ANNEX H: AGRICULTURE AND CROP HUSBANDRY

H.1 PREVAILING SITUATION

H.1.1 THE ROLE OF AGRICULTURE IN THE REGIONAL ECONOMY

The agriculture sector has been the mainstay in the economic activity of the Department of Quindio maintaining the highest proportion of GRP, although its importance has decreased as a result of having been diversified the economic structure of the Department. The agricultural sector represented about 27 percent of the Department's GRP in 1980 and accounted for about 46 percent of the total employment in 1986. Domination of the agricultural sector has been constantly diminishing since 1960, in which the sector occupied 43 percent of the GRP.

H.1.2 CULTIVATED AREA OF CROPS

Arable land extend from 900m to 2,500m above the sea level and the greater portion of the crop production in the Department is carried out in sloping lands. These lands are divided into three categories with different agricultural environment consist of lands' altitude and mean temperature.

a) 900-1,200m (22°C) Sorghum, Sugarcane, Soy Bean, Cassava, Plantain, Coffee, Grass

b) 1,200-1,800m (20°C) Coffee, Plantain

C) 1,800-2,500m (18°C) Vegetables, Bean, Grass, Forest

Most of arable lands for crop production have been already developed.

H.1.3 SITUATION OF CROP PRODUCTION

Total cultivated area of main crops was 117,880ha (including intercropped area) in 1984(see Table H.1.1), of which 55.2% is occupied by coffee, 37.5% by plantain, and cassava occupied 4.2%. The production of coffee, plantain and cassava shared 13%, 12% and 7% of total production in Colombia, respectively. They yield of coffee and cassava in Quindio were, especially, higher than that of national level. The perennial crops represented by coffee and plantain are main component of crop production in the Department.

The historical evolution of coffee production, indicates that there had been expansion in cultivated area in 1970-1984. The coffee output in 1980-1984, however, was about twice that of the production in 1970 owing to the diffusion of new variety(Caturra) with higher yield which was being substituted for such traditional varieties as Tipica and Borbon.
As to other crops than coffee, plantain, cassava and sorghum showed an increase in cultivated area, while the cultivated area for maize and potato as decreased during 1979-1984. Sorghum, soy bean and sugarcane are mainly cultivated in marginal areas for coffee in lower land region.
Annual crops are harvested twice a year because there are two rainy seasons(see Fig. H.1.1) . The primary planting period is February-March and the secondary in September-October.

H.1.4 CULTURAL PRACTICES OF MAIN CROPS

(1) Coffee

Both traditional varieties(Tipica and Borbon) and improved varieties(caturra and colombia) are planted in Quindio. Caturra can be planted at higher density than traditional varieties and higher average yield is expected. Caturra is more suitable to the region with higher temperature. Colombia variety with high resistance to leaf rust is multiplied in its cultivated area at present. The optimum conditions for coffee cultivation in Quindio are at 1,200-1,800m above the sea level, with temperature of 19°C-21.5°C.
Coffee cultivated area in Armenia, Buenavista, Montenegro and Quimbaya are 54.5% of the total coffee area and production of coffee in these municipalities occupied 58.8% of total production. Average yield of coffee in the whole of Quindio is 1.6 tons/ha, 1.1 ton/ha for traditional varieties and 2.2 ton/ha for improved varieties. Traditional varieties occupied 80% of total coffee in the area between 1,600-1,800m. Improved varieties occupied 60.7% of coffee area in the region at lower than 1,200m(see Table below).

DISTRIBUTION OF COFFEE AREA BY ALTITUDE

Altitude (m)	Traditional Variety(%)	Improved Variety(%)	Total Area (ha)
1,200-1,400	49.9	50.1	21,667
1,400-1,600	64.7	35.3	13,534
1,600-1,800	80.0	20.0	6,916

The average yield of traditional varieties in this area is about 850-1,000 kg/ha and 1,200-1,400 kg/ha for improved varieties, which are lower than that in suitable area for coffee production. Percent of Pasilla (small bean and low quality) caused by Mancha de Hierro to total coffee bean is about 20-30%; about 5% in suitable area, for coffee production this percentage is reduced to approximately 5%. Farm-gate price of pasilla(1,200 pesoes/12.5 kg) is lower than a half of that of good quality bean(4,000 pesoes/12.5 kg). The average yield of traditional varieties in the area higher than 1,600m is about 500-700kg/ha because cultural practices in these regions are poor and older coffee trees predominant.
The reasons why small farmers can not introduce improved varieties are lack of financial resources(first year; about 220,000 pesoes, the secondary year; about 120,000 pesoes) to buy seed or nursery plant, prepare land and transplant, and income for farmers decrease for two-three years until the first harvesting of coffee.
Tipica and Borbon commence bearing at 24-26 months after being planted and caturra at 17-20 months. Coffee trees will be full bearing at 4-5 years. It is necessary to stamped once and after that, it will be planted newly. However, a few small farmers stump because of no income from coffee for about two years after stumping.
Amount of fertilizer and rotted coffee pulp applied to coffee farm is a little. It is supposed that rain water washes down fertilizers in sloping lands. Some farmers weed on the whole coffee area by hoe, which may lead to soil erosion.
Representative disease of coffee is leaf rust. Leaf rust is commonly found in regions lower than 1,200m with high temperature and humidity. More leaf rust appear in traditional varieties. Serious damage by leaf rust cause to reduce vigor of coffee tree and then production at the next year. Mancha de Hierro caused by strong sunshine and poor fertilization is

found in this area. No leaf rust is found in coffee area higher than 1,700m. Coffee Committee recommended the application of a fungicide mixture at five times a year. Pest-disease controls in the Department are improvement of varieties with resistance to disease and application of agricultural chemicals because of high prices.
There are two harvesting periods of coffee in the area. In the low land regions, primary harvesting period is in October-November and the secondary period in April-May. The yield throughout the primary harvesting period is 60-65% of total annual yield and the secondary period 35-40%. The primary harvesting period in other high land regions is April-May and the secondary harvesting period in October- November. In the Department of Quindio, coffee is processed by wet method, which can produce coffee bean with better quality than dry method. This method recollected in order of full riping coffee fruits need to maintain good quality, which may lead to extension of harvesting period and increase in labor cost.

(2) Plantain

About 93% of plantain is cultivated as a mixed and inter crop with coffee.There were marked increase in monoculture area of plantain during 1979-1984.
Main variety of plantain is "Dominico Harton" which covers 85% of total plantain cultivation area. The suitable condition of plantain is the area between 1,200-1,500m above the sea level-(optimum altitude for dominico harton). Crop season is 11-12 months. In the area between 1,000-1,500m, plantain occupied 45-55% of total area. The growth of plantain in the area at lower than 1,200m is not so good because of high temperature, and the yield (300-500 bunch/ha) is lower than that (1,000-2,500 bunch/ha) in suitable area. According to an investigation, some 30% of the load deteriorate in quality due to mal-handling. Disease of "Sigatoka" are found in plantain area. "Sigatoka Amarillo" has had influence on the growth of plantain. Heavy damage by "Sigatoka Amarillo" may cause reduction of about 30% in production. The fungicide for "Sigatoka" is applied a few plantain area because of high price. Improvement of pest-disease control is important for plantain plantation.

(3) Cassava

"Chiroza" is main variety of cassava and cultivated in the more than 80% of total area. It gives good quality as food.

Cassava is grown at 1,000-1,400m (optimum altitude) in the Department. Crop season is 11-12 months.
Cassava cultivation need to be weeded at three months after planting, and no more cultural practices up to harvesting. The price of cassava is high.
Therefore, there is a tendency to expand casssava field. The production in 1984 was 115,000tons. Most of the production is transported to other province market. Some problems for transportation are; to easily spoiled, high transport casts.
Cassava is cultivated under poor fertilization. Yield of cassava decrease at the next year with reduction of soil fertility. It is guided to farmers how to cultivate, plough by a machine, make beds by a machine on the arable land with different slope and soil texture. Some farmers cultivate cassava in the steep sloping land, which cause soil erosion.

(4) Other Crops

1) Kidney Bean

Kidney bean is cultivated by good techniques in the low land area and by poor techniques in the high land area. Kidney bean is important as an inter-crop and rotation-crop for improvement of soil.

2) Sorghum

Sorghum is planted and harvested by tractor (80-90Hp) and combine (about 100Hp) on the gentle sloping land in low land region. Sorghum usually follows soy bean, so that soil preparation is relatively easy, and soil fertility is maintained.

3) Maize

Cultivated area of maize was 1,280 ha in 1984, of which 200ha was practiced by machines. The rest area was done by traditional cultivation methods, in where the inter-cropping area was with young coffee, young plantain and cassava in the sloping land.

4) Potato

Potato is grown in the region at 2,500-3,000m above the sea level. Average yield in 1984 was very low as compared with national average yield. Cultivated area on the sloping land

in very high land region needs high labor and transportation costs, so that management of cultivation is poor.

5) Tomato

Planting period, generally, is before rainy seasons. However, tomato may be planted at any season in the area with irrigation water. Tomato gives high returns for being marketable as food and juice processing.

6) Cacao

Cacao is cultivated by poor techniques in the region up to 1,250m above the sea level. Comite de cafeteros del Quindio has plans of agronomic investigation for cacao in the low land area (at 1,100m altitude) between Quindio and Barragan rivers.

7) Fruit

Papaya, orange, avocado and lemon are suited to the low land region,and lulo, black berry and tree tomato to the high land region. According to Comite de Cafeteros del Quindio, cultivated area is about 1,200ha, of which 75% is planted with other crops. Fruits are cultivated on a small scale. About 30% of total yield is damaged by insects.
Cultivation of fruits is suited to national environment in the Department. Fruits have great demand in Colombia. The selection of a suitable area for fruit cultivation, and the improvement of cultivation techniques are expected in Quindio. The investigation of breeding and agronomic test of orange, avocado and other fruits are carried out in El Agrado Agricultural Institute under Comite de Cafeteros del Quindio.

(5) Agricultural Institute

The investigation of breeding and agronomy of crops for improvement of agricultural situation are conducted in agricultural institutes.

AGRICULTURAL INSTITUTES

Institution	Organization	Investigation
GRANJA EXPERIMENTAL DE RIO VERDE	C.R.Q	Breeding of bamboo
GRANJA PARAGUAYCITO	CENI CAFE	Agronomy test of coffee plantation etc.
GRANJA EL AGRADO	CAFE COMIT	Breeding of citrus and plantain, agronomy test of coffee and plantain
GRANJA MARACAY	CENI CAFE	Breeding of colombia variety

There are not investigations of the cultural practices for annual crops, and of mechanization on the sloping land.

TABLE II.1.1 CROP PRODUCTION AND CULTIVATED AREA IN QUINDIO

Crop/ Year		1979	1981	1982	1983	1984
Coffee	A.(ha)	62,559*	61,950**	62,500	-	65,040
	P.(t)	53,268	99,789	100,794	-	104,054
	Y.(t/ha)	0.9	1.6	1.6	-	1.6
Plantain	A.(ha)	42,600	44,000	44,100	44,900	44,200
	a.(ha)	750	1,470	1,790	2,480	3,240
	P.(t)	256,500	250,800	246,900	251,400	265,200
	Y.(t/ha)	6.0	5.7	5.6	5.6	6.0
Cassava	A.(ha)	3,000	2,400	4,500	4,000	5,000
	P.(t)	54,000	54,720	108,000	92,000	115,000
	Y.(t/ha)	18.0	22.8	24.0	23.0	23.0
Kidney Bean	A.(ha)	-	-	300	440	280
	P.(t)	-	-	180	310	236
	Y.(t/ha)	-	-	0.6	0.7	0.8
Sorghum	A.(ha)	400	500	700	740	800
	P.(t)	1,200	900	1,700	2,220	2,400
	Y.(ha/t)	3.0	1.8	2.4	3.0	3.0
Maize	A.(ha)	1,400	1,100	1,100	1,050	1,280
	P.(t)	2,400	1,900	2,100	2,030	2,560
	Y.(t/ha)	1.7	1.7	1.9	1.9	2.0
Potato	A.(ha)	900	1,000	800	400	300
	P.(t)	11,100	10,000	7,700	3,800	2,700
	Y.(t/ha)	12.3	10.0	9.6	9.5	9.0
Cacao	A.(ha)	400	400	500	500	550
	P.(t)	200	200	200	300	300
	Y.(t/ha)	0.5	0.5	0.4	0.6	0.5
Sugar Cane	A.(ha)	300	400	500	300	330
	P.(t)	2,400	3,000	3,400	2,100	2,310
	Y.(t/ha)	8.0	7.5	6.8	7.0	7.0

A.:Area P.:Production Y.:Yield a.:Area of Plantain Only
*:1970 **:1980
Source : DIAGNOSTICO AGROPECUARIO DEL QUINDIO 1985

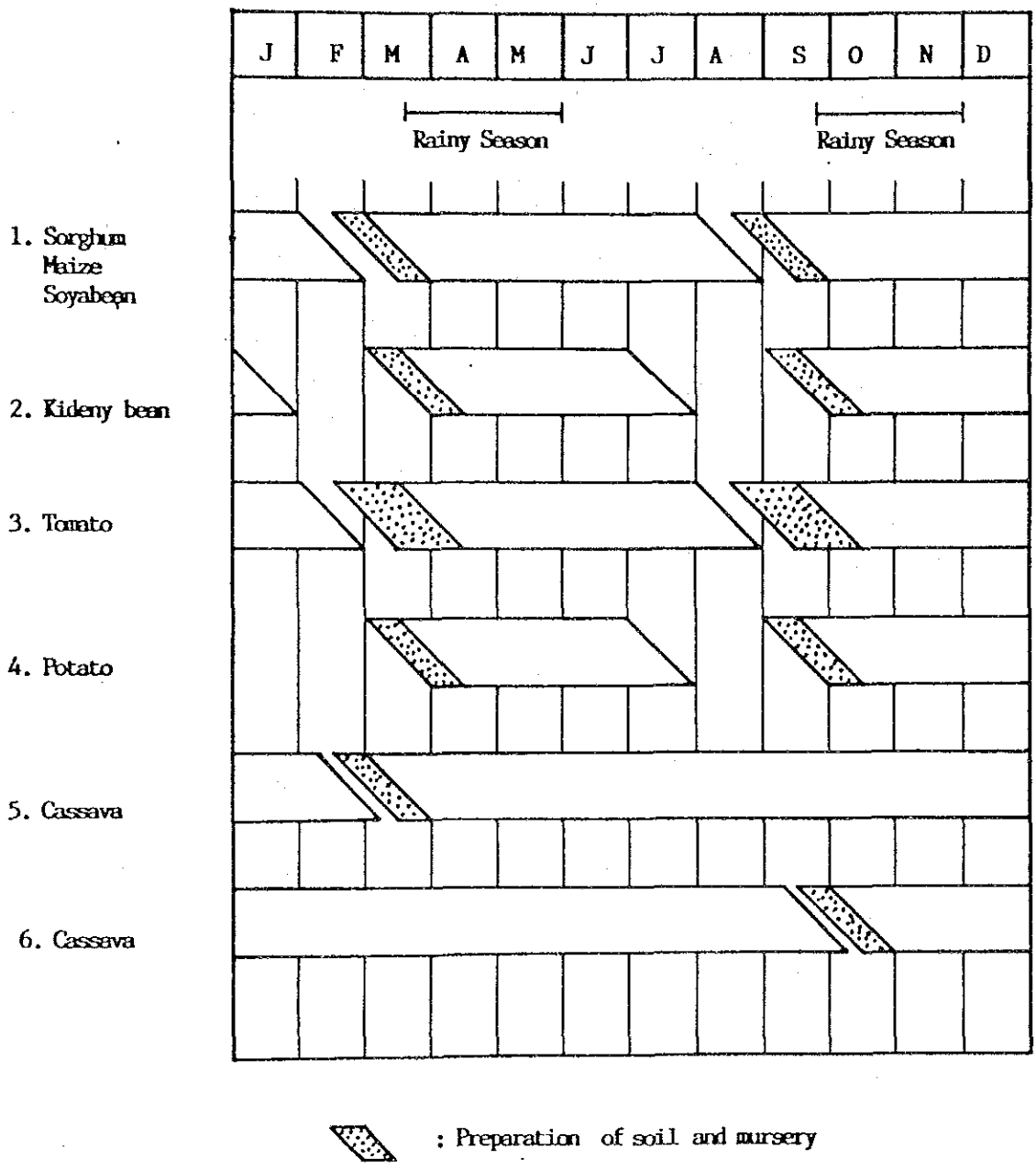


FIG.H.1.1. EXISTING CROPPING PATTERN

H.2 POSSIBILITY OF AGRICULTURAL DEVELOPMENT

Most of arable land for crop cultivation has been developed in the Department. The crop production in the area has been incroached into unsuitable area such as steep slope area with rain-fed cultivation. Therefore, it is impossible to increase crop production by expansion of cultivated area.
The share of agricultural production in 1986 was 78% for coffee, 10% for perennial crops except coffee, 6% for annual crops and 6% for livestock. An agricultural output in the coffee cultivated area which account for 32.5 % of the whole area produce most of agricultural output in the Department. The other agricultural area which account for more than 40% of the whole area produces about 10% of agricultural output. The non coffee cultivated area has high potential to develop, although the productivity in the area is very low in spite of endowing fertile soil. Therefore, development of the area is important for promoting the growth of agricultural sector in the Department.
A great deal of effort has been put into the agricultural development in the Department. Agricultural and livestock development plan and program, the following, have been elaborated.

a) Five Year Diversification Plan 1984-1989 (Coffee Committee)

b) Integrated Rural Development Program (DRI,CRQ)

c) Vegetable and Fruits Production Program Project (Bureau of Agriculture, Government Office of Quindio)

d) Agricultural and Livestock Development Plan 1987-1990 (Regional Agricultural and Livestock Planning Unit, Government Office of Quindio)

These development plan aims at crop diversification, improvement of productivity and promotion of the level of farmer's income in the marginal area for coffee production. In addition, an adequate supervision of farm, extend of improved cultural practices to farmers and establishment of supply systems for production input stress for promotion of crop production in these programs.
In these contexts the following basic concepts should be taken into consideration for agricultural development of the area.

1) Coffee should be cultivated in the only suitable area

through high cultural practices, introduction of improved varieties and soil conservation measures, which should be lead to increase coffee productivity and improve it's quality. Also, the high marketable crops as infer crop should be expanded in the coffee cultivated area, which will promote high level of farmer's income.

2) In the cultivated areas, except for coffee suitable area, with lower productivity, it is necessary to aim at conversion to new agricultural systems by crop diversification through introduction of high marketable crops, improvement of cultural practices and organizing of cooprative for vegetable and fruit producers. The promotion plan for increasing crop production should aim at increase in high income for farmers and contribute to development of agricultural sector in the Department.

H.3 AGRICULTURAL DEVELOPMENT PLAN

H.3.1 COFFEE CULTIVATED AREA

(1) Problem Identification

Problems concerning coffee cultivation in the study area are as below:

1) Traditional varieties are still dominant in the area that is associated with low productivity.

2) There are many small farmers who are faced with the difficulty of planting improved varieties due to the lack of financial resources together with high rate of interest for agricultural credit.

3) Amount of fertilizers applied to coffee farm is less than that recommended by Cafe Comite 1,125kg/ha/year (Table H.3.1). Fertilization to coffee trees is insufficient in the Department that coffee tree are grown relying on natural fertility of soil. The productivity and quality of coffee tree may be deteriorated if sufficient fertilization will not be applied . As shown in Table H.3.2 and Fig. H.3.1, the productivity of coffee increases as more fertilizer and rotten coffee pulp is applied. Fertilizer may be washed down by rain in sloping land. Some coffee farms are weeded with hoe, that may lead to soil erosion, which further may cause reduction of coffee production due to impairment of soil fertility.

4) Coffee cultivation in the Department of Quindio is carried out in the sloping land. The harvesting method recollected in order of full riping coffee fruits need long period. Pest and disease controls need high cost. These factors lead to higher percent of labor cost to total production cost. In the case of small farmers, about 80% of total production cost is labor cost, which in turn mean low amount of agricultural input to coffee field.

(2) Development Plan of Coffee Cultivated Area

In due consideration of problems mentioned above, coffee cultivation is recommended to be made in only suitable areas. It is necessary to improve productivity and quality, and maintain stable production under advanced cultural practices. Also, intercropping in coffee area may guarantee intensification of

land productivity, so more income may be brought to farmers. Improvement proposals of coffee production in the Department of Quindio are as follows:

1) To introduce more improved varieties with high productivity and high resistance to leaf rust in the coffee area, especially in higher land coffee area. Improved varieties should be expanded to enhance productivity and decrease risk from disease.

2) Promotion of intercropping with plantain in the area lower than 1,500m above sea level, and with fruit trees ("lulo" and tree tomato etc.) in the area higher than 1,500m. Mutual cultivation system with tree crops such as "lulo" and tree tomato with short life, and the other tree crops such as apple with long life is more useful as intercropping system in the high land coffee area.
Intercropping system may bring about higher income to farmers and better quality of coffee. Intercrops produce residual materials that is useful as organic manure having an effect on preventing soil erosion in the sloping land. Therefore, appropriate intercrop systems should be extended.

3) To facilitate planting of "guam" as a wind break in the area affected by strong wind, particulary, in those area where an intercropping with plantain is carried out.

4) To apply more agricultural chemicals and fertilizers as well as organic manure such as rotten coffee pulps. Application of organic manure may lead to high labor cost. However, it can be compensated by higher yield and prevention of soil erosion.

5) To conduct training and pruning which may lead to extension of coffee life and stable production, and rising harvesting efficiency.

6) To make step terrace when traditional varieties are substituted by improved varieties. Step terrace is effective for prevention of soil erosion, and may lead to rising working efficiency.

7) To promote intercropping with vegetables and beans in the low land after stumping improved varieties with less vigor of coffee tree, and with beans in the high land.

8) To prepare some tanks so as to store rain in the steep sloping land coffee area. The water stored in the tank could be use when agricultural chemicals are applied, which may lead to work-saving.

H.3.2 COFFEE MARGINAL AREA

(1) Basic Development Concept of Marginal area for Coffee Production

Marginal area for coffee cultivation consists of land with altitude lower than 1,200m above sea level and higher than 1,800m above sea level. In addition to these areas, areas where coffee is not grown well due to influence of micro-meteorology are also included in the marginal area.
To improve agricultural productivity, adequate farm and crop management, improvement of supply services for agricultural input, organization of farmer's cooperative and improvement of marketable conditions are required in these areas.
Crops with high yield and better marketability should be cultivated in these areas. Selection of crops which will be cultivated in each areas should be made taking the following factors into consideration.

- To raise the proportion of self-sufficiency within the Department
- To have resistance to transport
- To call high demand as food and for processing
- To be concentrated as forage for animals
- To be actually cultivated and to be accustomed to farmers, and have margin for raising their productivity by improving cultural practice

In due consideration of matters mentioned above as well as aiming at increasing farmer's income, it is required that crops and their cultivation technique acceptable to farmers should be selected. And, this selection of crops should be terracing account of under the long-term perspective comprising of profitability and acceptability to market. Furthermore, the increase in production of vegetables and fruits depends largely on the consolidation of processing and distribution systems together with national and local

demands.
From these viewpoints, some crops apt to these areas for cultivation are proposed (Table H.3.3 and H.3.4). Morphological characteristics of some crops are shown in Table H.3.5 and H.3.6.

(2) Development Plan of Marginal Area of Coffee Production

Crop cultivated area is extended in the range of 900m-2,500m above sea level in the Department. Areas with different natural conditions (soil, climate and topography) have different crops and cultivation practices. Therefore, development plans are proposed by zone as follows:

1) Zone 2: Intensive Agriculture Area (altitude: 950-1,200m)

The greater portion of lands in the area is used for upland crops (sorghum, soy bean, cassava and sugarcane), coffee and pasture. The area is endowed with fertile soil with high clay content and good topographic condition but comparatively low precipitation and higher temperature.
The area with altitude less than 1,200m above sea level is not suitable for the cultivation of coffee nor plantain because of high temperature and humidity, and poor drainage. Leaf rust is more common in this area. The productivity and quality of coffee and plantain is lower than those of the suitable area. Damage in production caused by disease and insects is more serious for annual crops because of poor cultivation practice due to high price of agricultural inputs and soil management. No an adequate plowing, timely planting date and harvesting is carried out in many field due to insufficiency of number of agricultural machines and high machine rent.
In due consideration of matters mentioned above, the region has high potential of improving crop production by planting some crops (forage crops, oil crops and citrus) adapted to local condition, suitable cultivation methods to topography and improvement of cultural practices. The following improvement measures will be required.

a) Introduction of improved varieties

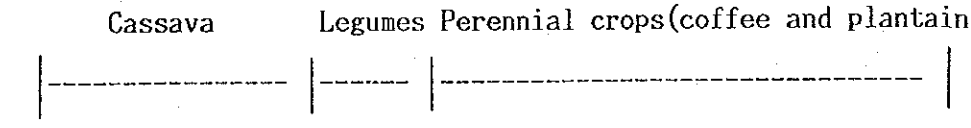
b) An adequate pest-disease control and fertilization (application of chemical fertilizers and organic fertilizers)

c) An adequate soil management (subsoiling once year and an adequate land preparation and plowing)

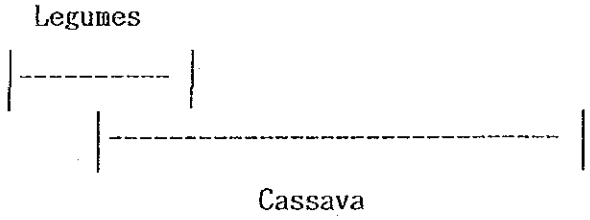
d) Introduction of cultivation methods adapted to topography

e) Establishment of medium agricultural machine systems adapted to topographic conditions

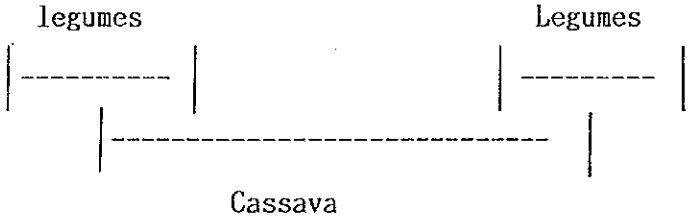
Proposed crops by the degree of slope in this area are shown in Table H.3.7. The following crop rotation of cassava is carried out in the Quindio. Cassava is planted in the cut-over areas of coffee and plantain for two years, and then it is planted in the other areas. The crop rotation of cassava has caused reduction of soil fertility in the land suited for even cultivation of other crops. In the case of the crop rotation of cassava, it estimates to take about six years after harvesting cassava to recover soil fertility.



The following intercropping with cassava and legumes is practiced in many fields.



The following intercropping with cassava and legumes is superior to maintain soil fertility.



This intercropping system is necessary to make wide space

between beds, resulting in reducing yield per hectare for cassava. However, according to results on effect of fertilization on yield of cassava for five years in Malysia (Fig. H.3.2), high yield of cassava was maintained for long time in the same field through an adequate methods of fertilizer application. Therefore, application of chemical and organic fertilizers is effective for maintenance of high yield of cassava in the same field as well as for preventing soil erosion. As mentioned above, development of this region aims at promotion of crop production through high level of cultural practices using medium agricultural machines, and soil improvement such as application of organic fertilizers and subsoiling for improvement of drainage. Agricultural research center that conduct experiments on cultivation of annual crops, fruit trees and plantain will be required for improvement of cultural practices in the region.
To aim at stable production in this area, these products will be processed through preparation of agro-based industries, and these foodstuff at lower price will be supplied to domestic markets.

2) Zone 4: Integrated Farming Area (altitude:1,650-2,000)

The greater portion of lands in this area is used for pasture under extensive husbandary. There are considerable areas with gentle slope. Soil is high fertility. Climate conditions are temperate and much rainfall. This area is most suitable area for planting vegetables that are insufficient in the Quindio, which promises higher productivity of vegetables. The cultivation of vegetables combined with fruit trees and livestock is recommended. The development of this area aims at conversion to new agricultural systems through development of new cultural practices adapted to local conditions, an adequate land improvement and introduction of high marketable crops, which may lead to producing high quality of vegetables and fruits, resulting in high level of income of small farmers in this area. The folloing improvement measures will be required in this area.

a) Land reclamation for preventing surface soil-loss caused by upland field converted from pasture.

b) Introduction of improved varieties adapted to local conditions.

c) Establishment of small-medium agricultural machine systems

d) An adequate pest-disease control and fertilization (application of organic manure)

e) Establishment of crop rotation with gramineous crops for preventing soil-borne diseases and injury by continuous cropping.

Farmers in this area are unaccustomed to intensive agriculture such as cultivation of vegetables. For this purpose, it is necessary to extend cultural practices to farmers, supply agricultural input at lower price to farmers, bring up farmers and agricultural research center should be required for supporting the development in this area, and development of cultural practices adapted to local natural conditions.

Table II.3.1 FERTILIZATION TO COFFEE FIELD AND OTHER CROP FIELD BY COFFEE FARMERS

	TOTAL APLICATION (t)	APLICATION TO COFFEE FIELD (kg/hu)	APLICATION TO OTHER CROP FIELD (kg/ha)
ARMENIA	8,046.3	778	805
BUENAVISTA	657.5	199	308
CALARCA	4,294.9	357	330
CIRCASIA	1,447.2	290	199
CORDOBA	672.5	155	234
FILANDIA	1,155.0	173	96
GENOVA	1,290.0	170	68
LA TEBAIDA	2,077.5	533	181
MONTENEGRO	2,394.1	259	82
PIJAO	1,445.0	214	101
QUIMBAYA	5,072.4	470	236
SALENTO	—	--	—
TOTAL	28,552.4	327 (average)	240 (average)

Fertilizer : 17-6-18-2, Urea, Kcl and 15-15-15

Other Crop field: Including pasture field

Source: Quindio's coffee growrs Committee 1986

Table H.3.2 EFFECT FERTILIZATION ON COFFEE YIELD

Fertilization g/tree/year	Plant spacing 1,25 x 1,25 m	1,5 x 1,5 m	1,75 x 1,75 m	2,0 x 2,0 m	Average
200	513	480	388	312	423
400	573	539	464	336	478
600	565	537	504	392	500
800	621	596	440	392	512
Average	568	538	450	538	

Remark : Yield ; Average three harvesting from 1972 - 1974 , unit; arrobas = 12,5 kg.
Variety; caturra
Source; PARAGUAYCITO Agricultural Institute

Table H.3.3 CROPS CULTIVATED AND OF CULTIVABLE POSSIBILITY IN THE COFFEE MARGINAL REGIONS (1)

Crops	Low land region	High land region
Leaf and fruit vegetables		
	Tomato	Cabbage
	Pimenton	Cerely
		Asparagus
		Welsh onion
Root and tuber crops		
	Cassava	Potato
	Onion	Garlic
		Carrot
Cereals and legumes		
	Maize	Maize
	Sorghum	Kidney bean
	Rice	Pea
	Soybean	
	Kidney bean	
	Snap bean	
	Groundnut	

Table H.3.4 CROPS CULTIVATED AND OF CULTIVABLE POSSIBILITY IN THE COFFEE MARGINAL REGIONS (2)

Crops	Low land region	High land region
Fruit trees		
	Citrus	Black berry
	Passion fruit	Lulo
	Cacao	Tree tomato
	Papaya	Pear
	Pineapple	apple
		curuba
Non food crops and oil crops		
	Sunflower	
	Sugarcane	

Table H.3.5 MORPHOLOGICAL CHARACTERISTICS OF PROPOSED ANNUAL AND SEMI - PERENNIAL CROPS

Crops Common name	Planting method	Plant hight	Maturity (days)	Expected Yield (t/ha)
Leaf and fruit vegetables				
Tomato	transplanted	short	85 - 90	52
Pimenton	transplanted	short	75 - 130	40
Cabbage	transplanted	short	80 - 120	45
Cerely	transplanted	short	100 - 130	40
Asparagus	transplanted	short	about 360	5
Welsh onion	hill	short	100 - 120	20 - 38
oqion	transplanted	short	130 - 140	30
Garlic	hill	short	145 - 180	7
Root and tuber crops				
Cassava	cuttings	medium	330 - 360	25
Potato	seed pieces cuttings	short	130 - 150	19
Carrot	hill	short	120 - 150	26
Cereals and legumes				
Maize	hill	medium	110 - 130 (low land)	6
			140 - 160 (high land)	3
Sorghum	drill	short or medium	90 - 110	4
Rice	transplanted	short	110 - 140	4.5
Kidney bean	hill	short or creeping	90 - 120 (low land)	2.5
			150 - 160 (high land)	2.5
Soy bean	drill	short	100 - 130	2.5
Snap bean	hill	creeping	55 - 75	24
Pea	hill	creeping	45 - 60	5
Ground nut	hill	short	100 - 130	1.8
Oil crop				
Sunflower	hill	medium	100 - 130	1.8

Plant hight : short 130 cm, medium 130 - 200 cm

Source : Hortalizas (ICA), Almanaque Creditario (1987), World vegetables (1983).

Table H.3.6 MORPHOLOGICAL CHARACTERISTICS OF PROPOSED FRUIT TREES

Crop	Planting to first harvest (gr)	Length of productive life	Spacing of Planting (m)	Punk production Age (gr)	Punk production Yield (t/ha)
Citrus	3 - 4	long	6 x 6	8 - 10	45 - 50
Passion fruit	1 - 2	short	3 x 3	2 - 3	15 - 18
Cacao	4 - 5	long	4 x 2.5	8 - 10	1
Papaya	1	short	3 x 3	3 - 4	40 - 60
Black berry	1 - 2	short	2 x 2	3 - 4	14 - 16
Lulo	1 - 2	short	2 x 2	3 - 4	10 - 15
Tree Tomato	1 - 2	short	2 x 2	3 - 4	15 - 20
Pear	2 - 3	long	5 x 5	10 - 20	13 - 15
Apple	2 - 3	long	8 x 8	10 - 20	15 - 20
Curuba	1 - 2	short	2.5 x 5	4 - 5	5
Pineapple	1.5	short	35 x 45 x 90	1.5	60 - 80

Length of productive life: short 5 years, medium 5-15 years, long 15 years

Source : Manual practico de frutales, fruticultura tropical.

Table H. 3.7 Proposed crops and topography

Hilly-land region around La Tebaida		Hilly-land region around Sanfoae	
Slope (%)	Proposed crops	Slope (%)	Proposed crops
0 - 5	Leaf and fruit vegetables Root and tuber crops Cereals and legumes	0 - 10	Cereals and legumes Root and tuber crops Non food and oil crops
5 - 15	Fruit trees Legumes Vegetables	10 - 30	Fruit trees Legumes Grasses
15 - 30	Fruit trees Grasses		

Remark; The soil in hilly-land region around Sanfose has high clay content.

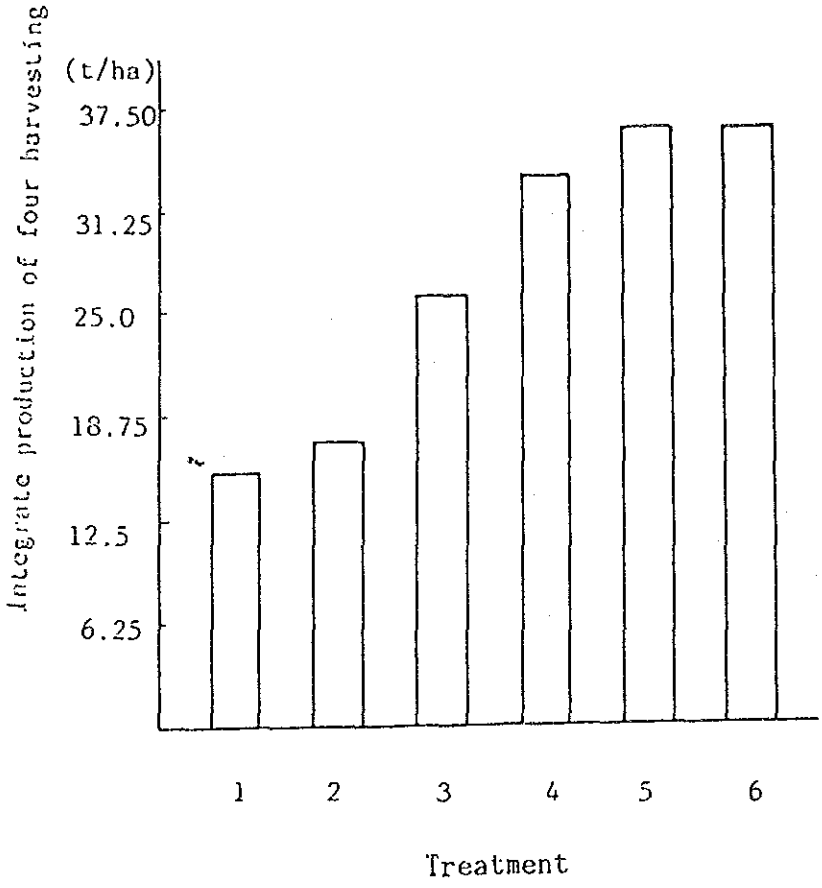


Fig. H. 3.1 Effect application of coffee pulp on yield

Treatment

1. No application of rotted pulps and fertilizers.
2. Application of rotted pulps (6Kg) in the planting hole at planting.
3. Trt.2 + application of rotted pulps (6kg/tree/year) on the surface soil.
4. Trt2 + application of rotted pulps (12kg/tree/year) on the surface soil.
5. Trt.2 + application of fertilizer (600g/tree/year) on the surface soil.
6. Application of fertilizer (600g/tree/year)

Source: AVANCES TECNICOS CENICAFE (No. 11)

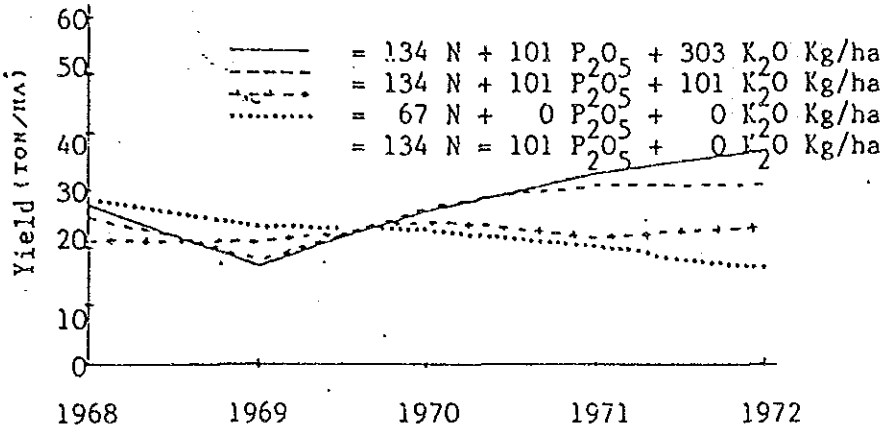


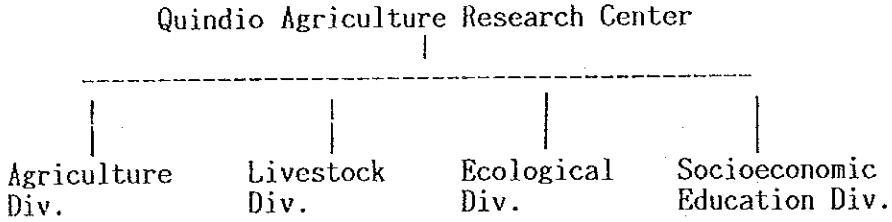
Fig. H. 3.2 Effect of different fertilization on Cassava yield in Malasia (1968 - 1972)

Source: FAO report 1985

H.4 PROPOSED DEVELOPMENT PLAN

H.4.1 AGRICULTURAL RESEARCH CENTER

The establishment of an agriculture research center is proposed in view of relaxing various constrains that the agricultural sector in Quindio confronts, and promoting the development of the Quindian agriculture. The Center is also expected to contribute to smooth implementation of related programs proposed in the Master Plan Study. The organization of the Center is proposed as follows:



The Center designed to as given below:

1) Headquarters

Location:	Outskirts of Armenia
Area:	10 ha
Main Buildings:	Administration Office, Meeting Hall, Training Hall, Research Unit, Laboratory, Auditorium, Dormitory, Warehouse, Parking Lot
Equipments:	Irrigation Equipments (pumps, sprinkler, etc.) Various Gagging, Investigation and Test Equipment (climate, soil, livestock and ecology, etc.) Processing (computer,etc.) Administration and Office supply (vehicle, copy machine, stationery)

2) Branch

a) La Tebaida Experimental Branch Farm

Main Duty: Irrigation Trial of Coffee, Vegetables and Forage Crop

b) Circasia Experimental Branch Farm

Main Duty: Cropping Pattern and Weed and Pest-disease Control Trials Introduction Trails of New Variety and Crop

c) Cordoba Experimental Branch Farm

Main Duty: Trails of Inter and Mixed Croping System with Coffee

d) Salento Experimental Branch Farm on Livestock
(refer to Annex I)

e) Filandia Experimental Branch Farm on Livestock
(refer to Annex I)

These branches will also be played the role of demonstration farm. Section and main research item are as follows:

1) Agriculture Division

a) Breading Section

Introduction of New Variety and Crop

b) Soil and Fertilizer Section

Soil Management Trail
Fertilization Trail

c) Pathology and Entomology Section

Disease and Insect Control Trail

d) Agronomy Section

Irrigation Trial for Coffee and Vegetables etc.
Cropping Trial for Inter and Mixed Crop with Coffee and Other Crop
Mechanization Trial for Ploughing, Seedlings, Spraying Chemicals and Harvesting

e) Processing Section

Utilization of Coffee Pulp and Other Agriculture West

Packaging of Fresh Vegetables and Fruits

2) Livestock Division

See Annex I

3) Ecological Division

See Annex G and K

4) Socioeconomic Education Division

Education and Training to Farmers, Extensionist, Holding Various Seminars

In establishment of the Center inter-institution coordination in relation to respective field of service shall be essential, and the integration of facilities together with the centralization of services shall be facilitated as far as possible so that an economical and effective management of the Center could be attained.
The Center will be managed under C.R.Q. and relevant organizations. The technical information to be obtained from the field trials will be promptly transferred to extension services and farmers through seminars and demonstration farms.

H.4.2 AGRICULTURAL DEVELOPMENT PROGRAM

On the basis of development concept in the Master Plan Study, the following five agricultural development programs have been identified.

a) Quindio River Left Margin Agricultural Development Project

b) Quindio River Right Margin Agricultural Development Project

c) San Jose Agricultural Development Project

d) Circasia Agricultural Development Project

e) Genova-Pijao Agricultural Development Project

Existing landuse and proposed landuse by Agricultural Development Area are shown in following Table.

TRANSITION OF LANDUSE IN AGRICULTURAL DEVELOPMENT AREA (UnitF100ha)

		Coffee	Upland Crop	Tree Crop	Pas-ture	For-est	Idle Land	Others	Total
Quindio River (Left Margin Area)	Existing	2.7	3.5	0	4.9	1.8	0.3	1.8	15.0
	2005	0	8.4	2.7	0	0	0	3.9	15.0
	Balance	- 2.7	+ 4.9	+ 2.7	- 4.9	- 1.8	- 0.3	+ 2.1	
Quindio River (Right Margin Area I)	Existing	10.0	6.2	0.7	2.7	1.4	1.0	3.0	25.0
	2005	8.0	8.0	3.0	0	1.4	0	4.6	25.0
	Balance	- 2.0	+ 1.8	+ 2.3	- 2.7	0	- 1.0	+ 1.6	
Quindio River (Right Margin Area II)	Existing	17.2	1.7	0.2	1.9	2.2	0	1.8	25.0
	2005	17.2	1.7	0.2	1.9	2.2	0	1.8	25.0
	Balance	0	0	0	0	0	0	0	
San Jose	Existing	14.0	8.9	0.5	2.4	4.0	0	4.2	34.0
	2005	9.0	8.8	6.8	0	4.0	0	5.4	34.0
	Balance	- 5.0	- 0.1	+ 6.3	- 2.4	0	0	+ 1.2	
Circasia	Existing	0.4	0	0	13.0	1.6	0	1.0	16.0
	2005	0.4	4.0	6.8	0	1.6	0	3.2	16.0
	Balance	0	+ 4.0	+ 6.8	-13.0	0	0	+ 2.2	

Genova-Pijao	Existing	0	0	0	3.7	0	0	0.3	4.0
	2005	0	0.7	2.7	0	0	0	0.6	4.0
	Balance	0	+ 0.7	+ 2.7	- 3.7	0	0	+ 0.3	

Others: Including infrastructure

(1) Quindio River Left Margin Agricultural Development Project

1) Objective

Rectification of disparity between optimum and marginal coffee production areas, diversification of crop production.

2) Existing Situation

Soil in this area is alluvial soil. There are some place with poor drainage. Poor germination and growth of sorghum and soy bean are found in the places with poor drainage. Weed and disease control are not practiced so much. Production of coffee cultivated in this area is low due to diseases (leaf rust and mancha de hirro) caused by high temperature and inappropriate soil condition.

3) Basic Concept for Crop Production

This area is the only flat area in the Department. The development of this area aims at promotion of modern agriculture by using different kind of agricultural machines. Forage crops, legumes and citrus adapted to local natural conditions will be cultivated in this area through land reclamation and improvement of drainage. This area aims at to be model area for agricultural mechanization of crops.

Proposed crops in this area are:

Cereals : maize, sorghum
Legumes : soy bean
Fruit tree : citrus
Other : pineapples

4) Proposed Cropping Pattern

Double cropping will be practiced for forage crops and legumes. Fig. H.4.1 shows proposed cropping pattern in this

area. Citrus will be cultivated in the gentle sloping area with good drainage. Pineapples will be intercroped in the citrus field up to the primary harvest of citrus. The planted area and production at full development is as follows:

Planted Area and Production

	Forage	Citrus	Pineapples
Planted Area(10 ha)	140	27	14
Production(1,000 ton)	5.6	6.8	4.7

More detailed deta shows in Fig. H.4.1.

5) Farming Practices

Points to notice for farming practices of forage crops and legumes are corresponded to that mentioned in Quindio River Right Margin Agricultural Development Project. Some points to notice for farming practices of pineapples are as follows:

a) Old stocks of pineapples will germinate if it is left in the soil. Therefore, it is necessary to destroy old stocks by fire or apply herbicide such as Parcoat.

b) Weed control are need to practice many times at the early stage of pineapples. An adequate land preparation before planting controls appearance of weed and leads to labor saving.

c) Deep plowing may accelerate growth of root.

d) Pineapples has shallow root and its root zone is small around plant. Fertilizer will be applied only around plant.

In consideration of the matters mentioned above, an adequate cultural practices are shown in Table H.4.1.

6) Agricultural Mechanization Plan

Agricultural mechanization of forage crops and citrus is corresponded to working system mentioned in the Right Margin Area. Speed sprayer for disease control of citrus will be introduced in the future. Agricultural machines(attachments)

for pineapples are disc harrow, tooth harrow, ridger, compressed air sprayer and portable power sprayer will be introduced.

(2) Quindio River Right Margin Agricultural Development Project

1) Objective

Development of marginal coffee production area, diversification of crop production and intensification of coffee production per unit of land.

2) Existing Situation

Citrus are cultivated in the garden of farmhouse and along a road under low techniques, which lead to lower productivity and quality. The seeds of annual crops such as sorghum and soy bean are not uniform and adaptable to local natural conditions. Weed and disease controls are poor. Working system by agricultural machine has been not established, which has been caused to miss timely planting and harvesting date. Cassava is cultivated under low fertilization, which lead to reduction of soil fertility. About 80 % of coffee cultivated in this area is improved varieties and the other traditional varieties that is unshaded coffee tree with 6-7 age.

3) Basic Concept for Crop Production

Climate conditions in this area are suitable for cultivation of annual crops and fruit trees. Fruit trees in the area are suitable for cultivation of annual crops and fruit trees. Fruit trees in the area are cultivated under low techniques, which lead to lower yield and quality. Some of soy bean and sorghum field are appeared pest and disease damages due to poor pest-disease control. Therefore, by more introduction of citrus with high demand as food and processing, and tomato used as processing, and other crops, development in this area aim at gaining products with high quality, and high production through intensive cultivation with high techniques. To aim at stable production in this area, these products will be processed through preparation of agro-based industries, and these foodstuff need to be exported to other markets.

Proposed crops in this area are:

Leaf and fruit vegetables :	tomato,pimenton
Root and tuber crops :	cassava,onion
Cereals and legumes :	maize,sorghum,soy bean, *kidney bean,snap bean, ground nut*

Fruit trees : citrus,passion fruit

Cultivation methods of proposed crop by the degree of slope in the area are as follows:

0-5%: Cultivation of vegetable crops and grain crops by medium-small tractor.

5-15%: Citrus or passion fruit will be cultivated. Legumes or vegetable crops will be planted as intercrops with citrus and passion fruit. Intercropping methods with citrus and passion fruit. Intercropping methods with citrus are : legumes-tomato-legumes or legumes-pimenton-legumes. Legumes will be cultivated as intercrop with passion fruit up to primary harvesting of passion fruit.

15-30%: Cultivation of citrus and passion fruit in grass land

4) Proposed Cropping Pattern

The average annual rainfall is approximately 1,900mm, and mean temperature about 22 C. There is no seasonal changes of temperature in this area. There are two rainy seasons (April-May and October-November). Annual crops are enable to plant at any seasons but should be planted before rainy seasons. The following three years-crop rotation will be proposed in consideration of soil-borne disease and land preparation.

```
Legumes---Vegetables-  |
                       |---Cassava---Legumes---Gramineous Crop
Vegetables---Legumes-  |
```

Ground nut and kidney bean, as intercrop, will be planted between cassava. Fig. H.4.2 shows proposed cropping pattern in this area. About 50% of area where citrus will be planted in a future is in sloping area less than 15% slope. Vegetables and legumes will intercroped with citrus in the area for two years up to primary harvest of citrus. The planted area and production at full development is as follows:

Planted Area and Production
(I)

	Coffee	Plantain	Cassava	Forage
Planted Area(10ha)	80	80	20	80
Production(1,000 ton)	1.5	11.2	6.0	3.2

Beans	Tomato	Vegetables	Citrus
40	7	13	30
1.9	3.6	4.5	7.6

(II)

	Coffee
Planted Area(10 ha)	172
Production(1,000 ton)	3.1

5) Farming Practice

Cultural practices are based on practices decided by agricultural research institutes of Colombia. Some points to notice for farming practices in the area are as follows:

a) Introduction of improved varieties with high yield and high resistance to diseases.

b) Land ploughing are practiced with disc harrow(one-two times). And then, land preparation is practices with tooth harrow(two-times) after removal of residual roots with it. In the vegetable field, beds are made with ridger. Deep plowing is practiced with subsoiler once a year.

c) Sorghum, soy bean are planted with drill seeder. Fertilizers and line are supplied with line sower.

d) Disease and weed control in the vegetable field are prac-

ticed with compressed air sprayer and disease-control of citrus with portable power sprayer.

e) Sorghum and soy bean are harvested with combine and the other crops by hand. Residual plants after harvesting are used as organic manure.

f) An adequate fertilization should be carried out. Organic manure should be supplied for improvement of soil fertility.

g) For cultivation of vegetables, it is necessary to apply a lot of chemical and organic fertilizers, resulting in causing soil acidity. Vegetable crop field may be in danger of appearance of soil-borne diseases in the future. When damages by soil-borne diseases will be serious, it will be necessary to disinfect soil chemically.

h) For cultivation of citrus, it is very important to control diseases and pests which limit production. For efficient disease and pest control, it is necessary to understand the nature and cause of disease, and the most of defective control measures. Moreover, for management of citrus, training and pruning are important for keeping balance of vegetative growth and flowering-fruiting, and maintaining life of tree long, and for raising efficiency of harvest and agricultural chemicals application. To establish an orchard, it is important to prevent soil erosion through covercropping, making drainage canal along the contour and making terraces. Injuries must be avoided during collection of citrus.

i) When application of fertilizers in the coffee field, fertilizers applied are covered with soil for reduction of fertilizer-loss in the sloping land area. More plantain as intercrop with coffee should be introduced.

In consideration of matters mentioned above, an adequate cultural practices are shown in Table H.4.2.

6) Agricultural Mechanization Plan

Land plowing and preparation in this area is easy because soil distributed in this area is volcanic ash soil. Working system by medium agricultural machines is advisable in the sloping land area such as this region. Intensive use of limited arable land, high efficiency of farmworking and settlement of crop

season through using medium agricultural machines should be promoted. With this in view, in consideration of cropping pattern and cultural practices in this area, working capacity of some proposed agricultural machines (attachments) are shown in Table H.4.3. Medium type tractors of 45-50Hp are proposed for the area.

(3) San Jose Agricultural Development Project

1) Objective

Development of marginal area for coffee production and diversification of crop production should be targeted. For attaining this goal, irrigation system and road network will be adequately provided and formation of farmer's cooperative will be encouraged.

2) Existing Situation

Cultivation of coffee and plantain in the area at lower than 1,200m above the sea level and at higher than 21.5 C besides is not suitable because of high temperature. More leaf rust is found in the coffee area in the region. Average yield of traditional varieties of about 850-1,000kg/ha, and unshaded improved varieties about 1,800-2,500kg/ha. In the suitable area for coffee in the Montenegro, average yield of improved varieties with about 30% of shade is about 1,800-2,500kg/ha. Plantain also give lower average yield in the area because of high temperature. Annual crops such as sorghum, soy bean and etc. have lots of diseases because of lower standard with cultural practices. Poor growth of annual crops and sugarcane are found in some places with poor drainage because clay content soil in this area .

3) Basic Concept for Crop production

By introduction of crops adapted this environment and selection of crops in correspondence to livestock promotion, development in this area will be aim at promotion of crop production through high level of cultural practices using medium agricultural machines, and improvement of soil such as application of organic fertilizers and subsoiling for improvement of drainage. Proposed crops in this area are as follows:

Tuber crop:	cassava
Cereals and legumes:	maize, sorghum, soy bean, kidney bean, snap bean, ground nut
Fruit trees:	cacao, papaya
Non food and oil crops:	sunflowers, sugarcane

In the consideration of soil characteristics and topography, cultivation methods of proposed crops by the degree of slope are shown in Table H.4.4.

4) Proposed Cropping Pattern

Fig. H.4.4 shows cropping patterns of annual crop and cassava. Papaya will be planted in the area with gentle slope, and ground nut will be cultivated between papayas as intercrop during the early stage of papaya. Cacao will be cultivated with gamo or negal as shade crop in steep slope land area. The planted area and production at full development is as follows:

Planted Area and Production

	Coffee	Cassava	Forage	Beans	Cacao	Papaya	Sugarcane
Planted Area(10ha)	90.0	24.5	70.0	92.0	54.0	13.5	28.0
Production(1,000ton)	1.6	7.4	2.8	1.0	0.3	4.5	2.8

5) Farming Practice

Ploughing by medium tractor can be practiced because clay content of soil is higher. However, it is necessary to plough subsoil by using sub soiler once two-tree years for improvement of drainage and for preventing soil-loss of surface soil. Improvement of application techniques of agricultural chemicals and timing of applications are important for high productivity.
Some problems for cultivation of sugarcane in the area may be poor soil managements, poor disease control and etc. High production of sugarcane will be expected through improvement of the following measures:

a) Improvement of soil characteristics by mixture with surface soil and subsoil through ploughing subsoil by using subsoiler.

b) More application of organic fertilizers

c) Improvement of disease control

(4) Circasia Agricultural Development Project

1) Objective

This program aims to diversify crop production and upgrade small farmers who are concentrated on hill lands located around the urban area of Circasia.
Mixed farm management consists of vegetables-fruits production and swine farming is envisaged by forming a cooperative. For intensifying the farm management, an irrigation system will be introduced and roads within the area will be improved. The level of income of farmers will be promoted by improvement of productivity and stable agricultural productions.

2) Existing Situation

According to present landuse, most of this area is pasture. There are a considerable areas with gentle slope. Soil is high fertility. Climate conditions in this area are temperate and much rainfall.

3) Basic Concept for Crop Production

This area is most suitable area for cultivation of vegetables in the Quindio. High quality's vegetables would be produced through introduction of high marketable vegetables, improvement of cultural practices and an adequate land area will result in high level of income for small farmers in this area. There are many small farmers except for coffee production. Crop production of this area aims at promotion of small farmer's income through integrated farming with vegetable and fruit tree cultivation, and livestock.

Proposed crops in this area are;

Leaf, fruit and root vegetables:	cabbage, welsh onion, potato, carrot
Cereals:	maize
Legumes:	kidney bean, pea
Fruit trees:	lulo, tree tomato, black berry

The average family structure is a family of 4.5 and labor force per a family is 2.5 manpower. Proposed farm size will be about 3ha which is enable to practice by a family. The size of houselot and home garden is 0.3ha.

4) Proposed Cropping Pattern

Vegetables would be planted before rainy seasons. Planting period could be changed in response to marketable conditions. The following two years-crop rotation will be proposed in consideration of soil-borne disease, maintenance of soil fertility, residual fertilizers effect from previous crops and land plowing.

```
        |---Maize---Cabbage
Potato---Pea---|
               |---Carrot---Kidney bean
```

Welsh onion is cultivated in the same field for two years. Cropping pattern of these crops is shown in Fig. H.4.5. Legumes as intercrop will be cultivated in the lulo and tree tomato fields for one year. Proposed cultivated area at full development by family is as follows;

Potato--Pea	0.4ha
Maize--Cabbage	0.2ha
Carrot--Kidney bean	0.2ha
Welsh onion	0.2ha
Lulo	0.6ha
Tree tomato	0.6ha
Black berry	0.5ha
Total	2.7ha

The planted area and production at full development is as follows:

Planted Area and production

	Potato	Forage	Beans	Vegetables	Fruits	Pork	Coffee
Planted Area(10ha)	16	8	24	24	68		4
Production(1,000ton)	3.0	0.5	2.4	6.8	7.2	0.4	0.1

5) Farming Practices

Cultural practices are based on practices decided by agricultural research institutes of Colombia. Some points to notice for cultural practice in this area are as follows;

a) Introduction of improved varieties with high yield and high resistance to diseases. Parda, Partosa and Guantiva var. of potato are adapted to local natural conditions.

b) Contour cropping is proposed due to prevent soil erosion for vegetable cultivation.

c) Disease-control of vegetables will be practiced with boom sprayer and compressed air sprayer, and fruit tree with portable power sprayer.

d) An adequate chemical fertilization should be carried out. Organic manure should be supplied for improvement of soil fertility.

e) For cultivation of vegetables, it is necessary to apply a lot of chemical and organic fertilizers, resulting in causing soil acidity. Application of lime is important to prevent soil acidity. Vegetable crop field may be in danger of appearance of soil-borne diseases in the future. When adamages by soil-borne disease will be serious, it will be necessary to disinfect soil chemically.

f) For cultivation of fruit tree, it is very important to control diseases and pests which limit production. When appearance of nematode will be found in lulo and tree tomato, application of chemicals will be required twice a year.

g) To establish an orchard, it is important to prevent soil erosion through covercropping, making drainage canals along the contour and making terraces.

In consideration of matters mentioned above, an adequate cultural practices are shown in Table H.4.5.

6) Agricultural Mechanization Plan

Land plowing and preparation by agricultural machines in this area is easy because soil distributed in this area is volcanic ash soil. Working systems by medium agricultural machines is advisable in the sloping land area.
Application of agricultural chemicals in the vegetable field will be required many times per year. For promotion of efficiency of framworking in the field with the machines and using machines economically, farmers should use the machines in cooperation. Planting, fertilization and weeding in the orchard would be done by hand, and application of chemicals with small agricultural machines. Working capacity of some agricultural machines(attachments)proposed are shown in table below. Medium type tractors of 30-45Hp are proposed for this area.

Attachment	Standard	Target crops	Operating ha/hrs	Duty/day hrs	Area/day ha
Disc harrow	1.8m	vegetables	0.65	8	5.2
Tooth harrow	3.0m	"	1.35	8	10.8
Ridger	2.4m	"	1.00	8	8.0
Line sower	1.4m	"	0.45	8	3.6
Boom sprayer	14.1m	"	15.00	6	90.0
Compressed air sprayer		vegetable & fruit	0.15	5	0.75
Portable power sprayer			0.3	5	1.5

In consideration of matters mentioned above, the following joint utilization of agricultural machines is proposed.

Number of joint utilization farmers---five farmers

Joint utilization machines----------tractor(one),
disc harrow(one),
tooth harrow(one),
ridger(one),line sower(one)
boom sprayer(one)

Machines owned by each farmer---------compressed air sprayer(two),
portable power sprayer(two)

(5) Genova-Pijao Agricultural Development Project

1) Objective

The area is located on the southern part of the Department which has been under-developed due to the inferior condition of topography. The program is formulated within the mixed farm management proposal composed of tree crops and swine farming. The intensification of farm lands is expected by providing irrigation system, implementing terrace reclamation of a cooperative among farmers will be promoted.

2) Existing Situation

The area characterized steep slope topographic condition. Existing land use is mainly grazing land. Generally, productivity in the area is very low compare with other area in Quindio. Steep slopes as well as inappropriate landuse and soil management cause disaster and rural-urban migration of population, both of which are serious problems.

3) Basic Concept for Crop Production

In view of cool climate and soil conservation, fruits(apple, "lulo", and tree tomato) in large local demand will be mainly introduced for the perishables market and food processing. High quality products are expected by labor-saving as a result of proper farming, pest control, and introduction of small - scale agriculture machines. For animal raising, the pork hog production on a contract basis is envisaged. Vegetables will be cultivated for the sake of domestic consumption of farmers and, if surplus production is expected, for the supply of local market.

Table H.4.1 LABOUR INPUT MATERIAL REQUIREMENT OF SOME CROPS

LABOUR INPUT MATERIAL REQUIREMENT OF PINEAPLE.

Labour (md/ha) / year		0	1	2	3
Land preparation		0	21	0	0
Tracing - planting		0	60	0	0
Replanting		0	10	0	0
Selection of nursery stocks		0	20	0	0
Making - drainages		0	20	0	0
Diseases control		0	10	0	0
Fertilizing		0	40	20	0
Herbicidides app.		0	10	0	0
Weed control		0	20	20	0
Pesticides app.		0	80	30	30
Thinning		0	0	80	0
Maintenance of drainage		0	20	20	20
Harvesting and packaging		0	0	280	120
TOTAL		0	311	450	170
Fumigadora		0.0	0.4	0.0	0.0
Nursery stocks		0	50000	0	0
Herbicides	kgs	0	8	4	0
Fertilizer [$(Nha)_2SO_4$]	kgs	0	1000	0	0
Fertilizer [K_2 So_4]	kgs	0	315	0	0
Micronutrients	kgs	0	120	0	0
Fertilizer (17-6-18-2)	kgs	0	160	1000	500
Pesticides		0	7	5	2
Tools		0	2	2	2
Baggs		0	0	2800	1200
YIELD/ha	TONS	0	0	70	30

Table H.4.2-(1) LABOUR INPUT MATERIAL REQUIREMENT OF SOME CROPS

LABOUR INPUT MATERIAL REQUERIMENT OF TOMATO

Labour	Unit	Requeriment
Land clearing- ploughing furroving	tract.hrs.	6
Nursery	md/ha	30
Transplanting	"	34
Pruning - thinning	"	80
Weeding - covering	"	110
Envarda	"	66
Supporting	"	68
fertilizing	"	50
Diseases control	"	140
Harvesting - wash - packaging	"	234
Fumigadora	unids	0.2
Seed	kgs	0.5
Fertilizing	kgs	1200
Lime	kgs	4000
Organic manure	tons	6
Supports		2700
Wire	rolles	3
String		12
Pesticides		16
Package (box)		182
Tools		3
YIELD/Ha	TONS	52

LABOUR INPUT MATERIAL REQUERIMENT OF ONION

Labour	Unit	Requeriment
Land clearing- ploughing -	tract. hrs.	3
Nursery	md/ha	30
Harroving - furroving	tract.hrs.	3
Transplanting	md/hrs	40
Weeding- covering	"	80
Fertilizing	"	50
Diseases control	"	80
Herbicides app.	"	6
Harvesting- washing- packaging	"	90
Fumigadora	Unids	0.2
Seed	kgs	6
Fertilizer (complete)	kgs	1200
Lime	kgs	4000
Organic manure	Ton	10
Pesticides		8
Herbicides		2
Tools		2
Package (baggs)		510
YIELD/ha	TONS	30

Table H.4.2-(2) LABOUR INPUT MATERIAL REQUIREMENT OF SOME CROPS

LABOUR INPUT MATERIAL REQUERIMENT OF PIMENTON

Labour	Unit	Requeriment
Land clearing- ploughing- furrowing	tract.hrs	6
Nursery	md/ha	30
Transplanting	"	80
Weeding	"	80
Covering	"	24
Fertilizing	"	60
Diseases control	"	80
Harvesting - wash - packaging	"	120
Fumigadora	Unit	0.2
Seed	kgs	1
Fertilizer (complete)	kgs	3000
Lime	kgs	3000
Organic manure	kgs	6000
Packages		145
YIELD/ha/year	TONS	40

LABOUR INPUT MATERIAL REQUERIMENT OF KIDNEY BEAN

Labour	Unit	Requeriment
Land clearing - ploughing - furrowing	Tract.Hrs	6
Planting	"	1
Fertilizing	md/ha	3
Weeding - covering	"	15
Diseases control	"	5
Harvesting - selection - packaging	"	20
Fumigadora	Unit	0.2
Seed	kgs	60
Fertilizer (complete)	kgs	200
Pesticides		4
Tools		2
Package (baggs)		38
YIELD/ha	TONS	2.5

Table H.4.2-(3) LABOUR INPUT MATERIAL REQUIREMENT OF SOME CROPS

LABOUR INPUT MATERIAL REQUERIMENT OF SNAP BEAN

Labour	Unit	Requeriment
Land clearing-ploughing - furrowing	tract. hrs	6
Planting	md/ha	30
Pruning - thinning	"	20
Weeding - covering	"	50
Enverda	"	60
Fertilizing	"	20
Diseases control	"	32
Harvesting - wash - packaging	"	144
Fumigadora	Unid	0.2
Seed	kgs	60
Supports	Unid	2700
Wires	Rolles	3
Strings		12
Pesticides		10
Fertilizer (complete)	kgs	800
Organic manure	tns	12
Tools	Unid	2
Package (baggs)		480
YIELD/ha	TONS	24

LABOUR INPUT MATERIAL REQUERIMENT OF GROUND NUT

Labour	Unit	Requeriment
Ploughing	tractor hrs	3
Horrowing - furrowing	"	5
Shelling	md/ha	2
Planting - fertilizing	"	10
Weeding	"	15
Hilling up	"	2
Pesticides app.	"	6
Picking - houling of pods, cleaning, drying, bagging	"	20
Seed (unshelled)	kgs	80
Fertilizer (14-14-14)	kgs	200
Pesticides		4
Package(bagges)		30
YIELD/ha	kgs	1800

Table H.4.2-(4) LABOUR INPUT MATERIAL REQUIREMENT OF SOME CROPS

LABOUR INPUT MATERIAL REQUERIMENT OF CASSAVA

Labour	Unid	Requeriment
Land clearing -ploughing - furrowing	tract.hrs	6
Planting	md/ha	15
Weeding and covering	"	55
Fertilizing	"	5
Diseases control	"	10
Harvesting - packaging	"	30
Fumigadora	Unit	0.2
Stem cutting		10000
Fertilizer (complete)	kgs	500
Insecticides	lts	2
Strings	rolles	10
Tools	unids	2
Package (baggs)		400
YIELD/ha	TONS	30

LABOUR INPUT MATERIAL REQUERIMENT OF MAIZE

Labour	Unit	Requeriment
Ploughing /harroving	tractor hrs	3
Furrowing	"	3
Planting	"	1
Fertilizing	md/ha	4
Herbicides	tractor hrs	1
Weeding	md/ha	8
Pesticides app.	"	4
Harvesting	"	8
Reaping	"	2
Packaging	"	2
Transportation	"	2
Seed	kgs	30
Fertilizer (complete)	kgs	200
Urea	kgs	200
Pesticides	kgs	2
Herbicides	kgs	2
Package		40
YIELD/ha	TONS	6

Table H.4.2-(5) LABOUR INPUT MATERIAL REQUIREMENT OF SOME CROPS

LABOUR INPUT MATERIAL REQUERIMENT OF SORGHUM

Labour	Unit	Requeriment
Ploughing/ harrowing	tractor hrs	6
Fertilizing	"	1
Land levelling	"	1
Planting	"	1
Diseases and pest control	md/ha	4
Herbicides app.	tractor hrs	1
Harvesting	combine hrs	2.5
Transportation	md/ha	2
Seed	kgs	20
Fertilizer	kgs	350
Pesticides	kgs	3
Herbicides	kgs	2
Packages		44
YIELD/ha	TONS	4

LABOUR INPUT MATERIAL REQUERIMENT OF SOYBEAN

Labour	Unit	Requeriment
Ploughing / harrowing	tractor hrs	6
Land .levelling	"	1
Herbicides app.	"	1
Planting	tractor hrs	1
Fertilizing	"	3
Diseases and pest control	md/ha	10
Herbicides app.	tractor hrs	1
Harvesting	combine hrs	2.5
Transportation	md/ha	2
Seed	kgs	80
Fertilizer	kgs	350
Pesticides	kgs	2
Herbicides	kgs	4
Package		32
YIELD/ha	TONS	2.5

Table H.4.2-(6) LABOUR INPUT MATERIAL REQUIREMENT OF SOME CROPS

LABOUR INPUT MATERIAL REQUERIMENT OF CITRUS

Labour (md/ha) /Year		1	2	3	4	5	6	7	8	9	10
Land preparation		21	0	0	0	0	0	0	0	0	0
Tracing - making hole - planting		15	0	0	0	0	0	0	0	0	0
Weeding		45	45	40	40	40	30	30	30	30	30
Fertilizing		2	4	4	5	5	5	5	5	5	5
Diseases control		10	10	10	10	10	10	10	10	10	10
Pruning		10	4	4	4	4	4	4	4	4	4
Harvesting - selection - packaging		0	0	24	36	60	90	114	135	150	150
TOTAL		103	63	82	95	119	139	163	184	199	199
Fumigadora	unid	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2
Nursery stocks		357	0	0	0	16	0	0	0	0	16
Fertilizer (complete)	kgs	240	470	470	710	710	710	710	710	710	710
Urea	kgs	30	95	180	280	425	425	425	425	425	425
Microelement	kgs	0	50	120	120	140	140	140	140	140	140
Pesticides		2.0	3.0	4.0	4.5	5.0	5.0	5.0	5.0	5.0	5.0
Tools		2	1	1	1	1	1	1	1	1	1
Packaging (box)		0	0	0	35	35	70	35	35	0	0
YIELD/ha	TONS	0	0	8	12	20	30	38	45	50	50

Table H.4.2-(7) LABOUR INPUT MATERIAL REQUIREMENT OF SOME CROPS

LABOUR INPUT MATERIAL REQUIREMENT OF PLANTAIN (1,100 plants)

Labour / Year		0	1	2	3	4	5	6	7	8	9	10
Land preparation	md/ha	0	40	0	0	0	0	0	0	0	0	0
Treatment of nursery stock	md/ha	0	2	0	0	0	0	0	0	0	0	0
Marking hole-planting	md/ha	0	30	0	0	0	0	0	0	0	0	0
Replanting	md/ha	0	2	0	0	0	0	0	0	0	0	0
Weeding	md/ha	0	45	25	20	20	20	20	20	20	20	20
Fertilizing	md/ha	0	7	7	7	7	7	7	7	7	7	7
Pest control	md/ha	0	5	6	6	6	6	6	6	6	6	6
Cutting bunch and stem	md/ha	0	2	15	15	15	15	15	15	15	15	15
Harvesting	md/ha	0	0	30	45	45	45	36	36	36	36	36
TOTAL	md/ha	0	133	83	93	93	93	84	84	84	84	84
Fumigadora	Unit	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nursery stock	Unit	0	1100	0	0	0	0	0	0	0	0	0
Tools	Unit	0	2	2	2	2	2	2	2	2	2	2
Fertilizer (complete)	Kgs	0	300	300	300	300	300	300	300	300	300	300
Urea	Kgs	0	300	300	300	300	300	300	300	300	300	300
Calcium fhosphate	Kgs	0	180	0	0	0	0	0	0	0	0	0
Chemicals for treatment nursery stock	Kgs	0	2	0	0	0	0	0	0	0	0	0
Pesticides	Unit	0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
YIELD/ha	TONS	0	0	21	34.5	34.5	34.5	27.6	27.6	27.6	27.6	27.6

Table H.4.3 PROPOSED AGRICULTURAL MACHINES

Attachments	A Standard	Targer crops	Operationg hectare per hours (ha/hrs)	Hoursof duty per day (hrs)	Operating area per day (ha)
Disc harrow	1.8m	veget-	0.65	8	5.2
Tooth harrow	3m	ables	1.35	8	10.8
Ridger	2.4m	ables	1	8	8
Line sower	1.4m	ables	0.45	8	3.6
Boom sprayer	14.1m	ables	15	6	90
Compressed air Sprayer		veget- able & fruit	0.15	5	0.75
Portabl epower Sprayer			0.3	5	1.5

TABLE H.4.4 PROPOSED CROPS AND TOPOGRAPHY (SAN JOSE)

Slope (%)	Hilly-land region around Sanfose Proposed crops
0 - 10	Cereals and legumes Root and tuber crops Non food and oil crops
10 - 30	Fruit trees Legumes or grasses

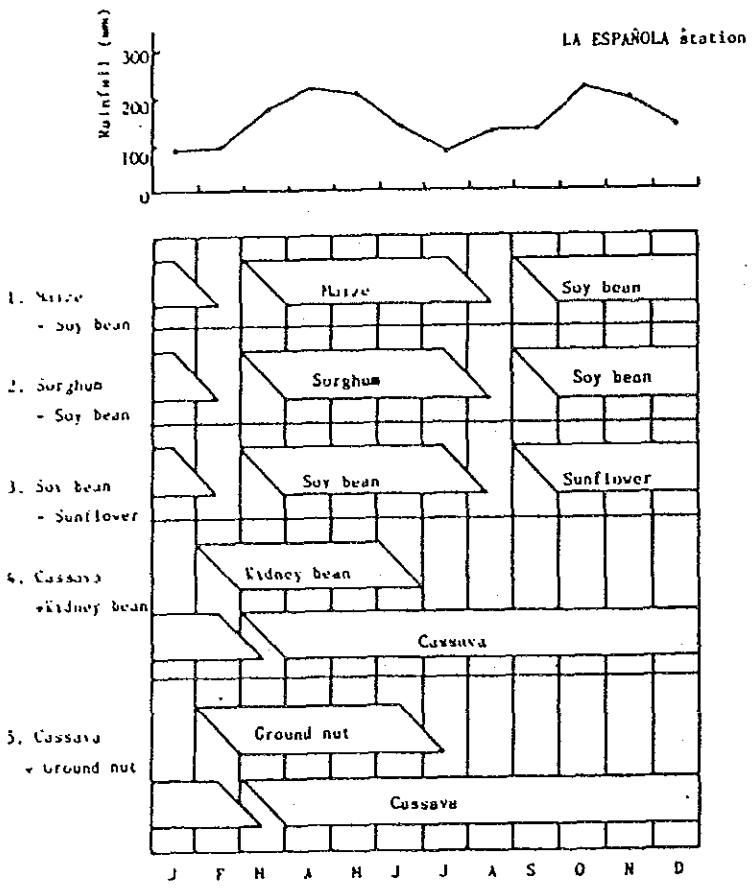


FIG H.4.3 PROPOSED CROPPING PATTERN IN HILLY-LAND REGION AROUND SAN JOSE

Table H.4.5 -(1) LABOUR INPUT MATERIAL REQUIREMENT OF SOME CROPS

LABOUR INPUT MATERIAL REQUERIMENT OF POTATO

Labour	Unit	Requeriment
Land clearing- ploughing - furrowing	tract.hrs	6
Preparation of seed pieces	md/ha	5
Making hole	"	5
Planting	"	16
Weeding - covering	"	32
Organic manure app.	"	16
Fertilizing	"	8
Pesticides app.	"	32
Harvesting - packaging	"	40
	"	
Seed pieces	kgs	625
Organic manure	kgs	15000
Fertilizer (complete)	kgs	1000
Urea	kgs	50
Fungicide	kg.	2.4
Insecticide	lts	2.5
YIELD/ha	TONS	19

LABOUR INPUT MATERIAL REQUERIMENT OF PEA

Labour	Unit	Requeriment
Land clearing- ploughing-furrowing	tract.hrs.	6
Envarada - tying	md/ha	60
Planting	"	40
Weeding - covering	"	60
Fertilizing	"	30
Diseases control	"	32
Harvesting and packaging	"	112
Fumigadora	Unid	0.2
Seed	kgs	160
Fertilizer (complete)	kgs	1000
Lime	kgs	6000
Supports		2700
Wire	rolles	3
String		12
Pesticides		5
Tools		2
Packaging - (baggs)		280
YIELD/ha	TONS	14

able H.4.5 -(2) LABOUR INPUT MATERIAL REQUIREMENT OF SOME CROPS

LABOUR INPUT MATERIAL REQUERIMENT OF CABBAGE

Labour	Unit	Requeriment
Land clearing- ploughing - furrowing	tract.hrs	6
Nursery	md/ha	10
Transplanting	"	20
Replanting	"	3
Fertilizing	"	8
Diseases- pest - control	"	30
Weeding	"	24
Harvesting - packaging	"	30
Transportation	"	3
Seed	kgs	0.5
Fertilizer (complece)	kgs	400
Urea	kgs	120
Organic manure	kgs	2000
Lime	kgs	500
Package (baggs)		500
YIELD/ha	TONS	30

LABOUR INPUT MATERIAL REQUERIMENT OF CARROT

Labour	Unit	Requeriment
Land clearing- ploughing	tract.hrs	3
Furrowing	"	3
Planting	md/ha	10
Fertilizing	"	3
Diseases-pest control	"	5
Weeding	"	30
Harvesting - wash - packaging	"	30
Seed	kgs	5
Fertilizer (complete)	kgs	500
Organic manure	kgs	1000
Pesticides	gal.	2
Package (baggs)		300
YIELD/ha	TONS	26

Table H.4.5 -(3) LABOUR INPUT MATERIAL REQUIREMENT OF SOME CROPS

LABOUR INPUT MATERIAL REQUERIMENT OF WELSH ONION

Labour	Unit	Requeriment year 1	2
Land clearing - ploughing - furrowing	Tract.hrs.	6	0
		20	0
Planting	md/ha	30	0
Organic manure app.	"	20	20
Diseases control	"	10	10
Fertilizing	"	10	10
Weeding - covering	"	50	50
Harvesting - selecion - packaging	"	30	57
Seed	kgs	5500	0
Fertilizer (complete)	kgs	500	500
Organic manure	ton	10	10
Pesticides		5	5
Tools		2	2
Package (baggs)		360	684
YIELD/ha	TONS	20	38

LABOUR INPUT MATERIAL REQUIREMENT OF LULO

Labour (md/ha) /Year		1	2	3	4
Land preparation		21	0	0	0
Making hole - planting		33	0	0	0
Fertilizing		20	20	20	20
Weed controling		60	30	30	30
Diseases control		15	20	20	20
Pruning and other		10	15	15	15
Harvesting - selection - packaging		0	90	135	68
TOTAL		159	175	220	153
Fumigadora		0.4	0.0	0.0	0
Nursery stocks		2500	0	0	0
Fertilizer (complete)	kgs	2000	2000	2000	2000
Fertilizer (Ca+Mg)	kgs	1000	0	1000	0
Pesticides		4	4	4	4
Nematicides	kgs	160	160	160	160
Tools		2	2	2	2
Packaging (box)		0	185	95	0
YIELD/ha	TONS	0	10	15	8

Table H.4.5-(4) LABOUR INPUT MATERIAL REQUIREMENT OF SOME CROPS

LABOUR INPUT MATERIAL REQUIREMENT OF TREE TOMATO

Labour (md/ha) /year		1	2	3	4
Land preparation		21	0	0	0
Making hole - planting		25	0	0	0
Fertilizing		15	12	12	12
Weed control		60	30	30	30
Diseases control		10	15	15	15
Pruning and other		8	10	10	10
Harvesting- selection - packaging		0	60	80	60
TOTAL		139	127	147	127
Fumigadora	1	0.4	0.0	0.0	0
Nursery stocks		1100	0	0	0
Fertilizer (complete)	kgs	825	990	990	990
Fertilizer (Ca+Mg)	kgs	1000	0	1000	0
Microelement	kgs	55	55	55	55
Nematicides (Furadan)	kgs	90	90	90	90
Tools		2	2	2	2
Package (box)		52	18	0	0
YIELD/ha	TONS	0	15	20	15

LABOUR INPUT MATERIAL REQUIREMENT OF BLACK BERRY

Labour (md/ha) / year		1	2	3	4
Land preparation		20	0	0	0
Tracing - making hole-planting		45	0	0	0
Weeding		45	45	45	45
Fertilizing		6	6	6	6
Pruning		15	20	20	20
Supporting		55	5	5	5
Diseases control		2	4	4	4
Harvesting and packaging		0	224	256	224
TOTAL		188	304	336	304
Fumigador		0.4	0.0	0.0	0.0
Nursery stocks		2400	0	0	0
Supports (2.5m)		1700	0	0	0
Wire (No.14)	kgs	60	0	0	0
Nails	kgs	15	0	0	0
Fertilizer (complete)	kgs	2400	2400	2400	2400
Micronutrients	kgs	1200	1200	1200	1200
Insecticides	lts	10	10	10	10
Fungicides	kgs	15	15	15	15
Baggs	kgs	0	40	40	40
Tools		2	2	2	2
Package (box)		0	190	200	0
YIELD/HA	TONS	0	14	16	14

Table H.4.6 Propsed crops and topography

Slope (%)	Hilly-land region around Circasia
	Proposed crops
0 - 5	Leaf and fruit vegetables Legumes Root crops
5 - 15	Fruit trees Legumes Vegetables
15 - 30	Fruit trees Grasses

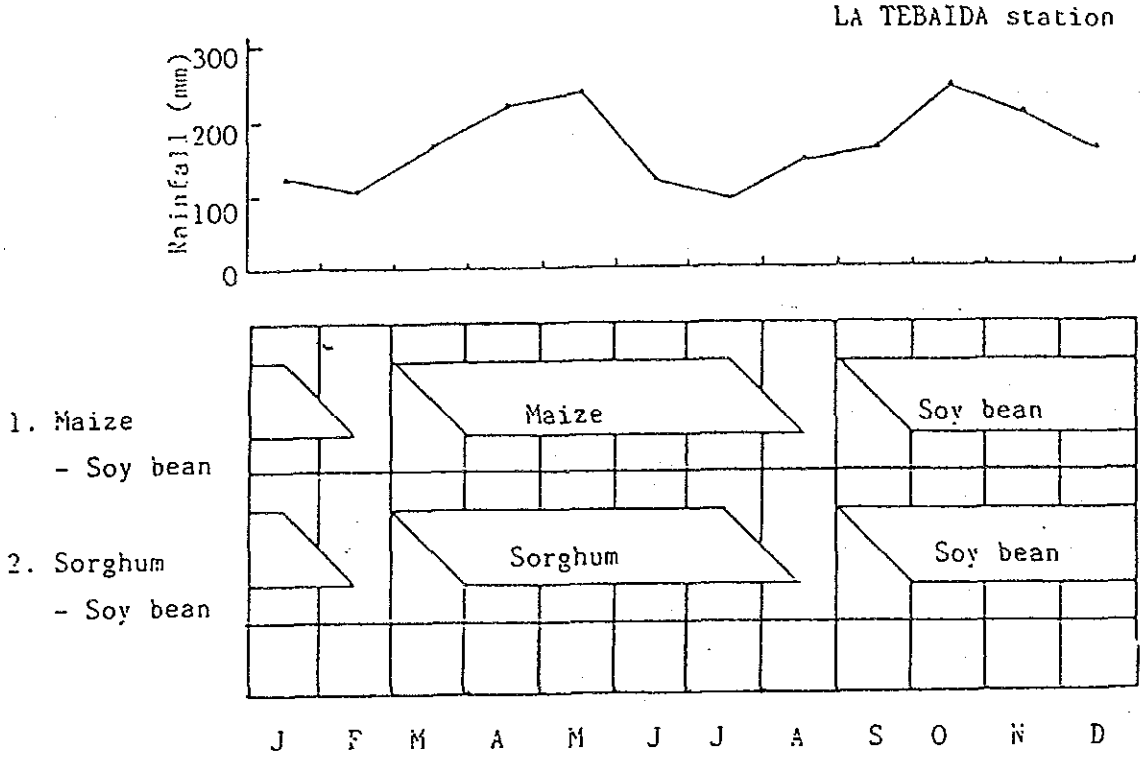


Fig. H.4.1 Proposed cropping pattern in Quindio river region

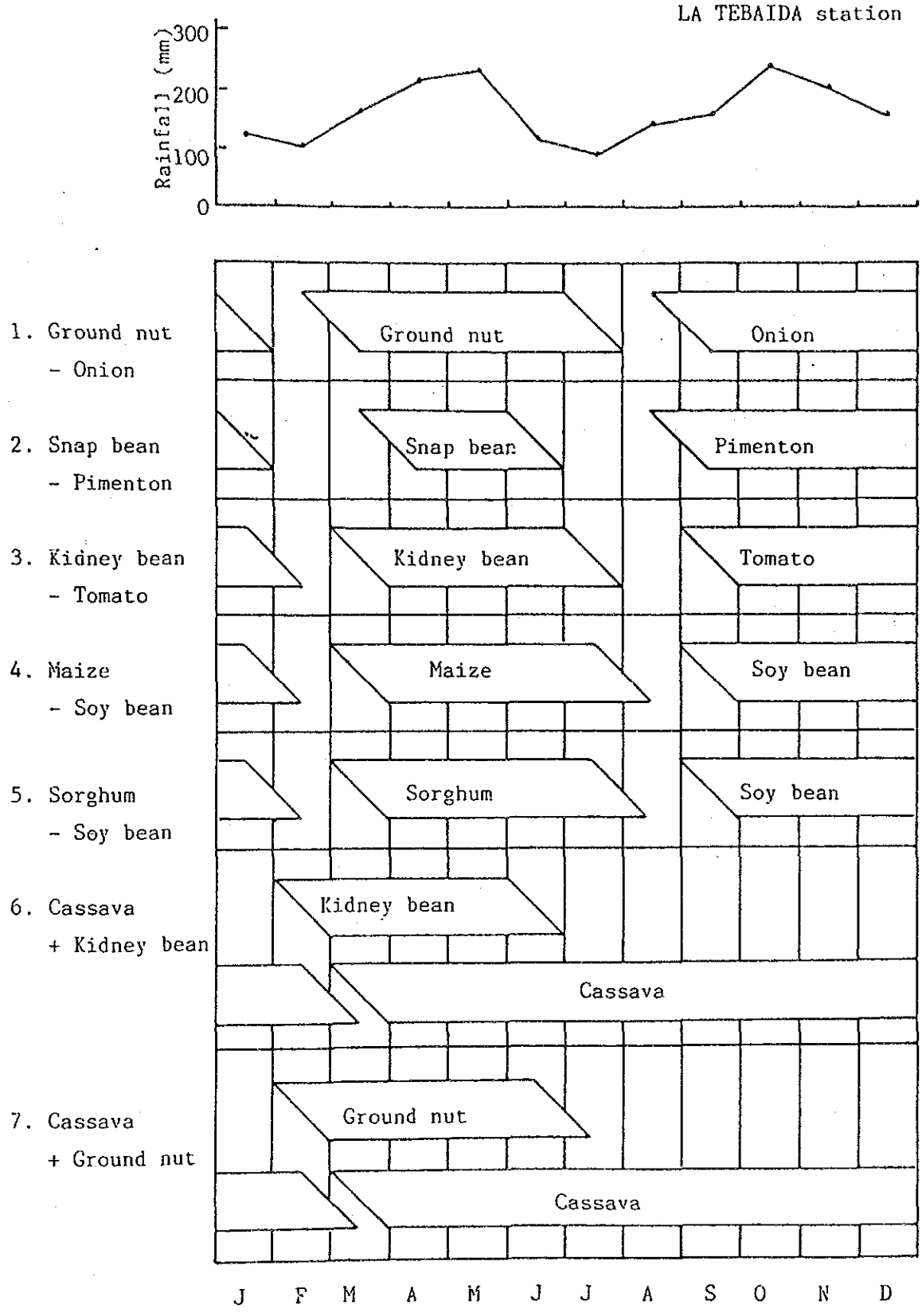


Fig. H.4.2 Proposed cropping pattern in the hilly-land region around La Tebaida

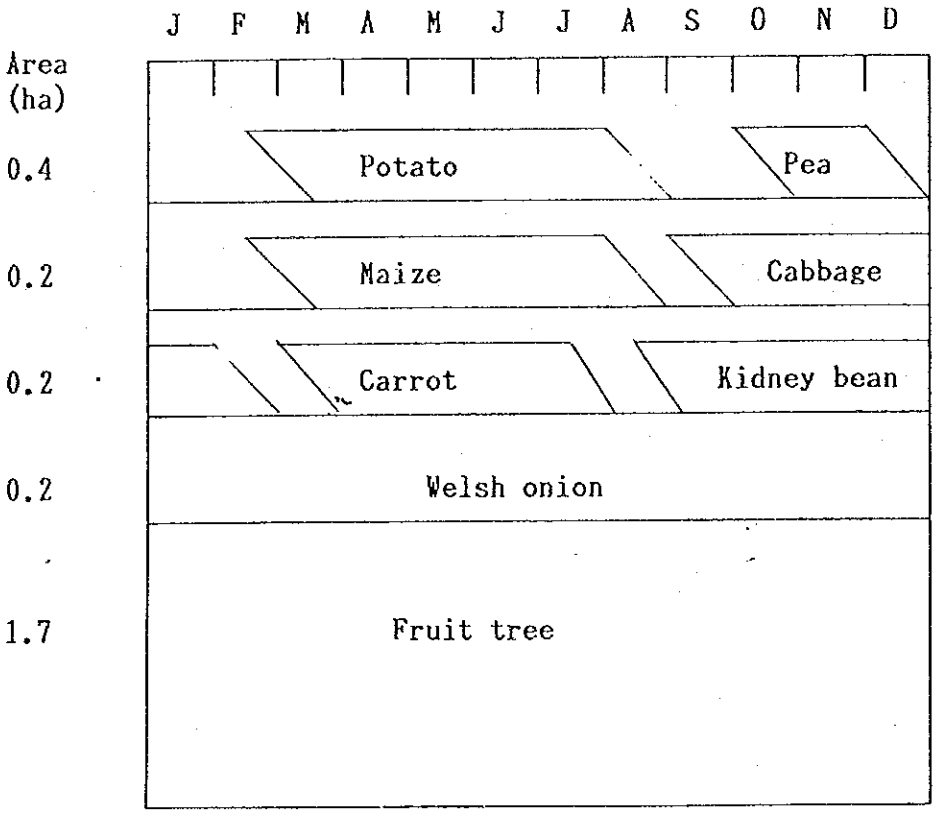


Fig. H.4.4 CROPPING PATTERN

H. 5 SUPPORTING INFORMATION

Future Crop Production (Quindio River Right Margin Area)

Crops	Cultivation area (ha/year)	Year 1 Yield (t/ha/year)	Year 1 Prod. (t/year)	Year 2 Yield (t/ha/year)	Year 2 Prod. (t/year)	Year 3 Yield (t/ha/year)	Year 3 Prod. (t/year)	Year 4 Yield (t/ha/year)	Year 4 Prod. (t/year)	Year 5 Yield (t/ha/year)	Year 5 Prod. (t/year)	Year 6 Yield (t/ha/year)	Year 6 Prod. (t/year)	Year 7 Yield (t/ha/year)	Year 7 Prod. (t/year)	Year 8 Yield (t/ha/year)	Year 8 Prod. (t/year)	Year 9 Yield (t/ha/year)	Year 9 Prod. (t/year)
Tomato	70	36	2,520	47	3,200	52	3,640	52	3,640	52	3,640	52	3,640	52	3,640	52	3,640	52	3,640
Onion	70	21	1,470	27	1,890	30	2,100	30	2,100	30	2,100	30	2,100	30	2,100	30	2,100	30	2,100
Pimenton	60	28	1,680	36	2,160	40	2,400	40	2,400	40	2,400	40	2,400	40	2,400	40	2,400	40	2,400
Kidney bean	70	0.8	56	2.5	175	2.5	175	2.5	175	2.5	175	2.5	175	2.5	175	2.5	175	2.5	175
Ground Nut	70	1.3	91	1.6	112	1.8	126	1.8	126	1.8	126	1.8	126	1.8	126	1.8	126	1.8	126
Snap bean	60	17	1,020	22	1,320	24	1,440	24	1,440	24	1,440	24	1,440	24	1,440	24	1,440	24	1,440
Cassava	200	23	4,600	30	6,000	30	6,000	30	6,000	30	6,000	30	6,000	30	6,000	30	6,000	30	6,000
Maize	100	2	200	5	500	6	600	6	600	6	600	6	600	6	600	6	600	6	600
Sorghum	100	3	300	4	400	4	400	4	400	4	400	4	400	4	400	4	400	4	400
Soy bean	200	2	400	2.5	500	2.5	500	2.5	500	2.5	500	2.5	500	2.5	500	2.5	500	2.5	500
Coffee	800	1.7	1,360	1.9	1,520	2.5	2,000	2.5	2,000	2.5	2,000	2.5	2,000	2.5	2,000	2.5	2,000	2.5	2,000
Citrus	300	0	0	0	0	8	2,400	12	3,600	20	6,000	30	9,000	38	11,400	45	13,500	50	15,000
Intercrop with cassava																			
Kidney bean	100	0.3	30	0.9	90	1.0	100	1.0	100	1.0	100	1.0	100	1.0	100	1.0	100	1.0	100
Ground nut	100	0.6	60	0.7	70	0.8	80	0.8	80	0.8	80	0.8	80	0.8	80	0.8	80	0.8	80
Intercrop with citrus																			
Kidney bean	300	0.5	150	1.6	480														
Tomato	150	18	2,700	24	3,600														
Pimenton	150	20	3,000	26	3,900														
Intercrop with coffee																			
coffee																			
plantain	800	0	0	11.5	9,200	17.25	13,800	17.25	13,800	17.25	13,800	13.75	11,000	13.75	11,000	13.75	11,000	13.75	11,000

Intercropping systems with citrus are kidney bean - tomato and kidney bean - pimenton for two years.

(1) Crop budget per hectare (Quindio River Right Margin Area)

(Unit : 1,000 Col.$)

Crops	Year 1			2			3		
	Total Production cost	Gross income	Net income	Total Production cost	Gross income	Net income	Total Production cost	Gross income	Net income
Tomato	650	920	270	650	1,201	551	650	1,329	679
Onion	477	609	132	477	783	306	477	870	393
Pimenton	453	868	415	453	1,116	663	453	1,240	787
Kidney bean	74	98	24	74	308	234	74	308	234
Ground nut	68	78	10	68	96	28	68	108	40
Snap bean	462	510	48	462	660	198	462	720	258
Cassava	146	575	429	146	750	604	146	750	604
Maize	48	114	66	48	190	142	48	228	180
Sorghum	46	90	44	46	120	74	46	120	74
Soy bean	45	127	82	45	159	114	45	159	114
Coffee	340	510	170	340	570	230	340	750	410

(2) Crop budget per hectare (Quindio River Right Margin Area)

(Unit : 1,000 Col.$)

Crops	Year									
	1	2	3	4	5	6	7	8	9	10
Citrus										
Total production cost	145	64	84	104	133	139	153	165	174	181
Gross income	0	0	136	204	340	510	646	765	850	850
Net income	-145	-64	52	100	207	371	493	600	767	669
Plantain										
Total production cost	70	38	41	41	41	38	38	38	38	38
Gross income	0	173	259	259	259	207	207	207	207	207
Net income	-70	135	218	218	218	169	169	169	169	169

(3) Crop budget per hectare (Quindío River Right Margin Area)

(Unit : 1,000 Col.$)

Crops	Year 1			Year 2			Year 3		
	Total Production cost	Gross income	Net income	Total Production cost	Gross income	Net income	Total Production cost	Gross income	Net income
Intercrop with Cassana									
Kidney bean	31	34	3	31	111	80	31	123	92
Ground nut	26	36	10	26	42	16	26	48	22
Intercrop with citrus									
Kidney bean	47	62	15	47	197	150	-	-	-
Tomato	332	460	128	332	613	281	-	-	-
Pimenton	331	620	289	331	806	475	-	-	-

Actual crop budget (unit: 1,000 Col.$)

Crop	Cutivation area (ha/year)	Yield (ton/ha)	Gross income	Total production cost	Net income
Citrus	70	15	17,850	9,774	8,076
Sorghum	200	3	17,800	13,301	4,499
Soy bean	200	2	25,400	19,576	5,824
Cassave	170	23	97,750	72,835	24,915
Coffee	940	1.6	451,200	316,335	134,865
Total					178,179

Cost and income analysis (unit: 1,000 Col. $)

Year	Gross income	Total production cost	Net income
1	958,430	652,080	306,350
2	1,367,770	601,780	765,990
3	1,382,350	496,630	885,720
4	1,402,750	502,630	900,120
5	1,443,550	511,330	932,020
6	1,452,950	511,130	941,820
7	1,493,750	515,330	978,420
8	1,529,450	518,930	1,010,520
9	1,554,950	521,630	1,033,320
10	1,554,950	523,730	1,031,220

Future Crop Production (Quindio River Left Margin Area)

Crops	Cultivation area (ha/year)	Year 1 Yield (t/ha/year)	Year 1 Prod. (t/year)	Year 2 Yield (t/ha/year)	Year 2 Prod. (t/year)	Year 3 Yield (t/ha/year)	Year 3 Prod. (t/year)	Year 4 Yield (t/ha/year)	Year 4 Prod. (t/year)	Year 5 Yield (t/ha/year)	Year 5 Prod. (t/year)	Year 6 Yield (t/ha/year)	Year 6 Prod. (t/year)	Year 7 Yield (t/ha/year)	Year 7 Prod. (t/year)	Year 8 Yield (t/ha/year)	Year 8 Prod. (t/year)	Year 9 Yield (t/ha/year)	Year 9 Prod. (t/year)
Maize	525	2	1,050	5	2,625	6	3,150	6	3,150	6	3,150	6	3,150	6	3,150	6	3,150	6	3,150
Sorghum	525	3	1,575	4	2,100	4	2,100	4	2,100	4.5	2,100	4	2,100	4	2,100	4	2,100	4	2,100
Soy bean	1,050	2	2,100	2.5	2,625	2.5	2,625	2.5	2,625	2.5	2,625	2.5	2,625	2.5	2,625	2.5	2,625	2.5	2,625
Citrus	270	0	0	0	0	8	2,160	12	3,240	20	5,400	30	8,100	38	10,260	45	12,150	50	13,500
Pineapple	140	0	0	70	9,800	30	4,200	0	0	70	9,800	30	4,200	0	0	70	9,800	30	4,200
Intercrop with citrus																			
Pineapple	270	37	9,990	16	4,320														

(1) Crop budget per hectare (Quindio River Left Margin Area)

(Unit : 1,000 Col.$)

Crops	Year								
	1			2			3		
	Total Production cost	Gross income	Net income	Total Production cost	Gross income	Net income	Total Production cost	Gross income	Net income
Maize	48	114	66	48	190	142	48	228	180
Sorghum	46	90	44	46	120	74	46	120	74
Soy bean	45	127	82	45	159	114	45	159	114
Pineapple	519	0	-519	547	1,470	923	218	630	412

(2) Crop budget per hectare (Quindio River Left Margin Area)

(Unit : 1,000 Col.$)

Crops	Year									
	1	2	3	4	5	6	7	8	9	10
Citrus										
Total production cost	145	64	84	104	133	139	153	165	174	181
Gross income	0	0	136	204	340	510	646	765	850	850
Net income	-145	-64	52	100	207	371	493	600	767	669

(3) Crop budget per hectare (Quindio River Left Margin Area)

(Unit : 1,000 Col.$)

Crops	Year 1			Year 2			Year 3		
	Total Production cost	Gross income	Net income	Total Production cost	Gross income	Net income	Total Production cost	Gross income	Net income
Intercrop with citrus									
Pineapple	276	0	-276	289	777	488	116	336	220

Actual crop budget (unit: 1,000 Col.$)

Crop	Cutivation area (ha/year)	Yield (ton/ha)	Gross income	Total production cost	Net income
Sorghum	525	3	46,725	34,915	11,810
Soy bean	525	2	66,675	51,387	15,228
Coffee	288	1.2	103,680	96,919	6,761
Total					33,799

Cost and income analysis (unit: 1,000 Col.$)

Year	Gross income	Total prodution cost	Net income
1	240,450	169,260	71,190
2	535,500	286,850	248,650
3	458,820	222,430	236,390
4	477,090	223,200	253,890
5	610,530	201,260	409,270
6	529,650	163,030	366,620
7	487,350	206,730	280,620
8	729,870	214,490	515,380
9	644,400	171,670	472,730
10	579,250	216,180	362,970

Future crop production of one model farm (Circasia Area)

Crops	cultivation area (ha/year)	Year 1 Yield (t/ha/year)	1 Prod. (t/year)	2 Yield (t/ha/year)	2 Prod. (t/year)	3 Yield (t/ha/year)	3 Prod. (t/year)	4 Yield (t/ha/year)	4 Prod. (t/year)
Potato	0.4	13.3	5.3	17.1	6.8	19	7.6	19	7.6
Pea	0.4	9.8	4	12.6	5	14	5.6	14	5.6
Cabbaye	0.2	21	4.2	27	5.4	30	6	30	6
Carrot	0.2	18.2	3.6	23.4	4.7	26	5.2	26	5.2
Kidney bean	0.2	0.8	0.2	2.5	0.5	2.5	0.5	2.5	0.5
Maize	0.2	2	0.4	5	1	20	1.2	6	1.2
Welsh onion	0.2	14	2.8	26.6	5.3		4	38	4
Lulo	0.6	0	0	10	5	15	7.5	8	4
Tree tomato	0.6	0	0	15	7.5	20	10	15	7.5
Black berry	0.5	0	0	14	7	16	8	14	7
Intercrop with Fruit trees (lulo, Tree tomato)									
Kidney bean	0.6	0	0	0.9	1.1	0.9	1.1	-	-

Kedney bean as intercrop will be planted two times for one year and expected yield is annual average.

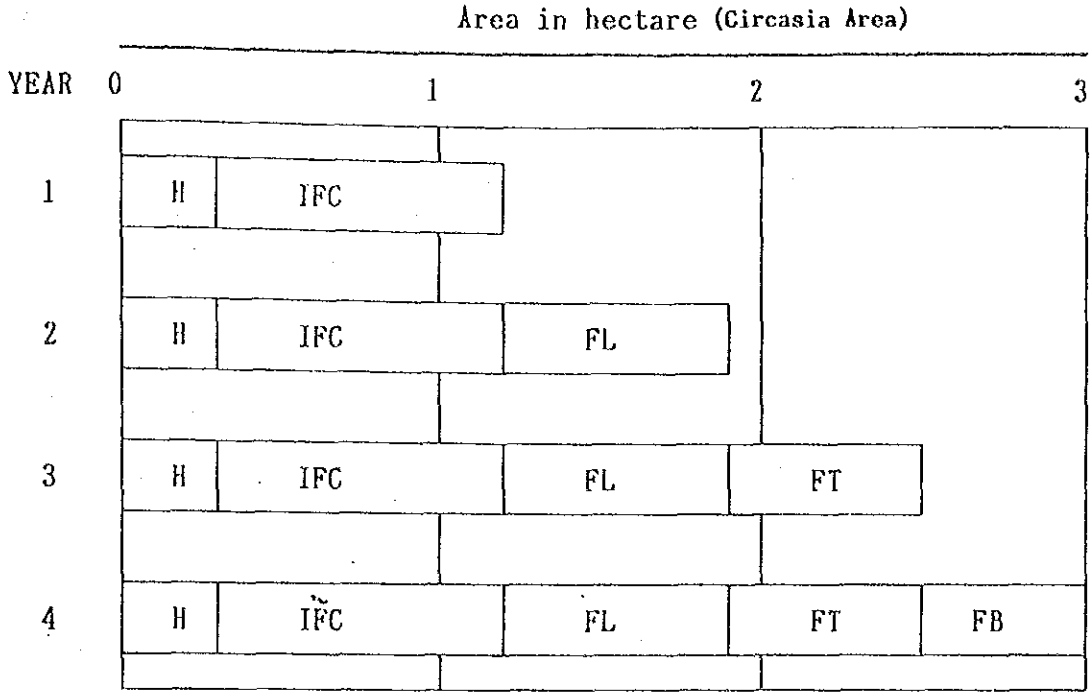
Crop budget per hectare (Circasia Area)

(Unit : 1,000 Col.)

Crops	Year 1			2			3			4			5			6			7		
	Total Production cost	Gross Income	Net Income	Total Production cost	Gross Income	Net Income	Total Production cost	Gross Income	Net Income	Total Production cost	Gross Income	Net Income	Total Production cost	Gross Income	Net Income	Total Production cost	Gross Income	Net Income	Total Production cost	Gross Income	Net Income
Potato	265	270	5	265	376	91	265	416	133	265	416	133	265	416	133	265	416	133	265	416	133
Pea	447	662	215	447	851	404	447	915	496	447	915	496	447	915	496	447	915	496	447	915	496
Cayenne	150	236	146	150	432	282	150	480	330	150	480	330	150	480	330	150	480	330	150	480	330
Carrot	123	251	128	123	374	251	123	416	293	123	416	293	123	416	293	123	416	293	123	416	293
Kidney bean	74	88	14	74	304	230	74	304	230	74	304	230	74	304	230	74	304	230	74	304	230
Melon	48	114	66	48	180	132	48	228	180	48	228	180	48	228	180	48	228	180	48	228	180
Welsh onion	316	280	-36	316	537	316	316	400	84	316	600	284	316	600	84	316	600	284	316	600	84
Taro	-	-	-	125	0	-125	200	650	450	183	975	793	140	320	340						
Iron tomato	-	-	-	-	-	-	177	0	-177	131	375	244	141	500	359	130	375	245			
Black berry	-	-	-	-	-	-	-	-	-	592	0	-592	437	770	333	451	640	418	341	770	429
Intercrop with Fruit Trees																					
Kidney bean				43	111	68	43	111	68	-	-	-	-	-	-	-	-	-	-	-	-

Cost and income analysis (Unit: 1,000 Col.$) (Circasia Area)

Year	area	Gross income	Material cost	Net income
1	1.0	606	244	362
2	1.6	990	333	657
3	2.2	1435	385	1035
4	2.7	1762	524	1238
5	2.7	1909	432	1477
6	2.7	1929	416	1513
7	2.7	1929	416	1513

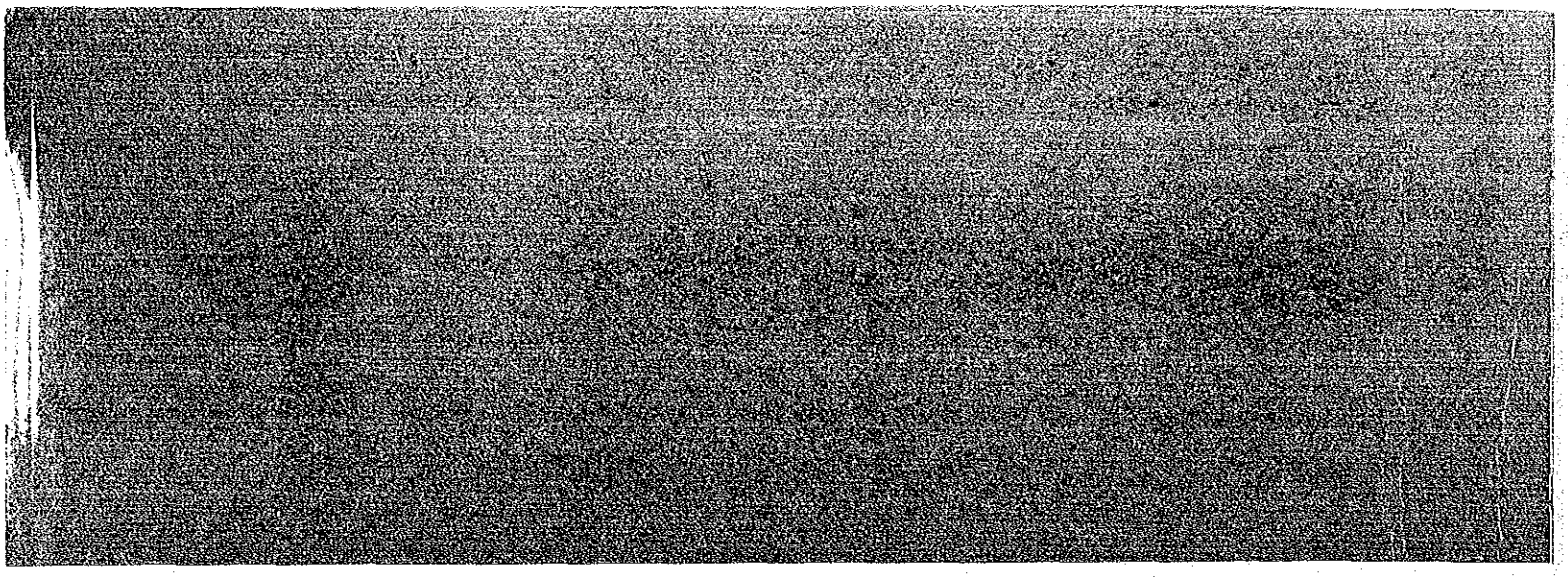


Legend: H House lot pluse Home garden
IFC Intensive Food Crop
FL Fruit tree -- Lulo
FT Fruit tree -- Tree tomate
FB Fruit tree -- Black Berry

Future land use for model farm

Estimated labour requirements in Man-days per year (Circasia Area)

Year	Intensive food crop	Fruit tree			Intercrop	Total
		Lulo	Tree tomato	Black berry	kidney bean	
1	383	0	0	0	0	383
2	382	95	0	0	52	529
3	383	105	83	0	52	623
4	382	132	76	94	0	684
5	383	92	88	152	0	715
6	382	92	88	168	0	730
7	383	92	88	152	0	715



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