguan side will guarantee the operation and maintenance of the pilot study farm.

5. MAG requested that the additional vehicles and necessary equipment (personal computer, copying machine, etc.) for the study other than provided by Nicaraguan side and should be provided by JICA. The Team promised to convey the request to the GOJ.

6. MAG requested that the counterpart personnel training in Japan related to the study to promote an effective technology transfer. The Team promised to convey this request to GOJ.

7. The Final Reports shall be opened to public whenever it shall be requested.

ANNEX 1

LIST OF PARTICIPANTS

1. Nicaraguan Side

1) MAG

Alvaro Montalvan Pallais	Direccion General de Cooperacion Externa
Cecilia Baez Ordonez	Direccion General de Cooperacion Externa
Carmen Largaespada	Direccion Politicas y Programas
Eduardo Hanon	Direccion Politicas y Programas
Cidar Cardenas	Unidad Formuladora de Proyectos
Alberto Jose Morales	Unidad Formuladora de Proyectos
Ottoniel Saravia C.	Unidad Formuladora de Proyectos
Erwing Gutierrez	Direccion Delegaciones Regionales
Alvaro Icaza V.	Direccion Delegaciones Regionales
Luis Mejia Selva	Direccion Delegaciones Regionales
Francisco Montalvan	Delegado Regional II
Carlos M. Espinoza	Delegado Regional IV
Arkangel Abhaunza	Programa Agricola
Orlando Siu S.	Consultor

2) PNDR

Juan Jose Quintanilla	Region IV (PROSESUR)
Carlos Espinoza	Region II

3) MARENA

Damaso Barquero	Planif. Forestal

4) INRA

Francisco Chevez H.	Direc. Planific.

5) INTA

Danilo Montalvan	Cooperacion Externa

6) MCE

Alejandoro Maltez	Consultor

2. Japanese Side

1) Preparatory Study Team

Noboru Saito	Leader
Tomoki Sato	Member
Shigeru Nishihara	Member
Kenichiro Kobayashi	Member
Yoshitaka Ishikawa	Member

2) Embassy of Japan

Satoshi Uematsu	Second Secretary

The Pilot study on Agricultural Development for the region 2 and 4 in the Pacific Coast

1. Justification of the Pilot Study

In the study area, the rural economy has deteriorated due to a considerable drop in the cotton price. There is an urgent need to establish more productive agricultural system including the introduction of new crop varieties and technologies as well as the provision of agricultural infrastructure.

Groundwater is the main water source for agriculture in the study area. Irrigation development with more sophisticated groundwater exploitation seems to have a great potential and is likely to be given a priority for the agricultural development in the area. Appropriate farming systems and the operation and maintenance are the key factors to determine the sustainability of such project. Thus the pilot study is proposed in order to verify the sustainability of groundwater irrigation and to identify possible difficulties and problems which might arise in due course. Based on these close monitoring and evaluation of the pilot study, it makes it possible to formulate plans that are more feasible and realistic to be implemented.

In addition to the existing wells, if necessary, a new well will be dug to carry out pumping tests and to monitor the groundwater level. This new well will serve as water source for the irrigation component for the pilot study.

2. Outline of the pilot study

(1) Objectives

1) During the phase Ⅲ, the activities proposed in the study (e.g. introduction of new crops) will be put into practice on a small scale. It is intended to examine whether the groundwater reserve will be the sustainable water supply source for irrigation proposed in the study as well as to identify difficulties and problems that are not fully addressed in the initial plan. These findings will be taken into consideration prior to the formation of the plan on a full scale.

2) The pilot study will offer opportunities to transfer new technologies on irrigation farming to the Nicaraguan counterparts and local farmers through practical training on the ground. At the same time, the pilot farm is expected to have a demonstration effect to the surrounding areas.

(2) The Location

An appropriate area selected in the Region 2 with the high groundwater potential

(3) Pilot Farms

1) The number of farmers to participate in the pilot study

About 10 households : a part of one polo preferably

2) Area to be irrigated

About 10 ha : the area which could be irrigated by the groundwater tapped from one well.

3) Crops to be planted

Will be decided

4) The design of the facilities (tentative)

Whether the following facilities and equipment will be provided by the Japanese side or not will be examined as soon as the details are agreed upon. The proposed designs specified in the below are subjected to changes in the course of the study.

a) Well (test well is used)

b) Pumping facilities

Pump (head 30-50m and 10 l/s)

Dynamo (20 HP)

Switchboard

Shed

c) Irrigation facilities

Main pipeline

Movable sprinkler

(4) Monitoring activities on the pilot farm

a) The ground-water level and the water quality (the monitor of the ground-water level and the water quality are conducted other existing wells).

b) Underground water use (pump up results and irrigation results, etc.)

c) Operation and maintenance (pump operation condition and operation and maintenance organization activity condition, etc.)

d) Farming (growing condition, yield, and farming work)

e) Farm household economy (farming cost and earnings)

3. Action of the Study Team

(1) The Study Team dispatch schedule to Nicaragua

In dry season (from November to April) and in rainy season (from May to October) ; 2 seasons,

respectively.

Japanese side will decide a period that the study team is dispatched in obedience to farming pattern etc.

(2) Matters by which study and guidance are done

Irrigation technique (Irrigation volume of water, time, and method etc.)

Operation and maintenance (operation and organization etc.)

Farming guidance

Additional, advice to various problems

Japanese side will dispatch experts (e.g. experts in irrigation, farming, operation and maintenance).

4. Activities to be done by the Nicaraguan side for the pilot study

(1) In order for the pilot study to succeed, farmers will have to be the main actors to implement the plan with the assistance and advice from government staff in accordance with the pilot study plan (e.g. farming system, operation and maintenance, implementing mechanism), which will be formulated by the study team in close cooperation with the Nicaraguan side. The Nicaraguan government should also be actively involved in the implementation of the pilot study, for example, collecting data and information (keeping records of on-farm activities from planting to harvesting, operating hours of pumps, amount of fertilizers and pesticides applied, etc.).

(2) Prior to the selection of the pilot farms, the candidates will be selected with consultation between MAG and the farmers who will be the beneficiary in the region.

SCOPE OF WORK
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Managua, 20 March, 1997

Dr. Horacio Jarquín Delgado
Vice Minister,
Ministerio de Agricultura y Ganadería
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Mr. Noboru Saito
Leader,
Preparatory Study Team,
Japan International Cooperation
Agency (JICA)

Ms. Isolda Frixione Miranda
Directora General Gestión Bilateral
Ministerio de Cooperación Externa
(MCE)

I. Introduction

In response to the request of the Government of the Republic of Nicaragua (hereinafter referred to as "GON"), the Government of Japan (hereinafter referred to as "GOJ") has decided to conduct the Study on Agricultural Development for the Region 2 and 4 in the Pacific Coast in the Republic of Nicaragua (hereinafter referred to as "the Study"), in accordance with the relevant laws and regulations in force in Japan.

Accordingly, Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programs of GOJ, will undertake the Study in close cooperation with the authorities concerned of GON.

The present document sets forth the scope of work with regard to the Study.

II. Objectives of the Study

The objectives of the Study are;

1. To formulate a Master Plan for agricultural development for region 2 and 4 in the pacific coast in the Republic of Nicaragua,

2. To conduct a Feasibility Study to formulate development plans prioritized in the Master Plan, to execute a pilot study in the selected area identified in the course of the study, and

3. To carry out technology transfer to the Nicaraguan counterpart personnel through on -the-job training in the course of the Study.

III. Study area

The Study area are Region 2 (approximately 9,900km^2) and 4 (approximately 4,700km^2) in the Pacific coast.

IV. Scope of the Study

In order to achieve the above objectives, the Study will consist of three (3) phases and the following items.

1. Phase I (Master Plan Study for Region 2 and 4)

1.1. To review the existing development plans and policies.

1.2. To collect, review and analyze relevant existing data and information and field survey:

(1)Natural condition
- a. topography
- b. vegetation
- c. meteorology
- d. hydrology
- e. geology
- f. soil
- g. water quality
- h. others

(2)Social and economic condition
- a. population
- b. household
- c. gender issues
- d. employment
- e. regional economy
- f. farmers' economy
- g. land tenure
- h. rural and social infrastructure
- i. agricultural credit
- j. others

(3)Agricultural condition
- a. land use and cropping pattern
- b. agricultural production
- c. livestock production
- d. irrigation and drainage system
- e. water management
- f. agricultural facility and infrastructure
- g. farmers' organizations
- h. agricultural supporting system
- i. postharvest and marketing system
- j. others

(4)Environmental conditions
- a. natural condition
- b. social condition
- c. others

(5)Other information related to the project
- a. administrative organization
- b. others

1.3. To identify development needs and constraints.

1.4. To formulate basic development plan, considering the following points:
(1) Land use
(2) Farm management
(3) Livestock production
(4) Irrigation and drainage
(5) Agricultural and rural infrastructure
(6) Investigation, agricultural extension and supporting system
(7) Agricultural credit
(8) Postharvest and marketing system
(9) Farmers' organization

1.5. Initial Environmental Examination (IEE) .

1.6. To select priority projects for the feasibility study in Phase II .

2. Phase II (Feasibility study for selected projects)

2.1. To collect additional data and information, and detailed field survey.

2.2. To conduct feasibility study for the selected projects, considering the following points:
(1) Land use
(2) Farm management
(3) Livestock production
(4) Irrigation and drainage
(5) Agricultural and rural infrastructure
(6) Operation and maintenance
(7) Investigation, agricultural extension and supporting system
(8) Agricultural credit
(9) Postharvest and marketing system
(10)Farmers' organization
(11)Environmental conservation
(12)Preliminary design of major structures
(13)Estimation of the projects cost and benefit

2.3. To conduct test well drilling, pumping test, and to collect data, if necessary

2.4. To prepare implementation schedule

2.5. To evaluate the projects

2.6. To formulate pilot study plan, with the following components:
(1)Inventory survey on actual conditions of communities in the selected

area
(2)Selection of a community for the pilot study
(3)Planning for pilot study (facilities, crop production, extension, groundwater observation, operation and maintenance, etc.)

2.7. To make preliminary recommendations

3. Phase Ⅲ (The pilot study implementation and final recommendations)

3.1. To implement the pilot study
(1)Construction of the facilities for the pilot study
(2)Monitoring of groundwater use condition
(3)Monitoring of crop production
(4)Monitoring of operation and maintenance
(5)Evaluation of the pilot study and feedback for the development plan

3.2. To make final recommendations

V. Study schedule

The Study will be carried out in accordance with the attached tentative work schedule.(ANNEX 1)

VI. Reports

JICA shall prepare and submit the following reports in Spanish to GON.

1. Inception Report
Twenty (20) copies at the commencement of the Phase I field work.

2. Progress Report (1)
Twenty (20) copies at the end of the Phase I field work.

3. Interim Report
Twenty(20) copies at the commencement of the Phase II field work.

4. Progress Report (2)
Twenty (20) copies at the end of the Phase II field work.

5. Draft final Report
Twenty(20) copies in Spanish and English (only Main Report) at the end of the Phase II home office work. GON shall submit their comments within one (1) month after the receipt of the Draft Final Report.
In case any doubt arises in interpretation, English text shall prevail.

6. Monitoring Progress Report(1)
Twenty(20) copies around the halfway of Phase Ⅲ.

7. Monitoring Progress Report(2)
Twenty(20) copies at the end of Phase Ⅲ. GON shall submit their comments within one (1) month after the receipt of the Monitoring Progress Report(2).

8. Final Report
Fifty (50) copies in Spanish and English (only Main Report) within four (4) months after the receipt of the comments by Nicaragua on the Monitoring Progress Report(2).
In case any doubt arises in interpretation, English text shall prevail.

VII. Undertakings of GON

1. To facilitate the smooth conduct of the Study, GON will take the following necessary measures:

(1)To inform members of the Japanese study team (hereinafter referred to as "the Team") any existing risk in the Study area and to take any measures deemed necessary to secure the safety of the Team.

(2)To permit the members of the Team to enter, leave and sojourn in Nicaragua for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees,

(3)To exempt the members of the Team not only from taxes on purchase of equipment and other materials as well as services required for the conduct of the Study, but from taxes, duties, fees and any other charges on equipment, and other materials brought into Nicaragua for the conduct of the Study,

(4)To exempt the members of the Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Team for their services in connection with the implementation of the Study,

(5)To provide necessary facilities to the Team for the remittances as well as the utilization of the funds introduced into Nicaragua from Japan in connection with the implementation of the Study,

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(6)To take necessary action to obtain permission for the Team to enter into private properties or restricted areas for the implementation of the Study,

(7)To secure permission for the Team to take all data and documents including photographs and maps after authorization by responsible organizations concerned, related to the Study out of Nicaragua to Japan,

(8)To provide medical services in case of necessity, and the fees shall be chargeable to the members of the Team.

2. GON shall bear claims, if any arises, against the members of the Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Team.

3. Ministerio de Agricultura y Ganaderia (hereinafter referred to as "MAG"), shall act as a counterpart agency to the Team and also as coordinating body in relation with other relevant organizations for the smooth implementation of the study.

4. MAG shall, at its own expense, provide the Team with the following, in cooperation with other relevant organizations;
   (1) Available data and information related to the Study,
   (2) Additional survey related to the Study, if necessary,
   (3) Counterpart personnel and supporting staff,
   (4) Suitable office space with necessary equipment in Managua and selected project areas,
   (5) Credentials or identification cards, and
   (6) Necessary number of vehicles with drivers.

VIII. Undertakings of JICA

For the implementation of the Study, JICA shall take the following measures;

1. To dispatch, at its own expense, the study team to Nicaragua,
2. To pursue technology to counterparts personnel in the course of the Study.

IX. Consultation

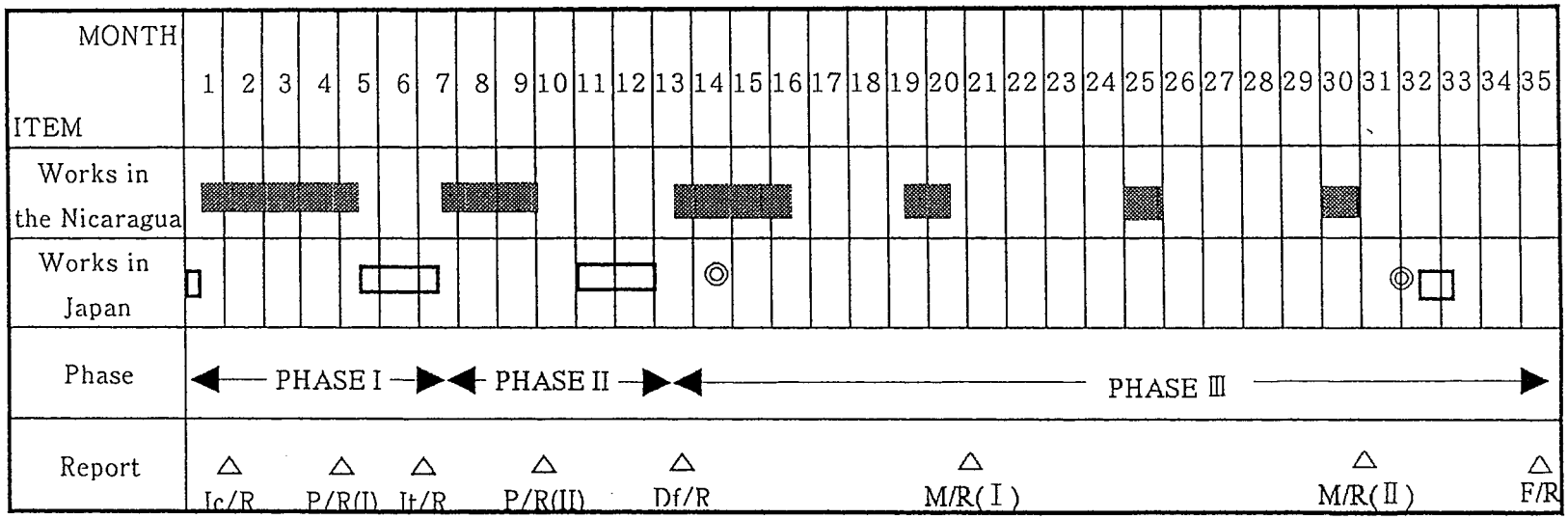
JICA and GON shall consult with each other in respect of any matter that may arise from or in connection with the Study.

X. Translation

The Scope of Work is prepared both in English and in Spanish, and the both versions are signed by the both parties. In case any doubt arises in interpretation, the English text shall prevail.

ANNEX 1

TENTATIVE WORK SCHEDULE



(Remarks) Ic / R : Inception Report
P / R(I) : Progress Report(1)
It / R : Interim Report
P / R(II) : Progress Report(2)
Df / R : Draft Final Report
M / R(I) : Monitoring Progress Report(1)
M / R(II) : Monitoring Progress Report(2)
F / R : Final Report
◎ : Comments on Df /R or M/R(Ⅱ) by the Nicaragua side

ATTACHMENT-2

MINUTES OF MEETING

MINUTES OF MEETING
ON
THE DRAFT FINAL REPORT
FOR
THE STUDY
ON
AGRICULTURAL DEVELOPMENT
FOR
THE REGION II AND IV
IN
THE PACIFIC COAST
IN
THE REPUBLIC OF NICARAGUA

AGREED UPON BETWEEN
MINISTERIO AGROPECUARIO Y FORESTAL
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Managua, 27 October, 1998

Dr. Mario A. De Franco
Ministro
Ministerio Agropecuario y Forestal

Mr. Takashi Fujita
Leader of Study Team
Japan International
Cooperation Agency (JICA)

Witness by

Dr. Mauricio Gómez
Director General de Gestión
Secretaría de Cooperatión Externa

Mr. Makoto Kitanaka
Leader of Advisory Mission
Japan International
Cooperation Agency (JICA)

In accordance with the Scope of Work for the Study on Agricultural Development for the Region II and IV in the Pacific Coast in the Republic of Nicaragua (hereinafter referred to as "the Study") signed by the Government of the Republic of Nicaragua (hereinafter referred to as "the Government") and the Government of Japan on 20 March, 1997, the Government of Japan dispatched a JICA Study Team.

The JICA Study Team headed by Mr.Takashi Fujita submitted and explained the Draft Final Report on 26 October, 1998, under the attendance of the JICA Advisory Mission headed by Mr.Makoto Kitanaka, to the Government headed by Mr. Juan F Rodriguez and to the Nicaraguan official members involved to the present Study, at the same time exchange of opinions was made between the Nicaraguan side and the Study Team.

As the result of the said explanation and an exchange of opinions, the Nicaraguan side and the Study Team have agreed the followings:

1. The Government received from the Study Team twenty five (25) copies of the Draft Final Report, and twenty five (25) copies of the Annex of Draft Final Repot in Spanish.

2. The Government has agreed with the contents of the Draft Final Report and study schedule.

3. The Government mentioned that it will present to the Study Team the comments on the Draft Final Report during its stay in Nicaragua. The Study Team will analyze the comments and incorporate them, where relevant, into the Final Report.

4. The Government requested the Study Team further technical cooperation of the Seed Development Program and the Study Team promised to impart the Government's desire to the Government of Japan.

This Minutes of Meeting is prepared in English and Spanish. In case that any discrepancy may arise between these two versions, the English version shall prevail.

List of Participants

1. Nicaraguan side

1) Ministerio Agropecuario y Forestal (MAG - FOR)

Mario De Franco	Ministro
Juan F. Rodriguez	Secretario General
Eddy Jeréz	Director Cooperación Externa
Alvaro Icaza V.	Director Delegaciones Regionaes
Eduardo Marín Castillo	Asesor en Planificación de la Tierra
Dinorah S. Moreno	Asist. Técnico Administrativo OPSA
María Auxiliadora Espinoza	Consultor OPSA
Arkangel Abaunza	Consultor OPSA
Eduardo Hanón	Consultor OPSA
Roger Paguaga	Consultor OPSA

2) Instituto Nicaragüense de Tecnología Agropecuaria (INTA)

Róger Urbina A.	Director General

3) Secretaría de Cooperación Externa (SCE)

Mauricio Gómez	Director General de Gestión
Auxiliadora Vindel R.	Responsable del Dpto. Japón
Minoru Arimoto	Asesor Especial
Alejandro Maltez M.	Consultor Cooperación Japonesa

2. Japanese side

1) Japan International Cooperation Agency (JICA)

Makoto Kitanaka	Leader of Advisory Mission

2) The JICA Study Team

Takashi Fujita	Team Leader
Zetsugaku Kurita	Agronomy
Yasushi Wada	Rural Society, Gender and Farmer's Organization
Akira Nakamura	Hydrology / Meteorology
Yuko Matsunaga	Interpreter

MINUTA DE REUNION
DEL
BORRADOR DEL INFORME FINAL
PARA
EL ESTUDIO
SOBRE
DESARROLLO AGRICOLA
EN
LAS REGIONES II Y IV
SOBRE
LA COSTA PACIFICA
DE
LA REPUBLICA DE NICARAGUA

ACORDADO ENTRE
MINISTERIO AGROPECUARIO Y FORESTAL
Y
AGENCIA DE COOPERACION INTERNACIONAL DEL JAPON

Managua, 27 de Octubre de 1998

Dr. Mario A. De Franco
Ministro
Ministerio Agropecuario y Forestal

Ing. Takashi Fujita
Jefe de Equipo de Estudio
Agencia de Cooperación
Internacional del Japón

Testigo

Dr. Mauricio Gómez
Director General de Gestión
Secretaría de Cooperación Externa

Ing. Makoto Kitanaka
Líder Misión Asesora
Agencia de Cooperación
Internacional del Japón

De acuerdo con el Alcance de Trabajo para el Estudio sobre el Desarrollo Agrícola en las Regiones II y IV sobre la Costa Pacífica de la República de Nicaragua, (en lo adelante denominado como "el Estudio") firmado entre el Gobierno de la República de Nicaragua (en lo adelante denominado como "el Gobierno") y el Gobierno del Japón el día 20 de Marzo de 1997, el Gobierno del Japón envió el Equipo de Estudio de JICA.

El Equipo de Estudio de JICA encabezado por el Ing. Takashi Fujita entregó y explicó el Borrador del Informe Final el día 26 de Octubre de 1998, con la asistencia de la Misión Asesora de JICA encabezado por el Ing. Makoto Kitanaka, el Gobierno encabezado por el Lic. Juan F. Rodriguez y los miembros oficiales Nicaragüenses relacionados con el presente Estudio. Al mismo tiempo se intercambiaron opiniones entre la parte Nicaragüense y el Equipo de Estudio.

Como resultado de dicha explicación y del intercambio de opiniones entre la parte Nicaragüense y el Equipo de Estudio se acordó los siguientes puntos;

1. El Gobierno recibió de la parte del Equipo de Estudio Veinticinco (25) copias del Borrador del Informe Final y otras Veinticinco (25) copias del Anexo del Borrador del Informe Final en español.

2. El Equipo de Estudio explicó el alcance del Estudio de Factibilidad y la metodología a aplicarse para el mismo. El Gobierno entendió y aceptó dicha explicación.

3. El Gobierno manifestó que presentaría al Equipo de Estudio los comentarios sobre el Borrador del Informe Final durante su estadía en Nicaragua. El Equipo de Estudio analizará los comentarios e incorporará los mismos, en donde sea relevante, en el Informe Final del Estudio de Factibilidad.

4. El Gobierno solicitó al Equipo de Estudio la posibilidad de que el Gobierno de Japón amplíe la ayuda en el aspecto de cooperación técnica al Programa de Desarrollo de Semillas, y el Equipo de Estudio se comprometió a informarlo al Gobierno de Japón.

Esta Minuta de Reunión está elaborada tanto en Inglés como en Español, no obstante en caso de que exista alguna discrepancia entre las dos versiones, la versión Inglesa prevalecerá.

Lista de Participantes

1. Parte Nicaragüense

1) Ministerio Agropecuario y Forestal (MAG - FOR)

Mario De Franco	Ministro
Juan F. Rodriguez	Secretario General
Eddy Jeréz	Director Cooperación Externa
Alvaro Icaza V.	Director Delegaciones Regionaes
Eduardo Marín Castillo	Asesor en Planificación de la Tierra
Dinorah S. Moreno	Asist. Técnico Administrativo OPSA
María Auxiliadora Espinoza	Consultor OPSA
Arkangel Abaunza	Consultor OPSA
Eduardo Hanón	Consultor OPSA
Roger Paguaga	Consultor OPSA

2) Instituto Nicaragüense de Tecnología Agropecuaria (INTA)

Róger Urbina A.	Director General

3) Secretaría de Cooperación Externa (SCE)

Mauricio Gómez	Director General de Gestión
Auxiliadora Vindel R.	Responsable del Dpto. Japón
Minoru Arimoto	Asesor Especial
Alejandro Maltez M.	Consultor Cooperación Japonesa

2. Parte Japonesa

1) Agencia de Cooperación Internacional del Japón (JICA)

Makoto Kitanaka	Líder del Comité Asesor

2) Equipo de Estudio de JICA

Takashi Fujita	Jefe de Equipo
Zetsugaku Kurita	Agronomía y Extensión
Yasushi Wada	Sociedad Rural, Género y Organización Campesina
Akira Nakamura	Meteorología e Hidrología
Yuko Matsunaga	Intérprete

MINUTES OF MEETING
ON
THE MONITORING REPORT (1)
FOR
THE STUDY
ON
AGRICULTURAL DEVELOPMENT
FOR
THE REGION II AND IV
IN
THE PACIFIC COAST
IN
THE REPUBLIC OF NICARAGUA

AGREED UPON BETWEEN
MINISTERIO AGROPECUARIO Y FORESTAL
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Managua, 14 January, 1999

Lic. Juan F. Rodriguez
Secretario General
Ministerio Agropecuario y Forestal

Mr. Takashi Fujita
Leader of Study Team
Japan International
Cooperation Agency (JICA)

In accordance with the Scope of Work for the Study on Agricultural Development for the Region II and IV in the Pacific Coast in the Republic of Nicaragua (hereinafter referred to as "the Study") signed by the Government of the Republic of Nicaragua (hereinafter referred to as "the Government") and the Government of Japan on 20 March, 1997, the Government of Japan dispatched a JICA Study Team.

The JICA Study Team headed by Mr.Takashi Fujita submitted and explained the Monitoring Report(1) on 14 January 1999, to the Government headed by Mr. Juan F Rodriguez and to the Nicaraguan official members involved to the present Study, at the same time exchange of opinions was made between the Nicaraguan side and the Study Team.

As the result of the said explanation and an exchange of opinions, the Nicaraguan side and the Study Team have agreed the followings:

1. The Government received from the Study Team twenty (20) copies of the Monitoring Report (1) in Spanish.

2. The Government has agreed with the contents of the Monitoring Report (1).

3. The Government requested the Study Team to provide an opportunity of counterpart training in Japan and the Study Team promised to impart the Government's request to the Government of Japan.

This Minutes of Meeting is prepared in English and Spanish. In case that any discrepancy may arise between these two versions, the English version shall prevail.

List of Participants

1. Nicaraguan side

   1) Ministerio Agropecuario y Forestal (MAG - FOR)

Juan F. Rodriguez	Secretario General
Eddy Jeréz	Director Cooperación Externa
Alvaro Icaza V.	Director Delegaciones Regionaes
Dinorah S. Moreno	Asist. Técnico Administrativo OPSA
Arkangel Abaunza	Consultor OPSA

2. Japanese side

   1) The JICA Study Team

Takashi Fujita	Team Leader
Zetsugaku Kurita	Agronomy
Yasushi Wada	Rural Society, Gender and Farmer's Organization
Akira Nakamura	Hydrology / Meteorology
Yuko Matsunaga	Interpreter

MINUTA DE REUNION
DEL
INFORME DE MONITOREO (1)
PARA
EL ESTUDIO
SOBRE
DESARROLLO AGRICOLA
EN
LAS REGIONES II Y IV
SOBRE
LA COSTA PACIFICA
DE
LA REPUBLICA DE NICARAGUA

ACORDADO ENTRE
MINISTERIO AGROPECUARIO Y FORESTAL
Y
AGENCIA DE COOPERACION INTERNACIONAL DEL JAPON

Managua, 14 de Enero de 1999

Lic. Juan F. Rodriguez
Secretario General
Ministerio Agropecuario y Forestal

Ing. Takashi Fujita
Jefe de Equipo de Estudio
Agencia de Cooperación
Internacional del Japón

De acuerdo con el Alcance del Trabajo para el Estudio sobre el Desarrollo Agrícola en las Regiones II y IV sobre la Costa Pacífica de la República de Nicaragua, (en lo adelante denominado como "el Estudio") firmado entre el Gobierno de la República de Nicaragua (en lo adelante denominado como "el Gobierno") y el Gobierno del Japón el día 20 de Marzo de 1997, el Gobierno del Japón envió el Equipo de Estudio de JICA.

El Equipo de Estudio de JICA encabezado por el Ing. Takashi Fujita entregó y explicó el informe de monitoreo (1) el día 14 de Enero de 1999 al Gobierno representado por el Lic. Juan F. Rodriguez y los miembros oficiales nicaragüenses relacionados con el presente Estudio. Al mismo tiempo se intercambiaron opiniones entre la parte Nicaragüense y el Equipo de Estudio.

Como resultado de dicha explicación y del intercambio de opiniones entre la parte Nicaragüense y el Equipo de Estudio se acordó los siguientes puntos;

1. El Gobierno recibió de parte del Equipo de Estudio Veinte (20) copias del Informe de Monitoreo (1) en español.

2. El Gobierno está de acuerdo el contenido del Informe de Monitoreo (1).

3. El Gobierno solicitó al Equipo de Estudio que le facilitara una oportunidad de capacitación para las contrapartes en Japón , y el Equipo de Estudio se comprometió a informarlo al Gobierno de Japón.

Esta Minuta de Reunión está elaborada tanto en Inglés como en Español, no obstante en caso de que exista alguna discrepancia entre las dos versiones, la versión Inglesa prevalecerá.

Lista de Participantes

1. Parte Nicaragüense

1) Ministerio Agropecuario y Forestal (MAG - FOR)

Juan F. Rodriguez	Secretario General
Eddy Jeréz	Director Cooperación Externa
Alvaro Icaza V.	Director Delegaciones Regionaes
Dinorah S. Moreno	Asist. Técnico Administrativo OPSA
Arkangel Abaunza	Consultor OPSA

2. Parte Japonesa

1) Equipo de Estudio de JICA

Takashi Fujita	Jefe de Equipo
Zetsugaku Kurita	Agronomía
Yasushi Wada	Sociedad Rural, Género y Organización Campesina
Akira Nakamura	Meteorología e Hidrología
Yuko Matsunaga	Intérprete

MINUTES OF MEETING
ON
THE MONITORING REPORT (2)
FOR
THE STUDY
ON
AGRICULTURAL DEVELOPMENT
FOR
THE REGION II AND IV
IN
THE PACIFIC COAST
IN
THE REPUBLIC OF NICARAGUA

AGREED UPON BETWEEN
MINISTERIO AGROPECUARIO Y FORESTAL
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Managua, 8 July, 1999

Lic. Juan F. Rodriguez
Secretario General
Ministerio Agropecuario y Forestal

栗田絶学

Mr. Zetsugaku Kurita
Agronomist
Japan International
Cooperation Agency (JICA)

In accordance with the Scope of Work for the Study on Agricultural Development for the Region II and IV in the Pacific Coast in the Republic of Nicaragua (hereinafter referred to as "the Study") signed by the Government of the Republic of Nicaragua (hereinafter referred to as "the Government") and the Government of Japan on 20 March, 1997, the Government of Japan dispatched a JICA Study Team.

The JICA Study Team headed by Mr. Zetsugaku Kurita submitted and explained the Monitoring Report(2) on 8 July 1999, to the Government headed by Mr. Juan F Rodriguez and to the Nicaraguan official members involved to the present Study, at the same time exchange of opinions was made between the Nicaraguan side and the Study Team.

As the result of the said explanation and an exchange of opinions, the Nicaraguan side and the Study Team have agreed the followings:

1. The Government received from the Study Team twenty (20) copies of the Monitoring Report (2) in Spanish.

2. The Government will check the content of the Monitoring Report (2) and submit the comments later to the JICA Study Team.

3. The Government requested the Study Team to provide an opportunity of counterpart training in Japan and the Study Team promised to impart the Government's request to the Government of Japan.

This Minutes of Meeting is prepared in English and Spanish. In case that any discrepancy may arise between these two versions, the English version shall prevail.

List of Participants

1. Nicaraguan side

   1) Ministerio Agropecuario y Forestal (MAG - FOR)

Juan F. Rodriguez	Secretario General
Dinorah S. Moreno	Asist. Técnico Administrativo OPSA
Arkángel Abaunza	Unidad de Tecnología
Juan Velazquez	Director de Operaciones

2. Japanese side

   1) The JICA Study Team

Zetsugaku Kurita	Agronomist

MINUTA DE REUNION
DEL
REPORTE DEL MONITOREO (2)
PARA
EL ESTUDIO
SOBRE
DESARROLLO AGRICOLA
EN
LAS REGIONES II Y IV
SOBRE
LA COSTA PACIFICA
DE
LA REPUBLICA DE NICARAGUA

ACORDADO ENTRE
MINISTERIO AGROPECUARIO Y FORESTAL
Y
AGENCIA DE COOPERACION INTERNACIONAL DEL JAPON

Managua, 8 Julio de 1999

Lic. Juan F. Rodriguez
Secretario General
Ministerio Agropecuario y Forestal

栗田絶学

Ing. Zetsugaku Kurita
Agrónomo
Agencia de Cooperación
Internacional del Japón

De acuerdo con el Alcance de Trabajo para el Estudio sobre el Desarrollo Agrícola en las Regiones II y IV sobre la Costa Pacífica de la República de Nicaragua, (en adelante denominado como "el Estudio") firmado entre el Gobierno de la República de Nicaragua (en adelante denominado como "el Gobierno") y el Gobierno del Japón el día 20 de Marzo de 1997, el Gobierno del Japón envió el Equipo de Estudio de JICA.

El Equipo de Estudio de JICA encabezado por el Ing. Zetsugaku Kurita entregó y explicó el Reporte de Monitoreo (2) en 8 Julio de 1999, al Gobierno encabezado por el Lic. Juan F. Rodríguez y los miembros oficiales Nicaragüenses relacionados con el presente Estudio. Al mismo tiempo se intercambiaron opiniones entre la parte Nicaragüense y el Equipo de Estudio.

Como resultado de dicha explicación y del intercambio de opiniones entre la parte Nicaragüense y el Equipo de Estudio se acordó los siguientes puntos;

1.- El Gobierno recibió de parte del equipo de estudio veinte (20) copias de el Reporte del Monitoreo (2) en Español.

2.- El Gobierno estuvo de acuerdo en revisar el contenido del Reporte de Monitoreo (2) y someter sus comentarios al Equipo de Estudio del JICA.

3.- El Gobierno solicitó al Equipo de Estudio de proveer una oportunidad a las contrapartes de ser entrenados en Japón y el Equipo de Estudio prometió transmitir la solicitud del Gobierno al Gobierno de Japón.

Esta Minuta de Reunión está elaborada tanto en Inglés como en Español, no obstante en caso de que exista alguna discrepancia entre las dos versiones, la versión Inglesa prevalecerá.

Lista de Participantes

1.- Parte Nicaragüense.

1) Ministerio Agropecuario y Forestal (MAG - FOR)

Juan F. Rodríguez	Secretario General
Dinorah S. Moreno	Asist. Técnico Administrativo OPSA
Arkángel Abaunza	Unidad de Tecnología
Juan Velazquez	Director de Operaciones

2.- Parte Japonesa.

2) Equipo de Estudio JICA

Zetsugaku Kurita	Agrónomo

MINUTES OF MEETING
ON
THE MONITORING REPORT (3)
FOR
THE STUDY
ON
AGRICULTURAL DEVELOPMENT
FOR
THE REGION II AND IV
IN
THE PACIFIC COAST
IN
THE REPUBLIC OF NICARAGUA

AGREED UPON BETWEEN
MINISTERIO AGROPECUARIO Y FORESTAL
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Managua, 27 January, 1999

Lic. German Angulo López
Coordinador Unidad de Riego y Drenaje
Ministerio Agropecuario y Forestal

栗田絶学

Mr. Zetsugaku Kurita
Agronomist
Japan International
Cooperation Agency (JICA)

In accordance with the Scope of Work for the Study on Agricultural Development for the Region II and IV in the Pacific Coast in the Republic of Nicaragua (hereinafter referred to as "the Study") signed by the Government of the Republic of Nicaragua (hereinafter referred to as "the Government") and the Government of Japan on 20 March, 1997, the Government of Japan dispatched a JICA Study Team.

The JICA Study Team headed by Mr. Zetsugaku Kurita submitted and explained the Monitoring Report(3) on 27 January 2000, to the Government headed by Mr. German Angulo López and to the Nicaraguan official members involved to the present Study, at the same time exchange of opinions was made between the Nicaraguan side and the Study Team.

As the result of the said explanation and an exchange of opinions, the Nicaraguan side and the Study Team have agreed the followings:

1. The Government received from the Study Team twenty (20) copies of the Monitoring Report (3) in Spanish.

2. The Government will check the content of the Monitoring Report (3) and submit the comments later to the JICA Study Team.

This Minutes of Meeting is prepared in English and Spanish. In case that any discrepancy may arise between these two versions, the English version shall prevail.

List of Participants

1. Nicaraguan side

   1) Ministerio Agropecuario y Forestal (MAG - FOR)

Lic.German Angulo López	Coordinador Unidad de Riego y Drenaje
Ing.Cidar Cárdenas	Jefe Departamento Técnico Unidad de Riego y Drenaje
Ing. Silvio Prio	Supervisor Unidad de Riego y Drenaje Región II
Ing.Arkángel Abaunza	Director de Análisis DGSAF
Lic. Roger Paguaga	Director de Políticas DGSAF

2. Japanese side

   1) The JICA Study Team

      Mr. Zetsugaku Kurita

MINUTA DE REUNION
DEL
REPORTE DEL MONITOREO (3)
PARA
EL ESTUDIO
SOBRE
DESARROLLO AGRICOLA
EN
LAS REGIONES II Y IV
SOBRE
LA COSTA PACIFICA
DE
LA REPUBLICA DE NICARAGUA

ACORDADO ENTRE
MINISTERIO AGROPECUARIO Y FORESTAL
Y
AGENCIA DE COOPERACION INTERNACIONAL DEL JAPON

Managua, 27 Enero del 2000

Lic. German Angulo López
Coordinador Unidad de Riego y Drenaje
Ministerio Agropecuario y Forestal

栗田絶学

Ing. Zetsugaku Kurita
Agrónomo
Agencia de Cooperación
Internacional del Japón

De acuerdo con el Alcance de Trabajo para el Estudio sobre el Desarrollo Agrícola en las Regiones II y IV sobre la Costa Pacífica de la República de Nicaragua, (en adelante denominado como "el Estudio") firmado entre el Gobierno de la República de Nicaragua (en adelante denominado como "el Gobierno") y el Gobierno del Japón el día 20 de Marzo de 1997, el Gobierno del Japón envió el Equipo de Estudio de JICA.

El Equipo de Estudio de JICA encabezado por el Ing. Zetsugaku Kurita entregó y explicó el Reporte de Monitoreo (3) el 27 de Enero del 2000, al Gobierno encabezado por el Lic. German Angulo López y los miembros oficiales Nicaragüenses relacionados con el presente Estudio. Al mismo tiempo se intercambiaron opiniones entre la parte Nicaragüense y el Equipo de Estudio.

Como resultado de dicha explicación y del intercambio de opiniones entre la parte Nicaragüense y el Equipo de Estudio se acordó los siguientes puntos;

1.- El Gobierno recibió de parte del equipo de estudio veinte (20) copias de el Reporte del Monitoreo (3) en Español.

2.- El Gobierno estuvo de acuerdo en revisar el contenido del Reporte de Monitoreo (3) y someter sus comentarios al Equipo de Estudio del JICA.

Esta Minuta de Reunión está elaborada tanto en Inglés como en Español, no obstante en caso de que exista alguna discrepancia entre las dos versiones, la versión Inglesa prevalecerá.

Lista de Participantes

1.- Parte Nicaragüense.

1) Ministerio Agropecuario y Forestal (MAG - FOR)

Lic.German Angulo López	Coordinador Unidad de Riego y Drenaje
Ing.Cidar Cárdenas	Jefe Departamento Técnico Unidad de Riego y Drenaje
Ing. Silvio Prio	Supervisor Unidad de Riego y Drenaje Región II
Ing. Arkángel Abaunza	Director de Análisis DGSAF
Lic. Roger Paguaga	Director de Políticas DGSAF

2.- Parte Japonesa.

2) Equipo de Estudio JICA

Ing. Zetsugaku Kurita	Agrónomo

MINUTES OF MEETING
ON
THE DRAFT FINAL REPORT (2)
FOR
THE STUDY
ON
AGRICULTURAL DEVELOPMENT
FOR
THE REGION II AND IV
IN
THE PACIFIC COAST
IN
THE REPUBLIC OF NICARAGUA

AGREED UPON BETWEEN
MINISTERIO AGROPECUARIO Y FORESTAL
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Managua, 17 May, 2000

Lic. Germán Angulo López
Coordinador
Unidad de Riego y Drenaje
Ministerio Agropecuario y Forestal

Mr. Takashi Fujita
Leader of Study Team
Japan International
Cooperation Agency (JICA)

Witness by

Mr. Kunimasa Matsumoto
Leader of Advisory Committee
Japan International Cooperation Agency (JICA)

In accordance with the Scope of Work for the Study on Agricultural Development for the Region II and IV in the Pacific Coast in the Republic of Nicaragua (hereinafter referred to as "the Study") signed by the Government of the Republic of Nicaragua (hereinafter referred to as "the Government") and the Government of Japan on 20 March, 1997, the Government of Japan dispatched a JICA Study Team.

The JICA Study Team headed by Mr.Takashi Fujita submitted and explained the Draft Final Report(2) and Monitoring Report(4) on 16 May 2000, under the attendance of JICA advisory committee headed by Mr. Kunimasa Matsumoto, to the Government headed by Lic. Germán Angulo López and to the Nicaraguan official members involved in the present Study, at the same time exchange of opinions was made between the Nicaraguan side and the Study Team.

As the result of the said explanation and an exchange of opinions, the Nicaraguan side and the Study Team have agreed the followings:

1. The Government received from the Study Team twenty (20) copies of the Draft Final Report (2) in Spanish.

2. The Government received from the Study Team twenty (20) copies of the Monitoring Report (4) in Spanish.

3. The Government has agreed with the contents of the Monitoring Report (4).

4. The Government expressed to the Study Team the comments on the Draft Final Report (2), which will be presented by letter by 16 Jun, 2000. The Study Team will analyze the comments and incorporate them, where relevant, into the Final Report.

This Minutes of Meeting is prepared in English and Spanish. In case that any discrepancy may arise between these two versions, the English version shall prevail.

List of Participants

1. Nicaraguan side

   1) Ministerio Agropecuario y Forestal (MAG - FOR)

Ing. Jorge Castillo Quant	Secretario General
Germán Angulo López	Coordinador de Unidad de Riego y Drenaje

2. Japanese side

   1) Japan International Cooperation Agency(JICA)

Kunimasa Matsumoto	Leader of Advisory Mission
Shigeru Takagi	Resident Representative

   2) The JICA Study Team

Takashi Fujita	Team Leader
Zetsugaku Kurita	Agronomy
Yasushi Wada	Rural Society, Gender and Farmer's Organization
Akira Nakamura	Hydrology / Meteorology
Mari Ikai	Interpreter

MINUTA DE REUNION
DEL
BORRADOR DEL INFORME FINAL (2)
PARA
EL ESTUDIO
SOBRE
DESARROLLO AGRICOLA
EN
LAS REGIONES II Y IV
SOBRE
LA COSTA PACIFICA
DE
LA REPUBLICA DE NICARAGUA

ACORDADO ENTRE
MINISTERIO AGROPECUARIO Y FORESTAL
Y
AGENCIA DE COOPERACION INTERNACIONAL DEL JAPON

Managua, 17 de Mayo de 2000

Lic. Germán Angulo López
Coordinador
Unidad de Riego y Drenaje
Ministerio Agropecuario y Forestal

Ing. Takashi Fujita
Jefe de Equipo de Estudio
Agencia de Cooperación
Internacional del Japón (JICA)

Testigo

Sr. Kunimasa Matsumoto
Jefe del Comité Asesor
Agencia de Cooperación Internacional del Japón (JICA)

De acuerdo con el Alcance de Trabajo para el Estudio sobre el Desarrollo Agrícola en las Regiones II y IV sobre la Costa Pacífica de la República de Nicaragua (en lo adelante denominado como "el Estudio") firmado entre el Gobierno de la República de Nicaragua (en lo adelante denominado como "el Gobierno) y el Gobierno del Japón el día 20 de marzo de 1997, el Gobierno del Japón envió el Equipo de Estudio de JICA.

El Equipo de Estudio de JICA encabezado por el Ing. Takeshi Fujita entregó y explicó el Borrador del Informe Final (2) y el Informe de Monitoreo (4) el día 16 de mayo de 2000, en presencia del Comité Asesor de JICA encabezado por el Sr. Kunimasa Matsumoto, al Gobierno encabezado por el Lic. Germán Angulo López y los miembros oficiales Nicaragüenses relacionados con el presente Estudio. Al mismo tiempo se intercambiaron opiniones entre la parte Nicaragüense y el Equipo de Estudio.

Como resultado de dicha explicación y del intercambio de opiniones entre la parte Nicaragüense y el Equipo de Estudio se acordaron los siguientes puntos:

1. El Gobierno recibió de parte del Equipo de Estudio veinte (20) copias del Borrador del Informe Final (2) en español.

2. El Gobierno recibió de parte del Equipo de Estudio veinte (20) copias del Informe de Monitoreo (4) en español.

3. El Gobierno manifestó estar de acuerdo con los contenidos del Informe de Monitoreo (4).

4. El Gobierno expresó al Equipo de Estudio los comentarios sobre el Borrador del Informe Final (2), y los presentará por escrito antes del 16 de junio de 2000. El Equipo de Estudio analizará los comentarios e incorporarán los mismos, en donde sea relevante, en el Informe Final.

Esta Minuta de Reunión está elaborada tanto en Inglés como en Español, no obstante en caso de que exista alguna discrepancia entre las dos versiones, la versión Inglesa prevalecerá.

Lista de Participantes

1. Para Nicaragüense

   1) Ministerio Agropecuario y Forestal (MAG - FOR)

Ing. Jorge Castillo Quant	Secretario General
Lic.Germán Angulo López	Coordinador de Unidad de Riego y Drenaje

2. Parte Japonesa

   1) Agencia de Cooperación Internacional del Japón (JICA)

Kunimasa Matsumoto	Jefe del Comité de Asesor
Shigeru Takagi	Representante Residente

   2) Equipo de Estudio de JICA

Takashi Fujita	Jefe del Equipo
Zetsugaku Kurita	Agronomía
Yasushi Wada	Sociedad Rural, Género y Organización Campesina
Akira Nakamura	Hidrología y Meteorología
Mari Ikai	Intérprete

ATTACHMENT-3

LIST OF MEMBERS

Member of the Japanese Study Team and their Nicaraguan Counterpart Personal

Japanese Study Team	Field of Specialization	Nicaraguan Counterpart Personnel
Mr. Takashi Fujita	Team Leader	Mr. Juan Fco. Rodrígues
		Mr. German Angulo
Mr. Takashi Isozuka	Rural Infrastructure	Mr. Eduardo Marín
Mr. Zetugaku Kurita	Agriculture & Extension	Mr. Arkángel Abaunza
		Mr. Pedro Rubí
		Mr. Rolando Rivas
Mr. Yasushi Wada	Rural Sociology & Gender	Mrs. Carmen Largaespada
		Mr. Silvio Prio
		Mr. Josefa Mendoza
		Mr. Angel Navarrete
Mr. Jorge E. Tokeshi N	Agro-economy & Project Evaluation	Mr. Orlando Siu
Mr. Akeshi Mori	Marketing	Mr. Róger Paguaga
Mr. Akira Nakamura	Meteorology & Hydrology	Mr. Eduardo Hanon
		Mr. Cidar Cardenas
		Mr. Ajax Fonseca
Mr. Tukasa Kishimoto	Environment	Mr. Victor Tercero
Mr. Daigo Yano	Structures Design & Cost Estimation	Mr. Eduardo Hanon
Mr. Hideki Mori	Hydrogeology	Mr. Eduardo Hanon
Mr. Yusuke Goto	Rural Development	Mr. Eduardo Hanon