

7.4 SUB-PROJECT : IMPROVEMENT OF AGRICULTURAL AND LIVESTOCK PRODUCTIVITY OF LOW INCOME FARMERS IN THE SANTA CRUZ AREA (CORN PRODUCTION AREA)

7.4.1 Diagnosis of the Subproject Area

(1) Geographical Location and Administrative Division

The subproject area (Canton Santa Cruz) is situated in the Frontera Hidalgo municipality. The municipality is located at the 14° 46' North Latitude, and the 92° 13' West Longitude, and is one of the municipalities of the Soconusco Region, adjoining to the border with Republic of Guatemala along to the Suchiate River.

There are 52 farm households who grow corn and practice agriculture and livestock activities, with a total number of 270 family members, conformed of 140 males (51.7%) and 130 females (48.3%).

The location map of the area is shown in Fig. 7.4.1

(2) Climate conditions and natural resources

The mean annual rainfall is about 1,903mm and more than 90% of the rain is concentrated in the rainy season which is during May and October. In contrast, the mean monthly temperature varies from 26.8°C and 28°C, with an annual average temperature of 27.4°C.

Month	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Precipitation (mm)	3.3	6.5	15.6	73.5	227.8	315.4	284.9	322.6	396.4	193.5	49.4	14.3	1903.3
Temperature (°C)	26.8	27.3	27.9	28.8	28.2	27.5	27.3	27.2	27.0	27.2	27.3	27.1	27.4
Evaporation (mm)	140.5	146.6	173.0	163.5	128.8	108.9	125.1	122.2	108.6	118.8	116.5	111.1	1563.6

Source : CNA Frontera Hidalgo Observation Station (1976~1996)

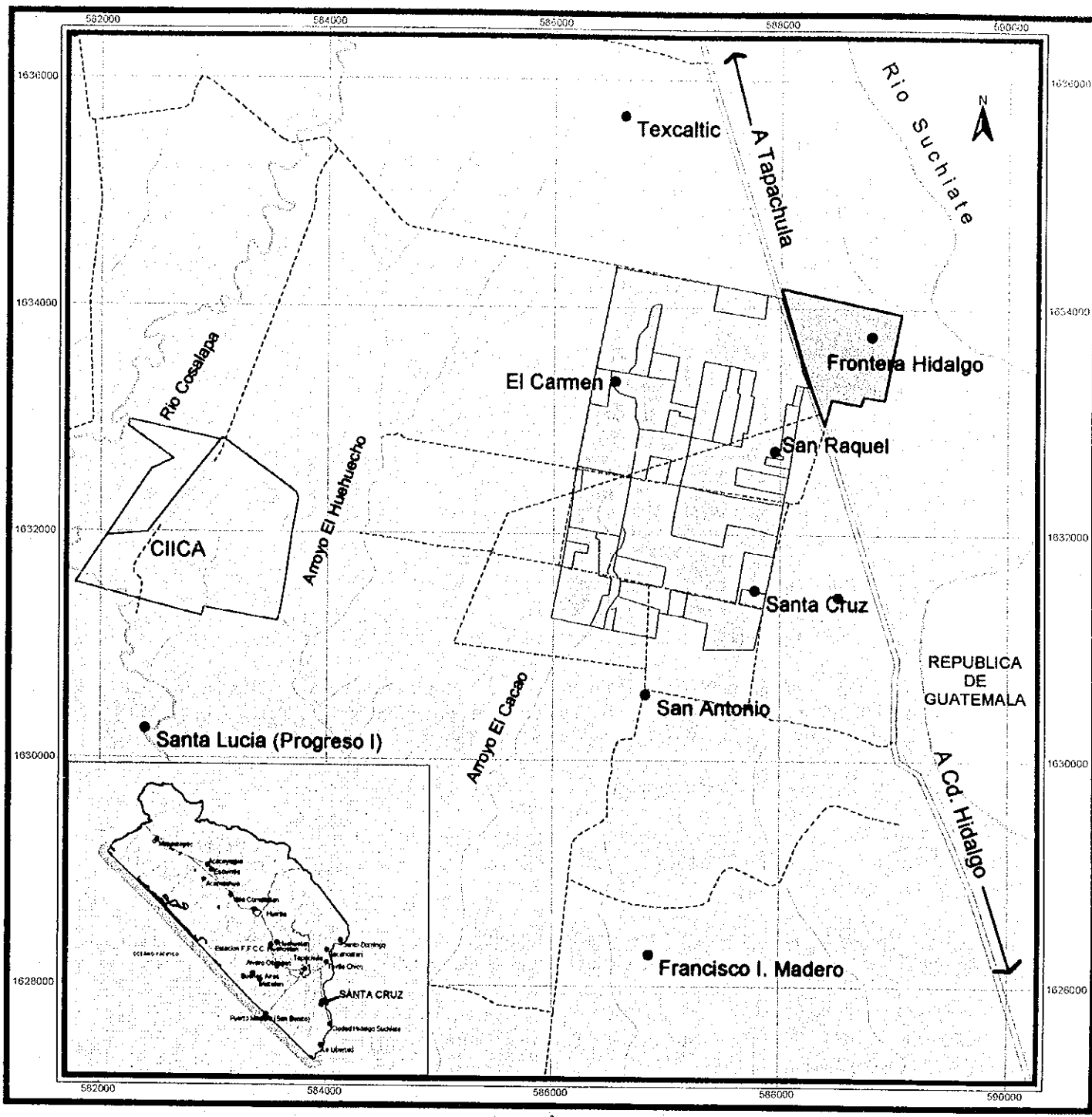
(3) Land Use and Land Tenure

1) Land Use

The actual land use is shown in the following table.

Land Use	Area	
	(ha)	(%)
Corn and annual crops	327.8	61.0
Fruit Trees	46.5	8.7
Pasture	129.0	24.0
Subtotal	503.3	93.7
River and others	34.0	6.3
Total	537.3	100.0

Source : JICA Survey Team (1999)
Data for agricultural year 1998/99



2 0 2 Kilometros

SIMBOLOGIA

- Vías de Comunicación
- BRINCHA
- CALLES
- CARRETERAS EN CONSTRUCCION
- CARRETERAS PAVIMENTADAS DE 1 CARRIL
- FERROCARRIL DE SERVICIO PUBLICO
- PISTA AEREA
- TERRACERIA TRANSITABLE TODO EL TIEMPO
- VEREDA
- Localidades
- Area de Proyecto: Santa Cruz
- ▨ Ecurrimientos superficiales

Fig. 7.4.1 LOCATION MAP FOR PREFEASIBILITY STUDY AREA (SANTA CRUZ, FRONTERA HIDALGO)

ESCALA 1 : 50,000

2) Land Tenure

The farmland in the area, which was part of the Valparaiso Plantation before 1930, was distributed to producers through the agrarian reform. With the conclusion today, of the certification of land titles, all the producers are classified as small-scale landowners because of the land tenure. Although these producers were originally distributed with 20 ha each, the same division among family members has brought about an unbalanced condition in farmer's land tenure since the lots vary between 1.25 ha and 24 ha at the present, an average of 7.54 ha. The number of these landowners in the area is 52, which is distributed in the following manner according to the land size.

Lot Size	Number of Landowners	Total Area	
	Number	Area (ha)	%
Less than 5 ha	23	111.8	22.22
5 ha - 10 ha	11	214.1	42.54
10 ha - 15 ha	6	77.3	15.35
15 ha - 20 ha	6	57.2	11.37
More than 20 ha	6	42.9	8.52
Total	52	503.3	100.0

Source: JICA Study Team

(4) Social Aspects

The majority of landowners, i.e., private producers, live in the municipal urban area of Frontera Hidalgo municipality, leaving a small population formed by farm workers (non landowners) who are being employed by the landowners. A large percentage of the family heads of these private producers have an educational level higher than elementary school, some of them with even a high school or university education.

Because of their location in the municipal urban area, the houses of these private producers have electricity, water supply and sewerage, plus a relatively satisfactory provision of educational and public health infrastructure.

A total of 29 landowners, i.e. 55.8% of the total landowners in the subproject area, is affiliated to the SPR Frontera Hidalgo (Frontera Hidalgo Rural Production Society), and the surface of the lots include 47% (246.5 ha) of the total farmland area. The majority is corn grower and some of them grow mango and cacao. The landowners who are not affiliated to the society are 23 with a total surface of 321.25 ha. Women's groups do not exist amongst the landowners of the area.

The SPR was created in 1993, with a working capital of \$93,000 and the total number of matriculated member at present is 80. All of them are small-scale private farmers, which are dedicated to corn (production value of \$27,100,000), sorghum (\$300,000) and sesame (\$302,500) which is the main crop in this area. The main activity of the SPR consists on supplying agricultural products, liaison for technical support from FIRA and provision of credit services for members. The consciousness on cooperation amongst the members is quite high, which helps to invigorate the society's activities amongst members. The society owns agricultural machinery for harvesting and fertilization and these are used amongst the members. It also has an experimental field for the development of advanced technologies where agricultural technology transfer is carried out three times a year.

(5) Agricultural Production

1) Cultivation Area

The cultivation area according to the farming type in the subproject area is as follows:

Average Cultivation Area (1998/99) according to Farming Type in the Subproject Area

Farming Type	Number of Farmers		Planting Area (ha)			
	Number	(%)	Corn	Perennial	Pasture land	Total
Corn	31	59.6	7.2	--	--	7.2
Fruit trees	6	11.5	--	6.5	--	6.5
Pasture land	2	3.8	--	--	23.5	23.5
Corn and fruit trees	3	5.8	7.2	2.5	--	9.7
Corn and pasture	10	19.2	8.3	-	8.2	16.5
Average	52	100.0	7.4	5.2	10.8	9.7

Note: Fruit trees include oil palm
Source: JICA Study Team (1999)

From the 52 farm households in the subproject area, the average cultivation area is 9.7 ha, 31 farm households are engaged in corn mono-cultivation and its average cultivation area is about 7 ha. From the 31 farm households, 25 of them have a lot smaller than 10 ha and the average is 4.25 ha.

From the 13 diversified farming households, 3 of them are engaged in corn-fruit tree cultivation and 10 of them are engaged in corn-pasture cultivation with an average cultivation area 9.7 ha and 16.5 ha, respectively. The largest crop is corn or fruit trees as mono-cultivation. Six farm households are engaged in growing fruit trees and their area of cultivation is almost the same as their propriety size, as well as the ones involved in corn mono-cultivation. Two farm households are engaged in pasture cultivation and its cultivation area is 2.5 ha.

Annual crops such as Corn, sorghum, sesame, field beans etc. and perennial crops such as mango, cacao, oil palm, pain apple are planted in the subproject area. Only pineapple is grown under irrigation and the rest are grown under rain fed conditions or residual soil moisture condition.

2) Agricultural Production

Agricultural production in the Study Area is as follows:

Crops	Cultivation area (ha)	Yield (ton/ha)	Production (ton)
Corn (PV)	327.8	2.7	885.1
Sesame (RH)	30.3	0.6	18.2
Sorghum (RH)	17.2	3.1	53.5
Mango	19.0	13.1	255.4
Cacao	9.5	0.2	0.19
Pineapple	3.0	40.0	120.0

Source: JICA Study Team (1999)

Average yield of corn is 2.7 ton/ha, which is higher than the one from the Soconusco Area (1.9 ton/ha). The yield of sesame, sorghum and mango are also higher than that of Soconusco Area. Since cacao has been planted carelessly, its yield is lower than that of Soconusco Area.

3) Cost of Production and Balance of Agricultural Development

The cost of production of the crops cultivated in the subproject area are shown below:

Cost of production of crops cultivated in the Study Area

Crops	Cost of production (\$/ha)	Yield (ton/ha)	Unit price (\$/ton)	Income (\$/ha)	Gross profit (\$/ha)
Corn (Normal seeding)	2,967	2.6	1,350	3,510	544
Corn (Non-tillage seeding)	2,987	2.8	1,350	3,780	794
Sorghum	1,807	3.1	1,100	3,410	1,603
Sesame	1,347	0.6	5,900	3,540	2,193
Pineapple (First year, planting)	52,887	-	-	0	-52,887
Pineapple (Second year, planting)	7,887	-	-	-	-7,887
Pineapple (Second year, harvest)	8,737	40.0	2,667	106,680	97,943

Source: JICA Study Team (1999)

The low profitability of corn, sesame and sorghum are compensated by PROCAMPO, nonetheless, this will be abolished in the year 2009 and therefore corn productivity should be improved before that, in order to become a profitable crop since it is one of the main crops in the Study Area.

4) Limiting Factors in Corn Production

The average yield of corn in the Study Area is 2.7 ton/ha, which is higher than other areas in the Soconusco Region. Although 20 kg/ha of hybrid corn, which is the amount of seed recommended by CADER are sown by 90 % of farmers, the productivity potential of hybrid corn is not shown. The cause of the low yield is attributed to the insufficient amount of fertilizer input, imperfect weeding and inadequate pest control.

The amount of Nitrogen fertilizer applied by the farmers is about half of the amount of nitrogen fertilizer (190 kg/ha) recommended for hybrid production.

Soil pests such as *Gallina Ciega*, and stem borer such as *Spodopera frugiperda* seriously damage corn production. Gramineae weeds such as *Echinochloa colono L.* are dominant weeds and very difficult to eradicate.

Although all farmers carry out herbicide applications, there are farmers who have adopted Non-tillage Farming applying herbicide twice a year, i.e. before and after planting corn, but farmers who have adopted the farming method by plowing will only apply once, i.e. after planting the corn. Only 40 % of farmers in the Study Area apply insecticides to control soil pests and stem borers.

Non tillage farming method has been introduced in the last three years and 40 % of the farmers in the Study Area have adopted this method, while other farmers are preparing the land by tractor. Most of the agricultural practices are carried out by labor living in the surrounding area of Frontera Hidalgo. It seems that the agricultural labor is sufficient in the subproject area.

Few farmers own agricultural machinery and the majority rents from others who own them or from the agricultural society to which they belong, competing with other farmers for the same machines in order to plant at optimal period, especially in case of a long spell of rain at planting time.

One of the traditional cultivation methods of corn in the Study Area is culm bending at physiological maturity to dry the seeds in the field, then thresh the field. This method causes the seed to lose its quality, and it is therefore sold at a low price.

(6) Livestock

1) Bovine Cattle Raising

There are 537.25ha of farming land in the area, from which 129 ha (24.6%) are pasturelands. From a total of 52 production units, 12 have pasture and the one with the largest amount of surface has 24 ha, the smallest being of 3ha, with an average of 12.4ha. The owner of the 24 ha of pastureland apparently is dedicated exclusively to cattle raising, but actually he is an intermediary, one who is commonly called a 'Coyote'. He is dedicated to purchase calves of about 1 to 2 years old, raising them for a period of about 6 to 12 months and finally selling them to larger cattlemen from other states. It can be observed that the herd that he manages is from Guatemalan origin and due to the closeness to this country, it is said that most of this cattle is being smuggled. The most prevailing breed is Creole of Centroamerican variety or crossbreeds with Holstein or Frisian, noticing a difference with the local varieties that are crossbred with Cebu.

The rest of the cattle growers raises milk and meat dual purpose calves, mainly Cebu and Brown Swiss and it is sold to the cattlemen mentioned above, as calf for fattening while the rest stays at the local market for milk production. This milk is sold fresh and is consumed in the region. There are only 4 small-scale cattle owners.

Each pasture lot has a surface of 5 ha and there is a lack of an orderly utilization because when the cattle finishes all the pasture, the cattlemen will simply move them to another lot. There is a lack of pasture control, with the exception of the large-scale cattle owners, because most of it is a mixture of natural grass with African Star, a combination that deteriorates the flavor of meat. In the lot boundaries, they tend to plant trees called Piñones and their maintenance is good and simple, even for small-scale cattle owners. Pasture on the large scale cattle owners is located close to the streams originated from springs, therefore even during the dry season their grass will not dry up due to their privileged location, as opposed to the small owners whose pastureland dries completely during this season and their cattle has to graze on corn, sesame and sorghum crops, after the harvest is over.

2) Minor species of Cattle

Around the region, various swine corrals can be observed sponsored by the project for fattening swine from Alianza para el Campo, but within this subproject there is none. Some producers fatten up swine formally from crossbreeds between fine and common. Few producers have Creole chicken and we suppose that is due to the fact that the property owners live in the urban zone and they only have a person in charge of the lot who is uninterested. There is a development of Peligüey sheep.

(7) Marketing and Commercialization System

1) Corn

This grain constitutes the leading traditional crop of the subproject area. In 1998, the total production of the area reached 900 tons approximately, of which 2% was for self-consumption and for seeds. The main marketing destination of the harvest was to middlemen and to CONASUPO, which was still purchasing at Soconusco. According to the producers, the purchase price of CONASUPO was set at \$1,330/ton plus a bonus of \$25.00, but according to the institution, the price at the receiving center was \$1,062.00/ton discounting for shortages and quality. The producer delivers the corn grains in sacks to BORUCONSA (presently in the process of being assigned to the State government) in Frontera Hidalgo, where there is a warehouse with a storage capacity of 6,150 tons and the farmer has to pay an unloading charge of \$5.00. The farmer

also pays the transportation cost of \$50/ton.

It is worthwhile to indicate that on the previous harvest (1998) CONASUPO purchases were sold to milling industries such as Maseca y Minsa to be used in the dough and tortilla industry. Up to 1996, farmers had sold white corn directly to these industries, without having capability to negotiate with them, but in 1997 and 1998 they worked with CONASUPO and were able to get better prices.

2) Other Crops

In the subproject area sesame is sowed making use of the residual humidity of soils. The production is sold totally to middlemen, who ship the product to such states as Puebla, Oaxaca and Guanajuato as well as to the Republic of Guatemala responding to high demand there. Farm-gate price is around \$ 8,000/ton at the end of 1998.

Perennial crops, although insignificant in the area, are represented by mango with planted area as small as 20 ha in total. The harvest season of the fruit is concentrated between March and beginning of May. Due to the small amount of harvests, local farmers sell their products not by quantity but by area, at fix prices for a year or two, with prices varying between \$20,000 and \$22,000 per ha. under conditions of contract with middlemen who supply farmers with all the required farm inputs.

Other producers sell to intermediaries. When the production hits the market in February, the price of a 28 kg crate is \$150.00, but the price reduces weekly as the regional producers bring in their product, so in March the crate is worth \$60.00 and in April it is paid at \$40.00. An unidentifiable volume of this production is given to middlemen to be taken to packing sheds to be commercialized in foreign markets and the rest stays at national markets.

(8) Rural Finance

It is of general knowledge that the farmers are being unable to access the agricultural loan system, which has become a bottleneck discouraging farmers from improving their planting activity and cattle raising. This is the case with the subproject area, where less than 30% of the farmers had access to an agricultural loan last year (according to the farm survey conducted by the Study Team). The financing source for the credits to farmers was exclusively BANRURAL, therefore none of the producers were benefited by the commercial banks. This is due to the fact that the farmers in the area are mainly low-income and Banrural awards loans to those confronting access to commercial banks. These credits are exclusively for short-term cropping loan called "avio", used for planting corn; there was no farmer benefiting by the long-term credit called "refaccionario" which is for capital goods. The average credit amount was \$28,300 per farmer with benefited area of 11 ha. Since the net income level of these farmers is less than 1,000 times the daily minimum salary, the interest rate was set to be equal to CETES (24% per annum, annual average in 1998). Apart from these bank loans, some farmers were supported with credit in the form of input supply provided by the farmers' organization to which they are affiliated.

The great majority of the farmers in the area are engaged in corn cultivation, and the state government through SAGAR offers financial support with PROCAMPO. The farm survey carried out by the Study Team has disclosed that close to 80% of the farmers in the area are beneficiaries of the program. In 1998, the financial support with PROCAMPO was set at \$5,321 per farmer, corresponding to an area of 8.5 ha per farmer.

In addition, about 75% of the local farmers had received a subsidy to purchase under the program of Alianza para el Campo (subprogram of "Kilo por Kilo"); thanks to this subsidy farmers could

get grain's seeds at 42% of the market price.

(9) Agricultural and Rural Infrastructure

1) Irrigation Facility

The only irrigation facilities in the area are shallow wells in two farms. The first farm installed a well 3 years ago and it irrigates 1.5 ha of pineapple, 0.5 ha of beans and a trial area of 10 m² with tomato. The other farm constructed a well in 1998 and it only irrigates a small trial area with pineapple. The shallow wells have 2 m in diameter, 10 m of depth and a water level of 5 – 6 m on March.

Some farm owners in the Area believe that there is a great potential for available groundwater considering the existing conditions of springs and shallow wells close to the subproject area.

There are also two deep wells in the area which are not in operation because the farmers did not finish placing the necessary equipment for its function, even after being rehabilitated by SAGAR in 1992.

2) Roads

The target area is located approximately at 27 km from Tapachula City, along the Highway No.19, which leads from North to South direction up to the border of Guatemala. From the Highway, there are 4 local access roads to the Area. The width of these roads is about 6 – 8 m, gravel coated and relatively well constructed and maintained.

There are three local roads (length of 2.4 ~3.2 km), two bordering the Area and one central road running exactly through the middle of the subproject area. The roads are classified according to their East-west and North-east direction. There are four coated roads(1.4 ~1.8 km of lengths) going across the Area in East-west. In the North-south Besides, there are many farm roads that mainly connect farms to the inner road network. The farm roads have a width of about 3 – 4 m. The inner roads are coated by gravel in fair condition, except for some sections where there is a lack of maintenance but vehicles can pass in case of rainfall. However, there are some sections of inner and farm roads which are not coated and where passage is difficult in case of rainfall. Therefore, maintenance works on the road surface are necessary.

3) Water Supply Facility

Most of the farm owners are living in Frontera Hidalgo Municipal header and therefore have use of all the basic services. Nonetheless, water supply facilities are not established in the Area, except for a shallow well (about 10m depth) installed in each house using a bucket to draw water from them. None of these wells ever dry up, even during dry season.

4) Sewerage Facility

In the Area, there is no sewerage facility except for the one located in San Raquel neighborhood village, at the southeastern border of the zone. However it could not operate because a sewerage pipeline is not connected to the main pipeline for municipal header.

7.4.2 Development Plan

(1) Contents of the Plan

Development plan of the improvement of agricultural and livestock productivity of low income farmers in Santa Cruz, Frontera Hidalgo is included following plans:

- a. Crop diversification and diversified farming system
- b. Strengthen of Agricultural Extension Services
- c. Commercialization of agricultural products
- d. Agricultural and rural infrastructure improvement
- e. Farmers' organization
- f. Rural credit

(2) Projects for the Crop Diversification and Diversified Farming System

This program aims at the crop diversification by introducing ornament plant and pineapple into the Corn cultivation. The program to increase Corn production will be investigated at first, then program to introduce the ornament plant and pineapple into the Corn production will be investigated.

1) Target Farm Households

Of 32 farm households engaged in Corn mono cultivation in the Study Area, 25 farm households, which farm size is less than 10 ha (4.25 ha in average farm size) will be target farm households.

2) The Program to Improve the Corn Production

The object is to increase in the Corn yield in the Study Area, which average 2.7 ton/ha, to 6 ton/ha by the improvement of cultivation method. Therefore, 190 kg/ha nitrogen fertilizer suitable herbicides and insecticides will be applied.

Moreover, yellow corn, which has rich in nutrient value, will be introduced as feed to introduce diversified farming system with hog raising into the farming system with Corn mono cultivation. In this case, target yield will set as 4 ton/ha, and the agricultural input other than nitrogen fertilizer, which is 120 kg N/ha, are same as white Corn.

Agricultural imputes to be modified	
Items	Remarks and amount of application
Variety	Hybrid with lodging resistance
Amount of seed	20 kg/ha, with coating with dust of Volaton
Amount of nitrogen fertilizer as basal dressing	600 kg/ha of 18-46-00
Amount of nitrogen fertilizer as top dressing	150 kg/ha of Urea
Herbicide	Before tillage: Faena, After sowing: Gezaprim
Insecticide	Soil pests: Volaton, Stem borer: Semevin

One of traditional cultivation method of Corn in the Study Area is culm bending at physiological maturity to dry seeds in the field, then threshed in the field. This method causes to lose the quality of seed and to keep the selling price low.

It will be stopped to vend culm at physiological maturity to dry seeds in the field, which is one of traditional cultivation method of Corn in the Study Area. Then it should make the vest use of the storehouse (capacity: 6,150 ton) and drying machine for Corn owned by BARUCONSA, which is substructure of CONASPO at Frontera Hidalgo, to dry and store Corn seeds.

3) The Program to Introduce the Diversified Farming System with Ornament Plant and Corn

Farmers group will be organized to introduce Hawaiana (*Alpinia purpurata*), which is one of tropical ornament plants, into the Corn mono cultivation farming for diversified farming system. Also farmers group will collect and ship their agricultural products to turn to farmer's advantage at the negotiation without brokers. Furthermore, Corn production will be improved by their group activities such as joint buying of agricultural materials at low price and joint working.

Hawaiana can be harvested in two years after rhizomes are transplanted. Although rhizomes will be bought to transplant at the beginning, when the cultivation area will increase at 6 years, the rhizomes from the field can be transplanted to reduce the production cost. The cultivation area at the beginning will be 5 ha in the Study Area, i.e. each farmer of 25 farmers plants Hawaiana in 0.5 ha, which is the maximum farm size to take care the plants and control its quality by family labors. After 5 years, the cultivation area will be increased by each 5 ha annually, then 20 ha at 8 years. Twenty percent of the total Hawaiana will palanted to export to USA and other foreign countries

The production will be expected by 125,000 flowers per year for five years from the beginning, 625,000 plant per year from 7 years, 2,500,000 flowers per year at 10 years. Hawaiana will be shipped every two weeks.

Productions of Hawaiana and Corn for first 10 years are as follows:

Year	Hawaiana			Corn		
	Cultivation area (ha)	Harvesting area (ha)	Production (Flowers/farmer)	Cultivation area (ha)	Yield (ton/ha)	Production (ton/Farmer)
1	0.2	0	0	4.05	3.5	14.2
2	0.2	0.2	24,840	4.05	3.5	14.2
3	0.2	0.2	24,840	4.05	4.0	16.2
4	0.2	0.2	24,840	4.05	5.0	20.3
5	0.2	0.2	24,840	4.05	6.0	24.3
6	0.4	0.2	24,840	3.45	6.0	20.7
7	0.6	0.4	49,680	3.45	6.0	20.7
8	0.8	0.6	74,520	3.45	6.0	20.7
9	0.8	0.8	99,360	3.45	6.0	20.7
10	0.8	0.8	149,040	3.45	6.0	20.7

Dominican banana (75 plans/ha) and Cedro rojo (25 trees/ha), which is one of the useful tree, will be planted as shade trees for Hawaiana. These shade trees will be planted at the same time as Hawaiana will be planted. Cedro rojo can be harvested at 15 years after transplanting, Dominican banana can be harvested at every 8 – 10 months from 1 years after transplanting.

The changes in the income of each household by diversified farming with Hawaiana, Corn and banana are as follows:

The changes in the income of each household by the diversified farming with Hawaiana, Corn and Banana

Years	Hawaiana			Corn			Banana	Income of household
	Production cost	Gross income	Profit	Production cost	Gross income	Profit	Profit	
1	6,250	0	-6,250	18,877	19,136	259	750	-5,241
2	5,441	24,840	19,399	18,877	19,136	259	750	20,409
3	5,441	24,840	19,399	18,877	21,870	2,993	750	22,142
4	5,441	24,840	19,399	18,877	27,338	8,460	750	28,610
5	5,441	24,840	19,399	18,877	32,805	13,928	750	34,077
6	9,387	24,840	15,453	16,080	27,945	11,865	750	28,068
7	14,827	49,680	34,853	16,080	27,945	11,865	750	47,467
8	20,268	74,520	54,252	16,080	27,945	11,865	750	66,867
9	21,762	99,360	77,598	16,080	27,945	11,865	750	90,212
10	21,762	149,040	127,278	16,080	27,945	11,865	750	139,142

Although the farm income at the first year is the red, because of rhizome cost, it turns the black from second year, then it can be 140,000 Pesos per year after 10 years.

4) The Program to Introduce the Diversified Farming System by Pineapples and Corn

Farmers group will be organized to introduce pineapple into the Corn mono cultivation farming for diversified farming system. Also farmers group will collect and ship their agricultural products to turn to farmer's advantage at the negotiation without brokers. Furthermore, Corn production will be improved by their group activities such as joint buying of agricultural materials at low price and joint working.

Each farmer will plant one hector of pineapple, i.e. 25 hectors of pineapples will be introduced into the Study Area. Each farmer's field will be divided into four blocks to get the income periodically, to avoid from the risk such as heavy fall of farm price, to distribute the harvesting time and to ship to the different markets. Pineapple seedling will be planted every 6 months for four times. Then flower bud of the pineapple will be induced by ethylene at one year after planting, and pineapple will be harvested at 1.5 years. The seedling for the first planting should be purchased from somewhere, but after the third planting, the seedling from mother plants can be used.

All of one hector will be covered by pineapple after 2 years from the beginning, then pineapple will be harvested every six months after 4 years. Moreover, the field after second harvest (3.5 years after the beginning) will be fallow for six months.

Production plan of Corn and Pineapple shown as follows:

Production plan of Corn and Pineapple

Years	Pineapple				Corn		
	Cultivation area (ha)	Planting area (ha)	Harvesting area (ha)	Production (ton)	Cultivation area (ha)	Yield (ton)	Production (ton)
0	0.25	0.25	0	0			
0.5	0.50	0.25	0	0			
1.0	0.75	0.25	0	0	3.25	2.8	9.1
1.5	1.00	0.25	0.25	22.5			
2.0	1.00	0.25	0.25	22.5	3.25	3.5	11.4
2.5	1.00	0.25	0.25	22.5			
3.0	1.00	0.25	0.25	22.5	3.25	4.0	13.0
3.5	1.00	0.25	0.25	22.5			
4.0	0.75	0	0.25	22.5	3.25	5.0	16.3
4.5	0.75	0.25	0.25	22.5			
5.0	0.75	0.25	0.25	22.5	3.25	6.0	19.5
5.5	0.75	0.25	0	0			
6.0	1.00	0.25	0.25	22.5	3.25	6.0	19.5
6.5	1.00	0.25	0.25	22.5			
7.0	1.00	0.25	0.25	22.5	3.25	6.0	19.5
7.5	1.00	0.25	0.25	22.5			
8.0	1.00	0.25	0.25	22.5	3.25	6.0	19.5
8.5	0.75	0	0.25	22.5			
9.0	0.75	0.25	0.25	22.5	3.25	6.0	19.5
9.5	0.75	0.25	0.25	22.5			
10.0	0.75	0.25	0	0	3.25	6.0	19.5

Changes of annual farm income by the diversified farming with Corn and pineapple are shown as follows:

Changes of annual farm income by the diversified farming with Corn and pineapple

Years	Pineapple			Corn			Farm income
	Production cost	Gross income	Profit	Production cost	Gross income	Profit	
1	117,717	0	-117,717	15,148	12,285	-2,863	-120,580
2	28,098	120,015	91,922	15,148	15,356	208	92,130
3	28,093	120,015	91,012	15,148	17,550	2,402	94,324
4	14,047	120,015	105,969	15,148	21,938	6,789	112,758
5	22,187	120,015	97,828	15,148	26,325	15,148	109,005
6	22,906	60,008	37,102	15,148	26,325	15,148	48,279
7	28,093	120,015	91,922	15,148	26,325	15,148	103,099
8	28,093	120,015	91,922	15,148	26,325	15,148	103,099
9	11,094	120,015	108,922	15,148	26,325	15,148	120,098
10	19,953	60,008	40,055	15,148	26,325	15,148	51,232

Although the farm income at the first year is red, because of purchase of pineapple seedling and no income, the amount of accumulation will be the black and produce much income after 3 years

5) Diversification Plan with Introducing of Medium Size Cattle

Organizing 25 existing corn growers as the beneficiaries, women groups will be organized and a pig pen will be installed per family or household. This pig pen will measure 3m x 3m, equipped

with concrete floor, block walls, feed trough and water drinker. The roof could provisionally be of palm, covered with metal laminate to efficiency reflect the sun's radiation.

Each pen will be introduced with five F1 or F2 feeder pigs (either Landrace, Large White and Duroc crossbred), two months old, properly vaccinated against hog cholera, male should be castrated and approximately weight of 20 kg, which would be feeding for about 4 months and sold alive finishing hogs. There would be 2.2 cycles per year (annually 11 market hogs) and introducing feeder pigs from UNACH Huehuetán campus or Ciudad Hidalgo Technical High school could be considered.

As for feed they could have mainly yellow corn, sorghum and white corn not using for human consumption, waste banana, pineapple, crushed cacao and chopped pasture grasses and mixed with kitchen leftovers. Feed will be given three times a day and the water will be consumed freely.

Dung should be removed daily and utilized as a fertilizer. Urine could be used to irrigate pasture or family gardens. In some cases, the production of methane gas from pig manure is made possible.

TECHNICAL ASSUMPTIONS

1. Number of participating family units	25
2. Surface for grain grown as pig feed	25 ha. (1 ha. per family)
3. Annual grain production for feed	100 tons (4 ton per family)
4. Grain consumption per pig	290 kg
5. Annual production of fattening pigs	345 pigs
6. Number of fattening pigs per cycle per family	6 pigs
7. Total number of fattening pigs per cycle	13 pigs
8. Annual fattening cycle	2.2 cycles

Once this project is successful, swine breeding for reproduction could be done collectively, in order to reduce production cost.

• Establishment of swine breeding for reproduction (future plan)

In order to stabilization of swine product and effective management, the reproduction of feeder pigs is necessary. To achieve the annual delivery of 361 pigs, following conditions will be applied.

Parent female pigs	20 pigs (19 pigs in case of 90% co-efficiency) Landrace x Large White crossbred
Parent male pig	1 pig (Duroc)
Total	21 pigs
Annual fattening cycle	2.2 cycles
Annual fattening pigs/Parent female	18 pigs
Annual grain consumption	1,000kg
Total annual grain consumption	31,000kg
Required area for grain production	10 ha (0.3 ha per each farmer)

(3) The Project for the Strengthening of Agricultural Extension Services

The improvement of each small-scale farmer's agricultural technique is indispensable to promote diversified farming by introducing the tropical ornament plant, the small and medium size cattle, in addition to the improvement of Corn production. Municipality of Frontera Hidalgo will act as

intermediate between the small small-scale farmer, who want to get new agricultural technique, and the organization on agricultural research and extension services to exchange of their information frequently and to arrange the technical transference effectively to the small-scale farmers. Each organization has the following responsibility to execute their role.

1) Small-Scale Farmers

The target farmers for the technical transference are the small-scale farmers who have the desire to improve their agricultural production and farming. They will make a group to receive the new technique, that is, the representative of the group will attend the technical training course and explain the content of the training to the constituent member and also informs the problems at their field to the organization.

When new crops are introduced, it is important to get the cultivation technique for new crops and maintain their stable production, therefor some of operational expenses of the group will be applied to the cost of the consultant to get advises at any time, if necessary.

2) The Organization on Agricultural Research and Extension Services

The organizations, which carried out the agricultural research and extension services, soil physical and chemical analysis, supply of seeds and seedlings, alianza para el campo, etc. are as follows:

Organization name	Activities
<u>Public organization</u>	
- INIFAP	Researches on Corn, sorghum, field beans and their technical guidance
- CEIDPHPACH	Production and supply of fruit tree, tropical ornament plant seedlings, and their technical guidance to produce
-SEMARNAP	Production and supply of useful trees and their technical guidance to produce
- UNACH (Huehuetán)	Diagnosis of pest and disease of crops and fruit tree
- SAG	Supply of Corn and other grain's seeds (Kilo por kilo), financial assistance to construct the irrigation facilities, technical guidance of grain crops cultivation, advises to organize farmers
- SAGAR	Technical guidance of grain crops cultivation, advises to organize farmers
- FIRA	Technical guidance of Corn, mango and banana cultivation
<u>Private organization</u>	
- CIICA	Soil analysis and design for fertilizer application, supply od pineapple seedling and its technical guidance

These organizations will arrange managers as the windows for agricultural technology transfer and have the following responsibilities:

- Each organization will inform their content of activities on agriculture to the persons in charge of the promotion of agriculture and animal husbandry who belong to the municipality of Frontera Hidalgo and train them.
- The manger of the organization will review the agricultural problems, which the farmer in the municipality of Frontera Hidalgo have, and inform their researchers and persons in charge to solve. He will inform the persons in charge of the promotion of agriculture and animal husbandry about their training course to the small-scale farmers
- Each organization will arrange the training course at any time by the request of the municipality of Frontera Hidalgo

- Each organization will recruit agricultural experts by newspaper e.t.c. and resist at their office, if they have not the agricultural engineer who to fit to the producer's intention on new crops and/or new cultivation technique in Frontera Hidalgo

3) Municipality of Frontera Hidalgo

As two agricultural experts in charge of the promotion of agriculture and animal husbandry work now at the municipality of Frontera Hidalgo, their services will be strengthened to act as intermediate between the small small-scale farmer and the organization. As the contract period of the expert is the same period as the mayor's terms of office, i.e. three years, it is necessary for the municipality to contract with them for two or more years not to be controlled by the mayor's terms of office.

When new crops and /or agricultural technique will be introduced, the municipality will arrange not to overlap their plan with that of SAG-SAGAR. The municipality also takes such budgetary measure, which include the adequate technical guidance to produce with stable to organize completely for two years, and technical guidance at every two weeks, as are necessary for the small-scale farmers who will not receive the technical guidance by SAG-SAGAR.

The experts belonging to the Municipality of Frontera Hidalgo have following responsibilities:

- They will inform SAG-SAGAR of the small-scale farmer's intention on new crops and cultivation technique, which will be introduced, and the activities of the group.
- They tell the policy on the technical guidance and organization, which targets the small-scale farmers who have the desire to improve the agricultural production and farming.
- They will register the small-scale producer who are organized to the municipality of Frontera Hidalgo and intermediate between the small-scale farmers and the organization for the agricultural technology guidance.

(4) Marketing of Agricultural Products

1) Corn

With disappearance of CONASUPO's intervention on marketing of grains as of March, 1999, farmers in the area are required to develop new marketing destination without participation of middlemen. An association of milling industry for Corn may be considered as proposed destination of the harvests and it is recommended that farmers would be organized an association so that they might negotiate satisfactorily with purchasers regarding conditions of the sales contract such as price, criteria on quality, payment method, etc.

2) Timber-yielding Tree

As a measures to increase income of Corn farmers, it is proposed to plants timber-yielding trees such as primavera, red cedar and oak. Of these trees, the marketing channel of primavera, which is generally used as materials for furniture, should be explored newly making contract with buyers, because it is under-developed up to date. On the other hand, red cedar has consolidated market having consistent demand to make valuable furniture. It is advised that sawmills would be established within the region for facilitating production of timber- yielding trees.

3) Tropical Flowers

Hawaiiana, proposed flower to be introduced in the subproject area, is planted besides Chiapas, in Tabasco, Veracruz, Guerrero, but Chiapas is the only state which has established marketing channel for the flower. The flower is shipped to both domestic and international markets and the

share among these two markets is four by one. Owing to growing demand (demand is assumed approx. 6 to 7 million flowers in the domestic market), production of Hawaiiana in the Soconusco region has increased by 25% yearly recently.

In view of the small amount de cultivated area as 5 ha in total at the initial stage of the subproject, the harvested flower shall be shipped exclusively for the domestic market. The harvested area is to be expanded gradually until to reach 20 ha in total, in that time the harvests from 15 ha shall be for the domestic market and 5 ha for export. So as to make consistent quantity of shipment as well as to get advantage over negotiation with buyers, it is prerequisite that farmers be organized in association. It is a preliminary proposed that five associations would be organized in the subproject area as a whole.

a. Collecting and Shipping Facilities

Stability of the price is aimed at through intensifying the shipment by installing a collecting and shipping center for agricultural products. The center is to be constructed in the part of the place where is close to the National Highway in the area.

The objective flower is *Hawaiiana*. Each farmer ships them in every two weeks through a year. The process of work is; sorting → washing → insect proofing → boxing → shipping. The facilities and space for dealing with the crops that are shipped from each farmer in a day within this process are needed.

b. Facility Plan

The design volume of collecting and shipping and the components of the facilities are as follows.

HAWAIANA; Design volume of collecting and shipping Number of cultivation farmers; 25

	Unit	Per household	Whole area
Yield	piece/ha/year	125,000	-
	box/ha/year	694	-
Maximum cultivation area	ha	0.8	20
Annual shipment	piece/year	100,000	2,500,000
	box/year	556	13,880
Frequency of shipping	time/year	26	26
Days of shipping	day/time	14	14
Design volume of the collecting and shipping	box/day	2	38

Measure of a box (for 12 dozens): 150cm x 60cm x 20cm

Main components of the collecting and shipping center

- Floor area : 78m² (6m x 13m)
Breakdown; the space for sorting ~ washing ~ insect proofing ~ boxing 52m², the spaces for collecting, clerical work, and so on 26m²
- Items of the facilities; washing and insect proofing water tanks, working tables, a warehouse for materials, and so on
- Structure: wet masonry foundation, concrete paved floor, wooden pillar materials and sluice wall, synthetic resin roof tile materials, and so on

The materials of each part can be procured and should be general in the area.

4) Pineapples

a. Collecting and shipping facilities

Pineapples are shipped twice a year. In the beginning, farmers will bring their products to the center individually, and then ship them together. With proceeding the organization of producing, collecting and shipping after 4 years of the project, a series of work such as bringing, collecting, and selling will be a common work carried out by farmers' organizations. The process of the work after the products are brought to the center is very simple; boxing → shipping. Therefore, the space to store the products that ship in a day temporally is needed.

b. Facility plan

The design volume of collecting and shipping, and main components of the facility are as follows;

Pineapples; Design volume of collecting and shipping Number of cultivation farmers; 25

	Unit	Per household	Whole area
Yield	piece/ha/year	45,000	-
	box/ha/year	3,750	-
Maximum cultivation area	ha	1.0	25
Annual shipment	piece/year	45,000	1,125,000
	box/year	3,750	93,750
Frequency of shipping	time/year	2	2
Days of shipping	day/time	45	45
Design volume of the collecting and shipping	box/day	42	1,050
	kg/day	1,000	25,000

Measure of a box (for a dozen): 60cm x 60cm x 30cm

Average weight per fruit: 2kg/piece

Main components of the collecting and shipping center

Floor area : 60m² (6m x 10m)

Breakdown ; the space for boxing 33.6m², the spaces for collecting, clerical work, and so on 26.4 m²

Structure : wet masonry foundation, concrete paved floor, wooden pillar materials and sluice wall, synthetic resin roof tile materials, and so on

The materials of each part can be procured, and should be general in the area.

5) Pork

Produced pork will be sold in municipalities of Frontera Hidalgo (28,498 habitants), Suchiate (35,738 habitants), Metapa (4,381 habitants) and Tuxtla Chico (32,395 habitants). After the fattening pigs in each farmer (100kg/head-after 4 months), the pigs will be collected and sold by the producers' organization. Usually pig cycle (the variation of price) will be appeared for four year interval, but in this case, producers' organization will slaughter pigs themselves and produce pork, sausage, bacon and other products to increase their income.

(5) Agricultural and Rural Infrastructure Improvement Project

1) Irrigation Facility Development Project

It is planned to install irrigation facilities for the cultivation of the tropical flower or pineapples which will be introduced in this Area for the NEW MULTIPLICATION PROGRAM.

a. Proposed Irrigation Area

The irrigation area for the flower and pineapples are as follows:

Tropical flower cultivation: 0.8ha/farmer x 25 farmers = 20 ha
 Pineapple cultivation: 1.0ha/ farmer x 25 farmers = 25 ha

b. Irrigation water Source

i. Selection of Water Source

A simple economical evaluation was conducted of the available water sources in the Area such as ground water, Rio Suchiate, Rio Cosalapa and a small stream of Rio Huehuecho. The groundwater using a shallow well was selected as the source for the irrigation water, where individual farmers will have their own shallow well. The result of comparison study is shown in below table.

	Rio Suchiate	Rio Cosalapa	Rio Huehuecho	Shallow Well
Available Water Volume	Sufficient	Sufficient	Insufficient during dry season	Sufficient with the proposed area
Water Source Facility	Pumping Station Intake Volume Qmax=1.08m ³ /min	Pumping Station Intake Volume Qmax=1.08m ³ /min	Reservoir Intake Volume Qmax=1.08m ³ /min	Shallow Well Qmax=0.78m ³ /min × 25 wells
Conveyance Canal	Mortar bribk canal L=4.0km	Mortar bribk canal L=4.5km	Mortar bribk canal L=2.5km	Not required
Technical Problem of Construction	Bank protection, diversion works etc are difficult	Bank protection, diversion works etc are difficult	Construction of fill dam is difficult.	Easy to construct the whole works.
Merit and Demerit	<ul style="list-style-type: none"> • Required formality to utilize international river. • High operating cost because of pumping water. • Required well management organization. • Required large area for facility 	<ul style="list-style-type: none"> • High operating cost because of pumping water • Required well management organization • Required large area for facility 	<ul style="list-style-type: none"> • Reservoir area occupied large farm area. • Required well management organization • Required large area for facility 	<ul style="list-style-type: none"> • Easy to maintenance facilities. • Easy to flexible operation of the pump • No required large area for facility.
Construction Cost	US\$357,000	US\$324,000	US\$780,000	US\$197,000
Evaluation (in the order)	4	2	3	1

ii. Available Water of Shallow Wells

The area is an alluvial area between the Suchiate and Cosalapa rivers. The soil in the region is formed by a gravel layer on an impermeable layer, that facilitates the groundwater accumulation. The area has a perpetual groundwater, where there are occurrence of permanent swamps and the well water doesn't dry even during the dry season. This water is utilized by the inhabitants. No groundwater study was realized in the area ttil now, so the estimation of the water availability was made from data of existing wells. There are wells for domestic and irrigation water and also for commercial drinking water in the area. During the dry season, those wells show a water availability of 0.02 to 0.04 m³/s. So, the availability of 0.02 m³/s was adopted for the project.

iii. Layout of Shallow Wells

The layout of the shallow wells is arranged by the following conditions.

1. For each well not interfere each other, the interval of each well is secured 300 m of minimums.
2. The well positions that able to irrigate the farmland of the individual farmer are selected for the smooth operation and management.

c. Irrigation Plan

i. Irrigation Method

The farmlands in this Area are flat, therefore, either furrow irrigation, spray irrigation or drip irrigation method can be adapted. The furrow irrigation is selected with consideration of the profitability in the economical aspect of the installation and maintenance costs.

The size of irrigation area of each farmland will be 0.8 ha for tropical flower and 1.0 ha for pineapple respectively.

ii. Irrigation Water Requirement

Crop Water Requirement (ET_{crop})

The crop water requirement was estimated by Penman-Monteith method using the meteorological data as follows.

	(Unit : mm/day)											
Month	1	2	3	4	5	6	7	8	9	10	11	12
ET _o	3.8	4.3	4.6	4.6	4.0	3.7	3.9	3.9	3.6	3.6	3.5	3.4
K _{cp}	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
ET _p	2.7	3.0	3.2	3.2	2.8	2.6	2.7	2.7	2.5	2.5	2.5	2.4
K _{ch}	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
ET _H	3.4	3.9	4.1	4.1	3.6	3.3	3.5	3.5	3.2	3.2	3.2	3.1

Note : P = Pineapple, H = Tropical flower

Estimation of Irrigation Water Requirement

The irrigation water requirement was estimated considering the crop water requirement, effective rainfall and irrigation efficiency. The effective rainfall and irrigation efficiency were determined as follows.

Effective Rainfall

The effective rainfall was estimated by the FAO method based on the rainfall characteristics, etc.

	(Unit : mm/Month)												
Month	1	2	3	4	5	6	7	8	9	10	11	12	Total
Rainfall	5.0	8.3	24.4	84.9	245.6	355.4	309.5	333.2	406.0	252.8	61.5	15.3	2101.9
Effective Rainfall	0.0	0.0	4.6	42.9	171.5	259.3	222.6	241.6	299.8	177.2	26.9	0.0	1446.4

Irrigation Efficiency

The irrigation efficiencies was determined as follows based on the geography, structure of canal, water distribution method, irrigation method in accordance with the FAO standard.

Application efficiency	:	70%
Field canal efficiency	:	80%
Conveyance efficiency	:	90%
Irrigation efficiency	:	50.4%

Irrigation Water Requirement

The irrigation water requirement calculated from the crop water requirement, the effective rainfall

and irrigation efficiency as follows.

(Unit : mm/Month)												
Month	1	2	3	4	5	6	7	8	9	10	11	12
ET _p	82.5	87.3	99.8	96.6	86.8	77.7	84.6	84.6	75.6	78.1	73.5	73.8
ET _H	106.0	112.2	128.3	124.2	111.6	99.9	108.8	108.8	97.2	100.4	94.5	94.9
Eft Rain	0.0	0.0	4.6	42.9	171.5	259.3	222.6	241.6	299.8	177.2	26.9	0.0
N.W.R _p	82.5	87.3	95.2	53.7	-	-	-	-	-	-	46.6	73.8
G.W.R _p	164.9	174.6	190.4	107.4	-	-	-	-	-	-	93.2	147.6
N.W.R _H	106.0	112.2	123.7	81.3	-	-	-	-	-	-	67.6	94.9
G.W.R _H	212.0	224.5	247.5	162.6	-	-	-	-	-	-	135.2	189.7

Note : P=Pineapple, H=Tropical flower, N.W.R=Net water requirement, G.W.R=Gross water requirement

The daily irrigation water requirement was estimated as follows.

(Unit : litter/day)												
Month	1	2	3	4	5	6	7	8	9	10	11	12
G.W.R _p	0.21	0.23	0.24	0.14	-	-	-	-	-	-	0.12	0.18
G.W.R _H	0.79	0.90	0.92	0.63	-	-	-	-	-	-	0.52	0.71

Note : P=Pineapple, H=Tropical flower, N.W.R=Net water requirement, G.W.R=Gross water requirement

iii. Irrigation Conditions

The average root depth of the pineapple and the hawaiana are 0.4 m and 0.6 m, respectively. So, the irrigation water depth, according to the soil characteristics, was settled as 28.6 mm for pineapples and 42.9 mm for hawaianas. The maximum irrigation time is 7.2 hours for pineapple and 7.0 hours for hawaiana. The irrigation interval was estimated in 5 days for both.

d. Facilities Plan

i. Summary of Facilities

Summary of the facilities included in the project is as follows.

	Facilities	Tropical Flower(20ha)	Pineapple (25ha)
Water Source	Number of well	25 wells	25 wells
	Diameter of well	2 m	2 m
	Depth of well	10 m	10 m
	Type of pump	Gasoline motor pump	Gasoline motor pump
	Pump house	6.0x6.0x2.0(height)	6.0x6.0x2.0(height)
Irrigation Facilities	Irrigation block	0.8ha(each farm)	1.0ha(each farm)
	Standard size	100 m x 80 m	100 m x 100 m
	Interval of ridge	2.5 m	1.5 m
	Length of canal	150 m	150 m
	Structure of canal	Mortal brick canal	Mortal brick canal
	Length of drainage	150 m	150 m
	Structure of drainage	Unlined canal	Unlined canal

ii. Irrigation Canal

The fields are relatively plain, with about 1% of slope. So, the earth canal was selected due to its economic construction cost. The water intake will be by small pumps and pipes, from the shallow wells to the irrigation canal. Siphons will be utilized to take water from the irrigation canals the furrows.

e. Operation and Maintenance Plan

Considering the scale of the facility and the individual farm management, the operation and

maintenance will be carried out by each farmer.

2) Road Improvement Project

a. Objective of the Project

The roads in the Area are well maintained, but some parts are not coated. The present road conditions of these sections are bad and traffic hindrance occurs during the rainy season, these parts of the roads should be improved in order to facilitate the transportation of agricultural products.

b. Contents of the Project

The content of the road improvement is the rehabilitation of the existing roads and it is not contained on the newly constructed roads.

c. Facilities Plan

The sections to be rehabilitated are the north-west section and south-east, a part of the branch road in the north-south direction. Those sections will be improved based on the type D of Mexican road standard. Summary of road improvement is shown as follow.

Item	North-west section	South-east section	Total
Road Surface	Gravel coated	Gravel coated	—
Length (m) Total	3,000 m	2,400 m	5,400 m
Improvement section	1,800 m	500 m	2,300 m
Width	6 m	6 m	—
Slope of cross section	2 %	2 %	—
Road drainage	Lateral drain 80cm—40cm	Lateral drain 80cm—40cm	—

(6) Farmers' Organization Plan

In order to strive for the stabilization of farm management of Corn producers in the area of Santa Cruz, it aims at formation of new producers' organization, which has collection and distribution, and joint selling, by introducing the crop diversification and multiple farming. On the other hand, through the group formation of rural women for involving multiple farming, the social status of rural women will be improved. With implementing the plan, both the organized and unorganized producers will be integrated into new organization, contributing to develop marketing system by an effective linkage of this new organization and existing association.

For the implementation of this plan, producers will fully examine the contents of this plan by themselves, then they will start it independently. In order to form the organization; the directorate of existing association will cooperate in consultation and guidance supports. Furthermore, it will obtain collaboration from SAG, SAGAR, INIFAP, FIRA, BANRURAL and the municipality. DIF, as a center, and SAG and SAGAR will cooperate with the activities of the women's group.

Formation of Association

- i. Confirm the producer's will to form the association, who is interested in the introduction of

- crop diversification and multiple farming. Twenty-five (25) producers are assumed.
- ii. After the mutual consent between producers on the formation of association with a collecting center for farm products, the introduced producers will hold a general assembly. Then they will confirm an establishment committee in order to prepare the legal registration.
- iii. Simultaneously, the committee for the collecting center project will be set up, and the establishment committee members will participate with this committee. The committee will formulate the project.
- iv. Apply for the legal registration as a producers' association with the related authorities.
- v. Apply for finance to the public financing institutions in order to implement the collecting center project.
- vi. The association shall have a general assembly, which performs determination of superior administrative policy.
- vii. The directorate of the association will be responsible for the administration.
- viii. Composition of the directorate of the association is as follow:
 - President: 1
 - Secretary: 1
 - Treasurer: 1
 - Vigilance committee: 3
- ix. Members of the directorate will be elected by the general assembly, and their terms are set up for three (3) years.

Administration of Association

- i. In the initial stage, the administrative body will have an emphasis mainly on production and marketing.
- ii. Production: acquisition of farming funds, development of cultivation techniques, control of farm products, etc.
- iii. Marketing: market information, marketing system development, collecting and distributing control, price control of farm products, etc.
- iv. In order to develop and manage the collecting system, which materializes in the collecting center project, the operating committee for the collecting center will be established by three (3) members.
- v. The administrative costs for the association will be collected from the members as member fee, which is fixed by the general assembly. In addition, 2% of the amount of product's selling handled by the center will levy as handling charge. A part of this handling charge will be appropriated for the repayment of the credit for the construction of the collecting center.
- vi. In order to strengthen the association's capital with the stabilization of member's farming, members of the association will contribute with capital.

Organization of Rural Women

- i. In order to introduce farming multiplication, rural women of 31 farms, which practice mainly Corn cultivation in the area, will organize as the women's group.
- ii. The members of the women's group will raise and fatten swine in their home and the group will sell them jointly.
- iii. Regarding production technology, nutrition and health of domestic animals, the improvement of production technology will be planned by exchanging technology with other similar groups in the surrounding areas. And women participating in the group will bear a part of multiple farming.
- iv. The funds for group activity will consider financing through a micro-credit.
- v. The total purchasing amount of young pigs is estimated at \$38,750 (5 head/family x 31

families=155 head, \$250/head).

(7) Improvement of Access to Rural Finance System

It is disclosed as a result of farm survey carried out by the Study Team that as few as 30% of the farmers in the subproject area got credit from banks. As a causes for this low coverage of rural finance, it may be count out as factors inherent to farmers like: 1) the return from farm operation is too low to repay the loan with interest, 2) arrears of the past loan, 3) no mortgage is provided, etc. In the light of this situation, it is suggested that, aiming at improvement of the access to rural finance system from farmers' side, to raise farm productivity to anticipate higher return, to boost morale of rural population to perform without fail obligation for repay of the loan and to encourage forming of organization to take mutual responsibilities; in particular, formation of organization is a critical condition to make better access to innovated rural finance system proposed in the Master Plan such as FIRA's PROCREA, state government-sponsored fund for integrated rural development and microcredit system. Therefore, so as to improve access to rural finance system and to make this improvement more sustainable, it is of importance that a development plan which integrates an improvement of access to rural finance system into comprehensive program which conceives farming system diversification and mixing, strengthening of technical assistance and extension services and promotion for rural organization.

At present, FIRA and federal and state governments are well aware of the importance of the role of the rural finance system that performs for development of the agricultural sector, and as measures to materialize their policies on the matter, various programs with a target set to low-income farmers have been formulated; some of them are put into implementation and other are ready to start soon. Of these programs the following three may be underlined:

- FIRA' PROCREA: this program aims to improve access of farmers to FIRA's credit line locating an intermediate agent between banks and farmers; loan amount is up to \$ 65,000, period is within 12 months, and interest rate is equivalent to CETES.
- Credit guaranteed by PROCAMPO's payment: This program has been undertaken by SAGAR since 1994 and BANRURAL has decided to participate this program in 1999; loan amount is up 25 ha-equivalence of PROCAMO's support (\$ 706/ha for 1999) minus interest rare (equal to CETES).
- Special credit to beneficiaries of Alianza para el Campo: Loan is provided by BANRURAL to beneficiaries of some subprograms of Alianza para el Campio (coffee production, Corn cultivation, farm mechanization, and cattle farming); loan amount is set as 40 - 70% of the production cost or purchase cost of machinery and the interest rate shall be CETES and intermediate commissions.

Crop production of the subproject area is represented by Corn and close to 80% of farmers in the area are beneficiaries of PROCAMPO, so farmers in the area are highly eligible to be beneficiaries of above-cited credit programs. Nevertheless, in order to enable local farmers more accesible to these programs, it is indispensable that a promoting campaign to disseminate them from the part of public entities should be made together with supporting services relevant to the programs. Worth while to indicate is that PROCAMPO-guaranteed credit is not exclusively for Corn farmers but also for farmers who cultivate other crops.

Thus, in so far as an improvement of rural finance system is concerned, emphasis in the short run would be placed on improvement of access to existing programs; in the medium and long run, expansion of credit would be envisaged through state government-sponsored fund for integrated

rural development proposed in the Master Plan.

On the other hand, the Master Plan under the present Study proposes an introduction of microcredit system as a measure to encourage rural women to engage productive activities as well as to increase income of rural families. This system would be applied to raising of swine proposed in this subproject within the context of the farming system diversification and mixing plan. The microcredit system is credit system to loan small amount and the provision of credit in this subproject is proposed to start with \$ 1,200 per beneficiary, which shall serve as fund to get three piglets. Loan under microcredit system would not be provided to individuals but to groups formed by 10 – 15 individuals, and the group should be responsible for all loans of its members. Loan amount is to be increased gradually to debtors who repay sincerely, so that they may be expanded their productive activities. At the same time, saving among users would be obligatory so as to induce to make their capital formation and to complement new farming activities.

7.5 SUB-PROJECT : IMPROVEMENT OF AGRICULTURAL AND LIVESTOCK PRODUCTIVITY OF LOW INCOME FARMERS IN MIXCUM AREA (COFFEE PRODUCTION AREA)

7.5.1 Diagnosis of the Subproject Area

(1) Location, Administrative Division and Population

The subproject area is situated in the Cacahoatán municipality. The area is located at the mountainside of the Tacana mountain with the 14° 01' North Latitude, and the 92° 08' West Longitude, and is one of the municipalities of the Soconusco Region, adjoining to the border with Republic of Guatemala along to the Suchiate river.

The subproject area belongs to the Ejido Mixcum with the 300 households and 1,496 inhabitants. The population structure is male of 755 persons (50.5%) and female of 741 persons (49.5%).

(2) Natural Condition

1) Precipitation and Temperature

Total rainfall is about 3,900mm and most of rain is fed during May and October. Temperature varies from 25 to 27 centigrade and annual average temperature is 26.7 centigrade.

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Precipitation	26.7	49.4	54.2	243.9	496.6	613.8	491.2	550.8	653.7	495.0	174.1	54.6	3903.3
Humidity	25.8	26.3	27.0	27.6	27.5	26.7	26.7	26.7	26.2	26.3	26.6	26.4	26.7
Evaporation	120.6	111.9	136.0	132.4	122.0	103.8	108.3	99.6	95.7	104.5	118.7	116.4	1370.0

Source : CNA Cacahoatán observation station (1976~1996)

2) Geological Condition

The volcanic ash origin from Tacana and Guatemalan volcanoes covers all over the area. The area is divided into two areas by the Mixcum river which flows the center of the sub-project area. The Sujobal river is situated at the east edge of the area. The height above sea level varies from 540m to 700m with about 4% of gradient in the right bank of the Mixcum river, and from 520m to 700m with about 3% of gradient in the left bank of the Mixcum river.

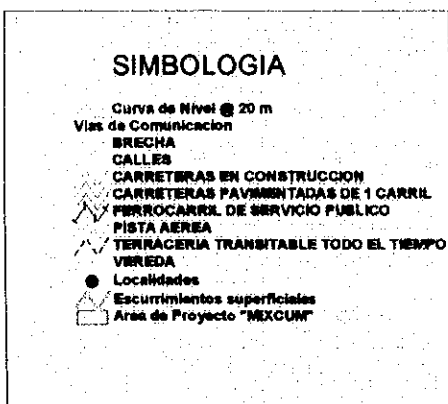
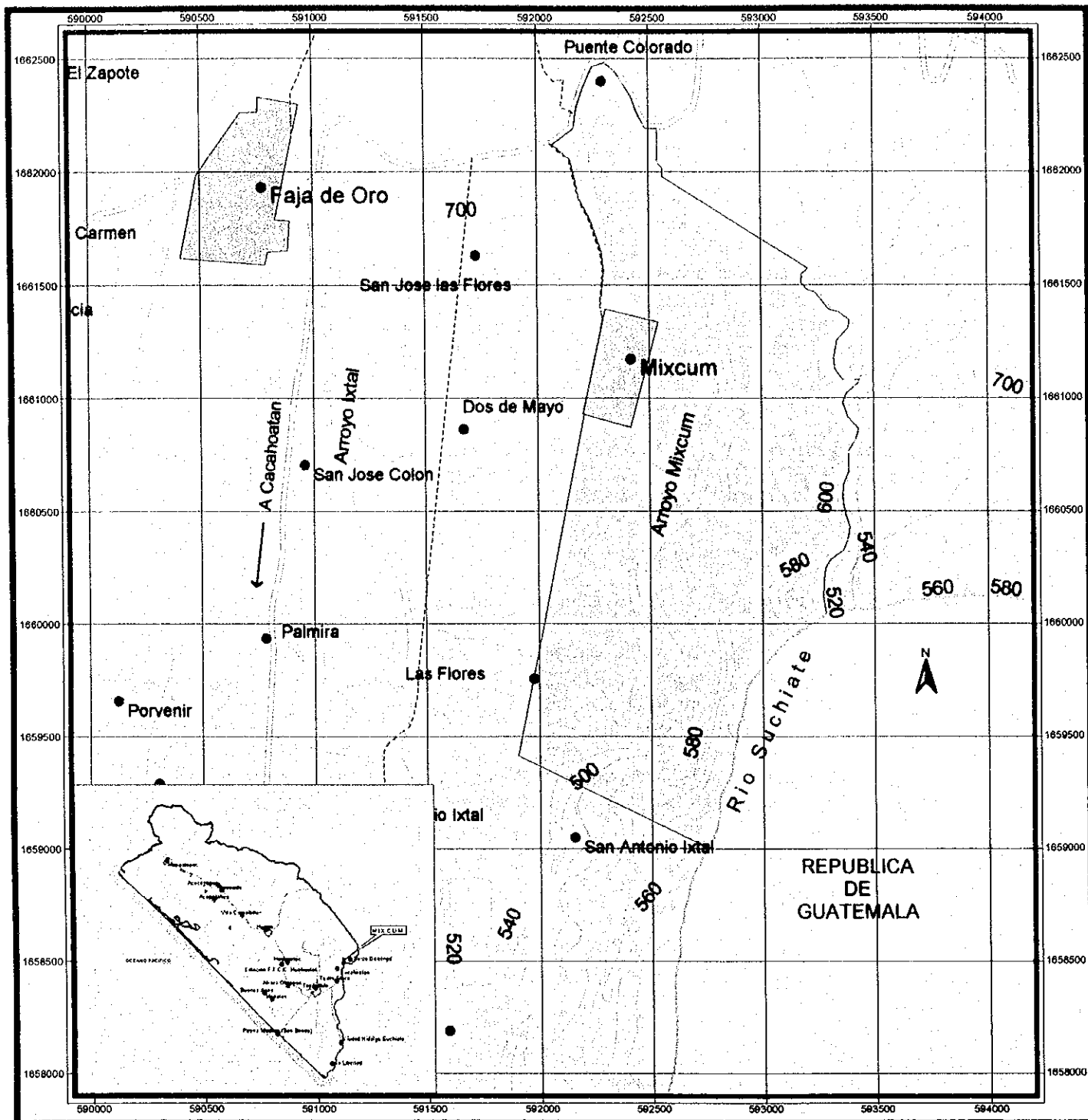


Fig. 7.5.1 LOCATION MAP FOR PREFEASIBILITY STUDY AREA (MIXCUM, CACAHOATAN)

ESCALA 1 : 25,000

3) Soil

Andosol with blackish fertile and rich organic matters is distributed all the area. The soil at the right bank of the Mixcum river is more sandy than left bank. Due to the rivers in the area flow throughout the year, dew drops even in the dry season and moisture contents of the soil is maintained during the season.

(3) Land Use and Land Tenure

1) Land Use

The land use of the sub-project area as shown in the following table.

Category	Area	
	ha	%
Coffee	375.0	89.5
Corn	10.0	2.4
Residential area	13.9	3.3
River and others	20.0	4.8
Total	428.9	100.0

When the establishment of the Mixcum area, each farmer had been given land for coffee (3 ha and 1 ha) and 1 ha for corn cultivation. After this, the land for corn production had turned to coffee. Actually, there are 20 ha of corn cultivating area, however, some land owners are intending change to coffee cultivation.

2) Land Tenure

The Ejido Mixcum was conceded land donation as the Ejido land, on May 10th, 1944, with the total area of 418.9 has. The land was donated equitability to 75 ejido farmers with an area of 5 ha. When the Ejido Mixcum was settled, each producer assigned the land for coffee (divided into 2 lots, one of 3 and rest of 1 ha), moreover, 1 ha for Corn. Since then, the Corn fields had been changed by coffee. Actually, there are around 20 producers who cultivate Corn, but most of them are intend to change it by coffee.

In the course of time, number of ejido farmers was tripled and, consequently, the donated lands have been divided between families of ejido farmers. Most of the ejido farmers have not been changed their nominally right. However, family of nominally right holder uses the land by subdivision as common producer (comunero). Number of these producers by land size is given to know in the following table.

Category	Area (ha)	%	Producer	%
Below 1 ha	47.25	12.2	51	35.9
1.1 ha – 2.0 ha	31.50	8.2	17	12.0
2.1 ha – 3.0 ha	68.50	17.8	19	13.4
3.1 ha – 4.0 ha	124.25	32.2	32	22.5
4.1 ha-5.0ha*	113.5	29.5	23	16.2
Total	385.00	100.00	142	100.0

Source : JICA Survey Team

(4) Rural Community and Farmers' Organization

1) Rural community

Rural community of the Ejido Mixcum is formed based on the general assembly of village, which is an authority (decision-making) of village community activities. The directorate of this community is composed of a commissary (comisariado), secretary (secretario), treasurer (tesorero) and members of the vigilance committee, and those members are elected every three years by the general assembly. The general assembly is also assigned members of construction committee (improvement of rural roads and public common facilities), health committee (health control by promoters as a center of the activity) and women's committee (support to DIF activities).

Regarding the living conditions of producers, all houses in the community count on electric illumination. The domestic and drinking water is intake from the Mixcum stream and supply each house with untreated; the water quality is inferior caused by contamination of residual water from the coffee processing plant. As fuel is generally utilized prune branches of coffee as firewood. Nearly 95% of houses are provided some type of sanitary system. Provision of social infrastructure (education and public health) also reaches satisfactory level. Concerning the road, the asphalt-paved road is existed conducting to the municipal urban area of Cacahoatán and to the Union Juarez municipality. Telecommunication system is provided only one public telephone.

2) Farmers' organization

The ejido farmers in the subproject area are participated to the Ejido Union "Lazaro Cardenas del Rio" and the CIOAC-Regional. Number of members to the Ejido Union is of 76 persons (56 men and 20 women) and the members of the CIOAC-Regional are 60.

The Ejido Union (Union de Ejidos "Lazaro Cardenas del rio) was established in 1979, supported by the Instituto Mexicano del Cafe and actually it conforms 56 ejido farmers. The total associated members are 1,554 persons. Average coffee planted area of a member is about 12.5 ha. Each ejido have a representative, who forms a part of the directorate of the Union. This organization counts on warehouse, drying yard, and ecological coffee shell removing machine, laboratory and coffee processing plant. For the improvement of coffee production, the Union contracts with an agronomist who carries out the activities of technical orientation in each ejido participated. The common interest of members is low and only 15% of them are active. Therefore, the leaders of the Union put emphasis to enlighten the consciousness of the members on the importance of joint work. Presently, the Union promotes crop diversification project and this year plans an introduction of tropical flowers. In addition, the useful trees are promoted.

The CIOAC-Regional was established among the ejido organizations, in 1988. The main objectives of this organization are to obtain the credit (Alianza para el Campo). However, due to many members, who have defaulted on the credit, the organization is not functioned as well.

(5) Agriculture and Livestock Production

The main crop in the Study Area is coffee and Corn is cultivated in small area as self-consumption. All crops have been cultivated under rain-fed condition. The outlines of cultivation practices of those crops are shown below.

Agricultural production of the Study Area is as follows.

Agricultural production of the Study Area

Crops	Cultivation area (ha)	Yield (Per hecter)	Production	Unit of weight
Coffec (Arabica)	225	5	1,125	Qq
Coffee (Robusta)	150	760	114,000	kg Serezo seco
Dominican banana	(*1)	1,800	675,000	kg
Corn	10	720	7,200	kg

Source: JICA Study Team (1999)

Note: (*1): Planted in the same field as coffee trees, planting density is about 60 plants/ha

1) Coffee

Two type of coffee, i.e. Arabic and Robusta has been planted in the Study Area. The main varieties of Arabic coffee are Arabe or Typica and Bourbon. Arabe or Typica is the general name of Arabic varieties, which had been planted since coffee introduced first in Mexico. Bourbon was selected in Africa. But in these 50 years, theses varieties have been replaced with the new high yielding varieties introduced from Brazil such as Caturra and Catuai, because of their high plant height and low yielding ability. The cultivation area of Bourbon, Arabe or Typica, Caturra and Robusta are 45 %, 10 %, 5 % and 40 % of the coffee cultivation area respectively.

The yield of Arabic coffee is 5 Qq/ha, which is lower than the average yield (12 Qq/ha) of the Soconusco Region. One of the causes of low yield attributes to low amount of fertilizer application, i.e. about 30 % of the farmers in the Study Area apply fertilizer, which amount is not enough to get good yield, because of shortage of fund to buy. Another cause attributes to old varieties, which can not be planted at high density because of their height, i.e. the plant density of these varieties is as low as about 930 trees/ha compared with 3,000 – 5,000 plants/ha of new high yielding varieties.

The hired laborers account for about 50 % or more of the total laborers on the farm practices of coffee cultivation. The hired laborers account for 80 % of the total laborers at the harvesting period and only two percent of the hired laborers are Guatemala laborers.

The renewal of coffee trees, which are about 200 – 500 old trees and/or trees injured by strong wind, have been carried out every year by each farmer. The most of the seedlings for the renewal are seedling from the fruit dropped at the coffee field. Only twenty percent of the farmers have the own sowing bed and/or nursery of coffee trees. Agricultural chemicals are not applied, except when a serious rust disease is generated. Weeding in the coffee field are carried out well by most of the farmers and weeded grass are kept on the surface of the soils.

Chalum is planted as shade tree (60 trees/ha), and other natural trees such as Tepemixtle (*Bumelia* sp), Guayabo (*Terminalia amazonia*), and Chiche (*Aspidosperma magalocarpum*) have been left as the shade tree. Other than original shade trees, some fruit trees such as Dominican Banana (100 plants/ha), which small size banana for table fruits, Lemon and Chico Zapote (*Achras zapota*), etc. have been planted as shade tree. Chalum is cut for firewood at 8 – 10 years after planting, then the seedlings from the field are planted again.

As the ripening period of Arabic coffee is shorter than that of Robusta coffee, the harvesting period of Arabic coffee is from middle of November to middle of November and coffee fruits are picked at three times in this period. On the other hand, the harvesting period of Robusta coffee is middle of November to the at the beginning of February and coffee fruits are picked twice in this period.

After harvesting, the fruits of Arabic coffee are processed to remove their pulp by hand-operate machine at each farmer' house and dried to sell with thin skin. On the other hand, the fruits of

Robusta coffee are dried to sell directly without any process on the concrete of the farmer's garden.

2) Corn

Corn are sown in the hollow dug with wood stick in the Study Area, when the rainy season starts on May. When Corn is physiologically matured in August, the culm are bent just below the cob and left for 20 – 30 days in the field to dry grain, then bring the ears to their garden for threshing grains. But when Corn are lodged by heavy rainfalls, as the precipitation of the Study Area is as much as about 4,000 mm or more, Corn are sown again in middle of September and harvested in January.

Corn yield in the Study Area is about 700 kg/ha, which is about one third of the yield at the plains in the Study Area. One of the causes of low yield attributes to the local variety and the amount of seed sown in the Study Area, which is about half of the amount recommended. Another cause attributes to few amounts of the fertilizer and the agricultural chemicals application.

3) Production cost, farmer's income and expenditure

The production cost of the coffee cultivation in the Study Area and Farmer's income and expenditure per hector are as follows:

Crops	Production cost(\$/ha)	Yield (ton/ha)	Price (\$/ton)	Income (\$/ha)	Gross profit (\$/ha)
Coffee (Without fertilizer)	2,050	5.0	800	4,000	1,950
Corn (Without fertilizer)	823	0.7	1,350	945	123

Source: JICA Study Team (1999)

The gross profit of coffee, which is the main crop in the Study Area, is only 1,950 Peso/ha. This figure means that the annual income of the typical coffee production farmer in the Study Area is 9,750 Peso.

(6) Livestock

1) Bovine Cattle Breeding

As the mono cultivation of coffee of this sub-project area, there is no cattle breeding. Only horses are kept for transportation. There is a possibility to introduce cattle breeding by zero-grazing method to utilizing herbs, growing even in the dry season, at the coffee field and shoulder of roads

2) Minor Species of Cattle

Same as the bovine cattle grazing, swine, sheep and poultry are not seen in this area. However, the weather condition is suite for minor species of cattle grazing, so that there is a possibility to introduce cattle grazing by easily obtaining of residues of coffee and cacao and grain feed. According to the meat supply is no sufficient in the surrounding of the area, the potential of cattle grazing is considered high.

(7) Marketing system

1) Coffee

Three type of coffee varieties: Typica, Bourbon and Robusta are planted in this subproject area.

Of these varieties, coffee fruits of Typica and Bourbon are pulped using equipment called "Despulpadora" and then pulped beans are dried at courtyard within farmers' residence to sell them to middlemen or to the ejido union in the form of parchment. The price at the harvest season in 1998 fluctuated between \$ 725/Qp and \$ 800/Qp. Coffee fruits of Bobusta, by contrast, are shipped to market without pulping and dry, because the fruits contain very little amount of humidity without containing viscous ingredient called "Miel", which serves to protect seed. The price of this variety was around \$ 8.50/kg and 80% of the fruits are sold to middlemen and the remaining 20% to the ejido union.

In the Soconusco region, for producing mild coffee beans, coffee fruits are pulped and processed through the humid system using domestic water; pulps are used as an organic fertilizer at coffee plantations. A large-scale processing system (Pulping capacity: 2 tons/hr. and washing capacity: 800 kg/hr.) is operated by the ejido union and farmers without processing system entrust processing of their fruits to this union.

2) Other products

Although in very small quantity, Corn is cultivated at the subproject area, but the harvests are exclusively for self-sufficiency of farmers. The area also produces banana from trees planted as shading tree; the harvests are sold to middlemen (\$ 1.00/kg), who, in turn, forward them to the local market.

(8) Rural finance system

Judging from the farm survey conducted by the Study Team, farmers who were benefited by the rural finance remain as low as 30% of the total farmers, of which only one-third had loan directly from banks and others were through intervention of the ejido union because they had no mortgage. Loan period is 8 year on average and the loan benefited planting or renovating coffee trees for 2 ha on average. Higher rate of farmers who suffer from arrears constitute the leading factor to prevent local farmers to make access to banks' loan.

Because of longing to the coffee-dominated zone, farmers benefited by PROCAMPO are limited to 30% of the total farmers and benefited area among beneficiaries is as few as 0.9 ha per farmer, only one-ninth of the beneficiaries in Frontera Hidalgo.

Coffee farmers in the Soconusco region were seriously damaged by extraordinary drought (it is reported that first time for the past forty years) prevailed the region during April - May, 1998, which brought about a substantial loss in the harvests. This loss was partly compensated with financial support (\$ 750 per farmer) provided by FIRCO under the program denominated "Climatological emergency program".

In Mexico, rural finance program denominated "Credit a la parabra" is underway within context of social development program. In this finance system no interest is imposed over beneficiaries and those who perform obligation to repay the loan are entitled to get loan for the subsequent years. One-third of farmers in the area were benefited by this finance system for use of loans for purchase of inputs, employ of farm workers and so on.

(9) Agricultural and Rural Infrastructure

1) Agricultural Infrastructure

In the Area, there is no irrigation facilities since all cultivation is developed in the Temporal system. Coffee is the large cultivation occupied the covering 93 % of the Area.

2) Rural Infrastructure

a. Roads

The Area is located at about 35 km Northeast of the Tapachula City and at approximately 5 km from the Municipal Header of Cacahoatán. The local road, which is located at the foot of Mt. Tacana, connects the Municipality of Union Juárez with Cacahoatán where it leads to the Federal Highway No.200. The access road to the Area branches, which communicates the town of Mixcum, is paved and has a length of 1.0 km.

The inner roads in the Area are classified as urban and farm roads communicating the residential zone with the area where coffee is being produced. The length of this road is 1.0 km and is paved with asphalt, with a rolling surface width of 6 m, in regular condition.

There is another road considered a pedestrian road going across the center part of the coffee farm, Arroyo Mixcum and leads to the high plateau. This farm road is not covered with any aggregate and it is in a bad condition, it is also a heavily transited road because of the products from a large number of coffee plantations located in that zone, with human and horse traffic. Transportation conditions get even worse on rainy season due to the lack of maintenance on the inner roads and bridges on the zone, as well as the steep slopes found in this area. There are many sections, which are damaged and eroded by rainfall. Vehicles cannot pass the bridge, making road maintenance very difficult due to the slopes and road conditions.

b. Water Supply Facility

Water supply facility is maintained by the Ejido. The water source is the Arroyo Mixcum with an intake and a canal where water flows for a distance of about 1.5 km. This intake supplies water not only to the municipal header of Cacahoatán but also to the irrigation district of Cacahoatán. The inhabitants of Mixcum receive their water supply through a connection with the channel. There is a water reservoir tank connected to the distribution pipe, with 950 m³/day (11 lts/sec) of water intake capacity (means 635 lts/person/day), then it is conducted to another tank located in the Municipal header through PVC pipes, where it is being chlorinated. This tank supplies water to each house in the Mixcum area through a distribution network.

c. Sewerage Facility

The sewerage system was established in the Area three years ago and is conducted by a network of concrete pipes along the center of each main street of the community where each household is connected. All the sewerage pipes are connected perpendicular to a main collector located in the lower part of the residential area in the same direction as the Mixcum river. All the houses in the residential area are connected with the pipeline, however all sewerage is drained to the river without any treatment.

7.5.2 Development Plan

(1) Contents of the Plan

Development plan of the diversification of agriculture in Santa Cruz, Frontera Hidalgo is included following plans.

- a. Crop diversification and diversified farming system
- b. Strengthen of Agricultural Extension Services
- c. Commercialization of agricultural products
- d. Agricultural and rural infrastructure improvement
- e. Farmers' organization

f. Rural credit

(2) Projects for the crop diversification and diversified farming system

This program aims at the crop diversification by introducing ornament plant into the coffee cultivation. The program to increase coffee production will be investigated at first, then program to introduce the ornament plant into the Corn production will be investigated. Moreover, the production of yellow corn as feed will be examined to introduce diversified farming system with hog raising into the Study Area.

1) Target farm household

Five hectares of the agricultural land were distributed among 75 Ejidatario in the Study Area at the beginning. After that, as five hectares are fractionized by their succession, the agricultural land are owned by 142 farm households at present. But so far as the actual agricultural farming and practices concerned, those are carried out with family in the same five hectares of agricultural land as before. Therefore, the program will be examined on the five hectares of agricultural land as a unit of the field, which owned by 75 Ejidatario originally.

2) The program to improve the productivity of coffee

The yield of the Arabic coffee, which has wide market in the world judging from the circulation side, will be increased by 20 Qq/ha in 5 years through the fertilizer application and high plant density such as 3,300 – 5,000 trees/ha.

As farmers will be able to employ the agricultural laborers for the agricultural practices, when the more production the coffee trees produce, the more income the farmer will get, Robusta coffee, which are planted because of little agricultural practices at harvest, and are sold to Nestle which is the only market in Mexico, will be replaced with Arabic coffee.

Renovation of coffee is not carried out all at once, but carried out every other row. The improved variety such as Caturra, Catuai, Catimor etc, which is short and suitable for dense planting, will be introduced at high density. The rest of coffee trees are treated by the Recepa treatment, which is cutting main trunk to introduce branches and to be rejuvenated. This Recepa treatment will be every 4 years for 12 years. This renovation will be carried out in one hectare of the coffee field every year. The coffee trees, which are not renovated, will keep as before getting income at the renovation period.

The changes in the production cost, yield, and income according to the renovation of coffee trees are shown the following table.

The changes in the production cost, yield, and income according to the renovation of coffee trees

Years Field*	1	2	3	4	5	6	7	8	9	10
Production cost (\$/ha)										
A	15,083	5,284	6,784	7,219	7,849	7,849	7,849	7,849	7,849	7,849
B	2,050	15,083	5,284	6,784	7,219	7,849	7,849	7,849	7,849	7,849
C	2,050	2,050	15,083	5,284	6,784	7,219	7,849	7,849	7,849	7,849
D	2,050	2,050	2,050	15,083	5,284	6,784	7,219	7,849	7,849	7,849
E	2,050	2,050	2,050	2,050	15,083	5,284	6,784	7,219	7,849	7,849
Total*	23,283	26,517	31,251	36,420	42,219	34,985	37,550	38,615	39,245	39,245
Yield (Qq/ha)										
A	0	8	15	17	20	20	20	20	20	20
B	5	0	8	15	17	20	20	20	20	20
C	5	5	0	8	15	17	20	20	20	20
D	5	5	5	0	8	15	17	20	20	20
E	5	5	5	5	0	8	15	17	20	20
Total*	20	23	33	45	60	80	92	97	100	100
Income (\$/Ejidatario)										
Total*	16,000	18,400	26,400	36,000	48,000	64,000	73,600	77,600	80,000	80,000
Gross income (\$/Ejidatario)										
Total*	-7,283	-8,117	-4,851	-420	5,781	29,015	36,050	38,985	40,755	40,755

* As coffee tree, which planted in 5 ha of one farm household, will be renovated in one hector every year, the field divided into one hector for the sake of convenience.

The Ejidatario will not profit from the renovation program for four years after the commencement of the program, since the renovation program will be still in progress, but after 5 years, he will profit. The Ejidatario, which has 5 ha of coffee tree field, will get 40,755 Peso annually.

3) The program to introduce the diversified farming system with ornament crops

Camedor palm, which is one of tropical foliage plants, will be introduced into the coffee mono cultivation farming for diversified farming system. Because, it is sufficient amount of rainfall and good soil moisture condition in the Study Area and the coffee trees and the shade trees can be used as shade trees for Camedor palm. Also the farmers group will be organized to collect and ship their agricultural products, not only Camedor palm but also coffee, and to turn to farmer's advantage at the negotiation without brokers. These processes will lead the farm household on the road to not only the improvement of farm economy but also that of coffee production.

Camedor palm will be introduced into the between row of coffee trees, where is under the shade of coffee trees. One hundred eighty thousand of Camedor palms will be planted in the Study Area. The collection and shipment of Camedor palm leaves will be carried out every two weeks and total amount of shipment is 2,000 boxes (1,000,000 leaves) annually. The maximum amount of shipment by each farmer is 500 leaves per every two weeks and will be arranged to each farmer according to their farm size.

Changes in the profit of each farm household by introducing Camedor palm

Years	1	2	3	4	5	6	7	8	9	10
Production cost	2,707	2,367	6,320	6,320	6,320	6,320	6,320	6,320	6,320	6,320
Gross income	0	0	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000
Profit	-2,707	-2,367	6,680	6,680	6,680	6,680	6,680	6,680	6,680	6,680

Note: Each farm household has 5 ha

4) The program to introduce the diversified farming system with useful trees

Cedro rojo, which is one of the useful trees, will be introduced to The Study Area, not only as shade trees for coffee but also as the diversified farming system with coffee.

Although it takes about 15 years at the minimum to cut for shipping, as Cedro rojo will be planted at the same time as the renovation of coffee tree for 5 years, the Ejidatario will get income regularly by the shipment of Cedro rojo. Although this useful tree will not produce the short-term profit, Cedro rojo will be replaced with the existing shade trees as the long-term farming cycle. Plant density of Cedro rojo at final stage will be fixed at 67 trees/ha (10 m x 15 m). Cedro rojo produce about 134,000 Peso/ha of the profit at the cutting.

5) The program to introduce yellow Corn as feed

About 20 Ejidatario have planted Corn as self-consumption in about 10 ha. Yellow Corn, as feed of hog raising, will be planted instead of the Corn to introduce diversified farming system with the small and medium size cattle.

The improvement of the cultivation method and the introduction of hybrid seed will attain Four ton per hecter of yellow Corn. Because, the facilities to protect from soil erosion are not necessary, as the field for Corn is not slope land but flat land

The amount of agricultural materials to be input is as follows:

The agricultural imputes indispensable for the yellow Corn production	
Items	Remarks and amount of application
Variety	Hybrid with lodging resistance
Amount of seed	To increase by 20 kg/ha, with coating with dust of Volaton
Amount of nitrogen fertilizer as basal dressing	300 kg/ha of 18-46-00
Amount of nitrogen fertilizer as top dressing	150 kg/ha of Urea
Herbicide	Before tillage: Faena, After sowing: Gezaprim
Insecticide	Soil pests: Volaton, Stem borer: Semevin

6) Diversification Plan with Introducing of Medium Size Cattle

As the field used for corn production is useful for raising grains for animal feed. It will be possible to introduce pig fattening project in this area as well as in Santa Cruz if the farmers can organize farming by themselves. However, this area is too small to raise grains, the size of pigpens must thus be reduced. Pigs will be sold in Cacahoatán and Union Juarez. The introduction of feeder pigs will be possible through large-scale swine farms in Cacahoatán. It depends on each case, but generally contract with farmers for purchasing should be required. As there are many limitations on raising pigs in this state, pig fattening project is highly recommended.

- Number of participating farmers 20 farmers
- Cultivated area for grain approx. 10 ha. (0.5 ha. per family)
- Annual grain production for feed 40 tons
- Grain consumption per pig 290 kg
- Number of fattening pigs per cycle 138 pigs
- Total number of fattening pigs per cycle 2.5 - 3 pigs
- Annual fattening cycle 2.2 cycle

Once this project is successful, swine breeding for reproduction could be done collectively, in order to reduce production cost.

(3) The project for the strengthening of agricultural extension services

The improvement of each small-scale farmer's agricultural technique is indispensable to promote diversified farming by the introducing Camedor palm, the useful tree and the small and medium size cattle, in addition to the improvement of coffee production. Municipality of Cacahoatán will act as intermediate between the farmers at Ejido Mixcum, who want to get new agricultural technique, and the organization on agricultural research and extension services to exchange of their information frequently and to arrange the technical transference effectively to the farmers. Each organization has the following responsibility to execute their role.

1) The Ejidatario at Ejido Mixum (Small-scale farmers)

The producer's group, which consists of 20 – 25 Ejidatario, will be organized to get the new cultivation technique. The representative of the group will attend the technical training course and explain the contents of the training to the constituent members and also inform the problems at their field to the manager of the organizations on agricultural research and extension services. This producer's groups will be included in the producer's group, which established by Ejido Mixum.

2) The organizations on agricultural research and extension services

The organizations, which carried out the agricultural research and extension services, soil physical and chemical analysis, supply of seeds and seedlings, alianza para el campo, etc. are as follows:

Organization name	Activities
<u>Public organization</u>	
- INIFAP	Researches on Corn and their technical guidance
- CEIDPHPACH	Production and supply of fruit tree, tropical ornament plant seedlings, and their technical guidance to produce
-SEMARNAP	Production and supply of useful trees and their technical guidance to produce
- SERNyP	Production and supply of useful trees and their technical guidance to produce
- SAG	Supply of Corn, other grain's seeds and coffee seed (Kilo por kilo), technical guidance of grain crops cultivation, advises to organize farmers
- SAGAR	Technical guidance of grain crops cultivation, advises to organize farmers
- COESCAPE	Technical guidance of coffee cultivation
<u>Private organization</u>	
- CIICA	Soil analysis and design for fertilizer application
- Union Ejido	advises to organize farmers, Technical guidance of coffee cultivation

These organizations will arrange managers as the windows for agricultural technology transfer and have the following responsibilities:

- Each organization will inform their content of activities on agriculture to the persons in charge of the promotion of agriculture and animal husbandry who belong to the municipality of Cacahoatán and train them.
- The manger of the organization will review the agricultural problems, which the farmer in the municipality of Cacahoatán have, and inform their researchers and persons in charge to solve. He will inform the persons in charge of the promotion of agriculture and animal husbandry about their training course to the small-scale farmers

- Each organization will arrange the training course at any time by the request of the municipality of Cacahoatán.
- Each organization will recruit agricultural experts by newspaper e.t.c. and resist at their office, if they have not the agricultural engineer who to fit to the producer's intention on new crops and/or new cultivation technique in Cacahoatán

3) **Municipality of Cacahoatán**

As two agricultural experts and two technical assistance in charge of the promotion of agriculture and animal husbandry work now at the municipality of Cacahoatán, their services will be strengthened to act as intermediate between the Ejidatario and the organization. As the contract period of the expert is the same period as the mayor's terms of office, i.e. three years, it is necessary for the municipality to contract with them for two or more years not to be controlled by the mayor's terms of office.

When new crops and /or agricultural technique will be introduced, the municipality will arrange not to overlap their plan with that of SAG-SAGAR. The municipality also takes such budgetary measure, which include the adequate technical guidance to produce with stable to organize completely for two years, and technical guidance at every two weeks, as are necessary for the small-scale farmers who will not receive the technical guidance by SAG-SAGAR.

The experts and assistances belonging to the Municipality of Cacahoatán have following responsibilities:

- They will make it known to everybody that they should work together to increase the farmer's profit. Then they will promote the organization of farmers to increase the farmer's profit by the improvement of the productivity, that is, the renovation of coffee trees to replace the existing coffee trees with new high yielding varieties.
- They will actively inform the problems on the agricultural production and the organization of farm household to the organization on agricultural research and extension services. They will also open the agricultural technology guidance etc. at any time.

(4) **Improvement of Commercialization and Agro-industry**

1) **Ornament Crop**

Due to the lack of the knowledge for the commercial rout of the Camedor palm, the farmers will organize a cooperation for sale. In the initial stage, the large scale farmer who is shipping to the Central market in the Mexico city will be considered as the buyer. At any rate, it is necessary to make a selling/buying contract between the producers and the trader to ensure the selling price, time to delivery, package method and etc.

a. **Collecting and Shipping Center**

The target flower is Camedor palm. Each farmer ships them in every two weeks throughout the year. The process of work is; sorting → washing → insect proofing → boxing → shipping. The facilities and space for dealing with the crops per day in this process are needed. It is a different building from the collecting and shipping center for coffee because water is used for washing and pest control.

b. **Facility Plan**

The volume of collecting and shipping to design a center, and the components of the facilities are as follows.

Camedor palm; the design volume of collecting and shipping

	Unit	Whole area
Maximum cultivation area	ha	22.5
Annual shipment	leaf / year	975,000
	box / year	1,950
Frequency of shipping	time / year	26
Days of shipping	day / time	3
Design volume of collecting and shipping	box / time	25

Measure of a box (for 500 leaves): 60cm x 60cm x 30cm

Main components of the collecting and shipping center

Floor area	: 78m ² (6m x 13m)
Breakdown	: the space for sorting ~ washing ~ insect proofing ~ boxing; 52m ² , the spaces for collecting, clerical work and so on; 26m ²
Items of the facilities	;washing and insect proofing water tanks, working tables, a warehouse for materials and so on
Structure	:wet masonry foundation, concrete paved floor, wooden pillar materials and sluice wall, synthetic resin roof tile materials and so on. The materials of each part can be procured in the area and should be general.

2) Coffee

The lack of the final treatment facilities of coffee is the main reason of the low price trading of coffee in this area. The coffee treatment equipment of the farmers is mostly old models without fermentation and cleaning. Because of this treated pergamino coffee has no good quality, so that the middle man purchase coffee with low price. In this sense, the facilities for treatment, collecting and delivery have been planned.

Improvement of the shipment price is aimed at through planning the facility for processing the coffee, "*Arabica*" among the varieties of coffee that is produced in the area. In the facility, the coffee beans are to be processed to *Pergamo*, which are the coffee beans whose pulps are removed, and then, dried in the sunlight.

Robusta, which occupies the half of total shipment at present, is shipped after drying as before. Nevertheless, all cultivation varieties of coffee in the area will be "*Arabica*" through the cultivation variety improvement, and then will be shipped after processing.

a. Coffee Processing Facility

Coffee processing will be done in two stages. On the initial project stage the collection and marketing will be done jointly, while the processing will be done individually. For the removing of the pulp in the initial stage, manual pulp removing equipment and the existing drying place in each farmer will be utilized. On the following stage, in order to process coffee intensively, improve its quality and reduce its cost, the facilities of removal of pulp and dryer will be mechanized.

i. For the Individual Processing

In the initial project stage, the coffee will be collected and shipped organizationally, and processed individually. Required facilities are as follows, and will be installed in the garden of each farmer.

- Manual remover of pulp (250kg/hr) 1 units
- Concrete water tank for washing and fermenting 3m³ x 2 tanks
- FRP water storage tank for pre-washing 1m³ x 1 tanks
- Drying place in the sunlight (concrete floor) 34m²

At present, each farmer owns drying place individually, therefore, existing drying place will be repaired a necessary part of concrete floor.

The design processing volume is as follows.

Processing volume of coffee		Number of farmers 75 households	
	Unit	Per farm household	Total area
Maximum cultivation area	Ha	5.13	385.0
Yield	Qq/ha/year	20.0	20.0
Annual processing volume	Qq/year	103	7,700
Days of harvesting	day / year	90	90
Operation hours	hr /year	4	10
Design processing volume	Qq / day	1.14	85.56
<i>Uva</i>	Qq /hr	0.29	10.69
	Kg / hr	70	2,096
	l /hr	71	2,122
<i>Despulpado</i>	l /hr	43	1,283
<i>Pilpa amarilla</i>	lit /hr	28	838
<i>Lavado</i>	l /hr	34	1,027
<i>Oreado</i>	kg / hr	29	856
<i>Pergamino</i>	kg / hr	16	492
	kg / year	5,903	442,750
	sack / year	79	5,923
<i>Oro</i>	kg /hr	13	394

The present water supply volume is enough for processing water requirement and domestic use. However, the reservoir tank will be installed to store water during the night because water use is concentrated during daytime.

ii. For the Intensive Processing

Coffee varieties will be changed to "Arabica" and processing will be changed to intensive measures.

The required facilities are as follows;

- Electrical powered remover of pulp (1200kg/hr) 2 units
- Pre-washing water tank for fruit 6m³ x 2 tanks
- Circulating washing water tank 1m³ x 2 tanks
- Washing water storage tank 30m³ x 1 tank
- Dryer powered by gasoline(15Qq/day) 3 units
- Drying place in the sunlight (concrete floor) 1,200m²
- Sewage sedimentation tank

Regarding the electrical powered remover of pulp, a water saving type so-called *Tipo Ecologico* is adapted. This uses circulating water for processing pulp. This type of the remover has already

introduced in three processing facilities (ISMAM-Tapachula, FINCA-Huixtla, and *Union de Ejido-Cacahoatán*). This makes effects on saving water and decreasing sewage. And as for this type of the remover, all of the equipment cost is supported by government under *Arianza para El Campo*.

As for sewage condition in Soconusco area, all sewage is discharged into rivers without any treatments. The standard for water quality of coffee sewage is not established, and treatment plant for it is not installed at present. By the introduction of this type of treatment facilities, it is possible to decrease the volume of the sewage at less than the half of the present volume.

b. Collecting and Shipping Facility for Coffee

The collecting and shipping facility will be installed in the area where close to a residential area for a steady handling on the coffee in order to decrease the expenses.

If the coffee is processed intensively, it could be shipped directly from the processing facility. At first, a collecting and shipping center will be installed, and then, only collecting and shipping will be undertaken intensively because farmers process their products individually until that time. In the future, a processing facility will be installed with the center, and collecting, processing, and shipping will be done intensively.

Coffee beans are easy to be stored. Thus, it is desirable to ship the products after collecting a certain amount of them so as to get advantage of the selling price. Therefore, the facility includes the space for storage. The design volume of the collecting and shipping, and the main components of the facilities are as follows.

Coffee; design volume of collecting and shipping

	Unit	Whole area
Maximum cultivation area	ha	385.0
Yield	Qq / ha / year	20.0
Annual shipment	Qq / year	7,700
	kg / year	442,750
	sack / year	5,923
Frequency of shipping	time / year	3
Days of shipping	day / time	1

The main components of the collecting and shipping center

- Floor area : 375m² (25m x 15m)
- Breakdown : the space for storage; 248m², the spaces for collecting and shipping, clerical work and so on; 127m²
- Structure : wet masonry foundation, concrete paved floor, brick wall materials, synthetic resin roof tile materials and so on. The materials of each part can be procured in the area and should be general.

5) Pork

Produced pork will be sold in municipalities of Cacahoatán (35,738 inhabitants) and Unión Juárez (25,535 inhabitants). It is assumed 726 ton of pork will be consumed for these municipalities. Compare with the production of this plan is only 8.3 ton, there is no risk for over production. After the fattening pigs in each farmer (100kg/head-after 4 months), the pigs will be collected and sold by the producers' organization. Usually pig cycle (the variation of price) will be appeared for four year interval, but in this case, producers' organization will slaughter pigs themselves and

produce pork, sausage, bacon and other products to increase their income.

(5) Rural Infrastructure Improvement Project

1) Road Improvement Project

The farm road that stretches from the residential area to the plateau, which is located in the left side of Rio Mixcum, will be improved for the change of better agricultural activities and also the protection against soil erosion. The sections to be improved are divided into the section from the residential area to Rio Mixcum (Section I:750m of improvement length), and that from Rio Mixcum to the plateau (Section II:580 m of improvement length).

The improving road width of Section I is to be the present road width, and the standard of total road width is 4m. The basic structure is simple concrete pavement, *Mixto* (mixed with concrete and stones), which is often used in the area, for that the organization of *Ejido* can operate and manage by itself. The wet masonry drainage canals are to be installed in both banks.

The Section II is to be used as a road and a drainage canal for rain because the present road width is very narrow; average 2m, and moreover, average slope is very steep; 17%. The road surface is to be paved by concrete, and wet masonry lagging is to be installed in both shoulders. Section II guides rain to the watercourse to prevent the leakage of water at the lower part of the slope. The section is located on the slope of the coffee cultivation area. Therefore, its road width is to be not expanded because the land is limited, and the stability of slope should be maintained.

(6) Farmers' Organization Activation Plan

In order to strive for stabilization of farm management of coffee producers, the strengthening and activation of the existing *Ejido* producers' organization, to improve the production technology of newly crops in addition to coffee, crop diversification and multiple farming (Camedor, Hawaiiana – Ginger, Cordyline, etc.) will be introduced. On the other hand, through group formation of rural women involving multiple farming, the social status of rural women will be improved.

1) Contents

The contents of the plan include an activation of the organization by strengthening the function of the existing organization and group formation of the women's group. The following steps will carry out this plan.

Strengthening of Producers' Organization

1. The producers' organization is an organization jointed with the *Ejido* Union "Lazaro Cardenas del Rio". (The organization of CIOAC-Regional does not function, and members are duplicated.)
2. The function of the general assembly is as usual.
3. The function and system of the directorate is as usual. The directorate will implement the farm survey regularly, and encourages the activities of disclosing the problems and its solution. The results will contribute to the activities of the organization.
4. The administration office is set up under the directorate, and employs a woman clerk. At the initial stage, the treasurer is carried out her works.
5. The production group and collection group will be formed among members. For the group activities, voluntary and independently participation is promoted. In particular, members who have interested in this matter will be put on a center of the group activities. Close communication among groups, enlightenment and improvement of the activities of the

- organization will be planned.
6. In order to establish the selling system by the organization, the directorate members compose the selling system and group committee members will be set up. The committee will carry out development of client, standardization of farm products, and grasp of market information.
 7. The function of the group is as follow; and each group has an operating committee (3 members). The group administration will be done democratically.
 - Production group: production management, technical control, technical extension and demonstration farm, and agricultural credit will be conducted.
 - Collection group: control, and collection and distribution of farm products will be carried out. In the future, farm input supply will be added.
 8. The producer's fund will be established in order to improve productivity and to manage the common facilities. For the strengthening of the fund, members will contribute fixed amount monthly, decided by the general assembly. In addition, 2% of the amount of product's selling handled by the center will levy as handling charge. This charge will be saved for the fund. The administration office will manage the fund.

2) **Organization of Women's Production Group**

1. In order to introduce farming multiplication, rural women of 20 farms, which practice mainly Corn cultivation in the area, will be organized as women's group.
2. Women's group members will raise and fatten swine in their home and the group will sell them jointly.
3. Regarding production technology, nutrition and health of domestic animals, the improvement of production technology will be planned by exchanging technology with other similar groups in the surrounding areas. And women participating to the group will bear a part of multiple farming.
4. The funds for group activity will be considered the financing by micro-credit.

(7) **Improvement of Access to Rural Finance System**

The improvement proposal to be applied to this subproject area is the same in principle as that is envisaged in the subproject area of Santa Cruz, Frontera Hidalgo. Nevertheless, it is worth while to indicate that PROCAMP-guaranteed credit shall have less impact in this area, because beneficiaries of PROCAMPO in the area are limited to 30% of total and the benefited area is as small as 0.9 ha per beneficiary. Under the circumstances, an emphasis should be placed on promotion of access to FIRA's PROCREA due to the fact that this program's target beneficiaries at its initial stage are coffee farmers.

7.6 **IMPLEMENTATION PLAN FOR THE ACTIVITIES AND COST ESTIMATION**

7.6.1 **Methodology for Implementation of the Activities**

Both activities established in the present plan do not require of a large public investment but its implementation is based on the investment of own resources from the producers. Nevertheless, to be able to carry out an increase in the production of present crops and to be able to introduce new ones, the producers from both entities that are lacking capital resources will have to invest the entirety of their production capital. The productive investment is necessary. The present situation is more than just a problem of lacking economic resources for a productive investment, but also of low profit and the high rate of default loans. Therefore, this problem of capital investment will have to be considered as a limiting factor in order to improve income substantially and focus in

the producers' organization for the fulfillment of the present plan. It is expected that besides agricultural investment loans, there will also be loans for construction of infrastructure and coffee processing plants. The funds for the loan will come from FIRA and will be given out through BANRURAL or any other commercial bank, but the producers will have to be informed about the loan programs with preferential rates offered by FIRA and it will also be necessary to carry out education activities in order to increase consciousness amongst producers on the responsibilities regarding the payment of debts and this could be done through municipal governments, SAG and SAGAR.

Regarding the utilization of agricultural and livestock loans, in order to surely pay them back it is vital to keep stable incomes through new crops or high yielding traditional ones. For this, it is indispensable to have a positive support to the farming techniques of the producers. Regarding this, the present plan contemplates the appointment of the ones responsible in the agricultural and livestock sector of the municipalities as the intermediaries between producers and extension offices with the objective to effectively transfer the appropriate techniques towards producers. For the proposed activities on both cases such as the introduction of irrigation works, swine breeding, purchase of improved corn seeds, renovation of coffee plantations and the improvement of coffee processing facilities, there are applicable categories in the program Alianza para el Campo and economic support is expected from the government utilizing these funds as much as possible. The responsibility will lie on SAG and SAGAR. In the construction of social infrastructure at municipal level, COPLADE is the coordinating organism where it carries out through the distribution in each municipality, a fund resource for municipal social infrastructure called FISM, so the road improvement works included in the two pilot areas will be done using this fund. The agriculture and livestock combined management activities include swine raising and partial financing proposed in the improvement plan for agricultural loans establishing the objective to insure a fund for micro-credits. In order to turn into reality these micro-credits, it is necessary to create a new organism within the state government, which will promote the creation and promotion of micro-credits and once this is established it will be necessary to be ready to provide technical assistance for the operation of the activities. The implementation of these activities in a more concrete manner is indicated in the Table 7.6.1. and Fig. 7.6.1.

Table 7.6.1 Implementation Method of the Activities

Name of Activity	Content of Activities	Support Expected from the Government	Related Offices
Plan for the improvement of agricultural and livestock productivity of low income farmers in Santa Cruz area (corn production area)	Flowers and pineapple crops	Agricultural and livestock loans	• FIRA(BANRURAL)
		Technical assistance for crops	• SAG • Municipal Presidency in Frontera Hidalgo • FIRA
	Increase of corn productivity	Agricultural and livestock loans	• FIRA(BANRURAL)
		Technical assistance for crops	• SAG • Municipal Presidency in Frontera Hidalgo • FIRA
		Budget supports from Alianza para el Campo (Kilo or kilo)	• SAGAR, SAG
		PROCAMPO	• SAGAR
	Swine raising	Establishing a system for micro-credits	• Chiapas State government
	Construction of Irrigation works	Loans	• FIRA(BANRURAL)
		Budget supports from Alianza para el Campo (Ferti-irrigation)	• SAGAR, SAG
	Construction of the collection center and distribution of agricultural and livestock products	Loans	• FIRA(BANRURAL)
	Improvement of rural roads	Public investment from FISM	• COPLADE • Municipal Presidency in Frontera Hidalgo
Plan for the improvement of agricultural and livestock productivity of low income farmers in Mixcum area (Coffee production area)	Renovation of coffee plants	Agricultural loan	• FIRA(BANRURAL)
		Finacial Support from Alianza para el Campo (Coffee Program)	• SAGAR, SAG
	Flower cultivation	Agricultural loan	• FIRA(BANRURAL)
		Agricultural loan	• SAG • Public investment from FISM • FIRA
	Swine raising	Establishment of a system for micro-credits	• Chiapas state government
	Construction of coffee processing facilities	Loans	• FIRA(BANRURAL)
		Financial support by Alianza para el Campo (Coffee Program)	• SAGAR, SAG
	Construction of rural roads	Public investment from FISM	• COPLADE • Public investment from FISM
	Construction of collection center and distribution of agricultural and livestock products	Loan	• FIRA(BANRURAL)

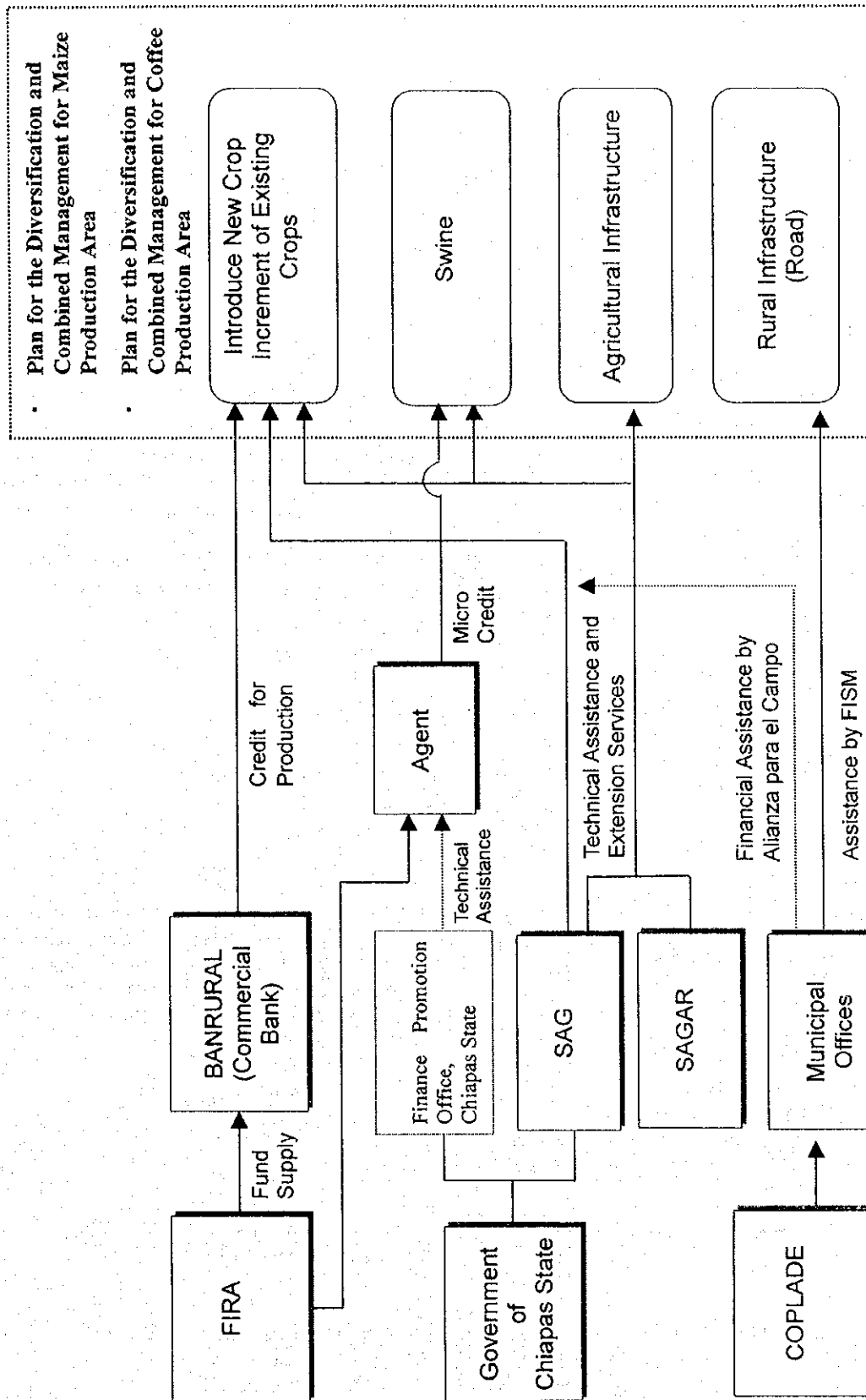
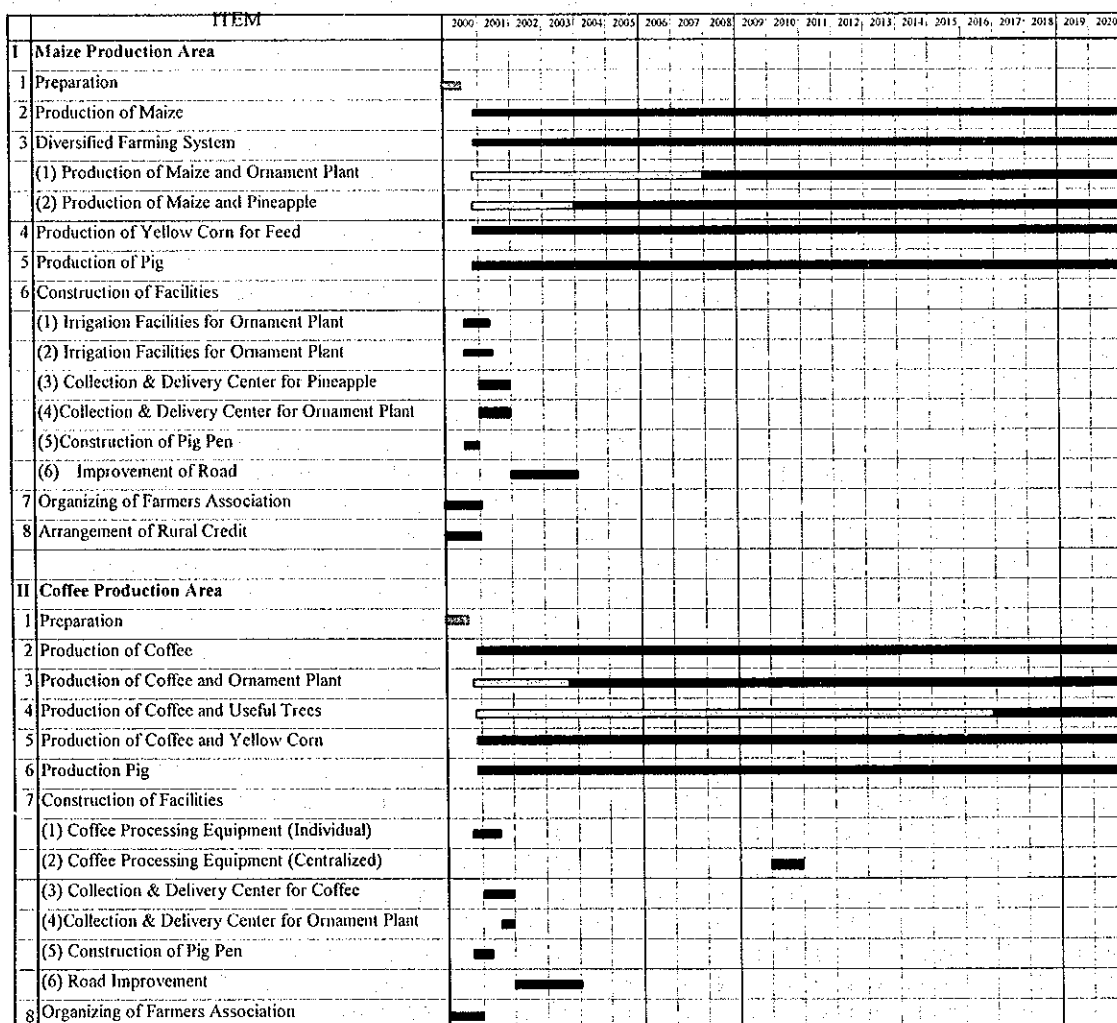


Fig. 7.6.1 ORGANIZATION OF PROJECT IMPLEMENTATION

7.6.2 Progress of the Implementation of Activities

From the necessary installations to carry out these activities, except for the coffee processing facilities, they will be planned in such manner that they are done in the initial stage of the activities so that these can produce results to the producers as soon as possible so they can pay their debts in an early manner and as a result of this, their living level can be improved. Also, at the beginning of the activities the organization of the producers will be carried out, but regarding this, it will be done with the help and cooperation of the federal, state and municipal governments. Parallel to the organization, all the necessary process required to prepare the loans in an early manner will be done.

The progress of the implementation of the activities is shown in Fig. 7.6.2.





Note:  Production increasing period
 Ordinary production period/implementation period

Fig. 7.6.2 WORK SCHEDULE OF PLAN FOR IMPROVEMENT OF AGRICULTURAL AND LIVESTOCK OF LOW INCOME FARMERS FOR CORN AND COFFEE PRODUCTION AREA

7.6.3 Project Cost Estimation

The estimated project costs for the improvement of agricultural and livestock of low income farmers in the corn and coffee production areas are shown in the following table.

Corn Production Area

	Items	Unit	Quantity	Amount(\$Mex)
1	Pig Pen	each	25	67,500
2	Collection and Distribution Center for Ornament Plant (Pineapple)	place	1	39,000 (24,000)
3	Irrigation Facilities	unit	25	2,765,000
4	Road Improvement	m	2,300	220,360
5	Physical Contingency	Lump sum	1	311,586
6	Engineering Cost	Lump sum	1	342,744
7	Loan Interest	Lump sum	1	188,510
	Total			3,934,700 (3,919,700)

Note : Figures in the parenthesis mean Pineapple case.

Coffee Production Area

	Item	Unit	Quantity	Amount(\$Mex)
1	Pig Pen	each	20	36,000
2	Coffee Processing Facilities (Individual)	unit	75	1,323,210
3	Coffee Processing Facilities (Centralized)	unit	1	1,625,940
4	Collection and Distribution Center for Coffee	place	1	262,500
5	Collection and Distribution Center for Ornament Plant	place	1	39,000
6	Road Improvement	m	1,330	1,491,200
7	Physical Contingency	Lump sum	1	474,185
8	Engineering Cost	Lump sum	1	521,603
9	Loan Interest	Lump sum	1	286,882
	Total			6,060,520

The cost is calculated in line with the following parameters.

Items	Parameters for Cost Estimate
Construction Cost	The unit cost for calculation is based on the unit prices of Mexican public works, contractors' cost estimate, prevailing unit prices in the study area and similar projects executed in the past
Procurement Cost of Materials and Operation Cost of Equipment	The procurement cost for construction materials such as aggregate, sand etc. and pumps, coffee processing equipment are calculated. The cost is at the site. The operation cost for heavy construction equipment and ownership cost are included in the unit cost of the construction works
Physical Contingency	10% of construction cost and procurement cost of materials and equipment is estimated
Engineering Cost	10% of construction cost and procurement cost of materials and equipment is calculated for engineering cost such as consultant services, topographic survey and design
Loan Interest	5 % of total cost is estimated as a cost for credit procedure
Land Acquisition	Land acquisition cost is not included because the organization of <i>Ejido</i> should provide the land that is required for the construction work for the work.
Others	Unit price and exchange rate were employed as of April 1999. The exchange rate is US\$1.00 = Mexican Peso 9.40 = Japanese Yen 120.00.

7.7 PROJECT EVALUATION

7.7.1 Principles for Project Evaluation

In undertaking an evaluation on two subprojects, target of the pre-feasibility study, the financial evaluation together with farm profit analysis shall be given priority over the economic evaluation due to the fact that the said two subprojects do not require great amount of public investment (the public expenditure is focused on financial support for the Alianza para el Campo) and the majority of the investment shall be born by farmers. Thus, the economic analysis is to be made for the reference sake only. It is worth while to point out that, in according with the prevailing practice in Mexico employed by the World Bank, BANOBRA, etc., the Net Present Value (NPV) shall constitutes the determinant for evaluation of the project at pre-feasibility level (the Internal Rate of Return – IRR – is to be calculated, but no other than reference only).

7.7.2 Evaluation Method

The NPV is to be calculated on the basis of the annual cash flow of the net incremental benefits (benefits minus costs) to cover the whole project life, which is obtained as a consequence of the balance of agricultural farming and investment between “With” project situation and “Without” project situation. Because it is not sure in this moment that the support related with the Alianza para el Campo should be rendered to proposed beneficiaries of the subprojects, the project evaluation shall be carried out with regard to the two cases: “With” and “Without” support under the Alianza para el Campo. Furthermore, the evaluation shall be conducted on condition that the agricultural credit is provided to proposed beneficiaries.

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

- (1) The discount rate to be applied for calculating the NPV shall be as follows. Financial evaluation: 9% (Approximate average real interest rate, which is deflated from nominal interest rate taking into account of inflation rate, for la last 12 months announced by FIRA). Economic evaluation: 13% (To follow the World bank's practice employed to poverty alleviation-oriented rural development projects).
- (2) The prices to be used for financial evaluation shall be those prevailed at the local markets for the last quarter in 1998 and the first quarter in 1999. In case of the “With” project situation, financial cost relevant to agricultural credit shall be contemplated. The economic evaluation shall be in according with the following principles.
 - ◆ The export (import) parity prices of traded commodities (Corn and coffee) and the price of fertilizer (also traded commodity) are to be estimated on the basis of the price projections made by the World Bank. On the other hand, the prices for non-traded commodities shall be the same as the market prices.
 - ◆ The conversion factor for the shadow exchange rate shall be 1.05.
 - ◆ The conversion factor for shadow labor cost shall be: 1.0 for qualified engineer and skilled workers, 0.8 for semi-skilled workers, and 0.7 for non-skilled workers.
 - ◆ From market price, transfer items (subsidies related with PROCAMPO and Alianza para el Campo, financial cost for credit, taxes, etc).
- (3) The financial cost for the agricultural credit shall be equivalent to CETES (24% per annum, an average for the past 12 months,) and the financial support under PROCAMPO is \$ 707/ha (to be applies for the spring-summer cropping season in 1999). And, subsidies regarding with the Alianza para el Campo are to be rendered in the following manner.

- ◆ Procurement of seeds for Corn (Kilo por kilo): 60% of the market price
- ◆ Irrigation facilities: 45% of the total investment
- ◆ Renovation of coffee tree: 80% of the cost for procurement of seedlings
- ◆ Installation of coffee treatment facilities: 45% of the total investment

(4) The project life shall be 16 years for the subproject for the agricultural diversification and agriculture-livestock mixed farming at Corn production area and 20 year for the agricultural (to take shipment time of shading tree into account) and 20 years for the subproject for the agricultural diversification and agriculture-livestock mixed farming at coffee production area (because collective coffee fruits processing facilities is scheduled to be installed in the 10th year of the subproject).

(5) Sensitivity analysis to disclose how projects return would be affected under change of given variations of the project (decline of farm-gate prices, reduction of unit yield of agricultural produces and rise in farm and capital investment) is to be carried out.

7.7.3 Financial and Economic Evaluation of Respective Subproject

(1) Subproject: Improvement of Agricultural and Livestock of Low Income Farmers at Corn Production Area

This subproject aims to convert actual low-productivity and unstable Corn mono-culture farming into diversified and high returns farming with introduction of tropical flower or pineapple among 25 Corn producing farmers (an average cultivated area: 4.25 ha) selected from 31 farmers at Santa Cruz area, municipality of Frontera Hidalgo. The subproject conceives at the same time to activate stagnated rural society by facilitating rural women to participate in productive activities starting from rearing of swine.

Farm production per model farm for both "Without" project situation and "With" project situation shall be as follows.

Without Project	With Project
<ul style="list-style-type: none"> ◆ Corn production: 4.25 ha ◆ Sesame production (Under residual humidity): 0.5 ha 	<p>(Alternative A: Combination of Corn with Hawaiiana)</p> <ul style="list-style-type: none"> ◆ Corn production (Including yellow corn): 4.05 – 3.45 ha ◆ Hawaiiana + shading tree (Banana, Cedro rojo): 0.2 ha – 0.8 ha ◆ Rearing of swine: 13 heads (Annual) <p>(Alternative B: Combination of Corn with pineapple)</p> <ul style="list-style-type: none"> ◆ Corn production (Including yellow corn): 3.25 ha ◆ Pineapple: 1 ha ◆ Rearing of swine: 13 heads (Annual)

The capital investment contemplated in this subproject is: irrigation facilities (shallow wells with motor), In-farm roads development, collection and packing center of Hawaiiana (Pineapple) and swine shed.

In pursuance with above-mentioned model for agricultural farming and capital investment,

farm-gate price, production cost and cost of capital investment have been calculated for both financial and economic prices as given hereinafter.

Categories	Unit	Financial Price ^{1/}	Economic Price	
Farm-gate price	Corn (White)	\$/ton	1,350	1,454
	Corn (Yellow)	\$/ton	1,210	1,454
	Hawaiana	\$/stem	1.0 (Domestic market) 3.0 (Int'l market)	1.0 (Domestic market) (Int'l market)
	Pineapple	\$/ton	2,670	2,670
	Swine	\$/kg	10.0	10.0
Production cost	Corn (White)	\$/ha	2,970 (W/O. Project) 6,559 (W. Project)	2,376 (W/O. Project) 5,476 (W. Project)
	Corn (Yellow)	\$/ha	4,406 (W. Project)	3,637 (W. Project)
	Hawaiana ^{3/}	\$/ha	34,625 (1 st year) 45,038 (2 nd year on)	27,673 (1 st year) 21,668 (2 nd year on)
	Swine	\$/year	9,303	8,098
Capital investment ^{2/}	Irrigation facilities	\$/unit	92,838	113,053
	In-farm road	\$/m	115.9	103.5
	Marketing facilities	\$/unit	53,797	40,798
	Swine shed	\$/unit	3,725	2,825

Note: 1/ Contemplates support under the Alianza para el Campo
2/ Includes physical contingencies, consulting fee and financial cost
3/ Comprises cost for banana and cedro rojo

Making input of above prices into the cash flow of the project life, the subproject's return was calculated in so far as two alternatives: Combination of Corn with Hawaiana and Combination of Corn with pineapple under different situations: With support from the Alianza para el Campo and Without support from the Alianza para el Campo and this result is given in the table below.

Returns based on the financial prices

Alternatives	Support from the Alianza para el Campo	NPV (At discount rate of 9%)	IRR (%)
A: Combination of Corn with Hawaiiiana	Yes	\$ 8,145,191	23.9
	No	\$ 6,852,266	19.3
B: Combination of Corn with pineapple	Yes	\$ 8,916,357	32.6
	No	\$ 7,623,431	25.3

Returns based on the economic prices

Alternatives	Support from the Alianza para el Campo	NPV (At discount rate of 9%)	IRR (%)
A: Combination of Corn with Hawaiiiana	Yes	\$ 6,611,930	29.9
	No	Ditto	
B: Combination of Corn with pineapple	Yes	\$ 11,849,621	77.3
	No	Ditto	

In any case, high financial and economic returns are anticipated, even without support from the Alianza para el Campo. Of the two alternatives, it is concluded that the Alternative B (Combination of Corn with pineapple) produces higher returns than the Alternative A (Combination of Corn with Hawaiana) within the 16 year-project life, even to the fact that the net farm return per unit of land is higher for the latter than the former; this adverse phenomenon is taken place because the cultivation of Hawaiana is increased gradually starting with minimum area of 0.2 ha bearing uncertainty of market and farmers' farming technical capabilities.

The sensitivity analysis was carried out with regard to the change of three variations: decline of farm-gate price by 10%, reduction of unit yield of agricultural produces by 10% and rise of cost for capital investment and recurrent expenditure by 10% and it is disclosed that the present subproject is more sensitive to change of unit yield of agricultural produces than other two variations.

In addition, farm budget analysis was made regarding with four cases on which the financial and economic evaluations were conducted. This analysis has revealed that the capital investment will be recuperated by the 2nd year, at the earliest, (farm to undertake production of pineapple with support from the Alianza para el Campo) and by the 8th year, at the latest, (farm to undertake production of Hawaiiana without support from the Alianza para el Campo). Farmers, once clears off their debt at earlier stage of their new farming, can anticipate capital formation which may be used for another farm investment to expand farming activities.

(2) Subproject: Improvement of Agricultural and Livestock of Income Farmers at Coffee Production Area

Target farmers of this subproject are ejido coffee farmers at Mixum area (75 farmers in total with farm size of 5 ha), municipality of Cacahoatán. This subproject envisages to raise unit yield of coffee plantation featured by decreasing productivity by renovating gradually aged coffee trees and planting more intensively seedlings. The subproject, apart from elevating coffee productivity, proposes to raise productivity per unit of land with introduction of camedor palm to intercrop with coffee plantation. At the same time, like Santa Cruz area, rearing of swine by rural women is also contemplated in the subproject.

Farm production per model farm for both "Without" project situation and "With" project situation shall be as follows.

Without Project	With Project
<ul style="list-style-type: none"> ◆ Coffee + shading tree (banana): 5 ha ◆ Corn production: 0.5 ha (20 farmers) 	<ul style="list-style-type: none"> ◆ Renovation of coffee trees : 5 ha (1 ha/year x 5 years) ◆ Camedor palm: To be intercropped with coffee as shading tree + shading tree ◆ Corn (Yellow): 0.5 ha (20 farmers) ◆ Rearing of swine: 6 heads (Annual)

This subproject includes as capital investment: coffee fruits processing facilities (Individual and collective ones), improvement of rural roads, farm commodities marketing facilities (parchment coffee and camedor palm) and swine shed.

On the basis of above-mentioned model for agricultural farming and capital investment, farm-gate price, production cost and cost of capital investment have been calculated for both financial and economic prices as given hereinafter.

Categories	Unit	Financial Price ^{1/}	Economic Price	
Farm-gate price	Coffee	\$/Qq	800	807
	Corn (White)	\$/ton	1,350	1,454
	Corn (Yellow)	\$/ton	1,210	1,454
	Camedor palm	\$/box	500	500
	Swine	\$/kg	10.0	10.0
Production cost	Coffee	\$/ha	2,050 (W/O. Project)	2,376 (W/O.. Project)
	Coffee	\$/ha	7,439 (W. Project – Average)	6,301 (W. Project – Average)
	Corn (White)	\$/ha	2,970 (W/O. Project)	2,376 (W/O. Project)
	Corn (Yellow)	\$/ha	4,406 (W. Project)	3,637 (W. Project)
	Camedor palma	\$/ha	1,506 (W. Project – Average)	960 (W. Project – Average)
	Swine	\$/year	4,233	3,685
Capital investment ^{2/}	Coffee facilities (Individual)	\$/unit	14,559	18,692
	Coffee facilities (collective)	\$/unit	1,341,766	1,458,009
	Rural road	\$/m	1,357	1,096
	Marketing facilities (Camedor palm)	\$/unit	58,516	40,798
	Marketing facilities (Coffee)	\$/unit	393,870	277,612
	Swine shed	\$/unit	4,233	3,175

Note: 1/ Contemplates support under the Alianza para el Campo

2/ Includes physical contingencies, consulting fee and financial cost

Making input of above prices into the cash flow of the project life, the subproject's return was obtained in the following manner:

Support from the Alianza para el Campo	Return on the basis of financial prices		Return on the basis of financial prices	
	NPV (At discount rate of 9%)	IRR (%)	NPV (At discount rate of 13%)	IRR (%)
Yes	\$ 7,985,932	19.5	\$ 7,199,054	24.6
No	\$ 4,897,785	14.2	Ditto	

Even though the improvement of rural road, which is not directly concerned with farm production, is included as an inventory, the subproject promises relatively high return. Furthermore, this return does not decline substantially unless the support from the Alianza para el Campo is expected.

The sensitivity analysis was carried out with regard to the change of three variations: decline of farm-gate price by 10%, reduction of unit yield of agricultural produces by 10% and rise of cost for capital investment and recurrent expenditure by 10% and it is disclosed that the present subproject is more sensitive to change of unit yield of agricultural produces than other two variations.

In addition, farm budget analysis on the two cases, with which the financial and economic evaluations were conducted, has revealed that the capital investment will be recuperated by the 6th year, (the case with support from the Alianza para el Campo) and by the 10th year (the case without support from the Alianza para el Campo). Thus, an investment on development of collective coffee fruits processing facilities may be made with own resources of the subproject's beneficiaries.

7.7.4 Socioeconomic Synergy Impact

Besides direct economic benefits (increase in farm income among beneficiaries) , the implementation of the subprojects is expected to bring about the following socioeconomic synergetic benefits.

- ◆ Major employment opportunity, in particular among rural women, is foreseen in such activities as harvest of coffee and tropical flowers as well as at marketing facilities related with these harvests.
- ◆ An expansion in production of coffee as well as tropical flower will contribute to generation of foreign exchange.
- ◆ An introduction of the microcredit system facilitates rural women to participate in productive activities, raise their position within families and gives an impetus to reforming the paternalism which stands out in the rural society in Mexico.
- ◆ An increase in coffee production and improvement in its quality result in upgrading the position of Soconusco Region as the leading coffee productive area.
- ◆ An installation of collective coffee fruits processing facilities enables the treatment of coffee-related wastes in easier way.
- ◆ Regional commercial activities becomes vigorous owing to an increase of farmers' income as well as generation of major employment opportunity.
- ◆ An exodus of rural population will be decelerated.

Meanwhile, in view of the fact that the subprojects do not call for great amount of the public investment, its implementation will not prejudice substantially the social development program, the top priority program of the Mexican government. Additionally, these subprojects do not contain large-scaled civil works , the negative impact of their implementation over surrounding ecosystem will be alleviated as far as possible.

7.7.5 Comprehensive Evaluation

The model enterprises aiming at diversification of farming activities which are within the context of subprojects shall offer opportunities for local farmers who have been persistent to the traditional low productive and unstable monoculture, to get rid of present unfavorable situation, to make capital formation and to lead, as a consequence, to enjoying more affluent and amenity rural life. Although these subprojects are extremely small in magnitude of capital investment, their target areas represent the leading farm production (coffee and Corn) of the Soconusco region and thus their success in terms of agricultural diversification shall have greater impact socioeconomically

The model projects (subprojects) have been forged in compliance with the policies of the Mexican government, which, among others, underline alleviation of intervention of the public sector into the agricultural sector and strengthening of the marketing competitiveness and have shown a signpost to which the agricultural sector in the Soconusco reion, which is confronted by stagnation without taking measures for optimization of abundant and valuable natural resoures, should be directed. It is thus anticipated that the subprojects should play a role of catalyst which brings the agricultural sector of the region to revitalization of the past its robust performance and to an accomplishment of sustainable and coherent development in the future.