

B : SOCIO-ECONOMY AND AGRICULTURE IN CÔTE D'IVOIRE

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B : SOCIO-ECONOMY AND AGRICULTURE IN CÔTE D'IVOIRE

B.1 Socio-Economic Conditions

B.1.1 Demography

(1) National Demography

According to the census in 1988, the population of Côte d'Ivoire was estimated at 10.816 million. Since then, an average population growth rate of 4% is observed between 1989 and 1994, with which the total population was estimated at 14.23 million in 1995. Economic active population is estimated by FAO at 5.19 million (36.4%), rural active population at 2.97 million (57.1% of the total active population). Average life expectancy during the same period was estimated at 56 years. The total population is estimated just over 16 million in 1998. Concentration of population in urban area has been accelerating. The ratio of urban and rural area population was 1 to 1.5 in 1985, and it is estimated to be 1.25 to 1 in 2010.

People living in the country are ethnically very much diversified and they can be classified into the four principal ethnic groups; 1) the Akan (primarily Baoulé and Agni) constitutes about 35 % of the total population and lives in the south-east, 2) the Krou (primarily Krou, Bété, and Wé) lives in the south-west, 3) the Voltaic Group (primarily Sénoufo and Lobi-Birifor) in the north-east, and 4) the Mandé (primarily Mandé and Malinké) in the north-west.

(2) Regional Demography

Table below gives the population of the Study Area in 1988 and an estimate for 1997. In nine years between 1988 and 1997, different villages had shown different population growth rates. The average annual growth rate of population in San-Pédro Municipality is 7.6% on average.

POPULATION: STUDY AREA

	1988	1997	AAGR*		1988	1997	AAGR*		1988	1997	AAGR*
Bernard	1,888	2,713	4.1%	Petit Pedro	1,195	1,717	4.1%	San-Pédro City	77,153	149,300	7.6%
Cite Agricole	400	497	2.4%	Poro	72	107	4.5%	Blaou	2,162	3,828	6.6%
Ivobois	267	384	4.1%	Others	2,646	6,800	11.1%	Fabe	72	1,036	34.5%
Grand Gabo	41	59	4.1%	Rural Area	6,593	12,800	7.6%	Scaf	1,722	2,520	4.3%
Petit Gabo	85	523	22.4%	Urban Area	70,559	136,500	7.6%				

* Average Annual Growth Rate

Source: 1988: Year-Book, Bureau du Sous-Prefecture San-Pédro

Source: 1997: ICF, ENSEA, *ibid*, 1998

Source: 1997: Bureau du Sous-Prefecture San-Pédro

B.1.2 National Economy

(1) National Economy

A drastic step was taken to devalue the CFA Franc 50 % in terms of rate against French Franc to CFA Franc 100 per 1.0 French Franc. on 12th January, 1994, which became a turning point of the national economy. The process of restructuring the centrally planned economy, guided by IMF, has gained its momentum. As shown in Fig. B.1.1, the annual real GDP growth rates have been positive since then, and in 1997 the per capita GDP was estimated to reach F.CFA 434,000 (743 US\$ as of 1997). With the agricultural reform and budgetal restraint in mind, recently, IMF has reached agreement with GOCI to disburse a new \$385 million three-year enhanced structural adjustment facility for 1998.

Consumer Price Index (CPI) for households workers, technicians and craftsmen in two consecutive years of 1996 and 1997 are 4.4% and 5.2%, less than a half of CPI in 1995, in spite of food price rise in the first half of 1997.

Privatisation has helped the government to augment its coffers. As of October 1997, there were six national ranches and one national vegetable growing company, none of them are not big, in the list of the companies scheduled for privatisation along with SIR - an oil refinery and CIDT - a cotton textile monopoly.

Cacao, an industrial crop, is the mainstay of the national export earnings. Like other cash crops, it always faces the two uncertainties, the weather in Côte d'Ivoire and the weather in other producer countries. As the primary measure, Côte d'Ivoire has been diversifying into other industrial crops, and coffee has become the second export crop, whose sale reached at about fifth of cocoa's in 1996. Fig B.1.2 shows the changes in production and export earnings of coffee and cocoa for past 30 years. The second diversification has directed to oil export, whose sale reached about 40 % of the cocoa's in 1996. Côte d'Ivoire will increase its export by five-fold by 2000, which will reflect in the forecast of export growth.

Since 1994, thanks to CFA Franc's devaluation, along with the effort on economic restructure, Côte d'Ivoire has been getting a breathing space in her economy. In this context, it should now be a great concern for Côte d'Ivoire how will be the exchange rate mechanism between French Franc and CFA Franc after the French Franc is absorbed into the ECU on 1st January 1999.

(2) National Economic Development Plan

It had been seven years since the IMF initiated its intervention in Côte d'Ivoire's national economic structure in 1984, when 'the Seventh Medium Term Economic Development Plan (1991-96) (7MTEDP)' was implemented. The focus of the plan was clearcut; stabilisation of national economy by introducing restructuring measure, which, on the one hand, would reinforce the competitiveness of industrial crops in the international market, then, on the other hand, would be supported by the development effort of human resources.

When CFA Franc was devalued by 50 % in 1994, an enhanced structural adjustment facility (ESAF) was agreed upon between the GOCI and IMF. The delayed new \$385 million three-year ESAF (April 1998- March 2001) was signed in June 1998, and "*Cadre de politique économique et financière pour 1998-2000*" was subsequently announced, in which the five pillars of the reforming theme, i.e., 1) smaller government, 2) privatization, 3) development of human resources, 4) decentralization, and 5) alleviation of poverty, have been resounding throughout.

(3) Social Problems and Efforts to Address Them

With the advancement of restructuring of the national economy as a whole, the bi-polarization of the middle social stratum has become an acute social phenomenon, especially in the periphery of Abidjan.

The social reform policies envisaged in the framework emphasise the need to attend the poorer sections of the population, in the form of improving education, especially of girls, public health services, and revitalisation of rural areas. Problems in the periphery of Abidjan are being planned to be solved by the creation of young farmers' groups which will produce vegetable for the markets

in Abidjan. As of July 1998, the poverty line lies at the level of monthly income of F.CFA 94,600, and those who are below the line comprise 37 % of the total population.

B.2 Agriculture in Côte d'Ivoire

B.2.1 General Situation of Agriculture

(1) General

Agriculture of Cote d'Ivoire mainly composed of exporting crops such as cacao and coffee has become motive power of the national economy with the share of 30 % of the GDP in 1995. Such the specialized agriculture to exporting crop achieved high growth of national economy called "Ivorian Miracle" during 1960s to '70s. However, the great break of the international price of cacao and coffee in 1977 and 1978 brought the serious economic depression in the 1980s. In 1994, the real GDP barely turned to plus.

Regarding population in this country, the increase rate is high as 3.7 % with the additional social condition of immigrants from the neighboring countries, especially 4.3 % during 1990 (11.72 million) to 1995 (14.23 million). While, the agricultural population in this country is rapidly decreasing with the outflow of the rural population to cities, from 71% in 1975 to 54 % in 1992 in ratio. With concentration of the population to cities, the rice consumption per capita largely increased from 30 kg/year in 1960s to 57 kg in 1994. Regarding the national rice production, though the remarkable growth was found out; from 150 to 200 thousand tons in early 1960s to 650 to 700 thousand tons in early 1990s, the self-sufficiency rate of the country has been stayed yet below 60 % in 1990s.

(2) Agro-Climate

The country is classified by climate condition into 3 climate zones; the southern climate zone, the central climate zone and the northern climate zone, based on the amount of rainfall. The agriculture in Cote d'Ivoire is strongly subjected by the climate condition.

1) Southern Climate Zone

The Southern Climate Zone covering around one third of the country along the shoreline of the Gulf of Guinea belongs to the tropical forest climate. The climate consists of main dry-season (December to February), Main rainy-season (March to middle of July), small dry-season (middle of July to middle of September) and small rainy-season (middle of September to end of November). The annual rainfall amounts to 2,200 mm in the West coastal region, 1,600 to 1,750 mm in the central coastal region and 2,000 mm in the East coastal region. The average monthly rainfall is below 100 mm in the dry-season, 200 to 650 mm in the rainy-season and 100 to 200 mm in the in-between period.

2) Central Climate Zone

The Central Climate Zone locating upper of the former and covering MAN, BOUAKE and BONDOUKOU shows climatic characteristics of a transitional zone between the Southern and the Northern Zone. The climate has three seasons of dry-season (November to February), rainy-season (March to middle of July and middle of August to October) and transitional season (middle of July to middle of August). The rainfall has an increasing tendency towered from the east to the west with the monthly rainfall below 60 mm in the dry-season and 100 to 200 mm in the rainy-season.

3) Northern Climate Zone

The Northern Climate Zone covering one third of the northern part of the country belongs to tropical savanna climate consisting of severe dry-season (November to middle of April) and rainy-season (middle of April to October). The monthly rainfall amounts to 80 mm to 200 mm in the rainy-season with the increase tendency towered from the east to the west and almost no rain in the dry-season.

(3) Agricultural Production

1) General

Côte d'Ivoire is one of the low-income food-deficit countries, according to the classification made by FAO, even though she has been famous for her production of diversified industrial crops, starting with so-called six C majors in French, *Cacao*, *Café* (robusta coffee), *Caoutchouc* (rubber), *Coton* (cotton), *Cocotier* (coco-palm), and *Canne de Sucre* along with Oil-Palm, Pineapple, and Banana. As shown in the following table, agricultural land for the above main products are limited to only 11.4%.

	Arable Land	Perennial Crop	Permanent Pasture	Forest & Woodland	Other Land	Total
Area(1,000 ha)	2,430	1,260	13,000	7,079	8,031	31,800
Share (%)	7.6	4.0	40.9	22.3	25.3	100.0

Source: FAOSTAT 1996

2) Major Crops

Major crops in Côte d'Ivoire are perennial cash crop, which occupies 59.9% of the total cropped land in 1994. The major perennial crops are cacao (31.2%), coffee (24.0%), oil palm (2.7%), rubber (1.1%) and coconut (0.9%). Food crops occupy 39.4% of the total area. The major food crops are maize (11.7%), rice (9.5%), yam (4.5%), cassava (4.2%), taro (3.7%), plantain banana (2.3%), groundnut (2.2%) and sorghum and millet (1.3%). The remainder is industrial crop such as cotton (0.4 %) and sugarcane (0.3 %).

3) Production

The production is clearly obeyed by the conditions of the climate zones. In the tropical rain forest zone, various crops such as oil palm, rubber, banana, mango, cola, citrus, pineapple, maize, rice, cassava, yam and plantain banana are produced with the principal crop of cacao and coffee.

In the central climate zone, cash crop such as vegetables, banana and mango are produced with the basal crop of maize and yam. In the northern climate zone, sugarcane and rice with irrigation, cereal crop such as sorghum and millet, cassava, groundnut and cotton are produced.

4) Production Trend

Crop production trend was examined with the comparison of productions during the 10 years from 1985 to 1994.

• Commercial Crops

The productions of cacao, banana poyo, oil palm, rubber and cotton during the 10 years increased by 37%, 37%, 35%, 27% and 15% respectively. Especially, cacao and banana poyo showed the remarkable increase. On the other hand, the productions of coffee (-37%), pineapple (-17%), sugarcane (-11%) and cola (-10%) decreased, especially that of coffee showed greatest decrease.

• Food Crops

All food crops increased the production during the 10 years by over 10%, especially millet (26%), sorghum (25%), taro (25%), plantain banana (22%), rice (21%), cassava (20%) and groundnut (20%) increased over 20 %.

Agricultural Production in 1994

Crop	Area Cultivated(ha)	Production(ton)	Yield(ton/ha)	Area Cultivated (%)
Cacao	1,800,000**	868,965	0.48	31.2
Coffee	1,385,000**	296,171	0.21	24.0
Oil palm	152,947	127,298	0.83	2.7
Rubber	63,497	64,301	1.01	1.1
Coconut	53,140	33,345	0.63	0.9
Total Perennial Crop	3,454,582	-	-	59.9
Cotton	21,298	258,343	12.13	0.4
Sugarcane	19,985	1,200,345	60.06	0.3
Total Industrial Crop	41,283	-	-	0.7
Maize	675,000*	536,000	0.79	11.7
Rice	545,000*	701,000	1.29	9.5
Yam	260,000	2,824,000	10.86	4.5
Cassava	245,000*	1,564,000	6.38	4.2
Taro	212,000*	343,000	1.62	3.7
Banana(Plantain)	133,000*	1,276,000	9.59	2.3
Groundnut	127,000*	138,000	1.09	2.2
Sorghum/Millet	74,000*	80,000	1.08	1.3
Total Food crop	2,271,000	-	-	39.4
Total	5,766,865	-	-	100

Source: ANNUAIRE DES STATISTIQUES AGRICOLES, 1994, MINAGRA

Remarks: *FAOSTAT, **MINAGRA Planning Department 1995

Agricultural Production Trend (ton)

Crop	Average(1985-'87)	Average(1992-'94)	(1992-'94)/(1985-'87)
Cacao	610	834	137%
Coffee	241	153	63%
Oil palm(Processed)	924	1,250	135%
Cotton(Cotton grain)	220	252	115%
Banana poyo(Processed)	145	199	137%
Pineapple(Raw)	169	140	83%
Rubber(Total)	53	68	127%
Cola	58	52	90%
Sugarcane(Molasses)	59	52	89%
Paddy	560	679	121%
Maize	462	522	113%
Millet	40	51	126%
Sorghum	22	28	125%
Fonio	7	8	114%
Yam	2,400	2,784	116%
Cassava	1,267	1,525	120%
Plantain banana	1,018	1,245	122%
Taro	265	332	125%
Groundnut	112	135	120%

(4) Livestock

Poultry are the most common and 26,200,000 heads are raised in the country in 1999, followed by cattle (1,231,000 heads) and sheep (1,251,000 heads). Pig accounted for only 403 thousand heads.

Number of livestock raised in San-Pédro Region is only 7.2 % on cattle and 9.3 % on ruminant of sheep and goat. On the supply and demand of livestock, cattle, sheep and goat, pig and poultry met 32.7 %, 56.2 %, 83.9 % and 91.2 % of the domestic demands in 1994, respectively. The egg production is self-sufficient, while the milk production met only 19.0 % of the domestic demand.

On the supply and demand of livestock, cattle, seep and goat, pig and poultry met 32.7%, 56.2 %, 83.9 % and 91.2 % of the domestic demands in 1994, respectively. The eggs met 100 %, but the milk met only 19.0 % of the domestic demand.

Number of Livestock Raised in Côte d'Ivoire (1,000heads)

	1990	1991	1992	19943	1994	1994/1990
Taurins	704	726	758	767	776	110.2 %
Zebus	404	419	422	438	455	113.8 %
Cattle total	1,108	1,145	1,180	1,205	1,231	111.1 %
Sheep	1,134	1,161	1,190	1,219	1,251	110.3 %
Goat	888	908	931	954	978	110.1 %
Traditional pig	314	324	332	340	349	111.1 %
Modern pig	46	48	50	52	54	117.4 %
Pig total	360	372	382	392	403	111.9 %
Traditional poultry	17,400	17,800	18,200	18,600	19,130	109.9 %
Modern poultry for meat	5,800	6,200	6,120	6,060	5,970	102.9 %
Modern poultry for egg	920	1,140	950	1,190	1,100	119.6 %
Poultry total	24,120	25,140	25,270	25,850	26,200	108.6 %

Source: D.G.R.A/D.P.E

Note: Data from D.P.E does not include modern pig and poultry

Production, Import and Consumption of Livestock in Côte d'Ivoire (ton, 1994)

	Cattle	Sheep, Goat	Pig	Poultry	Total	Egg	Milk
National production(TC)	19,791	6,189	7,728	18,711	52,419	15,986	21,632
Import*	40,776	4,828	1,482	1,800	48,886	0	92,134
National consumption	60,567	11,017	9,210	20,511	101,305	15,986	113,766
Production/Consumption(%)	32.7 %	56.2 %	83.9 %	91.2 %	51.7 %	100 %	19.0 %

T.C: Tones equivalent carcasses + abats (Source: MARA)

* Import: Production - Consumption

Source: Institute National De La Statistique

(5) Aquaculture

In Côte d'Ivoire, continental fishing is controlled by the Bureau of Aquaculture and Fishing, which belongs to the Directory of Fishing, itself part of the General Direction of Animal Production. The Bureau of Aquaculture and Fishing is in charge of registration of the fishermen, follow-up of the fishing activity and others. Police of the fishing activity is made by the so-called Agents of Water and Forest, who institutionally belong to the Bureau of Aquaculture and Fishing and not the General Direction of Water and Forest. The fishing license is delivered by the head of sub-prefecture.

As detailed in Table B.2.1 some varieties of carp, catfish and shrimp are found in inland water resources. People who live in the zone are earning by forest management and fishing. They have know-how of building wooden two men fishing boats, digging canoes and weaving fishing nets. Surplus catch of a day is sold on the dyke of the San-Pédro dam in the morning. There are a few fish ponds in the area. They grow either tilapia or catfish.

In the national level, *Direction de L'aquaculture et des Pêches* has been planning and implementing the policies of encouraging the small farmers to grow fresh water fish. With the advancement of the decentralisation, ten zonal centers of fish culture were established. Five of them are for lagune areas, four for big dams (one for Buyo lake in the west) and one for small farm ponds in Savanna Region as of November 1997. ANADER has also been involved in the process, and its zonal office in San-Pédro city has a special technician for pisciculture.

In the west and south-west zones, '*Projet de Développement de la Pêche Artisanale sur le Lac de Buyo*' were implemented with the finance of CCCI and GOCI. Then the first phase (1992-1995) of '*Projet d'Appui à la Professionnalisation Piscicole du Centre-Ouest*' was successfully implemented. It has created 100 model farm ponds in the area of Daloa-Gagnoa with the total cost of F.CFA 600 million financed by FAC and GOCI. At the moment, '*Projet Intégré de Développement Rural de la Région Forestière-Ouest*' is in the course of implementation (1994-1999). The total project cost of around F.CFA 2.7 billion is being financed by BAD and GOCI. Its objective is to create a total of 150 ha of farm ponds in the region. The project will provide credit for initial investment with the fund of F.CFA 2 billion, and will establish the distribution channel of catfish fries. Soubré Department is included in the project area, but San-Pédro Department is not involved in it. An NGO '*L'Association Pisciculture et Développement Rural en Afrique Humide-Section Côte d'Ivoire* (APDRA-CI)' is working in the Bas Sassandra. San-Pédro Department is not its area of operation.

B.2.2 Master Plan of Agricultural Development (1992-2015)

(1) Master Plan of Agricultural Development (1992-2015)

In such situation of agriculture, the Government of Cote d'Ivoire made the "Master Plan of Agricultural Development 1992 – 2015" in September 1993 for the improvement of weak national economy largely depended on the export crops and achievement of self-support of food.

1) Basic Strategy

- Improvement of productivity and competitiveness.
- Search of self-support and security of food.
- Diversification of agricultural production and the optimum use of agricultural resources.
- Promotion of marine and lagoon fisheries.
- Rehabilitation of forest resources.

2) Basic Policy

The basic policy for attaining the strategy is

- Withdrawal of the State from production and commercial activities.
- Return of the young to agriculture
- Rise in farmer's standing and activation of localities.
- Farmer' training and education, especially for young women.
- Land improvement and enforcement of land policies.
- Strengthening of research and development activities for food, animal and fisheries production.

3) Production Targets by Sectors

• Crop production (1,000 ton)

Crop	Base	Production target					Annual growth (%)	Major Actions to be taken
	1990	1995	2000	2005	2010	2015		
Coffee	260	250	320	360	400	400	2.0	Renewal of trees, Quality improvement, Expansion of Arabusta
Cacao	823	800	820	850	900	950	0.6	Reconstruction, Productivity
Oil palm	229	250	239	235	230	232	0.0	Competitiveness, Self-sufficiency
Copra	23	23	23	23	23	23	0.0	Utilization of by-products
Rubber	82	95	140	210	270	366	7.1	Sharing 4% of world market by 2010
Sugarcane	170	190	210	260	320	350	3.1	Meet to domestic demand
Cotton	250	300	375	470	587	734	5.0	Productivity, Diversification of Products
Banana	136	217	267	329	404	496	4.2	Productivity, Expansion of new area
Pineapple	214	269	481	601	751	1,032	6.5	Productivity, Improvement of Quality, Reconstruction, Market
Citrus for juice	18	23	28	35	44	55	5.0	Processing, Export
Other fruits*	45	56	70	88	109	137	5.0	Production in off-production season, Processing, Self-sufficiency, Export
Rice (Paddy)	687	1,171	1,609	2,260	2,990	3,990	9.0	Development of potential productivity, Price liberalization, Integration of production and processing
Maize	484	553	645	737	875	1,020	3.0	Intensification, Storage, Processing, Export
Other cereals	76	80	90	100	110	120	1.9	Research development
Yam	2,528	2,530	2,805	3,120	3,445	3,818	1.6	Storage, Distribution, Processing, Production in off-season
Plantain banana	1,086	1,400	1,843	2,180	2,685	3,343	4.6	Preserving, Distribution, Processing, Production in off-season
Cassava	1,393	1,678	1,710	2,050	2,420	3,600	2.8	Processing, Production in near consuming area
Groundnuts	134	162	195	224	255	297	3.3	Regional dispersion, Intensification, Preserving, Distribution, Processing, Production in off-season
Vegetables	392	526	648	781	890	1,040	6.6	Self-sufficiency, Export

*Other fruits: Citrus, cashew, avocado, mango, Guava, Papaya and others.

• Animal and Fisheries Production (1,000 ton)

Products	Base	Production target					Annual growth (%)	Major action to be taken
	1990	1995	2000	2005	2010	2015		
Beef	18	30	41	50	60	71	3.8	Sanitary, Genetic improvement
Mutton	6	8	19	25	30	36	3.8	Improved traditional and modern animal raising
Pork	7	11	24	30	55	65	3.8	
Chicken	18	42	63	70	80	95	3.8	
Eggs	14	34	50	65	75	89	3.8	
Milk	18	22	28	36	46	58	3.8	
Marine and lagoon fisheries	72	86	100	100	120	132	2.0	Maximum utilization of potential marine fisheries
Fresh water fisheries	20	25	30	55	86	138	12.0	Utilization of potential productivity

• Timber Production (1,000 m³)

Products	Base	Production target				
	1990	1995	2000	2005	2010	2015
Natural forests	2,100	1,600	1,200	1,000	1,000	1,000
Maintained forests	31	252	563	1,100	1,500	1,800
Enterprise forests	55	190	280	1,146	692	1,253
Total	2,186	2,042	2,043	3,246	3,192	4,053

B.2.3 Importance of Rice

(1) Rice Production and Development Plan

In Côte d'Ivoire, average production growth of main staple foods, roots and tubers (yam, taro etc.), cassava and rice, between 1976 and 1995 was estimated at 1.8%, 2.7% and 4.6%, respectively. Comparing to the estimated annual population growth of 4.0%, production of staple food except rice could not meet the requirement the amounts of food crops production almost meet the domestic demand except rice. The self-sufficiency ratio of rice was estimated at 58 % in 1994 with the domestic production of 455,650 ton, and the imported amounts of 329,000 ton in rice, and the consumption amounts of 57 kg per person per year. The total irrigated area was estimated at 20,000 ha by the FAO in 1970, but it increased up to 73,000 ha in 1994 and at present, paddy occupies about 40 % of the irrigated area. Rice is mainly produced in the western and southern part of Côte d'Ivoire including the Study Area

Since cheaper imported rice and wheat were introduced to urban area in 1970's, people intend to buy them instead of the traditional staple foods (yam and cassava). Among these three crops, only rice is an international crop. Rice import increased to 320,000 tons in 1990's from 113,000 tons in 1970's (Fig. B.2.1). The imported rice counted 50% of total domestic products and shared 5% of total import value in 1990. The rice import of the country is the largest among the West African countries. The quality, distribution and price fluctuations of imported rice are given in Table B.2.2.

According to the food balance (average 1992-96, demand base) of FAO, rice is most important roll of the food and nutrient supply in Côte d'Ivoire; 1) food consumption is 11% followed by Yam (21%), Cassava (18%), Plantains(15%), 2) the first on calories (24%), and 3) the first on the protein supply (22%) as shown in Table B.2.3 and Fig.B.2.2.

Population growth in general, demands increased food crops production; concentration of population in the urban area demands the concentration on the specific foodstuff, i.e., rice, wheat flour, meat, and milk products. So increased rice production has special implication in this context. In order to meet the national demand for rice, the Government has made the 10-year plan '*Plan de Relance de la Riziculture*'. The target is to increase the production at 9 % in annual rate. The details are as follows:

Rainfed paddy:	Expansion of land from 573,000 ha to 853,000 ha Increase in yield from the present 1.2 ton/ha to 2 ton/ha
Irrigated paddy:	Expansion of land from 22,000 ha to 78,000 ha Increase in yield from the present 3.2 ton/ha to 5 ton/ha

Within the framework of the 7 MTEDP, the Ministry of Agriculture and Livestock Resources (MINAGRA) announced "*Plan directeur du développement agricole (1992-2015)*" in 1993 with medium term programme for rice crop. After the devaluation of CFA Franc, MINAGRA has reviewed the programme. As one of the revised detail programmes, "*Plan de relance de la*

riziculture” was announced in 1996 in the perspective of food self-sufficiency. At the same time, the policy makers felt it is necessary to remind the theme of the overall food self-sufficiency in which diversification of food crops, another pillar of the policy, should always be pursued in order to reduce the pressure of boosting rice production.

When all the aspects of the programme work out according to the plans envisaged by MINAGRA, the medium term future production of paddy would result in the figures given in table of B.2.2. Without the programme, the deficit of rice would reach 600,000 ton in 2005, whereas, with the programme, the deficit would only amount to 100,000 ton. The estimated savings derived from the import substitution would reach some F.CFA 110 billion at 1997 price. The plan counts generation of wastes after harvest as one of the unsatisfactory results of the food crops production and mentions the necessity of ameliorating the situation. It does not yet elaborate a plan to quantify the process. If it is introduced, sizable amounts of rice may be reclaimed from the wastes..

(2) External Assistance in Paddy Agricultural Sector and Ongoing Projects

External assistance covers very wide range of activities in paddy production as shown below:

USA: PL-480

Amount of F.CFA 6 billion for 1998 in two loan agreements of equal amount. The latter half is specifically meant for importing brown rice from the USA. This is the tenth agreement since PL-480 started in 1989, and the total have reached F.CFA 63 billion., equivalent to US\$ 106 million at the present exchange rate.

China

As of the end of 1997, completed 45 % of the Guiguidou irrigated rice culture project in the Sud-Bandama Prefecture, i.e., two dams with 20 km access road, and 68 ha of irrigated rice field, which are to be cultivated by 164 farmers. The project was started in 1996. After the project was re-evaluated, the original scale of 442 ha was reduced into a quarter, and the total cost was estimated at F.CFA 10.2 billion, in which China's share will be F.CFA 7 billion. For further finance, China has agreed to provide about F.CFA 3.6 billion.

France, FAC, 1997

F.CFA 1.5 billion for agronomy research programs.

ADF, 1997

US\$34 million grant, for studies on agro-processing industries.

WFP, Oct. 1997

2,200 tons of rice (equivalent to F.CFA 500 million) donation for school canteens. (at the rate of F.CFA 227,000 / ton)

Japan, JICA, 1996

D/D and implementation of an earth-dam construction on the Lokakpli river which will irrigate 126 ha of paddy field.

IBRD, 1995

US\$5.83 million for Agricultural Export Promotion and Diversification Project which will be completed in 2001. The project is co-financed by GCI, CIDA, EU, Japan, & Agricultural Producers/Exporters. The total cost is equivalent to US\$16.4 million.

An estimated increase in irrigated area generated by the projects' implementation as of 2000 will consist of 21 % of the rehabilitation plan and 40 % of the new installation plan. The plan is actually implemented according to the schedule. Locakpili Project has been implemented ahead of schedule; a part of N'zi project was tendered, and implementation works on seven swamp areas in the Cavally basin, and one in the Sassandra in the Ouest/Man project financed by BAD/ CI, for example, are being tendered on 6th July, 1998.

B.2.4 Institutional Framework

(1) Ministère de l'Agriculture, des Ressources Animales (MINAGRA)

Côte d'Ivoire is a unitary republic, whose legal system is based on the 1960 constitution and the Code Napoléon. National legislature is National Assembly, whose 175 members are elected at five year interval. Head of state is President elected by universal suffrage for a seven-year term. National Government consists of Prime Minister and his appointed Council of Ministers. At present, the government consists of offices of president, the prime minister, 30 ministers and three high commissioners.

The Ministry of Agriculture and Animal Resources (MINAGRA) is responsible for development activities in the field of Agriculture and Rural Development. The organizational structure of MINAGRA is shown in Fig. B.2.3

(2) Agence National d'Appui au Développement Rural (ANADER)

"Agence National d'Appui au Développement Rural (ANADER)" was established in accordance with "Le Programme National d'Appui aux Services Agricoles (PNASA)-Phase I" in 1994 as a successor of CIDV, SATMACI, and SODEPRA with the sole objective of contributing to the welfare of the rural area as a whole by building up the professional agriculturists, be they farmers, foresters, animal breeders, fish growers, or fishermen. The organizational structure of ANADER is presented in Fig. B.2.4. It has five directorates at the national level besides that for general affairs. They are 1) agricultural extension, 2) R&D, 3) supporting OPA, 4) development and management of human resources, and 5) financial and accounting matters. At the regional level, it has five technical services for the corresponding directorates at the center, except for the facts that 1) and 2) at the national level are combined and that for follow-up and evaluation is included. The latter has the corresponding unit under the general directorate at the national level. It has further decentralized its function into the departmental level to satisfy the specific needs of individual agriculturists. In pursuit of bringing up the rural families both in the food crop production and in the industrial crop production, the second phase of PNASA is going to be implemented in continuation to the first phase, while ANADER itself has been restructured (Fig. B.2.5)

(3) Projet National Riz (PNR)

Projet National Riz (National Rice Project - PNR) was established under MINAGRA's jurisdiction by Degree No. 307 of MINAGR in 1996. It aims to 1) formulate policy and strategy for rice cultivation development and 2) systematic information management of rice from production/importation/manufacturing up to marketing. Its organization composed with 1) Director's Office, 2) 2KR Cell, 3) Development of Production Infrastructure Office, 4) Agronomy and Modernization Office, 5) Rice Observation Office and others as shown in Fig. B.2.6.

(4) Centre Nationale Reseach Agricole (CNRA)

Centre Nationale Reseach Agricole (National Agricultural Research Center - CNRA) was formulated together with CIRT, IDEFOR and IDESSA under the Ministry of High Education, Research and Technical Innovation in 1998. Provisional Organization is shown in Fig. B.2.7.

Table B.2.1 Aquaculture

INLAND FISHING & PISCICULTURE

Peches Artisanale	1991	1992	1993	1994		
	ton	ton	ton	ton	1000CFA	CFA/kg
National	21,401	15,404	13,477	15,604		
Dep.San Pedro				229	123,715	540

Pisciculture *1: Silure (*heterogranchus longifilis*)

National		20	20	78	78	66,300	850
Tilapia	Fry	74,000	1000	No/ton	74	62,900	850
Catfish *1	Fry	27,500	6875	No/ton	4	3,400	850

Source: MINAGRA, 'Annuaire des Statistiques Agricoles', 1994
Pisciculture in the Department of San Pedro in 1996

Department	Registered			In Production		
	Farm No.	Area: ha	Area/farm	Farm No.	Area: ha	Area/farm
San Pedro	101	20.20	0.20	23	4.03	0.18
Others (3)	289	51.04	0.18	52	8.10	0.16
Region Bas-Sassandra	390	71.24	0.18	75	12.13	0.16

Source: ANADER 1997

Table B.2.2 Import of Rice

		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Quantity	1000t	361	479	182	323	309	398	277	387	253	404	292
Value	bil.F.CAF	28	32	20	33	27	34	23	33	42	67	51
Unit Price	FCAF/kg	78	67	110	102	87	85	83	85	166	166	175

Source: MINAGRA, 'Plan de Relance de la Production de Riz', 1997

DISTRIBUTION OF QUALITY AND FORM OF IMPORTED RICE

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Bulk						5%	6%	13%	0%	22%	
Higher Quality						12%	6%	2%	2%	2%	
Standard: 16% broken						83%	89%	84%	96%	74%	
Lower Quality						0%	0%	1%	2%	3%	

Source: PNR, 1997

UNLOADING

		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Abidjan		399	375	252	348	320	431	284	433	228	397	
San-Pédro		47	113	47	52	75	76	71	93	56	52	
Total	1000 ton	446	488	299	400	395	507	355	526	284	449	
SP/Ttl	%	11%	23%	16%	13%	19%	15%	20%	18%	20%	12%	

Source: INS, ibid, 1997

Fig. B.2.3 Food Balance Sheet (average 1992-96)

(Method = Demand)

Population 13 294 800

PRODUCTS	Domestic Supply (1,000 metric tons)					Domestic Utilization (1,000 metric tons)						Per Capita Supply			
	Production	Imports	Stock Changes	Exports	Total	Feed	Seed	Processing	Waste	Other Use	Food	Kg year	Per Day		
													Calories	Protein (g)	Fat (g)
Grand Total												2,404	502	438	
Vegetable Products												2,298.0	400	380	
Animal Products												106.0	102	58	
Cereals - excluding Beer	1,225	647	-23	11	1,838	61	79	42	200		1,456	109.5	952.0	223	50
Wheat		235	0	5	230			0	5		225	17.0	120.0	36	06
Rice (milled equivalent)	596	375	-15	5	951		45	8	95		803	60.4	554.0	11.4	1.5
Barley - excluding beer		19	0	0	19			19			0	0.0	0.0	0.1	
Maize	537	11	-7	1	540	54	31	1	89		367	27.6	240.0	6.3	26
Millet	55	2	-2	0	55			14	6		33	2.5	22.0	0.5	02
Sorghum	26	0	1	0	28	7	2		3		16	1.2	9.0	0.3	0.1
Cereals, other	11	4		0	14		0		1		13	1.0	7.0	0.2	0.0
Starchy Roots	4,525	7		2	4,530	183	583		714		3,051	229.5	649.0	8.1	09
Cassava	1,574	0		0	1,573	79			157		1,337	100.6	303.0	2.5	03
Potatoes	0	7		0	7				0		7	0.5	1.0	0.0	0.0
Sweet Potatoes	36			0	36				5		31	2.3	6.0	0.1	0.0
Yams	2,596			1	2,594	104	519		519		1,452	109.2	299.0	4.8	06
Roots, other	320				320		64		32		224	16.8	40.0	0.7	0.0
Sugarcrops	1,373				1,373		41	1,265	30		36	2.7	2.0	0.0	
Sugar Cane	1,373				1,373		41	1,265	30		36	2.7	2.0	0.0	
Oilcrops	1,793	8	0	96	1,706		14	1,590	10	0	91	6.8	89.0	3.9	7.2
Soyabeans	4	0		0	4		0		0		4	0.3	3.0	0.3	0.1
Groundnuts (Shhd Eq)	101	5		0	106		8	9	10		79	5.9	83.0	3.5	6.7
Cottonseed	116	4	0	2	117		6	112		0					
Coconuts - incl. Copra	236	0		79	157			150			7	0.5	2.0	0.0	0.2
Palmkernels	1,317			5	1,311			1,311							
Vegetable Oils	365	10	5	214	167				1		59	8.0	194.0	0.0	21.9
Palm Oil	275	3	0	151	127						47	6.0	146.0		16.5
Copra Oil	19	0	3	22	0						0	0.0	0.0		0.1
Olive Oil		0		0	0						0	0.0	1.0		0.1
Oilcrops Oil, other	33	1	1	27	8				1		5	0.2	3.0	0.0	0.4
Vegetables	508	40		1	546				62		485	36.5	38.0	1.5	0.5
Tomatoes	106	22		0	128				16		112	8.4	5.0	0.2	0.1
Vegetables, other	402	18		1	418				46		373	28.0	33.0	1.3	0.4
Fruit - excluding Wine	1,827	4	0	317	1,513			24	313		1,176	88.5	203.0	1.9	0.5
Bananas	212	0		168	44				22		22	1.6	3.0	0.0	0.0
Plantains	1,321			0	1,321				264		1,057	79.5	194.0	1.7	0.4
Pineapples	217	0	0	142	75				18		57	4.3	4.0	0.0	0.0
Stimulants	1,114	2	-20	1,039	58						7	3.9	13.0	0.8	1.0
Coffee	154	2	30	186	0						0	0.0	0.0	0.1	
Cocoa Beans	960	0	-50	653	57						7	3.8	13.0	0.8	1.0
Tea		0		0	0						0	0.0	0.0	0.1	
Spices	15	0		1	14				1		14	1.0	9.0	0.3	0.5
Alcoholic Beverages	208	19		0	227						227	17.1	20.0	0.2	
Meat	137	7		0	144						0	10.8	48.0	4.1	3.4
Beef and Veal	36	6		0	42						0	3.2	16.0	1.3	1.2
Mutton & Goat Meat	9	0		0	9						9	0.7	3.0	0.3	0.2
Pigmeat	16	0		0	16						16	1.2	10.0	0.4	1.0
Poultry Meat	48	1		0	48						48	3.6	12.0	1.2	0.8
other Meat	28	0		0	28						28	2.1	7.0	1.0	0.3
Milk - excl. Butter	22	172		1	193				1		192	14.4	22.0	1.3	0.7
Eggs	16	0		0	16		3		1		13	0.9	3.0	0.3	0.2
Fish, Seafood	75	225		123	177	20		-12			169	12.7	24.0	3.9	0.8
Miscellaneous												0.0	0.0	0.0	0.0

Source: FAOSTAT Dec 1998

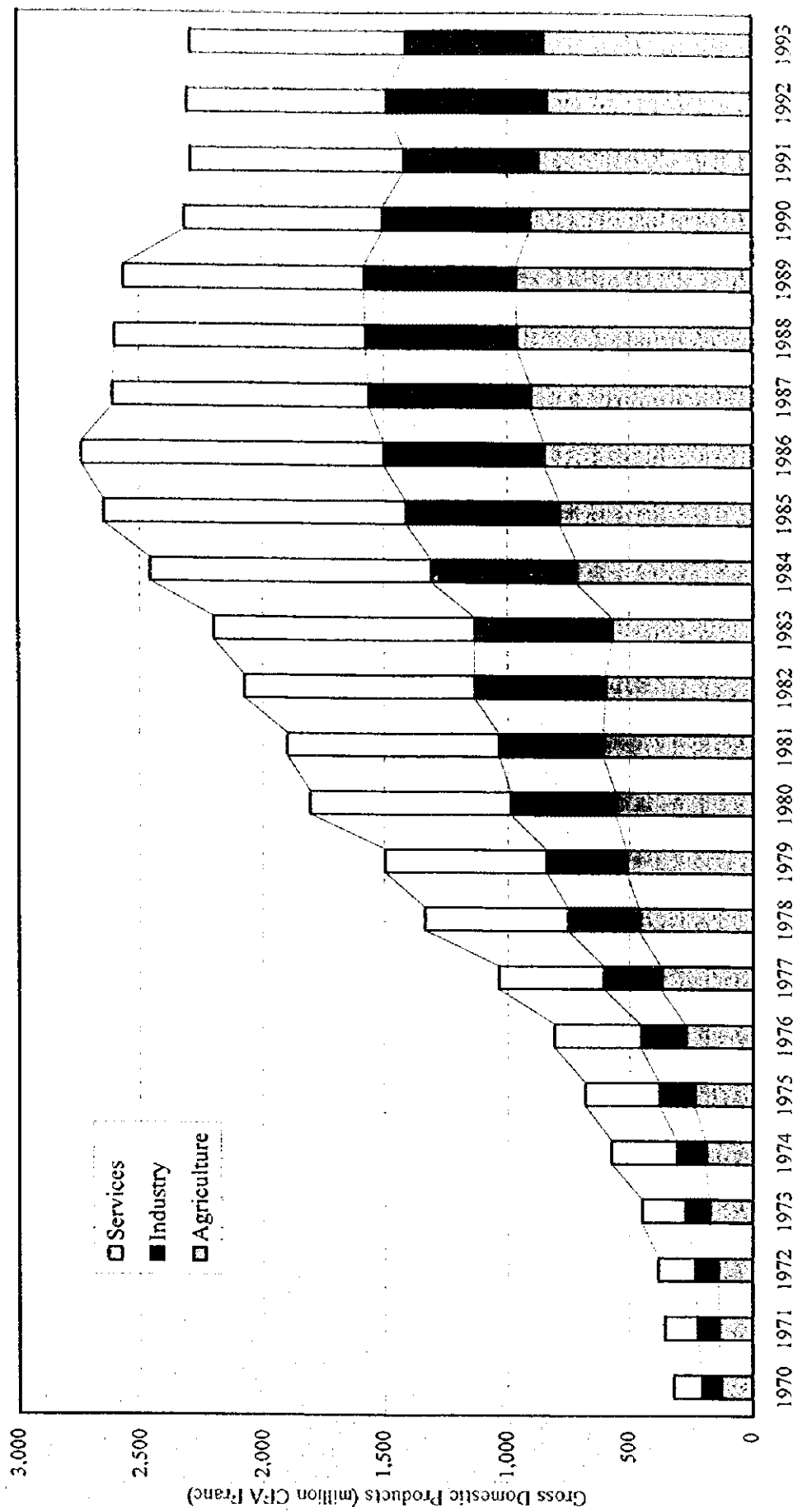


Fig. B.1.1 GDP by Sector (1970 - 1993)

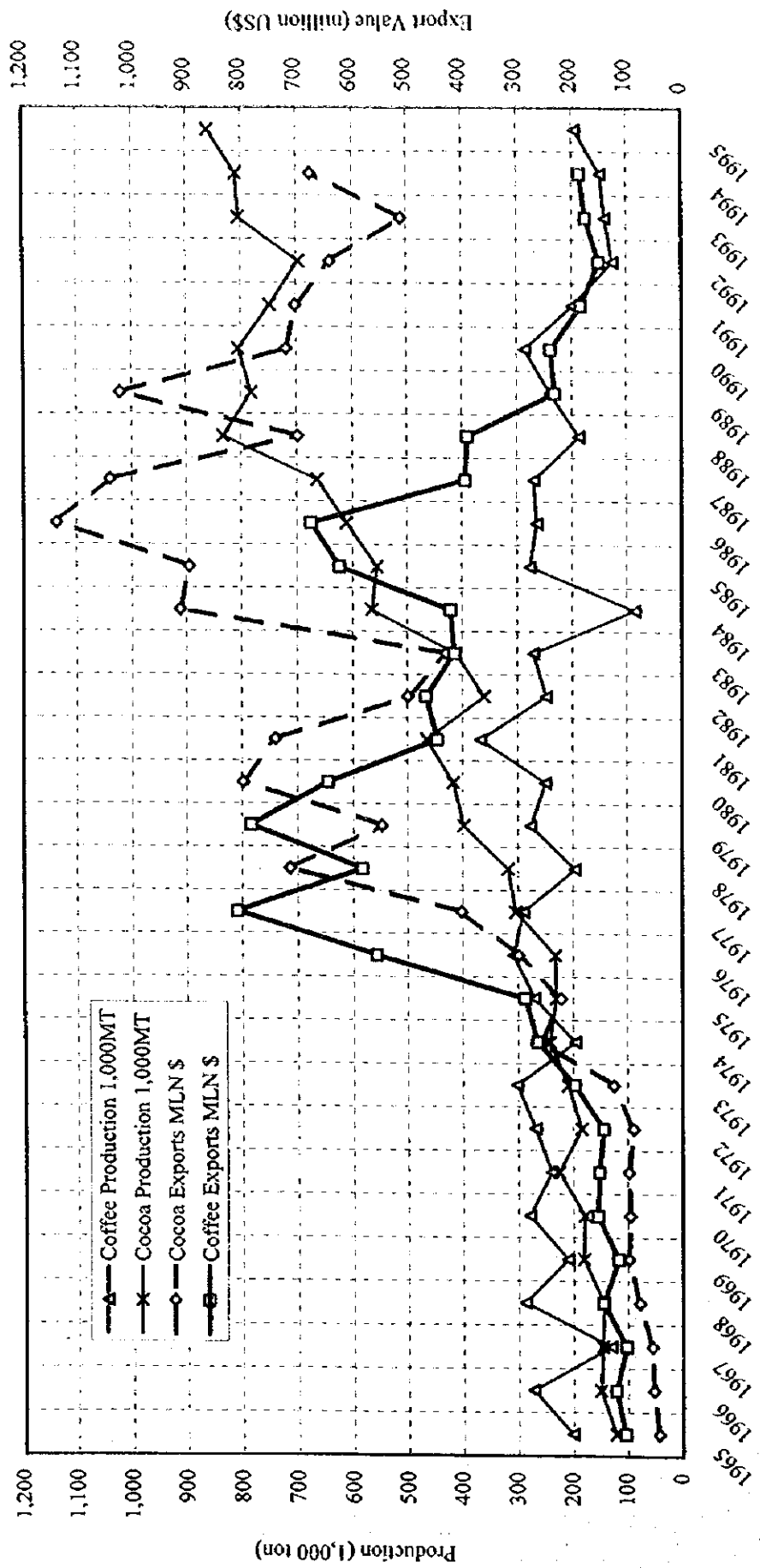
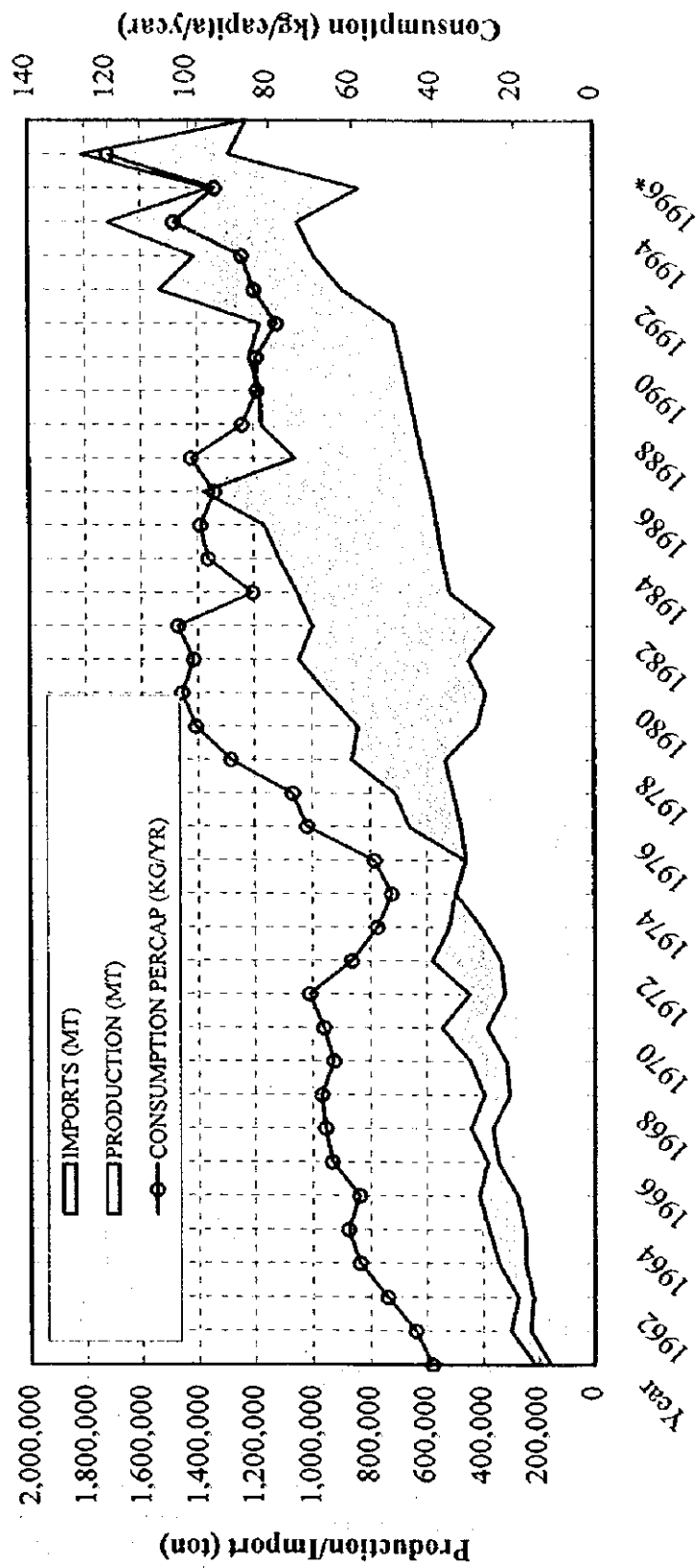
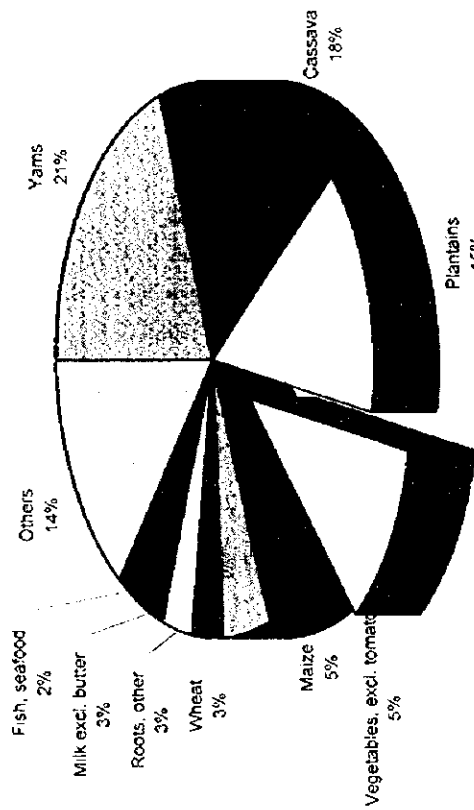


Fig. B.1.2 Production and Export Value of Cacao and Coffee



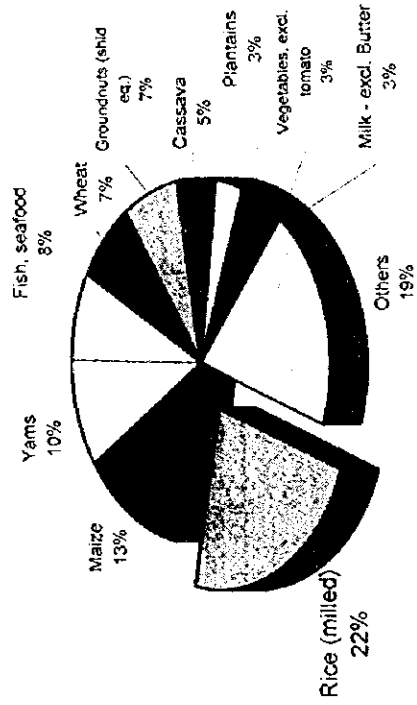
Source * FAOSTAT, Dec. 1998

Fig. B.2.1 Domestic Production and Import of Rice

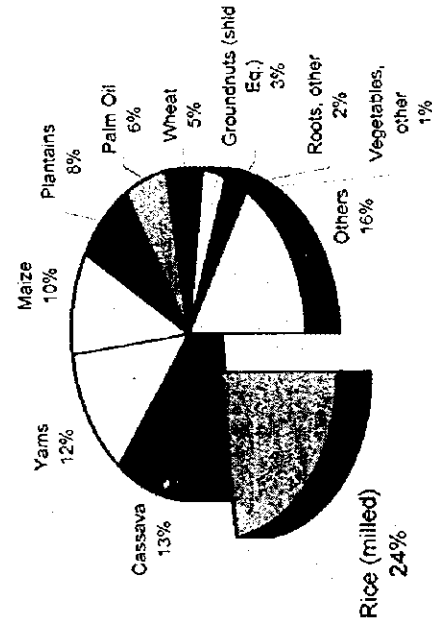


Food Consumption (kg.year)

Rice (milled) 11%



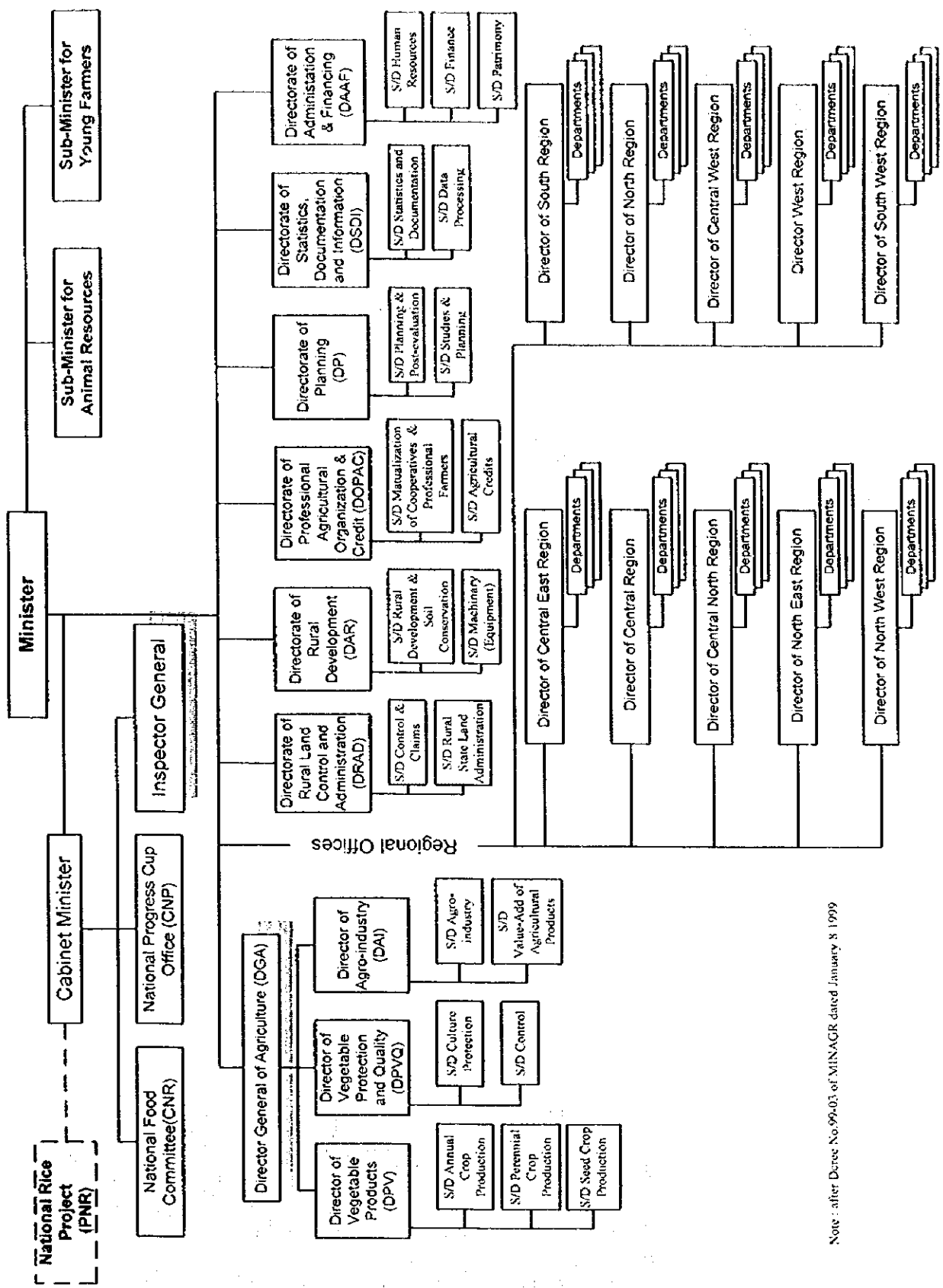
Protein (g/day/capita)



Calories (Day/Capita)

Source : FAOSTAT, 1998

Fig. B.2.2 Food Consumption and Nutrition Supply in Côte d'Ivoire (average 1992-96)



Note : after Decree No.99-03 of MINAGR dated January 8 1999.

Fig. B.2.3 Organization of Ministry of Agriculture and Animal Resources

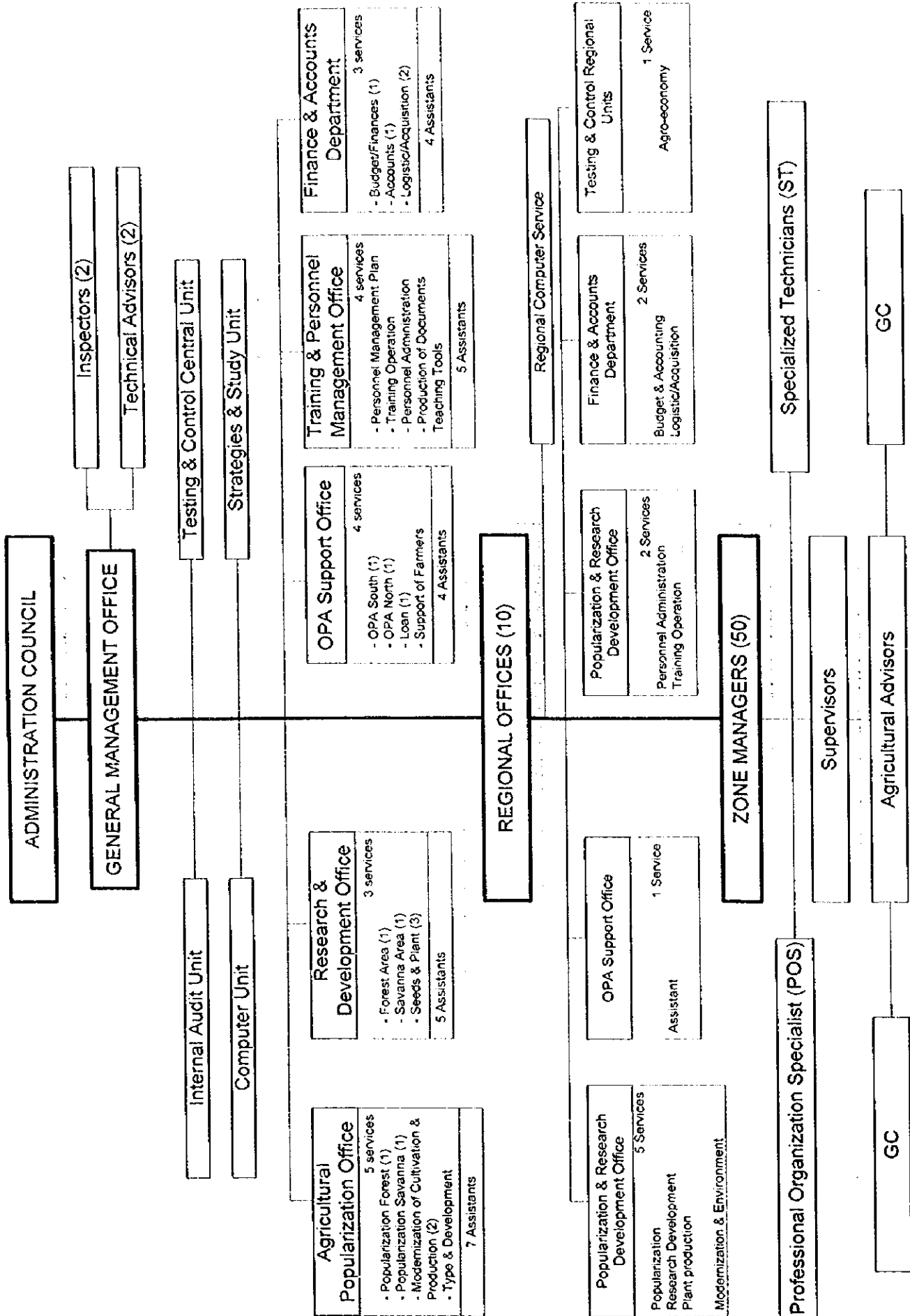


Fig. B.2.4 ANADER Organization PNASA 2(1998)

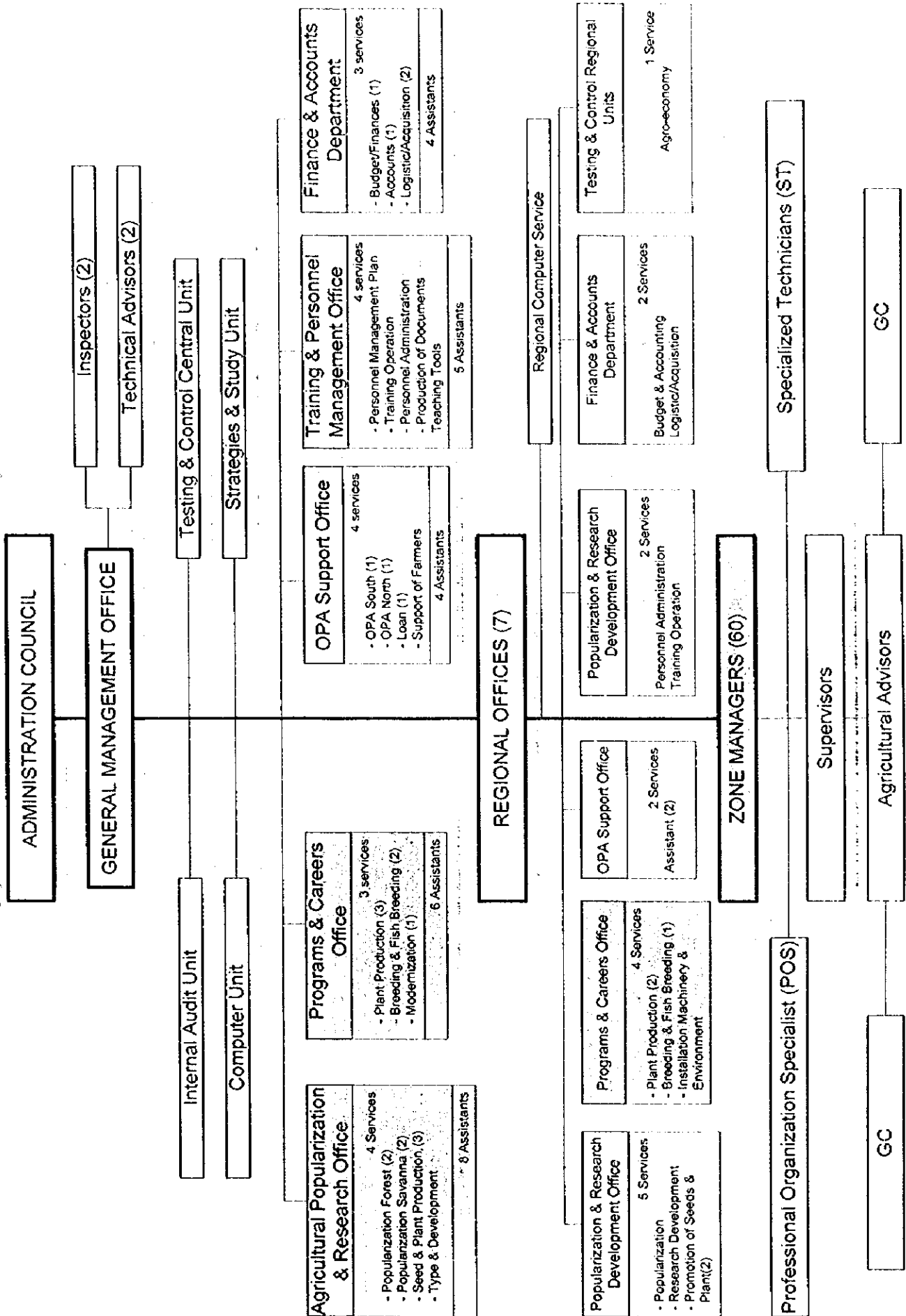


Fig.B.2.5 ANADER Organization PNASA 2(1999)

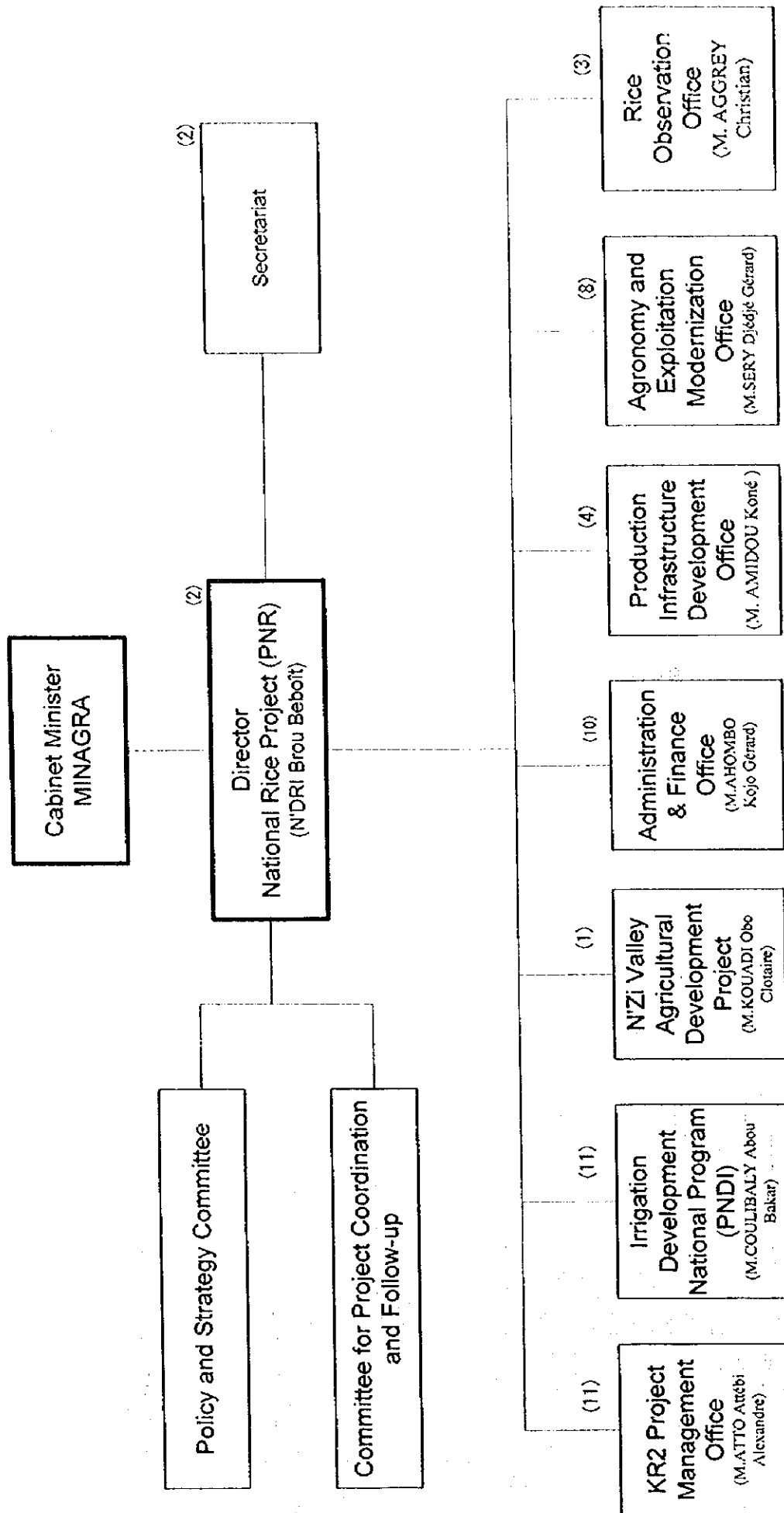


Fig. B.2.4 Organization of National Rice Project (PNR)

Source: PNR, Dec. 1998

MINISTRY OF HIGH EDUCATION,
RESEARCH AND TECHNICAL INNOVATION

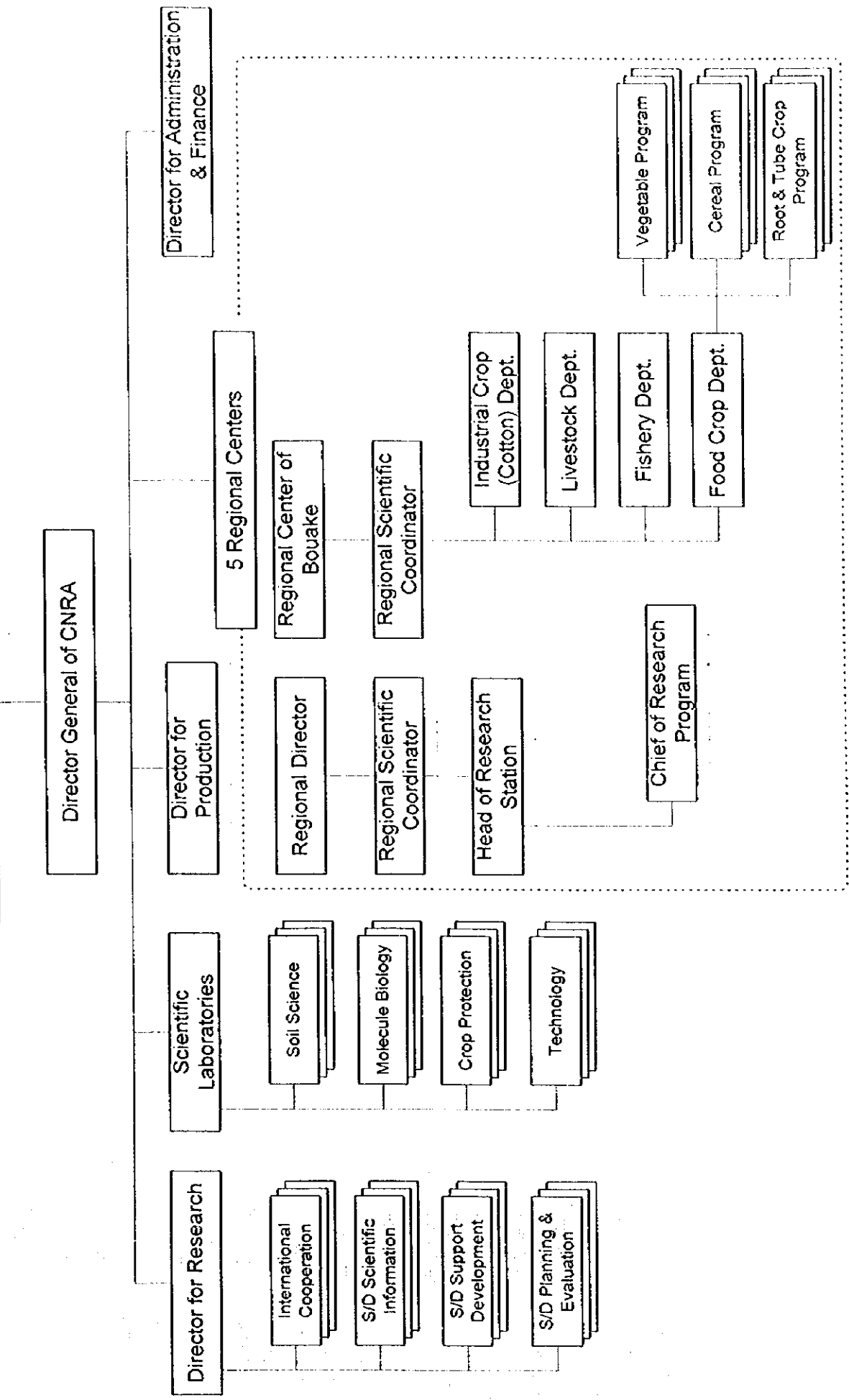


Fig. B.2.4 Provisional Organization of National Research Center for Agriculture (CNRA)

C AGRICULTURE AND FARM HOUSEHOLD ECONOMY

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C : AGRICULTURE AND FARM HOUSEHOLD ECONOMY

C.1 Agriculture In The Study Area

The existing agricultural conditions in 1997 in the Study Area has been made clear through the two interview surveys carried out for the all farmers (912 farmers) having farming land in the Study Area and for the 100 farmers selected from the above farmers in more details with questionnaire. Also the detailed survey for the agriculture of the Project Area in 1998 was carried out for the 70 farmers having farming land in the area with questionnaires. These surveys were carried out in cooperation with the extension workers of ANADER, San-Pedro. Their quaternaries are shown in Volume III : Data Book.

C.1.1 Number of Farm Households and Farming Land

Total number of farm households in the Study Area is estimated at 912, and the total farming land is estimated at 5,458 ha with the average holding land of 6.0 ha per farmer. Based on the land classification, it is analyzed that in the Study Area, tree crop land shares 71 % of the total farming land with the holders of 83.4 % of the total farm households. The remaining land is shared by upland (15 %) with the holder of 15.0 % and lowland (14 %) with the holder of 14 %. In the Project Area, 62 % of the farming land is classified to lowland with the holder of 94.3 % of the total farmers, followed by upland (20.0 %) and tree crop land (17.6 %). The total holding land per farmer is 6.7 ha being slightly larger than that of the Study Area.

Number of Farm Households and Farming Land

	Land Classification	Total area		No. of farmers holding land		Area per farmer (ha)	
		(ha)	(%)	(No.)	(%)	Whole	Holder
Study Area	Lowland	770	14.1	635	69.6	0.8	1.2
	Upland	819.3	15.0	618	67.8	0.9	1.3
	Tree crop land	3868.2	70.9	761	83.4	4.3	5.1
	Total	5,457.5	100.0	912	100.0	6.0	6.0
Project Area	Plain lowland	234.9	50.3	66	94.3	3.4	3.6
	Valley lowland	56.4	12.1	22	31.4	0.8	2.6
	Upland	93.6	20.0	52	74.3	1.3	1.8
	Tree crop land	82.0	17.6	32	45.7	1.2	2.6
	Total	466.9	100.0	70	100.0	6.7	6.7

C.1.2 Crop Production

(1) Study Area

The yield in 1997 was remarkably low, especially in the lowland paddy due to severe drought and submergence, which was estimated at 33.9 % of the high-yield year. The average yield per ha in 1997 was 1,178 kg for lowland paddy, 866 kg for maize, 2,314 kg for cassava, 343 kg for cacao and 447 kg for coffee. It is noticed that in the recent years, the yield of cocoa has tendency to decrease. The cause seems to be disease and soil. At present, the scientific study is being carried out in IDEFOR.

The total crop production in the Study Area was estimated at 3,769,996 kg in 1997. The production of lowland paddy had the largest share of 24.1 % of the total production even in the severe drought year, followed by cacao (23.4 %), cassava (13.8 %), coffee (12.7 %), maize (8.9 %), rubber (5.3 %), yam (5.0 %), oil palm (3.4 %), banana (3.0 %) and upland rice (0.3 %). On the other hand, the total crop production in the high-yield year was estimated at 7,986,082 kg corresponding to 2.1 times of 1997. The lowland paddy shared 33.5 % of the total production.

(2) Project Area

The greatest crop in the Project Area is lowland paddy sharing 36.7 % of the total cropped area, followed by maize (22.6 %), cassava (16.3 %) and tree crops such as coffee (13.6 %) and cacao (5.1 %) in 1998. The average yield per ha in 1998 was 1,118 kg for lowland rice, 701 kg for maize, 4,222 kg for cassava, 494 kg for coffee and 250 kg for cacao, which corresponded to 94.9 %, 80.9 %, 182.5 %, 110.5% and 72.8 % of those of the Study Area in 1997, respectively.

Crop	Study Area (1997)			Project Area (1998)		
	Area (%)	Production (%)	Yield (kg/ha)	Area (%)	Production (%)	Yield (kg/ha)
Lowland paddy	14.1	24.0	1,178	36.7	30.2	1,118
(Plain lowland)	-	-	-	(32.7)	(28.2)	(1,171)
(Valley lowland)	-	-	-	(4.0)	(2.0)	(682)
Maize	7.1	8.9	866	22.6	11.7	701
Cassava	4.1	13.8	2,314	16.3	50.5	4,222
Yam	1.5	5.0	2,268	0.4	1.5	5,000
Upland Rice	0.2	0.4	974	0	-	-
Vegetable	2.0	-	-	2.0	3.2	-
Coffee	19.7	12.7	447	13.6	1.6	494
Cacao	47.7	23.4	343	5.1	0.2	250
Rubber	2.9	5.3	1,247	0	0	0
Oil palm	0.3	3.4	(8,000)	0	0	0
Cola	0.5	0.1	80	0	0	0
Banana	0.1	3.0	(12,500)	1.7	-	-
Others	0	-	-	1.6	1.1	-
Total	5,457 ha	3,769,996 kg	-	179.6 ha	243,990 kg	-

C.1.3 Farming

(1) Farming Type

Farming type in the Study Area can be classified into 7 types as shown in below Table. The most popular type is mixed farming of lowland, upland and tree crop, which shares 67.1 % of the total area and 48.7 % of the total farmers. The total area of single farming type such as lowland farming, upland farming and tree crop farming occupies 11.1 % of the total area and 23.1 % of the total number of farmers.

In the Project Area, 4 farming types exist. The most popular type is mixed crop farming composing by lowland, upland and tree crop, and shares 59.4 % of the total farming land with 43.0 % of the total farmers. The (L) + (U) farming shares 22 % of the land with 31.0 % of the farmers, the lowland farming shares 17.4 % of the land with 23.0 % of the farmers and the (L) + (T) farming shares 2.9 % of the land with 3.0 % of the farmers. Single farming type is lowland type farming only.

Farming Type	Study Area				Project Area			
	Area by Type		No. of Farmers		Area by Type		No. of Farmers	
	(ha)	(%)	(No.)	(%)	(ha)	(%)	(No.)	(%)
Lowland (L)	53	1.0	40	4.4	83.0	17.4	16	23.0
Upland (U)	38	0.7	28	3.1	0	0	0	0
Tree Crop Land (T)	512	9.4	142	15.6	0	0	0	0
(L) + (U)	158	2.9	58	6.3	97.0	20.3	22	31.0
(L) + (T)	563	10.3	118	12.9	14.0	2.9	2	3.0
(U) + (T)	468	8.6	82	9.0	0	0	0	0
(L) + (U) + (T)	3,657	67.1	444	48.7	283.9	59.4	30	43.0
Total	5,449	100.0	912	100.0	477.9	100.0	70	100.0

(2) Farming Income

The net crop income in the Study Area was estimated at F.CAF 281,481 per farmer with F.CAF 47,042 per ha in 1997 and F.CAF 1,237,241 per farmer with F.CAF 206,793 per ha in high-yield year. The income in 1997 corresponded to only 23 % of the high-yield year. On the other hand, the net income per farmer in the Project Area in 1998 was only 39.3 % of that in the Study Area in 1997 and was 91.6 % on per ha, in spite of the crop situations in 1997 and 1998 were nearly the same. Such low farming income in the Project Area is caused by the less cropped area due to low land utilization and less income per ha. The details of the farming income are shown in Table C.1.1 to C.1.4.

Area	Cropped Year	Area Cropped per Farmer (ha)	Net Crop Income per Farmer (F.CAF)	Net Crop Income per ha (F.CAF)
Study Area (A)	1997	5.98	281,481	47,042
Study Area	High-Yield Year	5.98	1,237,241	1,237,241
Project Area (B)	1998	2.57	110,542	43,084
(B)/(A) (%)	-	43.0	39.3	91.6

Regarding the net income by farming type, the mixed crop farming had the maximum net income per farmer among the farming types, which was 37% higher than the average in the area. While, the upland farming showed the minimum net income, which corresponded to 8% of the average in the area, due to the smallest farming area and the minimum net income per ha. The net income of the lowland farming corresponded to 42% of the average in the area, in spite of the greatest net income per ha among the farming types. The farming situation in 1997 evaluated by farmers themselves was the worst in upland farming and was not good in lowland farming, (L) + (U) farming, (L) + (T) farming and (L) + (U) + (T) farming, and was standard in tree crop farming and (U) + (T) farming.

The net crop income in the Study Area mainly originated in tree crops. While that of the Project Area only originated in upland crops. The net income of lowland rice in the Project Area was minus F.CAF 2,935,228 due to both the low land utilization rate by rain-fed field condition and the low yield. In the Study Area, there are two types of lowland, namely, valley bottom lowland and plain lowland. Though both the lowlands are almost all in rain-fed condition, water source of the valley bottom lowland is more stable than that of the plain lowland.

Type of Farming	Study Area				Project Area			
	Area		Farming Income		Area		Farming Income	
	(ha)	(%)	(F.CAF)	(%)	(ha)	(%)	(F.CAF)	(%)
Lowland	770	14.4	18,203,570	7.1	68	38.0	-2,935,228	-137.9
Upland	710	13.3	8,777,921	3.4	73	40.8	10,684,956	138.1
Tree Crop	3,868	72.3	229,728,995	89.5	38	21.2	-11,797	-0.2
Total	5,348	100.0	256,710,486	100.0	179	100.0	7,737,932	100.0

(3) Labor Input and Production Cost

The present labor input for crop production is shown in Table C.1.5 for the Study Area and Table C.1.6 for the Project Area. The labor input for crop production in the Study Area is the minimum. In the annual crops, around 80 % of the total labor input is allotted to the land preparation, seeding and harvesting, which are the minimum requirement indispensable for crop cultivation. The remainder is allotted for weeding, application of fertilizer and disease and pest control,

except bird control for paddy. Regarding the labor input by crop, the highest labor input is paid for vegetable cultivation, followed by tree crops. Labor input for upland crops is lowest where the input is nearly half of paddy cultivation (Table C.1.6). The total labor input for lowland paddy cultivation was 217 man-day/ha in the Project Area, of which 5 %, 9 %, 5 %, 2 %, 9 % and 70 % was paid for land preparation, sowing and transplanting, weeding, harvesting and bird control, respectively (Table C.1.6). Such extremely high labor input paid for bird control is due to the isolated small paddy fields where the bird attack is concentrated.

The present labor wage is 1,100 F.CAF/day on average in the project Area. The wage is differed by farm works from 750 F.CAF/day for driving away of birds to 1,800 F.CAF/day for chemical application work (Table C.1.7).

Regarding the production cost, as shown in below Table, about 85 % of the crop production costs is allotted to labor cost. The details are shown in Table C.1.8 and C.1.9.

Crop	Crop Production Costs						Total
	Seed/Seedling	Fertilizer	Herbicide	Pesticide / Insecticide	Machinery	Labor	
Paddy (Direct-sowing)	17,308 (7.6%)	9,244 (4.0%)	10,174 (4.5%)	2,794 (1.2%)	14,593 (6.4%)	174,180 (76.3%)	228,292 (100.0%)
Maize	1,438 (11.0%)	0 (0%)	0 (%)	0 (0%)	0 (0%)	11,620 (89.0%)	13,058 (100.0%)
Cassava	2,000 (2.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	90,860 (97.8%)	92,860 (100.0%)
Vegetable*	15,338 (3.7%)	28,948 (6.9%)	21,185 (5.1%)	0 (0%)	0 (0%)	350,743 (84.3%)	416,214 (100.0%)
Coffee**	2,575 (1.4%)	0 (0%)	0 (0%)	6,120 (3.4%)	700 (0.4%)	169,440 (94.8%)	178,835 (100.0%)
Cacao**	225 (0.1%)	0 (0%)	0 (0%)	1,091 (0.4%)	381 (0.2%)	244,017 (99.3%)	245,651 (100.0%)

* Tomato, Egg-plant, Okra, Cucumber, ** Fruit-bearing tree
Source: F/S survey, JICA Study Team

(4) Consumption and Sale of Products (Table C.1.10 and C.1.11)

In the Study Area, in 1997, 39 % of the paddy farmers, 21% of the maize farmers, 33 % of the cassava farmers and 67 % of the yam farmers sold 45 %, 26 %, 30 % and 25 % of the products with the prices of 159, 104, 53 and 100 F.CAF/kg on average, respectively. The markets sold the products are mainly local ones. On the tree crops, all the products of cacao, coffee, rubber, cola and oil palm were sold with the prices of 402, 520, 172, 1,000 (white variety) and F.CAF 32 /kg on average, respectively. The markets are mainly contract company on cacao, coffee, rubber and cola and wholesale market on oil palm.

In the Project Area, in spite of the extremely low productions, 50 % of the food crops produced, 88 % of the vegetable produced and 100 % of the tree crop produced were sold by the produced farmers of 80 %, 100 % and 100 %, respectively in 1998. Especially, paddy was sold 843 kg (62 %) out of 1,360 kg produced, and the remainder was consumed at home by 7.5 persons of the family members, which corresponded to only 45 kg per person per year in rice.

C.1.4 Lowland Rice Cultivation

In the Study Area, there are two morphological types of lowland, that is, valley bottom lowland and plain lowland. The former share about 70 % of the lowland in the Study Area and the latter share about 30%, which is concentrated in the Project Area.

(3) Field Conditions and Lowland Utilization

Almost all of the lowland paddy fields in the Study Area are rain-fed field. At present, irrigable fields are limited to only 10 to 20 ha located near the San-Pedro river-mouth. Irrigation to these fields is carried out with pumps from the river. However, in sever drought years, the river water is unusable due to salinity. The existing irrigation and drainage facilities in the plain lowland of the Project Area are not function and the surface of the fields is not level. Such field conditions largely restrict cropping time of paddy and bring unstable yields. According to the data obtained from the interview survey, the plain lowland utilization in the Project Area during the last 5 years was estimated at only 26.9 % of the plain lowland on average as shown in table below: On the valley lowland, the land utilization ratio is higher than that of the plain lowland because of the more stable irrigation water.

Plain Lowland Utilization in the Project Area

	1994	1995	1996	1997	1998	Average
No. of farmers possessing plain lowland (A)	67	67	67	67	67	67
No. of farmers cultivated paddy (B)	49	43	51	48	51	48
(B)/(A)	73.1%	64.2%	76.1%	71.6%	76.1	72.2%
Area of plain lowland (ha) (C)	234.9	234.9	234.9	234.9	234.9	234.9
Area cultivated paddy (ha) (D)	56.7	59.9	74.8	63.0	58.7	62.6
Area cultivated other crops (ha) (E)	0.5	0.4	0.6	0.3	0.6	0.5
(D+E)/(C) (%)	24.4%	25.7%	32.1%	26.9%	25.2%	26.9%

Source: Feasibility Study, JICA Study Team

About the distance from house to field in the Study Area, 24 % of the fields locates within one (1) km from their living houses, 59 % is one (1) to five (5) km and the remainder is over five (5) km. The size of plots is below 0.1 ha in 83 % of the fields.

(2) Number of Family Member and Agricultural Labor Force

The number of family member in the Study Area is estimated at 8.6 persons per farm household, in which 6.4 persons live together in the same house. Among them, the economic active population is 3.6 persons (2.3 men) including 2.2 agricultural labors (1.5 men).

In the Project Area, the number of family member was estimated at 7.5 persons, 4 males and 3.5 females. The age consists of 29 % in below 10, 69 % in 11 to 54 and 2 % in above 55 years old. The exclusive agricultural labor is 2.5 persons and the temporary agricultural labor is 2.5 persons per farm household. The average age is 29 in youngest and 44 in oldest in the exclusive labor, and 11 in youngest and 24 in oldest in the temporary labor (Table C.1.12).

(3) Machinery and Agricultural Tools

In the Project Area, 21 farmers (30.0 %) have one unit of power tiller, one farmer (1.4 %) has a pair of draft animal, 23 farmers (32.9 %) have a human power sprayer, one farmer (1.4 %) has a motor pump and one farmer (1.4 %) has a harvester. Among them, 62 % of the power tillers, 25 % of the human power sprayers and the motor pump are not able to use at present (Table C.1.13).

(4) Type of cultivation

In the Study Area, 62 % of the farmers had direct-sowing with broad casting under dry field condition, 33 % had direct sowing with drill sowing under dry field condition and 5 % had transplanting under wet or submerged field conditions (Table C.1.14). In the Project Area, 73 %

of the farmers had direct-sowing with broad casting (63.5 %), hill sowing (1.6 %) and mixed sowing of them (7.9%), 3 % had transplanting and 24 % had mixed cultivation of direct-sowing and transplanting (Table C.1.15).

In the transplanting in the wet fields, seedlings are planted in the holes made with handle of daba (hoe). The mixed cultivation of transplanting and direct-sowing is applied for the unlevelled field; that is, the transplanting cultivation is applied for the ill-drained parts of the field.

(5) Cropping Season (Table C.1.16)

In most fields, sowing was taken from March to June with the peak in May, and harvesting was done around 4 months later from August to September.

(6) Variety and Seeds (Table C.1.14 and Table C.1.15)

BUAKE-189 is the most common with 73 % of the farmers in the Study Area and 94 % in the Project Area. The remainder is WITA-9, SC-1 and others. In the Study Area, 92 % of the farmers used own produced seeds, but in the Project Area, 67 % used own seeds. The remainder used purchased seeds from ANADER or friend. The average seed rate was 71 kg/ha for direct sowing culture and 45 kg/ha for transplanting culture. 13 % of the farmers in the Study Area and 25 % of the farmers in the Project Area had pre-germination treatment of seeds with soaking in the water for 2 days.

(7) Nursery

In the Project Area, a half of the transplanting farmers applied upland nursery and the other applied submerged nursery. 92 % of the nursery located in the main fields. The nursery period ranged from 14 days to 30 days with the average of 18 days (Table C.1.15). On the nursery management, 1.6 times of weeding, 1.1 times of fertilizer application and disease and pest control, and once a day of water management was taken during the nursery period.

(8) Land Preparation of Main Field

Prior to plowing, land cleaning is carried out by burning down or cutting of weeds. In the Project Area, 44 % of the farmers did not perform plowing, 35 % performed once and 22 % twice under the wet field condition (67 %) and the dry field condition (33 %) by family (71 %) and contractor (29 %) with daba (55 %), power tiller (36 %) and tractor (10 %) (Table C.1.14).

In the Project Area, plowing was done once by family (82 %), contractor (15 %) and family + contractor (3 %) with power tiller (75 % of the farmers), human (23 %) and draft animals. 20 % of the farmers had 2nd plowing (harrowing and puddling) under the field condition of wet (69 %), dry (15 %) and submerged (15 %) (Table C.1.15).

(9) Weeding (Table C.1.15 and Table C.1.17)

Weeding is carried out more intensively in direct-sowing fields than in transplanting fields though both the fields have weeding more than once in the growing period of paddy. In the transplanting fields, mainly manual weeding is taken by family labor, but in the direct-sowing fields, weeding with herbicide is common.

(10) Application of Fertilizer

In the Study Area, the number of farmers applied N, P and K in 1997 were 23.6 %, 20.0 % and 20.0 %, respectively (Table C.1.17).

In the Project Area, the number of farmers applied fertilizer is more than the Study Area. The basal was applied 10, 18, 18 kg/ha in N, P, K each with fertilizers of 10-18-18 or 10-20-20. For top-dressing, 22 to 25 kg/ha of N with Urea was applied at 24 days after sowing or after transplanting (Table C.1.18).

(11) Disease and Pest Control (Table C.1.17 and Table C.1.19)

In the Study Area, 27.3 % of the farmers controlled disease and pest. In the Project Area, 43 % of the farmers controlled pest with Furadan. In the Study Area, it seems that control of disease and pest is not economical at present due to the low degree of the damage. However, attention should be paid for Rice Yellow Mottle Virus because there were found out some fields completely infected with this Virus in the area of Polo II, San-Pedro being adjacent to the Project Area in the main season of 1998.

(12) Harvest and Post Harvest (Table C.1.20 and Table C.1.21)

In the plain lowland fields, harvest was carried out by cutting hills with sickle in 94 % of the fields, but in the valley lowland fields, picking panicles with knife was taken in the fields more than 20 %. Threshing by striking panicles against board is common. The drying of harvested grains is done at house yard and field. Harvested grains are stored in living house or storage. The milling of rice with private milling machine is common, but occasionally use manpower at home. The milling charge is 20 F.CAF/kg on average with the range of 15 to 25 F.CAF/kg in white rice.

C.1.5 Upland Crop Cultivation

(1) Cropping Pattern and Land Utilization

Main upland crops in the Study Area are maize (7.1 % of the total agricultural land), cassava (4.1 %), vegetables (2.0 %), yam (1.5 %) and upland rice (0.2 %). These crops are cultivated in the main rainy season from April to August in the mixed crop cultivation of maize and cassava, maize and upland rice, or in the single crop cultivation, but the long duration crops such as cassava and yam are cultivated throughout a year. Sometimes, short duration maize is cultivated in the 2nd rainy season. The upland utilization in the Study Area in the last 6 years is estimated at 28 %, 47 % in the wet season and 8% in the Dry season as shown in below. It is considered that intensive land utilization is key point for improvement of upland farming in the Study Area.

Upland Utilization in the Study Area

		Wet season	Dry season	Total
Lowland	No. of samples	59 fields	59 fields	59 fields
	No. of cropped seasons in the last 6 season	3.7	0.1	3.8
	Percentage of cropped seasons	62%	2%	32%
Upland	No. of samples	89 fields	89 fields	89 fields
	No. of cropped seasons in the last 6 season	2.8	0.5	3.3
	Percentage of cropped seasons	47%	8%	28%

(2) Upland Rice Cultivation

1) Variety (Table C.1.14)

83 % of the farmers used local varieties such as *Klouon*, *Kouissa*, *Namlondji* and *Pohssounman*, and 17 % used B-189. The duration of these local varieties is around 4 months

2) Land preparation (Table C.1.14)

Prior to sowing, all fields had land cleaning with burning weeds. Plowing was done in the fields of 43.6% with use of daba by family labor (53.3%) or contractor (40.0%), and the remainder was not plowed.

3) Sowing (Table C.1.14)

Sowing was done from March to April by drill sowing (76.2 %) or broad casting (23.8 %) with the seed rate of 57 kg/ha on average. Non selected or non pre-germinated own produced seeds were used.

4) Weeding, fertilizer application and disease and pest control (Table C.1.17)

Weeding was done in all the fields by manual (94.7 %) and with chemicals, but there was no fields applied fertilizer and controlled disease and pest.

5) Harvest and post-harvest (Table C.1.20)

Harvest was taken in August by picking panicles (82.1%) or cutting hills (20.5 %). Threshing was done by beating panicles on board (83.3 %), trampling them (12.5 %) or by manpower thresher (4.2 %). Drying of grains is mainly taken at house yards (38.2 %) or fields (29.4 %). 74.4 % of the farmers stored paddy in storage and 33.3% in living house. All the farmers used machine for polishing rice, but 69 % of the farmers polished rice at home by manpower also.

(3) Other Upland Crop Cultivation (Table C.1.22)

Land preparation was done as same as upland rice. Weeding was done almost all fields, but the farmers applied fertilizer were negligible except vegetable cultivation where 21% to 24 % of the farmers applied fertilizer. Control of disease and pest was taken by 42 % to 54 % of the farmers for vegetable cultivation, but negligible for maize, cassava and yam.

C.1.6 Tree Crop Cultivation (Table C.1.22)

In the Study Area, almost all the farmers had weed control for tree crop cultivation, but the farmers applied fertilizer were only 10 % for cacao and 5 % for coffee. The farmers controlled disease and pest were 58 % for cacao, 40 % for rubber and 12 % for coffee. Of late years, the decrease in yield of cacao becomes the biggest problem among the cultivators. Based on the field survey of JICA Study Team, 1) production cost of cacao is F.CFA 110,979/ ha, 2) unit price in 1998 was F.CFA 402/kgm, therefore, 3) marginal yield is estimated 280 kg/ha. From the data of the interview survey, it is estimated that the deficit farming area of cacao amounts to 27 % of the cropped area of cacao in the Study Area with 35% of the farmers as shown below:

Cacao Farm Condition	No. of cacao farmers		Area cultivated	
	(number)	(%)	(ha)	(%)
Young tree farmers before bearing *	118	19	206	8
Farms of marginal yield	216	35	696	27
Farms yielding more than 280 kg/ha	284	46	1,675	65
Total Farmers	618	100	2,577	100

Note: *trees younger than 4 years)

Source : Inventory survey , JICA, 1998

The deficit farming is caused by the decreased yield due to seems to unsuitable natural conditions for cacao cultivation such as drought condition during December to February (optimal rainfall is 100 to 200 mm/month) and acidified soil (below 6.0 pH set back the growth). In due consideration of such farming situation of cacao, ANADER has recommended coffee cultivation

in place of cacao.

Important Natural Conditions of the Study Area for Cacao Cultivation

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	Study Area*	17.5	48.3	82.9	108.0	240.0	366.0	91.4	66.5	76.2	128.0	90.3	38.8
	Optimal Growth	100 mm to 200 mm/month											
Soil pH (water)	Study Area**	5.0 (Average of 64 points), 5.8 (Maximum), 4.4 (Minimum)											
	Optimal Growth	Above 6.0											

* IDEFOR, San-Pedro station, ** JICA-BNETD, 1998 and ORSTOM

C.1.7 Yield Constraints and Farmer's Intention

Yield constraints of major crops being ranked by the farmers in the Study Area are shown in Table C.1.23. The greatest yield constraint of the annual food crops was water stress followed by soil fertility and weeds. On cassava, soil fertility was the greatest constraint rather than water stress. This ranking seems to be reasonable because cassava was relatively tolerant to drought. In vegetables, the greatest constraint was disease and pest. In the perennial tree crops, disease, pest and soil have become the greatest constraint than the water stress. In commercial crops, marketing price has become large yield constraint.

Concerning the way to increase farming income, as shown in Table C.1.24, farmers gave the highest priority to the increase of yield and gave the following ranks to the improvement of market and expansion of land and introduction of new crops. Looking from the farming types, the upland farmers who have the smallest income gave the highest priority to the expansion of land. Their desirable area of land was 10 ha. While, the lowland farmers gave the least priority to the extension of land with the ideal land area of 3 ha. The results suggest following the two points. In the present lowland farming, improvement of irrigation and drainage facilities is urgent than expansion of farming land, and the lowland farming requires more extensive labor force than the upland farming or the tree crop farming. In the farming of (L)+(U), the farmers expected an introduction of tree crops with expansion of the land to 8 ha. It is worthy to note that the farmers of (U)+(T) farming and (L)+(U)+(T) farming gave the highest priority to strengthening of GVCs, which suggests the GVCs' activities indispensable for cash crop farming.

Regarding the farmer's expectation to this project, as shown in Table C.1.25, the farmers in the Study Area gave the highest expectation to the technology support as well as irrigation facility. The lowest expectation was given to the social support and financial support. The lowland farmers expected improvement of irrigation and drainage facilities than technology support.

C.1.8 Animal Production

In the Study Area, poultry is the most common, which was raised by 60% of the farmers in the area in 1997. Sheep, goat and pig were bred by 8%, 8% and 5% of the farmers in the area, respectively. There are no farmers bred cattle in the Study Area, except a pair of draft cattle in the Project Area. The number of livestock raised per farmer was nine (9) on sheep, seven (7) on goat, fourteen (14) on pig and thirty-six (36) on poultry in 1997. The number of livestock sold was one (1) head on sheep, five (5) on pig and seven (7) on poultry per farmer in the year. Thirteen (13) pieces of egg were produced by a head per year and the price of egg sold was F.CFA 58 per piece. While, one (1) seep, two (2) pigs and ten (10) poultry were consumed at home per year. In recent years, new-castle disease is prevailing in the Study Area and the Government encourages farmers to get vaccination against the new-castle disease. (Table C.1.26 and Table C.1.27)

The raising of livestock in the Project Area is inactive compared with other places in the Study Area due to poor production of self-sufficing feed.

C.2 Master Plan Study of Agricultural Development

C.2.1 Lowland Agricultural Development Programs

The objective area for irrigation development in the Study Area is estimated at around 1,326 ha in total, that is; 766 ha in San-Pédro paddy area, 430 ha in Fahé of the San-Pédro Dam downstream, 130 ha in Ctp. Colonel. From the viewpoints of ensuring own foodstuff and contribution to the national policy, it is proposed to introduce rice double cropping programs suitable for these irrigation development areas. However, to secure the best farming income and the more effective use of irrigation water, rice double cropping programs combined with vegetables are also proposed.

(1) Required Agricultural Infrastructure

In order to accomplish of the lowland agricultural development programs, the following agricultural infrastructure improvement measures are required:

1) Stabilization of irrigation water

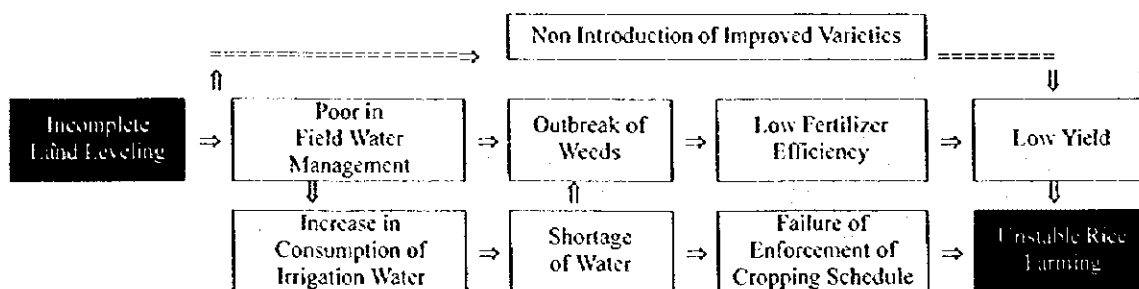
- Ensuring water source: This subject is indispensable for stabilization of lowland farming.
- Improvement of irrigation canal: The canal density should be as same as the level to be able to carry out the irrigation schedule.

2) Development of drainage canal

Many of the fields have low productivity because of poor drainage resulting in decrease of yield and abandonment of cropping due to submergence.

3) Land leveling

Land leveling is the basic practice for the success in lowland rice farming. One of the great constraints on lowland rice farming in Africa is weeds, in general. Water shortage and unlevelled field conditions have brought the severe outbreak of weeds as shown below: In this project, land leveling by machinery at the stages of land reclamation and land preparation are to be planned.



(2) Rice Double Cropping Program

Two type of rice double cropping programs, for transplanting culture and for direct sowing culture are proposed in consideration of the present habitual rice cultivation practice.

a) Variety to be used

New rice varieties WITA 7, WITA 8 and WITA 9, recently released from WARDA are introduced

in both the programs of transplanting culture and direct sowing culture. The characteristics of these varieties are shown in C.2.1 of this report.

b) Cropping schedule

Two cropping schedules for transplanting culture and direct sowing culture are described in C.3.1 and shown in Fig.C.3.1.

c) Mechanized land preparation

Mechanized land preparation with power tiller was introduced in these programs because well land leveling is the basic practice for the success in lowland rice culture as previously stated. The cost of mechanized land preparation with power tiller is estimated at F.CFA 65,092/ha including the cost for the 1st and 2nd plowing (Table C.3.5).

4) Improved cultivation method

Details of the improved cultivation methods are shown in Table C.3.1 for transplanting method and Table C.3.2 for direct-sowing method.

5) Production, production costs and income

The target yield of paddy is set at 5,500 kg/ha for the transplanting cultivation, and 4,500 kg/ha for the direct-sowing cultivation. The production cost and income of the rice double cropping programs in 1.5 ha of paddy field are shown in Table C.3.3 and summarized as below:

		Production (kg/ha/year)	Unit Price (F.CFA/kg)	Production Cost (F.CFA/ha/year)	Gross income (F.CFA/ha/year)	Net Income (F.CFA/ha/year)
Present	In 1997	1,178	159	163,661	187,302	223,611
	High-yield year*	3,478	159	163,661	553,002	389,341
With Project	Transplanting	11,000	157	837,580	1,727,000	889,420
	Direct Sowing	9,000	157	754,500	1,413,000	658,500
	Average	10,000	157	796,040	1,570,000	773,960

*: Crop cutting survey by ANADER in high yield year.

(3) Rice and Vegetables Cropping Program

Two types of rice and vegetable cropping programs, that is, Rice and Tomato cropping program and Rice and Lettuce cropping program, are proposed as shown in Fig. C.3.2. In this case, the vegetables are to be introduced to an area of 0.1 ha of the paddy field 1.5 ha, which will result in estimated net annual income twice that of the rice double cropping. Though a remarkably high income is obtained, the cultivation area will be restricted by the relationship between the demand and the supply of market and the available labor in the area. The estimated incomes and expenditure of the rice, tomato and lettuce are shown in Table C.3.4, and those of the rice cultivation combining tomato and lettuce farming in the total irrigation potential area, 965 ha, are shown the table below.

Total Production and Net Income of Rice Double Cropping Program at Mature Stage

Cropping pattern	Season	Area (ha)	Crop	Yield (kg/ha)	Production (ton)	Gross Income (F.CFA 1,000)	Production Cost (F.CFA 1,000)	Total Net Amount (F.CFA/year)
Rice + Rice	Wet	836	Rice	5,000	4,182	656,574	332,904	323,670
	Dry	836	Rice	5,000	4,182	656,574	332,904	323,670
Rice + Tomato	Wet	64	Tomato	5,000	1,286	900,200	61,776	838,124
	Dry	64	Rice	20,000	322	50,476	25,593	24,883
Rice + Lettuce	Wet	64	Rice	5,000	322	50,476	25,593	24,883
	Dry	64	Lettuce	20,000	1,286	128,600	39,313	89,287
Total	Wet	965			5,790	1,607,250	420,273	1,186,977
	Dry	965			5,790	835,650	397,810	437,840
	Total	1,930			11,579	2,442,900	818,083	1,624,817

(4) Appropriate Land Holding Size for Rice Double Cropping Agriculture

The agricultural development in the Study Area is expected to absorb the immigrants from the Rapide Grah Classified Forest by SODEFOR. And the re-distribution of developed land will be prepared to get the opportunity for farmers to join the project.

The estimation of minimum scale of the farmland for one farm household is made based on the following criteria:

- Farm income of the paddy double cropping shall be more than the average annual salary of Côte d'Ivoire at F.CFA 1,200,000.
- Rice double cropping income a year is F.CFA 773,960/ha (average of direct sowing and transplanting)

Then the minimum farmland requirement is estimated at 1.5 ha.

Number of Farms, Production and Net Income by Proposed Area

Area	Net area to be developed(ha)	No. of farms	Amount of production (ton/year)	Amount of net income (F.CFA 1,000/year)
Fahé, Dam downstream	300	200	3,000	232,188
Cpt. Colonel	90	60	900	69,656
San-Pedro Paddy Area	575	383	5,750	445,027
Total	965	643	9,650	746,871

C.2.2 Upland Agricultural Development Programs

(1) Intensive Use of Land

In the Study Area, the net income of upland farming is the lowest (F.CFA 113,374 /ha), which is 62 % of the tree crop farming and 29% of the lowland paddy farming (Table C.1.4). The lowest farming income is due to low yield and low land utilization resulting from the lowest input farming and the shifting cultivation. From such situation, the plan of upland agricultural development focuses on the intensive land use and increase in yield.

(2) Cropping Program

To achieve the targets, cropping programs combined with upland paddy (wet-season of the 1st year), maize (wet-season of the 2nd year) and high drought tolerant crops/varieties of cowpea (Tvu 11979, Tvu 11986, Tvu 12348, *Vigna unguiculata* L.) or groundnut in dry-season is proposed (Fig C.2.1). These cowpeas were recently selected at International Institute for Tropical Agriculture (IITA) and have been obtained the grain yields of 1 ton/ha in dry season of savanna in Nigeria. The adaptability test to the dry-season in the Study Area is making the plan in CNRA by the request of JICA Study Team.

The recommended cultivation and the estimated income and expenditure of the upland rice and the maize cultivation are shown in Table C.2.1 to C.2.4. Alley cropping food production method, in which maize or upland rice is grown in alleys formed by hedgerows of trees or shrubs of leguminous species *Leucaena leucocephala* planted along contour lines is also proposed. The alley cropping provides green manure and mulching material for companion food crops, provide prunings for browse, staking material and firewood, provide biologically fixed nitrogen to the companion crops and planting along the contours of sloping land controls soil erosion. It can easily be adopted by resource-poor farmers. The summarized results of the farming performance

are shown below. The net incomes are quite higher than that of the present farming. Moreover, the cowpeas and groundnut may contribute maintenance of fertility through the nitrogen fixation and the prevention of soil erosion by covering the soil.

Cropping Year	Cropping Season	Crop	Production (kg/ha)	Production Cost (F.CFA/ha)	Gross Income (F.CFA/ha)	Net Income (F.CFA/ha)
1 st Year	Wet-season	Upland Rice	3,000	183,575	477,000	293,425
	Dry-season	Cowpea	1,000	52,500	200,000	147,500
2 nd Year	Wet-season	Maize	3,500	170,600	364,000	193,400
	Dry-season	Cowpea	1,000	52,500	200,000	147,500
Average per Year			4,250	177,088	6720,500	390,913

C.2.3 Tree Crops Development Program

(1) Low Productivity of Cacao

The target of tree crop development program is to increase the financial returns from cacao farming. The low yield seems to be due unsuitable natural conditions for cacao cultivation such as soil drying during December to February and the soil acidity, below pH 6.0. According to the data of interview survey in the Study Area, the low productivity area of cacao is estimated at 27 % of the total cacao production area. And 35 % of the farmers under the marginal yield of 280 kg/ha ([production cost of cacao at F.CFA 110,977 /ha] / [unit price of cacao at F.CFA 402 /kg] = [276 kg/ha]). The low productivity of cacao dues to unsuitable natural condition described in C.1.6 of this report. Therefore, in the low productive cacao farming areas, a change of crop from cacao to coffee is proposed. ANADER also recommends coffee cultivation in place of cacao.

(2) Development Program

The plan changing from cacao to coffee is shown as below:

Year of change to coffee	Number of Cacao Farmers		Area Cultivated		Average Net Income* (F.CFA/ha)
	Number	(%)	(ha)	(%)	
No Change	118	19	206	8	-46,054**
2000-2005	68	11	258	10	-27,432
2006-2010	148	24	438	17	52,582
No Change	284	46	1,675	65	310,031
Total	618	100	2,577	100	-

* Average of 1997 and high-yield year

** Young tree farms before bearing

Source: Interview survey, JICA

In the plan, 258 ha (10%) of the cacao field is to be changed to coffee within 5 years from 2000 to 2005, and 438 ha (17%) in the following 5 years.

C.3 Feasibility Study of the High Priority Project

C.3.1 Rice Cultivation Plan

(1) Cropping Calendar

As shown in Fig. C.3.1, the following paddy double-cropping calendars for transplanting or direct sowing cultivation methods are proposed:

Cultivation Method	Variety to be Used	1 st Cropping		Fallow Period (days)	2 nd Cropping		Fallow Period (days)
		Sowing	Harvesting		Sowing	Harvesting	
Transplanting	WITA 7	Mar/20-May/04	Jul/26-Sep/09	46	Sep/10-Oct/25	Jan/16-Mar/02	63
	WITA 8	Mar/20-May/04	Jul/23-Sep/06	49	Sep/10-Oct/25	Jan/13-Feb/27	66
	WITA 9	Mar/20-May/04	Jul/18-Sep/01	54	Sep/10-Oct/25	Jan/08-Feb/22	71
Direct sowing	WITA 7	Mar/20-May/04	Jul/21-Sep/04	51	Sep/10-Oct/25	Jan/11-Feb/25	68
	WITA 8	Mar/20-May/04	Jul/18-Sep/01	54	Sep/10-Oct/25	Jan/08-Feb/22	71
	WITA 9	Mar/20-May/04	Jul/13-Aug/27	59	Sep/10-Oct/25	Jan/03-Feb/17	76

These are determined based on the following three conditions;

- **Evasion of harvesting times in rainfall period:** The harvesting times in both cropping seasons are set in the least rainfall period because the rainfall at harvesting time will become the most serious problem for timely operation of harvesting work and for drying of large quantities of harvested paddy (around 7.5 tons / season / farmer).
- **Set of staggering period for 45 days:** A staggering period of 45 days is set taking into considerations efficacious utilization of machinery and family labor, irrigation canal capacity, fallow periods between cropping and growing period and varieties to be introduced etc.
- **Introduction of high yielding varieties with tolerance to RYMV¹:** Three varieties, WITA 7, WITA 8 and WITA 9 are introduced. These varieties have the characteristics of shorter duration (120 to 128 days) than the present variety of B-189 (130 to 135 days), high yield potential (8.3 to 8.6 tons/ha) and tolerance to RYMV.

(2) Target Yield

The target yield of rice is set at 5.5 tons/ha for the transplanting culture and 4.5 tons/ha for the direct sowing culture taking into consideration the meteorological conditions in the area such as remarkably low sunshine hours (4.8 hours on annual average), high temperature (26.2°C) and high humidity (84.7 %).

The key points for accomplishment of the target yields are assured supply of irrigation water, good land preparation (leveling and puddling) and weed control. Without execution of these key points, any improved technology can not be effective. For making the rice cultivation plan, special considerations are paid on the following points;

- a) Amount of nitrogen to be applied is saved at 66 kg/ha taking into consideration of the unfavorable meteorological conditions mentioned above in the area.
- b) Synthetic weed control countermeasure is introduced such as mechanical land preparation which is the most effective control method of weeds, pre-germination treatment with herbicide and in-field water management where water depth is kept around 3 inches throughout the growing period of paddy except application time of herbicide and before 10 days of harvesting.
- c) Two control methods for RYMV are employed. That is, introduction of tolerant varieties and land preparation method, which has been, confirmed the effect at Grand-Lahou. The method is to in-corporate ratoons and paddy stocks left in the field with soil at the 1st plowing of paddy field with power tiller under submerged field condition and keep the fields under submerged condition for 2 weeks until the 2nd plowing (puddling and leveling).
- d) Preventive control measure does not be employed for rice disease and pest due to the reason of economical point of view.

¹ Rice Yellow Mottle Virus

C.3.2 Rice and Vegetables Cropping

(1) Cropping calendar

In order to increase the farming income, combined cropping of rice and vegetables is proposed as shown in table below and Fig.C.3.2. Vegetables to be introduced are selected in consideration of suitability of the vegetables to the Area, profitability of the vegetables and adaptability of the cropping season in combination with rice.

Cropping System	1 st Cropping		2 nd Cropping	
	Sowing	Harvesting	Sowing	Harvesting
Tomato + Rice	Mar/10 – Apr/24	Jun/10 – Aug/31	Sep/10 – Oct/25	Jan/16 – Mar/02
Rice + lettuce	Mar/20 – May/04	Jul/26 – Sep/09	Sep/01 – Oct/15	Nov/30 – Jan/14
Tomato + Lettuce	Mar/10 – Apr/24	Jun/10 – Aug/31	Sep/01 – Oct/15	Nov/30 – Jan/14

(2) Target Yield

The target yield of the paddy and vegetables cropping is set up at 5,000 kg/ha for the average of transplanting and direct-sowing rice cultivation and 20,000 kg/ha for both tomato and lettuce.

C.3.3 Farming and Production

(1) Appropriate Land Holding Size

As discussed in C.2.1 (4), the appropriate land holding scale is decided at 1.5 ha per farm household based on the net income obtained from the rice double cropping farming, which is equivalent to the average annual salary (F.CFA 1,200,000) in Côte d'Ivoire. Looking from the viewpoint of labour requirement, 1.5 ha is also proper farming scale for the rice double cropping by mutual use of family labour in the Project Area.

(2) Rice Double Cropping

Farmer holds 3.6 ha of plain lowland on average at present. The average cropped area of rice in the last 5 years is only 1.0 ha/farmer under the rain-fed field condition. And its yield is estimated at 1,171 kg/ha on average. Then, the net income is estimated at minus F.CAF 39,524/farmer.

In the plan, rice is cultivated twice a year. The paddy production is estimated at 15,000 kg/year per farmer, which is equivalent to 13 times that of the present. The net income is estimated at F.CAF 1,160,940/farmer, which is nearly equivalent to the average annual salary in Côte d'Ivoire. The details of the recommended technology for the transplanting culture and for the direct sowing culture are shown in Table C.3.1 and C.3.2, respectively, and the estimated cost and income of the proposed transplanting culture and direct sowing culture of rice are shown in Table C.3.3.

(3) Rice + Vegetable Cropping

In the case of introduction of tomato under the area of 0.1 ha of the 1st cropping, the total net income per farmer is estimated to be F.CAF 2,426,162/year, which is twice the average annual salary in Côte d'Ivoire. In the case of introduction of lettuce under the area of 0.1 ha of the 2nd cropping, the net income per farmer is estimated to be F.CFA 1,263,852/year as shown below. The estimated income and costs of the proposed tomato and lettuce culture are shown in Table C.3.4.

Conditions	Land Holding size (ha)	Cultivated Crops	Cultivated Area (ha)	Yield (kg/ha)	Production (kg)	Net Income (F.CAF)
Present	3.6	Rice	1.0	1,171	1,171	-39,524
[Plan 1] Rice + Rice	1.5	Rice(1 st)	1.5	5,000	7,500	580,470
		Rice(2 nd)	1.5	5,000	7,500	580,470
		Total	3.0	-	15,000	1,160,940
		Rice(1 st)	1.4	5,000	7,000	541,772
[Plan 2] Rice + Tomato	1.5	Rice(2 nd)	1.5	5,000	7,500	580,470
		Tomato(1 st)	0.1	20,000	2,000	1,303,920
		Total	3.0	-	16,500	2,426,162
		Rice(1 st)	1.4	5,000	7,000	541,772
[Plan 3] Rice + Lettuce	1.5	Rice(2 nd)	1.5	5,000	7,500	580,470
		Lettuce(1 st)	0.1	20,000	2,000	141,610
		Total	3.0	-	16,500	1,263,852
		Rice(1 st)	1.4	5,000	7,000	541,772

C.3.4 Labour Requirement and Mechanized Farming

(1) Labour Requirement

Labor requirement for proposed rice cultivation is shown in Fig.C.3.3. The largest labor is required for transplanting and harvesting, that is, 40 man-day/ha for transplanting and 50 man-days/ha for harvesting including threshing. To complete these farm works in a day, around five times the family labor is required. However, the labor shortages for these farm works can be solved by mutual use of family labor in the Project Area by staggered cropping for 45 days. Therefore, mutual use of family labor among the different staggered areas in the Project Area is needed.

(2) Mechanized Farming

Mechanized land preparation is indispensable to carry out scheduled rice double cropping smoothly and to ensure the target yield. The number of power tillers required for the Project Area (575 ha) is around 60 units of 14 CV power tiller as one unit for each 10 ha. In the Project Area, there are 21 units of power tiller at present, 13 units of which are unusable (Table C.1.3). In the case of Sakassou Project, 24 out of 64 units are unusable. It is essential for mechanized farming to have proper maintenance of machinery, training of operators and complete equipment of spare parts. The cost of mechanical land preparation is estimated at F.CFA 65,092 /ha (Table C.3.5). The Important spare parts of power tiller are shown in Table C.3.6 and Fig. C.3.4. The cost of the power tiller (14 CV) was F.CAF 3,000,000 per unit at KR-II price in 1998. It is, therefore, necessary to prepare the funds of F.CAF 180,000,000 for purchase of 60 units of power tiller. The amount can be paid back in 5 years.

C.3.5 Agricultural Input Requirement

The following agricultural equipment with spare parts and inputs shall be purchased through KR-II and ANADER:

Item	Quantity	Unit Rate	Cost (F.CFA)	Remarks
Power tiller (14 CV)	60 units	3,000,000	180,000,000	Cost w/o spare parts
Manual sprayer	366 units	35,000	12,810,000	
NPK (10:20:20)	120 tons	190,000	22,800,000	
Urea	60 tons	170,000	10,200,000	
Herbicide	5,750 lit.	6,000	34,500,000	
Total			260,310,000	

Notes : Repayment period Power tiller (14 CV): 5 years (F.CFA 600,000/year/unit x 5 years)
Others: 6 months to 1 year.

It is proposed that the arrangement of the above rice seeds is left to ANADER, San-Pédro, that is, ANADER produces the necessary amounts of seeds at the training and demonstration fields combining with farmer's training. After the 2nd year, the farmers use their own produced seeds. And ANADER bears responsibility for renewal of the seeds.

C.3.6 Training Plan

(1) Basic Concept of Demonstration and Training

The present level of farmer's rice cultivation technique is extremely low and the immigrants mostly have no experience for irrigated rice farming. Moreover, ANADER has no extension worker who has the required knowledge and experience of irrigated rice cultivation. On the other hand, irrigated rice double cropping cultivation requires precise water management and scheduled cropping in the project area and high-yielding cultivation technology. The project also needs to train power tiller operators, as mechanical land preparation will be introduced. The farmer's training is basically field practice training carried out in a 30 ha of the training farm, and the operator's and extension worker's training are lecture and practices carried out at CFMADG. The demonstration activities are carried out at farmer's fields in the Project Area so as to demonstrate the outcome of the recommended technology.

(2) Farmers/Immigrants Training

Training of farmers / immigrants (384 persons) is to be carried out in a 30 ha a training farm, with pump irrigation facilities, during the period from February 2002 to February 2003 before the completion of field preparation of the Project Area as described below:

1) Target of training

The target of training is to give farmers experience of high yielding irrigated rice cultivation technology through field practices.

2) Contents of training

Training consists of field practices and brief site lectures. Each trainee can get experience of recommended rice cultivation techniques throughout a whole rice-growing period in the assigned paddy field of 0.15 ha. The costs of necessary inputs for the rice cultivation such as fertilizer, herbicide, pesticide and land preparation by power tiller are to be paid by the trainee themselves after harvesting the paddy. The product obtained from the 0.15 ha lot belongs to the trainees. The main practices to be trained are as follows:

- Preparation of quality seed (selection of seed, pre-germination of seed, disinfection of seed)
- Establishment of nursery
- Raising of seedling
- Land preparation (plowing and puddling)
- Transplanting
- Application of fertilizer
- Weed control
- Disease and pest control
- In-field water management
- Harvesting, threshing and drying of harvested grains

The main lectures are:

- knowledge of scheduled rice double cropping
- Mutual use of agricultural labor

- Irrigation system in the Project Area
- Scientific explanation of each farm practice.

(3) Training Schedule

Technical direction for cultivation practices and brief site lecture for rice cultivation technology are to be carried out by two (2) extension workers of ANADER, San-Pédro specially trained at CFMAG and possibly by rice experts. The training schedule is given below:

Batch	No. of trainees to be received	Period of training	Cropping season
1	48	March/16 -- July/28 (135 days)	1 st season
2	48	April/01 -- Aug/13 (135 days)	1 st season
3	48	April/16 -- Aug/28 (135 days)	1 st season
4	48	May/01 -- Sep/12 (135 days)	1 st season
5	48	Scp/16 -- Jan/28 (135 days)	2 nd season
6	48	Oct/01 -- Feb/12 (135 days)	2 nd season
7	48	Oct/16 -- Feb/27 (135 days)	2 nd season
8	47	Nov/01 -- March/15 (135 days)	2 nd season
Total	383	March/16, 2002 -- March/15, 2003	

(4) Training of Extension Workers and Operators of Power Tiller

At least two persons are needed to work as full time agricultural extension workers in charge of the Project Area are needed. Therefore, prior to the above farmers/immigrants training, two extension workers of ANADER, San-Pedro are to be selected and specially trained at CFMAG on theoretical and practical aspects of mechanized irrigated rice cultivation and power tiller operation and maintenance courses.

Course	Trainees and Number	Period	Substance
Power tiller operation and repair	Operator of farmers 60	2 weeks	Practice and brief lecture
Mechanized irrigated rice cultivation	Extension workers 2	2 weeks	Lecture and practice

(5) Demonstration

1) Demonstration Plot

Field demonstration is also important as same as training so as to confirm the results of the input technology by farmer's own eyes. The demonstration is performed using the actual farmer's farmland in the Project Area as follows:

Scale	Demonstration
1 plot of 0.3 ha for each field lot	Rice double cropping by transplanting
1 plot of 0.3 ha for each field lot	Rice double cropping by direct sowing
1 plot of 0.3 ha for each field lot	Vegetables (tomato for the 1 st season and lettuce for the 2 nd season)

The demonstration activities for vegetable cultivation have to be carried out carefully with technical support of CNRA.

2) Input and Output

The farmer offers the necessary labor force and input materials under the guidance of the extension workers. All the outputs belong to the farmers. Extension workers collect the necessary data for technical and economic analyses of the demonstration plots.

C.4 Farm Household Economy

C.4.1 Farm Household Economy in the Region

Table C.4.1 shows the average farm household size in the region as 6.4 members (3.9 economically active persons). Average farm size is 6.9 ha. 81 % of the farm holding grow four cash crops; cacao, coffee, oil palm, and coco-palm. 19 % grow two food crops; paddy and maize. Paddy is cultivated in three different natural conditions; i.e. upland, marsh and irrigated land. Food is almost self-sufficient. Besides those major crops listed in the table, they grow cassava, yam, taro, plantain banana, and vegetables. Poultry and their eggs and goats are at their service. Manpower is also self-sufficient. Enough spare manpower to attend other work allows them to seek other income sources like fishing and commercial activities. In this way, income sources are diversified into two tiers; the first, in types of crops, the second, in types of profession outside the farm. These facts serve the security of income. As far as time is concerned, for those who belong to younger generation, they can afford to have higher education.

The monthly income from the sale of the industrial crops and surplus food crops is about F.CFA 70,000. For reference, the poverty line as of July 1988 is estimated at a monthly income of F.CFA 94,600, in which more than 41 % accounts for food in the case of the poorer citizens of San-Pédro urban area.

C.4.2 Farm Household Economy in the Department

Table 2.2.1 shows the average farm household economy of San-Pédro Department. An average farm holding per household is estimated at 6.1 ha; 88 % of the average of the region. They do not grow oil-palm, but grow coco-palm twice as many as the region's average. The area for paddy growing is 71 % of the region's average. They grow other crops more or less at the level of the region's average. Assuming the number of household members and economical active members, unit labors and farm gate prices etc. are equal to those of region's averages. The incomes from the farm as well as labor requirement are 86 % of the region's average.

San-Pédro city where rural population constitutes 8.6 %, spent annually F.CFA 277,000 per head after saving F.CFA 36,000 in 1996. 41 % of the expenditure went to food, 8% to energy and water. If an average farm household is self-sufficient in food, energy and water, and without saving, their average disposable income is estimated at 81% of the average citizen's consumption level; this gap felt by the rural population is easily understandable.

C.4.3 Farm Household in the Study Area

The survey result using the questionnaire indicates that the crop production is the most important income source for nearly 80 % of the interviewed households and 45 % out of 80 % depend on this activity entirely without any other income source. The following tables show the total average income amount by category. The average income by village ranges between 1 and 1.5 million F.CFA except Scaf, Pont Bascul and Cité Agricole. Cité Agricole recorded a relatively or absolutely very small annual income, which represents less than 30 % of the average income of the Study Area. This village is heavily depend on food crop production in lowland as shown in the following sections and few households have second income sources. On the other hand, two other villages have higher average income, one being consist mainly of Burkinabé immigrants who perform dynamic activities in industrial crop production, and the other is the village where all the interviewed households have their incomes from more than one source. The diversification of agricultural or economic activities could be, therefore, one of the factors which determine income sizes, although other two factors are, the abnormality of precipitation in 1977

that devastated the food production in the lowland, and the food crops consumed first in farmhouses, for also indirectly linking to low cash income.

Annual average income by category		Annual average income by village concerned (1997)		
Income source	Amount (F.CFA) (per related household)	Village	Annual average income(F.CFA)	Household having second income source (%)
Crop Production	913,272 (982,760)	Cité Agricole	354,708	17
		Grand Gabo	1,079,621	57
Agriculture*	990,221 (1,021,166)	Camp. Bernard	1,347,410	72
		Pont Bascule	2,054,500	100
Non-agriculture	301,573 728.101	Petit Pédro	1,592,905	61
		Blahou	1,112,865	20
Total	1,289,907	Fahe	1,167,874	50
		Scaf	2,121,000	33
		San-Pédro	1,429,996	88
		Zone	1,289,907	52

* Agriculture: Crop production +
Livestock + Fishing

Source: JICA Study Team

Nearly 42 % of the current expenses are for the purchase of foods, of which 28 % and 25 % are spent for the purchase of rice and other staple foods respectively. In fact, 70 % of the sampled households answered that they could not achieve self-sufficiency in food production, and 61 % of them experienced the shortage of food during the certain period of a year. The reasons are presumed to be due to;

- Mainly, predominance of the industrial crop production in the Area on which the farmers focus their efforts and;
- Unfavorable conditions of related factors such as recently hit inadequate rainfall distribution, the increasing population pressure and so on.

In addition to high ratio of Engel's coefficient, the distribution of expenses also indicates the considerable portion on clothing (19 % of total expenses) due to "the compulsory purchase of women's clothes". Moreover, the large portion of expenses on social activities (14 %) is also affecting households showing the importance of various ceremonies in the society.

Throughout a year, farmers have to prepare the cash for three major occasions i.e. 1) school fees in October, 2) land preparation for their farming between February to April and 3) new year and religious festivals including Ramadan for Muslims. Especially school expenses as well as the case of illness often become the reasons for serious debts.

For the year 1997, 32% of the sampled households declare a financial deficit, which could be compensated by debt. In addition, the deficit often observed at farmers' household could suggest that whole expenses and incomes were not quantified during the interview. Especially, the income from "small trade of all kinds by women" regarded, as barter (sale and purchase on the spot) is impossible to be counted.

C.4.4 Farm Household under the High Priority Project

(1) Agricultural Income under the Project

The estimated income and costs of the proposed rice, tomato and lettuce cultivation are discussed in C.3.3 and shown in Table C.3.3 and C.3.3.4.

(2) Farm Household under the Project

Table C.4.2 gives the farm economy of an average satellite household¹ of the Project Area. With the introduction of transplanting method, in which an average yield of 5.5 ton/ha/crop is envisaged, the household economy of the Project Area will eventually be improved. With the land holding of 1.5 ha and two crops a year, an average net farm income of the majority households will reach F.CFA 1.6 million of 1998 price by selling paddy to their cooperative at the price of F.CFA 157 /kg minus 1 % commission after deducting 1.2 ton of paddy for its self-consumption.

In the rice cultivation calendar in 1.5 ha field, in which mechanization is limited to the land preparation only, requirement of manual labour exceeds its supply from the household concerned during the transplanting and harvesting periods. However, if mutual labor exchange among the COOP members goes smoothly and people overcome an unaccustomed posture in manual rice transplanting, there won't be any shortage of the labor pool as a whole.

After paying the annual debt of housing loan F.CFA 234,000, and deducting 10% saving, disposable income would be F.CFA 1.4 million. Assuming that most of the basic foodstuff be self-sufficient, the disposable income would be 28 % more than that of the average residents of San-Pédro city. O&M of the canals require wage labor, which will be filled by some members' family labor.

¹ The farm household which does not have a cultivator.

Table C.1.1 Crop Production and Income in 1997 in the Study Area

Crop Cultivated	Area (ha)	Yield (kg/ha)	Production (kg)	Unit Price (FCFA/kg)	Gross Income		Production Cost		Net Income	
					(FCFA)	(FCFA/ha)	(FCFA)	(FCFA/ha)	(FCFA)	(FCFA/Farmer)
Cacao	2,577	343	882,588	402	354,800,477	110,977	285,976,631	26,708	68,823,845	111,365
Coffee	1,075	447	480,498	520	249,859,152	86,854	93,341,994	145,638	156,517,159	306,896
Lowland Rice	770	1,178	907,060	159	144,222,540	163,661	126,018,970	23,641	18,203,570	28,667
Upland Rice	14	974	13,149	159	2,090,691	157,869	2,131,232	-3,003	-40,541	-2,703
Maize	388	866	336,008	104	34,944,832	99,829	38,733,652	-9,765	-3,788,820	-9,592
Cassava	225	2,314	520,187	53	27,569,922	(130,947)	29,436,886	-8,305	-1,866,964	-6,182
Rubber	161	1,247	200,268	172	34,446,130	(165,750)	26,619,450	48,734	7,826,680	163,056
Vegetable	110	-	-	-	-	-	-	-	-	-
Yam	83	2,268	187,337	135	25,290,468	(130,947)	10,816,222	175,233	14,474,246	117,677
Cola	30	80	2,400	150	360,000	(165,750)	4,972,500	-153,750	-4,612,500	-230,625
Oil Palm	16	(8,000)	128,000	32	4,096,000	(165,750)	2,652,000	90,250	1,444,000	120,333
Banana	9	(12,500)	112,500	100	11,250,000	1,280,021	11,520,189	-30,021	-270,189	-18,013
Total	5,457	-	3,769,996	-	888,930,212	-	632,219,725	47,047	256,710,487	281,481

Remarks:

1) No. of orchards by age of tree:

Cacao: Below 5 years-37.2%, 5 to 20 years-51.0%, Over 20 years-11.8%

Coffee: Below 5 years-34.7%, 5 to 20 years-53.1%, Over 20 years-12.2%

Rubber: 6 to 20 years-100%

2) (): Estimated

Source: JICA Study Team

Table C.1.2 Crop Production and Income of High-Yield Year in the Study Area

Crop Cultivated	Area (ha)	Yield (kg/ha)	Production (kg)	Unit Price (FCFA/kg)	Gross Income		Production Cost		Net Income	
					(FCFA)	(FCFA/ha)	(FCFA)	(FCFA/ha)	(FCFA)	(FCFA/Farmer)
Cacao	2,576.9	612	1,577,063	402	633,979,246	110,977	285,976,631	135,047	348,002,614	563,111
Coffee	1,074.7	776	833,967	520	433,662,944	86,854	93,341,994	316,666	340,320,950	667,296
Lowland Rice	770.0	3,478	2,678,060	159	425,811,540	163,661	126,018,970	389,341	299,792,570	472,114
Upland Rice	13.5	1,685	22,748	159	3,616,853	157,869	2,131,232	110,046	1,485,621	99,041
Maize	388.0	1,903	738,364	104	76,789,856	99,829	38,733,652	98,083	38,056,204	96,345
Cassava	224.8	4,502	1,012,050	53	53,638,629	(130,947)	29,436,886	107,659	24,201,743	80,138
Rubber	160.6	(1,600)	256,960	172	44,197,120	(165,750)	26,619,450	109,450	17,577,670	366,201
Vegetable	110.4	-	-	-	-	-	-	-	-	-
Yam	82.6	3,812	314,871	135	42,507,612	(130,947)	10,816,222	383,673	31,691,390	257,654
Cola	30.0	5,000	150,000	150	22,500,000	(165,750)	4,972,500	584,250	17,527,500	876,375
Oil Palm	16.0	15,000	240,000	32	7,680,000	(165,750)	2,652,000	314,250	5,028,000	419,000
Banana	9.0	18,000	162,000	100	16,200,000	1,280,021	11,520,189	519,979	4,679,811	980,550
Total	5,456.5	-	7,956,082	-	1,760,583,799	-	632,219,725	206,793	1,128,364,074	1,237,241

(): Estimated

Source: JICA Study Team

Table C.1.3 Crop Production and Income in 1998 in the Project Area

Classification of Land	Crop	Area Cultivated		Yield (kg/ha)	Production		Unit Price (F/kg)	Gross Income (F/area)	Production Cost (F/ha)		Production Cost (F/area)		Net Income (F/area)		Including Labor Cost (%)		
		(ha)	(%)		(kg)	(%)			Including Labor Cost	Excluding Labor Cost	Including Labor Cost	Excluding Labor Cost	(%)	(%)			
Plain Lowland (66 farmers)	Paddy	38.70	32.7	1,171	68,740	28.2	157	10,792,180	228,292	54,112	13,400,740	3,176,374	2,608,560	33.7	7,615,806	29.2	
	Egg plant	0.30	0.2	5,500	1,650	0.7	61	100,650	550,210	46,680	165,063	14,004	64,413	0.8	86,646	0.3	
	Ground Nuts	0.31	0.2	710	220	0.1	207	45,540	149,810	8,000	46,441	2,480	901	0.0	43,060	0.2	
	Cabbage	0.03	0.0	14,333	430	0.2	250	107,500	161,400	30,500	4,842	915	102,658	1.3	106,585	0.4	
	Piment	0.25	0.1	416	104	0.0	(200)	20,800	215,900	30,000	53,975	7,500	33,175	0.4	13,300	0.1	
	Tomato	0.12	0.1	7,419	920	0.4	489	449,858	585,587	79,307	72,613	9,834	377,246	4.9	440,024	1.7	
	Sub-total	49.71	33.3	-	72,064	29.5	-	11,516,528	1,891,199	248,599	13,743,674	3,211,107	2,227,146	28.8	8,305,921	31.9	
Valley Bottom Lowland (22 farmers)	Paddy	7.15	4.0	682	4,875	2.0	157	765,375	228,292	54,112	1,632,288	386,901	866,913	11.2	378,474	1.5	
	Cucumber	1.00	0.6	2,000	2,000	0.8	113	226,000	263,376	89,216	263,376	89,216	37,376	0.5	156,784	0.5	
	Tomato	0.50	0.3	2,000	1,000	0.4	489	489,000	585,587	79,307	292,794	39,654	196,207	2.5	449,347	1.7	
	Sub-total	8.65	4.8	-	7,875	3.2	-	1,480,375	1,077,255	222,635	2,188,457	515,770	708,082	9.2	964,605	3.7	
	Cassava	29.21	16.3	4,222	123,325	50.5	83	10,235,943	92,860	2,000	2,712,441	58,420	7,525,503	97.2	10,177,523	39.1	
Upland (52 farmers)	Maize	40.61	22.6	701	28,468	11.7	117	3,350,710	13,038	1,438	530,285	58,397	2,800,425	36.2	3,272,313	12.6	
	Yam	0.75	0.4	5,000	3,750	1.5	100	375,000	295,620	32,500	231,715	24,375	151,285	2.0	350,625	1.3	
	Tomato	0.35	0.2	(2,000)	700	0.3	489	342,300	585,587	79,307	204,955	27,757	137,345	1.8	314,543	1.2	
	Potato	0.85	0.5	(1,714)	1,457	0.6	127	185,026	69,520	0	59,092	0	125,934	1.6	185,026	0.7	
	Ground Nuts	0.90	0.5	1,000	900	0.4	207	186,300	149,810	8,000	134,829	7,200	51,471	0.7	179,100	0.7	
	Egg plant	0.25	0.1	1,600	400	0.2	61	24,400	550,210	46,680	137,553	11,670	113,153	1.5	12,750	0.0	
	Okra	0.25	0.1	800	200	0.1	(150)	30,000	265,680	46,680	66,420	11,670	36,420	0.5	18,530	0.1	
	Cucumber	0.01	0.0	40,000	400	0.2	113	45,200	263,376	89,216	2,634	892	42,566	0.6	44,308	0.2	
	Sub-total	73.18	40.7	-	159,599	65.4	-	14,794,880	2,283,721	305,821	4,069,924	200,382	10,684,956	138.1	14,554,498	55.9	
	Tree Crop Land (32 farmers)	Coffee(Young)	16.30	9.1	0	0	0.0	582	0	21,200	9,395	411,249	153,139	411,249	5.3	153,139	0.6
		Coffee(Born)	8.00	4.5	494	3,952	1.6	582	2,300,064	178,835	9,395	1,430,680	75,160	869,384	11.2	2,224,904	8.5
		Cacao(Young)	7.25	4.0	0	0	0.0	504	0	31,811	1,634	230,630	11,847	230,630	3.0	11,847	0.0
Cacao(Born)		2.00	1.1	250	500	0.2	504	252,000	245,651	1,634	491,302	3,268	239,302	3.1	248,732	1.0	
Banana		3.00	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avocado		0.50	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cola		0.50	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Palmitre	0.50	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Sub-total	38.05	21.2	-	4,452	1.8	-	2,552,064	481,527	22,058	2,565,861	243,413	11,797	2,308,651	0.2	2,308,651	8.9	
Total	179.59	100	-	243,990	100	-	30,303,848	5,735,702	799,113	22,565,916	4,370,673	7,737,932	100.0	26,133,175	100		
Average per Farmer(n=70)	2.57	-	-	-	-	-	432,912	-	-	-	322,370	59,581	110,542	-	373,331	-	

Source: F/S survey, JICA Study Team

Table C.1.4 Crop Production and Income of High-Yield Year by Farming Type in the Project Area

Type of Farming	Crop	Area (ha)	Yield (kg/ha)	Production (kg)	Unit Price (FCFA/kg)	Gross Income (FCFA)	Production Cost		Net Income (FCFA)	Area per Farmer	Net Income (FCFA)	
							(FCFA/ha)	(FCFA)			per ha	per Farmer
Lowland Farming	Lowland Paddy	53	3,478	185,377	159	29,475,007	163,661	8,723,131	20,751,875	1.3	389,341	518,797
	Total	53	3,478	185,377	159	29,475,007	163,661	8,723,131	20,751,875	1.3	389,341	518,797
Upland Farming	Upland Paddy	2	1,685	3,370	159	535,830	157,869	315,738	220,092	0.1	110,046	7,806
	Maize	15	1,903	28,545	104	2,968,680	99,829	1,497,435	1,471,245	0.5	98,083	52,544
	Yam	1	3,812	3,812	135	514,620	130,947	130,947	383,673	0.6	383,673	13,703
	Cassava	6	4,502	27,012	53	1,431,636	130,947	755,682	645,954	0.2	107,659	23,070
	Vegetables	15	-	-	-	-	-	-	-	0.5	-	-
	Total/Average	24	2,614	62,739	87	5,450,766	113,742	2,729,802	2,720,964	0.9	113,374	97,177
Tree Crop Farming	Coffee	133	776	103,208	520	53,668,160	86,854	11,551,582	42,116,578	0.9	316,666	296,596
	Cacao	320	612	195,840	402	78,727,680	110,979	35,513,280	43,214,400	2.3	135,045	304,327
	Rubber	53	1,600	84,800	172	14,585,600	165,750	8,734,750	5,800,850	0.4	109,450	40,851
	Oil palm	3	15,000	45,000	32	1,440,000	165,750	497,250	942,750	0.6	314,250	6,639
	Cola	4	5,000	20,000	150	3,000,000	165,750	663,000	2,337,000	0.6	584,250	16,458
Total/Average	513	875	418,848	337	151,424,440	111,130	57,009,862	94,414,578	3.6	184,038	664,870	
Lowland + Upland	Lowland Paddy	83	3,478	288,674	159	45,899,166	163,661	13,583,863	32,315,303	1.4	389,341	557,160
	Maize	44	1,903	83,732	104	8,708,128	99,829	4,392,476	4,315,652	0.8	98,083	74,408
	Yam	3	3,812	11,435	135	1,543,860	130,947	392,841	1,151,019	0.1	383,673	19,845
	Cassava	21	4,502	94,542	53	5,010,726	130,947	2,749,887	2,260,839	0.4	107,659	38,980
	Vegetables	9	-	-	-	-	-	-	-	0.2	-	-
	Total/Average	151	3,168	478,384	128	61,161,880	139,861	21,119,067	40,042,813	2.6	265,184	690,393
Lowland + Tree Crop	Lowland Paddy	127	3,478	441,706	159	70,231,254	163,661	20,784,947	49,446,307	1.1	389,341	419,037
	Coffee	143	776	110,968	520	57,703,360	86,854	12,420,122	45,283,238	1.2	316,666	383,756
	Cacao	278	612	170,136	402	68,394,672	110,979	30,852,162	37,542,510	2.4	135,045	318,157
	Rubber	12	1,600	19,200	172	3,302,400	165,750	1,989,000	1,313,400	0.1	109,450	11,131
	Cola	3	5,000	5,000	150	750,000	165,750	165,750	584,250	0.6	584,250	4,951
	Banana	3	18,000	54,000	100	5,400,000	1,280,021	3,840,063	1,559,937	0.6	519,979	19,220
	Total/Average	561	1,420	801,010	257	205,781,686	124,206	70,052,041	135,729,645	4.8	240,655	1,150,251
Upland + Tree Crop Farming	Upland Paddy	7	1,685	11,795	159	1,875,435	157,869	1,105,083	770,352	0.1	110,046	9,394
	Maize	52	1,903	98,956	104	10,291,424	99,829	5,191,168	5,100,256	0.6	98,083	62,199
	Yam	11	3,812	41,932	135	5,660,820	130,947	1,440,417	4,220,403	0.1	383,673	51,468
	Cassava	23	4,502	103,546	53	5,437,938	130,947	3,011,781	2,426,157	0.3	107,659	30,197
	Coffee	114	776	88,464	520	46,001,280	86,854	9,901,356	36,099,924	1.4	316,666	440,243
	Cacao	221	612	135,252	402	54,371,304	110,979	24,526,359	29,844,945	2.7	135,045	363,963
	Rubber	35	1,600	56,000	172	9,632,000	165,750	5,801,250	3,830,750	0.4	109,450	46,716
	Banana	1	18,000	18,000	100	1,800,000	1,280,021	1,280,021	519,979	0.6	519,979	6,341
	Vegetables	12	-	-	-	-	-	-	-	0.1	-	-
	Total/Average	464	1,191	553,945	244	135,120,171	112,624	52,257,375	82,862,796	5.7	178,584	1,010,522
Mixed Crops Farming	Lowland Paddy	508	3,478	1,766,834	159	280,925,016	163,661	83,139,788	197,785,228	1.1	389,341	415,462
	Upland Paddy	3	1,685	5,055	159	803,745	157,869	473,607	330,138	0.6	110,046	744
	Maize	278	1,903	529,034	104	55,019,536	99,829	27,752,462	27,267,074	0.6	98,083	61,412
	Yam	69	3,812	263,028	135	35,508,780	130,947	9,035,343	26,473,437	0.2	383,673	59,625
	Cassava	176	4,502	792,332	53	41,994,656	130,947	23,046,672	18,947,984	0.4	107,659	42,676
	Coffee	687	776	533,112	520	277,218,240	86,854	59,668,698	217,549,542	1.5	316,666	489,976
	Cacao	1,758	612	1,075,896	402	432,510,192	110,979	193,101,082	237,409,110	4.0	135,045	534,705
	Rubber	61	1,600	97,600	172	16,787,200	165,750	10,110,750	6,676,450	0.1	109,450	15,037
	Oil palm	14	15,000	210,000	32	6,720,000	165,750	2,320,500	4,399,500	0.6	314,250	9,909
	Cola	26	5,000	130,000	150	19,500,000	165,750	4,309,500	15,190,500	0.1	584,250	34,213
	Banana	5	18,000	90,000	100	9,000,000	1,280,021	6,400,105	2,599,895	0.6	519,979	5,856
	Vegetables	110	-	-	-	-	-	-	-	0.2	-	-
	Total/Average	3,585	1,532	5,492,901	214	1,175,987,355	117,534	421,358,507	754,628,858	8.1	210,496	1,699,615
Whole		5,354	1,458	8,023,204	220	1,764,393,315	118,269	633,243,785	1,131,148,528	5.9	211,266	1,240,294

* - : Not available data

Source : JICA Study Team

Table C.1.5 Labor Input by Crop in the Study Area in 1997

(Man day/ha)

		Nursery Preparation	Main Field Preparation	Sowing	Transplanting	Weeding	Disease, Pest Control	Fertilizer Application	Harvesting	Total
Lowland Paddy	Male	2.8	15.9	18.4	13.1	15.7	1.1	0.8	27.4	95.2
	Female	0	0.5	9.4	0	12.2	0	0.1	13.8	36
	Total	2.8	16.4	27.8	13.1	27.9	1.1	0.9	41.2	131.2
	(%)	2.1	12.5	21.2	10	21.3	0.8	0.7	31.4	100
Upland Paddy	Male		22.3	20.8		23.6			44.7	111.4
	Female		1	4.4		2.7			15.7	23.8
	Total		23.3	25.2		26.3			60.4	135.2
	(%)		17.2	18.6		19.5			44.7	100
Maize	Male		16.9	10		14.8			25.3	67
	Female		0.1	3.7		7.4			15.5	26.7
	Total		17	13.7		22.2			40.8	93.7
	(%)		18.1	14.6		23.7			43.5	100
Manioc	Male		17.4	10.5		25			29.3	82.2
	Female		1.3	3.8		10.3			26	41.4
	Total		18.7	14.3		35.3			55.3	123.6
	(%)		15.1	11.6		28.6			44.7	100
Cacao	Male		14.6		12.1	21.6	1.4	0.6	10.9	61.2
	Female		0.3		1.8	0.1	0	1.2	0.5	3.9
	Total		14.9		13.9	21.7	1.4	1.8	11.4	65.1
	(%)		22.9		21.4	33.3	2.2	2.8	17.5	100.1
Coffee	Male		14.8		10	16.8	1.3	1.2	28.4	72.5
	Female		0.3		1.3	0.9	0	0	3.1	5.6
	Total		15.1		11.3	17.7	1.3	1.2	31.5	78.1
	(%)		19.3		14.5	22.7	1.7	1.5	40.3	100

Source: JICA Study Team

Table C.1.6 Labor Input by Crop in the Project Area in 1998

(man day/ha)

Crop	Nursery preparation	Land preparation	Sowing	Transplanting	Weeding	Disease, pest control	Fertilizer application	Bird control	Harvesting	Total	(%)
Rice(Direct sowing)	0.0	11.6	9.8	0.0	10.1	1.3	2.6	150.8	19.3	205.5	91.6
Rice(Transplanting)	3.6	11.6	9.8	18.9	10.1	1.3	2.6	150.8	19.3	228.0	101.6
Average	1.8	11.6	9.8	9.5	10.1	1.3	2.6	150.8	19.3	216.8	96.6
(%)	1	5	5	4	5	1	1	70	9	100	-
Maize	0.0	14.8	9.4	0	18.1	36.2	0	0.0	13.1	91.6	40.8
Cassava	0.0	19.5	0.0	13.5	18.3	0.0	0.0	0.0	31.3	82.6	36.8
Ground nut	0.0	26.9	14.3	0.0	17.2	0.0	10.7	0.0	56.9	126.0	56.1
Potato	0.0	13.4	14.4	0.0	12.8	0.0	0.0	0.0	22.6	63.2	28.2
Haricot	0.0	41.5	16.2	0.0	60.4	1.5	0.2	0.0	11.5	131.3	58.5
Yam	0.0	29.2	29.2	0.0	58.3	0.0	0.0	0.0	122.5	239.2	106.6
Average	0.0	24.2	13.9	2.3	30.9	6.3	1.8	0.0	43.0	122.3	51.5
(%)	0	20	11	2	25	5	1	0	35	100	-
Egg plant	3.2	60.0	25.1	9.9	13.2	7.2	9.5	0.0	327.3	453.4	202.9
Tomato	5.4	94.9	54.5	103.0	41.3	5.1	8.3	0.0	144.1	456.6	203.5
Okra	0.0	84.0	10.0	0.0	46.7	2.0	2.0	0.0	53.3	198.0	88.2
Cabbage	4*	80*	0.0	20*	30*	0.0	7*	0.0	50*	191*	85.1
Piment	4*	80*	0.0	20*	30*	0.0	7*	0.0	100*	241*	107.4
Cucumber	0.0	14.0	10.0	0.0	10.0	1.7	1.7	0.0	120.0	157.4	70.1
Average	2.8	68.8	16.6	25.5	28.5	2.7	5.9	0.0	132.5	283.2	126.2
(%)	1	24	6	9	10	1	2	0	47	100	-
Collec	6.2	19.5	0.0	25.3	22.7	3.0	2.3	0.0	141.2	220.2	98.1
Cacao	5.8	38.0	0.0	22.5	83.3	2.7	0.0	0.0	178.2	330.5	147.3
Average	6.0	28.8	0.0	23.9	53.0	2.9	1.2	0.0	159.7	275.4	122.7
(%)	2	10	0	9	19	1	0	0	58	100	-
Whole Average	2.7	33.3	10.1	15.3	30.6	3.3	2.9	37.7	88.6	224.4	100.0

* Estimated

Source: F/S survey, JICA Study Team

Table C.1.7 Labor Wage for Crop Production in the Project Area in 1998

(FCFA/day)

	Nursery preparation	Land preparation	Sowing	Transplanting	Weeding	Disease, pest control	Fertilizer application	Bird control	Harvesting
Lowland rice	1,100	1,100	1,100	1,500	1,100	1,800	1,100	750	1,100
Upland crop	-	1,100	1,100	1,100	1,100	1,400	1,400	-	1,100
Tree crop	1,100	1,100	1,100	1,200	1,100	1,300	1,200	-	1,200

Source: F/S survey, JICA Study Team

Table C.1.8 Crop Production Costs in the Study Area in 1997

(FCFA/ha)

Crop	Seed/Seedling	Fertilizer	Herbicide	Fungicide/Pesticide	Machinery	Labor	Total
Lowland Paddy	4,941 3%	6,049 4%	5,257 3%	2,877 2%	13,337 8%	131,200 80%	163,661 100%
Upland Paddy	13,018 8%	0 0%	7,730 5%	216 0%	1,705 1%	135,200 86%	157,869 100%
Maize	2,490 2%	281 0%	1,500 2%	0 0%	1,858 2%	93,700 94%	99,829 100%
Vegetable	2,552 2%	3,138 2%	2,000 1%	3,843 3%	2,162 2%	123,600 90%	137,295 100%
Cacao	33 0%	13,513 12%	1,162 1%	12,513 11%	18,657 17%	65,100 59%	110,977 100%
Coffee	6 0%	1,739 2%	1,232 1%	1,893 2%	3,884 4%	78,100 90%	86,854 100%
Average	23,040 3%	24,720 3%	18,881 2%	21,342 3%	41,603 5%	626,900 83%	756,486 100%

Note: On the tree crops, costs of seedlings, land preparation and transplanting were allotted to 20 years, and cost of weeding was allotted to 4 years after planting.

Source: JICA Study Team

Table C.1.9 Crop Production Costs in the Project Area in 1998

(FCFA/ha)

Crop	Seed/Seedling	Fertilizer	Herbicide	Pesticide	Insecticide	Machinery	Labor	Total
Direct sowing paddy	17,308	9,244	10,174	256	2,538	14,593	174,180	228,292
Upland paddy	15,000	0	6,000	0	0	0	174,180	195,180
Maize	1,438	0	0	0	0	0	11,620	13,058
Cassava	2,000	0	0	0	0	0	90,860	92,860
Coffee(Young)	2,575	0	0	1,120	5,000	700	15,835	25,230
Coffee(Born)	2,575	0	0	1,120	5,000	700	169,440	178,835
Cacao(Young)	225	0	0	1,091	0	318	30,177	31,811
Cacao(Born)	225	0	0	1,091	0	318	244,017	245,651
Ground nuts	8,600	0	0	0	0	0	141,810	149,810
Potato	0	0	0	0	0	0	69,520	69,520
Yam	32,500	0	0	0	0	0	263,120	295,620
Egg plant	4,000	20,000	0	22,680	0	0	503,530	550,210
Tomato	21,978	34,615	0	22,714	0	0	506,280	585,587
Okra	4,000	20,000	0	22,680	0	0	219,000	265,680
Cucumber	31,373	41,176	0	16,667	0	0	174,160	263,376
Cabbage	10,000	12,000	0	8,500	0	0	130,960*	161,400*
Pimento	18,000*	12,000*	0	0	0	0	185,900*	215,900*
Avocado	15,000	0	0	0	4,000	0	19,000	19,000
Cofa	15,000	0	0	0	4,000	0	19,000	19,000
Average	11,178	7,844	851	5,154	1,081	875	182,619	209,602
(%)	5.3	3.7	0.4	2.5	0.5	0.4	87.1	100.0

* Estimated

Source: F/S survey, JICA

Table C.1.10 Consumption and Sale of Products in the Study Area in 1997

	No. of Farmers		Production (kg)	Consumption (kg)	Sale (kg)	Unit Price Sold (F/kg)	Amount Sold (F)	Sold to *
	Produced	Sold						
Rice	72	28	117,800	64,635	53,095	159	8,412,105	1(74%), 2(22%), 3(4%)
(%)	100	39	100	53	45			
Maize	43	9	40,280	29,980	10,300	104	1,067,500	1(89%), 3(11%)
(%)	100	21	100	74	26			
Manioc	12	4	21,550	15,045	6,505	53	344,765	1(100%)
(%)	100	33	100	70	30			
Yam	9	6	6,491	4,874	1,620	100	162,300	1(60%), 2(20%), 3(20%)
(%)	100	67	100	75	25			
Cacao	63	63	108,039	0	108,039	402	43,395,080	1(49%), 2(76%), 3(5%)
(%)	100	100	100	0	100			
Coffee	47	47	56,504	0	55,004	520	28,621,380	1(24%), 2(63%), 3(12%)
(%)	100	100	100	0	100			
Rubber	5	5	24,062	0	24,062	172	4,136,975	1(20%), 2(60%), 3(20%)
(%)	100	100	100	0	100			
Cola	1	1	800	0	800	1,000	800,000	2(100%)
(%)	100	100	100	0	100	(White Vari)		
Oil palm	1	1	200,000	0	200,000	32	6,400,000	3(100%)
(%)	100	100	100	0	100			

* 1: Local market, 2: Dealer including company, 3: Wholesale market

Source: JICA Study Team

Table C.1.11 Consumption and Sale of Products in the Project Area in 1998

		No. of farmers produced	No. of farmers sold product (%)	Production (kg)	Home consumption (kg)	Quantity sold (kg)	Percentage of quantity sold (%)	Unit price sold (F/kg)	Amount sold (F)	Percentage of Amount Sold (%)
Food Crops	Cassava	8	100	2,198	1,113	1,086	49.4	83	90,438	4.3
	Yam	1	100	1,250	800	450	36.0	100	45,000	2.2
	Rice	62	72.6	1,360	522	838	61.6	157	131,230	6.3
	Maize	43	88.4	838	362	476	56.8	117	55,569	2.7
	Ground nuts	3	66.7	417	257	160	38.4	207	33,100	1.6
	Sub-total	117	80.3	6,063	3,053	3,010	49.6	118	355,336	17.0
Vegetables	Potato	2	100	550	240	310	56.4	127	39,504	1.9
	Egg plant	4	100	1,391	88	1,303	93.7	61	78,938	3.8
	Cabbage	1	100	430	30	400	93.0	250	100,000	4.8
	Haricot	2	100	141	0	141	100	300	43,000	2.1
	Tomato	3	100	630	0	630	100	489	308,000	14.7
	Cucumber	2	100	275	0	275	100	113	31,000	1.5
	Others	3	100	1,133	190	943	83.2	207	195,707	9.4
Sub-total	17	100	4,553	518	4,006	88.0	199	796,148	38.1	
Tree Crops	Coffee	4	100	1,250	0	1,250	100	582	727,500	34.8
	Cacao	2	100	420	0	420	100	504	211,750	10.1
	Sub-total	6	100	1,670	0	1,670	100	562	939,250	44.9
Total		140	83.6	12,286	3,601	8,685	70.7	241	2,090,734	100

Source: F/S survey, JICA Study Team

Table C.1.12 Number of Farm Households and Family Conditions in the Project Area

No. of farm households*		70 Fm households
No. of persons per household	Male	4.0(53.3%)
	Female	3.5(46.7%)
	Total	7.5(100%)
Age of family member	Below 10	29.0%
	11- 54	68.7%
	Above55	2.3%
Agricultural labor per household	Exclusive	2.5 persons
	Temporary	2.5 persons
	Total	5.0 persons
Average age of agricultural labor	Exclusive	28.6(Youngest) - 44.2(Oldest)
	Temporary	11.1(Youngest) - 23.6(Oldest)

Note: * Farm household: Household having agricultural land in the Priority Project Area

Source: F/S survey, JICA Study Team

Table C.1.13 Possession of Machinery and Agricultural Tools in the Project Area

	No. of farmers possessing machinery	% of farmers possessing machinery	No. of machinery possessed	Conditions of machinery		Average unit price purchased (FCAF)
				Usable	Unusable	
Power tiller	21	30.0	21	8	13	3,289,474
Draft animal	1	1.4	2	2	0	200,000
Plow	1	1.4	1	1	0	150,000
Harrow	1	1.4	1	1	0	250,000
Sprayer	23	32.9	24	18	6	55,850
Motor pump	1	1.4	1	0	1	250,000
Harvester	1	1.4	1	1	0	350,000
Machette	67	95.7	163	153	10	1,957
Daba	68	97.1	288	270	18	1,321
Sharpener	10	14.3	15	15	0	1,500

Source: F/S survey, JICA Study Team

Table C.1.14 Rice cultivation in the Study Area in 1997

			Lowland						Lowland		Upland	
			No. of Farmers	(%)					No. of Farmers	(%)	No. of Farmers	(%)
Type of Cultivation	Lowland	Broad Castin	37	61.7	Leaning of Land Before Plowing	No. of Farmers Surveyed	55	100	39	100		
		Drill Sowing	20	33.3		Taken with Sickle/Hoe	12	21.8	7	17.9		
		Transplanting	3	5.0		Taken with Machine	3	5.5	0	0		
	Upland	Drill Sowing	32	76.2		Taken with Herbicide	7	12.7	1	2.6		
		Broad Castin	10	23.8		Taken with Fire	42	76.4	37	94.9		
Variety	Lowland	B-189	40	72.7		Taken by Family	34	61.8	26	66.7		
		Others	15	27.3		Taken by Contractor	16	29.1	12	30.8		
	Upland	B-189	6	17.1		Taken by F+C	5	9.1	1	2.6		
		Others	29	82.9		Weed Condition	Farmers Answered	52	100	39	100	
Seeds Used	Own Produced		86	91.5		Before Cleaning	Heavy	49	94.2	36	92.3	
	Purchased		8	8.5		Not so heavy	3	5.8	3	7.7		
	Selected Seed		2	2.2	Plowing	Farmers Answered	55	100	39	100		
	Non Selected Seed		87	97.8		No Plowing	24	43.7	22	56.4		
	Pregenerated Seed		13	14.0		Once	19	34.5	15	38.5		
	Non Pregenerated S		80	86.0		Twice	12	21.8	2	5.1		
	Amount Sown		56.6 kg/ha			Farmers Answered	31	100	17	100		
Nursery (Lowland Paddy)	Type	Upland Nurse	1	100		Taken with Hoe(Daba)	17	54.8	17	100		
	Location	Part of Main	2	100		Taken with Draft animal	0	0	0	0		
	Nursery Period		21days		Taken with Power tiller	11	35.5	0	0			
	Applicat of Fertiliz	No	1	50.0	Taken with Tractor	3	9.7	0	0			
		Once	1	50.0	Farmers Answered	31	100	15	100			
	Weeding	No	1	50.0	Taken by Family	22	71.0	8	53.3			
		Once	1	50.0	Taken by Contractor	9	29.0	6	40.0			
					Taken by F+C	0	0	1	6.7			
					Farmers Answered	30	100	16	100			
					Done under Dry Condition	10	33.3	13	81.3			
					Done under Wet Condition	20	66.7	3	18.7			
					Done under Submarged Cond	0	0	0	0			
					Harrowing or Puddling	Farmers Answered	47	100	30	100		
					No Harrowing/Puddling	41	87.2	30	100			
					Once	6	12.8	0	0			
					Farmers Answered	4	100	-	-			
					Taken with Man-power	1	25	-	-			
					Taken with Draft animal	1	25	-	-			
					Taken with Power tiller	2	50	-	-			
					Farmers Answered	6	100	-	-			
					Taken by Family	4	66.7	-	-			
					Taken by Contractor	2	33.3	-	-			

Source: JICA Study Team

Table C.1.15 Rice Cultivation in the Plain Lowland of the Priority Project Area in 1998

Items	Details	No. of Farmers Applied	%	Cultivation	Items	Details	No. of Farmers	%
1) Cultivation type	Direct sowing (Broad casting)	40	63.3	Direct sowing culture	12) Method of sowing	Broad casting	56	93
	Direct sowing (Hill sowing)	1	1.6			Line sowing	3	5
	Direct sowing (Broad casting + Hill sowing)	5	7.9			Mixed (Broad casting and hill sowing)	1	2
	Transplanting	2	3.2			Total	60	100
	Mixed (Broad casting + Transplanting)	15	23.8		13) Field condition at sowing time	Dry	27	45
Total	63	100	Wet			32	53	
2) Variety used	BUAKE-189	58	93.3			Mixed (Dry and wet)	1	2
	WITA-9	3	4.8			Total	60	100
	SC-1	1	1.6		4) No. of weeding	Once (at 19 days after sowing)	47	78
	Total	62	100			Twice (at 18 and 55 days after sowing)	12	20
3) Seed used	Purchased from ANADIR	12	19.0	Three times (at 18, 45, 60 d a sowing)		1	2	
	Purchased from friend	9	14.3	Total		60	100	
	Own produced	42	66.7	15) Method of weeding	Herbicide	33	55	
	Total	63	100		Hand with daba and mashette	25	42	
4) Seed rate	For direct sowing culture	55	71 kg/ha		Herbicide and hand	2	3	
	For transplanting culture	2	45 kg/ha	Total	60	100		
5) Treatment of seed (Soaking seeds in water)	Treated (Average soaking time: 1.8 days)	16	25.4	16) Labor for weeding	Family labor	59	98	
	No treated	47	74.6		Contractor	1	2	
	Total	63	100		Total	60	100	
6) Nursery type of transplanting culture	Upland nursery	6	50.0	Transplanting culture	17) Method of transplanting	Random planting	9	56
	Submerged nursery	6	50.0			Line planting	7	44
	Total	12	100		Total	16	100	
7) Location of nursery plot	In the main field	11	91.7		18) Field conditions at transplanting time	Wet	11	79
	In the other field	1	8.3			Dry	2	14
	Total	12	100			Submerged	1	7
8) Nursery area (Including nursery for mixed cultivation of direct sowing and transplanting)		35 m ² /ha (2m ² to 100 m ²)			Total	14	100	
9) Nursery period	18 days (14 days to 30 days)				9) No. of weeding	Once (at 18 days after transplanting)	11	92
10) Nursery management	No. of times of weeding	1.6 times				Twice	0	0
	No. of times of fertilizer application	1.1 times				Three times (at 15, 30, 60 d a transplanting)	1	8
	No. of times of disease/pest control	1.1 times		Total		12	100	
	No. of times of water management	16.4 times		15) Method of weeding	Herbicide	5	42	
11) Land Preparation of main field	Method of weed burning burning down burning down before plowing	Burning down	19		29	Hand with daba and mashette	6	50
		With machine	11		17	Herbicide and hand	1	8
		With mashette	10	15	Total	12	100	
		With burn/bg + machine/mashe	25	38	16) Labor for weeding	Family labor	10	83
		Total	65	100		Contractor	2	17
	Total	65	100	Total		12	100	
	Labor for weed cleaning	Family labor	53	82	11) Plowing of field	With power tiller	49	75
		Contractor	12	18		With draft animal	1	2
		Total	65	100		With human	15	23
	Total	65	100	Total		65	100	
	Labor for plowing of field	Family labor	53	82	Labor for plowing of field	Family labor	53	82
Contractor		10	15	Contractor		10	15	
Family and contractor		2	3	Family and contractor		2	3	
Total		65	100	Total		65	100	
Method of harrowing burning down and puddling	No operation	52	80	Method of harrowing burning down and puddling	No operation	52	80	
	With power tiller	10	15		With power tiller	10	15	
	With draft animal	1	2		With draft animal	1	2	
	With human	2	3		With human	2	3	
Total	65	100	Total	65	100			
Field conditions at harrowing and puddling	Wet	9	69	Field conditions at harrowing and puddling	Wet	9	69	
	Dry	2	15		Dry	2	15	
	Submerged	2	15		Submerged	2	15	
Total	13	100	Total	13	100			
Labor for harrowing and puddling	Family labor	12	92	Labor for harrowing and puddling	Family labor	12	92	
	Contractor	1	8		Contractor	1	8	
	Total	13	100		Total	13	100	

Source: FS survey, JICA Study Team

Table C.1.16 Cropping Season of Rice Cultivation in the Project Area in 1998

Sowing Time		Harvesting Time	
Month	No. of farmers (%)	Month	No. of farmers (%)
3	9	2	2
4	26	6	4
5	40	7	17
6	19	8	28
7	2	9	30
8	2	10	17
11	2	11	2
Total	100	Total	100

Source: F/S survey, JICA Study Team

Table C.1.17 Rice Cultivation in the Study Area in 1997

			Lowland		Upland	
			No. of Farmers	(%)	No. of Farmers	(%)
Weeding	No. of farmers answered		53	100	40	100
	No. of Weedings	Once	37	69.8	26	65
		Twice	15	28.3	14	35
	Method	By manual	9	20.9	6	15.8
		By manual with hoe/sickle	25	58.1	30	78.9
		By chemical	2	4.7	1	2.6
		By manual/chemical	7	16.3	1	2.6
		Done by family	36	73.5	8	80.5
Done by contractor		5	10.2	1	10	
Done by F + C	8	16.3	1	10		
Fertilizer Application	No. of farmers	Surveyed	55	100	40	100
		Applied Fertilizer	13	23.6	0	0
		Applied N	13	23.6	0	0
		Applied P	11	20.0	0	0
	Amount applied	Applied K	11	20.0	0	0
		N (kg/ha)	42.6	-	0	-
Disease and Pest Control	No. of farmers	P (kg/ha)	27.5	-	0	-
		K (kg/ha)	27.5	-	0	-
		Surveyed	55	100	40	100
Disease and Pest Control	No. of farmers	Controlled	15	27.3	0	0
		No controlled	40	72.7	40	100

Source: JICA Study Team

Table C.1.18 Fertilizer Application for Lowland Paddy in the Project Area in 1998

Type of cultivation	No. of farmers cultivated	Base				Top (At 24 days after sowing/transplanting)				Total amount applied (kg/ha)		
		No. of farmers applied	Percentage of applied farmers	Amount applied (kg/ha)		Kind of fertilizer applied	No. of farmers applied	Percentage of applied farmers	Amount applied (kg/ha)		Kind of fertilizer applied	
Direct sowing	63	20	31.7%	N	9.8	(10-18-18) and (10-20-20)	23	36.5%	N	24.5	Urea	31.3
				P	17.8				P	0	-	17.8
				K	17.8				K	0	-	17.8
Transplanting	2	2	100%	N	10	(10-18-18) and (10-20-20)	2	100%	N	24.9	Urea	31.9
				P	18.5				P	0	-	18.5
				K	18.5				K	0	-	18.5

Source: F/S survey, JICA Study Team

Table C.1.19 Disease and Pest Control for Lowland Paddy in the Project Area (1998)

Control for	No. of farmers cultivated paddy	No. of farmers controlled	Percentage of controlled farmers	No. of times controlled	Kind of chemical used
Disease	65	1	1.5%	-	-
Pest	65	28	43.1%	1.4	Furadan

Source: F/S survey, JICA Study Team

Table C.1.20 Harvest and Post-harvest of Rice in the Study Area in 1997

		Lowland Rice		Upland Rice	
		No. of Farmers	(%)	No. of Farmers	(%)
Harvesting	No. of Farmers Answered	51	100	39	100
	Picking Panicle	16	31.4	32	82.1
	Cutting Hill	41	80.4	8	20.5
Threshing	By Trampling Panicles	13	22.4	3	12.5
	By Beating panicles at board	45	77.6	20	83.3
	By Human power thresher	0	0	1	4.2
Drying of Grains	No. of Farmers Answered	53	100	34	100
	At Field	17	32.1	10	29.4
	At House Yard	30	56.6	13	38.2
	At Road Side	1	1.9	0	0
Storing of Paddy	No. of Farmers Answered	53	100	39	100
	At Storage	12	22.6	29	74.4
	At Living House	30	56.6	13	33.3
	At Other Place	1	1.9	3	7.7
Polishing of Rice	No. of Farmers Answered	44	100	29	100
	By Human-Power	27	61.4	20	69.0
	By Machine	44	100	29	100

Source: JICA Study Team

Table C.1.21 Harvest and Post-harvest of Lowland Rice in the Project Area in 1998

Works	Method	No. of farmers applied	Percentage of applied farmers
Harvesting	Cutting hill	61	94%
	Picking panicle	4	6%
	Total	65	100%
Threshing	Beating	64	98%
	Trampling	1	2%
	Total	65	100%
Drying place of harvested grains	At house yard	35	54%
	At field	12	18%
	H.Y and F.	18	28%
	Total	65	100%
Drying period of harvested grains	1-2 days	3	5%
	3-4 days	35	58%
	5-6 days	15	25%
	Over 7 days	7	12%
	Total	60	100%
Storing place of harvested grains	Living house	60	92%
	Storage	5	8%
	Total	65	100%
Milling rice	Milling machine	48	74%
	Human power	17	26%
	Total	65	100%
	Milling charge	in rice (15-25F/kg)	

Source: F/S survey, JICA Study Team

Table C.1.22 Upland Crop and Tree Crop Management in the Study Area in 1997

Crop	Application of Fertilizer			Control of Weeds			Control of Disease and Pest		
	No of Farmers Answered(A)	Controlled Farmer(B)	(B)/(A) %	No of Farmers Answered(A)	Controlled Farmer(B)	(B)/(A) %	No of Farmers Answered(A)	Controlled Farmer(B)	(B)/(A) %
Maize	86	2	2.3	86	83	96.3	86	1	1.2
Manioc	89	0	0	89	89	100	89	1	1.1
Yam	45	0	0	45	45	100	45	1	2.2
Okra	42	9	21.4	42	41	96.7	41	17	41.5
Egg plant	43	10	23.3	43	43	100.0	43	23	53.2
Cacao	79	8	10.1	79	79	100.0	79	46	58.2
Coffee	66	3	4.5	66	65	98.5	66	8	12.1
Rubber	5	0	0	5	5	100	5	2	40.0

Source: JICA Study Team

Table C.1.23 Yield Constraints by Crop in the Study Area

(Total of score)

Crop	Degree of Constraint	Water	Soil	Weed	Disease and Pest	Labor	Market
Paddy	Greatest	207	114	60	30	27	48
	2nd	30	62	104	36	38	16
	3rd	2	18	15	23	32	7
	Total	239	194	179	89	97	71
Maize	Greatest	120	54	24	3	0	30
	2nd	48	52	83	18	24	8
	3rd	12	25	25	20	31	6
	Total	180	131	137	41	58	44
Manioc	Greatest	63	96	24	12	3	30
	2nd	28	41	98	12	30	12
	3rd	37	23	26	15	37	5
	Total	128	163	148	39	70	47
Yam	Greatest	72	78	6	9	6	21
	2nd	44	22	66	4	8	6
	3rd	7	10	16	16	27	4
	Total	123	110	88	29	41	31
Vegetables	Greatest	18	12	9	24	0	3
	2nd	6	10	12	6	2	0
	3rd	0	1	4	1	9	4
	Total	24	23	25	31	11	7
Cacao	Greatest	108	132	3	138	30	114
	2nd	60	40	62	76	16	12
	3rd	10	10	36	2	33	5
	Total	178	182	101	216	79	161
Coffee	Greatest	75	90	36	21	39	102
	2nd	40	34	76	20	24	2
	3rd	6	9	8	14	23	3
	Total	121	133	120	55	86	107
Rubber	Greatest	3	15	0	12	6	21
	2nd	10	4	12	12	4	0
	3rd	1	0	1	0	5	0
	Total	14	19	13	24	15	21

Note: Degree of yield constraints is expressed by score, which are given 3 points to the answer of greatest, 2 points to the 2nd, and 1 point to the 3rd.

Source: JICA Study Team

Table C.1.24 Way to Increase of Farming Income (Farmers' Opinions in the Study Area)

Farming Type	No of Farmers Answered	Expansion of land		Increase in yield		Introduction of new crop		Improvement of market	Details
		Priority	Ideal area(ha)	Priority	Priority	Details	Priority		
Lowland(L)	4	3	3	1	3	Rubber	2	No suggestion	
Upland(U)	1	1	10	2	1	Poultry	1	Construction of storage	
Tree crop(T)	8	3	5	1	3	Rubber,Rice	2	Fixed price, Price up	
(L)+(U)	5	1	8	1	1	Tree crops	1	Price up, Storage	
(L)+(T)	14	2	6	1	2	Tree crops	2	Price up, Storage	
(L)+(U)+(T)	9	2	6	1	2	Rice, Oil palm	1	Organization of GVC, Price up	
(L)+(U)+(T)	55	2	7	1	2	Rice, Tree crop	1	GVC, Storage, Fixed Price, PU	
Total Average	96	21	66	11	20	-	14	-	

Note: 1 Highest priority, 2 2nd priority, 3 3rd priority

Source: JICA Study Team

Table C.1.25 Farmers' Expectation to the Project in the Study Area in 1997

(Unit: Priority)

Farming Type	No. of Farmers	Irrigation facility	Drainage facility	Farm road	Leveling of field	Technology support	Financial support	Social support	
								Priority	Details
Lowland(L)	4	2	2	5	5	3	5	7	No suggestion
Upland(U)	1	1	1	1	1	1	1	1	Water, Electricity
Tree crop(T)	8	2	3	3	3	2	5	3	Dispensary
(L)+(U)	5	1	1	2	2	1	2	3	Dispensary, Electricity
(L)+(T)	14	2	2	3	2	1	3	3	Dispensary, Electricity
(U)+(T)	9	1	2	2	2	1	3	1	Health center, School
(L)+(U)+(T)	55	1	2	2	2	1	2	2	School, Health center
Total	96	1.4	1.7	2.6	2.4	1.4	3.0	2.9	-

Note: 1: Highest priority, 2: 2nd priority, 3: 3rd priority

Source: JICA Study Team

Table C.1.26 Raising Livestock in the Study Area in 1997

	Sheep	Goat	Pig	Poultry
No. of Farmers Surveyed	99	99	99	99
No. of Farmers Raised Livestock	8	8	5	59
% of Farmers Raised	8.1	8.1	5.1	59.6
(Number of Heads Per Raised Farmer)				
No. of heads Raising at Present	9	7	14	36
No. of Newborns in 1997	7	2	8	40
No. of Dead Heads in 1997	4	1	1	23
No. of Heads Purchased in 1997	0	0	0	1
No. of Heads sold in 1997	1	0	5	7
No. of Heads Consumed in 1997	1	0	2	10
No. of Eggs Produced (Pieces/Head/Y)	-	-	-	13
Unit Price Sold (FCFA/Head)	25,000	-	5,000	2,500

Source: JICA Study Team

Table C.1.27 Raising Livestock in the Project Area in 1998

	No. of livestock in the area	No. of farmers raising	Percentage of farmers raising	No. of livestock raising per
Cattle	2	1	1.3	2
Sheep	22	5	6.5	4.4
Goat	9	2	2.6	4.5
Pig	2	2	2.6	1.0
Poultry	708	36	46.8	19.7

Source: JICA Study Team