CHAPTER VI REVIEW OF EXPERIENCE IN AMAZON REGARDING AGRICULTURE, FISHERY, MARKETING AND ENVIRONMENTAL CONSEVATION

6.1 Research Conducted by EMBRAPA and Others, Similar Projects and Related Programs

6.1.1 Environment Friendly Agriculture and Fishery

More than 160 papers and documents from the Amazon region were reviewed. It was found that there are not specific researches for the Itacoatiara municipality. Most documents are general for the Amazon region. Most investigations are underway and only partial results are available.

A summary of the researches is presented in three ways:

- A consolidated summary of findings from researches and general publications is presented in tabulated form and included in the Annex 6.1.1-1.
- A selected bibliography is presented in the Annex 6.1.3-1.
- Description of more relevant and practical research findings which is presented in the following sections.

(1) Agroforestry

(a) Institutions involved

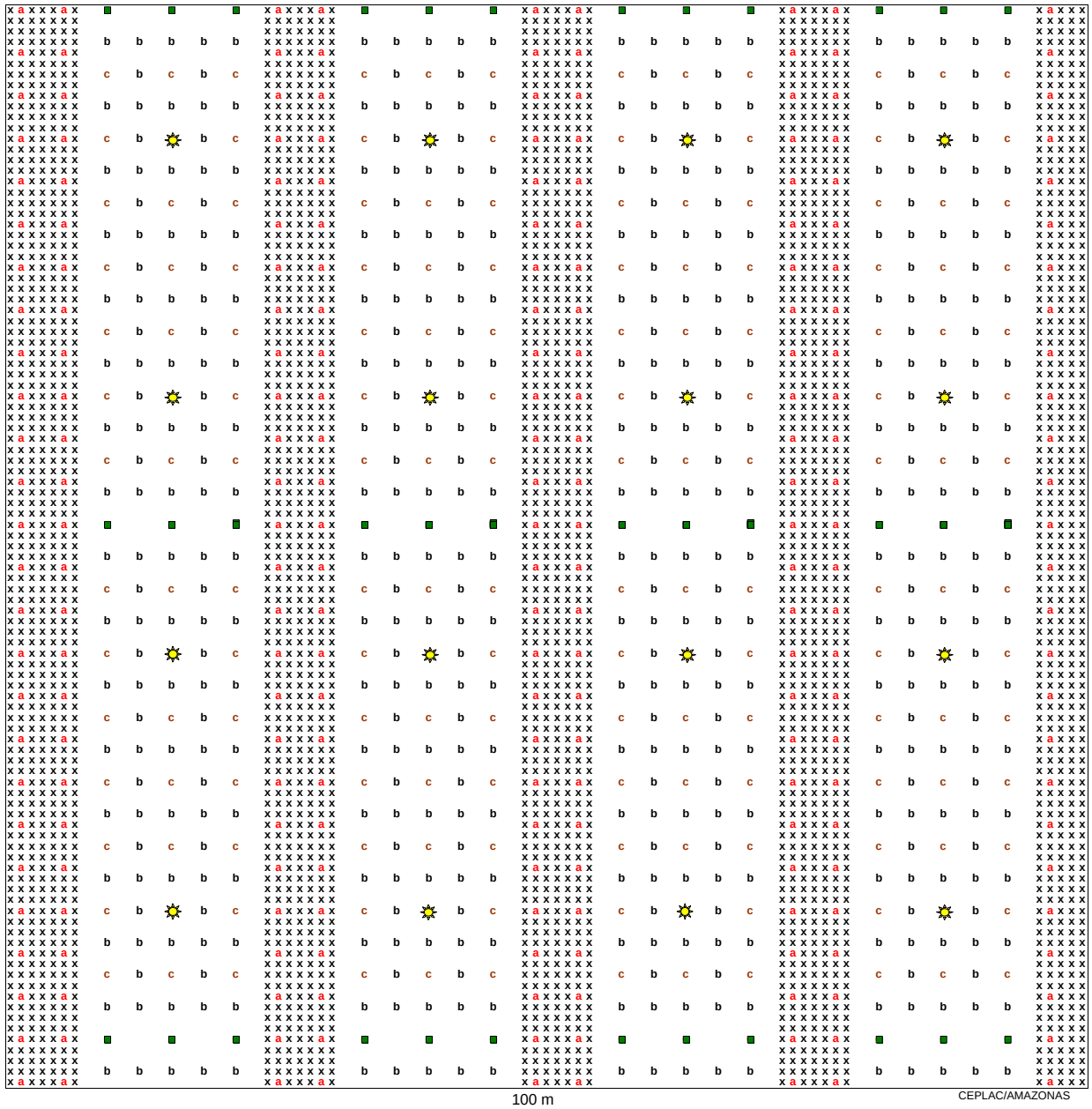
Many local, regional and international institutions are involved in research, promotion and implementation of SAF (Agroforestry System) projects. The most important ones are: EMBRAPA, INPA, CEPLAC and Universities. Besides these institutions many other Brazilian institutions are involved. At the same time, 13 foreign institutions and 7 foreign universities are cooperative in SAF research.

(b) Agroforestry systems

The subjects of research in the region are agroforestry, silvopastoral and agrosilvopastral systems. Agroforestry system is most popular and the only one that has been implemented among farmers. Project PPG7 (1998) reports more than 14 combination of cropping systems has been used by farmers. Home orchards are present in most farms. Sena-Gomes et.al (2000) describes Alley crops used by CEPALC. Figure 6.1.1-1 shows an example of CEPLAC's agroforestry systems using alley crops.

(c) Plant species in SAF (Agroforestry System)

Leeuwen (1998) indicates that 170 species are found in SAF in the region. But a survey on 181 SAF (Wandelli,2000) indicate that in 66% of them there are only 3



Legend:

■ = Puxuri no espaçamento 6,0 X 48,0 m na área do cupuaçu (36 plantas/ha).

c = Cupuaçu no espaçamento 6,0 X 6,0 m em faixas triplas (152 plantas/ha).

☼ = Castanha-do-Brasil no espaçamento 24,0 X 24,0 m nas faixas do cupuaçu (16 plantas/ha).

a = Açai no espaçamento 4,0 X 4,0 m em faixas duplas (234 plantas/ha)

b = Banana no espaçamento 3,0 X 3,0 m na faixa do cupuaçu (456 plantas/ha)

x = Mandioca no espaçamento de 1,0 X 1,0 m na faixa do açai (3.099 plantas/ha)

Obs: Durante o período de implantação e desenvolvimento do sistema agroflorestal, a faixa do cupuaçu será aproveitada para o cultivo de culturas anuais como arroz, feijão-caupi, abacaxi e/ou milho.

Figure 6.1.1-1 Sketch of Alley Crop for CEPLAC Projects

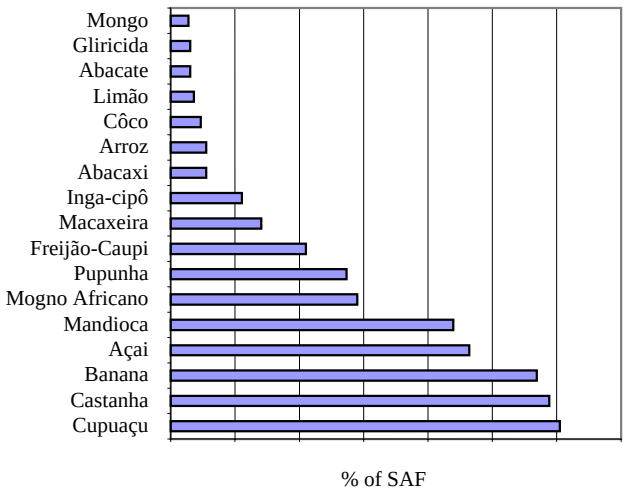
species; this can be seen in Figure 6.1.1-2. Table 6.1.l-1 shows the list of the most common species. It can been noted that cupuaçu (60.5%), Brazil nut (58.84) and banana (56.91%) are the most used crops. Mandioca (43.92%) is the most common annual legume tree because it provides shade, nitrogen and organic matter for other crops and serre as essential part in the system.

Table 6.1.1-1 Species in 181 SAF in Amazonas

Brazilian name	English	Scientific name	No of SAF	Crop %inSAF
Cupuaçu	Cupuaçu	Theobroma grandiflorum	110	60.50
Castanha	Brazil nut	Bertholettia excelsa	107	58.84
Banana	Banana	Musa spp	103	56.91
Açai	Açai	Euterpe oleracea	84	46.41
Mandioca	Bitter Cassava	Manihot spp.	80	43.92
Mogno Africano	African Mahogany		53	29.01
Pupunha	Peach palm	Bactris gasipaes	50	27.35
Freijão-Caupi		Cordia spp.	38	20.99
Macaxeira	Cassava	Manihot spp.	26	14.09
Inga-cipô	Ingo	Inga spp.	20	11.05
Abacaxi	Pineapple	Ananas comosus	10	5.52
Arroz	Rice	Oryza sativa	10	5.52
Côco	Coconut	Cocos nucifera	9	4.70
Limão	Lime	Citrus limon	7	3.59
Abacate	Avocado	Persea americana	6	3.04
Gliricida	Gliricida	Gliricida spp.	6	3.04
Mogno	Mahogany	Sweitenia macrophylla	5	2.76

Source: Wandelli, 2000/Embrapa

Sena-Gomes (2000) explains the CEPLAC agroforestry system indicating several layouts depending on the combination of trees. As an example, the model ESEOP consists of the high size (timber trees) mogno (*Swietenia macrophylla*), bandarra (*Shilozobicum amazonicum*), teca (*Tectona grandis*), cedro rosa (*Cedrela odorata*), freijó louro (*Cordia alliodora*); (fruit trees): mango (*Mangifera indica*), bread fruit (*Arthocalpus altilis*), avocado (*Persea americana*), coconut (*Cocos nucifera*), pupunha (*Bactris gasipaes*); low size species: graviola (*Annona muricata*), araça-boi (*Eugenia stipitata*), cinnamon (*Cinnamon zeylanicum*), orange (*Citrus sp.*), ponça (*Citrus nobilis*), banana/cupuaçu , banana/cocoa, papaya/pepper/maracuja.



SAF: Agroforestry System

Figure 6.1.1-2 Species in 181 SAF in Amazonas

(d) Evaluation of species

Evaluation of species is one of the current researches underway. EMBRAPA, INPA and CEPLAC are the main institutions engaging in the research.

Legumes

Some EMBRAPA's researches are presented in a PPG7/EMBRAPA (1998) publication. Table 6.1.1-2 from that publication presents an evaluation of legume tree species. It shows that Acacia auriculiformis produces de most dry matter with 7.8 tons/ha. It also produces 122.3 Kg/ha of Nitrogen, 4.8 Kg/ha of P, 60.17 Kg.ha of K, 48.46 of Ca and 6.75 Kg/ha of Mg. This research also shows a remarkable response to phosphorous application with a difference of 3.3 ton/ha of dry matter for Acacia. Magalhaes et.al (2000) found that Cassia rotundifolia produced 9.95 ton/ha of dry matter and Codariocalix gyroides 5.7 ton/ha. Menezes-Filho (2000) found that Inga edulis had the best performance in an Acre experiment, they also found good response to phosphorous fertilization.

Table 6.1.1-2 Mean Dry Matter Production and Macro-nutrient Content in Pruned Material from Legume Trees

unit: kg/ha

Specie	P	DM	N	P	K	Ca	Mg
Inga edulis	No	663	14.8	0.58	6.19	3.16	0.8
	yes	1537	35	1.42	10.45	7.12	1.42
Senna reticulata	No	763	17.1	0.96	6.3	7.41	1.98
	yes	1920	31.5	1.83	11.4	13.56	3.75
Gliricida sepium	No	256	5.8	0.26	3.9	1.25	0.6
	yes	424	10.9	0.69	4.95	2.39	1.42
Acacia auriculiformis	No	4597	75.9	2.69	43.31	31.83	4.72
	yes	7854	122.3	4.8	60.17	48.46	6.75
Acacia angustíssima	No	200	4.8	0.22	1.86	0.67	0.2
	yes	854	20.8	1.15	7.26	2.27	0.81

Phosporous fertilization influence (EMBRAPA-Roraima, 1998)

Timber trees

Table 6.1.1-3 presents the result of 3-year measurements of tree species in Roraima (PPG7/EMBRAPA, 1998). Acacia mangium and Eucalyptus camaldulensis presented the best growth rate with heights of 12.47m and 7.71m respectively. In this study it was proved that mogno (Swietenia macrophylla) and Cedrela sp. are vulerable to the attack of a pest (Hysyphilla grandella) that affects terminal buds of plants. Caliri et.al (2000) in an evaluation of samauma (Ceiba pentandra) found that the specie presented better growth in SAF than in the open. Table 6.1.1-4 shows the results indicating a DAP[1] of 44 cm at the 5th year in SAF against 18 cm. in the open. Franke (2000) evaluated 12 species in Acre and found that Acacia mangium and Acacia pollyphylla had the best performance; results are shown in Table 6.1.1-5. Schwengber et.al (2000) evaluated four timber trees in Roraima and found that Acacia mangium and Teca are superior to Freijó and Pau-rainha.

[1] DAP is diameter at chest height

Table 6.1.1-3 Diameter at chest height (DAP) and total height of arboretum forest species, Measured from 1995 to 1998.

SPECIE	DATE	DAP (cm)			Height (m)		
		1996	1997	1998	1996	1997	1998
Acacia mangium	Jun-95	9.44	13.1	16.3	6.19	10.38	12.47
Cedrela sp.	Jun-95	n.m.	2.8	3.1	1.48	2.39	2.14
Parkia pendula	Jun-95	n.m.	1.9	3.9	0.88	1.45	3.31
Swietenia macrophylla	Jun-95	n.m.	2.7	4.1	1.51	2.63	4.11
Albizia guachapelle	Jun-96	n.p.	3.9	5.8	n.p.	3.74	5.68
Bagassa guianensis	Jun-96	n.p.	2.2	5.4	n.p.	2.64	5.25
Bertholletia excelsa	Jun-96	n.p.	n.m.	2.9	n.p.	1.38	2.70
Byrsonima sp.	Jun-96	n.p.	n.m.	n.m.	n.p.	2.30	4.11
Carapa guianensis	Jun-96	n.p.	n.m.	3.6	n.p.	1.36	2.81
Colubrina acreana	Jun-96	n.p.	1.7	4.9	n.p.	2.13	4.61
Cordia alliodora	Jun-96	n.p.	1.5	5.1	n.p.	1.49	3.16
Erythrina fusca	Jun-96	n.p.	n.m.	n.m.	n.p.	1.86	1.89
Eucalyptus camalsulensis	Jun-96	n.p.	3.4	6.0	n.p.	4.56	7.74
Gmelina arborea	Jun-96	n.p.	5.0	8.3	n.p.	4.23	7.02
Goupia glabra	Jun-96	n.p.	n.m.	2.2	n.p.	1.20	2.69
Hymenaea courbaril	Jun-96	n.p.	n.m.	n.m.	n.p.	0.56	1.05
Jacaranda copaia	Jun-96	n.p.	5.0	10.4	n.p.	3.00	6.17
Schizolobium amazonicum	Jun-96	n.p.	3.8	7.9	n.p.	3.43	7.14
Tabebuia sp.	Jun-96	n.p.	n.m.	4.4	n.p.	1.80	4.51
Copayphera	Jun-97	n.p.	n.p.	n.m.	n.p.	n.p.	1.86
Pithecelobium saman	Jun-97	n.p.	n.p.	3.0	n.p.	n.p.	2.49
Cumaru	Jun-97	n.p.	n.p.	2.5	n.p.	n.p.	2.35

Source: EMBRAPA-Roraima,1998 n.m= not measured n.p.=not planted

Table 6.1.1-4 Mean diameter (cm) at chest height (DAP) and height (meters)or sumaúma *(Ceiba sp.)* In SAF and without shade (SUN).

	Year													
	1		2		3		4		5		6		7	
Place	DAP	h	DAP	h	DAP	h	DAP	h	DAP	h	DAP	h	DAP	h
SUN	5.22	2.78	12.72	5.65	14.79	7.22	16.64	8.28	18.05	8.76	18.97	9.78	19.65	9.67
SAF	-	-	-	-	-	-	-	-	44	14.24	-	-	-	-

Source: JICA Study Team, 2001

Table 6.1.1-5 Total height (m) and mean annual growth rate (IMA) in meters in multi-use species, native and foreign, from 1994 to 2000 in Rio Branco

Species	1994	1997	2000	IMA - 1997	IMA - 2000
Acacia mangium	2.87	11.72	14.50	2.91	1.91
Acacia pollyphylla	1.32	9.29	10.29	2.66	1.35
Aspidosperma vargasii	0.25	1.67	4.45	0.47	0.59
Calycophyllum spruceanum	1.27	5.94	6.88	1.56	0.91
Cedrela odorata	0.43	2.66	4.74	0.74	0.62
Erythrina berteroana	1.48	3.84	4.61	0.78	0.61
Erythrina fusca	2.09	5.53	6.00	1.35	0.79
Erythrina poeppigiana	1.48	4.63	4.96	0.85	0.65
Gliciridia sepium	1.66	5.87	7.04	1.40	0.93
Leucaena leucocephala	3.07	7.23	7.61	2.38	1.00
Spondias lútea	0.95	4.43	5.74	1.16	0.76
Torresea acreana	1.36	3.77	5.92	0.80	0.78

(e) Competitiveness and complementarily

Research shows that in SAF plants get more competitiveness and complementarily than in the open. Main effects are to provide shading, nutrition, soil moisture, and tolerance against pest and diseases. Shade is beneficial for some crops like cupuaçu, coffee and cocoa in their early stages. During adult phase, all crops produce more

with full sunshine but some problems, like diseases and deterioration of fruit quality, could counteract potential higher production. In cupuaçu, it was found shade of 50 to 60 % will be ideal (FAO,1999). Gomes et.al (2000) found that some crops under mixed cropping have overall better performance. Table 6.1.1-6 presents the results. In this case plantation with pupunha gave better results in mixed cropping. Best economical results were found with pupunha and pineapple with R$ 4,224 per ha as compared with R$ 1,756 of pupunha (*Bactris sp*) as monoculture. Martinez (2000) found out that banana under shade presents less Black Sigatoka damage than in the open. He found a reduction of US$ 768.7 in cost production due to savings in disease control. Findings of Caliri et.al (2000), previously mentioned indicate positive results. Miller (2000) studying shade effect on crop development found that coconut, graviola and cupuaçu are affected by shade. Meirelles and Mochiutti (2000) found that pasture in Amapá are severely affected by shade of taxi-branco (S. Paniculatum). Müller et.al (2000) found that timber trees in SAF with cupuaçu had better development than in the open. In Table 6.1.1-7 it is shown that all species behave better in SAF than in the open. In the case of paricá (Schizolobium amazonicum), at 18 months of age, had a 86 cm diameter in SAF and 13.5 in the open.

Table 6.1.1-6 Productivity and income from different consortium systems and monoculture with economical important crops in the Amazon.

Crop	Pupunha			Manihoc	Pineapple	Banana	Urucu	Total
	1990	1991	1992	1987	1987/88	1988	1989	
				Production (ton/ha)				
P - MD	0.66	1.92	1.11	9.27	-	-	0.34	12.96
P - UR	0.62	2.17	0.91	-	-	4.43	-	4.04
P - B	1.57	2.68	1.71	-	-	-	-	10.49
P - AB	1.73	2.23	1.80	-	5.73	-	-	11.49
P	0.81	1.81	0.57	-	-	-	-	3.19
Monoculture				9.74	2.71	3.51	0.35	-
				Revenue (US$/ha)				
P - MD	363	1057	611	459	-	-	-	2490
P - UR	341	1195	501	-	-	-	225	2261
P - B	919	1475	947	-	-	888	-	4224
P - AB	952	1228	991	-	789	-	-	3959
P	446	996	314	-	-	-	-	1756
Monoculture				483	373	703	231	

P = Pupnha, MD = Manihoc, B = Banana, AB = Pineapple
Source: Gomes et. Al (2000)

Table 6.1.1-7 Mean height rate (cm/monoculture) of tree forest trees and 3 palm trees from age of 6 to 18 months after planting

Permanent Species	Temporary Species			
	Maracujazeiro	Bananeira	Macaxeira	Pleno sol
Mogno africano	26.5	30.5	23.5	18.3
Paricá	86.0	81.5	63.5	13.5
Freijó	21.0	13.0	2.0	4.6
Pupunheira	17.5	15.0	19.0	3.6
Açaizeiro	14.0	12.0	10.5	8.0
Coqueiro	14.5	12.5	9.5	2.6

Source: Feb/1999 unit: cm

(f) Advantages farmers economy in productivity

Shown in Table 6.1.1-6, savings from Black Sigatoka control are examples of the merit of mixed cropping on farmers economy. Leite (2000) found that in a mixed cropping of coconut with cupuaçu, farmers can obtain, in the 5th year, an additional income of R$ 4084 per hectare. Alves (2000) found that coconut associated with other crops had better performance than monoculture. Table 6.1.1-8 shows the results of the economical analysis indicating that combination of coconut with pineapple gives R$ 8540 net income compared with income for coconut monoculture (-R$26). Highest cost-benefit ratio (5.65) was obtained with the combination of coconut with beans but net income was only R$ 2855.

Table 6.1.1-8 Economical analysis of four mixed crop with coconut in Ponta de Pedras, Pará

Economical Indicators		Coconut in Mono-culture	Coconut with Caupi bean	Coconut with Pineapple	Coconut with Corn + Caupi	Coconut with Rice + Caupi
Productivity						
Coconut	unit/ha	60	13,200	13,200	13,200	13,200
Pineapple	unit/ha	-	-	26,600	-	-
Caupi bean	kg/ha	-	900	-	900	900
Corn	kg/ha	-	-	-	2,500	-
Rice	kg/ha	-	-	-	-	20
Revenue						
Coconut	R$	12	2,640	2,500	2,560	2,620
Pineapple	R$	-	-	7,980	-	-
Caupi bean	R$	-	720	-	752	728
Corn	R$	-	-	-	625	-
Rice	R$	-	-	-	-	680
Gross Revenue (Total)	R$	12	3,360	10,480	3937	4,028
Production Cost	R$	38	505	1,939	1,038	921
Net Income	R$	-26	2,855	8,540	2,899	3,106
Cost/Benefit		-0.68	5.65	4.40	2.79	3.37

Remark: Coconut = R$ 0.20 /unit, Pineapple = R$ 0.30 /unit, Caupi bean = R$ 48.00 /60kg, Corn = R$ 15.00 /60kg, Rice = R$ 30.00 /50kg
Source: Alves, 2000

(g) Labors

Agroforestry system demands labor force intensively during planting, but it is reduced considerably afterwards. With only family labor, total cropping are is limited under SAF. During peak months, hiring labor may be required. Silva et.al (2000) studied labor utilization in SAF. Tables 6.1.1-9 shows that after stabilization of SAF it requires only about 40 men/ha/year, while in early years of implantation it required 229 men/year/ha. After the 8th year farmers will have extra time for other activities and therefore more income.

Table 6.1.1-9 Labor Demand (man/day/ha) at Agrossilvicultural Ssystem throughout 8 years

Species	Activity	1991	1992	1993	1994	1995	1996	1997	1998
Cupuacu	Seedling Preparing	13.30							
	Plantation		16.70						
	Replantation		3.30						
	Fertilization			4.00	3.70	4.00	3.80	1.70	1.70
	Harvest				0.50	1.00	1.70	2.80	2.70
	Prune								2.10
Sub-total		13.30	20.00	4.00	4.20	5.00	5.50	4.50	6.50
Manioc	Seedling Preparing		16.70	13.30	11.70				
	Plantation		24.90	13.40	9.10				
	Fertilization			5.70					
	Harvest			10.40	10.00	8.00			
Sub-total			41.60	42.80	30.80	8.00			
Colubrina	Seedling Preparing				5.30				
	Plantation				4.70				
	Replantation					0.80			
Sub-total					10.00	0.80			
Gliricidia	Seedling Preparing		0.30						
	Plantation		6.60						
	Replantation			0.50					
	Prune				14.70	15.00	10.10	8.00	6.70
Sub-total			6.90	0.50	14.70	15.00	10.10	8.00	6.70
Pupunha (palmito and fruit)	Seedling Preparing	33.30							
	Plantation		4.30						
	Replantation		2.00						
	Fertilization		5.50	5.30	9.30	10.00	2.70	2.70	2.70
	Fruit Harvest							13.50	14.00
	Palmito Harvest						1.80		1.50
Sub-total		33.30	11.80	5.30	9.30	10.00	4.50	16.20	18.20
Rice	Plantation			22.60					
	Fertilization			20.00					
	Harvest			20.00					
Sub-total				62.60					
Mucuna	Plantation		16.00						
	Control			7.60					
Sub-total			16.00	7.60					
Centro - sema	Plantation						5.60		
	Control								1.20
Sub-total							5.60		1.20
Acai	Seedling Preparing			24.00					
	Plantation				34.60				
	Replantation				0.80				
	Fertilization						0.50	0.40	
Sub-total				24.00	35.40		0.50	0.40	
Common activities to all species	Slash and burn	47.00							
	Grubbing		50.00	35.00	20.00				
	Clearing					5.00	3.00	2.00	1.00
Total		46.60	96.30	146.80	104.40	38.80	26.20	29.10	32.60

Source: Silva et. Al, 2000

(2) Organic Fertilization

This is an old practice and therefore there are many publications on the subject, most of them are general and practical like the ones published by SEBRAE (2000) “Produção de Adubo Organico” and Da Costa (1986). New trends in organic

agriculture have increased research on the subject. A paper presented by Scialabba (2000) point out that underdeveloped countries are giving attention to organic agriculture because it gives them opportunity to gain markets for their products.

(a) Organic fertilization in the Amazonas State

There are no specific researches on the subject nor detailed statistics on the use of organic fertilizers. According to the last agricultural census (1996), only 9.5% of farmers in Itacoatiara use chemical fertilizers and 84.3 % do not use any input. The RRA (JICA, 2000) indicate that in the surveyed communities of Itacoatiara, 0.34% of farmers use organic fertilizers and 14.77% use chemical fertilizers and 83% do not use fertilizers.

IBGE (1998) data indicate that the State of Amazonas was the fourth least user of chemical fertilizers in Brazil, but its use is increasing at a high rate, jumping from 1532 tons in 1996 to 3794 in 1997 which is 148 % increase.

(b) Compost and residue utilization

There are many publication on the subject and indicate the convenience of organic fertilizer. At local level the Escola Agrotecnica Federal of Manaus is doing some practical research.

(3) Green Manure and Cover Crops

Green manure was promoted in the middle 20th century, but as Primavesi (1984) mentioned, was abandoned in all tropical countries for several reasons. Cruz (1984) indicates some contradictory elements of green manuring, nutrition and soil moisture; he also indicates that dead cover proved to be better than living cover but fire hazard is a main concern. These two references indicate the status of green manure in Brazil in the 80'.

At present, green manure is mainly used in SAF. Research has been centered on legume species evaluation for its biomass production and nutrient composition. Table 6.1.1-2 shows the results of legume trees evaluation (EMBRAPA/PPG7, 1998). Acacia auriculiformis produced 6,225 Kg/ha of dry matter. Gliricida sepium proves to have the highest nutrient content and a high rate of decomposition. In Rondônia, similar evaluation with some other species, showed that Cassia rotundifolia and Codariocalyx gyroides were the best species with dry matter production of 9.95 and 5.7 ton/ha respectively. Meneses-Filho et.al (2000), in other evaluation in Rio Branco, RO, found that Inga edulis had the best performance. These results indicate the potentiality of the species and the differences in performance according to local climate and soil conditions.

(4) Integral Farms

Recently there has been several new models of environment friendly agriculture or

organic agriculture. Most new approaches tend to utilize all farm resources having a more holistic view of natural resources (IPAB, 2001). Names like “Ecological villages”, “Permaculture”, “Organic Agriculture” tend to be synonymous with an “Integral Farm” concept that try to maximize all farm output and resources.

This type of concept try to have a more self-sufficient farm that will have less external inputs and, optimize farm natural resources. This farm will include SAF, vegetables, medicinal plants, poultry, aquaculture and forest. Organic fertilization will include the use of compost and green manure, residue decomposition in the field and earth-worms. All farm residues and wastes will be utilized in feeding animals and in compost preparation. In some cases, apiculture also includes fruit tree pollination and honey production. This type of project aims at using alternative energy like bio-gas. In Brazil there are found several movements and institutions, that are working on that. In the area, the Escola Agrotecnica Federal de Manaus has a permaculture unit that is doing research and training in the subject. There are a Brazilian Institute of Permaculture and several other organizations like the “Instituto de Permacultura Austro Brasileiro” and the “Projeto Novas Fronteiras da Cooperação Para o Desenvolvimento Sustentável”.

(5) Capture Fishery

There are several projects focussing on environmental protection or wise use of environmental resources in which fishery supportive scheme is included. Those are summarized as follows:

Table 6.1.1-10 Major projects on aquatic environmental protection and wise use of resources.

Name of the Project	Starting from:	Major project sites	Major steering organizations	Fishery-related scheme
Project IARA	1991	Santarem, PA	IBAMA/GTZ	Fishery resource management (education and low enforcement)
Project Mamiraua	1991	Tefe, AM	Mamiraua (NGO) /IBAMA	Fishery resource management
Project Varzea	1994	Santarem, PA	IBAMA/DFID/WWF/UNEP	Community base lake resource management
Lago do Piranhya	1997	Manacapuru, AM	SUFRAMA/Municipal government	Ecotourism, support to traditional fishing activity
Project ProVarzea	2000	Parentins, AM Santarem, PA	IBAMA/DFID/GTZ/UNDP/PPG7	Sustainable fishery in varzea, Examination of net cage culture

PA: Para State, AM: Amazonas State

Lacking of reliable fishery statistics is one of the major constraints on scientific management of fishery resources. As a scheme of Project ProVarzea, network of fish landing monitoring system is going to established by collaboration of relevant other projects (Table 6.1.1-11).

Table 6.1.1-11 Fishery production monitoring network to be established in ProVarzea

Monitoring Station	Responsible Projects	Since	Supporting organizaition
Para State			
1 Icoaraci	-		
2 Belem	MPEG-Ictiologia	1992	FINEP/SUDAM
3 Abaetetuba	-		
4 Almeirim	Project IARA	1994	Municipal office
5 Monte Alegre	- do -	1993	Municipal office/GTZ
6 Alenquer	- do -	1993	Municipal office
7 Santarem	- do -	1991	IBAMA/GTZ/CNPq
8 Obidos	- do -	1993	Municipal office
9 Oriximina	- do -	1994	Municipal office
Amazonas State			
10 Parintins	Project PESCA	1996	FUA/INPA/IBAMA
11 Itacoatiara	- do -	1996	FUA/INPA/IBAMA
12 Manaus	- do -	1993	FBB/FUA/INPA
13 Manacapuru	- do -	1996	FUA/INPA/IBAMA
14 Coari	-		
15 Tefe	Mamiraua Project	1991	Mamiraua (NGO)/IBAMA
16 Tabatinga	-		

Source: Ruffinio (Personal communication)

(6) Aquaculture

Consideration on environmental impact of aquaculture activity and creation of environment friendly measures to minimize the effects shall be of importance. However, there are few such studies at the moment in Amazon basin, due to short history of this sector.

In general significant environmental problems such as soil erosion, water pollution and serious damage to wild fauna and flora have not been generated by aquaculture activity until now. On the other hand, catching of wild juveniles as seeds for aquaculture may cause damages to wild fishery resources, although very little is known about extent of this extractive activities.

As a broad sense of aquaculture, an experimental seed stocking program of tambaqui has started by INPA since 2000 in Iranduba. This project is one of research program of PPG7 and called “Extensive aquaculture of tambaqui in varzea forest”.

6.1.2 Guarana

(1) EMBRAPA Research Activities in Amazonia

(a) History of EMBRAPA in Amazonia

Most of the research literature on guarana involves the pharmaceutical, chemical, and therapeutic properties of products obtained from guarana seed. Research on the field production aspects of guarana began in the 1960’s and was carried out by two institutions which no longer exist:

- Northern Institute of Agricultural Research and Experimentation (IPEAN) - Belem, PARA
- Western Amazon Institute of Agricultural Research and Experimentation (IPEAOc) – Manaus, AM

In the 1970's, IPEAN became EMBRAPA's Eastern Amazon Research Center, and IPEAOc became EMBRAPA's Western Amazon Research Center. During the 1970's, EMBRAPA research focused on rubber production, and during the 1980's there was a new shift to research on dende production. EMBRAPA initiated field research on guarana in the early 70's. In 1991, EMBRAPA's research center in Manaus became known as the Western Amazon Research Center for Agro-Forestry (EMBRAPA/CPAA) and the research emphasis shifted away from plantation production of rubber and dende to agro-forestry systems, and to new crops, including guarana. In 1994, in accordance with EMBRAPA's National System Plan (SEP), two important guarana subprojects were created:

Development of a Sustainable Production System for Guarana (SubProject #07.0.94.018-03)

Objectives:

1. Anthracnose control
2. Alternative harvesting procedures
3. Study of phenotypic stability of guarana clones under different environmental conditions (virgin forest vs. capoeira) in three locations (Maues, Manaus, Iranduba)

Guarana Active Germplasm Bank (SubProject #02.0.94.191-04)

Objective: Establish a living repository to preserve the genetic diversity of all existing guarana accessions.

In 1998, a series of nuclear core themes with a regional nature were introduced to better focus the research efforts of EMBRAPA/CPAA. These included:

- Regional support programs for dende and guarana
- Meso-regional programs for rubber and tropical forestry

These core themes had the following objectives:

- Environmentally sustainable production
- High social and economic benefit
- Low levels of environmental impact
- Alternative models for urban migration
- Meeting the needs of agro-industries
- Acquiring additional interest and funding from state government

(b) Current Research at EMBRAPA/CPAA:

EMBRAPA's current research program for guarana had its foundation in 1999 and two major programs were established:

- Guarana breeding (Project #07.2000.001)
- Guarana cultural practices (Project # 07.2000.002)

The Guarana Breeding Project:

Two research approaches are being used:

- Intraspecific recurrent selection
- Clonal selection (has 8 subprojects with a total of 15 experiments at local, regional, and national level)

This approach has two main experiments with the following objectives:

- Select clones with yields of > 1.5 kg/ha, good stability, tolerant to the major diseases, with good fruit quality.
- Generate an improved "Cycle 1" population

The Cultural Practices Project:

This project has four subprojects with the following objectives:

- Define optimum spacing patterns for guarana varieties
- Define doses of N, P, and K that are economically viable
- Weed control
- Define the agronomic techniques necessary to rejuvenate old guarana fields through pruning, fertilization, grafting, and thrips control

(c) EMBRAPA/CPAA Major Research Results:

Cultural Practices Results

After more than 10 years of research, in 1998, two major manuals were produced by EMBRAPA which summarized the technical recommendations for producing both the guarana crop and guarana seedling planting material. One manual ("Guarana: How to Grow") was produced as a simple extension publication for the farmers. The other manual ("The Production System for Guarana") presented techniques in more detail and was targeted more at extensionists and researchers. These publications presented technical recommendations based on EMBRAPA research for the following general topics:

1. Effect of soil and climate
2. Soil preparation
3. Planting techniques
    i) Seedling preparation
    ii) Planting period
    iii) Shading techniques
4. Cultural Practices
    i) Weeding between rows
    ii) Weeding around base of the plant
    iii) Mulching
    iv) Pruning

v) Fertilization
vi) Insect control
vii) Disease control

5. Mixed cropping
6. Techniques to improve flowering and fruit development
7. Harvest techniques
8. Post harvest techniques
   i) Seed removal
   ii) Seed drying/fermentation
9. Marketing

These technical recommendations are presented in more detail in Table 7.1.2-1 in the section on "Lessons Learned". Each individual technical recommendation was discussed with staff from IDAM, EMBRAPA, and Ceplac in order to determine present levels of adoption in Amazonas and Bahia. IDAM was then consulted as to what should be the target levels of acceptance for the JICA project to set as its objective after 5 years of interventions.

Guarana Breeding Results

1999 - After more than 6 years of clonal selections and trials (some in cooperation with AmBev), two improved varieties for Amazonas State were released to the public in 1999:

- BRS-Amazonas
  Characteristics: high yield, high caffeine, anthracnose tolerant, fusarium susceptible
- BRS-Maues
  Characteristics: high yield, high caffeine, tolerant to anthracnose and fusarium

2000 – An additional 10 clones were released for Amazonas State with even higher yield levels and disease tolerance:

BRS-CG372; BRS-CG648; BRS-CG189; BRS-CG505; BRS-CG610; BRS-CG612; BRS-CG850; BRS-CG882; BRS-CG608; BRS-CG611

(d) Current Status of EMBRAPA Research and Demonstration Facilities for Guarana Research

Central Research Farm – Maues

EMBRAPA maintains a 100 ha research farm in Maues which focuses on the following:

i) Research on cultural practices
ii) Research on breeding new varieties
iii) Maintenance of a living germplasm bank (mother plants, parental materials for crosses)

iv) Production facility for clonal planting materials (currently produces 60,000 clones/year)
v) Site for farmer field days and training sessions

Demonstration Farms – Rural Maues

EMBRAPA maintains 4 demonstration farms in rural Maues communities where plots using new varieties and proper management techniques are compared to traditional farmer methods as a rural extension tool.

Table 6.1.2-1 Location of EMBRAPA Testing Sites for Guarana Research

State	Number of Research Sites
AMAZONAS	12
Acre	3
Amapa	2
Bahia	2
Mato Grosso	2
Para	2
Roraima	2
Rondonia	2

Source: EMBRAPA/CPAA, 2001

Variety Trial Sites for Breeding Programs

Local - EMBRAPA maintains 12 sites throughout Amazonas State where promising clonal materials are tested for yield and disease reaction.

Regional - EMBRAPA manages a variety trial network in seven other States to more fully evaluate the potential of clonal materials:

EMBRAPA/CPAA (Manaus Headquarters)

The Headquarters facility has the following infrastructure to support the Guarana Program:

a) Personnel: 4 fulltime researchers, 2 research assistants, 8 field and office staff
b) Active Germplasm Bank: 1 ha of mother plant materials kept in the field
c) Clonal Production Facility: Open air production facility with shading and irrigation, capable of producing 60,000 clones/year
d) Mini Processing Facility: Small factory which produces up to 500 kg of guarana powder per year
e) Demonstration Farm for Sustainable Agro-forestry: CPAA maintains a series of demonstration and research trials for SAF on SUFRAMA plantation on the Manaus/Presidente Figueredo Highway. The land was formerly used as a large rubber plantation and is considerably degraded. Although many trials are underway examining interactions between fruit, nut, and hardwood tree species, there is only one small trial which involves guarana in a SAF system. This trial is designed to test the performance of three EMBRAPA clones under SAF conditions, but no results are available since it was planted in 2000.

Collaborative Research with other Organizations:

EMBRAPA/CPAA has collaborative research projects with other organizations in the following areas:

Table 6.1.2-2 Partnerships with EMBRAPA/CPAA in Guarana Research

Research Partner	Research Topic
Project SHIFT	Flux of soil nutrients in guarana fields
University of Amazonas	1. Techniques for improving root growth in guarana clones 2. Weed control through herbicides in guarana fields
University of Campinas – Sao Paolo	Analysis of guarana seed components and their use
University of Maringa – Parana	Analysis of guarana seed components and their use
University of Vicosa – Minas Gerais	Plant breeding techniques for guarana

Source: EMBRAPA/CPAA Operational Plan, 2001

(2) CEPLAC (Executive Planning Commission for National Cacau Production)

(a) CEPLAC/Bahia

Introduction: CEPLAC's center for cacau research and extension in Itabuna, Bahia is the largest in the CEPLAC system. CEPLAC/Bahia has extensive research and development experience not only in the production of cacau, but in the participation of cacau in sustainable agro-forestry systems. In the early 1990's, low international market prices for cacau devastated the economy of farmers in southern Bahia since cacau was essentially grown under monoculture conditions. For that reason, CEPLAC/Bahia initiated a crop diversification program for cacau farmers which included a new research and development focus on crops such as guarana, clove, pepper, piacava, pupunha, banana, cupuacu, and other tropical fruits. As a result of that research effort that began in the early 1990's, guarana production in Bahia now equals or exceeds that of Amazonas, and yields in Bahia are 3-5x higher than in Amazonas.

CEPLAC/Bahia Research in Guarana:

CEPLAC/Bahia research efforts in guarana focused on fertilization and cultural practices, whereas EMBRAPA research efforts in Amazonia focused on genetics and breeding. CEPLAC researchers borrowed heavily from existing information on guarana cultural practices from research already conducted by EMBRAPA in Amazonia. As for genetic materials, CEPLAC researchers and individual farmers from Bahia collected seed and vegetative materials from Amazonia (mainly Maues) and brought these back to southern Bahia for propagation back in the 1980's. Improved genetic materials (clones) from EMBRAPA were never used extensively in Bahia. Instead, farmers performed their own individual selection on the Amazonia materials under local Bahia conditions, which in combination with the proper use of fertilizers and cultural practices, has resulted in the extremely high yielding plants currently present in Bahia. CEPLAC research recommendations for guarana production are essentially identical to those of EMBRAPA, the main differences being adjustments in fertilizer rates due to differences soil types and the use of seedlings from seeds instead of EMBRAPA clonal materials.

CEPLAC/Bahia Efforts in Sustainable Agro-forestry Research for Guarana

Unlike EMBRAPA which focused on a monocultural approach to guarana production in Amazonia, CEPLAC/Bahia has developed a series of research recommendations for the planting of guarana in association with banana and cassava. In fact, in 1999, 401 farms out of a total of 3,323 in southern Bahia were known to be systematically planting guarana in association with these crops (see Table 6.1.2-3).

Table 6.1.2-3 Monoculture vs. "Mixed" Cropping of Guarana in Southern Bahia, 1999

Crop	# Farms	# Farmers	Area (ha)
Guarana (monoculture)	2922	2990	1654 (75)
Guarana x Cassava	241	241	320 (14)
Guarana x Banana	160	170	247 (11)
TOTAL	3323	3401	2221 (100)

Source: Ceplac, 2000

Thus, approximately 26% of guarana production in southern Bahia used a "mixed crop" model in 1999. Although "mixed cropping" of guarana with banana and cassava is not true "sustainable agro-forestry", it is a step in the right direction. CEPLAC is currently working on research recommendations for guarana production that include tropical fruits and some hardwood species such as mahogany. They also have a complete set of research and technical recommendations for "cabruca" land preparation techniques based on cacau systems. "Cabruca" is a type of "selective" slash and burn technique which retains much of the native vegetation before the planting of a commercial tree crop. When CEPLAC expertise in "cabruca" and in mixed planting of guarana with tropical fruit crops is more thoroughly pursued, a true "sustainable agro-forestry" model for guarana can evolve from research into a practical recommendation.

Ceplac/Bahia Sub-Project: "Economic Viability of Demonstration Plots Using Agro-forestry Systems"

This sub-project falls under the objectives of the larger "Agricultural Diversification Program" of Ceplac/Bahia. It was designed to determine the most economically viable agro-forestry options for southeastern Bahia, given the need to offer cacau farmers alternives for diversification. The twelve treatments that are to be examined include:

1. Cacau x Banana
2. Cacau x Acai x Arboreal Trees
3. Cacau x Pupunha x Arboreal Trees
4. Rubber x Cacau
5. Dende x Cacau
6. Cacau x Caja
7. Rubber x Pupunha x Cupuacu
8. Cupuacu x Banana x Caja
9. Graviola x Banana x Pupunha
10. Cacau x Arboreal Trees x Sequencias

11. Home Gardens

A detailed plan was developed in order to relate production data from these systems to market demand. Accordingly, items such as present liquid value, internal rate of return, cost/benefit ratio, and corrected payback were to be determined. Ceplac also had the intention to replicate the experiment in other parts of Brazil, including Amazonia. The project was fully designed and approved but never initiated due to lack of funds.

Ceplac/Bahia Sub-Project: "Sustainable Agro-forestry Demonstration Plots":

Ceplac Headquarters in Itabuna Bahia has agro-forestry demonstration plots that have been planted and maintained for over 5 years. The treatments currently being used are as follows:

1) Caja x Cacau x Banana
2) Caja x Cupuacu (6 x 6) x Banana
3) Caja x Cupuacu (3 x 3) x Banana

The experimental site is has a total of about 1 ha and production data has been recorded for the past 3 years. Ceplac mentioned that guarana plants could be introduced into these agro-forestry systems through a systematic replacement of cacau and cupuacu.

(b) CEPLAC/Para

Introduction: CEPLAC/Para focuses on research and development of the cacau crop for the eastern amazon region (mainly Para and Amazonas). In their effort to diversify the economic potential of Amazonian cacau farmers, CEPLAC/Para has recently undertaken an initiative to include guarana in cacau production systems, both in Bahia and the Amazon region. CEPLAC/Para is encouraging a small farmer approach to guarana production, and is especially encouraging the production of guarana in agro-forestry systems.

Research on Guarana Varieties CEPLAC is currently collaborating with EMBRAPA/Manaus in a series of guarana variety trials for the Amazon. Experimental clones have been produced by EMBRAPA/Manaus and have been planted by CEPLAC/Para at several locations in Para and Rondonia with technical assistance from EMBRAPA. Results of these trials are still premature and research recommendations for the best guarana varieties will be available in 2002.

Research on Agro-forestry: Ceplac/Para has many years of experience developing cacau production systems that are suitable for the amazon. In the last five years, their research has focused on cacau production for varzea systems and cacau production in agro-forestry systems (mainly terra firme). They have also done a lot of work in cacau processing and utilization of the waste products of cacau processing in organic production. If the proper funding is provided, these learnings could quickly be used

to develop research and extension programs for guarana in the areas of agro-forestry and by product utilization. Their major research findings for cacau are as follows:

1. The best association crops for cacau are banana, acai, and pupunha.
2. The best densities for agro-forestry model are 3 row of cacau (3x3m) using two rows intervals of either acai or pupunha (2x3m).
3. Economic analysis showed that there was no significant difference in farmer income over a 10 year period if mixed cropping was used instead of monoculture of cacau.
4. Mixed cropping of cacau with pupunha gives a better economic result than acai.

Ceplac/Para Sub-Project: "The Evaluation of 32 Promising Guarana Clones in the Region of Medicilandia/Transamazonica, Para State":

This is a joint project with EMBRAPA/Manaus in which 32 EMBRAPA clones that are being evaluated in Amazonas and other States, will be evaluated in Medicilandia - Para, a region with over 10 years experience in cultivation of native guarana plants. The new clones will be evaluated for archquitectural characteristics, disease and pest resistance, and yield. Ceplac personnel will be responsible for installing and maintaining the site - EMBRAPA/Manaus staff will make frequent visits for the evaluations of guarana performance.

In this clonal trial, the guarana is planted strictly in a monoculture basis. It would be very useful to have a companion experiment at the same site which evaluates the performance of these clones under mixed cropping or agro-forestry conditions. The agro-forestry trial could be maintained by Ceplac and evaluated by visiting EMBRAPA staff as in the case of the initial trial. Ceplac has agreed in theory to conduct such a companion trial. They are already planning a cacau agro-forestry project in the Medicilandia area and are willing to include guarana in the project design if JICA support is provided. They feel that guarana should be planted in combination with banana and acai, using initial annual crops such as pineapple and beans.

(3) INPA/Manaus (National Research Institute for the Amazon)

INPA's activities in field production research and breeding of guarana are quite limited. This is primarily due to an informal agreement between EMBRAPA and INPA that was made in the late 1980's stating that guarana production research would be exclusively covered by EMBRAPA. Currently, INPA maintains limited research programs involving the following areas:

- Studies on soil analysis and mycorrizal associations in guarana fields (Department of Crop Production)
- Botanical variation in guarana (Department of Botany)
- Guarana as an ecological component of tropical rainforests (Department of Ecology)

- Chemical analysis of active components of guarana (Department of Food Technology)
- Shelf-life studies of guarana products (Department of Food Technology)
- Role of guarana in agro-forestry systems (Agro-forestry Unit)

Of most interest to the JICA project is INPA's work in agro-forestry, and the potential role of guarana in agro-forestry systems. INPA's approach to agro-forestry is quite unique and is known as "participative agro-forestry". With this approach, small farmers are educated about agro-forestry principles and are presented with options as how to associate different perrenial and annual crops in an agro-forestry system. INPA conducts a land use survey, proposes an agro-forestry scheme, and provides some of the planting materials. However, it is the farmer himself who eventually decides upon what to plant, how to plant, when to plant, and where to plant. INPA does not impose a set of treatments or a fixed research model on the farmers. INPA makes an agreement with the farmer that his plots can be used as a demonstrative unit, permitting the entry of INPA researchers and interested visitors. The researchers collect ecological and crop production data within the plots, and closely follow the decision-making patterns of the farmer – attempting to understand the reasons behind the decisions.

The first of these agro-forestry plots was established in 1993. Since then, more than 100 demonstration plots have been established with the collaboration of 76 farms throughout Rondonia and Amazonas. The following table presents a profile of INPA's agro-forestry trials:

Table 6.1.2-4 On-farm agro-forestry plantations managed by INPA's Agro-forestry Unit

	REGIONS			TOTAL
	Amazonas (upland)	Rondonia (upland)	Amazonas (varzea)	
Municipalities	Manacaparu Iranduba Indigenous Reserve	Jamari Ariquemes Rio Crespo Alto Paraiso	Careiro da Varzea Maniquiri Iranduba Manacapuru	
First Planting	Feb. 1993	Feb. 1995	Nov. 1997	
Farms	23	30	24	77
Agro-forestry systems	9	10	10	14
Pilot plantations	39	46	27	112
Fruit species	27	26	3	42
Timber species	8	17	10	27
Legume species	4	3		4
Other species	1	2		3
ALL SPECIES	39	48	13	76

Source: INPA Agro-forestry Unit Briefing Paper, 1998

Interestingly enough, some of the upland farmers in the Amazonas municipalities of Manacaparu and Iranduba have chosen to incoporate guarana trees into their agroforestry scheme. Thus, the beginnings of a research model do exist for guarana in mixed association with other tree crops. The experiences of these guarana farmers needs to be carefully documented and the number of demonstration plots

with guarana needs to be amplified. Based on existing plots, the following combination of other species with guarana is proposed in order to effectively develop and utilize three distinct canopy layers (Table 6.1.2-5).

Table 6.1.2-5 Potential Groupings of Species within a Guarana-based Agroforestry System.

Group	Tree type	Spacing	No. of Species (since 1993)	Examples
I	Small	4 x 4m	8	Guarana, cupuacu, guava
II	Medium	8 x 8m	19	Pupunha, biriba, tucuma
III	High	16 x 16m	8	Piquia, mahogany, castanha

Source: INPA Agro-forestry Unit Briefing Paper, 1998

(4) IDAM Guarana Production Projects

IDAM currently has two major projects under consideration which involve field production of guarana and guarana research. Both these projects have been initiated by EMBRAPA/CPAA.

(a) Project #1: "Production of Guarana Cloned Seedlings for Rural Development in the State of Amazonas"

This project was approved by IDAM for funding (R$ 337,500) and was initiated in June, 2001. The objective is to strengthen the guarana production sector in Amazonas through the vegetative propagation of high yielding, disease resistant seedlings from EMBRAPA clonal materials. Specifically, 125,000 clones will be produced from 4 EMBRAPA lines:

BRS-Maues, BRS-Amazonas, BRS-CG189, BRS-CG608

EMBRAPA will undertake through expanded activities at four existing guarana nurseries (3 in Maues, 1 in Manaus). The seedlings will be produced in small, easy to handle "tubetes" and distributed to AFEAM-approved farmers by IDAM extensionists.

(b) Project #2: "Use of Plant Breeding and Cultural Practices to Control Guarana Diseases"

This project was submitted to IDAM in June 2001 and has not yet been approved for funding (total funding requested was R$ 470,300). The objective of this project is to conduct further research to define the optimum cultural practices to be used in the field production of EMBRAPA clonal materials. Project activities will focus on the following areas:

- Recuperation of guarana orchards that are in decline through the use of pruning, fertilization, and grafting
- Definition of optimum spacing for guarana trees depending on plant architecture
- Definition of fertilizer dosages that are economically viable
- Control of weeds
- Disease control methods for anthracnose in non-resistant materials (with a focus on integrated control minimizing the use of fungicides)

(5) Visits to Other Related Activities

(a) Maues Farmer's Associations

Meetings with Farmer Associations and "farmer leaders" in Maues revealed the following current priority problems in guarana production:

Lack of investment capital; lack of guarana storage facilities; the desire for contracts for guarana production; difficulty in transporting EMBRAPA clones to remote communities; need for local community guarana nurseries; lack of infrastructure for the associations (no buildings, office, storage areas); over 55% of loans to guarana farmers have failed; reluctance of some farmers to apply fertilizer, even when donated; more emphasis needed on seedlings from seeds instead of expensive EMBRAPA clones; EMBRAPA clones too delicate for Maues conditions; believe that EMBRAPA clones are very good for disease resistance, but yields are not high; clones are often mislabeled, or not labeled at all (they don't know which clones they have received from EMBRAPA).

(b) Urucura Farmer's Associations

Meetings with Urucura Farmer Associations and "Farmer Leaders" revealed the following current priority problems in guarana production:

Guarana is 2nd most important crop after cassava; currently Urucura area produces 50T but if marketing was better could easily sell 80T without any additional planting areas; need to find new contractual buyers to avoid influence of brokers; need to control anthracnose and thrips (only 10-20% of material in field is resistant EMBRAPA material, therefore disease is building up in many plantings); existing clones in EMBRAPA "clonal gardens" are not well identified due to mislabeling at shipment time - EMBRAPA experts need to arrive and identify which clones are doing well in Urucara; farmers feel that EMBRAPA clones from Maues are superior to those from Manaus, but all have very high seedling failure if fertilizer, pruning, and weeding recommendations are not followed carefully; EMBRAPA clones yield 1000 gr/tree if properly managed, if management is poor yield is 300 gr/tree; trees from traditional native seeds yield 300-400 gr/tree even with poor management; sustainable agro-forestry systems are working, both with cloned guarana and native guarana – but require disciplined use of intensive cultural practices.

(c) Santa Maria Guarana Farm (Itacoatiara)

This farm has about 200 ha planted to guarana – currently, 180 ha are producing. Three years ago planted 30 ha with EMBRAPA clonal materials from the EMBRAPA guarana nursery in Manaus. Seedling growth has been very poor and approximately 80% of this planting is a total loss. The farmers claim they followed EMBRAPA technical recommendations very carefully, but seedling mortality was high nonetheless. They felt the clones had very poor root systems upon planting and that

many plants were yellowed and weak. They also had miscommunications with EMBRAPA as to the labeling of the clones and could not identify the clones by accession number. The majority of the plantation is planted with seedlings from their own nursery – they use native seeds selected from their best plants. They feel their average yield with their non-EMBRAPA materials is in the range of 800 – 1500 gr/plant. They have their own processing operation and produce powder, syrup, and guarana drink under the "Santa Maria" label. 70% of their consumer base is within Amazonas and 30% is sold by distributors in other States such as Mato Grosso, Minas Gerais, Sao Paolo and Rio de Janeiro.

(6) Summary of Key Research Results for Guarana Production

Hundreds of articles exist on the cultivation, processing, and marketing of guarana. Many of the articles come from research conducted between 1930 – 1970 and are very outdated. Most of the articles concern evaluations of genetic material (i.e. breeding efforts) and cultural practices to lower disease and pest incidence. Most of these articles are the results of EMBRAPA research conducted in the State of Amazonas. Next in importance would be articles by Ceplac describing guarana research activities in Bahia State. As for the potential of guarana in sustainable agro-forestry systems, the research is extremely limited. Most articles on guarana processing come from research and development done by EMBRAPA/CPATU in Para State. There is also some research done by EMBRAPA/CTAA in Rio de Janeiro concerning compositional analysis of guarana, and the development of processing equipment for processed products such as "cupulate". Annex 6.1.2-1 presents a summary of recent, key research articles and publications on aspects of guarana production:

6.1.3 Vegetable

(1) Vegetable Research at EMBRAPA/H (National Center for Vegetable Research)

EMBRAPA /H is one of EMBRAPA's oldest and most successful research centers. It has extremely good infrastructure including central computer system, laboratories, experimental farms, vehicles, and training facilities. EMBRAPA/H is most noted for its research contributions in the areas of :

1. Vegetable seed production
2. Vegetable production techniques (advanced)
3. IPM and biological control of vegetable pests
4. Post harvest management of vegetables

EMBRAPA /H also has a strong Economics Divisions which has considerable statistical information on national vegetable consumption, market trends, and market movement of vegetables within Brazil. Their current approach is to approach vegetable production from an agribusiness perspective. Therefore, most of their programs are practical in nature, with the goal to promote vegetable research that will permit the "sustainable development of vegetable agribusinesses".

The major areas in which EMBRAPA/H conducts vegetable research are:

Biotechnology	Plant Pathology	Entomology	Soil Fertility
Plant Nutrition	Irrigation	Post harvest	Seed Production
Hydroponics	Farm Management	Nematology	Virology
Cell Biology	Food Technology		

The following are the major products and services offered by EMBRAPA/H:

1. Basic seed materials
2. Pelletized seeds
3. Seedlings
4. Soil analysis
5. Antisera for virus detection
6. Publications and production manuals
7. Technical Production Courses
8. Literature searches
9. Consultancy services and contract research
10. Disease diagnosis
11. Climate data
12. Economic databasing

EMBRAPA/H is a world-renowned center for vegetable research and conducts collaborative work with other international institutions, such as:

1. INTA (Argentina)
2. INIA (Chile)
3. MGAP (Uruguay)
4. JICA
5. Cornell U. (USA)
6. U. Wageningen (Holland)
7. Procisur
8. IPC-CGIAR

Some of the major contributions EMBRAPA/H has made to Brazilian agriculture include the following:

1. Development of production systems for over 20 vegetable crops
2. IPM protocols for potato, pea, tomato, cabbage
3. Development and release of over 30 vegetable varieties
4. Production of pre-basic potato seed
5. Seed technology protocols for pea, carrot, tomato, sweet corn, cabbage
6. Development of antisera for vegetable virus diagnosis

EMBRAPA/H is especially well known for its research in the area of IPM for vegetables. Current IPM programs can be summarized as follows:

1. Strongest IPM programs are in tomato, cabbage, and garlic. Work in tomato focuses on the fruitworm (T. absoluta) and work in cabbage against the

diamondback moth (Plutella species)

2. In cabbage and garlic, economic injury levels against key pests have been determined (In cabbage: if > 6 lesions/head, spray one month after heading; In garlic: spray only if >20 insect/plant)
3. Have developed IPM training programs for possible use in other States
4. Have developed programs in "organic vegetable production", especially for cabbage

(2) Vegetable Research at EMBRAPA/CPPA (Agroforestry Research Center for Western Amazonia)

Research on floodplain agriculture in the central Amazon was conducted in the last decades by today EMBRAPA (CPAA: Agroforestry Research Center for Western Amazonia), the Department of Agronomic Services of the National Research Institute for the Amazon (INPA), and the Federal University (FUA).

EMBRAPA/CPPA:

The Amazonian Agroforestry Research Center (CPPA) of Brazilian Agricultural Research Corporation (EMBRAPA) was established in 1989 and research activities are grouped into several areas such as agroforestry, fruits, vegetables, guarana, hardwoods and so on. The main purpose of CPPA's research is to develop and promote technologies for sustainable agriculture in Amazonas through the rational utilization of renewable natural resources.

The major researches on vegetable conducted by EMBRAPA /CPPA are introduction and evaluation of new varieties and kinds of vegetables such as cabbage, couri-flower, cucumber, okra, sweet potatoes, corn, watermelon and young corn. The some results of these researches are summarized following Table.

Research Title	Subject
Evaluation of the Couve de Floha (Collard) in the Ecosystem of Terra Firme and Varzea of the Amazonas	Evaluation of commercial varieties of leaf cabbage (couve): Hevi-crop, Top-bunch, Georgia-superior, Georgia
Productivity of Lettuce under rain-cover condition in the field in the rain season in Manaus	Examination of new technology: Rain-cover cultivation of lettuce in the rainy season for control deseases
Evaluation of Genotypes of Cabbage in Ecosystem of Dry Land in the Area of Manaus-AM	Evaluation of commercial varieties of cabbage: Shutoku, Fuyutoyo, Cosmos, Kenzan, Uniao, Matsukaze, Sooshu
Tomato Plants Control in the Areas Uniformilly Infested by Pesudomonas Solanacearum	Evaluation of commercial varieties of tomato: Yoshimatsu, Caraiba, Belem-70-Elite, C-38
Agronomic Development of the Cucumber Cultivate in the Area of Manaus-AM	Evaluation of commercial varieties of cucumber: Nikkei, Hokushin, Safira, Runner, Sprint, Aodai, Amazonas

The recommendable varieties of the vegetable and farming prctices introduced to our plan were examined on the basis of these research results.

(3) Soil Survey

Up to now, There are only a few studies related to the varzea soils and their physical and chemical modifications caused by farming. Generally, the soils in varzea relativery rich in nutrients. The soils in varzea will not cause serious problems

through the agricuktural use. However, the several research results about the varzea soil in the study area until now pointed out several important notices as follows.

Nitrogen (N) and Carbon (C)

In the várzea, the annual flooding deposits rich sediments in minerals and renew the soil, and making it very fertile. The soil of the várzea is distinguished by its high fertility and low acidity. However, in spite of showing good natural fertility, the majority of the várzea from muddy water rivers of the State of Amazonas, is insufficient in nitrogen. The contents of Organic Carbon (C) and Total Nitrogen (N) in its soils are relatively low. The analysis results of the soils of várzea from Paraná do Ramos (Barreirinha) showed contents of Organic Carbon, around 0,14% to 2,33% and contents of Organic Nitrogen around 0,05% to 0,19% (Corrêa & Bastos, 1982). Although the value of the relation C/N (around 3 to 28) exposes good capacity of mineralization of Organic Nitrogen, the low contents of Total Nitrogen indicates that the natural reserve of N in the soil is limited.

Boron (B)

With papaya and cabbage, boron deficiency was observed, causing the deformation of fruits and reducing the commercial value.

Fe, Zn and Mn

The contents of Fe, Zn and Mn were high in some island soils (Cochrane et al. 1983). The recent soil analysis aimed at three islands in Solimoes river (Oliveira et al 1997) result shows larger variations in the areas were Fe (184 to 645mg/kg), Mn (32 to 150 mg/kg) and Zn (8 to 32 mg.kg). Although it is not known if these levels are toxic to the plants.

(4) Integrated Pest Management

Integrated Pest Management (IPM) is an approach to pest and disease control that utilizes regular monitoring to determine if and when treatments are needed and employs physical, mechanical, cultural, biological, and educational tactics to keep pest numbers low and spread of diseases low enough to prevent unacceptable damage or annoyance.

EMBRAPA/CNPH, Brazsilia

EMBRAPA's National Center for Vegetable Research (CNPH) is the leading institute for development of high yielding vegetable technologies. They have national level programs in every area of vegetable research, and considerable experience with greenhouse production techniques. The center has extremely good infrastructure including computer system, laboratories, experimental farms vehicles and training facilities. The research activity covers the area of vegetable seed production, Vegetable production techniques (advanced) IPM (Integrated Pest Management) and biological control of vegetable pests and Post harvest management of vegetables.

EMBRAPA CNPH's contributions to IPM are as followings

1. Strongest programs are in tomato, cabbage and garlic. Work in tomato against fruitworm (T. absoluta) and in cabbage against Plutella (diamondback moth)
2. In cabbage and garlic, economic injuly levels against key pests have been determined (cabbage: if>6 lesions/head, spray one month after heading/garlic: spray only if >20 insect/plant)
3. Have development IPM training programs for possible use in other states.
4. Have developed programs in organic vegetable production, especially cabbage

There is very little work being done on vegetable IPM in Amazonas at the current time. Disease and Pest control through agro-chemical is receiving too much attention and there is much misuse of agro-chemical by poorly trained farmers.

(5) Organic Agriculture

The organic agriculture of vegetables is nowadays one of the most promising opportunities of agriculture and agro-business in the rural area, registering growth index of 10% year in Brazil (EMATER-DF). EMATER-DF has a defined sub-program in Organic Agriculture with over 10 years of experience.

The several projects of EMATER-DF in this area, are following below, and object the guarantee of the appearance of an organic agriculture marked by a high professionalism index and competitiveness, from the production to the commercialization

Project Incentive to the Organic Production.

It has the objective of stimulating the production of organic, with initiatives like the creation of demonstrative units in the agricultural area, with the production of selected species, and motivating the organic handling of the cattle raising (milk and meat), of pig-culture and so on.

Project Technological Training of the Organic Agriculture

It objects the generation and transference of technology, capacity of producers and training to the technicians to strengthen the organic agriculture. This project objects also the promotion of adoption of national norms and standards for organic production and installation or capacitation of certification entities and local laboratories that make the needed analysis to the process of certification.

Project Commercialization

Objects stimulating the creation of specific places for commercialization of organic products at supermarkets and at other sale places and important distribution, besides the adoption of a quality stamp, and the popularization of the area's products, in Brazil and out of here. In Brazil, many researches about the organic farming have accomplished and the study report, the manual and the guidebooks, etc. are published.

However, research of the vegetable cultivation which made the organic agricultural technique the subject in the Amazon is not yet started, and the example of a farmhouse level practice is also restricted. Although there is a plan which performs examination cultivation of the small-scale organic agriculture, by IDAM Manakapuru, it is not yet moved to execution.

(6) Related Project

Plasticulture in the Amazon State

This is a recently launched (1999) loan assistance program, coordinated by IDAM and the Mayor's Office, designed to specially improve the productivity of vegetable farmers located mainly in and around Manaus.

Municiparity	Number of Producers	Number of Plastic houe
Iranduba	96	530
Manaus	8	20
President Figueiredo	9	18
Manacapuru	6	12
Parintins*	1	4
Eirunepe*	1	2
Rio Preto da Eva	1	1
TOTAL	122	587

*: Municipalities starting in this activity from this year.

It stands out the municipality of Iranduba, having with the program PROVERDURA, with resources from FTI by AFEAM, that already financed 49 producers with 432 vegetation houses in the year of 2000. Besides FTI, AFEAM financed, through FMPES 13 projects from 1997 until 2001, in a total of 52 projects. Producers who present solid business plans and acquire the loans are eligible for technical assistance from IDAM. As of June 2001, 96 producers are engaged this activity and the total number of plastic-houses will reach at 530 within this year. These structure are ideal for maximizing the production and quality of crops such as green pepper, couve, tomato and cucumber.

6.1.4 Tropical Fruits

(1) Cupuaçu

(a) Introduction

Cupuaçu research is quite recent. Literature on research covers such topics as: Plant breeding; pest and disease control; cultural practices and processing. In recent years most research have centered in the selection of plants for the production of clones and the control of witches broom (Crinipellis perniciosa) disease. Literature review indicate that 30% of research is on plant breeding, 26% on pest and disease control, 17.6% on post harvest, 11.7% on general crop topics, 7.4% cupuaçu in SAF and 7.4% on environment and production (soils and climate).

(b) Research Institutions

EMBRAPA is the most important research institution dedicated to cupuaçu. In recent years, INPA, CEPLAC and some Universities have conducted some research. Literature listings indicate that EMBRAPA has 50% of the published research on cupuaçu against 16% of the universities. EMBRAPA's research in the area is

conducted by Western Amazon Center located close to Manaus. Eastern Amazon Center, in Belem is also conducting research on cupuaçu. The main research topics are a) Plant Breeding and b) Crop management. In recent years, both centers have conducted research related the inclusion of cupuaçu in AFS.

(c) Research Programs

Local research is conducted at the EMBRAPA's Western Research Center near Manaus. The main research topics are plant breeding and cultural practices. Under these, research is centered in:

- Plant breeding and seedling production.
- Disease and pest control
- Crop management and Cultural Practices

(d) Results

Main results from research are related to certain advances in cupuaçu's phenology, clone production, disease control and productivity. The EMBRAPA/CPAA has a collection of clones that is evaluating. Have results for pest and disease control related to the witches broom disease and fruit weevil (Conotrachelus sp). As a result of research, EMBRAPA has published several papers and manuals. The most recent are: Chronological and Biological aspect of Fruit Weevil of the cupuaçu tree; Diagnosis of main diseases of cupuaçu tree; Production chain of cupuaçu in Amazonas; and the "A cultura do Cupuaçu" (The Cupuaçu Crop), which condenses EMBRAPA's recommendations for the crop.

Results from selected regional research is presented in the following sections.

i) Clone selection and evaluation.

EMBRAPA/CPAA is working in the selection and evaluation of cupuaçu clones. Souza et.al (1999) in an evaluation of 6 clones of cupuaçu in the Amazonas State found mean values of 31 fruits per plant; 30.8 kg/plant of fruits, equivalent to 7.2 ton/ha; 12.1 kg/plant of pulp, equivalent to 2.8 tons/ha; 4.6 Kg/plant of seeds, equivalent to 1.2 ton/ha. The same research indicate that in 6 years of evaluation, mean production varied from 26 to 37 fruits/plant and pulp variation was from 10.3 to 15.6 kg/plant of pulp. It was also observed a great variation of production for individual plants. Clone MAP8401 had a variation from 23 to 85 fruits/plant and clone MAP8402 had a variation from 34 to 135 fruits/plant. Seasonal variation was also evaluated. In according to the fluctuation of production for clone MAP8404 in 10 years evaluation, It was indicated that variation was mainly due to variation in precipitation.

At EMBRAPA/CPATU, Alves (1997) made an evaluation of 16 clones of cupuaçu finding that the mean length of fruit was 177.96 mm, with a range

from 169.5 to 300mm; mean weight of fruits was 992.93 grams, with a range from 971 to 1836 grams; mean pulp percentage was 34.6%, with range from 35.46 to 42.65%.

ii) Flowering

Flowering occurs during the low precipitation season. Cupuaçu trees have a very low fruit/flower ratio. Alves et.al (1997) found a conversion of less than 2% concluding that this is due to an auto-incompatibily in pollination. Venturieri (1997) studied pollination of cupuaçu.Tests with artificial pollination, although positive do not guarantee full fruit production of pollinated flowers to negative environmental factors.

iii) Fruit production and harvest time

Souza (1999) indicate that harvest will occur 4 to 5 months after flowering. Muller and Carvalho (1997) evaluating 6 consecutive production cycles of cupuaçu plantations in Tomé-Açu, determined that harvest could from November to April and that fluctuations are due to precipitation variation. They show variation of monthly harvest percentage and precipitation during the 6 years period. They also found that fruit production also varied greatly. They show production variation for the 6-yr period. Bastos et.al (1997) analyzed climate at Tomé-Açu indicating that precipitation variation and water balance influence production and harvest pattern.Souza and da Silva (1997) also found an inter-annual variation in Manaus. The report shows that the mean production of fruit per plant of four cycles from 1991/1992 to 1994/1995 was 12.1, 17.7, 27.0 and 25.6 respectively.

iv) Pest and diseases

Witches broom (Crinipellis perniciosa) disease has been the focus of research. Souza et.al (1999) describe main disease and pest control. Stein et.al (1997) present field observations on Witches broom regarding disease development in relation to climate fluctuation. Aguilar and Duarte (1999) present detailed information on fruit-borer (Conotracherus sp.). Mendes et.al (1997) tested biological control of fruit-borer (Conotracherus humeropictus) with promising results.

v) Crop management

Souza et.al (1999) detail crop management practices indicating that pruning, crowning and fertilization are very important for good production. FAO (1999) also present main crop management practices for good crop production.

vi) Fertilization

Bueno (1997) presents aspects of cupuaçu nutrient requirements. His report

shows nutrient extraction by cupuaçu. These results indicate that potassium and nitrogen are the most important nutrients. It also shows that cupuaçu is the crop that less nutrient require. NPK requirements are 46.3 kg/ha/yr for an expected yield of 5 ton/ha of fruits. Comparing nutrient requirements with availability in soils demonstrate that nutrient will last only one year.

vii) Shade

FAO (1999) indicates that cupuaçu grows better with shade around 50%. Souza et.al (1999). Shade is necessary in early ages of trees and therefore temporal shade is needed. Banana is the most common shade.

viii) Cupuaçu in SAF

Cupuaçu management requires some shade for better production and therefore is one of the best crops for AFS. A research conducted by EMBRAPA (Wandelli et.al, 2000) found that cupuaçu was the most used crop in 181 evaluated SAF, with 61% of cases, followed by Brazilian nut (Berthollettia excelsa) with 58%. This indicate the acceptance of the crop as a SAF component. Souza et.al (1999) indicates that cupuaçu could be used in SAF with crops like: papaya (Carica papaya), ingo (Inga sp.), manihoc (Maniot sp.) and coconut (Cocos nucifera). Recommend that crops should planted at least 1.5m away from the cupuaçu plants. Care has been taken in the selection of species for compatibility in terms of: hand labor, market, harvest season, pest and diseases and competitiveness for light, nutrients and water. Locatelli et.al (1997) found that 6-yr accumulated cupuaçu production was higher when associated with brazil nut than with Freijó and pupunha (12.8, 8.2 and 7 ton/ha, respectivelly)

(h) Bibliography

In the Annex 6.1.4-1 is included a list of more relevant bibliography for cupuaçu.

(2) Banana Research

(a) Research Institutions and programs

EMBRAPA is the main institution in banana research, but several other institutions, like universities, are involved in research. Most research in the Amazon region is taking place at the EMBRAPA's Eastern Amazon Research Center located in Belem, Pará. Local research by EMBRAPA is just starting. Research is centered on disease resistant varieties and hybrids, especially Black Sigatoka.

(b) Research summary

i) Main results from research

Most research has been conducted in Bahia. Main results from research has been in plant breeding where EMBRAPA has released the "Caipira variety"

which is resistant to the yellow and black Sigatoka decease. Results from research on diseases have been summarizes in the publication: “Doenças da bananeira no estado Amazonas” (Banana’s diseases in the Amazon State). EMBRAPA (1999) research and recommendations are presented the publication: “A cultura da Banana, aspectos técnicos, socio-ecoomicos e agroindistrias” (The Banana Crop, technical, socio-economical and agro industry aspects) that covers the results of 16 years of research.

ii) Varieties

Banana has a great number of varieties and types. EMBRAPA (1999) present a detailed description of most common varieties and cultivars.As a result of research in Disease control, EMBRAPA has recently released several clones resistant to Black Sigatoka diseases. The “banana caipira” is the most important, followed by FHIA-18 and Zulu.

iii) Production

Production varies with types, varieties and cultivars. Silva e Alves (1999) indicate that evaluation of bananas in Bahia indicate that sub-group “cavendish” have mean productivity of 25 ton/ha. while “maça” produces 10 ton/ha. Caipira produces 12 ton/ha and FHIA18 26 ton/ha.

iv) Pest and diseases

EMBRAPA (1999) describe most important pests and disease indicating that Sigatoka is the most important disease in bananas. Although chemical control is effective, it is expensive and affects environment. The recommendation is to use resistant varieties. Zavala and Bermudez (1997) evaluating Black Sigatoka chemical control in Venezuela found that it represents 49% of production costs. Martinez (2000) found out that banana under shade presents less Black Sigatoka damage than in the open. He found a reduction of US$ 768.7 in cost production due to savings in disease control. Merchán (1988) found that chemical control is more efficient when crop is well fertilized. Garcia et.al (1998) found that biological control of banana weevil (Cosmopolites sordidus) is feasible, recommending further research.

v) Crop management and fertilization

There is no local research. EMBRAPA (1999) detail most crop management practices. Most important are crowning, litter use and thinning. Avilán et.al (1980) found that the use of ridges, in Venezuelan lowlands, improve crop development. Production with the method was 34 ton/ha against 5.9 tons in flat plantation. Borges et.al (1999) found that dead cover was better than living cover. According to his report, Banana is the fruit crop that exports more nutrients, needing 525 Kg/ha/yr of NPK. Potassium and nitrogen are the most important nutrients.

vi) Banana in SAF

Banana has been used as the initial or provisional shade for coffee, cupuaçu and cocoa plantations; therefore it is a semi-permanent crop in SAF. Recently EMBRAPA and other institutions like the University of Amazonas and INPA are conducting research regarding the use of banana in agroforestry schemes. The new schemes of SAF include banana as shade for cupuaçu.

(c) Bibliography

In the Annex 6.1.4-1 is included the most recent and important bibliography on bananas for the amazon region.

(3) Açaí Research

(a) General

Açaí research is very limited. This is because until recently açai was an extractive crop; therefore, there was little concern about the crop. Most research is done at EMBRAPA in Pará State. Recent inclusion of açaí in SAF has brought some interest in the crop, mainly in evaluation of its performance in SAF systems.

(b) Research institutions and programs

EMBRAPA research on açai is limited to field observation of it behavior in SAF. No publication has yet been published on research. CEPLAC and INPA are doing some research related to açai performance in SAF. EMBRAPA does not have research program for the crop in the area. Main research in related to açai in SAF and is conducted by EMBRAPA, CEPLAC and INPA.

(c) Results

i) Main results from research

No research is in the area. Results from research have been published as part of some very simple publications.

ii) Açai in SAF

Açaí is becoming an important SAF component, both for fruit or palmito. Since Açai have different harvest season that cupuaçu, it is used to ensure a more distributed income for farmers. Wandelli (2000) indicate that açai was present in 46.4 of 181 SAF evaluated.

(4) Maracujá

(a) General

No research for the area, most references are found as related to its use in some SAF. Most research is done in Pará State and at the EMBRAPA/CPATU center in Belem. EMBRAPA Fruticulture does main research. Most research in the area is related to its

inclusion in SAF as an alley or strip crop, but its high light requirements determines that it can only last 2 to 3 years.

(b) Research Results

i) Manuals

Most literature on maracujá research is very old. Steinberg (1991) has a more recent publication “Maracuja: Guia Pratico para um manejo equilibrado”. CATI (1998) has a publication named “Cultura do Maracuja Azedo”.

ii) Production

CATI (1998) indicate that production could be up to 50 ton/ha and that mean values for São Paulo are 15 ton/ha. It is indicated that production depends of ecological factor, crop management and pollination. The use of artificial pollination increases number of fruits and fruit quality. Vásquez (1999) indicates that fruit/flower ration is 25% and that manual pollination could increase fruit/flower ratios up to 75%.

iii) Cultural practices and crop management

CATI (1998) and Steinberg (1991) describe most used practices and crop management. Most important practices are: supporting system, pruning, weeding, pollination and fertilization.

iv) Fertilization

According to CATI (1998) information. NPK needs are 150 Kg/ha/yr for a expected production of 15-20 tons. Most important nutrient is potassium. Avilan et.al (1992) indicate that for a 10 ton/ha production, extraction will be 19.2 Kg/ha of nitrogen, 3.9 Kg/ha of Phosphorous and 40.8 ton/ha of potassium.

v) Maracujá in SAF

The use of maracujá in SAF is very limited and only used as an alley or strip crop in conjunction with cupuaçu. Sena-Gomes (2000) indicates that CEPLAC uses maracujá in their alley crop layouts. EMBRAPA use maracujá in their SAF experiment and project with farmers. Vásquez (1999) indicate good production under SAF in Amazon region.

(c) Bibliography

More relevant bibliography is listed in the Annex 6.1.4-1.

6.1.5 Cultured Fish

(1) Researches

Fishery related major research activities seen in the Amazonas State are summarized in Table 6.1.5-1.

Table 6.1.5-1 List of major research and technical development subjects on fishery in the Amazonas State

	No. of fishery-related specialists	Major subjects	Remarks
EMBRAPA-AM/CPAA	3	1.Feasibility of intensive pond culture of tambaqui and matrincha	
		2. Small-scale net cage culture system of tambaqui	Sub-component of Pro-Varzea Project which is linked with PPG7.
INPA			
Department of Aquaculture	8	1. On matrincha: broodstock management, reproductive physiology, induced reproduction, culture of larvae and juvenils, nutrition, culture systems, environmental impact assessment and culture related diseases.	
		2. On tambaqui: nutritional aspects and semi-intensive culture	
		3. On pirarucu: characterization of populations, biology and culture.	
Department of Aquatic Biology	More than 10	1. Biology and ecology of pirarucu	Bilateral cooperation project of Spain associated to PPG7
		2. Extensive aquaculture of tambaqui (Project Tambaqui)	A research component program of PPG7
		3. Aquactic fauna and flora	
		4. Ichtyology and basic aquatic biology	
Department of Food Technology	2	1. Processing of fishes such as surimi, minced fish	
		2. Processing of fish skin	
		3. HACCAP system	
FUA	More than 5	1. Population dynamics and management of fishes	
		2. Lake fishery management	
		3. Fishery economy and marketing	

Source: JICA Study Team, 2001

Researches on aquaculture are focused on such species as tambaqui, pirarucu and matrincha in this State. No research is now carried out about aquaculture of surubim, jaraqui and other potential species such as tucunare, pescard, etc. Brief explanations are given hereinafter for each research institutions.

(a) EMBRAPA-AM/CPAA

Unlike the agriculture sections of EMBRAPA that carry out basic research of agro-crops, the aquaculture section implements mainly practical experiments or on-farm research about culture system, because of lacking of laboratory and analytical equipment at present. EMBRAPA headquarters in Sao Paulo has understood significance and development potential of aquaculture in Brazil, and it is now on the process of recruiting more than 10 new researchers in this field, of which significant number is planing to be assigned for the Amazonas State.

(b) INPA

The Department of Aquaculture has small experimental ponds (3,000 m^2) and laboratories on fish nutrition and water quality analysis. This Department has decided three species as target of research and technical development, namely as pirarucu, tambaqui and matrincha.

The Department of Aquatic Biology is carrying out various basic studies from the academic point of view using various research funds and collaborating with overseas researchers.

The Department of Food Technology is carrying out practical studies on food processing not only fishes but also fruit, meat and daily products.

(c) FUA (University of Amazonas)

Basic researches and higher education on fishery and aquaculture are conducted mainly in the Institute of Biological Science and Faculty of Agriculture. At present, FUA is not offering compulsory course on aquaculture. The course will be started after two graduate students, who are now sent the University of Sao Paulo, take Ph. D. degree and back to the university.

(2) On-going Aquaculture Related Projects

At present, there are few specific projects focusing on comprehensive technical development or industrial promotion of fisheries and aquaculture among the government organizations in the legal Amazon. As for individual aquaculture activities investigated in this Study, major ones are summarized in Table 6.1.5-2.

Table 6.1.5-2 Summary of Aquaculture Activities Investigated in this Study

	Seed production		Grow-out culture			
			in pond		in net cage	
	Stage	Activities	Stage	Activities	Stage	Activities
Tambaqui	*A*	IDAM Balbina Hatchery	*A*	Progressive private farms such as in Rio Preto Da Eva and Manacapuru	*B*	Ecofish in Rio Urubu, Itacoatiara
	A	Private hatcheries in Amazonas State (AM)	*AB*	Other private farms in AM	*C*	EMBRAPA in Lago do Arianzinho, Iranduba
			BC	Small-scale family farmers in AM		
Matrincha	*A*	Projeto Pacu of Mato Grosso Do Sur State	*AB*	Progressive private farms such as in Rio Preto Da Eva and Manacapuru	*B*	A private farm in Lago Puraquequara, Manaus
	AB	IDAM Balbina Hatchery	*B*	Other private farms in AM		
	AB	Private hatcheries in AM	*C*	Small-scale family farmers in AM		
Pirarucu	*A*	Projeto Arapaima in Para State	*AB*	Projeto Arapaima in Para State	*B*	Amazonas Ecopexie in Iranduba
	AB	Amazonas Ecopexie in Manacapuru	*B*	Amazonas Ecopexie in Manacapuru		
			BC	Other private farms in AM		
			C	Small-scale family farmers in AM		
Surubim	*A*	Projeto Pacu of Mato Grosso Do Sur State	*A*	Agropexie of Mato Grosso Do Sur State		No activity at present
			AB	Other farms in the south region		
Jaraqui		No activity at present	*A*	Progressive private farm in Iranduba		No activity at present
			B	Other private farms in AM		
			C	Small-scale family farmers in AM		

Remark: Stage and its criteria are shown as follows:
A : Stable and continuous production and selling in commercial scale
AB : Transitional, from B to A.
B : Pilot production and selling partly or about to sell.
BC : Transitional from C to B.
C : Experimental rearing without selling of product, or for self-consumption.

(3) Important Basic Knowledge

Important basic knowledge on seed production such as reproductive biology of target species, seed production procesure of tambaqui and availability of fish fry for aquaculture, is reviewed in Annex 6.1.5-1.

6.1.6 Processing, Distribution and Marketing

(1) EMBRAPA Research Programs Related to Processing, Distribution and Marketing

(a) EMBRAPA/CTAA (Guaritiba, Rio de Janeiro)

i) Background

EMBRAPA/CTAA is EMBRAPA's National Research Center for Agro-industry and Food Technology). The overall mission of CTAA is to "make viable economically competitive technical solutions for the sustainable development of Brazil's food industries, for the betterment of society". CTAA has been developing technologies for Brazil's food industries since 1973. Clients range in size from small family producers to large multinational corporations. CTAA offers a wide range of services including:

- Consulting by experienced food scientists and engineers
- Fully equipped laboratories to assist the technical demands of food industries
- Design, installation, and maintenance of pilot plants
- Literature search services employing international databases

CTAA develops environmentally friendly technologies which aim to improve existing processes and develop new products from grains, fruit, vegetables, essential oils, edible oils, and other basic foods. The principal research areas of CTAA are:

- Post harvest
- Food engineering
- Biotechnology
- Sensorial analysis
- Food dehydration processes
- Thermoplastic extrusion

CTAA offers assistance in the following basic areas of "food technology" in order to modernize Brazilian food industries:

- Training courses in food analysis, Good Manufacturing Practices (GMP), Hazard Analysis and Critical Control Point System (HACCP)
- Food analysis services such as determination of physico-chemical, microbiological and sensory parameters
- Adjustment of product labeling to meet legal requirements on composition and nutrition
- Consulting in the area of meeting legal regulations in order to achieve product registration
- Pilot plant testing for development of new products

CTAA can offer customized consulting and training services to Amazonian food processing companies in the following areas:

- Step-by-step food processing techniques
- Selection and sourcing of food processing equipment
- Evaluation and certification of raw material suppliers
- Guidelines for the design and construction of processing plants
- Factory layout studies for processing plants
- Training courses for employees in food processing and quality
- Training in GMP and HAACP
- Support at federal level for product registration
- Development of handbooks and manuals for processing techniques

CTAA supports a "social approach" where CTAA and food processing companies work together to promote the socioeconomic development of less-privileged communities through:

- Educating less-privileged students in food processing and food hygiene
- Guided tours for students of processing facilities
- Installation of demonstration units in poorer communities

The basic infrastructure of CTAA is as follows:

- Office facilities to support 60+ professional staff and 40+ support staff
- Modern food technology library with internal database and internet connections
- Heat exchange equipment for studies on viscosity
- High pressure technology for microbial control
- Controlled atmosphere chambers for post harvest studies
- PCR lab to detect transgenic components in foods (in progress)
- Drying rooms (gas, electric, solar) for dehydration studies
- Food irradiation studies (conducted at nearby military facility)
- Laboratories for analysis of pesticide residues, minerals, essential oils, proteins, vitamins, alkaloids, mycotoxins, food pathogens

ii) Programs and Activities of Significance to the JICA Project

Marketing and Agribusiness Department

This group provides services to agribusinesses in the areas of marketing access, business planning, product improvement and new product development, and training in basic areas of food science and technology. During 1990-1999, this Department offered support to businesses mainly through subcontracts. Since 1999, mostly in-house staff are used as hired consultants to work on assignments. Typical services include speeches, workshops, diagnosis of on-site problems in food processing and food safety, production of customized manuals

and training materials. Areas of strength include:

- Processed fruits and derived products
- New product development for processed castanha products
- New product development for dairy products
- Installation of GMP/HAACP programs for fish processors

This is the Department which handles most of CTAA's requests for training and workshops. They have experience in training both private and public sector clients. They have conducted limited training in Amazonia in the areas of castanha processing (Rondonia, Para) and fruit processing into juice, pulp, and sweets (Rondonia). Most of the training experience has been in RDJ and in the Northeast Region of Brazil.

Program #10: "Harvest/Extraction, Post-harvest, Transformation, and Preservation of Agricultural Products"

CTAA has leadership of Program #10, which is one of many national level programs supporting food production in Brazil administered by the CTP (National Technical Commission for Programs). Program #10 has been organized since 1995 and currently has an annual budget of R$ 1,428,000. Although Program #10 is administered by CTAA, many different institutes are involved, all of which could be used as sources of expertise for food processing problems in Amazonia. The following table presents a summary of all the Program 10 project components which have some relevance to the JICA project:

Table 6.1.6-1 Selected Project Components of CTP Program #10 Relevant to the JICA Project, 1996-2000

Year	Component Name	Lead Institution
1996	Use of reduction techniques in the processing and conservation of tropical fruits	EMBRAPA/CNPAT
1996	Management and adaptation of pre- and postharvest cultural practices for tropical fruits in the Northeast Region	EMBRAPA/CNPAT
1997	Technologies for the packaging of tomato and green pepper	EMBRAPA/CNPH
1998	Non-conventional processing methods for the processing and storage of food products	EMBRAPA/CTAA
1999	Microbial evaluation of food safety and quality	EMBRAPA/CNPAB
1999	Development of minimal processing techniques for tropical fruits	EMBRAPA/CNPAT
1999	Development of low cost, dehydration techniques and equipment for small scale agro-industries	EMBRAPA/CTAA
2000	Quantification and reduction of post harvest losses for carrot, green pepper, and tomato	EMBRAPA/CNPH
2000	Recovery of aromas from tropical fruit juices through pre-evaporation	EMBRAPA/CTAA

Source: Program #10 Project Document, 2000

Program for Diffusion of Food Agro-industries in the Northeast Region

In this project, CTAA was hired by BNB-ETENE (Bank of the Northeast Region) to diagnose opportunities in the food processing sector and create "nuclei" or "learning centers" for training and technology diffusion. Opportunities for these agro-industries were to be revealed in selected

municipalities that had already received BNB-ETENE funding for upgrading of irrigation infrastructure. The following basic interventions were performed:

1. Identification of areas, selection of communities (BNB)
2. Selection of those communities with interest in the following agro-industries: fruit processing, grain processing, dairy processing, fish processing (BNB/CTAA)
3. Identify and design processing equipment needs for each community (CTAA)
4. Community meetings/discussion groups held to educate key local people as to the benefits of "adding value" to products through processing (CTAA with coops, Mayors, associations)
5. Construction and delivery of processing equipment to communities (CTAA, contractors)
6. Design, production, and diffusion of training manuals/videos for equipment set up and food processing courses (CTAA)
7. Training courses in equipment set up and processing (CTAA – over 30 courses held, over 600 people trained)

This project took place between 1997-2000 and is still in the process of final evaluation. It could serve as a model for a sectoral support project in Amazonas. The major criticism of this project was that marketing support was largely ignored and many processed products could not be linked to buyers.

Development of small scale "cupulate" processing equipment:

CTAA engineers have developed an entire processing line for the manufacture of cupulate from fermented cupuacu seeds. Several pieces of equipment in the line carry EMBRAPA patents. After design, the line was manufactured in Sao Paolo according to EMBRAPA specifications, and then shipped to EMBRAPA/Acre for installation and pilot testing. The line can process about 400 kg seed/day and is valued in the range of R$ 25-30,000. The two basic products that can be processed from this line are cupulate powder and cupuacu butter. The cupulate powder can then be further transformed into cupulate bars, candies, drinks, etc. The initial intent was to use this line in support of the RECA Project in Acre, but it could easily be duplicated for use with processors or cooperatives in Amazonas.

Development of small-medium scale dehydration equipment:

CTAA has extensive experience in designing small scale dryers for tropical fruits, vegetables, guarana, and fish. These dryers can be powered by various sources, namely electric, gas, or solar. The dryers and drying protocols are developed primarily for medium size companies wishing to process 1 – 2

ton/day of raw material, but equipment size can be easily adjusted based on the needs and size of the client. Solar dryers for guarana seed have already been designed and patented by EMBRAPA.

Customized GMP/HACCP programs for agro-industries involved in the processing of tropical fruits:

CTAA researchers have already designed complete GMP and HACCP protocols for the processing of acai and cupuacu. GMP, or "good manufacturing practices", focuses on how to change food processing and manufacturing practices in order to comply with basic principles of hygiene and safety that result in high food quality. HACCP, or "hazard and critical control point analysis" is a more detailed form of putting GMP's into practice through the identification and description of key points in the processing chain where neglect or poor maintenance can lead to different levels of food safety hazards. The acai project for GMP/HAACP was approved and is fully funded, whereas the cupuacu project was fully designed but has not yet been activated due to lack of funding. Once activated, these projects can be used to diagnose and install GMP and HACCP practices in existing fruit processing plants. In the case of acai, all of the critical control points for potential food safety hazards have been identified. Further work is needed with cupuacu processing in order to fully detail the critical control points. GMP's are very well understood for the processing systems used for both fruits.

Basic training in the principles of GMP and HACCP:

CTAA has conducted hundreds of training events in the area of GMP/HACCP to a wide range of audiences. CTAA has a wide record of experience training both private and public sector clients in these areas. Importantly, they can adjust their style of training to attend to the needs of a large multinational corporation or those of a small, rural cooperative. CTAA has significant basic training experience for GMP/HACCP in a wide variety of sectors, such processing of fruits, vegetables, fish, dairy, poultry, grains, and sweets.

Optimizing post-harvest environments for tropical fruits:

CTAA, in association with EMBRAPA/CNAT, is determining the optimum environmental conditions for the post-harvest handling and storage of cashew, cupuacu and acai. Parameters being investigated include temperature, relative humidity, gaseous composition (oxygen, carbon dioxide, ethylene, etc.)

Testing programs for aromatic and medicinal plants:

CTAA has an entire department with sophisticated laboratory equipment dedicated to the characterization and testing of exotic plants and herbs with

aromatic and medicinal properties. In the case of guarana and cupuacu, these laboratories can conduct analysis on seed components that are of extreme interest to the cosmetic industry. (For example, currently, guarana is being investigated by the cosmetics industry as a potential scavenger of "free radicals" in skin tissues. CTAA carries out such studies under contract to certain cosmetics firms). More typically, these laboratories evaluate the composition of samples of pepper, clove, cinnamon, zacaca, and "pau rosa" for use as flavors or components in perfumes.

Other laboratories:

CTAA has laboratories that are specifically designed to test for pesticide residues, food pathogens, mycotoxins/aflatoxins, vitamins, and minerals. Of most interest to the JICA project would be the pesticide residue laboratory capacity, which has invested over $ 1 million USD in equipment and is deemed to be one of the best in the country. Samples can be sent to these laboratories for analysis, and CTAA specialists can also be used to train and upgrade laboratory capacity in other States.

Library capacity:

The CTAA library has a wide range of information on food science and technology, and may be able to serve as a starting point for establishing a database in the areas of per capita consumption, future market demand, and import/export data. Information for Amazonian food products in these areas in extremely difficult to obtain. Some progress was made using targeted internet searching, and potentially useful contacts were found in the following areas:

a) UNDP/FAO program for processed products in Para State
b) "GenAmaz Network" for fruit pulp products and other "bio-industries" of Amazonia (www.genamaz.org.gr)
c) NUCEX - Nucleus of Information for the Export Sector (nucex@secex.mdic.gov.br)
d) Nielsen Marketing Services (RDJ: 021-262-8580/SP: 011-889-7077)
e) Brazil TradeNet (www.dpr.mre.gov.br)

(b) EMBRAPA/CPATU (Belem, Para)

i) Background

EMBRAPA/CPATU (EMBRAPA's Center for Agricultural Research in the Eastern Amazon) for many years focused on basic production research for primary Amazonian crops (such as rubber, dende, cacau, guarana, tropical fruits, castanha), with particular emphasis on supporting the State of Para. Currently,

CPATU's scope has expanded beyond Para, and its overall mission has been broadened to support the idea of farmers as a component of the agribusiness sector, therefore areas such as food processing and marketing have become increasingly important. CPATU has the following basic infrastructure related to food processing:

Personnel: Has 3 research staff who work on guarana processing and food technology projects on a part-time basis.

Pilot Plant: Has a well equipped pilot plant used to conduct research and training on guarana processing techniques.

Food Processing Laboratories: Has several laboratories where research on the composition of guarana and guarana products is conducted.

ii) Key Mission Objectives of EMBRAPA/CPATU:

Primary Objective: Create technological solutions for the development of a competitive agribusiness sector for the Eastern Amazon Region that can interact with the global marketplace

Specific Objectives:

1. Raise the level of productivity and quality of agricultural products considered of strategic economic importance to the Amazon;
2. Improve the entire farm-to-market production cycle of Amazonian products through proper use of human resources and inputs;
3. New product development for traditional Amazonian raw materials;
4. Develop new technologies that will permit the strengthening of the agro-industrial base;
5. Utilize biotechnology techniques to improve the quantity and quality of Amazonian products;
6. Accelerate the incorporation of worldwide scientific advances into the production of Amazonian products

iii) Research Experiences of EMBRAPA/CPATU of relevance to JICA Project:

The following is a list of key research topics already investigated by EMBRAPA/CPATU in the last 20 years:

Guarana Processing:

In the past, CPATU research has already made advances in the following areas:

- Technology for the processing of guarana into instant powder (spray drying)
- Compositional analysis of guarana and guarana products

In the future, researchers at CPATU would like to focus on the following areas:

1. Make guarana products easier to consume

a. Product development of instant guarana powder
b. Product development for capsules of instant guarana powder
c. Product development for effervescent tablets with a mixture of Vitamin C and guarana

2. Make traditional, village-level processed products more appealing
   a. Raise quality and safety level of home-made products such as powder, bars, extracts, and syrup

Tropical Fruits Processing:

Past research has focused on the following topics:

- Derivation of natural food colorings from Amazonian fruit products (especially acai)
- Food processing techniques for cupuacu
- Processing of nectar from bacuri, cupuacu, and graviola
- Pulp extraction for bacuri and cupuacu
- Chemical analysis of pulp from bacuri, cupuacu, and graviola
- Techniques to prepare cupuacu seeds for the processing of cupulate
- Techniques for the processing of cupulate tablets
- Techniques for the production of instant acai powder

CPATU is interested in the following future topics for fruit processing research:

1. Primary interest is production of chocolate from cupuacu seeds ("cupulate")
   - Product development of instant cupulate powder
   - Development of cupulate chocolate bars (semi-sweet, milk, white)
   - Development of machinery to remove shell from cupuacu seeds
2. Defining clear quality standards for frozen fruit pulps

(c) EMBRAPA/H (Brasilia, DF)

i) Background

EMBRAPA/H is EMBRAPA's National Center for Vegetable Research. This center has 14 research sub-stations in addition to the headquarters facility located in Brasilia. EMBRAPA/H has research programs in the following general areas:

1. Vegetable crop production
2. Vegetable performance in different eco-regional zones (Cerrado, Amazon, Pantanal)
3. Vegetable seed Production
4. Thematic Areas (biotechnology, genetic resources, post harvest, processing, etc)

ii) Agribusiness Philosophy:

The current philosophy of EMBRAPA/H is to approach vegetable production from an agribusiness point of view. Their primary goal is to promote research and development that will enable the "sustainable development of vegetable agribusinesses" in different eco-regional zones. The primary target crops are lettuce, garlic, potato, sweet potato, carrot, Peruvian carrot, squash, cucumber, tomato, sweet pepper, chili pepper, and onion.

iii) Vegetable Processing and Post Harvest Research Programs of Relevance to JICA

Although most research done at EMBRAPA/H involves basic vegetable production, well developed programs also exist in the areas of processing and post harvest. EMBRAPA/H has 5 fulltime researchers in these areas, and the following research areas are emphasized:

Table 6.1.6-2 Vegetable Research Thrusts at EMBRAPA/H in the Area of Processing and Post Harvest, 2001

Thrust	Research Topic
1.	Management of water relations through pre-harvest manegement practices; development of equipment to measure water and gas status of cells
2.	Control of post harvest plant diseases through study of mechanical stresses (especially Erwinia disease in Peruvian carrot)
3.	Cheap, effective packaging materials for vegetables
4.	Controlled atmosphere ripening for vegetable storage (ethylene scavengers)
5.	Quality evaluation of carrots (selection for nutrition, and for acceptance in minimal processing schemes)
6.	Evaluation of post harvest losses in the vegetable production chain

Source: EMBRAPA/H, 2001

Of special interest is Research Thrust #5. This program produced a very practical study that could be of utmost importance to vegetable production in Amazonas. Post harvest losses were quantified at key points in the production chain for tomatoes and carrots. With tomatoes, focus was on losses in the wholesale/retail market as it was discovered that up to 50% loss was occurring at wholesale/retail level (primarily in the facilities of the supermarkets themselves). In the case of carrots, the most significant problems were at pre-harvest points in the productive chain. In line with this research, EMBRAPA/H has developed a rough protocol for how to do critical control point analysis (HACCP) for the production cycle of any vegetable crop. This protocol could be used in Amazonas. EMBRAPA/H staff could be used to initiate evaluations of control points in vegetable production cycles, especially in the distribution chain between Iranduba and Manaus.

(2) Emater/DF

(a) Background

Emater is the equivalent of IDAM for the region known as the Federal District (or DF). Emater provides technical asistance and rural extension services to many

kinds of farmers and small agro-industries. They are especially known for their expertise in the area of supporting vegetable farmers and small vegetable processing industries.

The government of the DF is very aggressive in supporting its agricultural base. Over the last 5 years there was a project called PROVE (Rural Verticalization Program) that was the brain-child of the last Agricultural Secretary (Mr. Joao Luis Homem de Carvalho). It initiated a focus on technical assistance to the small family farmer, with a special effort to facilitate the direct marketing of the farm goods by the farmers themselves or through very proactive cooperatives. Farmers learned how to minimally process their vegetables, make fruit pulps and jams, make bakery items with fruit and vegetable products all with an emphasis on improving the quality and safety of the products so they could be successfully sold in demanding markets (especially supermarkets). Farmers received training in food safety, food quality, packaging and labeling techniques, and also learned how to sell directly through kiosk type distribution in key urban food centers.

PROVE was terminated in 2000 due to the exit of its creator from the political scene, but the new program which has replaced it, PRORURAL, continues many of the same programs. The major goal of both programs was to increase employment and income by expanding the agro-industrial and agro-processing sectors. The idea was that the establishment of more small agro-industries would help to decrease the high unemployment rates caused by high rates of immigration into the DF.

The three basic mechanisms through which PRORURAL supports agro-processing activities are as follows:

1. Add value to rural products through processing and improvements in food safety and quality
2. Improve market channels for rural processors
3. Generate more employment and income through increased survival of rural processing industries

Table 6.1.6-3 List of Principal Agro-processing Industries in the DF Supported by Emater, 2000

No.	Type of Processing Industry
22	Dairy processors
23	Meat processors
19	"Minimally Processed" vegetables
11	Sweets/candies from fruits
10	Preserved/pickled vegetables
9	Eggs & poultry
7	Bakery goods
4	Frozen fruit pulps
2	Sugar cane/brown sugar
2	Animal feeds
1	Honey and other apiculture products
1	Mineral water
1	Flour from grains

Source: Pro-Rural CD Rom Presentation Disk, 2000

Table 6.1.6-3 describes the principal agro-processing industries in the DF. There are approximately 112 establishments, and Emater supports 66-70% of these with technical and marketing assistance.

(b) Emater Agro-Processing Training Center

The center is part of a joint agreement between Emater and the DF's Department of

Education. Emater provides the teaching staff and equipment, DOE provides building infrastructure (classrooms, labs, dormitories). All equipment for the facility has been provided by PROVE and PRORURAL funding. Courses are attended mainly by private sector agro-processing staff, and housewives (both rural and urban). For rural dwellers, training is free – for urban dwellers, rate is discounted at 20-30$R/course. Approximately 800 students are trained per year in the following areas:

1. Milk processing (cheeses, sweets, pastuerization)
2. Fruits processing (crystallization, dehydration, compotes, sweets)
3. Bakery (cakes, pies, snacks, desserts)
4. Vegetable processing (minimal processing, preserves, pickling, tomato sauces, dehydration)
5. Meat processing (preserved meats, poultry processing, deboning, fish processing)
6. Miscellaneous (licors, food freezing, dehydration for herbs, products from eggs, corn, cassava, squash)

(c) Vegetable Processing Enterprises Supported by Emater

The following are brief descriptions of three agro-processing facilities supported by Emater/DF:

Cheiro de Roca Processing Plant

- Sells minimally processed vegetables directly to Carrefours supermarket chain
- Have highly diversified product base; sell over 50 kinds of minimally processed vegetable items
- Also sell edible flowers to Carrefours and other food markets
- Have reception, washing, preparation, weighing and packaging areas
- Relatively hygienic environment, workers using gowns, gloves, hairnets; surfaces are washed aseptically
- Principal products are squash, cassava, cabbage, couve
- Estimated production is 800 kg processed vegetables/month
- Started small, high quality of product led to large Carrefours contract
- Principal problem: struggling to meet volume demand of Carrefours; need to expand

Agro-industry "Produtos SECI"

- Small rural bakery started under PROVE program.
- Produce about 140 cakes per day from various fruit pulp products (maracuja, banana, carrot, orange). Also produces biscuits, cookies, breads from cassava starch and wheat flour
- Principal market is "Pau de Acucar", local "fairs", and contracts for "coffee breaks" with businesses and government offices

- Cost of production for cakes is 1.5$R per piece, can usually get 2.5-3 $R per pieceing to supermarkets and coffee breaks
- PROVE program enabled them to expand out of their house and start a small rural business
- Joined an agribusiness association “Rurate” that has 52 other members making handicrafts, but are having difficulty getting new loans
- Needs; want to expand production capacity to reach 200 cakes/day; need funds to buy special baking trays that don’t require washing.
- PROVE provided the following support to SECI:
    1. Facilitation to get 10,000$R loan at 6% interest (which enabled construction of factory and equipment purchases)
    2. Free chemical and microbiological analysis of water and other raw materials
    3. Technical assistance and free participation in workshops
    4. Arrangement of field trips to observe other small businesses in action

Champion “Vegetable Processing Co.”

- Concept for the business was over 3.5 yrs in development; owner of company is ex-politician entering into business for the first time
- Champion will buy vegetables from CEASA and from local coops and then will minimally process them under contract with “Cuisine International”, a French company which will supply frozen foods (prepared meals) to local and international markets (mainly Europe). Later, they also hope to develop contracts with high class restaurants in the DF.
- They are initiating operations at an approximate level of 30-50 tons of processed vegetables per week, but they have capacity to double or triple Product will be sorted, cleaned cut, placed in special plastic crates and sealed for delivery to client. Over 15 local vegetables will be processed for the “Cuisine International” contract.
- An estimated 20-30 new jobs will be created.

(3) IDAM Programs in Processing, Distribution, and Marketing

(a) IDAM Agro-Processing Project (APP)

IDAM’s Crop Production Department has designed a three year project to support the agro-processing sector of Amazonas State. The project was submitted for funding in late 2000 and still has not been fully approved for implementation. IDAM decided to focus on rural producers of tropical fruits and sugar cane, as processing of these two crops was judged to have high potential in increasing income for typical family farmers in Amazonas State. The target commodities will be frozen pulp from tropical fruits (cupuacu, acai, maracuja, pineapple) and unrefined, processed products from sugar cane (unrefined sugar, brown sugar, broth, “rapadura”, etc.). The specific objectives and goals of the APP are as follows:

Table 6.1.6-4 Objectives and Goals of IDAM Agro-Processing Project, 2000-2003

No.	Objectives
1.	Install processing infrastructure for tropical fruits and sugar cane
2.	Produce frozen fruit pulp under currently acceptable quality standards
3.	Reduce post harvest losses in fruits through processing activities
4.	Stimulate increased planting areas for fruits to meet demand in other markets
5.	Add value to fruits/sugar cane products to increase market competitiveness
6.	Improve the quality of processed sugar cane products
	Goals
1.	Launch 20 agro-processing businesses (9 for sugar cane, 11 for fruits)
2.	Generate 200 jobs that will benefit at least 3,626 rural producers of raw material
3.	Stimulate an annual production of 2,640T fruit pulp and 2,304T processed sugar cane

Source: IDAM APP Project Document, 2000

The basic project consists of the design, installation, and start-up of 20 processing plants in selected municipalities of Amazonas. The plants will be supported by a fleet of 17 trucks, six of these will have refrigeration capacity for the transport of frozen pulp to market. Budget will also be provided for the training (farmers, plant staff, IDAM staff) and for the operational costs of the plants. An illustrative budget for the three years time frame is presented below:

Table 6.1.6-5 Preliminary budget for IDAM's Agro-Processing Project, 2000-2003

Item	Unit	2000		2001		2002		
		#	Value (R$)	#	Value (R$)	#	Value (R$)	Total (R$)
Fixed Costs								
Pulp plant	Plant	3	806698	4	1075597	4	1075597	2957892
Sugar plant	Plant	5	586560	4	469248	-	-	1055808
Ref. Truck	Truck	3	270000	3	270000	-	-	540000
Truck	Truck	3	210000	4	280000	4	280000	770000
Sub-Total			1873258		2094845		1355597	5323700
Variable Costs								
Farmer Training	Course	-	-	10	36660	10	28700	65360
IDAM Training	Event	-	-	2	27010	-	-	27010
Operational Cost (plant)	Costs	3	131280	4	175040	4	175040	481360
Sub-Total			131280		238710		203740	573730
General TOTAL								5897430

Source: IDAM APP Project Document, 2000

IDAM has selected the following municipalities for installation of the processing plants and for the associated training sessions:

Table 6.1.6-6 Municipalities Chosen by IDAM for Installation of Processing Plants in the Agro-Processing Project, 2000-2003

No.	Municipality	# Plants	No.	Municipality	# Plants
	Frozen Fruit Pulp Plants			Sugar Cane Processing Plants	
1.	Itacoatiara	2	1.	Boca de Acre	1
2.	Manacaparu	1	2.	Careiro	1
3.	Manaus	1	3.	Labrea	2
4.	Presidente Figueiredo	1	4.	Canutama	1
5.	Rio Preto da Eva	1	5.	Apui	2
6.	Careiro	1	6.	Tefe	1
7.	Humaita	1	7.	Presidente Figueiredo	1
8.	Codajas	1			
9.	Apui	1			
10.	Autazes	1			
	TOTAL				20

Source: IDAM APP Project Document, 2000

Implementation of the project will employ the following basic strategies:

- IDAM will source the processing equipment, vehicles, and construction materials. The producers associations are responsible for managing the installation of the factories.
- IDAM will provide operating costs for each factory for the first six months of operation only. After that, each factory is expected to be self sufficient
- An Agro-Processing School will be established at IDAM's Training Center to support this and other processing projects in the State.
- IDAM will operate the fleet of trucks dedicated to the APP and will charge user's fee's to the producer's associations
- IDAM will be responsible for administrative oversight of the project through various visits to the factories. IDAM will review and evaluate the management and accounting procedures of each factory, making changes where necessary
- IDAM will make every effort to bring sources of technical expertise to the factories (especially in order to improve product quality and hygiene) and will also attempt to bring more associative skills to the producer associations.
- IDAM will seek to hire 3 new, full time staff to support the project (1 Food Engineer, 2 Agriculture Engineer).

(b) IDAM Distribution and Marketing Project ("PROVENDER")

i) Background

IDAM is the only agency in the State of Amazonas planning projects that are designed to improve the transportation of agricultural products from the farm to the final consumer. The "PROVENDER" project was designed by the Agribusiness Unit of IDAM's Crop Production Department and is basically an infrastructure improvement project meant to improve the post harvest portion of the production chain.

ii) Project Purpose

The main purpose of the project is to ensure the efficient, continuous flow of agricultural product between the centers of production and the centers of consumption through the creation of adequate transportation and marketing infrastructure.

iii) Specific Objectives

The specific objectives of "PROVENDER" are tabulated below:

Table 6.1.6-7 Objectives of Project PROVENDER

No.	Objectives
1.	Seek to establish stable year round prices for agricultural goods
2.	Enable the adequate transport of agricultural goods from farm to market
3.	Strengthen farmers and their rural associations, increasing income and generating more employment
4.	Improve the quality of agricultural goods through improved post harvest transport, handling and storage
5.	Establish a State system of guaranteed minimum prices for agricultural goods
6.	Establish and maintain an agricultural marketing information system for Amazonas
7.	Reduce the average price of agricultural goods offered to the public through minimization of post harvest losses, improved transport and storage infrastructure, while offering low cost processed food items to State programs (hospitals, jails, school lunch programs, etc.)

Source: PROVENDER Project Document, IDAM, 2001

iv) Coverage Area:

It is envisioned that the project will eventually affect all 62 municipalities of Amazonas, but initial focus will be on the following municipalities:

Table 6.1.6-8 Initial Target Municipalities of PROVENDER

Region	Municipalities
Jutai/Solimoes/Jurua	Tefe
Purus	Boca do Acre, Labrea,
Jurua	Carauari
Madeira	Apui, Borba, Humaita, Manicore
Rio Negro/Solimoes	Autazes, Careiro, Careiro de Varzea, Coari, Codajas, Iranduba, Manacaparu, Rio Preta da Eva
Medio Amazonas	Itacoatiara, Maues, Presidente Figueiredo
Baixo Amazonas	Urucura, Parintins

Source: PROVENDER Project Document, IDAM, 2001

v) Key Institutions Involved:

PROVENDER will support movement of agricultural goods in two basic ways:

- From individual farms to individual cooperatives located in the municipal centers
- From the individual cooperatives to a "Central Cooperative" in Manaus

The cooperatives are considered to be private sector participants in the project. The two principal public sector participants are IDAM and AFEAM (Growth Agency of Amazonas State). The following table summarizes the role of each major project participant:

Table 6.1.6-9 Key Roles of Public/Private Sector Institutions in PROVENDER

Institutions	Key Roles
IDAM	- Manage the Program; represent the interests of the State - Create and maintain services that will research and disseminate information on market prices - Create a statistical databank that will document the process of product flow from the farm to the consumer - Farmer training in marketing, quality standards, price variations - Provide logistical support of farm products through provision of trucks and boats to rural communities - Provide technical support and training to the rural cooperatives - Fund and manage a Central Cooperative in Manaus which will receive, process, and store product from the rural cooperatives - Restructure and strengthen the "Agribusiness Unit" of IDAM/SEBRAE/SENAR/EMBRAPA; relocate to the Central Coop. - Serve on the "Consultative Council" of PROVENDER
AFEAM	- Provide technical support and financial credit to the Program - Design credit support programs for the Cooperatives - Evaluate progress of credit support programs - Serve on the "Consultative Council" of PROVENDER
Rural Cooperatives	- Responsible for maintaining their own functional viability so they can participate in the Program - Provide assistance to the rural farmers, especially in transport and marketing of their crops - Provide transport for the rural farmers to the center of the municipality when needed - Organize the shipping of the produce to the Central Cooperative - Maintain functional, working relationship with Central Coop.
Central Coop.	- Responsible for maintaining its own functional viability so it can participate in the Program - Provide assistance to rural cooperatives to facilitate efficient transport of agricultural goods to Manaus - Establish functional mechanisms for arrival of produce from the river ports, highway ports, airports, and bus terminals to the Coop. - Develop new markets in Manaus and outside the State for produce from the rural cooperatives - Serve on the "Consultative Council" of PROVENDER

Source: PROVENDER Project Document, IDAM, 2001

vi) Structure of the Project

In order to effectively support the distribution and marketing of rural produce, PROVENDER is highly dependent on the creation of project infrastructure which has not yet been fully funded or approved. The main infrastructural components are as follows:

Central Manaus Cooperative: A huge central facility in Manaus is being planned for the reception of all agricultural produce from everywhere in the State. The facility must provide exhibition space and storage space to accommodate incoming produce and processed agricultural products from all over Amazonas.

Transport Fleet: A fleet of boats and trucks must be purchased by IDAM to attend the distribution needs of the rural communities. A Fleet Management Team must be organized to program the routing of the vehicles and ensure that they are well maintained.

Project Management Team: A PROVENDER management unit must be established inside IDAM's Crop Production Department. Existing staff must be given new assignments, and new staff must be hired to support the transportation and marketing objectives of the Project.

Operational Costs: A budget must be submitted and approved to pay for the expenses associated with the Management Team, fuel and maintenance costs for the vehicles, Central Coop support costs, training costs, etc.

Consultative Council: IDAM must organize the council from key participatory groups, provide a clear working agenda for the Council, and provide a working budget for Council activities.

Since none of the key infrastructure mentioned above has yet been fully approved and implemented, various aspects of this Program could be supported by the JICA Project.

(4) SEBRAE

(a) Background

SEBRAE is the Brazilian Federal Support Service for Small and Micro Enterprise. SEBRAE has offices and programs in every State of Brazil. In Amazonas, SEBRAE is one of the only institutions which has done research and evaluation of the distribution chain of agricultural products. SEBRAE has also provided technical assistance for many rural cooperatives and rural agro-processing enterprises. SEBRAE provides support to the agro-processing community through three basic approaches:

SEBRAE Agribusiness Unit/Headquarters:

Provides services mainly to medium and large sized food processing enterprises in and around Manaus. Will also tend to the needs of micro- and small businesses if asked. Provide a full range of services but most requests involve assistance with state registration, business administration, and marketing services.

SEBRAE "Proder" Training Program:

Organizes specific trainings and workshops, mainly in the remote rural communities, usually to farmers associations or cooperatives. Most trainings involve courses in association management and strengthening, handicrafts, planning and administration of the family farm and farm-related micro-enterprises, etc.

SEBRAE/IDAM/SENAR/EMBRAPA Agribusiness Unit ("Balcao"):

This is a "Team" approach to offering agribusiness support to primarily micro and small agroenterprises in the rural municipalities. EMBRAPA and IDAM focus on transfer of technologies relating to production and processing; SENAR focuses on training and workshops; SEBRAE provides overall coordination of the Unit and focuses on marketing assistance.

ii) SEBRAE Activities of Significance to JICA Project:

Distribution Studies:

SEBRAE is one of the only institutes that has researched and evaluated the complete production cycles for some key agricultural crops. So far, only the distribution systems for cupuacu, cassava, and wood products have been fully characterized. Described are flow of product from the farms to municipal centers, flow from municipal centers to urban markets, role of brokers, wholesalers, and retailers. Where appropriate, distribution paths to export markets are described. These studies are very useful and they need to be replicated for the remaining JICA Study Team target crops, but more importantly, numerical statistics are needed to indicate the volume of product traffic in the different distribution paths that are described.

Processing Technologies:

SEBRAE has conducted a variety of technical training courses in food processing and food safety, both in rural and urban settings. They have considerable experience in organizing workshops for processing businesses of any size, but they mainly use outside consultants on a contract basis. They are particularly well qualified to organize events in that affect food quality and hygiene.

Marketing Information:

SEBRAE has considerable experience in gathering marketing information on a custom basis for individual agro-businesses. They are skilled at collecting price

information, information on local and regional fluctuation in demand and supply, and have even helped some clients arrange sales in export markets. They have created a databank of potential buyers which can be linked to rural producers.

(5) Research on Select Private Sector Agro-Processors

During the course of Field Phase 3, many agro-processing establishments were visited in order to get an up to date evaluation of the factors creating success for agro-processors, current problems and priorities for agro-processors, and future demand for processed products. As much information was gathered during these visits, it was decided to shorten the many findings into a brief summary table. Annex 6.1.6-1 presents a summary of these findings, including a brief description of the enterprise, principal raw materials used, principal processed products, basic distribution of the products, and key features and needs of the processors. Contact information is provided should more detailed inquiries be needed:

(6) Summary of Research Literature on Processing, Distribution, and Marketing

In general, there are much fewer articles on the Processing, Distribution, and Marketing of JICA target crops as compared to publications on target crop "production". Articles on the distribution patterns of these crops are very scarce. Marketing articles exist but there has been very little research done on how to create market opportunities for these crops. Importantly, there has been very little marketing research performed to assess the future demand for the JICA target crops. Presented in the Annex 6.1.6-2 is a summary of some of the most recent and relevant publications in the area of processing, distribution and marketing for the JICA target crops:

6.1.7 Farmers' Organizations

The current PPG7 rainforest strategy requires federal, state and municipal agencies (including support service agencies, universities and technical schools) to work together with civil society organizations, NGOs, and private sector. As partners, they are collectively to implement a sustainable management strategy in each municipality. Joint national/international/local involvement aims at:

- Securing viable livelihoods for producers, extractivists and business developers;
- Supporting conservation and management of natural resources by co-government and community management, and
- Promoting sustainable development activities through civil organization development, partnerships, and collaborative research efforts.

(1) Impact of Past Government Policies on Farmer Organizations

(a) Japanese agribusiness development of jute/malva cultivation in Central Amazon and cooperative development in Tome-Acu.

Background. In the 1920's the federal government asked Japan to send settlers and help develop the local economy and offered 10,000km2 to Japanese immigrants. Japanese efforts resulted in the development of two successful agro-business programs based on scientific research of soils, climate, natural resources, market demand and systematic training of Japanese settlers in cultivation technologies. One was the jute/malva agro-industry based on varzea cultivation from Manacapuru to Maues. Started in 1927, the industry collapsed in 1987.

(b) Japanese agribusiness cooperative development in Tome-Acu.

The second agribusiness initiative resulting from an invitation for Japanese settlement was the establishment of a Japanese community in the district of Tome-Acu. The latter initiative continues today as a community of successful farms using systems of agro forestry and appropriate technologies for vegetable (especially green pepper) production. It includes a cooperative that owns a successful processing plant that sells quality products on national and export markets.

(c) Riverine Vegetable Development

After the collapse of the jute/malva industry, the government faced a serious problem. A large population of producers was either going to revert back to subsistence production or migrate to Manaus and other urban centers. The State wanted to restrain rural migration to Manaus because the commercial sector boom of the Free Trade Zone or Zona Franca of Manaus (ZFM) had declined.[2] CEPA, the State planning agency, decided to encourage vegetable production in Iranduba municipality. It reorganized farmers into linear river communities so that each family could easily water its vegetable plot, often located behind the house (Noda, 2001). Vegetable cultivation was expected to reduce the amount of cattle ranching and patrao relations (patron-client relations) through partnership in floodplain pasture farming (Ohly and Hund, 1996). Farmer associations were quickly formed by EMATER (the forerunner of IDAM) without formal training in how to run associations so that farmers could access municipality grants for inputs and seeds, tractors, and vehicles to start this agribusiness. Associations were also quickly formed to access subsided federal credit for related activities.

Government decided to promote labor-intensive varzea vegetable production without

[2] The Union rescinded import substitution laws and allowed companies to import electronic goods in other cities.

adequate production and market research. There were little systematic technical training programs in production and marketing for farmers. There was quick association formation with lack of organizational training of farmers on laws of association, how to collectively purchase inputs, how to keep farm accounts, or how to work together, other than in mutirio land preparation to have money to pay labor at critical periods of production, harvest and marketing. This resulted in inefficient use of local resources, high production costs, and sales prices mainly determined by middlemen (Noda, 2001).

In summary, Central Amazon varzea farmers worked as individual producers for an industry for several generations. Communities were constructed by the government and were not natural organizational units formed from trust relationships or social and economic relationships. There was no tradition of farmer organization except the mutirio system for land preparation. Previously varzea farmers were tied to the agro-industry and their focus was on coping with the flood pulse and uncertainty of production (Ohly, 1999). A change to vegetable production without any indigenous skills in their production nor association training in production or marketing has thus increased the vulnerability of these farmers to the flood pulse and uncertainty of production. It has also introduced agricultural roles to women, who had not been active in cash crop production during the jute/malva cultivation period (Ohly, 1999; Noda, 2001). It now places a high demand on forming farmer organizations to break middlemen control and improve livelihood opportunities from vegetable production.

(d) Operation Amazonia (Operacao Amazonia)

Background. In the mid-1960's, the Brazilian Government started Operation Amazonia for the northern part of Brazil. It was based on the premise that science and technology could be used to transform the Amazon region in a "humanized area". The plan included the development of overland roads, settlement programs, magaprojects for mineral exploitation, and hydroelectric energy production. The goal set for 2000 was to socially and economically integrate the Amazon into the national mainstream and enable its soil and raw materials to be transformed into consumer goods to make it one of the greatest production centers on earth (Tocantins, 1974). It was taken for granted that tropical rain forest soils were fertile and suitable to grow all kinds of cash crops adapted to the climate (Ohly, 1999, p.66). Developers also assumed that new immigrants would adapt to the various complex ecosystems and carrying capacities of microenvironments, as had the cabaclos (mixed Indian/European descendants) living for centuries in the Amazon.

In the seventies and eighties, subsidies and tax exemptions for the cattle industry also resulted in vast areas of what was originally intact rain forest being transformed into unproductive, unsustainable grassland (Hecht, 1983). Patron-client relations grew for floodplain grazing from Santarem to Itacoatiara. Livestock owner syndicates became

strong in varzea and terra firme areas. These livestock raising partnerships provided minor economic benefits to subsistence farmers (Panagides and Magalhaes, 1974).

Result. The first paved Amazon highway was from Manaus to Itacoatiara. As a result, farmers were brought in and placed in settlement scheme farmers to help with timber extraction, large-scale cattle ranching and monoculture projects. The result was the national rural labor union movement became strong in the late 1970's and 1980's in Itacoatiara and actively mobilized rural workers into syndicates of rural workers (STRs). STR members were trained how to collectively demand higher wages, fight legally land conflicts or evasions, and organize their documents.

The Ecclesiastic Base Community Movement of the Catholic Church, and the faith-based non-governmental community activist organization Comissao Pastora da Terra, also became active. They mobilized settlers to form communities and advocate their rights for basic services from government. CPT organized farmers to demand fair wages from large companies and encouraged settlers around lakes to keep control over their main food resources, fish, by supporting indigenous community lake management systems.

Comissao Pastora da Terra (CPT) has continued using its 25-year-old successful organization and advocacy strategy. This strategy includes dividing the Amazon into meso regions and training about 5-7 persons as trainers of trainers.[3] CPT volunteers teach human rights courses and monitor human justice violations at community level. CPT volunteers train local farmers how to practically organize an association, elect officers, keep financial and written records, and work together to accomplish a task. It supports legal assistance to small producers and extractivists to fight invasion cases or state violations of their rights.

Their strategy has led to micro-region congresses on specific topics, quarterly board meetings to review programs and budgets, research and documentation of farmer conflicts and successful resolution, and an annual congress in Manaus to develop resolutions from community leaders and representatives to formally take to government for action (Aldison, 2001).[4] CPT organized the first training of community lake management for rural producers, which are now being carried out by both NGOs and IBAMA. CPT has now trained 600 out of the 800 environmental voluntary agents on community lake management. It has spun off various NGOs to continue advocacy and human rights training with specific rural producers in specific regions.

[3] Itacoatiara and Maues are each meso-regions; Iranduba is organized from Manaus.

[4] As of June 2001, IBAMA hired NGO contractors to train 800 environmental agents in the Amazon. CPT trained 600 of them in a series of 3-4 day, 30 hour courses occurring 4-5 times per region at a cost of R$200- 267 per person per course. CPT micro-region volunteers carry out follow up on environmental watch issues through community visits, micro-region congresses, and annual congress held in Manaus. IBAMA demonstrates less active involvement (Missami, 2001; Alison, 2001).

Since the system is volunteer, it is not known how many CPT trained volunteers are still active in Amazon but 25 years of this practical advocacy and basic training program, as will be seen later in review of projects, has been significant in affecting the development of farmer associations in the Amazon.

Another result was the development of environmental movements by extractivists' informal organizations. Popular movements, like that led by Chico Mendez, drew international attention to cultural survival of local inhabitants and Indians. It further led to the development of the Rainforest Trust Fund and the development of civil society NGOs to work with rural producers in the varzea, around lakes, and in riverine communities on cultural survival. Farmers formed informal associations to organize armed conflicts over land use rights. Farmers' organizations and the emerging support NGOs focused on social justice and community management. Few organizations except through CPT initiatives have helped farmers learn to form organizations specifically to address their production and marketing needs.[5]

(e) Free Zone of Manaus and Urban-Industrial Development.

Background. The Free Zone of Manaus (Zona Franca de Manaus, ZFM), founded in 1967, is a strategy to "diffuse development through out the region" by using a model of industrial development based on tax exemptions for semi-finished products and components and urban commercial development through the promotion of a free trade market of imported electronic, optical and electro-domestic goods. The commercial market collapsed when the government rescinded import substitution laws in the late 1980's (Motta, 1995).

Result. Manaus attracts young rural migrants who perceive of the city as a haven of jobs and opportunities. This migration, while less dynamic now than in the 1980's, includes youth from the rural Amazon state, Para and the heavily populated Northeast. Estimates of annual population increase for the Amazon State are expected to decrease due to improved education and more accessible family planning services in the next 10 years. However, annual population increase of Manaus is expected to remain high due to continued in-migration from rural areas and neighboring states until the end of the ZFM (estimated to be in 2013). Activities for rural youth to do in rural areas through youth leadership training, education, or involvement in agribusiness activities are thus a high priority of state government. In-migration causes burdens on public service infrastructure, and lack of jobs has created social disorder including crime, prostitution, and drug trade.

[5] Local activists like rubber taper leader Chico Mendes started in the 1970's. The Rio de Janeiro International Environmental Conference raised international concern on globalization and the destruction of the world's largest remaining rainforest and resulted in the 1992 resolution to establish the Rain Forest Trust Fund.

(f) Decentralized and Participation Management Concept

Background. In 1992, a Rio de Janeiro Conference resolution established the Rain Forest Trust Fund. International concern over the destruction of the rainforest in the Amazon and the Atlantic Rain Forest has also led to a need to learn lessons on sustainable development by involving government, communities, civil society organizations, and private sector. The scope of projects supported under PPG7 is wide and involves multiple partnerships to succeed. Producer associations, community groups and civil society organizations are expected to have an active role.

Result. As evidenced above, there is not much experience in their formation of producer organizations, community mobilization or even civil society organizations that focus directly on extractivists or small producer livelihood needs as indicated in the vast number of program activities to be supported under PPG7 (see Table 6.1.7-1). There is also not much experience in how to guide resource users and decision-makers like state extension agencies and state government on how to develop partnerships with communities (which are not legal identities) or with producer or extractivists organizations that have been traditionally in opposition to government. There is also no deep agricultural extension experience to farmers to simplify help them learn the legal processes to set up small farmer associations and become involved with development programs as most extension training to farmers in association development was for the purpose of accessing credit or municipal grants. There is also little access to information to farmers to learn how they can become involved. From the list of project activities supported under PPG7, a critical input into its successful program implementation, however, will be systematic implementation of a farmer organization strengthening strategy, which offers training to local leaders and facilitates the formation of sustainable producer associations.

Table 6.1.7-1 List of PPG7 Project Activities: 2001

Name	Objective	Participants	Financing
Monitoring and Analysis	Promote learning about Pilot Program and application of strategic lesson	Ministry of Environment, Water Resources, Legal Amazon, all Pilot Program projects, diverse research personnel and institutions	$2.0 million-Rain Forest Fund; $.6 million Brazilian counterpart; GTZ
Indigenous Lands	Complete legalization and assist in protection of 121 indigenous areas	Ministry of Environment; Ministry of Justice; National Indian Foundation, NGOs, indigenous organizations	$22 million-Rain Forest Fund, German Govt, Brazilian counterpart, GTZ
Extractive Reserves	Develop and test appropriate approaches to social, economic and environmental management of extractive reserves based on refinements of traditional local knowledge and practices	Ministry of Environment, National Center for Sustainable Development of Traditional Populations at IBAMA; National Rubber Tapers Council; local reserve assoc., com.-based groups	$17.1 million-Rain Forest Fund, European Union for phase 1 and 2
Floodplain (Varzea) Resources Management	Lay scientific, technical, policy foundation for conservation and sound management of natural resources within varzea of central Amazon River basin, with special emphasis on fish	Ministry of Environment, IBAMA, Northern Fisheries Research and Extension Center (CEPNOR), diverse research personnel, institutions; NGOA, private sector organizations, community groups	$15.5 million-Rain Forest Trust Fund, DFID (British Govt), German Govt, Brazilian counterpart funds

Forest Resources Management	Support development and adoption of sustainable forest management systems in Amazon region by strategic actions and pilot experiments in priority areas	Ministry of Environment;IBAMA, NGOs, private sector organizations, community groups	$20 million-Rain Forest Fund, German Govt, DFID (British Govt), Brazilian counterpart funds
Rain Forest Corridors (in preparation)	Conserve biodiversity by creating rain forest corridors in Amazon and Atlantic rain forest regions	Ministry of Environment, IBAMA, Amazonas, Bahia, Espirito Santo, Minas Gerais state governments; corridor private and public stakeholders, civil society organizations, com. groups	Estimated $42 million
National Resources Policy	Support sustainable use of natural resources by defining and implementing appropriate models of integrated environmental management	Ministry of Environment, State Environment Council, municipal gob's, NGOS, civil society organizations	$83 million-Rain Forest Fund, German Govt, EU, federal/state Govt counterparts; GTZ, DFID
Fire and Deforestation Control	Improve surveillance and control of deforestation, burning, forest degradation in selected target areas	IBAMA, state environmental agencies, NGOS	Not finalized (in preparation)
Fire Prevention, Mobilization and Training Project	Carry out grassroots mobilization and training field campaign with strong participation of civil society to educate local communities to dangers of escaping fire, teach basic prevention, control methods	IBAMA, Amazon Working Group (GTA), NGOs, FETAGRI (rural workers' unions), church	$1 million from USAID to Rainforest Fund + $1 million from other sources
Private Sector Involvement	Build partnerships between PPG7 projects and private sector; Catalyze sustainable businesses in Atlantic Forest and Amazon; assure market penetration for community sustainable production; assist project preparation to become businesses (e.g. market research, business plans); Help access other sources of funding, credit lines and venture capital	Ministry of Environment, private firms and banks, BNDE, BASA, civil society organizations, state and municipal Govt, World Bank Rainforest Unit	Rainforest Fund (amt not available)
PD/A Demonstration Projects	Promote, test, disseminate community-based conservation and development initiatives in Amazon and Atlantic rain forest regions that are environmentally, economically, and socially sound and replicable	Ministry of Environment, Amazon Working Group (GTA), Atlantic Forest Network (RMA), community organizations, Banco do Brazil	$19.5 million-Rain Forest Fund, German Govt, EU; additional $7.5 (German and French gob's); $7.5 beneficiaries, + others
Science Centers and Directed Research	Support competitive grants for scientific research and strengthening of INPA-Manaus and Emilio Goeldi Museum-Belem	Ministry of Environment; Ministry of Science and Technology, (FINEP), INPA-Manaus, Emilio Goeldi Museum	$25.5 million-Rain Forest, EU, US Govt, Brazilian counterpart +$5.26 European Union bilateral;

Source: JICA Study Team, 2001

(2) Impact of Projects and NGO Organizations on Forming Farmer Organizations

Analysis II includes a review of farmer organization experience in the Amazon. Lessons learned for forming farmer organization will later be derived from these specific producer organizations or project experiences. Three projects studies are IDAM assisted (CEDARP, Antimary Association, ASCOPE); two are PPG7 assisted but initiated with other funding (RECA Project, Project Saude Alegria); one receives grant funds from DFID technical assistance related to PPG7 (Project Varzea) and other international funding, and the final is managed mainly by volunteers with minimal grant funding (GDA).

Farmer organizations are located on varzea, in terra firme areas, on settlement schemes, and in extractivists' reserves. All are located in the Amazon Region and four in the Amazon State. Focused group interviews were held between May and July 2001. Field visits included site visits and sleeping in the community. The purpose of this field study was to learn how farmer organizations have been formed in the Amazon and what interventions have been successful in building their capacity. Some organizations identified main reasons for their success. Others identified on-going constraints. Specifically reviewed were how to

- Mobilize farmers to form an association
- Initiate organization through capital investment
- Promote effective management of production and marketing
- Train producer groups and leaders
- Select leaders, voluntary agents, and managers
- Integrate men, women, youth into the agri-business chain of production or development
- Monitor and evaluate activities and impact on farmers' economy and social conditions
- Plan project activities.

Table 6.1.7-2 Farmer Associations and NGOs interviewed for Organization Formation and Association analysis, 2001

Name of Project/Location	Selection Criteria	Type organization	Initial Finance	Catalyst	Funding Source
RECA Project/Rondonia	Agro forestry, existing agribusiness in marketing and processing	Farmer association	Revolving fund	Settler organized	Original-Dutch Church grant; self-financing, PPG7 beneficiary
ASCOPE/Itacoatiara	Agro forestry, marketing cooperative; early stage of developing processing cooperative	Cooperative	FNO loan through IDAM	Catholic Church/CPT	Original-FNO loan; self-financing, not PPG7 beneficiary
Antimary Association/Boca da Acre	Extractivists marketing association; early stage of formation	Association	Prodex loan through IDAM	IDAM and IBAMA	Original-Prodex loan; not PPG7 beneficiary
Project Saude Allegria/Tapajos Extractivist Reserve- Santarem	Agroforestry, planning stage of agri-business;	NGO-integrated community management approach	Development grants	Medical doctor	Development foundations; recent PPG7 beneficiary
CEDARP/Parintins	Cantina based, varzea vegetable production, milk, farinha, fruit marketing	Marketing association	Municipal Govt grant	IDAM	Original-municipal grant; self-financing
Project Varzea/Santarem	Environmental education and training on community lake management of natural resources	NGO Research institution (INPA)	International donor and technical assistance	Professional staff and technical advisors	DFID, WWF, UNEP
GDA/Resex and Flona Reserve-Santarem	Farmer organization participatory planning and advocacy movement	NGO and movement	Church contributions and volunteers	Professor/student research	Volunteer contributions, UNDP; awaiting PPG7 funds

Source: JICA Study Team, 2001

Summarized Table 6.1.7-3 is the distinguishing features and major outputs of the seven projects.

The following part is described two projects in detail especially.

(a) Associacao does Pequenos Agrossilvicultores do Projecto Reflorestamento Economico Consorciado e Adenasado (RECA)

Of the seven projects studied, the Associacao does Pequenos Agrossilvicultores do Projecto Reflorestamento Economico Consorciado e Adenasado (RECA) project located on the border of Acre and Rondonia and the Associacao de Desenvolvimento Comunitario dos Trabalhadores Rurais da Comunidade Sagrado Coracao (ASCOPE) located in Itacoatiara Municipality have had the most successful land development and marketing organizations. Both initiated alternative systems of agroforestry on terra firme. The RECA project is organized as an association, has a wider line of products, and serves a larger number of farmers (340 compared to 115 in ASCOPE).

Table 6.1.7-3 Summary of Farmer Organizations and Projects Studied for Association Development: 2001 (1/2)

Organization /Project	Date Origin	Location	Beneficiaries	Objective	Main Activities	Outputs
RECA Project	1989	Settlement scheme near Nova California	*Original*: 50 families organized project and 200 families received initial capital *Current*: 247 families (association) 340 families (clients)	Improve incomes and health services to settlers through agro forestry production and marketing and participatory association formation	Land development in agro forestry Cupuacu and acai pulp processing; fermented seed sales; health care for families Originally set up produce marketing systems, later focused on process marketing by filling market contracts organized by Sao Paulo commission agents Enable members to borrow from their profits and require all members to participate in decision-making	Cupuacu fermented seed Cupuacu butter Cupuacu jelly Frozen cupuacu pulp Frozen acai pulp Frozen acerola pulp Frozen araca pulp Canned pupunha palm pieces of various types Honey Primary health care program
ASCOPE	1997	Community of Sagrado Coracao de Jesus near Novo Ramanso 1952-community 1976-informal association 1987-labor union 1994-Rural Workers Association	*Original*: 35 families with 30 with land *Current:* 26 families (cooperative) 76 families (clients for marketing) 115 families (for cantina sales)	Organize terra firme production livelihood after varzea floods for settlers Improve quality of life of members	Mobilize savings through cantina store and earn income from store sales Organize marketing cooperative for agro forestry products and pineapple Organize a cupuacu home based processing activity for fresh pulp sales	Floating cantina store, house and dock with sales averaging R$45,000 per month 3T Quick freezer container, 6T cold storage container to better control prices Marketing association for pineapples, papayas, fresh cupuacu pulp Improved housing, services, communication accessories, boats of members
Antimary Association	1997	Extractivists area under INCRA along Rio Antimary, Rio Purus	*Original*: 257 families *Current*: 223 families, 100 female factory workers from Boca do Acre	Provide independence from patron system of slave- like labor by forming an association to provide cash sales of brazil nuts to collectors	Set up collection points for brazil nut at river inlets Train women how to organize sales and collection points Set up a packing industry owned by the association	Industry plant set up by IBAMA Loan taken out under Prodex for about $200,000 to pay for collection and packing 25T of unsold packaged nuts in factory; 31T of raw collected nuts waited to be prepared for packaging
Project Saude Alegria	1987	Extractive communities along Amazon, Tapajos, Arapiuns rivers in Satarem and Belterra	*Original*: 16 communities *Current*: 82 communities, 20,000 inhabitants	Provide technical support to communities in environmental, reproductive health, youth mobilization, community planning, and integrated development	Integrated community organization formation Reproductive and health rights and service delivery Conscientization of planning, enterprise development, management of local resources	Community based popular theater Moroconga local newspaper organization, radio and video organization by adolescents Inter-community councils Agro forestry training and community processing plant planning support

Table 6.1.7-3 Summary of Farmer Organizations and Projects Studied for Association Development: 2001 (2/2)

Organization /Project	Date Origin	Location	Beneficiaries	Objective	Main Activities	Outputs
CEDARP	1998	Rural producer associations along varzea or rural producers with mixed terra firme and varzea production	*Original*: 23 producer associations *Current*: 23 producer associations 10 community associations (active)	Establish cantinas (community stores) for 10 associations and central office to organize market sales of rural produce of member organizations Trained communities in how to manage cantinas	Obtained all legal statues of association and tax documents Prepared market contracts and bids for supermarkets/ municipality bids Use Paulo Friere methodology to mobilize farmers into forming a business association	Prepared project document for loan to for working capital and development capital to set up 10 cantinas and an office Prepared contract for Carrefour/Manaus for bananas Prepared and won municipality tender to supply schools with farinha
Project Varzea/Santarem-Environmental Education Program	1995	Varzea schools and varzea communities in Santarem Municipality (Program of Amazon Institute for Environmental Research)	*Original*: 30 varzea schools 60 teachers, about 3 families per community *Current*: 55 varzea schools, 123 teachers, 3000 students	Develop environmental education program for primary schools which focuses on the varzea environment and its use by the local population Train teachers and families and students Train community leaders on community management of lake fisheries	Develop textbook with varzea families and fishermen Hold training courses for teachers and family representatives in nodal communities (to cover about 6 communities) every 2 months Develop training module for 1 year course on community lake management and train community selected extension agents	Textbook which explores physical geography, ecology, utilization of varzea environment using Paulo Friere methodology of social consciousness Municipality Secretary of Education has agreed to use methodology in varzea schools
GDA/Santarem	1978	Extractivists communities, especially those now in RESEX	*Original*: 71 communities, two regions *Current*: 25 communities in Phase I 14 communities in Phase II	Improve the quality of life of Amazon people by training in sustainable development planning and consciousness raising Stimulate rural and urban exchange of ideas and provide environmental education and human rights awareness Report government and private initiatives negatively affecting ecosystems, culture and economy	Training program of 3-4 days for youth and adults every 2 months in nodal communities on leadership – including how to develop programs, how to communicate information, how to help communities recognize their community accomplishments Develop project planning based on participatory diagnostic surveys, and grant funds to carry out low cost project Provide research materials on communities, Indians, culture for student research	Maps by communities of their natural resources, settlements Community development plans and project plans and grant fund monitoring Organization of communities to advocate and secure the RESEX (extractive reserve of Tapajos Indians)

Source: JICA STUDY TEAM ,2001

The RECA association strictly requires monthly participation in sub-producer group meetings and at bi-annual assemblies in which seasonal work plans and budgets are reviewed. While it is an association, it operates like a cooperative. The RECA project sells processed goods by filling contracts arranged by commission agents located in Sao Paulo. Its initial approach was to sell fresh produce locally, then to hire trucks to take produce to Sao Paulo, and to rent a warehouse in Sao Paulo until they found markets. They now pay private refrigerated truck drivers and sell processed goods by filling market orders without need of a warehouse. Initial capital for the RECA project came from farmer savings, followed by a R$5000 loan returned in 2 years to the Bishop, and a grant for land development of R$968/hectare per family from a Catholic NGO located in Holland.

Table 6.1.7-4 Key Features of Organization Activities and Outputs of RECA Project 2001

Design	Details
Organization outputs	Participatory structured decentralized and democratically run farmer organization with annually elected leaders, general assembly two times per year; Executive Council of elected coordinators from 14 producer sub-groups of 20 to 50 families. President, Producer sub-groups president and coordinators elected every two years. Seasonal work plans and budgets developed by council with advisory assistance from first President of association.
Agribusiness outputs	Frozen cupuacu pulp packed in 5 kg, 1 kg, and 10 packs of 100grams (Sales in 20001: 172T) Frozen acai pup packed in 5 kg, 1kg and 10 packs of 100 grams (Sales in 2000: 8T) Cupuacu butter in 10 kg plastic containers (.35T for market testing) Fermented cupuacu seed in 50 kg jute sacks (Sales in 2001:35T) Cupuacu cosmetic cream in 1 kg glass jars (no data) Pupunha certified seeds without spine in 1 kg plastic sacks (Sales in 2000:9.578T) Punpunha certified seeds with spine in 1 kg plastic sacks (Sales in 2000: 18.754T) Punpunha fresh fruit (Sales in 2000: 700T)
Membership/staff/volunteers	Members: farmers who have taken out 10 year development loans from RECA Staff: Central office and factor workers paid minimal salary at factory is R$250/month Volunteers: Executive Council, President, members
Key Mobilizing factors	Interest free land development loan, 4 year grace period, variable percentage returns and return through sale of products, not cash
	Participator style of association management to develop farmer ownership of project
	Profit making factory established from returns on loans
	Both men and women are involved
	Association meets health needs, savings needs, credit, social and environmental needs of members whether young or old, married or single
	Catholic priest in first 8 years was an active in solidarity mobilization. He trained farmers how to keep farm production records and preached on the importance of participatory as a human contribution. He did not direct the project
Leadership and decision-making strategy	Close supervision of farmer accounts by monthly monitory through farmer elected financial councils in open meeting. Farmer membership is conditioned by willingness to have financial accounts openly reviewed in farmer meetings
	Financial and Executive councils, factor manager, farmers all know how to keep farm accounts
	Farmers unwilling to participate are asked to leave – an enforced activity
	President makes hand-on decisions; is open to suggestions, uses consensus building and conflict resolution
	Government collaboration kept to minimum and only used for registration. Exception was access to PPG7-PD/A funds for which they have waited 4 yrs
	Vote of 60% agreement required on decisions
Patrimony	Factory, Office and product sales store, guest house, meeting center

Source: JICA Study Team, 2001

(b) Associacao de Desenvolvimento Comunitario dos Trabalhadores Rurais da Comunidade Sagrado Coracao (ASCOPE)

ASCOPE is a marketing cooperative of 26 families who make marketing and management decisions for 115 area producers. Established in 1997, its members are the same as the Rural Workers Association established in 1994. ASCOPE is located in Sagrado Coracao, which was established in 1952 but mobilized to be a community under the Ecclesiastic Basic Community Movement of the Catholic Church from 1962. Comissao Pastora da Terra for many years helped build solidarity, confidence, and leadership skills of members, and discipline through various training courses, exposure visits, and directs technical assistance. A CPT social activist is the key person who energized this group of families to first move out of wage labor into land ownership, and then form an association and later cooperative. He still remains a guide even though now elected counselor in Itacoatiara Municipality.

A mutirio strategy was the key "capital" input that helped each member clear one hectare of land to initiate a cash crop plantation. ASCOPE receives visits and technical assistance from many sources, including STR, Comissao Pastora da Terra, IDAM, EMPRABA, and SESCOOP. Recently they received assistance from the Municipality Government for construction of a secondary road (in progress) and from the State Governor for a generator. IDAM assisted the original 30 members when it was an association access FNO credit (R$7000/family) for 7 years for agro forestry development.

They operate a successful floating cantina (store) and floating dock with monthly turnover around R$45,000 and service area 7 communities or around 140 families. The management structure that effectively brings in these profits, according to ASCOPE President who is also President of the Rural Workers Association who organized the cantina, took 15 years. This includes 4-month change of business manager, inventory review at each turnover, two-month inventory purchase on cash basis from wholesalers in Manaus, and minimum 15 credit except for rural producers on pensions who get 30 days. Hours open are 6 AM to 8 PM Monday through Saturday and 3-8 PM on Sunday.

ASCOPE sells sell fresh pineapples, papayas and fresh cupuacu pulp to middlemen in Manaus. Pulp extraction is home-based and involves both men and women. ASCOPE sold its warehouse in Manaus and once FNO credit is repaid would like to set up a frozen cupuacu pulp processing industry. Sales unit is in process and once the FNO credit is repaid.

Table 6.1.7-5 Key Features of Organization Activities and Outputs of ASCOPE: 2001

Design	Details
Organization outputs	Democratically run farmer cooperative with annually elected leader from one of 26 members. Majority of members are related from 3 families. Frequent meetings. Seasonal work plans and budgets developed by cooperative with advisory assistance from accountant located in Itacoatiara and elected councilor (former CPT mobilizer).
Agribusiness outputs	Frozen cupuacu pulp packed in 5 kg packs (35T stored for sale in 2001) Fresh Cupuacu pulp (Sales in 2001: 125T) Fresh Pineapple (Sales 3 times per week) Fresh Papaya (Sales seasonal) Sugarcane Honey (1 kg jars)
Membership/staff/volunteers	Members: originally 30 reduced to 26 due 1 death, 1 moved away, 2 expelled). Members are farmers who have taken out 10 year development loans under FNO Staff: Cantina Store managers (2 brothers, 1 is paid $1200 per month for 4 months on duty, other $600 with 4 month rotations. Includes floating house) 2% of sales used to pay accountant and staff involved in organizing fruit sales
Key Mobilizing factors	Subsided land development loan of $7000/family for 30 families for 1 ha of agroforesty, 10 years, fixed annual rate and group guarantee.
	Comissao Pastora da Terra solidarity training in mutirio system, leadership training, forming an organization, planning, legal rights, labor rights, and administration
	Cantina or floating store earns profit, meets basic needs of families in 7 nearby communities, helps farmers save time and money
	First 30 years, strong Catholic priest who supported organization training, facilitated training links for courses, supported leadership and youth training
	STR promoted labor rights and INSS status for men as rural producers; recently help participatory planning exercises that have led to expansion planning of land development
	Many leadership courses, exposure visits of cooperative members
Leadership and decision-making strategy	Close supervision of cantina accounts by cooperative and cooperative accounts by professional accountant
	President of cooperative supervises organization of sales of produce and boat transport arrangements
	Other requests of farmers to be members has been denied until FNO loans are paid off
	President makes hand-on decisions; is open to suggestions, uses consensus building and conflict resolution
	Government collaboration kept to minimum. Exception was access to Third Cycle generator for electricity, and partnership costs for secondary road shortcut extension from main secondary road to Novo Remanso
	Vote of 51% agreement required on decisions
Patrimony	Cantina, floating dock, floating house, generator, 30T cold storage cantainer, 3T quick freezer unit

Source: JICA Study Team, 2001

CHAPTER VII LESSONS LEARNT FROM THE EXPERIENCE

7.1 Productivity and Crop Management on the Target Crops

7.1.1 Environment Friendly Agriculture and Fishery

This section presents a summary of the lessons from research, documents and personal experience. Subjects here presented are those relevant to the actions to be taken in Environmental policy for Natural Resources utilization in Itacoatiara municipality.

(1) Agroforestry

Agroforestry has become widespread recently because of demands in preserving Amazon forest and regenerating degraded lands in the region. Several government institutions and NGO are engaged in promotion, research and implementation of SAF (Agroforestry System). The lessons for agroforestry are summarized in Table 7.1.1-1 covering the following subjects:

- Institutions involved,
- Projects,
- Species,
- Systems,
- Planning and installation,
- Social aspects,
- Economical aspects,
- Technical Assistance,
- Training and
- Research needs.

(a) Institutions involved.

Main governmental institutions are EMBRAPA, CEPALC, INPA, IDAM, Ministry of Science and Technology (MCT), SUFRAMA and SUDAM. Some municipalities are also being involved, like Manacapuru in Amazonas State and Rio Branco in Acre. Itacoatiara municipality cooperates with CEPLAC on 103 projects.

(b) Projects in Itacoatiara

In Itacoatiara, the only one project is financed by SUDAM with participation of IDAM. This project was originally intended for 58 farmers, but for several reasons dropped to 20. Farmers growing cupuaçú in the area adopt agroforestry as common practice for cultivation but does not comply with formal SAF project. 103 projects under PRODEX, are financed and under implementation.

Table 7.1.1-1 Summary of Lessons from Experiences in Environmental Friendly Agriculture (1/3)

Agroforestry

Subject	Lessons from experience	Results to considered in projects.
1. Institutions Involved	EMBRAPA, CEPALC, INPA, IDAM, Ministry of Science and Technology (MCT), SUFRAMA and SUDAM. Itacoatiara municipality is going to participate with CEPLAC in 103 projects.	The fact of having many institutions involved is a signal of the interest on the subject but also mean a need for cooperation and coordination.
2.Projects	In Itacoatiara, the only "official project" is the one financed by SUDAM with the participation of IDAM. This project was originally designed for 58 farmers, but for several reasons this number dropped to 20. Farmers growing cupuaçú in the area are using agroforestry as a common practice for the crop but does not obey to a formal SAF project. PRODEX has 103 undergoing projects	Negative results in Itacoatiara implies the need for better planning, implementation and follow up of projects
3. Species in SAF in the region	SAF generally have 5 types of species: Timber trees: permanent fruit crops, semi-permanent fruit crops, annual and legume crops.	
3.1 Timber trees	Most common are: Brazil nut (Bertholletia excelsa), Mogno (Swietenia macrophylla), african mogno (Khaya senegalensis), teca (Tectona grandis). EMBRAPA and CEPLAC are introducing some crops like Eucalyptus camaldulensis, Carapa gunianensis (andiroba) and paricá (Shizolobium amazonicum).	Brazil nut and andiroba produce both timber and fruit and are preferred by farmers
3.2 Permanent Fruit crops	Permanent fruit trees mostly found are: cupuaçu (Theobroma grandiflorum), pupunha (Bactris gosipaes) açai (Euterpe oleracea) , graviola (Annona muricata), cocoa (Theobroma cacao), citrus (Citrus sp.) and guava (Psidum guava). Cupuaçu is the most frequent and recommended crop in SAF.	Cupuaçu, and Açaí have to be included
3.3 Semi-permanent crops	The most common semi-permanent crop is banana. Maracujá is found, but it is not of common use.	Use new Sigatoka resistant banana varieties. Maracujá could be used in alley cropping.
3.4 Annual crops	Cassava or manihoc is by far the most used annual crop. Some other crops like beans, rice and corn are very rare. In Roraima, soybean is being used lately.	Cassava is preferred by farmers and should be used in SAF
3.5 Legume crops	Legume trees have been usually used as shade for cupuaçu and cocoa. In SAF the most used is Ingo (Inga edulis) but lately, Gliricida (Gliricida sepium) is becoming very popular for its fast growth. Acacia mangium is being introduced in Roraima with good results.	Gliricida has a great potential as nitrogen fixing crop and organic matter. Ingo is also accepted by farmers.
3.6 Crop Competitivenes and complemetarity	Research shows than in SAF they're some competitiveness and complementarity among crops. Most common effects are shading, nutrient, soil moisture, pest and diseases and labor use.	
3.6.1 Shade	Is one of the main factors. Competiveness reduce yield of fruit crops and inhibits growth of cover crops in old SAF. Complementarity reduces Sigatoka in bananas, help early developments of tree crops. Layout, spacing and shade management mitigate the effects.	Layout, spacing and management are important design factors. More research is needed on the subject.
3.6.2 Water and nutrients	Crops compete for water and nutrients. Proper layout and spacing of trees diminishes competition. Crop management, like crowning is used to compensate effects.	Layout, spacing and management are important design factors. More research is needed on the subject.

Table 7.1.1-1 Summary of Lessons from Experiences in Environmental Friendly Agriculture (2/3)

Subject	Lessons from experience	Results to considered in projects.
4. Systems	Although literature indicate 14 SAF systems, only 3 main system dominate: Multistrata, alley crops and Home Orchard	
4.1 Multiestrata	Multistrata systems incorporate several species in the same area. Although crops are planted in lines, they are mixed. This systems are being promoted by INPA and EMBRAPA. The system has a more environmentalist purpose.	Is popular among farmers but requires more labor and aditional area for green manure crops
Alley crops or strip cropping	Crop are planted in strips to allow a better management, mainly shade. Timber trees are more widely spaced .Annual and fruit crops are plated in lines. Figure 4.1.1-1 shows an example of CEPLAC's layouts. System is more flexible permitting having lines of legume tree crops that will provide green manure in a more permanent fashion. Strip cropping use labor more efficiently and areeasier to manage. This system is being promoted by CEPALC and EMBRAPA.	It is being introduced by CEPALC and EMBRAPA who have experience in the system. It is the most flexible of SAF and guarantee a better labor and income distribution
Home Orchard	Very popular and almost every far has one around the farmhouse. Crops are generally planted in a random manner depending on farm's preferences. Timber trees are not a must. Home gardens have the largest variety of species and farmers use them for several reasons including food, medicinal and ornamental plants. Small animal are usually found. This small animals are usually fed with crop residues. Home gardens are farmer's research plot for evaluating new crops. This system is recommended by all institutions involved.	It should be included in all farms because it provides products for farmers use and provides a field for introducing new species. It closeness from the farm house optimize familiar labor.
5. Planning and installation	Planning and installation of SAF varies according to several approaches of institutions involved. Activities involve: Site selection; farmers selection; training; species selection; nursery and seed; installation.	
5.1 Site selection	Site selection involves social, soil and infrastructure. In Rio Branco, Acre, municipal projects require proper infrastructure conditions like transportation, electricity and services. Farmers Organization is required.	Site selection is important to guarantee project success
5.2 Farmers selection	Farmers selection will depend on strength of organization and willingness. In general an initial survey is performed.	Important for success
5.3 Training	Farmers are trained in practical subjects like crop production and management. Simple soil evaluation is also a subject.	Training is mandatory in projects
5.4 Species selection	Farmer's participation in crop selection is usually required. Experience has shown that many failures are a result of "imposed models". EMBRAPA in Roraima use field visit to projects and experimental plots, training and workshops to select species.	Farmer's participation is essential
5.6 Nursery and seeds	Quality and availability of seedligns is a requirement. Farmers have learnt that sometimes free seedlings of unknown source have turn out to be a problem. Nurseries are part of some projects.	Nurseries and good quality seeds are necessary
5.7 Installation	Farmers select proper layout with assistance from technicinas. CEPLAC uses a flexible layout in its projects. Since most project will start with "capoeira", installation will consist in land clearing, litter disposition, layout and crop planting.	Farmers participation is very important

Table 7.1.1-1 Summary of Lessons from Experiences in Environmental Friendly Agriculture (3/3)

Subject	Lessons from experience	Results to considered in projects.
6. Crop Management	Crop management in SAF is very complicate because it involves many species. SAF success will depend on a proper management. Required management practices are pruning, thinning, cover crops, litter management, pest and disease control and fertilization.	
6.1 Pruning	Required for some permanent crops and legume trees. In legumes trees it is essential to provide litter for green manure. In visited projects, only few farmers use the practice.	Farmers should be stimulated to use this practice
6.2 Thinning	Will involve the elimination of some plants, mainly temporal shade, semi-permanent crops and legume trees. This practice is used only for some framers.	Important for SAF formation. Farmers should be stimulated to use it.
6.3 Cover crops	Some project use cover crops, mainly kudzu. Farmers still are reluctant to use it.	Promotion, training and incentives are necessary to increase its use
6.4 Litter management	Is one of most importance in SAF. Litter management will provide crops with mulch and organic matter. Not all farmers use it. It is essential for organic agriculture.	Research is needed to improve use of this practice. Training and technical assistance is necessary to improve this practice
6.5 Pest and Disease control	Very little pest and disease control is used. Many cupuaçu plantations in SAF are affected by Witches broom but farmers do not control it. Most institution are providing farmers with Sigatoka resistant banana seedlings.	Research is necessary for integrated pest management (IPM)
6.6 Fertilization	One of the strongest vantages of SAF is the use of organic fertilization. Farmers are starting to use legume trees as green manure. Some chemical fertilizers and amendments are still necessary for proper crop production.	Compost production should be introduced. Confining of animals are important for manure collection
7. Social aspects	Most failure of SAF are due to social problems related to farmers organization, lack of training and political reasons. Farmers are reluctant to follow recommendations that involves use of labor if they do not see a return	Farmers organization strengthening is essential
8. Economical aspects	There are few studies and experiences in SAF feasibility. Most projects are recent and therefore no information is still available. Experience from visits to projects indicate that there are farmers with positive experience. Projects in Rio Branco in Acre; project RECA in Rondonia; projects in Presidente Figueiredo, Rio Preto da Eva, and Manacapurú in Amazonas and Tomé-Açu in Pará demostrates that SAF, when well conducted could generate good income for farmers.	Research is needed to assess different SAF feasibility
9. Technical Assistance	Technical assistance is essential for SAF success. This one of main limitations for SAF expansion. The multidisciplinary implications determine that technicians have to be trained in several subjects and specialists have to be available for specific cases. All institution involved recognize that it is necessary to have more well trained technicians to attend the demand. Central office of IDAM has only one technician dedicated to environment. In Itacoatiara, there is only one technician that is involved with SAF as part of his multiple obligations.	It is essential to increase technical assistance. IDAM has to create a unit for SAF. Cooperation and coordination between institutions is essential.
10. Training	Training is a must in SAF. Since Technicians and farmers has to be trained in several topics, it is necessary to have a training program. EMBRAPA and the Escola Tecnica Federal de Manaus have training programs that could used.	Training is essential in SAF. A training program should be a part of any project
11. Research needs	The new trends in agroforestry, variety of schemes and great number of species implies a great effort in research. EMBRAPA, INPA and CEPLAC are doing a good job but need more human and economical resources to improve and extend their research.	It is necessary to provide additional resources for research. Multidisciplinary research has to be encouraged.

(c) Agroforestry Systems

Agroforestry is a variety of agriculture that incorporates trees. There are found about 14 different systems in the region. The main differences in the systems are: crop species, layout and management. The most popular systems are:

- Multi-strata
- Alley crops
- Home gardens

Multi-strata system consists of several species of trees in the same area. Various crops are planted in line with mixture. In general, this system is composed of combination of annual, legume and perennial crops. Perennial crops consist mainly of fruits and timber trees. Legume crops grow usually until shade formed by the other trees prevents their growing. In addition to green manure fertilization, this system is expected of environmental preservation. The system is promoted by INPA and EMBRAPA.

Alley and /or strip cropping is based on different layout above. Timber trees are provided with wider space. Annual and fruits crops are planted in lines. Figure 6.1.1-1 shows an example of CEPLAC's layouts. This system would subject to benefit continuously from fallen leaves of legume tree as manure, besides to contribute more easily to maage. CEPLAC and EMBRAPA promote this system.

Home gardens are quite popular; almost all farmers have their gardens around their houses. There are proposed according to their preference. Prevailing species are fruits. In home gardens, many varieties of species are identified as utilization of food, medicine and ornament. Home gardens are also utilized as farmers' research plots for evaluating new crops. This system is recommended by all institutions related.

(d) Species in SAF

As is explained in chapter 6, there are found many species in SAF. Main species are:

- Timber trees
- Perennial Fruit trees
- Perennial crops
- Annual crops
- Legume crops

Prevailing timber trees are: Brazil nut (Bertholletia excelsa), Mogno (Swietenia macrophylla), african mogno (Khaya senegalensis), teca (Tectona grandis). EMBRAPA and CEPLAC introduce such crops as Eucalyptus camaldulensis, Carapa gunianensis (angiroba) and paricá.

Perennial fruit trees are: cupuaçu (*Theobroma grandiflorum*), pupunha *(Bactris gosipaes*) açai (*Euterpe oleracea*), graviola (*Annona muricata*), cocoa (*Theobroma*

cacao), citrus (*Citrus sp.*) and guava (*Psidum guava*). Cupuaçu is prevailing and most recommendable crop in SAF.

Banana is the most common perennial crop. Cassava (manihoc) is the most prevailing annual crop. Some other crops like beans, rice and corn are not comon. In Roraima, soybean is getting popular.

Legume trees have been usually used as shade for cupuaçu and cocoa. In SAF, Ingo (*Inga edulis*) is selected commonly but lately, Gliricida (*Gliricida sepium*) is adopted for its fast growth. Acacia mangium is introduced in Roraima with good results.

(e) Complemetarity

Research shows that in SAF they act complementarity among crops. Main effects are to provide shading, nutrition, soil moisture, and tolerance against pest and diseases. The overall effect will be positive.

(f) Planning and facilities

Planning will cover:

- Site selection
- Selection of objective
- Training
- Species selection
- Nursery and seeding
- Facilities

Site selection is important due to adaptation to attitude of soils. Selection of farmers will be emphasized on farmers' organization development. Training for farmers selected is essential for introducing new technologies under SAF and individual crops. Species selection has to be made under farmers' participation. Nurseries and seeding are required to introduce reliable originals.

(g) Crop management

Crop management in SAF is required to meet its complication because it involves many species. Required management practices consist of pruning, thinning, cover crops, litter management, pest and disease control and fertilization. Farmers usually do not pay much attention to these. It is necessary to promote optimum crop management, focussing specially on use of cover crops and organic fertilization.

(h) Social aspects

SAF development is essential to broad farmers' participation in suitable of their own accord which could be formed under farmers' organizations, so organizing farmers would be pre-requisite for SAF development.

(i) Economical view

According to projects identified; Rio Branco (Acre State), RFCF (Rondonia State), Presidente Figueiredo, Rio Preto da Eva, and Manacapuru (Amazonas State), Tomé-Açu (Pará State), SAF development could produce income increase for the farmers engaged.

(j) Technical guideline

Technical guideline for farmers would be essential to SAF extension in the scheme area. Technical staffs well trained for SAF are short, so it is required to train IDAM technical staffs for planning integrated crop management and utilization of organic fertilization.

(2) Organic Fertilization

Organic fertilization is esteemed to be one of the main factors on environment friendly agriculture as summarized in Table 7.1.1-2.

In Amazonas State, use of chemical fertilizers is small. The majority Itacoatiara farmers (83%) do not use fertilizers. Organic fertilization is only used for fruit tree planting. Farmers know the importance of fertilization but can not use it owing to high price. So it is important to promote organic fertilization.

Compost is not comonly used. When used, it is made only for vegetable and fruit tree planting. The Escola Agrotecnica Federal de Manaus (EAFM) has a role of demonstrative units for Permaculture project. Programs for manure and compost utilization by farmers should be accelerated.

Training and technical guidance for farmers on use of organic fertilizers should be also promoted. EMBRAPA and Escola Tecnica Federal de Manaus offer courses in this subject.

(3) Green Manure

Recently green manure has been identified by its effect and introduced in SAF system. Many farmers, however, do not have information on green manure. Promotion of legume tree planting and subsidies for it seems to be effective for farmers to use green manure.

EMBRAPA, CEPLAC and INPA recommended legume species to be used as green manure and temporal shade. Common species are Ingo (Inga edulis), Gliricida (Gliricida sepium), desmodium (Desmodium sp.). Gliricida and Acacia Mangium produce dried compost of 6 - 7 tons/ha. Legume crops supply considerable amounts of nutrients but total its quantity will depend on soil conditions, therefore species should be selected according to local soil conditions. Legume trees contribute mainly to provide nitrogen. Research records indicate that phosphorous fertilization is necessary to improve nutrient uptake by plants.

Table 7.1.1-2 Summary of Lessons from experiences in Environmental Friendly Agriculture

Subject	Lesson learnt from experience	Result to considered in projects
Organic fertilization		
1.Fertilization use	Amazonas State use little chemical fertilizers. Most Itaciatiara farmers (83%) do not use fertilizers. Organic fertilization is only used for fruit tree planting. Farmers know the importance of fertilization but do not use it for economical reasons.	Low use of fertilizers is positive for introducing organic fertilization.
2. Animal manure	Most technical manuals recommend its but use of manure is insignificant. Since cattle production is very extensive, manure collection is difficult. It is used mainly in vegetable production	A program for concentrating cattle and grow animals in a confined manner will provide manure source
3. Compost	Compost is not frequently used. When used, it is made only for vegetable and fruit tree planting. The Escola Agrotecnica Federal de Manaus (EAFM) has demonstrative units for it Permaculture project.	A program for manure use is necessary
4. Training	EMBRAPA and Escola Tecnica Federal de Manaus offer courses. Training is needed to teach farmers how to make compost from farm residues.	Training should be included in any project
Green Manure		
1.Use	Although an old practice, farmers do not use it. It has been introduced in SAF.	Promotion and susidies are necessary to make farmers to use green manure
2. Species	EMBRAPA, CEPLAC and INPA are evaluating legume species to be used as green manure and temporal shade. Most used species are Ingo (Inga edulis), Gliricida (Gliricida sepium), desmodium (Desmodium sp.). Evaluation indicate that Gliricida and Acacia Mangium can produce from 6 to 7 tons/ha of dry matter.	Local species evaluation is necessary for proper selection.
2.1 Nutrient production of species	Legume crops offer considerable amounts of nutrients but total quantity will depend on local soil condition therefore species should be selected according to local evaluation.	Local evaluation of species
2.2 Crop management	Legume trees are mainly used to provide nitrogen. Research findings indicate that phosphorous fertilization is necessary to improve nutrient uptake by plants. Rate of pruning will affect dry matter production. This findings indicate that more research is needed to have reliable results.	Research is needed to have more reliable and realistic results.
2.3 Litter management	Research indicate that dead cover (mulch) give better results than living cover. More research is needed to determine the best way to utilize legume crops.	Litter management is a subject to be included in projects
3. Promotion and 4. Technical Assistance	Crop manuals recommend use of green manure fertilization but farmers do not use it, therefore promotion is needed to incentive its use. Technical assistance is necessary to give farmers proper recommendations	Promotion and technical assistance is very important to increase the use of green manure.
5. Training	Technicians and farmers need training in the use of green manure. EMBRAPA and EAFM have courses on the subject	A training program is necessary to be included in projects.
6. Research	Research is needed to assess the real contribution of green manure in fertilization in especial because some results are contradictory	Research in local species evaluation and green manure management is needed to assess real benefits.
Integral Farms		
1. Concept	Experience indicate that for a proper Environmental Friendly Agriculture, it is necessary to have a different approach, to return to the old way of rural living. Due to small size of farms, hand labor and landform, a more integral use of farm could be introduced.	It is convenient to explore the possibilities of using this kind of approach to provide farmers a more self-sustainable farm
2. Permaculture	Permaculture is gaining adepts lately. It promotes the use of several kind of activity in the farm: Monocultre + SAF+ poultry+ organic fertilization+ home orchar+ pisciculture + apiculture + forest. It also promotes the use of biogas, eolic and hydraulic energy, among other activities.	Multiple use of land give farmers better distribution of hand labor and rent.
3. Experience	Farmers do that partially according to their educational level. In Manacapuru and Presidente Figueiredo farmers have SAF mixed with vegetables, bees, small animal and pisciculture. The Permaculture at EAFM is a showroom for the system.	At EAFM permaculture is experimental it will be advisable to test it in a real situation.
4. Promotion and Training	There are several NGO promoting the system. EAFM offers courses on the subject.	Installation at EAFM could be used as a promotion site and training facility.
5. Research	Research results are not available yet	More research is needed

(4) Integral Farms

Environment friendly agriculture would correspond to new approaches of land use and natural resources utilization. Integral Farms are conceptualized to utilize all farm resources. The more diversified use of farm resources would enable the more integral productivity.

Recently there are found several new models of environmental friendly agriculture or organic agriculture. Most new approaches tend to utilize all farm resources having a more holistic view of natural resources (IPAB, 2001). Names like “Ecological villages”, “Permaculture”, “Organic Agriculture” tend to be synonymous of an “Integral Farm” concept that would maximize all farm output and resources.

This concept indicates more self-sufficient farm that would enable less external inputs and, at the same time optimize farm natural resources. This farm will consist of SAF, vegetables, medicinal plants, poultry, bees, aquaculture and forest. Organic fertilization will include the use of compost and green manure, residue decomposition in the field and use of earth-worms. All farm residues and wasted will be utilized in feeding animals and in compost preparation. In some cases apiculture will also be included for fruit tree pollination and honey production. This type of project also aims at using alternative energy like bio-gas.

In Brazil there are found several movements and institutions as to integral farms. In the area, the Escola Agrotecnica Federal de Manaus has a permaculture unit that does research. There are Brazilian Institute of Permaculture and several other organizations like “Instituto de Permacultura Austro Brasileiro” and “Projeto Novas Fronteiras da Cooperação Para o Desenvolvimento Sustentável”.

In Manacapuru and Presidente Figueiredo farmers have SAF mixed with vegetables, bees, small animal and pisciculture. The Permaculture at EAFM can be said to be showroom for the system.

It is convenient to explore the possibilities of using this kind of approach to provide farmers a more self-sustainable farm. Multiple use of land give farmers better distribution of hand labor and rent. Installation at EAFM could be used as a promotion site and training facility. More pilot projects, evaluation and research on the subject is necessary to assess it feasibility

(5) Extensive Aquaculture or Lake Ranching Program

As introduced in Section 6.1.1, INPA has started an experimental seed stocking program since 2000, called “Extensive aquaculture of tambaqui in varzea forest” which is one of research programs of PPG7. The objectives of this program are to verify seed stocking practice as an alternative measures to improve depressed fish

resources, and to examine the economical contribution to rural communities. This is the first trial on seed release and recapture in the Amazon area.

Following varzea lakes are now being tested as experimental sites or control sites of this program.

Name of lake	Location	Water area (ha)		
		Min	Max	Mean
1. Lago do Arianzinho	Iranduba	20	33	26.5
2. Lago do Niuba	Ilha Paciencia, Iranduba	14	19	16.5
3. Lago do Jacaretinga	Careiro	24	26	25
4. Lago do Cavalo	Ilha Eva, Careio da Varzea			26
5. Lago do Pium	Ilha Baixio, Iranduba			20

The size of tambaqui juveniles released is 4 -5 cm or after nursing about one month in earthen ponds. Those juveniles are now procured not only from IDAM Balbina Hatchery but also from several private hatcheries. Their stocking density in lakes is 900 individual/ha at the first year and 1800 individuals/ha at the second year.

Although recapture rates have not been reported yet, this kind of extensive aquaculture or lake ranching program seem to be one of effective and environmentally sound measures to improve livelihood for rural communities.

The lake ranching program can be considered as one of lake fishery management programs, which are carried out several lakes such as Largo Grande of 57,000 ha (Project IARA, Para State).

7.1.2 Guarana

(1) Low Farmer Acceptance of Existing Research Recommendations

One of the most important “lessons learned” from the study period of Fieldwork was that there is a very low level of farmer acceptance of research recommendations for guarana production. In Table 7.1.2-1, the primary technical recommendations for guarana production based on EMBRAPA research are presented in detailed fashion.

Meetings were held with IDAM officials in Maues and Urucura, and with EMBRAPA field staff in Maues to approximate the average level of acceptance of these production practices in these two important municipalities that produce guarana. In a similar fashion, extension staff of Ceplac in Bahia were also questioned about level of acceptance of these practices in Bahia. Finally, discussions were held with IDAM officials to agree on “ 5 year target levels” of acceptance which would serve as goals for the future JICA project.

It was noted that in the area of commercial seedling production, most guarana nurseries in Maues and Urucura were already characterized by a high level of adoption of EMBRAPA technical recommendations. However, in the case of field production practices, levels of adoption were judged to be considerably lower - especially in the area of cultural practices.

Table 7.1.2-1 Current and Future (Target) Acceptance Levels for EMBRAPA Technical Recommendations for Guarana Seedling Production in Amazonas State (1/4)

Production Area	Technical Recommendation From Research	% Current Acceptance for Maues & Urucura (Ave. estimate of Embrapa & IDAM)	% Current Acceptance for Bahia (Ceplac Estimate)	% Target Acceptance for Maues in 5 yr (JICA/IDAM)
SEEDLING PRODUCTION				
1. Propagation of Cuttings (Estacas)				
1.1 Construction of Rooting Nursery	Use treated wood supports; use black nylon cloth to provide 30-50% shade;	93	N/A	100
1.2 Mist Irrigation System	Use mist nozzles to provide 70-80% humidity	87	N/A	100
1.3 Preparation of Propagation Sacks	Use black polyethylene plastic sacks (33 cm x 23 cm; 0.5 mm thick) with 25 holes (5 mm) for drainage; use peat/sand mix (4:1) with top layer of sand	93	N/A	100
1.4 Sack Placement	Place between irrigation nozzles; soil should be moist before planting	28	N/A	100
2. Rooting of Cuttings				
2.1 Harvesting of Cuttings				
2.1.1 Choosing the Mother Plant	Pick cuttings from mother plants that have been monitored for 2-3 yrs for high yield, high tolerance of disease, and no nutritional problems	60	N/A	100
2.1.2 When to Harvest the Cuttings	Harvest the cuttings in the morning hours of March/May (when the branches are undergoing maximum elongation)	63	N/A	100
2.1.3 How to Choose the Cuttings	Select cuttings from areas of new growth, but do not take from the tips of branches. Make cuts 2-3 cm above the internodal buds	77	N/A	100
2.1.4 Transport of Cuttings	Always keep cuttings as moist as possible during transport.	87	N/A	100
2.2 Preparation of Hormone for Rooting	Mix 5 gr of IBA (indole 3 butyric acid) with 800 gr of industrial talc to get a concentration of 6000 ppm. Mix very well in plastic sack.	97	N/A	100
2.3 Hormonal Treatment	Dip end of cutting in IBA/talc mix immediately before planting	97	N/A	100
2.4 Planting of Cuttings	Make hole in surface of planting mix with pointed stick and plant cutting (2/3rds of cutting should protrude above the soil). Irrigate immediately	83	N/A	100
2.5 Maintenance of Cuttings	Cuttings will need a period of 45-90 days to develop roots. Mist irrigation must be used frequently to avoid dehydration. Provide 70% shade.	73	N/A	100
2.6 Transfer of Rooted Cuttings to Propagation Nursery	After cuttings have grown roots, they should be transferred to an area of the nursery with 50% shade for development into seedlings	80	N/A	100

Table 7.1.2-1 Current and Future (Target) Acceptance Levels for EMBRAPA Technical Recommendations for Guarana Seedling Production in Amazonas State (2/4)

Production Area	Technical Recommendation From Research	% Current Acceptance for Maues & Urucura (Ave. estimate of Embrapa & IDAM)	% Current Acceptance for Bahia (Ceplac Estimate)	% Target Acceptance for Maues in 5 yr (JICA/IDAM)
3. Cultural Practices in the Seedling (Mudas) Nursery				
3.1 Irrigation	Rooted seedlings in plastic sacks require normal, manual irrigation methods which prevent dehydration	87	N/A	100
3.2 Fertilization				
3.2.1 Soil Fertilization	Apply 50 ml of following solution every 60 days (0.5 kg urea + 1.0 kg STP + 0.5 kg KCl in 20 ltr of water)	60	N/A	100
3.2.2 Foliar Fertilization	Once new set of leaves is full formed, apply the following products in rotation every 15 days: urea (80 g/20 ltr), "Ouro Verde"(60 ml/20 ltr), or "Plantin II (80 gr/20 ltr)	63	N/A	100
3.3 Weed Control	Periodic manual weeding of the sacks is required	100	N/A	100
3.4 Insect Control	Control mites and thrips with methamidofos (30 ml/20 ltr)	63	N/A	100
3.5 Disease Control	Fungicide applications not advised. Any seedlings showing symptoms from anthracnose or fusarium diseases should be discarded.	27	N/A	100
3.6 Selection of Rooted Seedlings for Planting	Only those seedlings that rapidly develop two healthy, vigorous composite leaves should be selected for field planting	53	N/A	100
3.7 Transport of Rooted Seedlings to Planting Site	Any reasonable means of transport is recommended which minimizes or eliminates mechanical damage to the roots.	20	N/A	100
FIELD PRODUCTION				
1. Site Selection: Soil/Climate				
1.1 Climate	Area should have well distributed rainfall: ideal is 2500 mm/yr, minimum of 1500 mm/yr. Average monthly temperature should be 23 – 28 deg C.	67	75	75
1.2 Soil	Soils should be as deep and well drained as possible, with an incline of 5-15%	67	75	75
2. Site Selection: Soil Preparation				
2.1 Site Clearing	Best areas are those with secondary vegetation, such as capoeira. First, all brush up to 20 cm in diameter should be cut by machete. 20 days later, larger trees should be removed by axe or saw. At 30 days, all cut vegetation should be burned (best during dry season, May – Sept.). Firebreaks should be used to prevent spread to neighboring lands.	73	90	90
2.2 Site Marking/Soil Samples	Planting holes should be marked with stakes on a 5m x 5m grid to give planting density of 400 plants/ha. 20 soil samples/ha should be taken in a zig-zag pattern for lab analysis	60	75	90
2.3 Preparation and Fertilization of Planting Bed	At each planting hole, a mound of topsoil should be scraped off and set aside. Holes are dug manually to a dimension of 0.4m x 0.4m x 0.4m. The topsoil should be mixed with 160gr of STP and 10 ltr of animal manure and put back in the hole. The hole is marked with a stake and planted 30 days later.	73	80	90

Table 7.1.2-1 Current and Future (Target) Acceptance Levels for EMBRAPA Technical Recommendations for Guarana Seedling Production in Amazonas State (3/4)

Production Area	Technical Recommendation From Research	% Current Acceptance for Maues & Urucura (Ave. estimate of Embrapa & IDAM)	% Current Acceptance for Bahia (Ceplac Estimate)	% Target Acceptance for Maues in 5 yr (JICA/IDAM)
3. Planting				
3.1 Planting Period	Planting should occur at beginning of rainy season, preferably on a cloudy day. The pre-marked hole is dug out up and the seedling is planted in the hole (plastic sack is removed). The seedling and the soil/mix around it must be well compacted using the planting stick in order to avoid formation of air pockets.	57	60	90
3.2 Shade	Each seedling should be shaded immediately after planting using a covering of 3 upright palm leaves, forming a tent above the seedling. Shading can also be accomplished by planting in association with crops such as banana, maracuja, or cassava. Shading can be discontinued one year after planting.	67	75	95
4. Cultural Practices				
4.1 Basal Weeding	Prior to fertilizations, all weeds should be removed around the base of each plant to a radius of 1-1.5 m. Dead weeds should be left in place as mulch. Care must be taken not to create a depression which will retain water.	53	90	95
4.2 Weeding Between Rows	Weeds should also be removed in a continuous 1-1.5m strip between the rows using machete or herbicides. Tractor should not be used in order to avoid soil compaction. Three weeding operations per year is adequate.	75	80	95
4.3 Mulching	Dead vegetation from weeding operations should always be placed around each seedling when possible – the mulch can come within 20 cm of the plant.	23	70	95
4.4 Pruning	Should take place immediately after the harvest. All dry, dead, and diseased branches should be removed and burned. Additionally, 33% of the tips of healthy new branches should be removed to provide aeration and stimulate production of more flower buds.	35	60	70
4.5 Fertilization	During years one and two, fertilizer is applied at 3, 6, and 9 months after planting. In years 3-10, fertilizer should be applied 3 times/yr (January/March/May) at the following approximate rates (gr/plant/yr): Urea (230 gr), STP (200 gr), KCl (250 gr), MgS04 (160 gr), Borax (10 gr), ZnS04 (10 gr). During years one and two, these yearly rates are decreased by 30 – 50%.	35	75	50
4.6 Insect Control	Thrips is most important insect problem. Control as needed with Methamidofos at dose of 30 ml/ 20 ltr of water, or Malathion at 200 ml/100 ltr. Chemical control is usually most needed during May (start of dry season).	30	15	25
4.7 Disease Control	Anthracnose: Use tolerant Embrapa clones, and eliminate any susceptible seedlings from nurseries. Chemical control not available. Superbrotamento: Control of thrips will help control this disease. During pruning, all affected branches should be removed and burned. Chemical control not available. Root rot: Avoid water logging of soils. Remove all affected plants and burn. Do not re-plant in the spots previously occupied by diseased trees.	17	20	50

Table 7.1.2-1 Current and Future (Target) Acceptance Levels for EMBRAPA Technical Recommendations for Guarana Seedling Production in Amazonas State (4/4)

Production Area	Technical Recommendation From Research	% Current Acceptance for Maues & Urucura (Ave. estimate of Embrapa & IDAM)	% Current Acceptance for Bahia (Ceplac Estimate)	% Target Acceptance for Maues in 5 yr (JICA/IDAM)
5. Flowering & Fruit Development	Flower removal: In year 1, flower buds should be removed in order to encourage vegetative growth. Fruit maturity: Fruits should be harvested when reddish outer layer begins to break and seed is exposed. Seed drop to the ground must be avoided.	4	30	20
6. Harvest Techniques	Multiple harvests are required during the period of October-December since the fruits ripen unevenly. Usually 2-3 harvests per work are recommended. Manual harvests are required to ensure that only mature fruit are picked.	63	50	95
7. Seed Removal	Seed with pulp attached is fermented in burlap sacks 2-4 days after harvest. Next pulp is removed manually and seeds are washed. Pulp removal and washing can be manual or by machine.	43	30	50
8. Seed Drying	Pan Roasting: Washed seeds are dried and roasted for several hours in metal pans (cassava pans) over open fire. Roasting can also be accomplished in ovens (usually clay). Constant stirring of the seeds is required for 3-4 hours in order to achieve a uniform final moisture (5%) for processing industries. Burning of seed must be avoided. Sun Drying: Drying on cement surfaces or tarps is possible but above ground solar driers are preferable. Final moisture will be 12-13% at best – good only for semi-processing into natural products. Mechanical Drying: Wood-fired mechanical driers (used for coffee or cacau can also be used)	97 (pan roast)	95 (mechanical)	100 (pan roast)
9. Storage	Seed that has been dried to a moisture of 5% of less can be stored in burlap bags under warehouse conditions for up to 3 yrs. Seed should be allowed to cool to room temperature before placing in the sacks.	5	30	50
USE OF SUSTAINABLE AGRO-FORESTRY TECHNIQUES (SAF)*				
1. Intensive SAF Management	Virgin forest never cut – always use capoeira or 2nd forest. Guarana in association with 3 or more commercial crops of high, medium, and low height. Mulching always used. No agrochemicals used. Organic manure used. Weeding and pruning 75% effective.	3	10	40
2. Medium SAF Management	Virgin forest sometimes cut but rarely. Guarana in association with 2 or more other commercial crops. Mulching and organic manure used 50% of time. Occasional use of synthetic fertilizer. No pesticides used. Weeding and pruning practiced 50%.	10	20	20
3. Low SAF Management	Virgin forest sometimes cut but rarely. Guarana in association with 1 or more other commercial crops. Mulching and organic manure used occasionally. Pesticides used occasionally. Weeding and pruning practiced by 25%.	15	30	10
4. No SAF Management	Land clearing is 50% virgin forest, 50% capoeira. No association with other commercial crops. Occasional synthetic fertilizer used. No organic manure used. Fertilizer, pesticides and cultural practices used only when guarana price perceived to be favorable	72	40	30

Source: Interviews with guarana farmers in Amazonas and Bahia, IDAM officials, Embrapa officials, Ceplac officials, 2001
N/A: Guarana seedling production is not an organized, commercial activity in Bahia. Most farmers grow their own seedlings.
* Embrapa has not yet developed technical recommendations for SAF. These are theoretical categories of SAF management.

In the critical areas of mulching, pruning, fertilization, and use of improved clones, only 4-35% of farmers were currently following these recommendations. However, in the case of Bahia, in almost every instance, a much higher percentage of Bahia farmers were found to be employing the proper planting techniques and cultural practices. Use of disease resistant EMBRAPA clones is still very low (20%) in Bahia, but these clones are not considered vital since local materials have very acceptable yields.

It is interesting to note that the cultural practices used to maintain a productive guarana field (third year of production) are very similar both in Bahia and Amazonas. The overall costs are R$ 797 for Amazonas vs. R$ 833 for Bahia. So the higher adoption rates for technologies in Bahia are not due to cheaper costs, but due to other factors such as better farmer organization, discipline, and confidence in the techniques themselves (Table 7.1.2-2):

Table 7.1.2-2 Guarana Production Costs Based on Research Recommendations of EMBRAPA (Maues) and Ceplac (Bahia), 1999

Item	Description	Bahia Cost (R$)	Maues Cost (R$)
Total Planting (Year 1)	Labor + seedlings	1,969	2,367
Seedling Cost (Year 1)	Bahia (550 plts x 0.6R$/plt) Maues (440 plts x 2.7R$/plt)	330	1,188
Total Cultural Practices Labor (Yr 3)	Labor	409	468
Weeding Labor (3X)	Between rows + around tree base	345	396
Pruning Labor(1X)	Once after harvest	14	18
Fertilizer Application Labor	Urea + 11-30-17 + manure	36	36
Pesticide Application Labor	Insectide for thrips	14	18
Total Materials for Cultural Practices (Year 3)	Fertilizer plus pesticide	424	329
Total Cultural Practices (Yr 3)	Labor + Materials	833	797

Source: EMBRAPA/Maues and Ceplac/Itubera, 2001

While the cost of cultural practices in the third year are comparable, note that overall planting costs in the first year are much lower in Bahia due to the high cost of seedlings in Maues.

It was also noted that the use of guarana as a component in sustainable agro-forestry systems was still quite low in both Amazonas and Bahia.

(a) Reasons for Low Farmer Acceptance of Research Recommendations

i) Technologies too sophisticated

Various farmers and other contacts in the guarana community noted that the existing package of technical recommendations for guarana production needs to be simplified. Most people agreed that the recommendations of EMBRAPA work well if instructions are properly followed, but that in practice, for many guarana farmers the techniques are too difficult to remember and implement.

ii) EMBRAPA clones too expensive

The price for EMBRAPA improved clones (R$ 2.7/seedling) is perceived to be

too high by the rural guarana communities. Seedlings from native seed selections can also yield well and can be acquired at R$ 0.5 - 1.0 per piece. Improved seedlings of other fruit species (cupuacu, acerola, acai) are usually priced in the range of R$ 1.0 - 1.5 per piece, thus the general feeling is that these EMBRAPA materials are overpriced relative to other offerings in the marketplace. Many communities want to establish their own nurseries, or hope for the development of low cost suppliers as an alternative to EMBRAPA nurseries.

iii) EMBRAPA clones not yet proven

Another reality is that many farmers are simply not yet convinced that the EMBRAPA clones have greatly improved yields relative to native materials coming from simple seed selection. Not enough demonstration work has been accomplished in the rural communities, and most farmers are very skeptical of demonstrations done on EMBRAPA or Ambev research farms.

iv) Misidentification of EMBRAPA clones

Many cases were noted where farmers, communities, and even IDAM officials who had received EMBRAPA clones were not able to tell us which clones had actually been planted. There was obviously a high level of confusion about which clones were doing well in certain areas due to inability to identify the clones. Both EMBRAPA and IDAM must undertake new measures to ensure clones are properly labeled when they are delivered to the communities. Another factor is that there are many “false” suppliers of seedlings claiming that their materials are “official” EMBRAPA seedlings. These suppliers often deceive the farmers and sell them completely false material, or EMBRAPA material which has already been discarded during the evaluation process.

v) Cultural barriers

Many farmers, despite having received specialized training and even free shipments of seedlings and agrochemicals, simply choose to ignore all the advice and decide to plant guarana according to local traditions. In many areas, there is a considerable culture of fear and superstition working against the introduction of anything “new”. This is because “newness” implies risk, and risk is not easily tolerated by subsistence farmers who are often on the brink of survival.

vi) Lack of appropriate explanation (technology transfer)

Despite the best efforts of municipal programs, EMBRAPA, and IDAM, due to lack of resources and the extreme isolation of many riverine farmers, most technical recommendations are never adequately explained. The basic

problem is lack of resources for follow-up visits to explain things for a second or third time, or to evaluate techniques already in progress.

(b) EMBRAPA overemphasis on breeding instead of cultural practices

EMBRAPA efforts in the area of genetics and varietal improvement of guarana have been extremely valuable (especially in the area of disease resistance), however, there has been an historic imbalance in EMBRAPA guarana programs favoring breeding research and limiting research on more practical, agronomic solutions for the crop.

(c) Need for crop diversification

Historically, EMBRAPA, IDAM, and municipal programs have not sufficiently encouraged the concept of diversified farming for the traditional guarana producers of Maues. In the past, diversification was hot considered a high priority since market prices for guarana were high, and since alternatives to the high quality of Maues guarana were not available. With the expansion of guarana in Bahia and Mato Grosso, all this has changed and Maues farmers need to produce a mix of commercially viable crops in order to lower their exposure to the risks inherent in the guarana market. Some of the most highly recommended crops for diversification would be pupunha, castanha, cupuacu, corn, beans, papaya, acai, rice, tucuma, orange, mango, and graviola.

(d) Lack of research in guarana as a component of SAF systems

EMBRAPA has historically pursued guarana research from the point of view that economical production of the crop is more viable in monoculture as opposed to a mixed cropping environment using sustainable agroforestry (SAF) techniques. This may be the case, however, very little research and development has been done to actually prove this point. Therefore, a critical need for future research would be experiments to determine which EMBRAPA materials offer highest yields under SAF conditions. Simultaneously, research is needed to develop a set of production protocols and cultural practices specific for guarana in SAF conditions. Undoubtedly, guarana in a mixed cropping system will yield less than in a properly managed monocultural system, but studies need to be done to determine the overall economic advantages of each entire system, in terms of biomass utilization, sustainability, and reduction of risk exposure to changing market conditions.

(e) Disconnection between IDAM, EMBRAPA, Ambev, and the Mayors Office

It was noted that these four individual players which greatly affect the future of the guarana farmer in Maues, all too often act independently and often speak poorly of each other’s contributions to the guarana community. Clearly, a new effort is needed to promote transparency and cooperation between these entities. The farmers themselves, simple as they are, can sense the level of disunity in these

organizations that are supposedly designed to improve their quality of life. Sensing this disunity only breeds frustration and high levels of distrust towards any sort of technical assistance that arrives at their farms.

(2) Lessons learned concerning the competitive situation with Bahia

(a) Background on Bahia:

Due to low yields and prices in Maues, farmers are currently allowing their guarana fields to decline. At the current price of 4.6 R$/kg, many Maues farmers are choosing to reduce or eliminate basic maintenance practices (such as fertilization, weeding, pruning), waiting for an improvement in market price. As a result, the availability and quality of guarana in Maues is starting to decline. This situation is causing the buyers to have an increased interest in non-traditional guarana production areas such as Urucura (AM), Mato Grosso, and Bahia. Bahia is of particular interest to the buyers since currently the prices are very low (1.0 - 2.0 R$/kg) and the yields are still high.

Over 90% of Bahia's guarana is produced in southern Bahia. The most important municipality is Itubera which is responsible for 17% of Bahia's total production (245 T), and has the highest yields of any Bahia municipality (625 kg/ha). This high yield is in contrast to the very low yields of Maues (40-50 kg/ha).

Table 7.1.2-3 Guarana Production Data for Municipalities in Bahia (1998)

Region	# Farms	Current Productive Area (ha)	Production (T)	Yield (kg/ha)
Bahia	1706	3041	1462	480
Taperoa	620 (36)	785 (26)	310 (21)	395
Itubera	281 (17)	392 (13)	245 (17)	625
Valenca	158 (9)	492 (16)	212 (15)	431

( )= % of Bahia Total; Ceplac Annual Report 1999

(b) Lessons learned which explain the higher yields of Bahia vs. Maues

i) Lack of significant diseases and pest pressure:

Some diseases/pests are present in Itubera but due to a generally favorable climate, disease pressure always remains low. Guarana can virtually be produced without any fertilizer or pesticides, thus organic guarana production can be considered as a viable production option.

ii) Better use of agronomic techniques:

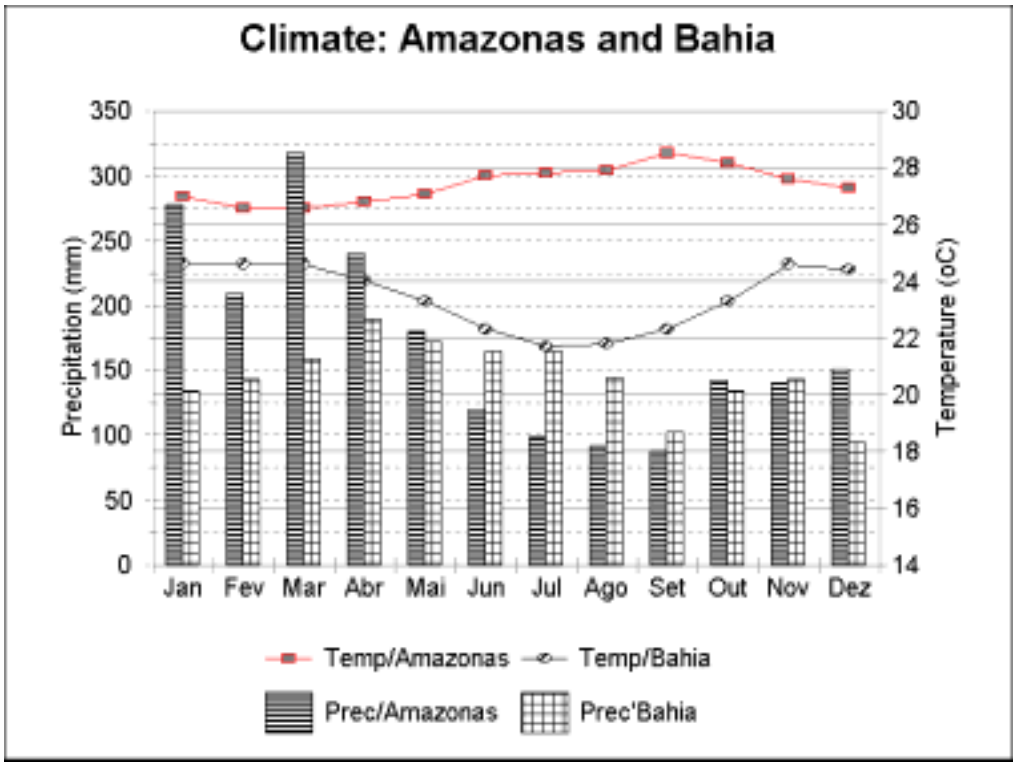
Bahia farmers are more disciplined in terms of land preparation, fertilization, weeding, pruning, and timely harvesting. There is a much higher tendency to invest in fertilizer applications as compared to Amazonas. As a result, individual trees are massive in size compared to those in Maues. The huge difference in tree size is surprising since there has been no breeding of improved clones for the Bahia region as in Maues. Most trees are the result of

random seedlings brought to Itubera from Amazonas over 15 years ago. These plants were selectively propagated in Itubera based on local farmer instinct. The soil and climate are actually so favorable in Bahia, that there is no major need for genetically improved material.

iii) Soil and climate:

As the figure below illustrates, rainfall and temperature are much more evenly distributed in Bahia vs. Amazonas. Rainfall pattern in Itubera is highly uniform (mostly between 100 and 175 mm/month the entire year) vs. the erratic patterns of Maues which can vary between 75 and 325 mm/month. Bahia rarely gets the extremely heavy tropical rainbursts that are common in Maues during the wet season (January - April). These rainbursts can interfere with flowering and reduce yields. Importantly, the Maues area has 2-3 months of near drought (July, August, September) when the rainfall average usually drops to less than 100 mm/month. Monthly rainfall averages for Itubera are always above 100 mm. These temporary drought conditions can severely limit yields. Also, average monthly temperatures are significantly lower in Itubera, especially during the critical flowering season (June - August).

Figure 7.1.2-1 Comparison of Rainfall and Temperature Data for the Principal Guarana Producing Areas in Amazonas and Bahia, 1990-1999



Source: **CEPEC (Bahia data); EMBRAPA (Amazonas data)**
Note: **Amazonas data is for Itaicoatiara, near Maues. Bahia data is for Itubera. All data are monthly averages for the period of 1990 – 1999.**

Soils are not extremely fertile in Bahia, but are deep with good structure, allowing prolific root growth. Soils in Amazonas are more shallow, often with

clay or rock hardpans that impede root penetration, and are generally less fertile than Bahia soils. Also important is that the topography of Itubera is rolling hills, instead of flat lands in Maues. Guarana yields drop considerably in poorly drained soils whereas trees planted on gently sloping hills have far fewer problems with drainage. The Bahia region is also affected by frequent sea breezes which ventilate the fields, reducing relative humidity and minimizing disease problems.

iv) Farmer resistance to change:

Bahia farmers are much more open to the idea of new farming practices and technology transfer than Amazonas farmers. They tend to follow the advice of extension agents with more discipline than farmers in Maues. Amazonas farmers are more skeptical of technological change since it represents an unknown risk, and they are already at a subsistence farming level.

v) Quality:

The quality of Bahia guarana is still considered to be inferior to that of Maues. This is mainly due to incomplete and disuniform drying techniques which adversely affect moisture levels in the grain. Bahia farmers tend to use a variety of mechanical dryers which are used for drying other crops such as pepper, clove, and cacau. Since the methods are different, each farmer obtains considerably different moisture levels, and the final lots combined by the buyers are highly variable in moisture content. The pan roasting technique used by Maues farmers is slower, but more thorough and much more consistent between farmers, resulting in homogeneous moisture levels prized by processors. Caffeine levels in Bahia guarana tend to be lower, and Bahia guarana tends to have higher levels of impurities (trash).

vi) Mixed Farming:

Bahia farmers are pursuing mixed farming in significant numbers. Planting guarana in association with banana and cassava is becoming more widely practiced. The Bahia guarana farmers traditionally farm four to six types of cash crops (e.g., cacau, clove, pepper, coconut, vanilla, graviola, cupuacu) on the same farm. This crop diversity lowers their overall risk should the market conditions for one or several crops deteriorate badly. This mixed culture environment is also very important in preventing the intense spread of disease in any one crop.

vii) Storage:

Many Bahia farmers have some on-farm storage capacity, enabling them to store some stocks of guarana up to 3 years, participating in the market when they choose. On-farm storage in Maues is very rare.

viii) Transport:

Bahia farmers are much better connected to the markets due to an excellent system of farm to market roads, and asphalted highways. Also, a high quality airport and seaport are available in nearby Ilheus. This contrasts with the difficult river transport system in Maues. In Itubera, even if farmers don't own a vehicle, it is very easy and cheap to hire rental trucks for hauling.

ix) Brokers:

Although brokers are still an obstacle to high profits for the farmers in Bahia, at least there is a tendency for brokers to actually visit the farmers and make deals with them on their property. Such practice is virtually non existent in Maues.

x) Price:

The biggest disadvantage of guarana production in Bahia (for the farmers) is the low market price. Farmers typically receive half the price which is available in Amazonas and other States. Currently, the Bahia price ranges from 1.0 – 2.0 R$/kg vs. 4.0 – 5.0 R$/kg in Maues. Although there is now a federal law stating that the minimum purchase price for guarana should be 4.3 R/kg, it is simply not enforced in Bahia. Farmers complain that their State and Municipal officials do nothing to lobby for their fair access to this federally mandated minimum price.

xi) Agro-industry:

Maues farmers have an advantage in that several large guarana processing buyers (AmBev, Coca Cola, Santa Claudia, Magistral) have beverage production facilities in the area and are always negotiating for supplies of local guarana. By contrast, most of the guarana sold in the Itubera area is sold to brokers who ship the guarana to Rio de Janeiro and Sao Paulo for further processing or export to foreign countries. Due to the associated transport costs, the brokers cannot offer a premium price. Medium-size processing industries for powder and energy drinks (such as Guaran'apis Co.) are starting to become established in the Itubera area and will probably expand due to the very low selling price of guarana vs. Maues. Additionally, farmers usually prefer to sell directly to local processing facilities as opposed to independent brokers.

(c) Lessons learned from Bahia concerning the future of Maues guarana farmers:

i) Low yields may lead to environmental damage:

Even with a 100% distribution of the new improved EMBRAPA varieties, it will be many years before Maues farmers obtain the average yields of Bahia. This is largely due to the significantly different climate conditions which favor Bahia. There is a great danger that unless improved technologies are soon

adopted by Maues farmers, they will have to clear cut more areas of forest in order to compete with the productivity of Bahia.

ii) Transfer of Bahia guarana to Amazonas:

Due to the significantly lower prices of Bahia, it is very likely that processors of guarana in Amazonas are secretly buying large quantities of Bahia guarana and mixing it with Maues guarana. During the Progress Report III phase, several guarana traders (some from Bahia) felt that a minimum of 100T of guarana seed from Bahia had been sold to various parties in Maues, both in 1999 and 2000. This was confirmed through talking to guarana traders in Maues.

iii) Transfer of processing capacity to Bahia:

There is also the distinct possibility that in the future, processing companies might transfer to the Bahia area to take advantage of the lower prices and improved infrastructure. The principal reason why they don't act upon this now is that they still prefer the higher quality of Maues guarana, and they also enjoy the public recognition that their products are produced from raw materials of Amazonian origin. This current preference for the Maues guarana could change very quickly if and when the Bahia farmers learn how to improve their post harvest quality. In order to stay competitive, Maues farmers must learn to significantly improve their yields, which is a far more difficult task.

7.1.3 Vegetable

(1) Abuse of Agro-chemicals

There is extensive use of pesticides in the study area, necessitated by the high incidence of pests and diseases. There is a high degree of agro-chemical mismanagement which results in serious problems, for the producer's and consumer's health. The stability of the ecosystem is also upset, which further aggravates the problems with pests and diseases. Phosdrin, the fungicide Manzate and most of the pesticides, are highly toxic (Mevinphos, Parathion methyl, Metamidophos and Diclorvós) and risky to use, mainly in the absence of specialized technical assistance.

Investigations which back up these information was performed by the Amazon Federal University.

Table 7.1.3-1 shows the used agro-chemicals, two of them are boarded as the toxicity, at the class of extremelly toxicants (class I), presenting a percentual of utilization relativelly high. The agrotoxicant Decis, is the one that presents high participation of utilization (50%), followed by Dithane with 30% of participation.

Table 7.1.3-1 Agro-chemical Types with the respective toxic level and % use for the farmers in Iranduba.

Agr-chemical	Toxicological Class	% of Use
Agrimicina	I	5
Decis	III	50
Dithane	III	30
Folidol	I	10
Funguran	IV	10
Malatol	III	15
Manzate	IV	10
Cupravit Azul	IV	20
Tamaron	II	20

Toxicological class of agrochemical (Compêndio de Defensivos Agrícolas, 1987)
I : Extremely toxicant (red)
II : Highly toxicant (yellow)
III: Middling toxicant (blue)
IV: Little toxicant (green)
Source: The usage of Agrotoxics by Farmers in

However, these chemicals are almost always bought without adequate guidance on their use. The questionnaire survey and field observations done by JICA study team shows that there is little or no orientation on the use of pesticides, and the farmers take very few precautions. The information provided by the extension service on the cultivation techniques, application equipment, and proper application equipment are all rudimentary.

According to the university report, 60% of farmers never use the protection equipment when they apply and prepare agro-chemicals and the rest (40%) that affirmed the utilization of a kind of equipment. Generally, farmer uses handkerchief instead of a mask and dress the same cloth after agro-chemical supply. There is no attention for other important factors such as direction and strength of a wind, surrounding people, etc.

The report is further described about the influence of the human body on agro-chemicals. According to the report, 60% of farmers feel some symptoms of the diseases after the utilization and/or application of agro-chemicals, 30% answered not feel the symptoms and the rest did not know how to describe. The symptoms complained by farmers are as follows: headache, heavy tongue, weakness, dizziness, nausea, body hard and shivering-fit, are more frequent the headache, heavy tongue and weakness.

These actual conditions proves that extension services are urgently and promptly needed by all the farmers. However, the visits provided by IDAM are very infrequent. IDAM realizes its own limitations and is very concerned about the long term effects of pesticides on the Iranduba environments. It is essential that The extension of the basic knowledge about agro-chemicals and its usage is taken in as one of the important components of development plan.

(2) The Necessity for Soil Survey

The reason solimoies river floodplains are more intensively used is the natural fertility of soils and availability of water. Generally, soils in the varzea are relatively rich in nutrients, being used preferably for vegetables and other annual crops. Except certain special cases, their agricultural uses do not cause problems for soil porosity, because seeming the flooding reserves soil compression resulting from agricultural uses.

Table 7.1.3-2 Chemical Parameters of Cultivated Floodplain Soils in Different Varzea Regions of the Central Amazon River

		Parana dos Ramos1	Manacapuru1	Manaquiri	**6 Varsea municipalities1			Careiro da Varzea2			Ilha Marchantaria2		
		n=11	n=10	n=16	n=49			n=25			n=11		
	unit	mean	mean	mean	mean	min	max	mean	min	max	mean	min	max
Ph(H2O)		4.6	5.3	4.7	5.0	3.9	6.6	5.9	5.0	6.5	5.3	4.6	6.3
Ca++	meq/100g	3.5	10.1	9.8	7.9	2.2	14.0	5.9	4.5	6.6	9.6	7.0	11.8
Mg++	meq/100g	2.1	2.9	2.5	1.7	0.2	4.5	2.8	1.8	4.0	2.6	2.0	3.3
Al+++	meq/100g	2.8	0.5	2.5	1.8	0.0	8.4	0.1	0.0	0.6	0.3	0.0	0.9
K	ppm	121	116	96	121	23	308	99	52	165	119	65	154
P	ppm	21	126	42	65	3	650	105	59	148	117	61	200

1.Correa (1984), 2. Olveira (1995); original data from plots cultivated with annual crops only.
*** Parana dos Ramos is situated in the Barreirinha municipality. ** Barreirinha, Careiro, Manacapuru, Manaquiri, Parintins, Urucara**

The above table shows the chemical characteristics of varzea soils in and around the study area. The table shows all value vary within a wide range. Organic matter generally very low and nitrogen contents are definitely limiting yields. Farmers are aware of this constraint and occasionally apply urea, a relatively cheap and readily available source of nitrogen.

Sedimentation during flooding adds the needed plant nutrients to the soil (Furch 1997). This natural fertilization is the prerequisite for floodplain farming. The regular renewal of the natural fertility level of floodplain is the important factor for the sustainable production. However, contrary to supposition, the flood did not always provide increases in soil fertility. It was observed that in some areas, the soils presented less fertility after the flood than soon after its agricultural uses, before the waters rose (Oliveira et al. 1995).

These research results shows that the chemical characteristics of the soils in varsea vary and that the mechanism of the contribution to soil fertility by a flood is not clear. More studies are necessary to verify in which situations this addition of nutrients is not caused by the flood, to understand better the enrichment dynamics, modification, and formation of the soils from the study areas. It is indispensable to investigate the chemical characteristics of soil in order to formulate the suitable soil fertility management.

In this plan, basic soil survey which covers the all community in the study area should be carried out in the early stage of implementation in order to grasp the feature of varsea soils. And soil investigation needs to be carried out continuously in order to examine the influence of agriculture and a flood.

(3) Rural Extension Conducted by EMATER-DF (Brasilia)

Emater is the equivalent of IDAM for the area known as the Federal District (or DF). Emater provides technical asistance and rural extension services to many kinds of farmers and small agroindustries. They are especially known for their expertise in the area of supporting vegetable farmers and small vegetable processing industries. Emater is an excellent example highly motivated and efficient rural extension service for farmers. A rural extension service is essential part of the research and development system for agriculture. Emater already established excellent relationship with EMBRAPA (EMBRAPA National Vegetable Center and EMBRAPA National Center for Genetic Resources). In many ways it could serve as a model upon which to base new institutional changes at IDAM. It is extension agents are well respected by the farmers, and they are trained in socisl service areas as well as technical areas. Emater is highly computerized in terms of storage of data and training programs. The computers in a headquarter are connected each other with LAN and the computers in a branch offices can also be connected to the Internet. Furthermore, Emater starts an original homepage, sends the information about agricultural statistics, agricultural technology, and agricultural economics etc., and provides for a user gratuitously.

<u>The Mission of Emater-DF</u>

Main goal: Technology transfer and education of farmers, rural workers, their families and organizations, concerning all technical and managerial aspects of agriculture, with a goal to increase employment, income, and rural sustainability.

Economic goals: investments in the rural economy should increase income

Social goals: improve the welfare of rural families, improve access to social benefits, equal distribution of income between various production systems

Environmental goals: environment should be preserved and provided a sustainable future

<u>Emater/DF Structure:</u>

- Emater is a national institute which has its strongest traditions in the DF, Minas Gerais, and Rio Grande Sul
- Technology transfer and rural extension is only part of the Emater/DF mission – they are also very concerned about teaching MANAGEMENT techniques for small farmers and agroindustries.
- They expressed a need for more staff knowledge in the area of cooperative formation and farmers associations. Farmers must be better organized to receive the many services of Emater in a more efficient manner
- Emater-DF has 16 local offices, two of which are located within EMBRAPA facilities. It has a staff of over 147 rural extension specialists of which more

100 have the advanced degree of Agricultural Engineer (or its equivalent).

- Major partners are EMBRAPA, Sebrae, Senar, Univ. of Brasilia, Sec. Of Health, Pronaf
- Social services role very important – all rural agriculture technicians must work in an area of social service in addition to their work in agricultural production

The integrated computer system of Emater can be transferred to IDAM, and should be realized in the early stages of the project.

Emater is can be an excellent source of technical information for IDAM, especially in the area of vegetable production and processing.

1. Organic agriculture:
2. Plasticulture:
3. Minimal processing
4. Small agribusiness development

In addition to technical extension, Emater already practices extension services which put emphasis on an agro-business (including marketing activity) and enhancement of farmers organization.

Emater staff is willing to work on consultancy basis in Amazon area for project design and development, or for use in technical training with farmers of IDAM staff. The integrated computer system of Emater can be transfered to IDAM, and should be realized in the early stages of the project.

Emater are performing agricultural extension activity which bears closely on the needs of farmers in cooperation with EMBRAPA. Although the huge difference of the area of both areas cannot be denied、it is thought that the activity of Enater-DF shows the figure which should have the future of IDAM.

(4) Plasticulture in Iranduba

The local vegetable expanded the market share against the import vegetable. From the economical point of view, cultivation of the green pepper in the plastic culture in Iranduba is mentioned as a remarkable example. The production of the green pepper of Iranduba in 2000 reached about 650t, and it has reached ten percent of the amount of presumed imported amount of a green pepper. This example gives suggestion that the introduce of new technologies and new vegetable varieties will make it possible to get share of imported vegetables in case of other vegetables.

The following table shows the present condition of the plastic house under cultivation. According to the information from IDAM Iranduba Local Unit, the 530 plastic houses of about 21.2ha have become under cultivation or construction now. The municipality plan shows that 1,000 plastic houses including existing ones will be established within this year.

Crops	Sweet Papper	Couve	Cucumber	Lettuce	Pasery	Cabbage	Melon	Tomato	Total
Area (sq.m)	143,980	600	1,600	800	2,900	400	800	400	151,480
%	95.0	0.4	1.1	0.5	1.9	0.3	0.5	0.3	100

The above table shows that 95% of cultivation area formed with the green pepper. It is considered the reason why the cultivation area of sweet pepper is quite large is the high market price of sweet pepper. However, when distribution of a market risk, avoidance of a injury by continuous cropping, etc. are taken into consideration, it is thought that a crop rotation system and crop diversification should be introduced. It is reported that a certain amount of cheap green pepper is actually imported to Manaus from other states, and the farmers who cultivate sweet pepper in plastic house was damaged.

The following teachings were obtained from this example.

Positive aspects:

Local vegetables can take share from import vegetable through introduce of new technologies and varieties.

The project were implemented by IDAM in cooperation with Emater-DF, EMBRAPA-Brasiria

Negative aspects:

The cultivation plan with consideration to the trend of a market has not accomplished.

The effort for giving price-competition power like a cost reduction is insufficient.

The rate of the farmers with little experience of vegetable cultivation is high. (There was no sufficient level of education and training before start cultivation.)

Extension activity did not catch up with the rapid increase of plastic culture cultivation. From the viewpoint of farmhouse management, farmers must understand the law of supply and demand that if the amount of supply increases, price should fall. The stability of the price based on the stable supply is the course which both a producer and a consumer should choose. It should realize by formulating the cultivation plan in alignment with this course.

Moreover, the feature of the Iranduba vegetable cultivation aimed at in this plan practices low input type vegetable production which considered the environment which was adapted for the ecology of varsea, and is to realize production of a safe vegetable at low price.Without being opposed to the farmer of varsea, and the farmer of the terra-firme, each farmer should make the best use of their feature in cooperate with each other.

(5) The Example of a Japanese Vegetable Farmers

The immigration to Manaus started from the establishment of the Free Trade Zone. Immigrants mainly came from central and south Brazil. They brought cultures which different from Amazon's one, and the consumption of vegetables was one of them. The demand of vegetables during initial stage of immigration was covered by import vegetables. Japanese immigrants started vegetable production since middle of 1970's. Japanese farmer was a Pioneers of vegetable production in Manaus. Most of Japanese farmers who cultivated now perform poultry farming. Although, there are a few Japanese farmers who cultivate vegetables adopting advanced techniques and ideas. The vegetables which they cultivate are quality and is highly esteemed from the market. There are many points which should be learned from the way and methodology of their vegetable cultivation. The main points for some item is described below.

(a) Soil Treatment

The Japanese farmers has a land in the Terra-firme. The soil in terra-fire is unfertile and farmers give priority to improvement of soil fertility and texture. They began poultry farming, in order to secure organic manure. For improvement of the soil, chemistry manure was made moderate and applied lime and phosphoric acid.

(b) Introduction of new technology

They have always tried introduction of new technology. They study new technologies and get new information through agricultural magazine or text books. Moreover, they attend training course and visit some advanced farmers in order to master the new technology. Sometime, they visit a university and a research organization personally aiming acquisition of knowledge and technology.

(c) Development of a new market (Introduce of New Varieties)

They always are making effort to develop new market. The introduce of new varieties is one of the activities. Useful information, such as the promising variety of a vegetable, is also collected paying attention to the market condition of big cities, such as Sao Paulo which is the advanced consumer place of a vegetable. They get the seeds of the vegetable regarded as promising, cultivate on trial personally, and sell to the market on trial.

(d) Farm management with consideration to production cost

Always taking cost and benefit into consideration, they select varieties of vegetables and formulate the cultivation plan. The stable price and the stable amount of products are their basic selling strategy, and the system intentionally delivered to the specific contractor including a supermarket is adopted. A profit is secured by this system and waste of products (unsold products) can be prevented as much as possible.

(e) Hydroponics

As the technology which does not pollute soil, hydroponics technology is introduced by them. Spread of hydroponics cultivation as environmentally friendly technique is expected in respect of high usage rate of fertilizer and easy plant management, etc.

(f) The careful cautions in the case of agricultural-chemicals use

They think that use of agro-chemicals is not desirable both for a consumer and for a farmer. They pay careful attention when they apply agro-chemicals, and they are trying to reduce dosage amount of agro-chamicals.

7.1.4 Tropical Fruits

Revision of research and publications on tropical fruits, field visit and conversation with technicians permitted to have a more detailed view of tropical fruit production situation. Findings are summarized for each crop and are presented in Table 7.1.4-1 which contain:

- Crop varieties
- Production
- Pest and diseases
- Crop management
- Fertilization
- Crop use in SAF
- Technical assistance and training
- Market

(1) Cupuaçu

(a) Varieties

Cupuaçu trees have a great variability in terms of productivity and fruit characteristics. EMBRAPA is working on the selection of clones to obtain more homogeneity, increase production and control diseases. Clone evaluation indicate a great variety in production. Variation occurs on a clone basis and at individual basis. Per plant fruit production could vary from a few fruits to more than one hundred. Variation with precipitation is also important. Research has to continue to evaluate clones properties related to production, flowering and disease resistance

(b) Production

Flowering occurs on the dry months responding to moisture stress. Fruit/flower ratio in cupuaçu is very low. Only 2 percent of flowers transforms in fruits. The use of artificial pollination and insects to improve this ratio indicate that it is feasible. Cupuaçu production depends on the quality of seedling, crop management and climatic conditions. Precipitation is the main factor in harvest time and distribution.

Table 7.1.4-1 Lessons Learnt from Tropical Fruits Production Experience (1/2)

Subject	Lessons from the Experience	Conclusions/ Recommendations
Cupuaçu		
1. Varieties and clones	Cupuaçu trees have a great variability in terms of productivity and fruit characteristics. EMBRAPA is working on the selection of clones to obtain more homogeneity, increase production and control diseases.	Research has to be continued to select and multiply best productive and homogeneous clones
2. Evaluation of clones	Clone evaluation indicate a great variety in production. Variation occurs on a clone basis and at individual basis. Per plant fruit production could vary from a few fruits to more than one hundred. Variation with precipitation is also important	Research has to continue to evaluate clones properties related to production, flowering and disease resistance
3. Flowering and tree production	Flowering occurs on the dry months responding to moisture stress. Fruit/flower ratio in cupuaçu is very low. Only 2 percent of flowers transforms in fruits. The use of artificial pollination and insects to improve this ratio indicate that it is feasible.	Research has to be made to improve findings on pollination and flowering timing.
4. Production	Cupuaçu production depends on the quality of seedling, crop management and climatic conditions. Precipitation is the main factor in harvest time and distribution.	Research has to be continued to evaluate the use of clones with different flowering habits and more homogeneous production
5. Pest and Diseases	Witches broom disease is the most important disease and its control s mainly mechanical. Farmers do not control the disease for economical reasons.	Promotion and/or incentives should be available to have farmers to control witches broom disease
6. Crop Management	Research indicate that crop management is important. Farmers do little crop management. More advanced farmers like in Tomé-Açu, do some crop management.	Crowning, pruning and organic fertilization must be encouraged
7. Fertilization	Although Cupuaçu is one of the crops that less nutrients require (Table 4.1.3-x), NPK needs are around 46.3 Kg/ha/yr. This means that in one year of full production, all soil NPK will be used. Souza et.al (1999) recommend higher rates of fertilization.	More research has to be made to asses real need of crop. Organic fertilization must be promoted.
8. Shade	Experience has shown that cupuaçu does better with a 50% shade. In Tomé-Açu, farmers do thinning to control shade.	Shade trees must permit thinning to control shade
9. Cupuaçu in SAF	Cupuaçu is the most used fruit crop in SAF.	Cupuaçu is already the most used fuit tree
10. Technical Assistance	IDAM does not have enough capability to attend farmers in the area. This is causing that some other institutions have to replace IDAM in that matter.	A more effective technical assistance is necessary. IDAM has to incorporate more technicians and improve logistics.
11. Training	EMBRAPA has the capability to train technicians	Most important training needs are related to disease control and crop management
12. Market	Local experience indicates that market prices is a problem for cupuaçu production. At peak season, prices drop to a less than half of non-harvest month values. Main problem lays in processing and storage. If farmers could solve these problems, prices will be stabilized. Regarding offer and demand, it is necessary to make a detailed study of the situation because almost all amazon regions and some Northeastern States are planting cupuaçu, mainly in SAF systems.	Processing and storage is important to stabilize prices. Use of clones with different flowering periods will also help in stabilizing offer and therefore prices.
Banana		
1. Varieties and hybrids	Due to Black Sigatoka disease, EMBRAPA is recommending the new “Caipira” , Zulu and FHIA18. This are the only varieties available. IDAM and EMBRAPA are distributing seedlings to farmers.	Sigatoka resistant varieties seedling production and distribution is very important to increment banana production
2. Evaluation of varieties	EMBRAPA research on banana is recent. EMBRAPA is working mainly in Sigatoka resistant varieties	Research has to continue to evaluate varieties
3. Production	No local research data is available. Production vary according to variety and environmental factors. Production with good management should be around 30 tons/ha/yr	Local research is important
4. Pest and Diseases	Sigatoka negra and amarela are the most important diseases. Chemical control is not done in the area. Resistant varieties are being introduced. Banana under some shade resist better to Sigatoka.	Promotion and/or incentives should be available to have farmers to use new varieties
5. Crop Management	There is no local research. Farmers do minimum management due to economical reasons. Research and expedience indicate that banana trees respond very well to cultural practices	Crop management has to emphasized among farmers
6. Fertilization	Research indicate that banana exports around 525 Kg/ha/ayr of NPK. Most important nutrient is potassium, followed by nitrogen. Phosphorous is important because it is very low in amazon soils. Litter is the most important source of organic fertilization	More research has to be made to assess real need of crop. Organic fertilization must be promoted.

Table 7.1.4-1 Lessons Learnt from Tropical Fruits Production Experience (2/2)

Subject	Lessons from the Experience	Conclusions/ Recommendations
7. Shade	Bananas production is affected by shade, although some shade improves resistance to Sigatoka. EMBRAPA has a research undergoing	Need research
8. Banana in SAF	Banana is the most important semi-permanent crop in SAF.	Banana is already the most used fruit tree in SAF
9. Technical Assistance	IDAM provides technical assistance, but there is only one technician at central level to cover the State. EMBRAPA is conducting technical assistance mainly in disease control by promoting new varieties.	A more effective technical assistance is necessary. IDAM has to incorporate more technicians and improve logistics.
10. Training	IDAM usually give training to farmers but lack of personnel limit the expansion of the activity.	Most important training needs are related to crop management
11 Market	Due to problems with diseases planted area is not increasing. Since banana produces year around no big price fluctuation exist.	
12 Research needs	EMBRAPA local research has just started.	Continue research on disease control. Research on organic fertilization and crop management
Açai		
1. Varieties	Açai is in the phase of domestication and therefore no varieties are identified. Adaptation to Terra Firme has to be investigated.	Research is need to better know this crop
2. Evaluation of varieties	EMBRAPA and CEPLAC are doing some evaluation of açai in SAF	Need more research
4. Production	No research in the area	Need research
5. Pest and Diseases	No research in the area.	Need research
6. Crop Management	Açai is new in Terra Firme soils, mainly in SAF systems. Crop management is part of SAF and includes only thinning and litter management.	Need research
7. Fertilization	Little information. Research only indicates nutrients in leaves.	Need research
8. Shade	No research on the subject. Açai is usually part of SAF and therefore shade will affect its growth.	Need research
9. Açai in SAF	Açai is being used as main component of SAF to accompany cupuaçu for a better income distribution.	Recommended in SAF
10. Technical Assistance	Açai is new as a crop. Although farmers know açai, technical assistance is necessary	A more effective technical assistance is necessary. IDAM has to incorporate more technicians and improve logistics.
11. Training	Since it is a new crop in the area, training is necessary.	Most important training needs are related to crop management
12 Research needs		Research is necessary to know better its behavior in Terra Firme SAF's
Maracujá		
1. Varieties	No local experiences	Need research on varieties for use in SAF
2. Evaluation of varieties	Local experience are related to maracujá in SAF	Need more research for use in Terrra Firme soils
3. Production	No local research	Research on Production in SAF. Pollination research
4. Pest and Diseases	No local research. No major problem	Research for IPM
5. Crop Management	Some experience in SAF. EMBRAPA and CEPLAC are studying it in SAF. More research is needed	Research and technical assistance in SAF
6. Fertilization	No research in area. Has medium nutrient requierement with 150 Kg/ha/yr of NPK for a 20 t/ha production. Main nutrient is potassium.	Research for fertilizer use in SAF
7. Shade	No research information. In SAF it last only 3 years, after that shade affect production.	Need research
8. Maracuja in SAF	Maracujá is used in SAF, mainly in alley crops. CEPLAC and EMBRAPA use it as a semi-permanent crop.	Need more research
9. Technical Assistance	IDAM provides some technical assistance. TA is needed for SAF use	Improve IDAM capabilities
10. Training	Too little area. Will be necessary for SAF	Training for use in SAF
11 Research needs	SAF behavior, pollination and crop management	Maracujá in SAF, fertilization and pollination.

(c) Pest and disease control

Witches broom disease is the most important disease and its control s mainly mechanical. Farmers do not control the disease for economical reasons. Promotion and/or incentives should be available to have farmers to control witches broom disease.

(d) Crop management and fertilization

Research indicates that crop management is important. Farmers do little crop management. More advanced farmers like in Tomé-Açu, do some crop management. Crowning, prunning and organic fertilization must be encouraged Although Cupuaçu is one of the crops that less nutrients require, NPK needs are around 46.3 Kg/ha/yr. This means that in one year of full production, all soil NPK will be used. Souza et.al (1999) recommend higher rates of fertilization. More research has to be made to assess real need of crop. Organic fertilization must be promoted. Litter could be used to prepare compost.

(e) Cupuaçu in SAF

Cupuaçu is the most important permanent fruit crop in SAF. It needs shade at early stages of growth. Experience has shown that cupuaçu does better with a 50% shade. In Tomé-Açu, farmers do thinning to control shade. Research and experience indicate that cupuaçu does well in mixed and alley cropping. All institutions involved in SAF use cupuaçu as the main fruit crop.

(f) Technical assistance and training

The importance of this crop requiere more technical assistance. IDAM does not have enough capability to attend farmers in the area. This is causing that some other institutions have to replace IDAM in that matter. A more effective technical assistance is necessary. IDAM has to incorporate more technicians and improve logistics. More important training needs are crop management and disease control.

(g) Market

Local experience indicates that market price is a problem for cupuaçu production. At peak season, prices drop to a less than half of non-harvest month values. Main problem lays in processing and storage. If farmers could solve these problems, prices will be stabilized. Regarding offer and demand, it is necessary to make a detailed study of the situation because almost all amazon regions and some Northeastern States are planting cupuaçu, mainly in SAF systems. This could result in a saturation of market if some measures like promotion and international export are not provided. Processing and storage is important to stabilize prices. Use of clones with different flowering periods will also help in stabilizing offer and therefore prices.

(h) Research needs

More research is needed to improve productivity and to produce clones with different flowering habits (early, medium, late) to better distribute harvest. Crop management, pollination and organic fertilization are other important research subjects.

(2) Banana

(a) Varieties

Due to Black Sigatoka disease, EMBRAPA is recommending the new “Caipira”, Zulu and FHIA18 varieties. These are the only varieties available in the area. IDAM and EMBRAPA are distributing seedlings to farmers. Sigatoka resistant varieties seedling production and distribution is very important to increment banana. Evaluation of new varieties is necessary, especially public acceptance and potential productivity.

(b) Production

No local research data is available. Production varies according to variety and environmental factors. Production with good management should be around 20 tons/ha/yr. Caipira has lower yields than FHIA-18. Experience indicates that about 50% of productivity reduction will happen due to Sigatoka disease.

(c) Pest and disease control

Sigatoka negra and amarela are the most important diseases. Production is reduced in the first year, after that it will uneconomical. Chemical control is not done in the area. Resistant varieties are being introduced. Banana under some shade resists better to Sigatoka. Biological control has proven to be feasible in other countries. Promotion and/or incentives should be available to have farmers to use new varieties. Research is needed to use integrated pest management.

(d) Crop management and fertilization

There is no local research. Farmers do minimum management due to economical reasons. Research and expedience indicate that banana trees respond very well to cultural practices. Research indicate that banana exports around 525 Kg/ha/ayr of NPK. Most important nutrient is potassium, followed by nitrogen. Phosphorous is important because it is very low in amazon soils. Litter is the most important source of organic fertilization, therefore proper management is needed. More research has to be made to assess real need of crop. Organic fertilization must be promoted.

(e) Banana in SAF

Banana is the most important semi-permanent crop in SAF. It is used as temporal shade for fruit and timber trees. After trees have grown, banana production is affected by shade. Some shade improves resistance to Sigatoka. EMBRAPA has a research undergoing.

(f) Technical Assistance, training and research needs

IDAM provides technical assistance, but there is only one technician at central level to cover the State. EMBRAPA is conducting technical assistance mainly in disease control by promoting new varieties. A more effective technical assistance is necessary. IDAM has to incorporate more technicians and improve logistics. IDAM usually give training to farmers but lack of personnel limit the expansion of the activity. Most important training needs are related to crop management and use of new varieties. It is necessary to continue research on disease control, organic fertilization and crop management.

(3) Açai

Açai is a crop in phase of domestication. Until now it is considered as an extractive crop. Very little research has been done. Its inclusion in SAF will help to have more information on the crop. No big problems have been found in açai production. Its use in Terra Firme lands will imply to do research on crop behavior.

(4) Maracujá

Although an important crop in amazon, there is little local research. Research from other location provides information on several aspects of crop management.

(a) Production

Production in Itacoatiara is very little as comapared with other crops. Maracujá has been a varzea crop for sometime but risks involving floods and market prices does not permit any significant production increase. Production is moving to Terra Firme where there is little experience for its management. Farmers in Tomé-Açu indicate that low price in Pará as discouraging farmers who say that it pays because production costs are shared with peper, when in mixed cropping. Field observation and conversation with technicians indicate that productivity in Itacoatiara is low.

(b) Use in SAF

Maracujá is being used in some SAF systems. Its great light requirement does not permit its use for more than 3 years. CEPLAC and EMBRAPA include maracujá as a semi-permanent crop. IDAM provides technical assistance.

7.1.5 Cultured Fish

(1) Dynamism of Aquaculture Development in Brazil

Aquaculture in Brazil is an emerging new industry. Its production has increased from 23,390 ton in 1991 to 115,398 tons in 1998 with an average annual growth rate of 26% (Ostrenky et al., 2000) and expected to be 500,000 tons in the next decade (Valle and Proenca, 2000). This means that the country will be a position amongst

top-ten aquaculture countries in the world. The potential aquaculture production may be equivalent to that of China, which is producing 24 million tons or 67% of world aquaculture production, although policy of aquaculture development might be different (Prof. N. Castagnolli, Aquaculture Center, Universidade Estadmeal Paulista, personal communication).

At present geographical center of aquaculture is the South Region namely the three States, Parana, Santa Catarina and Rio Grande Do Sul, producing 49% of the country (Annex 7.1.5-1). Their production system is characterized by small-scale operators (<0.5ha) who culture exogenous tilapia, carp and trout.

On the other hand, it is an urgent issue how to develop huge potential area in the North and Middle West Regions for aquaculture considering environmental management aspect.

(2) Evolution of Large-scale Pioneer Fish Farmers

(a) Project Pacu and its group companies

Project Pacu

Project Pacu was established in 1987 by Mr. Jaime Andre Brum, a livestock producer, in Campo Grande, the State of Mato Grosso Do Sur (Middle West Region). He started experimental culture of pacu, then invested to development of seed production technology of viable species. As a result, the company has achieved breakthrough about commercial-scale seed production of surubim, matrincha and so forth. Particularly for surubim (Annex 7.1.5-2 Photo F-1), it enjoys nearly 100% marketing share of hatchery-rise fry now in Brazil.

The seed production business of Project Pacu was aiming for provision of fish fry to leisure fishing ponds (pesque e pague) being developed around the Southeast Region including Sao Paulo. Parts of surubim fry are exported as ornamental fish. On the other hand in recent years, the demands of fish fry has been shifting gradually to grow-out culture in ponds.

Agropeixe LTDA

Project Pacu established a commercial-scale aquaculture company, namely Agropeixe LTDA in Itaporao, Mato Grosso Do Sur, as a joint venture with relevant business companies including a feed production company, Nutron LTDA, in 1996. Agropexie is now developing basic aquaculture infrastructure such as earthen ponds and canal system, a total of about 100 ha, adopting the technologies developed for American catfish in USA (Annex 7.1.5-2 Photo F-2). Its basic strategy is to share the investment required and benefit to be liquidated with contracted landowners. Agropexie as a aquaculture developer offers all the necessary technical services about construction and farm management, and marketing of products. The company plans to develop a total of 300 ha ponds in this locality with target production of 2,000 tons a year.

Financial viability of surubim culture calculated from its own pilot farm of 3 ha is shown in Annex 7.1.5-3. This type of aquaculture development, however, should be difficult to apply for small-scale operators in Amazonas State because of lower marketing price of surubim and higher construction cost of facility in Amazonas State in addition to lacking of farm management technology.

Amazonas Ecopexie LTDA

Other outstanding investment of this company group is development of large-scale pirarucu farm in the Amazonas State. In 1998, Amazonas Ecopexie LTDA was established as joint venture of Agropexie LTDA and local investors such as a frigorifico, Sta. Maria LTDA in Manacapuru. The total investment for Amazonas Ecopexie was planned to be US$2.5 million of which US$1.0 million was to be procured from SUDAM.

As a preparatory operation, it constructed a special vessel deployed with hatchery and laboratory (Annex 7.1.5-2 Photo F-3 and –4) aiming at experimental seed production of pirarucu. Taking wild-spawned eggs in Fonte Boa (upstream of Rio Solimoes), it has succeeded rearing of larvae and juveniles, and then carried out grow-out culture in metal net cages imported from Chili in Iranduba in 2000. However, probably due to nutritional insufficiency of feed given, health condition of fish got worse and they were transported to a large-scale harragem in Manacapuru for grow-out by feeding on residue or by-product from Sta. Maria LTDA.

Anyway, it was confirmed that juvenile pirarucu of 15 cm size grow up to the market size of 20 kg in 18-24 months. Amazonas Ecopexie has shipped pirarucu meat experimentally through Sta. Maria not only for domestic market but also for European market, and confirmed strong demand for this species.

As a relevant investment of this project, fish meal production plant with a capacity of 10 ton/day has already constructed inside Sta. Maria. Feed production plant is also planed to establish, but it is now postponed due to recent termination of SUDAM's financial collaboration.

(b) Project Arapaima

As for pirarucu, there is another large-scale pioneer fish farm in Para State, namely Project Arapaima. Aquaculture development of Project Arapaima has started in 1989 by Mr. Darcy Dalbero Uliana, owner of livestock processing company, D.D.Uliana Agropecuaria e Industrial LTDA. He purchased ex-irrigation land area of a total of 23,200 ha in Almeirim (2 days trip from Belem by boat) for aquaculture and livestock raising. This area was a part of former Jari Project, an integrated regional development program covering a total of 70,000 ha and conducted by a millionaire of USA.

At the start of this aquaculture project, Mr. Uliana shipped wild pirarucu meat 10

times by 25-ton truck to a supermarket of Sao Paulo, and confirmed effective demand for this species.

Production system

Aquaculture of Project Arapaima is said to be carried out in a total of 5,000 ha water area composed of irrigation canals and embanked ex-paddy fields. The culture method applied is just an extensive one. Pond water is naturally fertilized by dung of cow and water buffalo which are reared in broad ranching area around the ponds. More than 100 native fish species including tilapia are propagated in ponds as food for pirarucu. Stocking density of pirarucu is approximately 1000 fish/ha up to 10kg in body weight and 500 fish/ha for more than 10kg size. It is confirmed that pirarucu can be grown out to 10-20 kg size in 2 years by this extensive method without daily feeding, and cultured pirarucu reproduce in the pond naturally. The farm is managed by a total of 32 workers only.

Mr. Uliana stated that the farm is now producing 0.25 – 0.30 million pirarucu juveniles a year but most of them are continuously reared in order to increase number of broodstock. The target production of juvenile pirarucu is 5 million per year.

Marketing of pirarucu

At present, major business of Project Arapaima is export of juvenile pirarucu occurred naturally in the ponds together with other native fishes for ornamental fish market in USA, Europe and Japan. It obtained certification of CITES for this activity. Current FOB price of pirarucu juveniles is said to be US$ 20-40/individual, although total sales are not given.

At the same time, it started shipping of cultured pirarucu meat to supermarket of Para State in a form of fresh fillet (producer price: R$ 12/kg) and smoked fillet (R$ 25/kg). The Project Arapaima can utilize existing marketing channel of meat. At present, however, shipping amount is as small as 10 ton a year (30 tons as a whole fish weight), because of not satisfactory benefit for the company comparing to export of juveniles. There is still significant landing of wild pirarucu in Belem because pirarucu fishing is not forbidden in Para State from March to November.

Project Arapaima is now searching the timing of additional investment for improvement of fish processing plant for marketing of pirarucu meat to outside Para State and overseas market.

(3) Progressive Aquaculture Activity in Vicinity of the Study Area

(a) Integration of fish farm, hatchery and feed production plant in Manacapuru

In Manacapuru, a son of former Brazilian senator has developed a total of 20 ha fishponds with technical support of IDAM for credit of R$ 1.2 million in 1998. He

carries out intensive culture of tambaqui since 1999 using fish fry of IDAM Balbina Hatchery and at the same time operates feed production plant. He is now constructing own hatchery. Produced tambaqui are mainly sold for supermarkets in Manaus.

(b) Integration of fish farm and frozen-processing plant in Rio Preto Da Eva

In Rio Preto Da Eva, owners of three fish farms formed a production group and invested for establishment of their own fish marketing company facilitated with frozen-processing plant, Peixam LTDA in Manaus in 1999. The owners are not family farmers but a sort of businessmen. One of them interviewed in this study is a director of construction company and local supermarket.

EMBRAPA has been monitoring productivity of these fish farmers and prepare standard rearing table of tambaqui and matirncha (Table 7.1.5-1). This production group sets a standard productivity of 10 ton/ha and plans to produce a total of 1,000 tons in 2002.

Table 7.1.5-1 A model case of pond productivity in a 1 ha earthen pond culturing tambaqui and matrincha in Rio Preto Da Eva, Manaus and Manacapuru.

(1) Tambaqui (pond area 1 ha, number of larvae introduced: 5,000, survival rate: 85%)

Age	No. of fish	Size of fish		Biomass	Feeding amount		Food conversion
(month)	(ind./ha)	Length (cm)	Weight (g)	(kg/ha)	(kg/month)	(kg/day)	rate (*)
0	5,000	2.5	1	2.5	-	-	
1	4,750	7	30	143	74	2	
2	4,500	12	75	338	150	5	
3	4,500	15	150	675	270	9	
4	4,500	18	270	1,215	486	16	
5	4,375	23	451	1,971	810	27	
6	4,375	26	675	2,953	1,083	36	
7	4,375	30	945	4,134	1,418	47	1.04
8	4,250	33	1,250	5,313	1,735	58	1.13
9	4,250	35	1,550	6,588	1,785	60	1.19
10	4,250	37	1,850	7,863	1,913	64	1.24
11	4,250	39	2,100	8,925	1,913	64	1.30
12	4,250	41	2,310	9,818	1,919	64	1.38

(2) Matrincha (pond area 1 ha, number of larvae introduced: 10,000, survival rate: 85%)

Age	No. of fish	Size of fish		Biomass	Feeding amount		Food conversion
(month)	(ind./ha)	Length (cm)	Weight (g)	(kg/ha)	(kg/month)	(kg/day)	rate (*)
0	10,000	2.5	0.5	5	-		
1	9,500	10	30	285	295	10	
2	9,000	15	75	675	449	15	
3	9,000	20	150	1,350	1,345	45	
4	9,000	25	300	2,700	1,553	52	
5	8,750	28	450	3,938	1,620	54	
6	8,750	30	630	5,513	1,969	66	1.31
7	8,750	33	800	7,000	1,969	66	1.32
8	8,500	35	1,000	8,500	1,969	66	1.31
9	8,500	38	1,150	9,775	1,913	64	1.34
10	8,500	40	1,265	10,753	1,564	52	1.36
11	8,500	43	1,391	11,824	1,828	61	1.39
12	8,500	45	1,531	13,010	2,129	71	1.43

Remarks: This table is prepared using the unpublished data of Mr. Antermo of EMBRAPA (personal communication)
***: (Σfood amount given／Σbiomas gained)**

At present Peixam LTDA is producing frozen minced meat of cultured tambaqui (picadinho tambaqui) and selling the product with its own marketing brand at supermarkets as well as shipping fresh tambaqui. Since smaller size of fish can be afforded for minced meat processing, culture period can be shortened as less than 1 year. Peixam LTDA is also offering other fish farmers turn into their products for frozen processing.

(4) Net Cage Culture Trial in the Study Area

Despite the dynamism of the aforementioned brazilian aquaculture development and progressive aquaculture activities in vicinity, small-scale aquaculture of family farmers have not been developed. There are few studies nor projects regarding technical development of small-scale aquaculture except for experimental net cage culture trial of EMBRAPA-CPAA. This net cage culture experiment is one of the sub-components of Pro-Varzea Project which is linked to PPG7.

Since 1999, experimental net cages have been introduced to several varzea lakes such as Lago do Arianzinho in Iranduba (Annex 7.1.5-2 Photo F-6) and tambaqui is cultured experimentally. Experimental stocking density and expected productivities of EMBRAPA are 50-150 individuals/m^3 and 50-150 kg/m^3, respectively.

There are several other net cage culture trials in the study area and the vicinity (Annex 7.1.5-2 Photo F-7 and -8). In general those trials are conducted by ambitious persons from the view of promising developmental potential of net cages in Amazonas State, although the production is still pilot scale.

(5) Possibility of Ornamental Fish Culture

Export of ornamental fishes is an important source of revenue in the Amazon area. However, they are now mostly obtained by extractive activity. The Municipality of Barcelos in the Amazonas State is known as the center of such activities. Important species are the cardinal tetra (*Paracheirodon Axelrodi*), the neon tetra (*Hyphessobrycon innesi*), the acará disco (*Symphysodon discus*) and the coridoras (*Corydoras sp*).

Cultivation of ornamental fishes in commercial base is seen only in Para State, namely Project Arapaima that is mentioned above. Lack of knowledge on the reproduction and breeding of these fishes in controlled conditions should be the biggest problems behind the undeveloped state of ornamental fish culture (Val et al., 2000).

Ornamental fish culture has potential to be an alternative income source for rural communities, but there is no research on technical development and promotion activity at present.

(6) Conclusive notes on lessons learnt

Overall, there seems to be few successful cases on aquaculture conducted by small-scale family farmers in the Amazonas State, despite development of large-scale or progressive fish farms. The reasons behind this are examined in Section 9.2.3 of this report.

In order to introduce aquaculture as an alternative livelihood for small-scale farmers, those foregoing activities shall always be referred. For example, extensive pirarucu farming may be able to apply for some barragem when artificial seeds become available, not only for food commodity but also for source of ornamental fishes.

Apart from existing aquaculture practice using barragem, introduction of lake ranching program (extensive aquaculture) and net cage culture method should give lakeside communities significant benefit. Since preliminary examination of those activities have been started by INPA as a research program of PPG7 and by EMBRAPA as a part of ProVarzea Project which is linked with PPG7, further technical development and their practical application is highly expected.

7.2 Processing, Distribution, and Marketing

7.2.1 Agriculture Crops

(1) Availability of Research Publications

(a) Processing

A fair amount of published research on the processing of tropical fruits exists, especially for cupuacu and acai. Articles on the processing of guarana and vegetables are more difficult to find. The best sources for these articles are EMBRAPA/CTAA and CPATU for fruits and guarana. EMBRAPA/H and Emater/DF have written a few good articles on vegetable processing.

Publications describing processing equipment for Amazonian fruits do exist. Articles on guarana processing equipment are more difficult to find. Processing equipment for these crops can be designed by institutes such as EMBRAPA/CTAA or ITAL. Most of the actual construction of the equipment takes place in Sao Paolo. Most of the processing equipment design is for medium- or large-sized enterprises. It is more difficult to find descriptions of equipment specifically designed for micro- and small-sized operations typically needed for the Amazon river communities.

(b) Distribution

There is been extremely little research published on the movement of agricultural produce inside Amazonas, or on the movement of produce across State borders. SEBRAE has published some articles which describe the general flow of cupuacu, cassava, and wood products from farm to market, but no statistical information is provided.

Many instititutes in Amazonas have written articles on the need to reduce post harvest losses in the farm to market distribution chain, but no definitive studies have been performed to evaluate the actual % losses which occur at distinct points in the chain. Loss studies have not been performed on a per crop basis.

Government data (Ministry of Agriculture) exists for the entry of fruit and vegetables into the State, but the data is extremely disorganized and never tabulated by crop or by monthly or yearly periods.

Government data exist for the export of some processed products (guarana and fruits), especially in the case where a federal phytosanitary certificate is required. However, a very high percentage of product moves across State lines on a clandestine basis and is never recorded.

(c) Marketing

There is a striking lack of marketing research and lack of general marketing knowledge on typical Amazonian crops such as guarana, cupuacu, acai, pupunha, and castanha. Articles on marketing opportunities for these crops are very few, and very general. Careful research on opportunities in export markets has never been performed.

It is interesting that in the case of guarana, a series of articles on market opportunities was published in the 1970's and 1980's by ACER, the government extension agency of that period. These articles are now outdated, and articles for market opportunities in the 1990's simply do not exist.

Market studies are often commissioned on a crop basis by commodity groups and trade boards of major crops (e.g. grapes, citrus, soybeans, rice, beans), but the specialty crops of the Amazon have not reached sufficient volume to deserve such attention.

There is a distinct lack of economists, especially market economists, working on the problems of Amazonian products. Until this trend changes, Amazonian market research will remain in its infancy. Special projects are desperately needed to characterize market opportunities in the Amazon, and market assistance centers are needed to link supply and demand.

(2) Relevant Projects carried out by EMBRAPA and EMATER

(a) EMBRAPA/CTAA

EMBRAPA/CTAA is a highly capable institute focused on food technology research and development that can have considerable impact on food processing activities in Amazonas. Although it has very little experience in Amazonas, but they are more than willing to provide assistance on a consultancy basis. They already have considerable experience in the Northeast of Brazil, and have some project experience

in other parts of Amazonia (Acre, Rondonia, Para). Its activities are summarized as follows:

- In collaboration with IDAM, conduct a sectoral review for food processing opportunities in Amazonas (identify high priority communities, identify and design processing equipment needs, build and deliver necessary equipment, conduct group training in processing technologies and food safety, create manuals and videos for sustainability, create market linkages).
- Initiate a processing project in "new product development" in order to create new market opportunities for products from traditional crops (guarana, cupuacu, acai, etc.). Install pilot plants in select rural communities for demonstration purposes.
- Install a pilot plant for cupulate production in a region where a high volume of cupuacu seeds can be collected and fermented.
- In collaboration with SEBRAE, conduct a initiate a statewide "Food Safety Initiative" with training in GMP's and HACCP at 3 different levels:
    1. "Train the Trainers"- Urban classroom training for IDAM, SEBRAE, SENAR, and EMBRAPA staff in basic principles of GMP/HACCP.
    2. "Rural Group Training" - Training of select cooperatives, farmer's associations, rural extension agents, Mayor's staff at community level in principles of GMP/HACCP.
    3. "Train the Enterprises"- Evaluation team will conduct a diagnostic, food safety evaluation of a selected group of small, medium, and large sized food processing enterprises for internal improvement of these enterprises. A GMP/HACCP plan will be developed for each establishment. Results are kept confidential.
- Design and implement a "pesticide residue testing program", with an emphasis on comparative analysis of local vs. imported vegetable products.
- Design and implement a nationwide sensory testing program for consumption of Amazonian food products (e.g., guarana, cupuacu, acai, acerola, etc.). However, CTAA has very little information on the consumer acceptance of Amazonian products nor future demand for these products.

(b) EMBRAPA/CPATU

EMBRAPA/CPATU is an institute with a rich history in research and development of processing of Amazonian crops. They have considerable laboratory and pilot plant infrastructure, but due to current lack of funds, they have very few active programs that are having an impact on agro-industries.

- Production and marketing of a new generation of guarana products that are easier to consume, and therefore of higher appeal to middle class and export markets
- "Factory Field School" for traditional guarana processing in Maues and Urucura
- Production and marketing of cupulate products

- Leadership of a “quality certification” program for guarana products in Maues and fruit pulp products from Itacoatiara

(c) EMATER/DF

DF is the leading State extension service which supports vegetable growers and agro-industries which minimally process vegetables. They have many years experience helping vegetable processing industries initiate their business, and they have significant experience in helping these processors grow and maintain their business with clients such as large, supermarket chains. DF is regarded as one of the most highly organized and efficient extension services in all of Brazil. EMATER/DF has been supporting farmers association in terms of direct marketing, called “kiosk”. This type of assistance was confirmed very effective for improvement of rural farmer’s livelihood through the investigation of this study. A similar system should be considered as alternative project scheme in our project

(3) On-going Projects of IDAM

(a) Management of Manaus Central Receiving Station (CRS)

The Government of Amazonas has approved funding for the establishment of a “Central Receiving Station for Agricultural Products of the State of Amazonas” (CRS). The CRS will be located in Manaus near the Coca-Cola bottling facility. Land has been purchased and funding has been approved for the construction of the building. The CRS will serve as a central repository for all agricultural produce (including meats, fish) coming in from the rural communities. Accredited producers’ associations will be permitted floorspace and booths where they can promote and sell their goods. Further discussion on how to involve this scheme on the plan is now carried out between IDAM and JICA Study Team.

(b) Agro-Processing Project

The APP project that was described in the previous Chapter was approved and received its first tranche R$ 4.5 million of funds from State government. This budget is going to be used to establish fruit and sugar cane processing plants in the following four municipalities:

- Itacoatiara
- Nova Olinda do Norte
- Humaita
- Tabatinga

Several crops will benefit from this investment but the primary target crop for processing activities is Cupuacu.

- Organize training sessions in the following areas for the processing plants
    a) Management and accounting practices

b) "Good Manufacturing Practices"
c) Basic food safety and HACCP
d) New product development
e) Plant maintenance

- Organize training in the above areas for "Balcao de Agronecios" staff (IDAM, SEBRAE, SENAR, EMBRAPA) using consultants from CTAA and CPATU. These staffers will then be adequately prepared to support these and other processing plants which come on line in the near future.

(c) Distribution Supporting Project

IDAM has approved recently funds for the purchase of infrastructure to assist in the distribution of agricultural products from farm to market.

Table 7.2.1-1 Budget Allocation of IDAM for Improvement of Transportation and Distribution Equipment for Agricultural Products, 2000

Item	Number	Total Cost (R$)
Heavy duty boats (16m, 114 hp, covered)	9	540,000
Light boats (8m, 6hp, wood)	20	110,000
Heavy duty 4x4 trucks (10T)	16	1,200,000
Heavy duty 2x4 trucks (10T)	11	666,000
4x4 pickup truck	1	46,000
Packaging materials (cardboard boxes)	310K	152,500
Packaging materials (sacks)	200K	130,000
GRAND TOTAL		2,838,500

Source: IDAM Commercialization Project Document, 2000

The assets to be purchased can be summarized as Table 7.2.1-1.

These boats and trucks are to be initially allocated to the municipalities as Table 7.2.1-2.

Table 7.2.1-2 Municipal Allocation of Boats and Trucks in IDAM Commercialization Project, 2000

Municipality	Trucks (4x4)	Trucks (2x4)	Heavy Boat	Light Boat
Pr. Figueiredo	5	1	-	5
Manacapuru	1	2	2	3
R. Preta da Eva	4	-	-	2
Itacoatiara	3	-	2	5
Careiro	3	-	-	-
Manaus	-	4	-	-
Iranduba	-	4	3	5
Labrea	-	-	2	-
Total	16	11	9	20

Source: IDAM Commercialization Project Document, 2000

(4) Opinion of Private Sector

Discussions held with many diverse agro-processors both within Amazonas and outside the State, revealed the following key learnings:

- Government documentation of processing volume and movement of processed goods across the Amazonas border is extremely inaccurate. Actual inspection of factories and shipments is minimal, and a very high percentage of clandestine, non-documented commerce occurs.
- Processors want marketing assistance, especially with regard to finding buyers in export markets.
- Processors need information on the quality requirements of export markets.
- Processors want more laboratory testing capacity within Amazonas which can certify quality and safety levels for Amazonas products

7.2.2 Cultured Fish

Most of cultured fish is now marketing to fresh fish market without any processing. Strictly speaking, primary processing such as removal of gut of cultured fishes is not allowed at fish farm where sufficient sanitary facility is not facilitated.

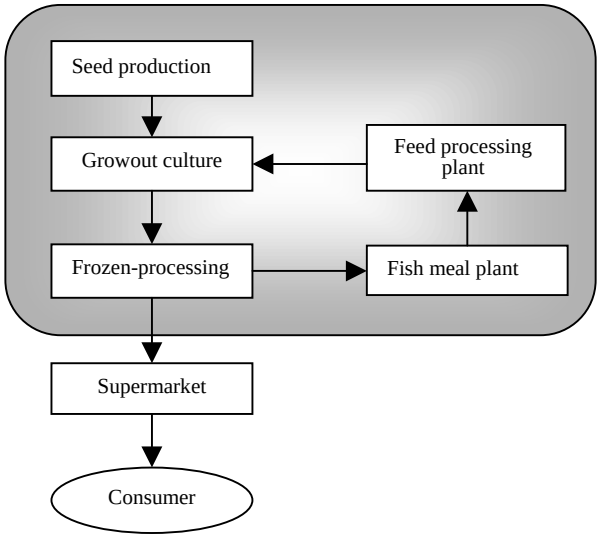


Figure 7.2.2–1 Integration of Acuaculture related Activity undertaken in Progressive Companies

At present, minced tambaqui (picadinyo tambaqui) of Peixian (see, Section 7.1.5) is the only processed form product using cultured fishes in the Amazonas State. Frozen fresh fillet and smolked fillet of cultured pirarucu are produced in Para State (see, Section 7.1.5). Those activities are considered to be integration of aquaculture related activity (Figure 7.2.2 - 1).

There are several traditional styles of fish processing as shown in Section 7.5.4. However, they are generally cheep in market and might be not viable for cultured fishes.

Following information was obtained about prospect of fish processing and distribution from INPA-CPTA:

- It is technically possible to produce modern style of fish products such as surimi, fish ball, smoke, etc. However, non of them are developed well in commercial base in Amazonas State. Fundamental reason is strong preference to fresh fish of local people coupled with abundant fresh fish supply in the State. Other reason is technical one. White surimi is difficult to produce using Amazon fishes such as jaraqui because of high content of fat. Due to the same reason, jaraqui is not suitable as material of piracui (fish powder).
- Considering people's preference and characteristics of Amazon fishes, minced fish as a material of fish ball and fish burger seems to have potential for development. This laboratory has already confirmed technical feasibility for aracu, jaraqui and mapara.
- HACCAP system is said to introduce for most of frigorificos in Amazonas State. However, actual production procedures seem not to follow the manual. This is partly due to low frequency of government inspection.
- Technique on fish skin manufacturing for shoes and handicraft is going to develop in this laboratory using pirarara, surubim, pirarucu, tucunare, curimata etc., although practical production for sale has not achieved yet.

7.3 Farmers' Organizations

7.3.1 Lessons Learned from Farmer Organizations and NGO Project Experience

The following section analyzes some of the findings from interviews with producers, extractivists, presidents and councils of associations, and project and NGO staff. A major learning from these case studies is that it not easy to form associations or to sustain farmer organizations in the Amazon. Producers and extractivists who live traditionally isolated lives need to be convinced that they have the skills to form an association and that they can gain personal benefit in doing so. A farmer is not willing to waste his time by working collectively for a common goal without some personal livelihood benefit. A producer or extractivist is more willing to work together if they can protect their food resources, especially their fish resources. They are least concerned with the legal requirements of forming an association and the bureaucracy required to get their personal legal papers in order nor the legal papers required to form a for-profit association that can sell and transport it out of their community. In every case of success farmer organization, there was a strong leader in the beginning who was a social activist or human rights activist, not a technician. The leader was creative, sought out ideas from others on what were low cost and minimal involvement successful interventions, and tested ideas in pilot activities. The successful leader also used discipline and encouraged joint technical, social, and economic review of results by other farmers and technical experts. Farmers were also mobilized to work collectively to form an organization when leaders used a human dignity approach to labor. That is their labor was re-identified from being the poor man's "capital" to being a form of mutual exchange that showed respect for each other's needs.

(1) Main Successful Interventions

Based on an institutional analysis of each organization and project, eight activities were identified as reasons given for successful formation and organization of producers and extractivists in the Amazon. These activities include

- Strong participatory requirements
- Resource mapping by producers/extractivists
- Human rights information sharing and advocacy
- Youth leadership training
- Participatory diagnostic surveys for project specific planning
- Sharing of common values
- Making time to recognize successes and celebrate
- Capital to make initial investment.

(a) Participation

Participation according to specific rules and format is a condition of membership in the RECA project. Unique as a method for collective management and developing producer collective responsibility, RECA used this human capital approach as a way to build solidarity, collective responsibility, and fiscal responsibility among members. Two participatory requirements coalesced the association. One is s that members must participate at each meeting if they are to access any RECA services, especially produce marketing services. Members who cannot or who are not willing to meet this time commitment are asked to leave or leave voluntarily.1 Original members pointed out that this strict requirement built solidarity because they better understood each family's struggle and what were common struggles. They also learned how to share ideas on how to set up agribusiness and social development services to benefit themselves. The second participatory requirement was also to keep monthly farm production and expense records (farm budgets). Volunteers were trained to train on record keeping and farmers were required to present monthly records at meetings. This requirement existed for 10 years until farmer investment loans were repaid and the factory acquired a computer. Farm records are now all computerized for them.

Participation was made possible because RECA divided the settlement into 12 groups formed with a minimum of 20 and maximum of 50 families. (There are now 14 groups). Small producer groups make it easy to express views, raise concerns and help each other solve problems. Ideas how to solve common problems or suggest new ideas to improve RECA activities were taken by the producer group elected representative and/or coordinator to monthly Executive Council meetings. Only two presidents have been elected. The first President developed the idea of participation and record keeping in consultation with the priest and core group of 84 farmers. The "solidarity spirit" and desire "to learn with the rain forest", according to the current president, is what keeps consolidation, minimizes conflicts, and keeps members active (INPA, 2001).

Table 7.3.1-1 Successful Methods Used by All Projects to Mobilize Farmers to Participate in an Association: 2001

Organization/ Project	Methods used in beginning	Methods used to settle conflicts	Methods used to keep members active
RECA Project	Set up of geographically based producer groups of agricultural families with strict requirement of monthly participation in meetings Training on production record keeping and transparent review of each farmers production record accounting at monthly producer group meetings Formation of producer group council with elected representatives Land development seed capital fund	Monthly meetings of farmers in decentralized groups based on geographic proximity Development of representative council Encourage exchange of ideas and problem solving on monthly basis or in emergency meetings	Required attendance at monthly meetings Required attendance at RECA Councils Organized Social Events Immediate payment by check to producers and computer kept production records after loans have been repaid

1 This has major economic consequences for the settlement farmer since RECA is the major marketing and wholesale buyer of inputs in the region.

ASCOPE	Mutirio system to help each member have 1 ha Human rights training	Frequent meetings (often weekly) Strict control on credit at cantina	Earn profits Close supervision of cantina Organized days for product sales
Antimary Association	IDAM technician visits and farmer meetings	Farmers come to IDAM office and discuss problems	Not keep extractivists informed of market problems and legal issues
Project Saude Alegria	Popular theatre, 2-3 day community based workshops	Form community organization, inter-community association	Every 2 months community based workshop, community newspaper, videos, development plans, community service management/operation plans
CEDARP	IDAM technician visits and farmer meetings Pilot cantina projects Rural Radio program by IDAM rural extensionist	Farmer Meetings IDAM staff intervention on contracts, project loan documents	IDAM works closely with CEDARP president All legal documents prepared for CEDARP operations
Project Varzea/ Santarem	Organization of joint research with fishermen and varzea families to prepare textbook and identify themes Research Studies on lake management and food/fish resources	Teacher training on materials in nodal communities every 2 months Training community lake management extension agents	Science Fairs Ministry of Education review and extension support of activities Series of textbooks, teacher training modules, environmental games, children's books
GDA/ Santarem	Diagnostic studies in regions and communities where no other NGO works Organized resource mapping exercises Train volunteer student linkages with youth in community	Train volunteers in nodal communities every 2 months/ 3years Develop partnership with communities Provide technical training on rights, leadership, org.	Small project community grant fund Preparation of community project plan Advocacy training and organized activities to secure community management of reserve

Source: Saulniers. Field Notes, 2001. Annual Report of GDA, 2000; Project Saude Alegria, 2000.

(b) Resource mapping by producers/extractivists

The way to help farmers work collectively is found to depend on the length of time the farmer association is organized, type of farmer, and his ecological system. In early stages, raising awareness of extractivists to existing local resources has been an effective step for conscientizing them to work together. GDA reported its most successful exercise is motivating extractivists to map their forest resources and list for each tree its uses, production cycle, diseases, benefits. They also ask extractivists to prepare maps of their communities and other local resources through need assessment participatory exercises. These efforts were found to pull members together to recognize what they have already, how to better use their resources, and what else needs to be done to use or protect what they have. It also made each person an equal contributor. This methodology of extractivists mapping has been identified by CRODAMAZON, a multi-national company who will set up collection of extractive products with 480 families as a phase I project of its business plan (Lina, 2001).

SaudeAlegria does similar mapping exercises with extractivists. Their mapping exercises also include detailed maps of the community settled area and often leads to establishment of streets and more organized settlement. Preparing maps together help community members recognize their contribution and role in planning serve delivery like water tanks and household tap linkage, organization of electricity lines, set up of drains and sanitation facilities for each house, and appropriate location of health

service center. Extractivists' maps also helped SaudeAlegria identify with farmers appropriate secondary growth locations to introduce alternative systems of agro forestry and pilot projects of quintal agro forestry orchards and nurseries.

Project Varzea does mapping exercises with varzea communities surrounding lakes. Their mapping exercises have found that floodplain tenure systems are usually different from those of uplands. The size of varzea properties is also usually calculated not in terms of their area, but their perimeter, especially length of frontage along a river or canal and distance inland. Varzea tenure systems were found to provide each landowner, large or small, with access to four main varzea environments and that there is a gradient of use rights from the riverfront inland to the lake.2. The lake is also considered common property and attempts to restrict access of other residents to lakes have largely been rejected (IPAM, p. 21. 2001).

The RECA project approached mapping in a more individualistic way. The executive council encouraged each farmer to make a site assessment of his newly acquired land so that each would know what forest resources were on his land and how he wanted to organize his land for alternative agro forestry, cattle raising, domestic use, and other land uses. The amount of money borrowed, $968 per ha, was based on the farmer's farm plan.

ASCOPE carried out mapping exercises to open potential areas around igarapes to production in its expansion phase due to the estimated 30% increase in population moving into the micro-region of Novo Remanso during a STR sustainable management project activity funded under CONTAG.

(c) Human rights information sharing and advocacy

A third effective catalyst is to provide human rights training on how to access documents that guarantee his basic rights as a citizen. This includes information on how to how to obtain legal documents to be identified as an individual, such as obtaining a birth certificate, registering with INSS, obtaining a rural producer card from STR or the Department of Labor, and registering with the Secretary of Fazenda for a CPF card. Legal mobilization has enabled farmers to recognize that they have power as individuals and encourages them to think they will have more power as an association. Awareness training also includes learning how to settle conflicts, how to negotiate, how to request services, and how to believe in yourself. Awareness Rights training was used by the Catholic Church priests and the Comissao Pastora da Terra serving farmers of RECA, Sagrado Coracao de Jesus (community of ASCOPE), the 23 CEDARP members, and GDA extractivists.3 It has also discouraged some farmer organizations from accessing all legal documents to set up a marketing association

2 On the levee bordering the river, private properties are recognized with clearly defined limits, other even demarcated by fences. The natural grasslands inland from the levees are regarded as a common. Cattle can circulate more or less freely in this zone, although individual property owners have the right to fence their property (IPAM, 2001)

3 Comissao Pastora da Terra was the founder of GDA and they follow similar methods as the parent organization.

because of the cost in time and money to prepare them.

The IBAMA lake management program to train environmental voluntary agents uses a human rights approach to promote community lake management of resources. Motivation to organize varzea or terra firme farmers to manage lake fishing for food resources by preventing predatory fishing has been a difficult task to implement (Periera, 2001; CPT, 2001) unless the communities are located in reserves (Periera, 2001; Durrigan, 2001).

(d) Youth leadership training and Community Leadership Training

A fourth effective strategy is training local volunteers and leaders, particularly youth to take more social responsibility. This also includes training of adults to help them respect decisions and involvement of youth in planning and management activities. RECA, ASCOPE, GDA, Project Saude Alegria, Project Varzea/Environmental program offer organized short courses in technical skills but use a social education approach to help them easily learn them and then want to apply them in their communities. Many of the courses are linked to CPT training courses. This was true in communities served by ASCOPE, GDA, and CEDARP.

CPT found training volunteers –usually young persons--through exposure visits to other communities then holding group analysis sessions on visit a highly successful method to transfer technologies and to develop the confidence of the volunteer to transfer information on return to community (Addison, 2001).

Environmental voluntary agent leadership training program design was originally set up by CPT and later taken over by IBAMA. As of June 2001, IBAMA trained 800 environmental agents in the Amazon with the training of 600 of them in a series of 3-4 day, 30 hour courses that occur 4-5 times per region at a cost of R$200- 267 per person per course being carried out by CPT. IBAMA does not follow up on volunteers. CPT micro-region volunteers make community visits and organize micro-region meetings to discuss problems. This case of lack of good co-management indicates the difficulty of government agencies to provide frequent and regular follow up visits to ensure program development and success.

Effective training approach used by GDA, Project Varzea/Environmental Program and Project SaudeAlegria are short (3-4 day), every other month courses on specific technical subjects in one community on a regular basis with 2-3 members also attending from 5 - 6 nearby communities. Another successful approach is having a student researcher live in the community for a short period (up to 6 months) and jointly carry out research with youth of similar ages. GDA, Project Varzea and SaudeAlegria pointed this activity as highly successful as a leadership training approach.

SaudeAlegria introduced community newspapers edited by youth as a key way to

build their capacity to learn new ideas and transfer them but also to gain respect as service providers in the community. The newspapers include technical, social, humorous, and personal messages. This activity was observed as highly popular and appreciated activity in two villages and the type of mimeographed or photocopied newspaper is low cost to produce. According to PSA evaluation reports, local newspapers are good technical information disseminators and leadership training activities.

Hence, leaders can be formed by enabling them to have access to technical information not commonly known; training them how to provide this information to others in a simple easily understood method –especially one that has a visual format (map, newspaper), and continuous training provided to them to build up their technical expertise so they will earn respect from others as well as develop confidence in themselves as a leader.

Table 7.3.1-2 Rank of Effective Types of Leadership Training Approaches By Project Leaders: 2001

Producer/Extractivist. Organization/Project	Short courses in community	Study Tours/ Visits	Partnerships with university students, researchers	Participatory Planning group leadership	Specific Project Activity
RECA Project	X	XX	XXX	XX	XXXXX Encourage secondary school attendance
ASCOPE	XXX	X	X	X	
Antimary Association					
Project SaudeAlegria	XXXX		XX	XXX	XXXXX Local newspaper, video and radio preparation, organize trash collections
CEDARP					
Project Varzea/Santarem	XXXX	XX	XXX	XXXX	XX Test training materials being developed
GDA/Santarem	XXX	XX	XXX	XXXX	
Comissao Pastora da Terra	XXX	XXXXX		XXXX	XXXX Micro-region quarterly congress, state annual congress

Source: Saulniers. Field Notes, 2001. Annual 2000 Reports and brochures of GDA, Comissao Pastora da Terra, Project SaudeAlegria.

(e) Participatory diagnostic surveys for project specific planning

GDA, Project SaudeAlegria, and Project Varzea found organizing participatory diagnostic surveys on specific topics to set up specific projects, rather than general needs assessments, was an effective mobilizing tool. It helped include all members of the community (men, women, youth) and in the process of jointly putting together a plan to prepare a commonly agreed project identified leaders and work groups. GDA uses simple diagnostic participatory surveys taking 3-4 days to prepare a community action plan. The plan is reviewed for nearly 6 months for technical requirements and again with technical revisions with the community. They said this helps extractivists value their indigenous knowledge when modern research results are also presented. Project Varzea is using a similar approach to preparing environmental textbook materials. Project SaudeAlegria carried out diagnostic surveys to look at production and marketing and labor issues as an initial stage of

setting up an agro-processing extractive fruit processing industry along the Rio Tapajos. The results, however, have not been shared yet with the community but the resource map remains with the community president. ASCOPE has recently completed a participatory diagnostic survey with STR assistance to assess where they want land development, and what impact it would have on the expansion of the cooperative and member incomes.

A lesson learned from GDA, Project Varzea, and Project SaudeAlegria is that producers can absorb new technical materials in short and frequent trainings over a long period. Recommends is to initiate every two months 2- 4 day training activities with community leaders (natural and appointed) on techniques and understanding of the concepts of participatory diagnostics, then implement a survey with them and a trained joint local farmer-student-farmer group technical team. The head of the Project Varzea/Environmental Program pointed out that this approach encourages volunteers and teachers to share their learning with other community members and teachers in advance, and builds their confidence to use participatory techniques (Gorda, 2001).

(f) Sharing of common values

Leaders of RECA, ASCOPE, CEDARP associations stated that if farmers organizations are to be successful there must be evidence of honesty in work effort, transparency in financial reporting, discipline in following agreed decisions, and shared belief in human dignity of the small producer. Another shared value is understanding the importance of saving to build capital other than labor. IDAM association development expert Wanderlay (2001) emphasized the importance of building these values when forming associations and working with extractivists and producers who have been years exploited by traders or a livelihood based on dependent patron-client relationships and decisions being made for them like in jute/malva cultivation.

A lesson learned is that the two most successful farmer associations reviewed the president and members shared all these values. RECA association principles required monthly participation to reduce isolation of members. Encourage members to recognize their ideas would be appreciated. RECA asked members to leave if they were not willing to abide by this rule of association. The association keeps transparent farm production records and required, as mentioned early, farmer reporting of income and expenses at monthly meetings for the first 10 years of the project. RECA reinforces discipline by taken to court defaulters and stopping purchase of produce of farmers who do not attend a meeting. RECA holds meetings after Catholic Church services not only because of convenience, but the President said the message of the socially activist priest encouraged them to remember that they were helping themselves and each other as human beings (Brombeck, 2001).

(g) Making time to recognize successes and celebrate

Keeping members interested in remaining in an association is not an easy task. While providing training on specific technical activities to volunteers and to them is an important motivation, producers also want to change the monotony of their activities. They appreciated celebrations and festivities and dances. Youth and women, in particular, were found to like the roles of organizing musical and food celebrations. RECA regularly organize dances and food/drink to help families socialize and reduce burden of work. They also organized big parties at the end of a marketing contract sale or season. ASCOPE members participated in organized big religious festivals. Project Varzea/Environmental Program organized an Ecological and Cultural Fair with Itiqui Communities. GDA organizes annual an Indian Cultural Week. Project Saude Alegria organizes popular theatre (or circus) with skits and songs by young children, youth, field workers at every end of a community-based workshop. The community president of Suruaca in the RESEX area where we spent several days reviewing Project Saude Alegria community management strategy said that annual celebrations "help keep the community together, earn money for the association, break the monopoly, and give them something to look forward to besides work."

The Brazilian culture of song, dance, celebration and get together to talk and be joyful are important to farmers. This cultural tradition can be used effectively, like in the RECA project, to encourage productivity and producer organization solidarity.

(h) Capital to make initial investment

The RECA Project used a revolving grant fund to enable members to develop their alternative agro forestry system. . Eighty-four families initiated a tropical fruit project with a $5000 grant from the Bishop and everyone paid him back within 2 years as a test of the "participatory requirement strategy". The priest then helped them receive a Dutch grant through the Catholic Church and the RECA association designed a land development credit scheme in which members could received R$968/ha for agro forestry development with a 4 year grace period and variable rates of return ballooning to 55% required repayment within year 9 and 10. The repayment of funds was used to set up a marketing fund. This fund was used to develop RECA facilities (which include office, social center, guest lodge for farmers, and cupuacu and acai pulp processing factory and fermenting unit). Savings was used also to set up a pupunha palm processing factory for which they are to receive PPG7 funds from PD/A to develop. The link of production – marketing capital fund has proved successful. Out of 200 families, only 14 have not fully repaid their money. These families are now facing court cases initiated by the project.

Small community development grants that provided training experience in project management and building the capacity of the association through pilot technical

projects were also found successful in forming farmer organizations. This is the philosophy of CPT, Project SaudeAlegria, Project Varzea, and GDA.

Various ways were used to provide capital for initial investments in project activities. Lesson learned is that labor is the best and cheapest capital used by farmers to organize an association. Another lesson learned is that an agribusiness grant fund approach that provides loans to farmers so that they have fiscal responsibility for their investment but turns the repayment into other investments that benefit the farmer is more sustainable than providing development grants or individual credit extension.

The most successful approach of all projects was to provide a grant fund for land development on terms of repayment appropriate to the type of cultivation with repayment from the borrowers used to develop a market fund to set up marketing services and value-added services to farmer produce. Farmers are given incentives to quickly repay their loans because they know the agribusiness plan is to use their repayment for capital funds to help them with marketing their new production.

Table 7.3.1-3 Effective Types of Initial Capital and Management Method Used by Farmer Organizations: 2001

Organization/Project	Type	Management method by Organization/Project
RECA Project	Revolving grant fund	Farmer Production record reporting, graduated credit repayment over 10 years with graduated % of return in later years after production returns are greater.
ASCOPE	FNO loan, municipal and state grants	2% of sales go to running costs. Professional accountant in Itacoatiara keeps accounts and files taxes.
Antimary Association	Working capital credit	IDAM staff and CEDARP president keep accounting books, contract offers, and loan documents. No loans to date. Grants are recorded in accounts.
Project Saude Allegria	Community grant	Community organizes plan and selects volunteers; PSA provides grant in kind and technical volunteers work with local volunteers in supervision
CEDARP	Municipal grant and savings from sales	IDAM association staff keep records and work closely with President to prepare work plans, loan documents, contracts
Project Varzea/Santarem	No capital	Project staff holds training session every two months; local teachers keep records of activities initiated in the nodal community areas. Project staff keeps financial and technical records. Capital is provided in terms of textbooks, educational materials, not money
GDA/Santarem	Community grant	Long training process with community, sometimes up to 6 years to prepare community managers and volunteer leaders. Small community grant managed by farmer organization and monitored by volunteer and permanent staff.

(2) Summary of Lessons Learned for Forming Associations

Lessons Learned for Initial Formation of Association

- An initial step is to identify natural leaders and facilitate their learning by building their self-confidence, analytical skills, and technical skills of how to practically organize an association. Required in this activity is patience to have them adopt new ideas according to his/her framework, willingness to take time to introduce new concepts through repetitive, building processes, and setting up

exposure visits or opportunities to learn new ideas outside their community.

- Prior to capital investment there needs to be social investment in the producer or extractivist family. Identification of what are their needs, human assets, and indigenous skills of male, female, youth and children is a first step to introducing new technologies. Identification of what are their needs, human assets, and indigenous skills of male, female, youth and children is a first step. A holistic "empowerment" approach needs to be used towards improving the livelihood of a rural small producer family not an economic approach.
- It cannot be assumed that persons on the varzea or extractivists or settlement poor families are similar. Each settlement or community has a different makeup of persons, contains various micro-ecosystems, and has experienced different forms of past economic development and environmental exploitation. Community specific diagnostic participatory strategies are best first steps to initiating activities and develop a strategy for working with the farmers to organize an association.
- Credit access or grants are not the most appropriate catalyst to form associations that are sustainable.

<u>Lessons Learned for Capacity building of associations in early stages of formation</u>

- Successful farmer organizations are those which set standards, policies, and methods of operation and require members to share values of discipline, transparency, and human self-worth.
- Successful farmer organizations also those that provide members opportunities to build confidence and self-dignity and technical skills. They do not think of their members as only producers but has human beings with social, personal and economic and food needs. Leaders learn to address the immediate needs of finding ways to increase incomes –often through simple time savings- then trying to set up major changes in their production systems to improve production. Improving ways to increase food resources, especially fish is an effective way to move a farmer from being individually oriented to collectively oriented.
- Develop youth leadership training programs. Youth leaders are effective for moving the process faster of forming an association. They learn easier, and can contribute quicker to transferring technologies because they are freer to learn and are often more similar in age to the technical agents or volunteers from organizations who are willing to work on association development. Development of local newspapers by youth is an excellent way to transfer simple technology messages.
- Take small steps to improve the livelihood of members. Because producers have no tradition of working together except in land preparation or transporting products from forest, accumulated experiences of benefits of collective effort are required to help extractivists start to value the time being taken away from family

subsistence efforts of production. Build the capacity of its members seems best accomplished through experience developing and implementing small projects and visiting other projects that have required joint efforts and have been successful in improving producer livelihoods without much capital investment. It requires building experiences of successful joint actions that demonstrate that promoting an " agribusiness oriented farmer association in a fragile economy in a fragile environment" is possible with a plan based on experience.

Lessons learned for institutionalizing a movement for forming farmer organizations

- Planning the use and management of existing resources is not an indigenous skill. Local environmental resources are not viewed as sacred places to sustain or preserve since they often only have use rights or are "just there" except on settlement schemes where there are land titles. Creating a spirit of developing a farmer association to make land and lake investments may require other policies related to giving more ownership or entitlement to farm families other than on settlement schemes
- New technology needs to be practical, demonstrate immediate benefit, and not require major change from traditional systems whether it is related to production, marketing, or food resource management. New technologies need to be proved with them, not by researchers in isolation from them. This may take years, especially if it is building fish stock and lake management or developing alternative agro forestry systems. A program development fund for farmer association development in these areas is a medium term project.
- A long term investment is required that covers at least two generations (or 20-25 years) to establish the spirit of entrepreneurship through establishing community based agro-based processing associations. Its establishment, however, will be influenced by government policies directed to communication infrastructure, education, decentralized government and legal facilities to guarantee land titles and community rights to local resource development.

7.3.2 Association of Aquaculture

(1) Association of Aquaculture in Coari

Association of aquaculture, Coari (Associacao dos aquicultores de Coari) was established on 5 May 1999 with five members. This is the first association about aquaculture in the Amazonas State. The number of members increased to be 36 in 2000 and 48 at present in 2001 due partly to effective local advertisement on radio and TV. IDAM provides a series of technical and administrative supports not only for the establishment but also for expansion of activity.

The primary objective for establishment of the association is to obtain government licenses in order to legalize aquaculture activity for selling the product outside the

municipality. Hence, holding land document is the criteria to be a member of this association. Member fee is R$ 10.00 per month. Actual procedures to obtain environmental license from IPAAM are shown in Table 7.3.2-1. It seems impossible to undertake those procedures by individual person, particularly for small-scale operators living in municipalities other than Manaus.

Table 7.3.2-1 Actual process of application and approval process of environmental license for aquaculture of IPAAM.

	Actions of applicants	Answer of IPAAM	Remarks
1st visit	Submission of a set of necessary documents	Please visit again after about 1 month, when we tell you the schedule of inspection	If some documents are lacking, applicant has to come again.
2nd visit	Asking the inspection schedule.	O.K., about 1 month later	
Inspection of IPAAM		IPAAM inspector visits the site. When the site is passed his inspection, he will say to applicants that come to the headquarters office to confirm license fee.	In many cases, direct expenses for inspector such transportation charge including flight fee, accommodation (hotel and food), etc have to be paid by applicant.
3rd visit	Asking license fee.	O.K. this much, would you sign the document and go to bank for pay.	There is a flexibility in the fee table, and changed frequently.
Payment to bank	Go to the bank with the document and pay license fee.		
4th visit	Asking issuance of license, with receipt of bank	Issue license within 48 hrs.	Strictly speaking, the license is not effective before public notice.
Public notice	Go to news paper company like A CRITICA and ask to notify the name and license on the news paper.		Cost: about R$ 200.00
5th visit	Asking verification of license with a copy of the news paper.	Verify and give stamp on the license.	

Remarks:
1) For license fee of IPAAM, see Annex 5.5.5-2.
2) In order to renewal of operation lisence, operators have to visit IPAAM every year..
3) When operators expand the facility, the same procedure of the above shall be repeated.

The association deputizes those legal procedures including negotiation of licensing with authorities as a group of farmers. Now, all the operative members (37 fish farms) have registered not only to DPA of MMA but also to IPAAM.

Most of members operate small-scale barragem (< 1 ha) but in many cases they are not recognized as family farmers because they have major jobs irrelevant to agriculture such as retailing, bakery, trading etc., staying in town and instruct site workers on routine farm management. Percentage of family farmers seems to be less than 30%.

However, it is confirmed through this investigation that it is possible to overcome problematic legal procedure by organizing fish farmers.

(2) Other associations

Other two aquaculture associations are established in the municipalities of Sao Paulo de Olivenca and Benjamin Constant, respectively in 2001. However, details could not be investigated in this study.

7.4 Supporting Services

7.4.1 Social Security for Rural Producers

(1) Organization of INSS (National Institution of Social Service)

The Federal Ministry of Social Assistance and Welfare (Ministerio da Previdencia e Assistencia Social) manages the INSS program which provides social benefits to aged persons, welfare benefits to handicapped, maternity benefits, rural pensions and provides social compensation for death and work related injuries. Some of the important services available to rural persons are the following:

Table 7.4.1-1 Types of Social Services Eligible to Rural Persons

Type of Benefit	Beneficiary	Requirements
Rural Pension for rural producers	Men 60yrs+, Women 55yrs+	Birth Certificate, 10yrs of proved work Tax payments for 10 yrs
Individual Contribution to social security if no receipts	Self-employed, enterprise laborer, extractivist, part time farm worker	Birth Certificate Minimum 2.7% of earnings
Retirement for teachers in service	Those with 25 years of service	Birth Certificate Service Records Contributed 180 months
Dividing Debt for Social Security	Those who did not put in full contribution for 60 months to INSS	Birth Certificate 4 parts of payment of R$50 or R$200
Individual Enterprises (unskilled; skilled)	Enterprises that are not associations or syndicates registered with Commerce	Negative Certificate of Debt when prove no debts; proof of business for years, tax card
Maternity Benefits	Women who can prove work 10 months previous to pregnancy	Birth certificate Rural Producer status, card, proof of employment dates
Death Benefits	Wife and son or sister under 21 yrs	Birth Certificates of dead, wife, children, sister, marriage certificate, death certificate, legal declaration guardianship for children under 21 years, Worker card (CTPS), proof of salary for 36 months, PIS/PASEP registration card, inscription card proof of contributions
Death Benefits from worker accident	More than 21 yrs old	Birth certificate, death certificate, accident certified document, others cards as above
Negative Certificate of Debt (CND)	Non-profit associations, syndicates, civil societies, associations with enterprise	Commercial registration certificate. Proof not in debt for 10 years. Proof of activity
SIMPLES (integrated tax system for contributions from small enterprises)	Micro enterprises with annual gross receipts less than R$120,000 or under special conditions, those with R$720,000	PIS/PASEP, IPI, CSLL, COFINS (different documents documenting taxes, accident insurance, INSS contributions, contributions from rural products, cadastral FCPJ, plus others
Solidarity Responsibility (building/ equipment insurance)	Owner, association, employer, rural producer who is legally registered, those involved in contracts	Various legal documents of legal person, entity

INSS divides the Union into specific regions for service delivery. In the Amazon State, there are 7 Regional Offices (eg Itacoatiara, Maues, Manacapuru, Parintins, Coari, Tonatins, Tefe) and a head office in Manaus. Each serves different municipalities within meso-regions, or official IBGE census divisions. Currently, in 24 municipalities with 430,000 inhiabitants , only 4.9% or 20,9000 are INSS beneficiaries. The national average is 11%.

Table 7.4.1-2 Estimate of Rural Population Eligible for Social Security and Maternity Benefits: Iranduba, Itacoatiara, Maues: 2000

Type of Benefit	Iranduba		Itacoatiara1/		Maues		Total	
	Rural	Total	Rural	Total	Rural	Total	Rural	Total
Total Population	22,299	32,228	50,956	122,728	18,854	39,978	92,109	194,934
Male	11,574	16,643	27,609	63,564	10,311	20,759	49,494	100,966
Female	10,725	15,585	23,347	59,164	8,543	19,219	42,615	93,968
Social Security2/								
Men (60 yrs and over)	1,279	1,839	3,050	5,731	2,083	4,417	10,176	21,536
Women (55 yrs and over)	968	1,406	2,106	5,337	930	1,873	4,465	9,109
Total eligible	2,246	3,245	5,156	11,069	3,013	6,289	14,641	30,645
Total recipients (6/2001)	1,303	1,303	4,354	2,468				
Est. No. in need	943	1,942	802	8,601	3,013	6,289	14,641	30,645
Percent in need	42	60	16	78				
Maternity Benefits3/								
Women (18yrs+occupied)	2,783	4,045	7,817	3,238	2,217	4,988	11,059	24,386
Est. No potentially .eligible	9,463	13,752	26,578	11,009	7,538	16,958	37,602	82,913
Other Social Welfare Benefits,								
Men 18 yrs and over	3,767	1,050	8,985	20,686	3,356	6,756	16,107	32,857
Women 18 yrs and over	3,993	5,803	8,693	22,029	3,181	7,156	15,867	34,987
Total Potentially eligible	7,760	6,853	17,678	42,714	6,536	13,911	31,974	67,845

1/Iranduba and Maues are provided for municipality population; Itacoatiara is the Itacoatiara census micro-region
1/ Iranduba and Itacoatiara estimates based on percent of population age/sex structure for Itacoatiara Municipality 1991 IBGE Census applied to totals of 2000 Census of rural population since data not available for Iranduba. Iranduba is considered all rural by census. Maues based on age/sex structure for 1998 Census preliminary data. % male 60yr+ is 11%; women 55yrs+ is 9%; men 18yrs+ is 32.5%; women 18yrs+ is 31.6%
2/Amazonas occupation rate minus military, domestic, unpaid, industrial employment is 69.7% in 2000; fertility rate is 3.4 for Amazon State; Itacoatiara data are for those receiving benefits in February 2001 in micro region
Source: IBGE: Demographic Census. 1991 and Table 1.5 IBGE. Demographic Census compact diskette, 2000.
IBGE. Synthesis of Social Indicators. Studies and Research. No. 5. 2000; INSS Office: Itacoatiara, June 2001.

Residents of Iranduba are served by the Manacapuru Office. Residents of Itacoatiara and Maues are served by their respective INSS Regional Offices. INSS staff review all documents of applicants, prepare INSS identity cards, and keep statistics on number of persons receiving benefits through direct monthly payment of welfare checks into approved banks. Most offices are understaffed , without vehicles or boats, and seldom follow up on the accuracy of information with neighberhood visits. incomplete documents are rejected. A rural worker or producer pension is currently R$180 per month, or the lowest level on the INSS class of benefits. Pension allocations are reviewed annually and usually increase yearly in April.

Regional offices each operate slightly differently. For example, most attention in Manacupuru is on serving needs of maternity benefits and child welfare. In May 2001, for example, 4 professional staff managed 91,000 beneficiary cases. Only 9262 were rural pension cases and only 1303 rural pension cases were from Iranduba. The Itacoatiara Office handles fewer cases and focuses more on pensions or social security. There were 6822 INSS beneficiaries in January 2001 of whom, 63.8%, or 4354 cases, were rural producers seeking pensions. In May 2001, the caseload increased to 11,055 beneficiaries, however, the percent seeking rural pensions remained at 61.7%, or 6822 rural producers. The 5 professional staff said most urban beneficiaries are pension recipients; but they do extend a large number of services for maternity benefits and child welfare services. No data by sex of beneficiary exists.

Table 7.4.1-3 INSS beneficiaries by INSS Office and Study Municipality: May 2001

INSS office	Municipality coverage	Rural	Urban	Total
Manacapuru	Manacupuru, Iranduba, Novo Ariau, Anama, Anori, Beuri	71,00	20,66	91,66
Itacoatiara	ItItacoatiara, Nova Olinda, Uurucurituba, Silves, Itaporanga, S. Lehanties Voitrira	7,821	3,117	10,938
Maues	Maues, Boa Vista da Ramos	3,550	1,159	4,700
Total		18,471	6,342	24,804

Source: INSS office, July 2001 Statistical Report

A person collects monthly pension at an INSS designated bank within the municipality of residence. INSS publishes in newspapers and provides to clients the calender days that their pension checks will be available to them. The client must show a INSS plastic identity card to receive the pension. Another person cannot collect the pension for them. This procedure is designed to prevent a person from collecting two social security checks if he/she has worked for 10 years for an urban employee and at least 10 years as a rural producer or laborer. River community residents distant from Itacoatiara town and sometimes collect their pension every two months due to transport cost.

Table 7.4.1-4 INSS Beneficiaries by Type of Beneficiary and INSS Designated Bank By Study Municipality: January 2001

INSS receipt location	Rural	Urban	Total	Percent Rural	Percent of Total Receipts
Iranduba- BEA	1303		1303	100.0	14.1
Itacoatiara – BEA	866	480	1346	64.3	19.7
BASA	955	409	1364	70.0	20.0
Banco Do Brasil	795	569	1364	58.3	20.0
Banco Bradesco	824	544	1368	60.2	20.1
Caixa Economica	914	466	1380	66.2	20.2
Total	4354	2468	6822	63.8	100.0

Source: INSS Manacapuru Office, June 6, 2001; INSS Regional Office. Itacoatiara. June 27, 2001.

A rural producer is assigned one bank. In Iranduba, Banco da Amazonias (BASA), now AFOEM is the designated bank for all pension recipients. In Itacoatiara, pension disbursement is evenly divided among all banks located in Itacoatiara, although BASA serves more rural pensioners (70%) and Banco Do Brasil the least (58%). In Maues, the number of beneficiaries who receive rural pensions is 3,016. The bank with the most rural pension clients is BEA.

(2) Eligibility of Rural Producers

A producer, partner, sharecropper, rural tenant, or fisherman is eligible for rural pensions. Any person of 16 years and older is eligible to pay into social security. A female spouse is eligible for pension provided all her documents designate her as a producer, partner, sharecropper, or rural tenant, and not a domestic worker. All rural persons paying into social security must complete INSS forms accurately and present adequate documentation that prove not only their identity, but also that they have worked in their family economy or have engaged in paid labor for others for the required work period of the year of application. They must also prove that they have paid income tax of 20% of minimum wage for at least 12 months. The number of years of required work to access a pension increases 6 months every year. At the present time it is 10 years, with at least 3 years of successive work. Hence, in 2002, a rural producer must show he/she has labored for 10 years, 6 months and by 2013, he/she would have to prove a work period of 16 years, 6 months.

(3) Required Documentation for Rural Pensions

While there are standard required documents used to trace employment history, the Head of each Regional Office sets priorities on which documents are acceptable. In 2001, seven documents must be present to start the process of review:

Table 7.4.1-5 Required Documents for Accessing Rural Pensions

Document Required	Details
Authorized birth certificate from Cartorio	Proof of eligible age: Men 60 years of age; women 55 years
Land title, user rights, rental contract of land	Land title from INCRA, user property rights title from the Fazenda or property rental contract that shows proof of rental payment; Imposto Territorial Rural (ITR) receipts for paying land taxes
CPF or Cadastro de Pessoas Fisical identity card	From Receita Federal, Secretary of Fazenda. Enables agency to trace credit history, search whether the rural producer or the person or company a person works for has paid INSS, and paid income taxes
Identification card	Rural producer card, election card, but prefer mainly Labor card issued by Department of Labor
Documentation as rural laborer or producer	Documentation from various sources that indicates at least 10 years of labor as a rural producer and at least 3 years of work successively as a rural producer or worker
INSS contribution	Documents that indicate payment to INSS of a minimum of 20% of minimum wage (R$36/ month or R$438) for 12 months prior to application

This year, the Federal Government (Union) passed a law stating that in 2006 all persons seeking rural or urban pensions would have to have an Income Tax Number identity card and show original income tax receipts for a ten year period to become eligible.

(4) Supplementary Documentation

Regional Offices often require additional documents for approval since land title or user rights documents from the government are usually available only to those in settlement schemes. Labor activity can be proved through old documents as well as labor records and income tax receipts. Each document needs to show that the farmer's profession is that of a farmer, rural worker, or artisanal fisherman. A woman who states she is a domestic worker is not eligible unless she can prove through other documents that she is a rural producer. These following eligible supplemental documents are carefully reviewed by the INSS employee for consistency and accuracy:

- Marriage license
- Children's birth certificate
- Register in TRE
- Verification of registration in school own or children’s
- Receipts of purchases of implements agricultural
- Association or cooperative original minutes receipts
- Verification of ITR land tax
- Inputs verification of EMATER/ new IDAM
- Income Tax
- Registration of religious entity
- Vaccination card
- Registration Record in a trade union (syndicate) and receipts of union monthly payments.

Office preferences vary. In Manacupuru, INSS staff do not place as much importance on the ITR and CPF (Receita Federal Number) because most rural producers do not keep receipts, pay land taxes, or have title to land to pay taxes, especially producers living on the varzea. They prefer official hospital and school records, marriage certificates or election cards. The most important documents are the official birth certificate and documents filled out by the Syndicate of Rural Workers that prove the rural producer paid his monthly contribution for at least 10 years (R$3 per month) and paid into INSS 20% of the minimum salary for 12 months (or R$36 per month or $432). The INSS Manacapuru staff actually encourages rural producers to ask the Syndicate of Rural Workers (STR) to help them complete required documents. The STR office in Manacapuru is well organized and helps complete INSS formulas for members in 250 communities, with only a STR delegate in Iranduba are most STR activities handled from Manaus. By contrast, the Itacoatiara Regional Office requires original income tax receipts documenting agricultural inputs purchases or sales produce over at least a 10 year period, including receipts for 3 years of successive work and the rural producer's ITR or land tax receipt number. They will review and also accept 10 years of official hospital records and receipts as well as official school records of children. These also document the occupation of the spouse. The only acceptable identification card accepted, is from the Department of Labor. Only producer association records in the original minute records showing regular attendance are accepted.

Table 7.4.1-6 Documents most used for approval of rural worker pensions by municipality and INSS office: 2001

Municipality	INSS Office	Documents in order of priority
Iranduba	Manacapuru	STR documentation of rural worker status Election card Hospital receipts (shows occupation of husband/father and wife/mother) Used not so frequently now-- IDAM declarations that rural workers have received seeds from IDAM
Itacoatiara	Itacoatiara	INCRA-posse, land title ITR or Receita Federal (indicating that a rural producer has paid his income tax (for minimum of 10 years) birth certificate from Cartorio. If these exist, other documents which help with approval are: (iv) Identity card (gives political status) and (v) labor card from Labor Dept. IDAM declarations are not used. STR preparations of pension documents are used as supportive evidence to the first three.

(5) Prevmovel Assistance for Rural Areas

INSS set up a new system called "Prevmovel flutante or floating INSS service" to aid people living in rural areas to access pensions and other social benefits. Already used in Para and Rondonia state, to serve 12,7000 people, Prevmovel was initiated in the Amazon in June 2001. The Prevmovel is a Catamara type ship that contains an office, medical clinic, bathrooms, waiting room, and lodging for the INSS team. It is equipped with 3 computers, a printer, and a Xerox machine. The INSS team assigned to the floating service boat consists of a coordinator, three assistants, one social assistant, a doctor, and DATAPREV computer technician. The operating cost of the boat is estimated at R$ 800,000 per year.

Services include:

- Registration for rural pensions
- Consultation on benefits for workers and their dependents
- Schedules for back payments of contributions to INSS
- Medical consultation
- Certificates of Negative Debt, i.e. certificates that demonstrate the person or company is debt free
- Registration for new companies
- Registration new work activities
- Registration new taxpayers

The INSS service boat or Prevmovel will spend 3 to 4 days in each of the 24 municipalities and return every 4 months for repeat service. The aim is to assist 36,100 beneficiaries of INSS to get benefits and to serve 64,100 taxpayers. Only Iranduba municipality will receive this service of the study municipalities.

Table 7.4.1-7 Municipalities to be involved in the INSS Prevboat Project

Municipality			
Autazes	Beruri	Novo Aripuana	Silves
Alvaraes	Caapiranga	Sao Sebastião do Uatuma	Barreirinha
Anori	Coari	Boa Vista do Ramos	Itapiranga
Uarini	Codajas	Nova Olinda do Norte	Iranduba
Anama	Careiro da Varzea	Uricurituba	Manaquiri
Borba	Manicore	Nhamunda	Urucara

(6) Mayor's Office Assistance with INSS Documentation

The Municipality Secretary of Social Assistance has staff to help rural producers get their documents, especially birth certificates. In Itacoatiara, this service is currently underutilized. The new Secretary of Assistance is of holding nuclear meetings in one location for 4-5 days in collaboration with a Cartorio. The first campaign enabled 510 persons to get a birth certificate. While this service is principally oriented so children can attend school, it will also help older rural producers get birth certificates as one step towards getting their INSS document. In Iranduba, the Secretary of Social Assistance organizes free bus service from Iranduba town to Manacapuru once a month to enable persons to process their papers. In Rio Preto da Eva Municipality, the Mayor's office supports a communication van that travels up and down secondary roads monthly to encourage rural producers to apply for an INSS card.

The Secretary of Production in Iranduba also encourages elderly rural producers to apply for pensions because they are the major source of capital for hiring young workers to stop rural out-migration. Some INSS offices will accept this card as part of supplemental documentation.

(7) IDAM Assistance with INSS Documentation

One of the documentations permitted by law for supporting rural producer or worker applications is a declaration by an IDAM chief that the person has received seeds or other inputs as a rural producer. The declaration must include the name of person,

date of declaration, dates-day/month/year service received from IDAM, IDAM chief signature, stamp, and be on letterhead paper. Manacupuru INSS office will accept these documents if they can show 3 years of continuous service from IDAM. Itacoatiara INSS office will not accept IDAM documents as they state they can be politically manipulated.

(8) Analysis of INSS Requirements, Activities, and Stakeholders

A major constraint on rural producers is lack of documentation. They do not keep documents, do not know which ones to keep, have difficulty conserving them in the humid climate, and culturally do not see the importance of building up documents for a future reward from government. Moreover, traditionally women rural producers have identified themselves as domestic workers or mothers on official documents. This now makes it difficult to access pensions as rural producers. Rural producers need training in what are documents, how they can benefit them now and in the future, where to get them, how much they cost, when it is appropriate to get them, and in what ways they can conserve them. The major constraints and main reasons for these constraints are summarized below:

Table 7.4.1-8 Lessons Learned in How to Improve Access to INSS Social Security for Rural Producers at Community level (1/2)

Constraint	Major Causes	Lessons Learned How to Overcome Constraints
Lack of Birth certificate	Rural producers born at home with mid-wife. Delay of acquiring birth certificate until Most learn from INSS that it is required for pension; or income tax number to access credit Get for children to go to school but do not keep it safe and secure.	Producer mobilization training in human and legal rights and importance of person to have a legal identity1/ Specific community based training on importance of acquiring a birth certificate early in life and not at retirement age; Mobilization training on saving money to pay expenses incurred to obtain certificate from Cartorio (notary public); More accessible Cartorio services for birth certificates Training in how to keep documents safe and away from insects
Lack of Land title or user rights document	Most rural producers do not have titles unless they were brought into settlement schemes by INCRA. Land 15 km on each side of the Amazon highway is owned by the government; producers cannot possess Varzea farmers do not have any proof of user rights because varzea land is managed by the navy. Varzea farmers have informal partnerships (partneiros) for cattle raising with a larger livestock owner with usually no cash exchange. Extractivist do not possess land or forest rights; only extractivists living in federal reserves (RESEX) have ownership rights. Extractivists living in PTA or protected reserves of the municipality have no formal land/tree rights	Policy research needed to determine different types of entitlement according to types of producer settlement organization2/ Policy awareness of legal and management constraints of rural producers living in different ecological conditions needs policy formulation and coordination at state level. Policy coordination on effects of federal, state, municipality, and traditional management and ownership systems on land title development and farmer organization business development needed Policy research on varzea title development and land rights

Table 7.4.1-8 Lessons Learned in How to Improve Access to INSS Social Security for Rural Producers at Community level (2/2)

Lack of Proof of rural economic activities	Most trade is in informal economy. Middlemen who buy at community, river ports, or Manaus do not give receipts and pay in cash Boat transporters charge passenger service and producer unit charges but provide no receipts Most producers do not keep production records	Train Rural producers (male and female) to keep record books on expenditures and revenue as a monthly habit3/ Mobilize farmer associations to discuss producer records at meetings to encourage saving receipts for inputs and sales and asking for cash receipts from purchases and sales Recommend change in government law to not require receipts as documentation of work, but producer record books
Lack of Proof that Women are producers or laborers	Women put domestic worker on official documents (school, health, marriage certificate) Female membership in STR is low	Mobilize and train women on the importance of her role in production and the production chain and importance of membership in producers association4/ Conscientize women to identify herself as " rural producer" on official records by frequent social education meetings5/
Lost of documents	- Valuable papers are often lost or deteriorate with humid climate and housing conditions	Mobilize groups to prepare safe boxes and use natural insecticides to secure documents

Source: INPA, Project Varzea, 2000. Interviews with Coordinators of Reca Project, Commissao Pastora da Terra. Conflictos da Campos, 1999 published by Commissao da Terra.

7.4.2 Infrastructure for Birth Certificate Services for Rural Producers

(1) Introduction

Acquiring a certificate of a legitimate birth is the single most difficult document to obtain for rural adults. In order to access government services, school entrance, factory employment, registration of an association, opening of a bank account, CPF card, and an income tax number, an identification card is required. The only acceptable identification card is one obtained with a birth certificate. Birth certificates are acquired at a Cartorio Office, of which there are three in Itacoatiara, two in Maues and one in Iranduba.

A Cartorio is a Notary Public Office that is privately run by families approved by the Federal Government. A Cartorio cannot require payment for the first birth certificate. It can require payment for those over 4 years and for replacement birth certificates for adults. Most cartorios assume anyone over four has lost the original true or untrue, and charge a replacement fee. For persons 11 years or older, the applicant must also present a judical approval paper. This is obtained from a municipal jude by resenting documents to prove a person's identify, often with a lawyer's help. In Itacoatiara, the usual fee is R$15-25, but it can go as high as R$50, depending on the urgency of request. For a newborn, a fee of R$20-25 may even be charged if the family wants to receive the newer federal birth certificate (color printed) instead of the older (black and white) certificate.[4]

(2) Required Documentation for Birth Certificates

Hired by the Municipality Secretary of Healt, the health agent does not motivate

4 Interviews with Itacoatiara Municipality Secretary of Social Assistance, Cartorios, and Rural Producers, June 2001.

adults to obtain theirs (Interview with Health Agents, Iranduba, Itacoatiara, Maues: 2000 and Santarem, 2001) . Culturally a health agent, usually a male, does not assist at delivery even though a Cartorio requires the Community Health Agent to be present with the mother to "prove the birth". A Cartorio will not accept the word of a traditional mid-wife (*parteira*) [5]

A birth certificate list parentage. If the mothers and chlid accompany the Health Agent to the Cartorio's office for interview, only the mother's name is legally accepted and listed. If the father (or father and mother) plus child and Health Agent are present, both parents names are officially accepted and listed. An important task of an Health Agent today is to promote birth certificates for newborns.[6]

(3) Municipal Assistance for Birth Certificates

The Municipality Secretary of Social Assistance in Itacoatiara is initiating a program of a 4 to 5 day Cartorio visits to help rural families obtain birth certificates. The first visit was at a military base and 510 persons obtained certificates in May 2000 in 4 days. The Municipal Secretary and a Cartorio are interested in expanding this program into a floating service of 4-5 days per month. A floating Cartorio Service boat will reduce the cost for rural families to obtain birth certificates. He can also provide other documents such as land titles and legal association registration papers. The municipality is currently preparing a plan of operations and budget for this effort.

(4) Lessons Learned from Birth Certificate Procedures

Access to birth certificates requires municipality collaboration with the Cartorios of the Municipality and incentives for them to expand this service. It also requires making rural producers aware of the importance of obtaining a birth certificate at birth, not only for the future education of their children but also for obtaining other government services as adults. IDAM extension program used to include this service under EMATER rural extension programs. IDAM no longer engages in this activity. As frontline rural extensionists, they could provide a valuable service by training local persons to conscientized young mothers and fathers of its importance and to prepare during pregnancy a savings fund to pay for such services, this would make their assistance to individual rural producers easier later on.

Over the last ten years in the Amazon State, there are increased efforts to help make persons aware of their rights as citizens. The efforts are at an early stage of development. They are based mainly on Municipality government initiatives and personal initiatives of individuals currently in government. The rural extension "monitor" program that assisted rural producers with consumer needs and citizen rights to obtain rural producer cards and pensions under EMATER stewardship is not a priority activity now under IDAM.

5 Interview with Cartorio, Itacoatiara Municipality, June 2001.

6 Confirmed in interviews with head of Cartorio 2, Municipality Secretary of Social Assistance, and INSS Regional Office Director, Itacoatiara, June 2001.

Table 7.4.2-1 Lessons Learned in How to Improve Access to Birth Certificates for Rural Producers

Constraint	Major Causes	Lessons Learned How to Overcome Constraints
Government requires official proof from someone other than parents of birth For newborn and children under 4, only the Health Agent's word is acceptable After 11 years old, the law states that a person has to go to a judge to prove identity	-Health Agent must be present at Cartorio interview. -Cartorio will not accept word of mid-wife (pateira). -Health Agents have other duties and some consider this a low priority activity -Most rural producers do not know citizen laws or legal procedures how to obtain birth certificates at any age	- Mobilize municipality government to allow others to be acceptable witness, such as Cathecist, Producer Association President, Community Association President - Mobilize rural producers of importance of obtaining birth certificates at time of birth
Repeat visits to Cartorio are required to obtain certificate Usually the process takes 2-4 months	- Cartorio, a private family business, provides birth certificates for government. As their main source of income is based on preparing land titles, association documents, and legal commercial tenders, they give this service low priority. - In Itacoatiara, 3 Cartorios provide birth certificate services one day per week. Main Cartorio reduced its service to the first 30 clients on Monday. Applicants taken on a "first come first serve" basis. In Iranduba and Maues they provide services 5 days/week. -Families usually do not have funds at time of birth for overnight stays, food, transport, quick service certificate preparation costs. Delay leads to postponement or nor acquisition.	- Municipality government supports a floating legal aid service for birth certificates for Cartorios to provide birth certificates and other services directly in rural areas1/ - Mobilize rural families to save or open special savings account for processing legal documents. - IDAM technical staff be trained in birth certificate advocacy and train multipliers at community level to help families organize papers and savings account
Both parents, child, health agent or father, child and health agent must be present to legitimately register a child	- Some "welfare scandals" have existed. - Government wants official word of identity to minimize their social expenditures ?	- Families need to save money to pay transport and lodging for father, mother and health agent so that child can get certificate at birth (which usually is free when normal process is used)

7.4.3 Improving Access to Social Security

Improving access to social security is a major source of income generation for each Municipality. According to the February 17, 2000 Executive Report on the Social Providence Report on the Movement to Increase Social Security Services to Communities (Projecto Movimentacao: A Previdencia Na Comunidade), INSS benefits paid to residents represents 50.5% of municipality revenues. It constitutes 67.4% of Iranduba revenue, 44.3% of Itacoatiara's and 50.2% of Maues' revenue.[7]

Table 7.4.3-2. Amount1/ and Percent of Contribution of INSS Payments to Iranduba, Itacoatiara and Maues Municipalities: 2000

Municipality	No. of INSS Recipients	%	FPM Receipts2/	%	ICMS Receipts3/	%	Total
Iranduba	2322.62	10.5%	2379.33	67.4%	1151.09	32.6%	3530.42
Itacoatiara	13217.57	59.5%	4211.06	44.3%	5284.25	55.7%	9495.31
Maues	6665.33	30.0%	3059.14	50.2%	3037.03	49.8%	,096.17
Total	22205.52	100.0%	9649.53	50.5%	9472.37	49.5%	19121.90

1/Amount is provided in R$1000
2/FPM Receipts are those paid by INSS.
3/ICMS Receipts are those collected by Municipality taxes.
Source: INSS. Executive Report: Project Movimentacao: A Previdencia Na Comunidade. 2000, pages 56,58, and 82.

For the federal government, the amount the government receives from INSS payments is much less than that paid to beneficiaries in each Municipality. The average annual contribution is five times more in Itacoatiara than in Iranduba and Maues, or R$2,557,230. This is likely due to higher wages from industrial employment, such as the timber industry and labor unions who required payment into INSS. The least number of beneficiaries of INSS are found in Iranduba in both 1997

7 INSS. Executive Report. Projecto Movimentacao: A Previdencia Na Comunidada, p. 56,58, and 82.

and 1998, and they represent less than 1% of all Amazon State INSS beneficiaries. The amount paid to INSS beneficiaries in all three municipalities was R$19,847,800, or slightly more than 6% of all INSS contributions made to the Amazon State.

Table 7.4.3-3. Average Annual INSS Contribution, Total INSS Beneficiaries, Total INSS Payments: Iranduba, Itacoatiara and Maues Municipalities: 1997 and 1998

Municipality / State	Average Annual INSS Contribution		Total INSS Beneficiaries		Total Value Paid to INSS Beneficiaries1/		Percent Total State Beneficiaries (%)		Percent Total Value Paid to State Beneficiaries (%)	
	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998
Iranduba	499.76	587.04	13,035	13,325	1,702.56	1,869.57	0.83	0.81	0.60	0.57
Itacoatiara	2557.23	2607.06	75,122	77,845	10,828.00	12,068.72	4.77	4.74	3.80	3.71
Maues	464.65	361.23	39,269	41,570	5,194.69	5,909.51	2.49	2.53	1.82	1.82
Municip. Total			127,426	132,740	17,725.25	19847.80	8.09	8.08	6.22	6.10
State Total			1,574,683	1,643,986	284,978.78	325,305.37				

1/ Value in R$1000

Source: INSS. Executive Report: Project Movimentacao: A Previdencia Na Comunidade. 2000, pages 56, 58, and 82

The current movement of Mayor's to increase birth certificates of young children to enable them to attend schools may also help them later in life receive access to social benefits. A movement to encourage adults to obtain their birth certificates, get registered with INSS, and become eligible for social security benefits can have a positive impact on the amount of money to be circulated in the State and specifically in the study municipalities. Increased circulation of money will have stimulate economic development.

7.4.4 Recommendations for Improving Access to Social Services

(1) Need for Social Education on Legal Rights and Available Services

The potential rural beneficiaries 18 years or older for state provided social welfare services in the study area is 32,000. Of these about 15,000 are eligible for rural pensions and a potential 37,602 rural women may eligible during their life for maternity benefits of 4 months. For rural and pregnant women the amount of social security is not large, but it could be the sole means of survival. However, considerable documentation is required that most rural producers, especially women, do not know they need nor know how to get them. Recommended is the IDAM staff organize a series of community based workshops to provide education on types of government services available to the, legal documents required to access them, and how to organize papers to meet specific conditions for getting maternity benefits, rural pensions, and their associations access certificates of no debt so that they can remain legal associations. To complement these workshops, visual aids and simple instruction stories or pamphlets that point out the benefits, procedures, and reasons not to wait until retirement age to get benefits to secure documents.

(2) Improved Access to Cartorio and Municipality Legal Services

A birth certificate is required as a supporting document for most services - including school entrance. This requires Cartorio service. Other documents such as marriage certificate, death certificate, certification as owner, partner, extractivists, sharecropper similarly require Cartorio service. For other services, legal and commercial certificates are required from the municipality services. Recommended is the project provide financial support to each municipality to organize a joint municipality/Cartorio mobile service to provide farmers with essential livelihood services for themselves and for the future of their children.. The mobile service would be two kinds. One would be a floating boat service. The second would be a mobile van. Both would be equipped like the earlier described INSS service boat. Not only birth certificates and death certificates can be obtained, but also the Cartorio could do other services of associations as well as of individuals. The municipality legal offices could perform needed services at reduced time and transport cost to farmers. The schedule and number of service units would need to be calculated for each municipality since the Cartorio would have to hire persons to cover time absence from office. A minimum of 5 days per month for floating and 5 for mobile van service would be recommended to test out the new delivery of municipality/Cartorio services approach to rural people.

(3) Subsidies for Safety boxes

Given the climatic conditions and housing conditions, keeping important documents safe is difficult. This is compounded if they must be kept safe for a lifetime. Training on which documents are essential and how to keep them safe would be recommended through IDAM extension or locally trained persons who would then train others in the community on security measures. Following this training, instead of certificates, recommended is the receipt of a metal safety box. This is expected to encourage more conscious monitoring and managing of their essential documents for themselves as persons, as families, and as an association.

7.4.5 Contag and Syndicate of Rural Workers Association Services

(1) Introduction

The Brazilian National Conferation of Agriculture Workers (Contag) is the largest producer or peasant union in Latin America. Founded in 1963, it comprises 15 million workers, organized in 25 state federations (FETAGRI) with over 3,600 syndicates of rural workers (STR) and community level delegates. Contag holds annual congresses and board elections. Its structure consists of a President, Vice President (Secretary of International Relations), General Secretary, Finance and Adminstration Secretary, Social Policy Secretary, Agricultural Policy Secretary, Secretary for Formation and Organization of Sindicates, Coordinator for National Commission for Rural women Workers, Secretary for Paid Workers, and Secretary

for Agricultural and Environmental Policy.

Contag represents the interests of permanent or temporary paid workers, family farmers (owners or tenants), landless, vegetal extraction activity (nuts, latex workers, fruit collectors, and medicinal plant collectors).

Restrained during the military government, the Syndicate Movement of Rural Workers (MSTR) has been a powerful force during certain periods of national development. During the late 1970's and 1980's, rural labor unions worked actively with the Community Eccelesastical Base movement in the Northeast and in the Amazon State to organize rural laborers gain INSS rights, fight for cash wages, access land titles and promote democratic government. Their main activities include

- land reform
- family agriculture
- paid-for rural workers' labor rights
- assistance with social security
- heath and education assistance
- gender awareness and rights
- organized struggle against child or slave-like labor

They hold annual congresses, offer technical courses in citizen and labor rights, provide training on agricultural technologies and systems of agroforestry, and develop basic information pamphlets, posters, and videos to be used for training rural producers and extractivists. Monthly membership fee is R$2.5 or R$3 per month.

(2) Activities Carried out in Study Areas Relevant to Our Study

Social security assistance. The most active program of Contag is providing rural producers and extractivists with social security assistance. STR office staff assist producers to complete INSS formulas, organize receipts, access their birth certificate, and discuss their case with the INSS staff. They provide members with rural producer cards and necessary receipts to demonstrate they have been paid members in specific years. At current rates of 20% of minimum wage, a rural producer must demonstrate payment of R$36 per month for 12 months, or R$432 into INSS. Some STR offices will provide 12 month receipts if the person pays a lump sum to them. The STR offices tend to be most active in areas where there are land struggles.[8]

For example, in Manacapuru, there is an on-going land struggle for 400 families whose land use rights were given to persons from Brasilia. This office not only assists members of 250 communities be registered as rural laborers or rural producers but assists the 400 families with legal action and finance. The Manacapuru STR coordinator also provides lodging for rural workers while they are completing their

pension paper work. In Parintins, STR staff frequently accompany rural producers to offices so they are not overcharged when they are securing documents. There is only a delegate office in Iranduba and a relatively unactive office compared to the 1970-s and 1980's in Itacoatiara.

Participation on PRONAF Municipality Councils of Rural Producers (CMDR). Under the federal program of PRONAF, each municipality prepares a decree stating size and type of membership every two years. Membership must be 50% from government offices and 50% non-governmental. CMDRs in the State of the Amazon have at least one Syndicate of Rural Worker delegate. The Mayor of Rio Preta Da Eva Municipality has even requested that STR hold meetings and elections to determine which communities and community leaders will be CMDR representatives and increased in the latest CMDR formation degree that out of 6 nongovernmental members, 2 are STR members.

Project on Sustainable Rural Development.

In 1995, Contag approved this participatory planning approach for municipalities and communities and received technical assistance from GTZ for developing design and implementation strategies. Project outputs are to enable rural families to identify, assess, and develop solutions to their land, labor, and capital constraints using participatory diagnostic surveys and community planning programs. Specific project objectives are to widen land reform, expand and strengthen family agriculture, create jobs and income in rural areas, develop alliances between rural and urban workers, promote changes in the rural education system and promote better social policies that favor extractivist and poor rural agricultural families. Core groups of Contag members and consultants have been trained in this methodology. Due to limited funding, about two communities in each municipality will be involved in this project as models for the community. None of the study municipalities have carried out this national project activity to date, but labor union staff in the Amazon are being technically trained in participatory methodologies.

Key organizational techniques emphasized in this project approach are useful for designing farmer organization interventions. These techniques can be used in programs to strengthen the capacity of CMDRs under PRONAF and train farmer organizations how to plan projects:

- form mobilization groups and train them in specific skills to stimulate rural families to participate throughout the project design and implementation process
- hold frequent meetings or development forums at each step to keep all families in the decision-making and process
- organize work groups and make distinctive from mobilization groups to

8 Nasciamento. STR Director, Manacapuru. June 2001.

increase the number of participants and provide checks and balances on persons involved in activities

- provide, specific training skills to each work groups so that they recognize they must work together or the planned development project cannot be achieved
- involve other institutional partners to ensure quality and appropriate training
- encourage families to evaluate their work so that they develop confidence and skills to continue the process themselves or with other agencies.

7.5 Environmental Management

7.5.1 Environmental Management

To develop a sustainable utilization of the tropical rain forest in Amazon Region, seventeen (17) subprojects under the PPG7 project are being under taken presently, and such projects are supposed to be carried out continuously through the leadership of MMA and the World Bank in cooperation with concerned government organization, NGO's and local residents living in the Amazon Region. Annex 7.5.1-1 shows the project components of the PPG7 project at phase one stage, and Annex 5.3.4-1 shows the project title and objectives of subprogram for on-going projects. PPG7 project includes basic policy and guidelines for the Environmental Management in the Amazon Region. Accordingly, it is recommended that IDAM shall take careful consideration of the new projects to be prepared in future, and all of the project planned by IDAM shall be carried out according to the result of the PPG7 project. The necessary data and information of the PPG7 project and related environment will be obtained through the organizations of : ⅰ) INPA, ⅱ) EMBRAPA, ⅲ) IPAAM/PGAI, ⅳ) IBAMA, etc. Figure 7.5.1-1 shows the data and information source for the PPG7 project.

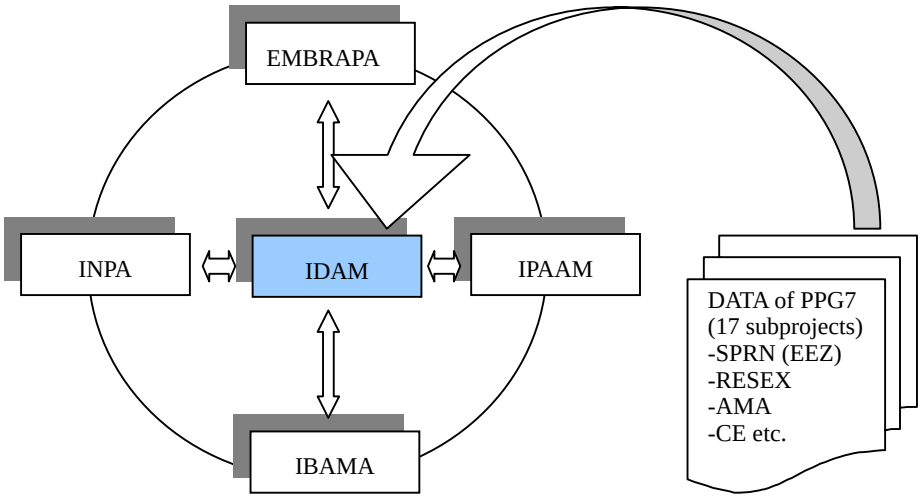


Figure 7.5.1-1 Data Source of Environment

It's been seven years past, since the start of the implementation of PPG7 project and the phase one work of this project is reaching its final stage (Transition phase of the project). Within this period, logical frameworks for the environmental preservation

have been completed and many environmental data and information regarding the Amazon Region have been reported through the activities of the subprojects. Presently, 68 projects are on going in the Amazon Region (Refer to Table 7.5.1-1 and Figure 7.5.1-2). In addition, it is supposed that many projects will be carried out in the Amazon Region in future under the PPG7 so that it is very important that the result of each subproject shall be reflected to the agricultural project prepared by IDAM.

Table 7.5.1-1 Selected Projects of the PPG7 by State in 1999

Name of Project	Acre	Amapa	Amazo-nas	Maran-hao	Mato Grosso	Para	Rondo-nia	Roraima	Tocan-tins
Natural Resources Policy Project (SPRN)	3	2	5	1	1	5	2	2	1
Demonstration Projects (PD/A)	20	7	14	17	5	36	9	3	4
Extractive Reserves (RESEX)	2	1	-	-	-	-	1	-	-
Indigenous Lands Project (PPTAL)	3	1	10	-	-	7	-	4	-
Forest Resources Management Project (PROMANJO)	2	1	3	-	3	7	2	-	-
Science Centers	-	-	1	-	-	1	-	-	-
Directed Research I	1	-	15	-	-	4	-	1	-
Directed Research II	2	2	13	-	-	12	-	1	-
Floodplain Resources Management (PROVARZEA)	-	-	6	-	-	8	-	-	-
Ecological Corridors	-	-	1	-	-	-	-	-	-
Total	33	14	68	18	9	80	14	11	5

Data source: STCP/World Bank

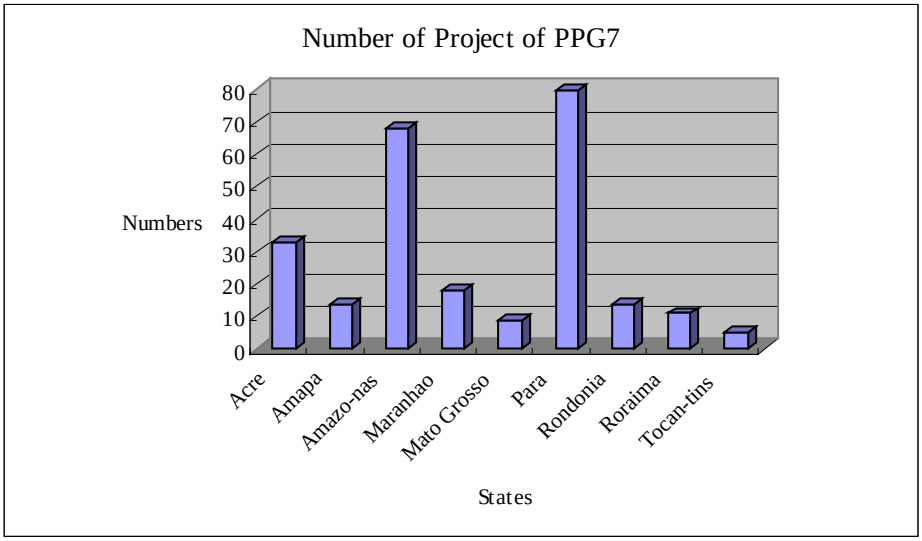


Figure 7.5.1-2 Selected Projects of the PPG7 by State in 1999

7.5.2 Existing Conditions of EEZ

Schemed areas of the JICA project are not assigned for priority area by EEZ, and the implementation of official zoning work is not started presently. Work execution and implementation plan of the zoning to be done in future is not clear at the present stage, however, Mause district, which is under the scheme area of JICA project is

being planned for implementation in the year of 2003 for approximately one year according to the information of PGAI and IPAAM. Survey schedule of Itacoatiara and Iranduba is not yet fixed presently by PGAI. It is said that there are no designated areas as national park, preserved forest area etc. in the schemed three project areas. Zoning work for all of Amazon Region will be done by the PPG7 project according to the implementation program finally. At the present stage, Graphic Interface System (GIS) map for several areas in Amazon states are prepared, and PGAI has completed the identification of national park, reserved forest area, and indigenous people's land in the priority area. It is supposed that only few data obtained through EEZ will be utilized for schemed JICA project at current progress.

7.5.3 Consideration of Result from EEZ

The remarkable matters identified in this survey under EEZ are zoning and clarification of hunting, fishing and extractive area and local residents living in the Amazon region. In the zoning work, conditions of those areas are clarified through the attendance and cooperation of local residents who knows well the local living conditions. Accordingly, it is required that the result of zoning obtained by EEZ shall be utilized in agriculture project by IDAM planned in Amazon Region.

7.5.4 Correspondence to Future Project

PGAI is proceeding with the preparation of vegetation map and geology map by GIS using TM picture obtained through the satellite of Landsat. In the next phase, it is planned that zoning work and accurate data acquisition in each district will be proceeded based on this GIS data. The work is to be carried out with the technical cooperation of GTZ and financing by KfW. To limit the environmental impact in the Amazon region caused by this project, careful consideration shall be provided to IDAM project for environmental preservation. The result of PPG7 that includes the basic policy and guideline shall be referred to IDAM project, and the result of EEZ that includes data and information such as hunting, fishing and extractive areas shall be utilized by IDAM project.

CHAPTER VIII MARKET DEMANDS AND CONSUMER'S TREND

8.1 Guarana

8.1.1 Recent Trend in Guarana Marketing

It is likely that the single most important factor that will determine demand for guarana in the future will depend on the success of Ambev's marketing campaign for the guarana soft drink. Ambev, in partnership with PepsiCo International, intends to export extract from the state of Amazonas. Guarana soda drink is very popular among Brazilians and the demand is expected to make a steady growth in the near future. On the contrary, marketing effort of guarana drink in Japan has almost terminated after several years of effort by major beverage companies such as Kirin Beverage and Sapporo Beer. Their guarana drinks such as "Metz Guarana" and "Ribon Guarana" did not attract enough customers, and reduced market area only in Hokkaido. Although the demand of raw guarana beans and processed products from guarana beans is considered to continue in the same level, there are still no recent published market research studies to confirm this demand. Even in the national statistics office of export such as DECEX: Dept de Operason de Comercio Exterior or NUCEX Information Center and Statistics of Trade, there is no record concerning the amount traded in recent years.

Confronting these difficulties, only possible method to estimate the future trend was to integrate available data with information taken from interviews to people involved in the processing and trading. Even though it is expected that the demand for nutritional drink will increase in the international market, the total amount exported outside the country is not very large, and thus the trend for total demand will be influenced by the trend of soda drink in the domestic market.

8.1.2 Review of Trend in Production, Price and Distribution

Based on the data in recent 4 years, weighted average indicate that two thirds of production is made in Bahia, and the Amazonas produce only around 23 %. Therefore it is assumed that the marketing trend in Bahia influences the total guarana marketing very strongly.

Table 8.1.2-1 Guarana Production in the recent years

(Unit : ton)

Year	1995	1996	1997	1998	Arithmetic Average	Weighted Average*	% to total
Acre & Roraima	167	23	40	29	65	45	2%
Amazonas	502	499	359	764	531	563	23%
Para	24	45	0	29	25	23	1%
Bahia	1,554	1,521	1,456	1,822	1,588	1,625	66%
Mato Grosso	143	182	140	294	190	210	9%
Total Brazil	2,390	2,270	1,995	2,938	2,453	2,467	100%

* Accelerated Weighted Average =(0.4 * yr98) + (0.3 * yr97) + (0.2 * yr96) + (0.1 * yr95)
Source: IBGE

Some information on farm gate prices for guarana seeds has been obtained. This price information was obtained from personal interviews with over 20 individuals and firms engaged in the guarana trading.

Table 8.1.2-2 Estimated Farm-gate Price (R$/kg), 1994-2000

Location	1994	1995	1996	1997	1998	1999	2000	2001
Maues	25	8	7	5	5	5	4.7	4.3
Urucara	23	10	8	5	4	3	3	3
Bahia	20	10	6	5	4	2	1	1

Source: Based on personal interviews with farmers and guarana traders in Maues, Urucura, and Bahia, 2001

Based on the interview survey to traders and processors, 1,000 tons of guarana seed is processed into soft drink and consumed domestically. The demand for this purpose in increasing in recent years and this tendency is expected to continue. By processing 1,000 tons of seed makes approximately 450,000 tons of soft drink, which coincide with IBGE data of domestic consumption 4.28 litre / person/ year multiplied by 100 million effective population.

Table 8.1.2–3 Consumption of Guarana by Beverage company (year 2000)

	Monthly	**Yearly**
Ambev	50	600
Coca-Cola	20	240
Tuchaua	4.0 – 5.0	50
Real	1.5 – 2.0	22
Magistral	1.5 – 1.8	20
Total	77	932

Marketing flow of Guarana in the whole Brazil is exhibited in the following diagram.

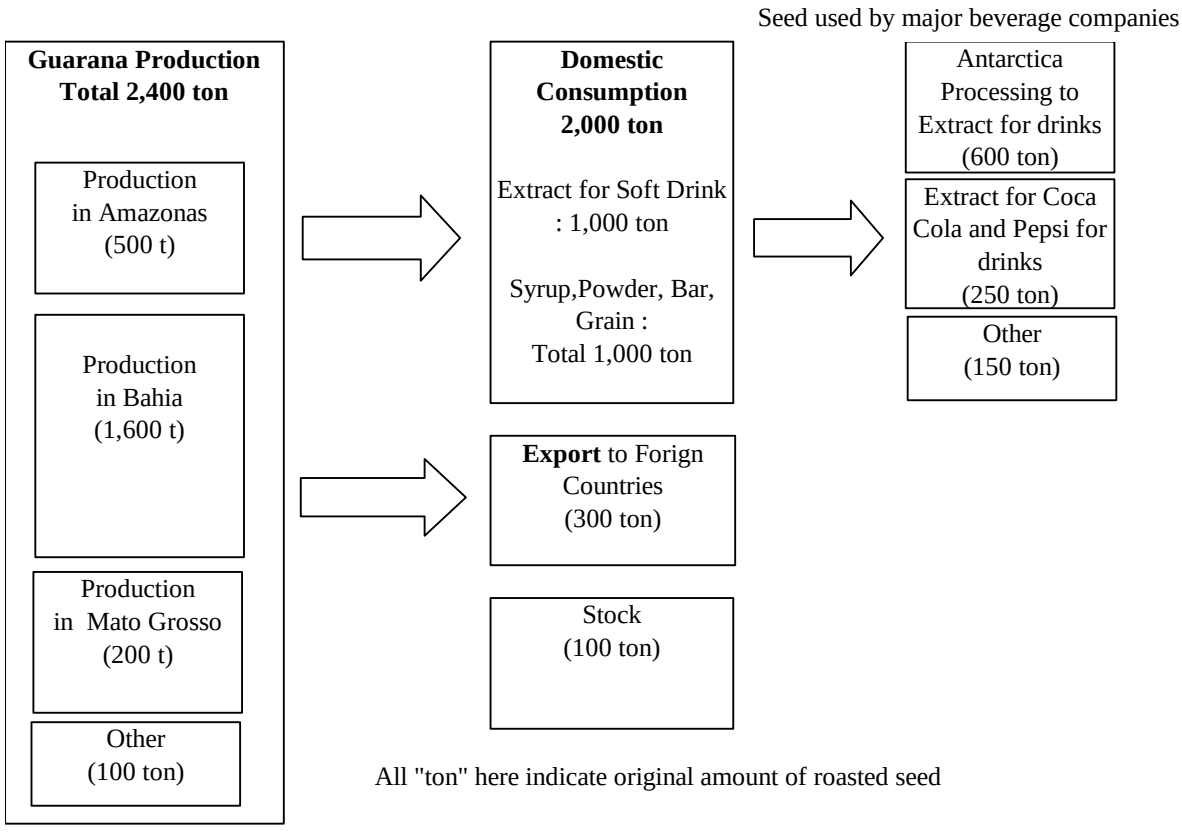


Figure 8.1.2-1 Marketing flow of Guarana

Based on the interviews to guarana traders, export data has also been collected for total tonnage of guarana seeds exported from Brazil. The table below summarizes the figures which indicates constant continuation of guarana demand for export market.

Table 8.1.2-4 Estimated Export Tonnage (MT) for Raw Guarana Grain, 1996 - 2000

State	1996	1997	1998	1999	2000
Bahia	220	300	200	200	220
Amazonas	50	100	100	100	80
TOTAL	270	400	300	300	300

Source: Guarana traders in Bahia and Rio de Janeiro

Judging from the farm gate price data and the export data presented here, it is difficult to declare any clear sign of demand increase in the near future. Price data shows consistent decline since 1994, and exports seem to have peaked in 1997 and may have recently stabilized.

8.1.3 Outlook of Market Demand

Consumption of guarana in Brazil is largely categorized into three types, 1) Soda drink, 2) Powder and bar to be consumed in the form of solution, 3) Export for Nutritional supplement. There is a constant growing demand for guarana soda drink in the domestic market, and Antarctica, one of the major beverage company, is planning to increase its production. Therefore the demand for Guarana drink is expected to grow.

Powder and bar will continue to be consumed in the domestic market including local areas, but it is difficult to expect an increase because powder form is not easy to handle. State Government of Acre is promoting a guarana powder packed by 2 grams or contain in a capsule for direct dosage. The air-tight package facilitate the portability of guarana powder and increase the value.

Export market is supported by the continuous demand for nutritional supplement drink, but it is difficult to expect a rapid increase because there are many other ingredients as nutritional source such as gin-seng. There are some farmers and traders already exporting their quality products directly to Europe.

Table 8.1.3-1 Trend of Consumption and Forecast

	2000	2005	2010
Soda Drink	1,000	1,300	1,600
Powder & Bar	1,000	1,000	1,000
Export	300	300	300
Others	100	100	100
Total	2,400	2,700	3,000

Note 1: Ambev is a merged company of Antarctica and Brahma.
Note 2 : Numbers are all tonnage in terms of guarana beans.

Maues guarana is traded in a higher price because it has a reputation to be superior to guarana of other area. Maues quality need to be preserved and guaranteed by the government so that the demand for Maues guarana will increase even in the stagnant increase in guarana demand as a whole.

Guarana demand is generally constant for the next ten years and some increase of demand for Soda Drink. As is shown in the table, the current consumption of 2,400 tons is estimated to grow to 3,000 tons in ten years.

8.2 Vegetable

8.2.1 Marketing Demand and Percapita Consumption

There are only a few studies related to marketing and the behavior of consumers. Regarding the marketing price, IDAM recently has just started a study in earnest. Other organization related to marketing also do not have enough information as well as knowledge backed by experience.

The information that the amount of supply of local produced vegetables such as leaf vegetables decrease during high water level season of Amazon river had been obtained by the study team. This fact is easily judged from the agricultural situation in Varzea. Periodic fluctuations water level of the Amazon river alters the availability of the cultivation land, causing significant variations in supply which influence price. Moreover, it was clear that the price of vegetables during high water level season of the Amazon river become high through the economical analysis of price record obtained from SEMARF. The same information obtained from a middlemen through former market survey done by the study team.

During this field survey, the more detailed market research was performed by the study team for the purpose which grasps not only the price but also amount of handling of vegetables in the market. The wholesale markets are the principal channels of distribution of vegetables. Feira Da Panair which currently deals with the local produced vegetable was selected as an object of investigation from the eight typical markets of Manaus city. The market survey was conducted on the all middlemen who deal with vegetables, and it aimed at grasping the monthly mean price and the monthly handling amount of vegetable for recent one year.

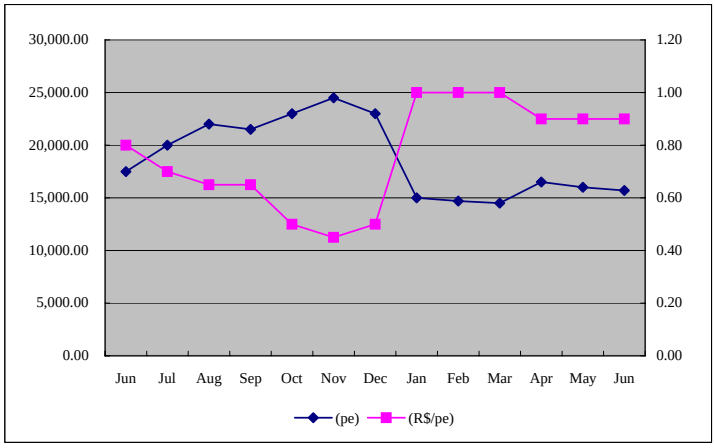
The outline of this survey result shown in the following Figure 8.2.1-1. The empirical knowledge was confirmed and backed up with figures through the survey.

The production season in varzea during the low water level phase is characterized by low prices. The table shows that each variety of vegetables is always exposed to price fluctuations due to the law of the supply and the demand.

The increase of vegetable production in varzea, which is only possible during low water level season, is restricted due to the limited absorption capacity of the regional market, risking price instability for the producers. Only an increase in per capita consumption and an increase of consumers purchasing power can justify an in vegetable production. However, a potential market still exists during the high water phase for vegetables. The production of vegetables during this period should be established through the introduction of new technology and new varieties of vegetables proposed by this project.

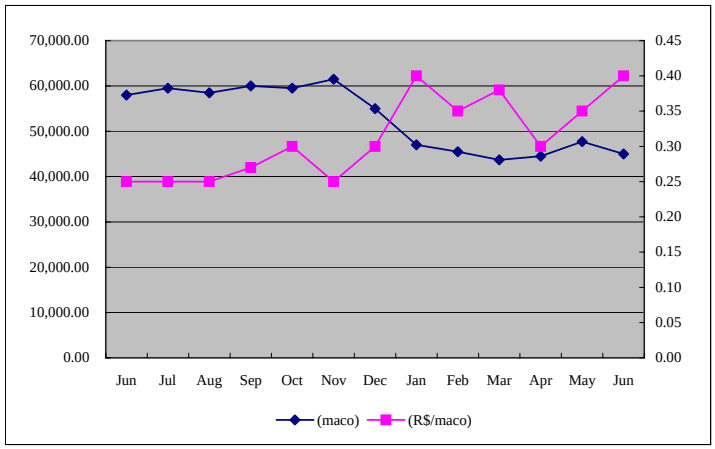
Lettuce (Alface)

	Amazon	
	Amount	Price (Buy)
Month	(pe)	(R$/pe)
Jun	17,500.00	0.80
Jul	20,000.00	0.70
Aug	22,000.00	0.65
Sep	21,500.00	0.65
Oct	23,000.00	0.50
Nov	24,500.00	0.45
Dec	23,000.00	0.50
Jan	15,000.00	1.00
Feb	14,700.00	1.00
Mar	14,500.00	1.00
Apr	16,500.00	0.90
May	16,000.00	0.90
Jun	15,700.00	0.90
Average	18,761.54	0.77



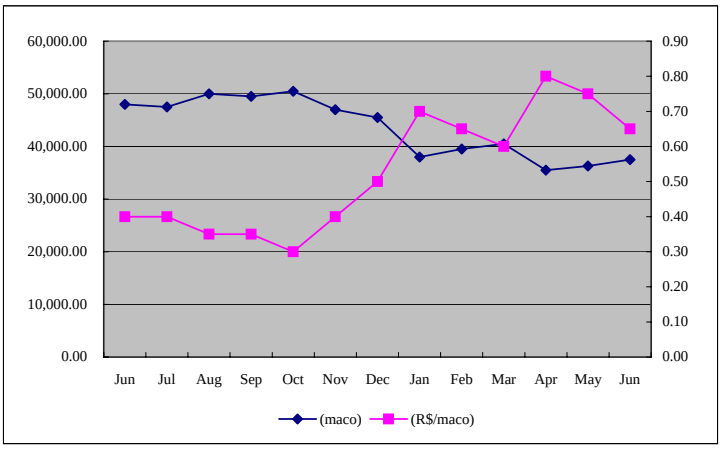
Spring Onion (Cebolinha)

	Amazon	
	Amount	Price (Buy)
Month	(maco)	(R$/maco)
Jun	58,000.00	0.25
Jul	59,500.00	0.25
Aug	58,500.00	0.25
Sep	60,000.00	0.27
Oct	59,500.00	0.30
Nov	61,500.00	0.25
Dec	55,000.00	0.30
Jan	47,000.00	0.40
Feb	45,500.00	0.35
Mar	43,700.00	0.38
Apr	44,500.00	0.30
May	47,700.00	0.35
Jun	45,000.00	0.40
Average	52,723.08	0.31



Coliander (Coentro)

	Amazon	
	Amount	Price (Buy)
Month	(maco)	(R$/maco)
Jun	48,000.00	0.40
Jul	47,500.00	0.40
Aug	50,000.00	0.35
Sep	49,500.00	0.35
Oct	50,500.00	0.30
Nov	47,000.00	0.40
Dec	45,500.00	0.50
Jan	38,000.00	0.70
Feb	39,500.00	0.65
Mar	40,500.00	0.60
Apr	35,500.00	0.80
May	36,300.00	0.75
Jun	37,500.00	0.65
Average	43,484.62	0.53

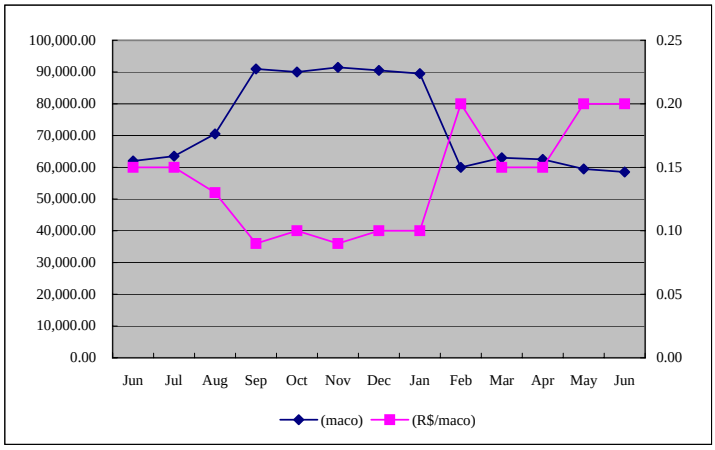


Data Source: Marketing Survey, JICA Study Team, 2001

Figure 8.2.1-1 Monthly Change of the Amount of Supply and Price of Major Vegetables in Panair (1/3)

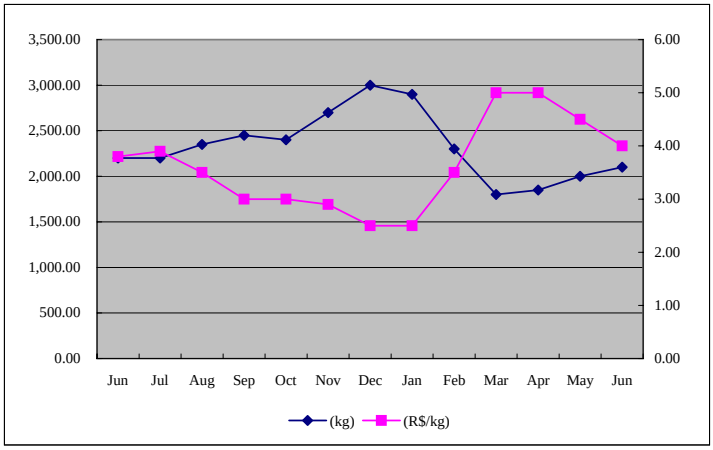
Leaf Cabbage (Couve)

	Amazon	
	Amount	Price (Buy)
Month	(maco)	(R$/maco)
Jun	62,000.00	0.15
Jul	63,500.00	0.15
Aug	70,500.00	0.13
Sep	91,000.00	0.09
Oct	90,000.00	0.10
Nov	91,500.00	0.09
Dec	90,500.00	0.10
Jan	89,500.00	0.10
Feb	60,000.00	0.20
Mar	63,000.00	0.15
Apr	62,500.00	0.15
May	59,500.00	0.20
Jun	58,500.00	0.20
Average	73,230.77	0.14



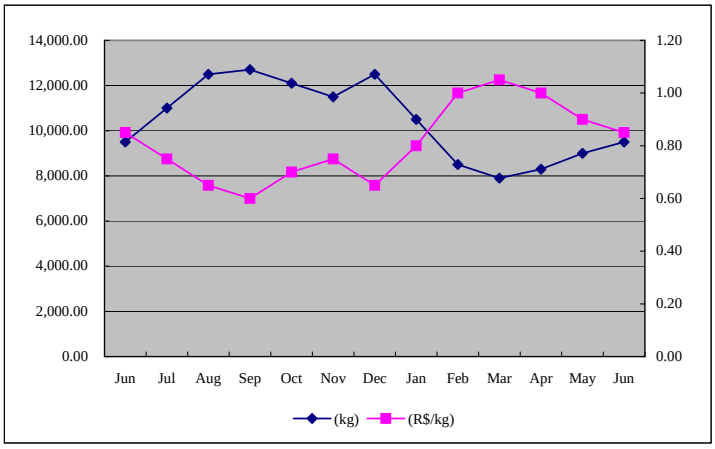
Long Beans (Fejao de Metro)

	Amazon	
	Amount	Price (Buy)
Month	(kg)	(R$/kg)
Jun	2,200.00	3.80
Jul	2,200.00	3.90
Aug	2,350.00	3.50
Sep	2,450.00	3.00
Oct	2,400.00	3.00
Nov	2,700.00	2.90
Dec	3,000.00	2.50
Jan	2,900.00	2.50
Feb	2,300.00	3.50
Mar	1,800.00	5.00
Apr	1,850.00	5.00
May	2,000.00	4.50
Jun	2,100.00	4.00
Average	2,326.92	3.62



Cabbage (Repolho)

	Amazon	
	Amount	Price (Buy)
Month	(kg)	(R$/kg)
Jun	9,500.00	0.85
Jul	11,000.00	0.75
Aug	12,500.00	0.65
Sep	12,700.00	0.60
Oct	12,100.00	0.70
Nov	11,500.00	0.75
Dec	12,500.00	0.65
Jan	10,500.00	0.80
Feb	8,500.00	1.00
Mar	7,900.00	1.05
Apr	8,300.00	1.00
May	9,000.00	0.90
Jun	9,500.00	0.85
Average	10,423.08	0.81

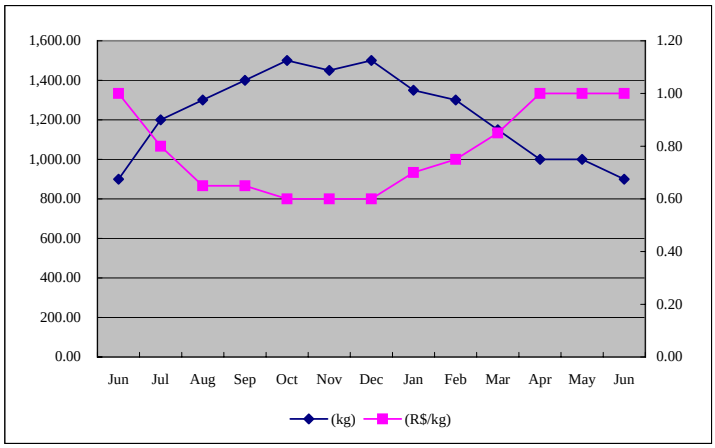


Data Source: Marketing Survey, JICA Study Team, 2001

Figure 8.2.1-1 Monthly Change of the Amount of Supply and Price of Major Vegetables in Panair (2/3)

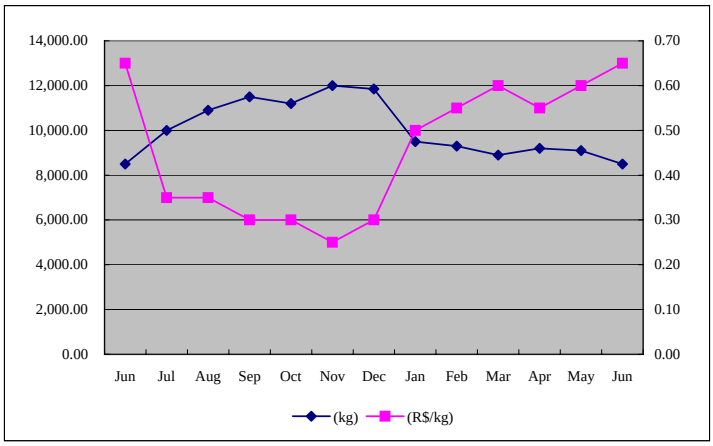
Eggplant (Brinjera)

	Amazon	
	Amount	Price (Buy)
Month	(kg)	(R$/kg)
Jun	900.00	1.00
Jul	1,200.00	0.80
Aug	1,300.00	0.65
Sep	1,400.00	0.65
Oct	1,500.00	0.60
Nov	1,450.00	0.60
Dec	1,500.00	0.60
Jan	1,350.00	0.70
Feb	1,300.00	0.75
Mar	1,150.00	0.85
Apr	1,000.00	1.00
May	1,000.00	1.00
Jun	900.00	1.00
Average	1,226.92	0.78



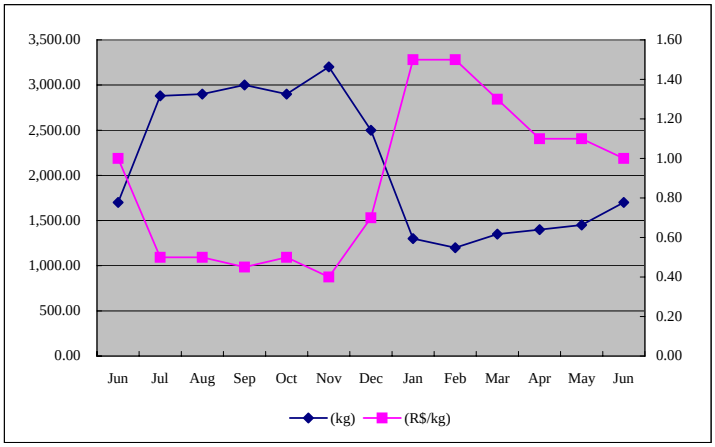
Cucumber (Pepino)

	Amazon	
	Amount	Price (Buy)
Month	(kg)	(R$/kg)
Jun	8,500.00	0.65
Jul	10,000.00	0.35
Aug	10,900.00	0.35
Sep	11,500.00	0.30
Oct	11,200.00	0.30
Nov	12,000.00	0.25
Dec	11,850.00	0.30
Jan	9,500.00	0.50
Feb	9,300.00	0.55
Mar	8,900.00	0.60
Apr	9,200.00	0.55
May	9,100.00	0.60
Jun	8,500.00	0.65
Average	10,034.62	0.46



Okra (Quiabo)

	Amazon	
	Amount	Price (Buy)
Month	(kg)	(R$/kg)
Jun	1,700.00	1.00
Jul	2,880.00	0.50
Aug	2,900.00	0.50
Sep	3,000.00	0.45
Oct	2,900.00	0.50
Nov	3,200.00	0.40
Dec	2,500.00	0.70
Jan	1,300.00	1.50
Feb	1,200.00	1.50
Mar	1,350.00	1.30
Apr	1,400.00	1.10
May	1,450.00	1.10
Jun	1,700.00	1.00
Average	2,113.85	0.89



Data Source: Marketing Survey, JICA Study Team, 2001

Figure 8.2.1-1 Monthly Change of the Amount of Supply and Price of Major Vegetables in Panair (3/3)

8.2.2 Estimation of Amount of Imported Vegetable

In Manaus, the demand of certain varieties of vegetables such as Potato, Beet, Onion, Carrot, Tomato, Sweet pepper and Cabbage was satisfied by imports from the southern part of Brazil. In the interim report, the actual condition of the imported vegetables was studied based on the EMBRAPA research paper and the survey result conducted study team in cooperation with the Agricultural Ministry of the State of Amazonas. During this field study, an additional detailed survey about the imported vegetables was conducted on middlemen and traders who deal with imported vegetables in Manaus Moderna which is the leading wholesale market in Manaus. The imported vegetables are handled by certain distributors of CEAçain Manaus, therefore the interview survey to the distributors also was carried out in order to confirm the figures which obtain through the market survey. The production and imported amount of each vegetable are shown in the below table.

Table 8.2.2-1 Production and Imported Amount of Each Vegetable

Crop	Production (ton)	Import (ton)	Total (ton)
1. Cabbage	2,995	6,789	9,784
2. Green Pepper	709	5,128	5,837
3. Long Beans	524		524
4. Okra	53		53
5. Pumpkin	1,602		1,602
6. Spring Onion	1,569		1,569
7. Sweet Potato	6,357		6,357
8. Lettuce	3,781		3,781
9. Couve	269		269
10. Coantro	371		371
11. Cucumber	6,920		6,920
12. Tomato	214	23,948	24,162
13. Eggplant	832		832
14. Maxixe	34		34
15. Garlic		784	784
16. Potato		11,102	11,102
17. Beet		461	461
18. onion		12,667	12,667
19. Carrot		11,702	11,702
20. Chayote		15	15
Total	26,230	72,597	98,827

Source: Relatorio de Atividades do IDAM, 2000, Marketing Survey conducted JICA Study Team (Manaus Moderna Administration Office, CEASA)

By this survey, it is thought that the outline of the actual condition of the import vegetable of the sate of Amazonas has been grasped. It is clear from the result of the survey that the state of Amazonas has imported a lot of vegetables from other states. The estimated amount of major import of the major vegetables reach 72,597 ton in recent one year. This amount accounts for 73 percent of estimated total consumption of vegetables in the state of Amazonas.

Thus, the result of the marketing survey was shown that a vegetable is in an extreme import excess state in the state of Amazonas. Promoting production of a reasional vegetable realizes curtailment of import, and the activation of local agriculture, and it can consider contributing to local development greatly simultaneously.

8.2.3 Estimation of Demand of Vegetables in Amazon and Percapita Consumption of Vegetables

Production and import of vegetables are shown in above table. Based on the these figures and estimated population, the per capita consumption vegetables in the State of Amazonas were estimated at approximately 31kg/person/year. The per capita consumption of vegetable in Brazil ranges from 40 kg (Nirlene and Gilmar, 2000) to 68kg (ANDEF). The amount of vegetable consumption of Brazil is remarkably low compared with advanced countries, and an Amazon's amount of consumption is still low than it. When several factors, such as change of eating habits and a life style, the improvement in an income, and interest on healthy life, are taken into consideration, it can be said that the potential demand of a vegetable fully remains in the state of Amazon.

The vegetable sector including agribusiness in Brazil has good prospect of increasing in consumption and new demand for high quality, value add products and diversification of vegetables. Although production of the vegetable in the state of Amazonas serves as reduction or leveling off by the some vegetables, cultivated area and the amount of production of vegetables will be in the tendency of an expansion fundamentally from now on.

8.2.4 Estimation of Future Demand of Vegetables

The results of the analyses in some reports （Waldemar Pires de Camargo Filho, Antonio Roger Mazzei, 1997、 Nirlene and Gilmar, 2000）show that the demand of vegetables including processed food in Brazil is likely to increase in the future. And, the trend in Amazonas State can also suggest such likelihood. It can be considered that, when several factors such as the quality improvement, addition of value through processing, the safety of food（low-level utilization of pesticides, organic cultivation）, and the changes of consumers' tastes can be successfully dealt with, the demand can increase furthermore.

The preconditions for the estimation of the future demand of vegetables can be considered as follows.

1. Estimation of the future demand of vegetables where the current trend is assumed to continue（The consumption serving as the base）
   Estimate based on the increase rate of population and the per capita consumption.
2. Estimation of the future demand of vegetables where the per capita consumption is assumed to increase
   Estimate based on the increase rate of population and the increase rate of per capita consumption.
   Estimate the future demand, based on the consumption, economic growth, and income increase of advanced areas in vegetable consumption.

3. Strategic increase

   Setting the strategies for the vegetable production during the high-water-level period of Amazon River (Effective use of varsea) and to recapture the market share of southern vegetables, aim at the expansion in accordance with such strategies.

   Grasp the amount of imported vegetables to estimate the alternative or newly introduced crops.

4. Promotion

   Grasp and excavate consumers' needs to actualize the potential demand.

   Using the marketing strategies worked out based on the accumulated data on new varieties and market sentiments, continuously provide the market with the information on the new (varieties), the new effects (nutrients), and the new utilization（cooking）to revitalize the market.

As shown in the above, in order to estimate the future demand of vegetables, complicated combinations of various kinds of preconditions（increase in population, consumption trend, income, economic growth）are needed. These are the external preconditions. Therefore, they can not be satisfied by the efforts of vegetable farmers. This Plan is designed, placing the emphasis on the demand possibly obtained by the efforts of vegetable farmers and the supporting organizations (i.e. the demand possibly obtained by aggressive efforts of humans). Not to mention, the aggressive efforts stated herein is to address to the actualization of the objective, "Reduction of the amount of imported vegetables through the improvement of the amount and quality of the production of local vegetables", on the vegetable production in Amazonas State.

As for the promising varieties of vegetables, naturally, the emphasis can shift to the strategic crops and new varieties possibly becoming the alternates of imported vegetables. Therefore, it can be considered that, in order to capture the market share, a more strategic but sound method is desirable. As the above-stated, if all the presently imported vegetables that can be grown even in Amazon are grown, the huge areas of 4,200ha are needed for the cultivation. This means that, if the cultivated varieties of vegetables and their cropped periods can be successfully coordinated, the farmers can manage the fully feasible agricultural production in Amazon.

8.2.5 Selection of Promising Vegetables

In order to accomplish the policy worked out based on the estimation of the future demand of vegetables, " Strategic Increase", the following items shall be considered for the selection of promising varieties.

1. Effective use of varsea　Production during the high-water-level period
   （Utilization of aquatic crop: Swamp cabbage etc.）

2.	Recapture of share	Local production of imported vegetables（Tomato, Green pepper）
		Examination of the alternates of imported vegetables（Red onion）
3.	Diversification	Diversification of the vegetables firmly established as local products（Parsley）

The analysis and trend of the current condition for each crop and each development direction are as follows.

(1) Key crops: (Lettuce, Coriander, Spring onion, Long beans, Leaf cabbage)

These crops are important crops as fundamental source of an income. However, the quantity of production is expanded quickly recent years according to the IDAM production statistics, and it is judged that crops, especially, lettuce, spring onion and coriander will not be extended further from now on. From the strategic point of view, crop diversification, improvement quality and production with the hanging bed system during high water season should be highlighted.

Lettuce:

Production is extended especially for salads. As a variety with bitter taste (Sympson) is dominant in the study area, it is essential to select better varieties which suite to the consumers' taste. Although disease spread widely during rain season, the new technologies which reduce usage of agro-chemicals should be introduced.

Coriander:

Consumption is extended as a herb vegetable indispensable to a fish dish. The production of Coriander is increasing quickly and is judged that the more increase in production from now on is difficult. Since it is expected that the production of parsley as an herb for a meat dish will increase, realization of the year-round culture by parallel cultivation of both kinds is desired. The introduction of a new variety will arouse consumers' interest, the potential demand will become effect.

Spring Onion:

Consumption is extended as a vegetable indispensable to a fish dish. Generally, coriander and spring onion are sold at a set. The production of spring onion is increasing quickly and is judged that the more increase in production from now on is difficult. It is effective to stimulate the consumption by the introduction of new variety.

Long beans:

Although there is steady demand, consumptive rapid growth will be not expectable. From the agricultural point of view, It is important as a leguminous crop in the crop rotation system.

Leaf cabbage:

There is steady demand. The production of the crop falls conspicuously during high water season. There is little production of a rise-of-water time, and there are many rates of the amount of import. The realization of the year-round culture or introduce of substitute vegetables is desired.

(2) Strategy crops: (Tomato, Eggplant, Cabbage, Green pepper)

As an import substitute, these vegetables are very important and need to expand the cultivation area and production as priority crops. Tomato and green pepper bear the important role of recapturing a market share from the import vegetables. It is also important to establish the stable local produce place of Eggplant.

Sweet pepper:

Recently, the production of green pepper with plastic houses in Iranduba is extended abruptly. However, the amount of import has exceeded the quantity of production far, and there is enough demand of the increase in local production. The concept of green pepper production in varsea is production of a cheap, fresh and small green pepper with technology suitable for varzea ecology.

Tomato:

The quantity of production does not show a remarkable change remarkable in recent several years. Tomato is considered as the most promised crops for expanding the production in the cultivated vegetables at present. The present quality (too small, uneven) is never accepted in a market. If quality of the product can be improved, it can get some share in a market as a fresh and a tasty tomato from the suburbs. In order to make tomato cultivation successful, the spread of rain-cover cultivation technology is indispensable.

Eggplant:

Cultivation of eggllant in Iranduba and Manaus is increasing recently. It is judged that there is still room of a consumption expansion. The increase of consumption will be expected judging from a market trend. Before market share is taken by import eggplant, it is essential to establish stable quality, supply and price of eggplant. It is the time when the promotion for a selling expansion is performed.

(h) New crops: (Swamp cabbage, Red onion, Parsley)

It is a key issue for a success to win the acceptance from consumers. The introduction of Swamp cabbage will offer the precious experience through marketing development activity for a producer and supporting organizations. A red onion is a kind of shallot. It has separated small bulbs which are never covered with outer scale. It is good to taste and is suitable both for salad and for cook. It is considered

that red onion can fully be become substitution of imported onion. It is considered that red onion can fully be become substitution of imported onion. Red onion will arouse consumers' interest, the potential demand will become effect.

Swamp cabbage:

The superior points of swamp cabbage compared with other candidate aquatic crops are as followings:

1. Low production cost
2. Low investment cost

Judging from these economic superior points, even when the expected effect is not obtained, it is considered that a farmer's damage is stopped to the minimum extent. Swamp cabbage should be introduced as a vegetable of the highest priority to the project. This vegetable will be expected expansion of consumption as an alternative vegetable of a cabbage and a leaf cabbage especially during high water season.

Red onion:

As mentioned above, red onion should be introduced as an import substitute of an onion. These crops are considered to be native to tropical West Asia, and can be grown under the high temperature of 30 degrees or more. Since the cultivation methods resemble each other in the technique, it is judged that introduction and extension to a farmer are also comparatively easy. The preservation after harvest is possible for the red onion. This feature enables shipment adjustment and contributes to the stabilization of supply and the stabilization of price.

Parsley:

The crops will be introduced in stead of coriander a part of crop diversification as mentioned above.

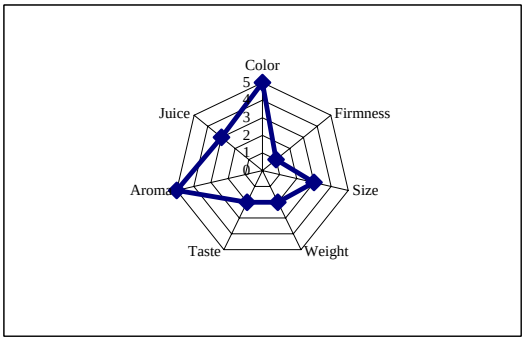
It is important to grasp consumers' needs and adopt crop diversification. The following figures (Figure 8.2.5-1) show the preference of the consumer to vegetables. In the near future, farmers should select and grow the possible varieties which restricted and suited the consumers' needs, on the basis of such kind of information.

8.3 Tropical fruits

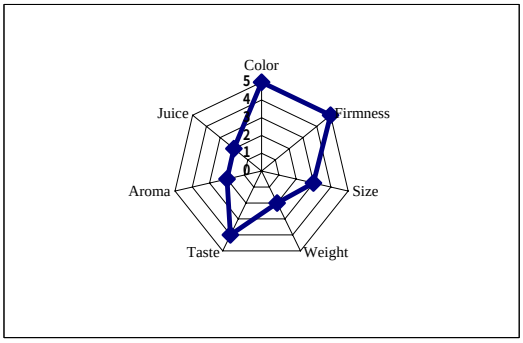
8.3.1 Current Consumers' Trend in Manaus Market

Current consumer's trend on target tropical fruits was examined based on the questionnaire survey to retailers at three major markets in Manaus, together with vegetables. There are clear negative correlation, between traded amount and retail price of Cupuacu, Banana and Maracujá, while the retail price of Asai did not change largely throughout the year. (Figure 8.3.1-1).

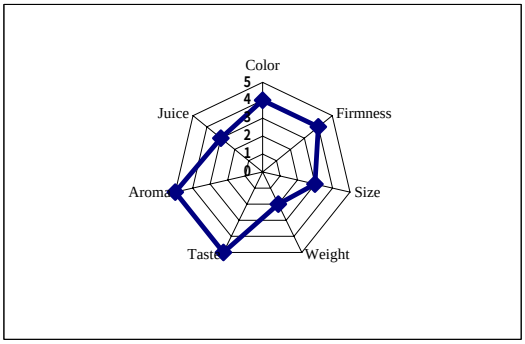
Lettuce (Alface)	
Index	Point
Color	5
Firmness	1
Size	3
Weight	2
Taste	2
Aroma	5
Juice	3



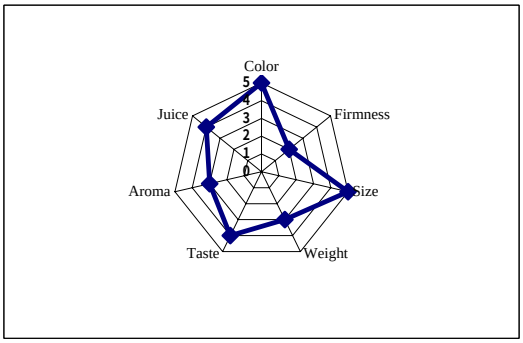
Spring Onion (Cebolinha)	
Index	Point
Color	5
Firmness	5
Size	3
Weight	2
Taste	4
Aroma	2
Juice	2



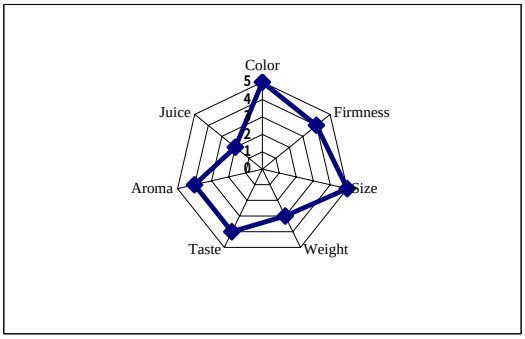
Coliander (Coentro)	
Index	Point
Color	4
Firmness	4
Size	3
Weight	2
Taste	5
Aroma	5
Juice	3



Leaf Cabbage (Couve)	
Index	Point
Color	5
Firmness	2
Size	5
Weight	3
Taste	4
Aroma	3
Juice	4



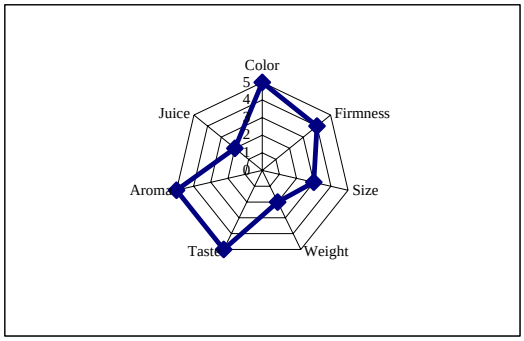
Long Beans (Fejao de Metro)	
Index	Point
Color	5
Firmness	4
Size	5
Weight	3
Taste	4
Aroma	4
Juice	2



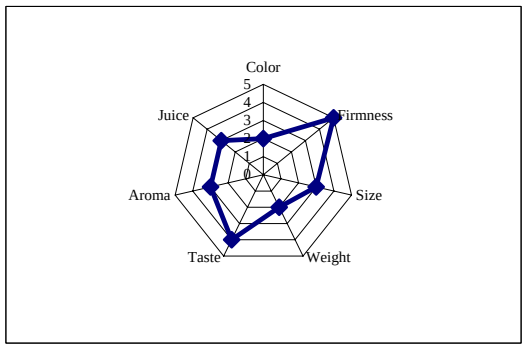
Data source: Questionnaire Survey, JICA Study Team, 2001

Figure 8.2.5-1 The Preference of the Consumers to Vegetables (1/4)

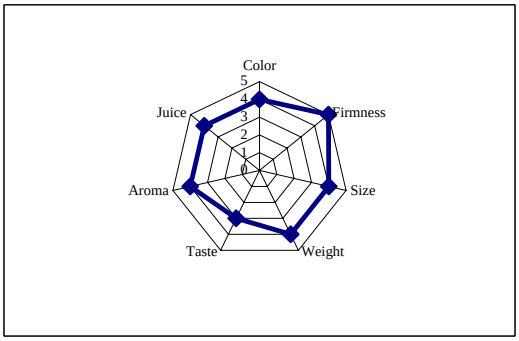
Green Pepper (Pimentao)	
Index	Point
Color	5
Firmness	4
Size	3
Weight	2
Taste	5
Aroma	5
Juice	2



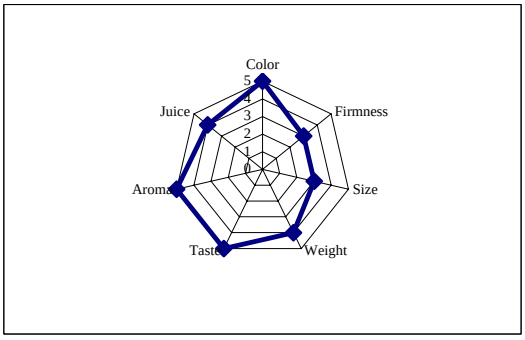
Cabbage (Repolho)	
Index	Point
Color	2
Firmness	5
Size	3
Weight	2
Taste	4
Aroma	3
Juice	3



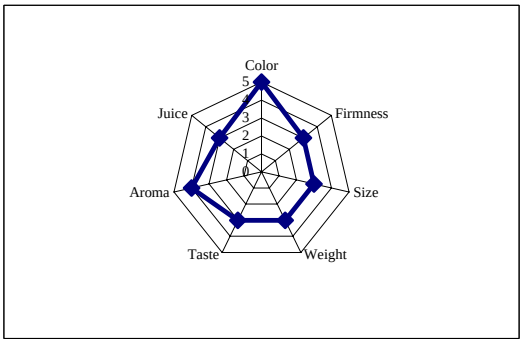
Tomato (Tomate)	
Index	Point
Color	4
Firmness	5
Size	4
Weight	4
Taste	3
Aroma	4
Juice	4



Eggplant (Brinjera)	
Index	Point
Color	5
Firmness	3
Size	3
Weight	4
Taste	5
Aroma	5
Juice	4



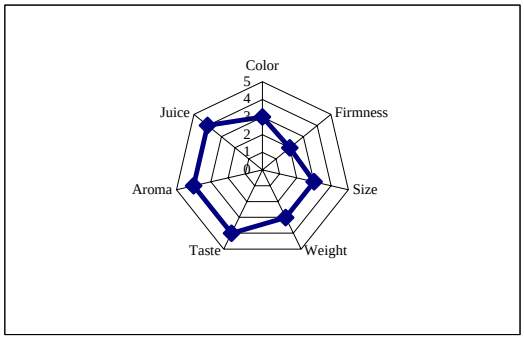
Cucumber (Pepino)	
Index	Point
Color	5
Firmness	3
Size	3
Weight	3
Taste	3
Aroma	4
Juice	3



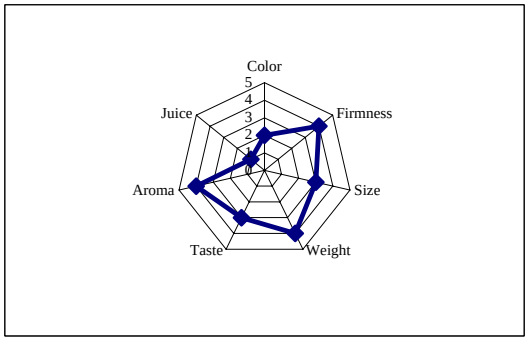
Data source: Questionnaire Survey, JICA Study Team, 2001

Figure 8.2.5-1 The Preference of the Consumers to Vegetables (2/4)

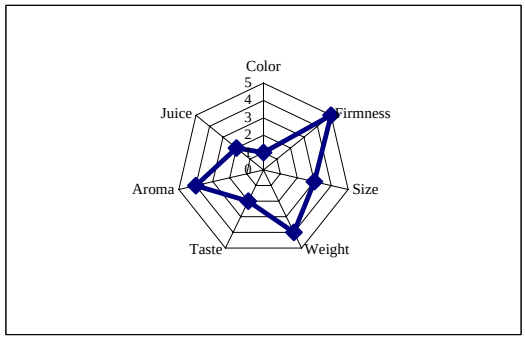
Okra (Quiabo)	
Index	Point
Color	3
Firmness	2
Size	3
Weight	3
Taste	4
Aroma	4
Juice	4



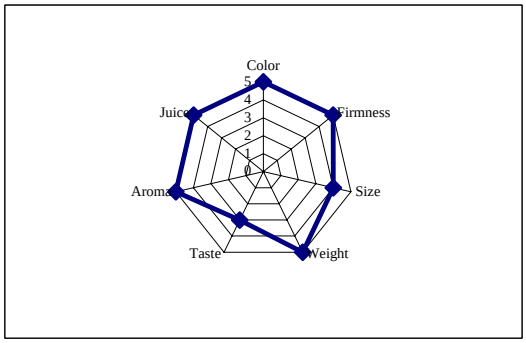
Pumpkin (Abobora)	
Index	Point
Color	2
Firmness	4
Size	3
Weight	4
Taste	3
Aroma	4
Juice	1



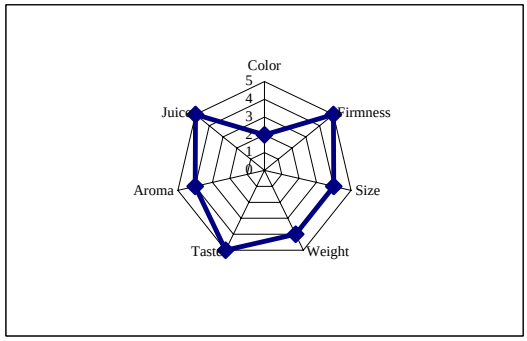
Sweet Potato (Batata-Doce)	
Index	Point
Color	1
Firmness	5
Size	3
Weight	4
Taste	2
Aroma	4
Juice	2



Watermelon (Melancia)	
Index	Point
Color	5
Firmness	5
Size	4
Weight	5
Taste	3
Aroma	5
Juice	5



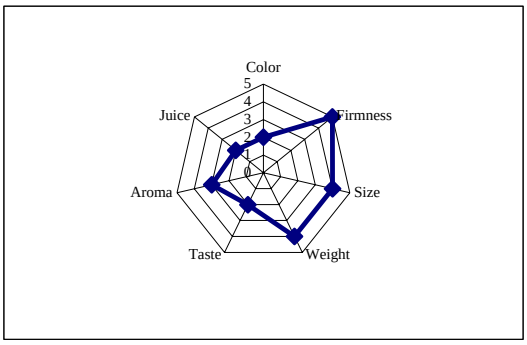
Garlic (Alho)	
Index	Point
Color	2
Firmness	5
Size	4
Weight	4
Taste	5
Aroma	4
Juice	5



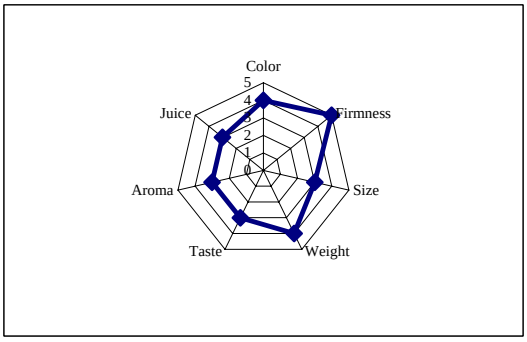
Data source: Questionnaire Survey, JICA Study Team, 2001

Figure 8.2.5-1 The Preference of the Consumers to Vegetables (3/4)

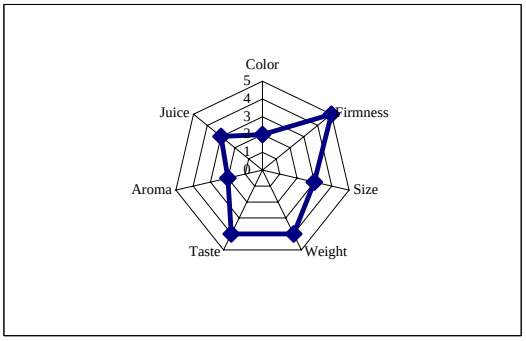
Batata (Potato)	
Index	Point
Color	2
Firmness	5
Size	4
Weight	4
Taste	2
Aroma	3
Juice	2



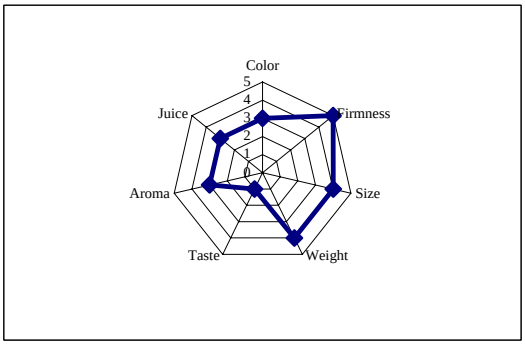
Beet (Beterraba)	
Index	Point
Color	4
Firmness	5
Size	3
Weight	4
Taste	3
Aroma	3
Juice	3



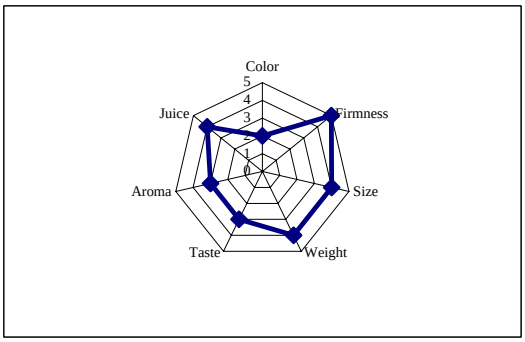
Onion (Cebora)	
Index	Point
Color	2
Firmness	5
Size	3
Weight	4
Taste	4
Aroma	2
Juice	3



Carrot (Cenoura)	
Index	Point
Color	3
Firmness	5
Size	4
Weight	4
Taste	1
Aroma	3
Juice	3



Chayote (Chuchu)	
Index	Point
Color	2
Firmness	5
Size	4
Weight	4
Taste	3
Aroma	3
Juice	4

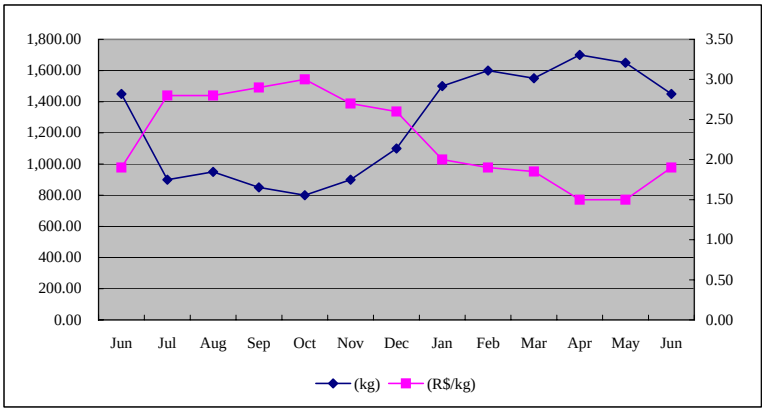


Data source: Questionnaire Survey, JICA Study Team, 2001

Figure 8.2.5-1 The Preference of the Consumers to Vegetables (4/4)

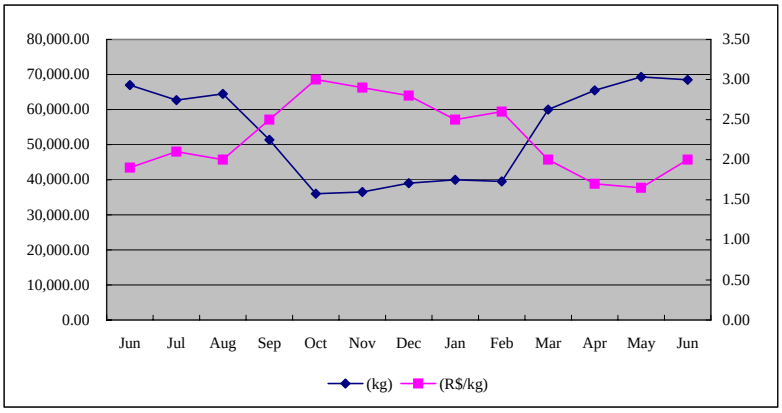
Cupuacu

	Amazon	
	Amount	Price (Buy)
Month	(kg)	(R$/kg)
Jun	1,450.00	1.90
Jul	900.00	2.80
Aug	950.00	2.80
Sep	850.00	2.90
Oct	800.00	3.00
Nov	900.00	2.70
Dec	1,100.00	2.60
Jan	1,500.00	2.00
Feb	1,600.00	1.90
Mar	1,550.00	1.85
Apr	1,700.00	1.50
May	1,650.00	1.50
Jun	1,450.00	1.90
Average	1,261.54	2.26



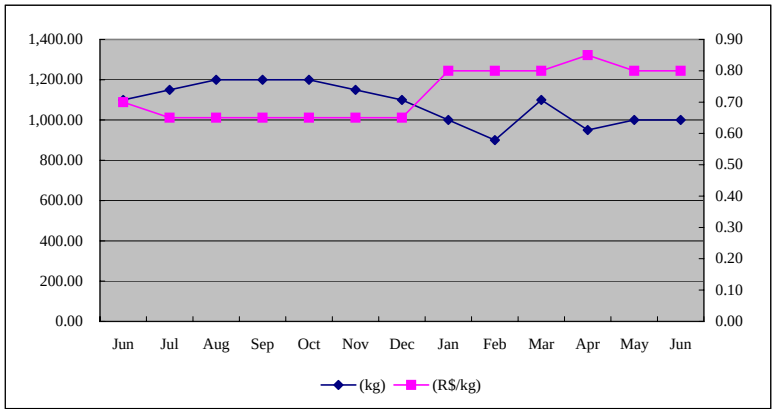
Banana

	Amazon	
	Amount	Price (Buy)
Month	(kg)	(R$/kg)
Jun	67,000.00	1.90
Jul	62,700.00	2.10
Aug	64,500.00	2.00
Sep	51,400.00	2.50
Oct	36,000.00	3.00
Nov	36,500.00	2.90
Dec	39,000.00	2.80
Jan	40,000.00	2.50
Feb	39,500.00	2.60
Mar	60,000.00	2.00
Apr	65,500.00	1.70
May	69,300.00	1.65
Jun	68,500.00	2.00
Average	53,838.46	2.28



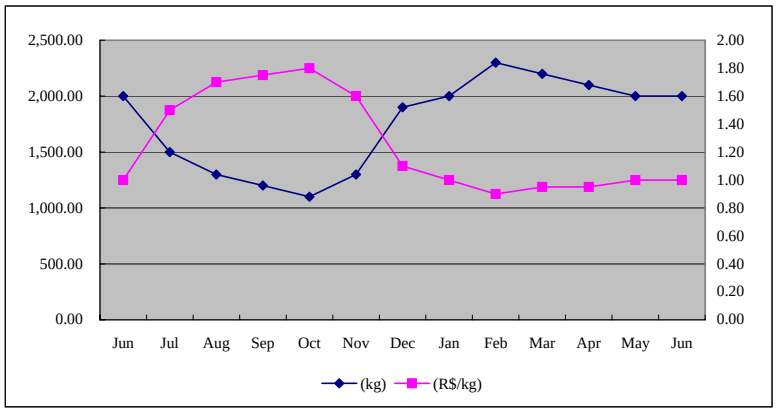
Acai

	Amazon	
	Amount	Price (Buy)
Month	(kg)	(R$/kg)
Jun	1,100.00	0.70
Jul	1,150.00	0.65
Aug	1,200.00	0.65
Sep	1,200.00	0.65
Oct	1,200.00	0.65
Nov	1,150.00	0.65
Dec	1,100.00	0.65
Jan	1,000.00	0.80
Feb	900.00	0.80
Mar	1,100.00	0.80
Apr	950.00	0.85
May	1,000.00	0.80
Jun	1,000.00	0.80
Average	1,080.77	0.73



Maracuja

	Amazon	
	Amount	Price (Buy)
Month	(kg)	(R$/kg)
Jun	2,000.00	1.00
Jul	1,500.00	1.50
Aug	1,300.00	1.70
Sep	1,200.00	1.75
Oct	1,100.00	1.80
Nov	1,300.00	1.60
Dec	1,900.00	1.10
Jan	2,000.00	1.00
Feb	2,300.00	0.90
Mar	2,200.00	0.95
Apr	2,100.00	0.95
May	2,000.00	1.00
Jun	2,000.00	1.00
Average	1,761.54	1.25



Data Source: Marketing Survey, JICA Study Team, 2001

Figure 8.3.1-1 Monthly Change of the Amount of Supply and Price of Target Fruits in Panair

The existing price fluctuation indicate possibility of processing industry to bring in preserved fruits such as frozen pulp in order to meet potential demand during the off-season. For asai which is relatively low for its retail price, being R$ 0.65 - 0.85/kg, it is likely that the demand of this fruit is not conspicuous in the local market at present.

As for consumer preference, the questionnaire survey to retailers indicate that consumers have general concern to juice and aroma. They also have interest in weight and size. In the case of banana this preference is conspicuous, and other elements such as color, firmness and taste are not considered important. In the case of maracuja (passion fruits), both color and firmness are considered less important than other elements. The result is exhibited in Figure 8.3.1-2.

8.3.2 Examination of Market Demand of Cupuacu and Acai

(1) Review of crop characteristics from marketing aspects

Cupuacu and Asai are originated in the Amazon rainforest and current production is restricted to such states as Amazonas, Pará, Amapá, Acre and Rondônia. The crop characteristics can be summarized as follows:

1. Production is unstable compared to other fruits, since the producers of these fruits are all small scale and not organized
2. It is difficult to keep freshness, because of the vulnerable nature after harvest. It is known that significant amount of fruits are discarded in the field without harvested.
3. Harvest season is limited to 3 to 4 months.
4. Due to the limited marketing amount compared with other fruits such as Strawberry and Grape, the recognition of people to these fruits are very limited in the southern states.

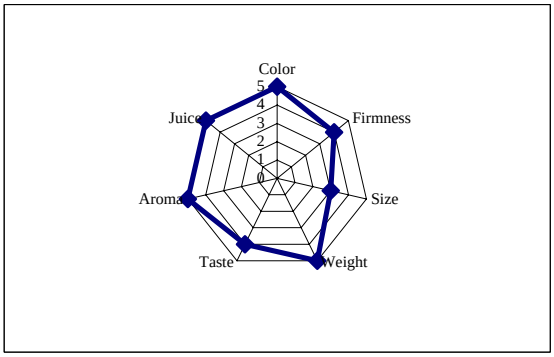
(2) Estimation of Present Marketing Amount

There is no official data available for marketed amount of Cupuacu and Asai. In this study, the actual processed and traded amount was measured at three major stages, (a) farm gate stage, (b) Primary processing stage in Amazonas State, (c) Final processing and wholesale stage in São Paulo and Rio de Janeiro. Please note that these fruits are rarely marketed to overseas at present.

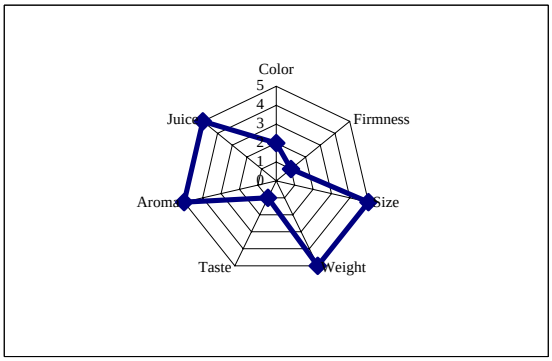
(a) Farm gate stage of the Amazonas State

Based on the available data of IDAM and EMBRAPA, actual traded amount of Cupuaçu and Açai is obtained as shown (Table 8.3.2-1). Cupuaçu and Açai are estimated to ship out from farmers for 530 ton and 603 ton, respectively in 2000.

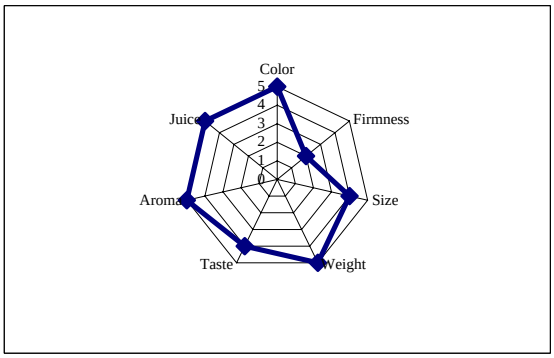
Cupuacu	
Index	Point
Color	5
Firmness	4
Size	3
Weight	5
Taste	4
Aroma	5
Juice	5



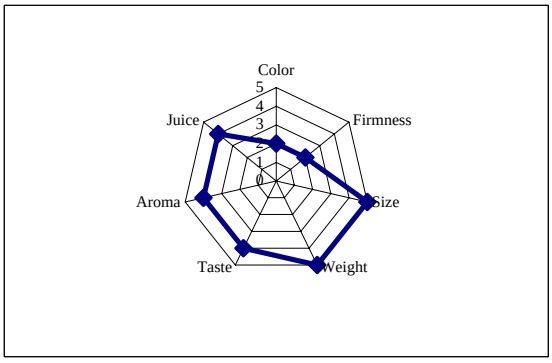
Banana	
Index	Point
Color	2
Firmness	1
Size	5
Weight	5
Taste	1
Aroma	5
Juice	5



Acai	
Index	Point
Color	5
Firmness	2
Size	4
Weight	5
Taste	4
Aroma	5
Juice	5



Maracuja	
Index	Point
Color	2
Firmness	2
Size	5
Weight	5
Taste	4
Aroma	4
Juice	4



Data Source: Marketing Survey, JICA Study Team, 2001

Figure 8.3.1-2 The Preference of the Consumers to Target Fruits

Table 8.3.2-1 Estimated Actual Traded Amount of Cupuaçu and Açai in the Amazonas (2000)

	Cupuaçu	Açai
Total planted area (ha)	9,240	1,700 (*1)
Total Harvest Area (ha)	4,218	419 (*1)
(piece or ton) / ha	1,400	9 (*2)
Estimated fruit production (piece, ton)	6,060,000	3,771 (*3)
% of effective harvest	0.35	0.4 (*4)
Pulp ton / (piece of Cupuaçu or ton of Açai)	0.25	0.4 (*3)
Estimated pulp production (ton)	530	603 (*4)

Based on the data of IDAM with interview to local municipalities and factories

*1: Data from IDAM (Annual production data in the year 2000)

*2: Data from IDAM and data from EMBRAPA (Planter's Guide)

*3: Calculation based on the data above Data from IDAM (Annual production data in the year 2002)

*4: Information based on the interview to IDAM officers, farmers in municipalities and industry operators.

(b) Primary processing stage at Amazonas State

Processing amount of Cupuaçu and Açai was obtained by surviving-up on production of processors on Amazonas State (Table 8.3.2-2)

It was 544 tons for Cupuaçu and 520 tons for Açai, which were nearly corresponding to aforementioned farm-gate amount.

Based on the interview survey to municipalities and factories. The number indicates the amount marketed in major cities, and does not include the local consumption.

Table 8.3.2-2 Processed amount of Cupuaçu and Açai in Amazonas State (in 2000)

Municipality	Cupuaçu Pulp (ton/yr)	Açai Pulp (ton/yr)
Presidente Figueiredo	38	0
Careiro	38	45
Autazes	15	20
Itacoatiara	75	10
Rio Preto da Eva	19	20
Manacapuru	31	50
Maues	4	10
Manaus(1)	250	300
Manaus (2)	25	30
Humaita & others	50	35
Total	544	520

Source: Interview Survey to Municipalities and Factories by JICA Study Team, 2001

(c) Final processing and wholesale stage in São Paulo and Rio de Janeiro

Marketed amount of Cupuacu and Asai in Sao Paulo and Rio de Janeiro is shown in Table 8.3.2-3, which was obtained from the interview survey to each trader. According to the traders, it was 1993 when Cupuacu was started to be marketed in these large cities. Since then consumer's demand has been gradually increasing. Asai, which was introduced into the market in 1997, increased the sales amount more rapidly and sells more than four times of Cupuasu in Rio de Janeiro. Because Asai is known as high calorie supplement rich in calcium and iron, it became popular among sports instructors such as marshal arts trainers in Rio de Janeiro.

The information obtained in this study indicates increasing demand for those two exotic fruit among consumers in large cities.

In the current situation of southern cities, Cupuacu is not sufficiently supplied to the market. It is limited to only a special restaurant or to one of ice creme flavors. So the demand for Cupuacu is expected to grow according to the sales effort of restaurant and shops in the major cities.

Table 8.3.2-3 Trading Amount of Cupuaçu and Açai in São Paulo and Rio de Janeiro

São Paulo			
Company Code	Type of activity	Cupuaçu	Açai
SA	B2	150	200
SB	B1	4	20
SC	B2	10	60
SD	B1	5	20
SE	B1	200	50
SF	B1	250	150
Total		619	500
Rio de Janeiro			
Company Code	Type of activity	Cupuaçu	Açai
RA	B1	35	860
RB	B1	5	350
RC	B1	2	45
RD	B1	35	210
RE	B1	4	200
RF	B1	2	80
RG	B1	0	70
RH	B1	0	80
RI	B2	45	800
RJ	B1: Dry Pulp : Dist	2	10
Total		130	2,705
Total of Two Cities		749	3,205

B1: Trader & Wholesaler, B2: Processor wholesaler.

Based on these examinations, marketing diagrams for Cupuaçu and Açai are prepared as shown in Figure 8.3.2-1.

Almost all processors in the Amazon area send frozen pulp to the processing companies in major cities in the South, then the pulp is processed and packaged to be a final product then distributed to retailers and consumers. Under the current situation, numbers by tonnage in the diagram indicate the traced amount collected from major processors in both Amazonas and Major cities.

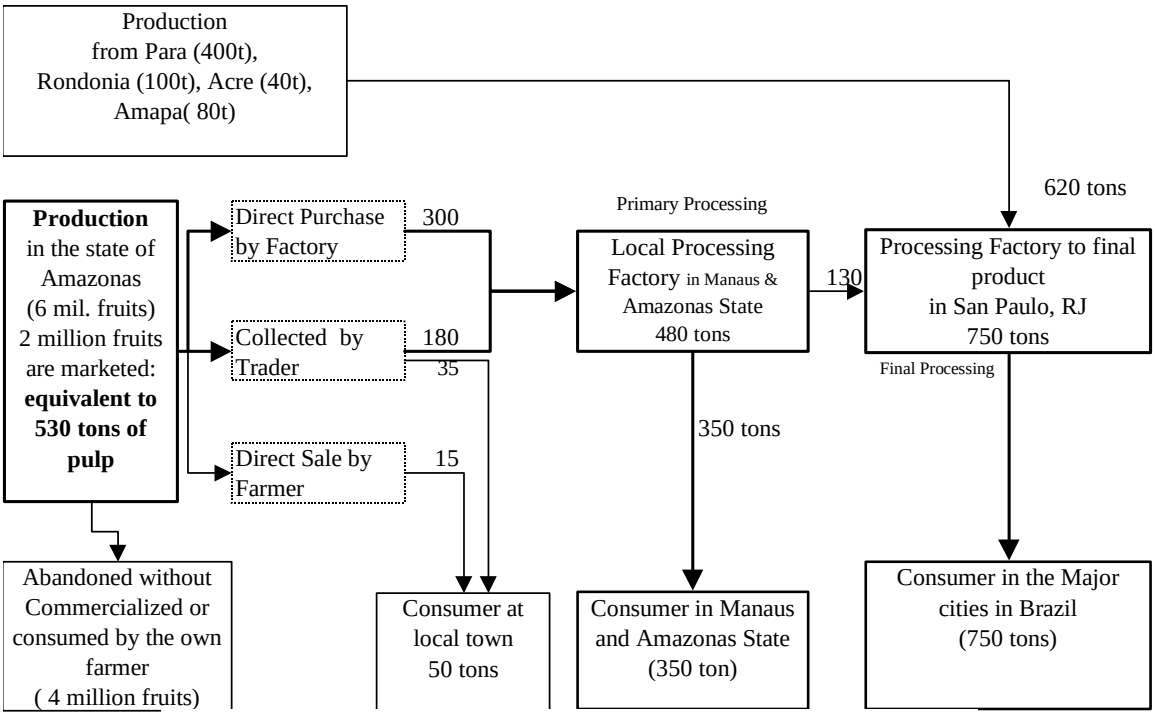


Figure 8.3.2-1 Cupuacu Marketing Diagram (year 2000)

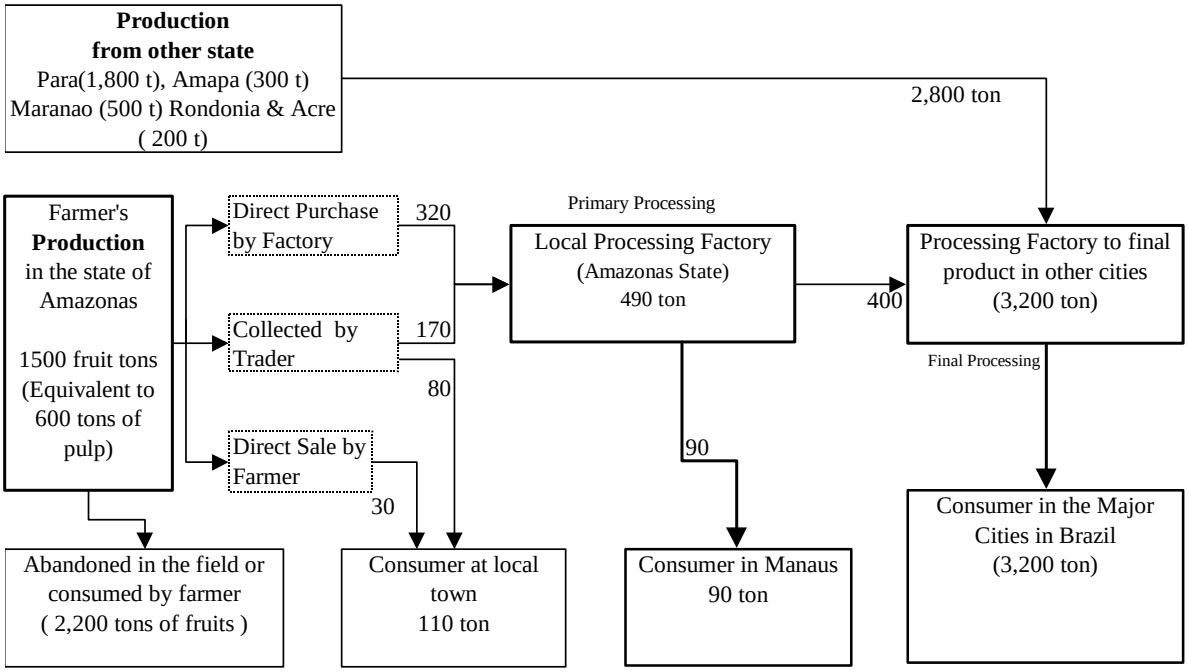


Figure 8.3.2-2 Acai Marketing Diagram (year 2000)

(3) Preliminary Examination on Potential Demand

In the local markets such as Manaus, Cupuaçu is one of the popular fruit juice, therefore the people's preference for Cupuaçu is at the same level as other fruit juice, unless value-added measures are introduced.

According to the research of EMBRAPA, Cupuacu is mainly consumed by middle and high-income families in Belem in Para state. The annual consumption of Cupuacu is estimated to be 410 tons, in Belem, and 623 tons in Para, in 1994, EMBRAPA estimated the potential demand as 2,368 tons or 3,8 times the present marketing amount in Para State.

Considering the population of Para state as approximately 6 million, this estimate means per capita consumption of 0,39 kg/year. When this amount is adopted temporarily, damand of cupuacu in Amazonas state is calculated to be 488 ton, (0,39 x 1,25 million people).

Asai is regarded as a meal rather than a drink. Therefore restaurants usually do not have Asai in the menu but rather serve as one type of meal mainly for lunch. As a result local consumption of Asai is not as much as that of Cupuacu. The recent trend of manufacturers is to make frozen pulp and sell to traders in the Southern States.

As a whole, examination of potential demand for the southern states is the key issue in order to understand the future market potential of these fruits. Marketing strategy shall be established from this viewpoint considering competitive situation with other states such as Para, Amapa, Rondonia and Acre. For example, major area of Asai production is the state of Para and traders focus on this area. Other states have chance to market only when the Para is in its off season which is between March to

September. Harvest season in the Amazonas fits to this monthly timing, so the increase of production will be expected.

As was analyzed in the sales amount in San Paulo and Rio de Janeiro, supply of Cupuasu to these cities has potential to open additional market, at least constant increase is expected in these cities as a result of traders effort.

Consumption of Asai in Rio de Janeiro seems to have reached peak amount because traders are suffering from decline of sales price by over supply. On the other hand In San Paulo, supply of Asai is not enough and there are still rooms for encouraging consumers to try. As a whole, promotional effort has not been done in either cities so far, and supply of product by quality conscious manner is expected to create new demand.

8.3.3 Examination of Market Demand for Banana and Maracuja

Many States in Brazil produce banana and maracuja. Amazonas produces 8.7% of the national banana crop, and 0.67% of the maracuja crop. Therefore, for Amazonas there is significant competition from other States for these two crops. In Amazonas, almost all municipality produces these crops and Manaus is the most important market.

Based on IDAM data, Amazonas is not even self sufficient in banana production. The inability to meet demand is largely due to devastating losses caused by the Sigatoka fungal diseases of banana. IDAM is making its own effort to increase Banana production by supplying one million new seedling to local farmers every year for three years. It is hoped that the deficiency will be alleviated in a few years.

Maracuja has fairly steady equilibrium between supply and local consumption in Amazonas. In other parts of Brazil, production is increasing while prices are falling. Therefore, Amazonas maracuja farmers must lower their production costs in order to compete with inexpensive imports from other states.

Table 8.3.3-1 Current supply and consumption of Banana and Maracuja

	Banana	Maracuja	Source
Supply	4,790 ton	1,252 ton	IDAM (2000)
Consumption	18,300 ton	1,200 ton *1)	IBGE (2000)
Balance	-13,510 ton	+ 52 ton	

Remarks *1): Fruit ton is converted to pulp ton.

8.4 Cultured Fish

8.4.1 Current Consumers' Trend in Manaus Market

(1) Preference of Local People

People in the Amazonas State traditionally prefer fishes having scales, e.g., pirarucu, tambaqui, jaraqui, tucunare, matrinchã and pacu, to non-scaled fishes, namely

catfishes particularly for those of the family Pimelodidae, such as dourada, piramutaba and piraiba. Large catfishes of this family have been considered taboo food for riverine people. They believe that those catfishes cause diarrhea if eaten on a daily basis. However, it shall be noted that surubim is the only Pimeloid that is captured for consumption (Pereira, 1999), although local people's preference is not very high. Preference of riverine people investigated by researchers of FUA is shown in Annex 8.4.1-1.

At first it can be pointed out that seasonal fluctuation of price is very large in smaller characiforms species (jaraqui, pacu, matrincha, curimata) which are caught abundantly with high seasonal fluctuation compared to other relatively large-size species (Tambaqui, Pirarucu, Surubim, Tucunare). This indicates that market demand for the latter species is relatively consistent throughout the year comparing to the former species.

In recent years, however, surubim is very popular not only at fresh fish markets but also at supermarkets in Manaus. There should be little taboo about scaleless catfishes for urban population which is composed of significant number of immigrants from other States.

(2) Per capita fish consumption

Per capita fish consumption of the Amazonas State is said to be highest in Brazil. Although examination at State level is difficult because of difficulty for estimating fish catch by family fishing, it would be more than 40 kg per person per year based on existing published information shown in Table 8.4.1-1. This amount corresponds to more or less 10 times the national average, 4.4 kg.

Table 8.4.1-1 Study Review on per Capita Fish Consumption

Study Area	Per capita fish consumption		Authers
	(g/day)	(kg/year)	
Published information			
Manaus	155	56.6	Shrimpton et al. (1979)
Manaus	102	37.2	Amoroso (1981)
Itacoatiara	194	70.8	Smith (1979)
Middle Amazon, Para State	369	134.7	Cerdeira, et al. (1997)
Flood plain communities	550	200.8	Batista et al. (1998)
JICA Study Team			
Iranduba-Manacapuru			
a. High income group (N=9)	256	93.4	
b. Small-scale farmers (N=11)	230	84.0	
c. Fishermen (N=14)	402	146.7	

Source: Ruffino (1999) and JICA Study Team

Per capita fish consumption was supplementary examined in this study for people in Iranduba and Manacapuru (see Section 5.7.4). Although sample number is insufficient, the results agreed with the previous studies (Table 8.4.4-1).

Per capita fish consumption of the State differs largely between Manaus and local communities. In particular, that of local riverine community is calculated as high as 200kg, which is probably the highest in the world and will not increase in future

(Batista, 1998). About the data of Manaus, available information is a little old. Citing the estimates of fish unloading data in this study (37,000 tons in 2000 in Manaus, Table 5.5.4-1) and population data (about 1,400,000 in 2000), it is calculated at 26.4 kg. Although this datum is not including consumption of frozen fish and cultured fish as well as fish catch by family fishing, present per capita fish consumption of Manaus should be slightly decreased comparing to that in 20 years ago or 37.2-56.6 kg in Table 8.4.1-1.

8.4.2 Current Market Demand for Cultured Fishes

(1) Fresh Fish Market

Market demand for cultured fishes was investigated by questionnaire survey to the retailers of three major fish markets in Manaus (Manaus Moderna, Panair and Adolfo Lisboa) in July 2001. Amount of fish sale in those three markets is estimated to be about 40 tons/day in total or 1/3 of fresh fish amount unloaded in Manaus.

Among the 212 retailers investigated, more than 80% have experience in selling cultured fishes such as tambaqui and matrincha (Table 8.4.2-1). This indicates that aquaculture fishes are already popular in the fresh fish market. Significant number of retailers answered experience about dealing cultured pirarucu and tucunare. However, it is confirmed through follow-up interview that the pirarucu is mostly received from the Mamiraua Natural Reserve of Tefe with IBAMA's official permission of catch and associated smuggling catches although there are some pirarucu grown-out in fishponds. About tucunare, catches of the Balbina Lake seem to be included as cultured fish.

Table 8.4.2-1 Amount of fish sale and experience in selling cultured fishes.

Fish market	Sample number	Amount of fish sale (kg/day/retailer) *1)		Experience in selling cultured fishes							
				Yes or not		Experience by species					
		In peak month	In lean month	Yes	No	Tambaqui	Matrincha	Pirarucu	Tucunare	Curimata	Aracu
Manaus Moderna	102	260 ± 148	169 ± 162	68	20	61	60	28	14	7	10
		(48 ～ 580)	(15 ～ 550)	77%	23%	90%	88%	41%	21%	10%	15%
Panair	82	213 ± 82	122 ± 64	69	13	58	37	30	21	0	0
		(85 ～ 400)	(30 ～ 310)	84%	16%	84%	54%	43%	30%	0%	0%
Adolpho Lisboa	28	161 ± 49	74 ± 30	24	4	20	15	3	8	0	0
		(70 ～ 250)	(2 ～ 140)	86%	14%	83%	63%	13%	33%	0%	0%
Total	212	228 ± 120	138 ± 124	161	37	139	112	61	43	7	10
		(48 ～ 580)	(2 ～ 550)	81%	19%	86%	70%	38%	27%	4%	6%

Remarks: 1) Uppr lows indicate mean±standard deviation, lower lows, range.
2) Upper lows, number of answer, lower lows percentage.

Since major suppliers of cultured fishes are fish farmers in vicinity of Manaus, such as Manaus, Rio Preto Da Eva, and Manacapuru, they are very fresh or still alive at delivery, even though no ice is used. However, their meat quality is evaluated no good comparing to that of naturally caught individuals (Figure 8.4.2-1). They said that meat of culture fish is often oily with muddy smell. However, it is reality that the price of cultured fishes is maintained as nearly the same level as natural fishes

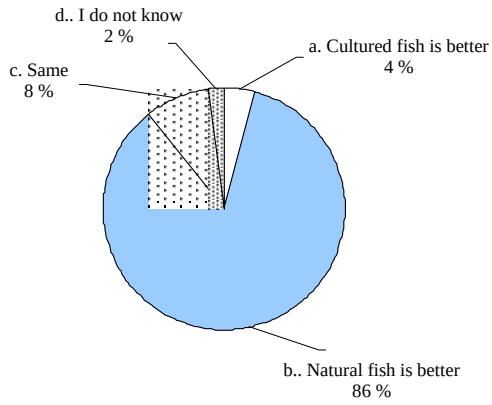


Figure 8.4.2-1 Evaluation of cultured fish quality by retailers in Manaus (N=212)

because fish farmers bring fish (or retailers ask fish farmers supply of fish) when natural fish catch is scarce. In particular, during the holy week in April when Christians do not eat livestock meat, the highest demand for cultured fish is elaborated and the price is decided by producer's initiative.

Present market demand for cultured fishes is examined by species based on the opinion of retailers (Figure 8.4.2-2). The most strong demand or expectation is confirmed for pirarucu. More than 70% of retailers answered that they want to deal in cultured pirarucu, if available, throughout the year. The second high demand is seen for ruelo (young tambaqui less than 3kg: common size of cultured tambaqui), tambaqui and matrincha. More than 80% retailers answered that they want to deal them in throughout the year or when wild fish catch is not sufficient. On the other hand, demand for cultured surubim, jaraqui, tucunare and curimata is lower than those species in fresh fish market. In case of jaraqui, about 70% retailers answered that they do not want to deal in cultured jaraqui because there are abundant wild fish landing.

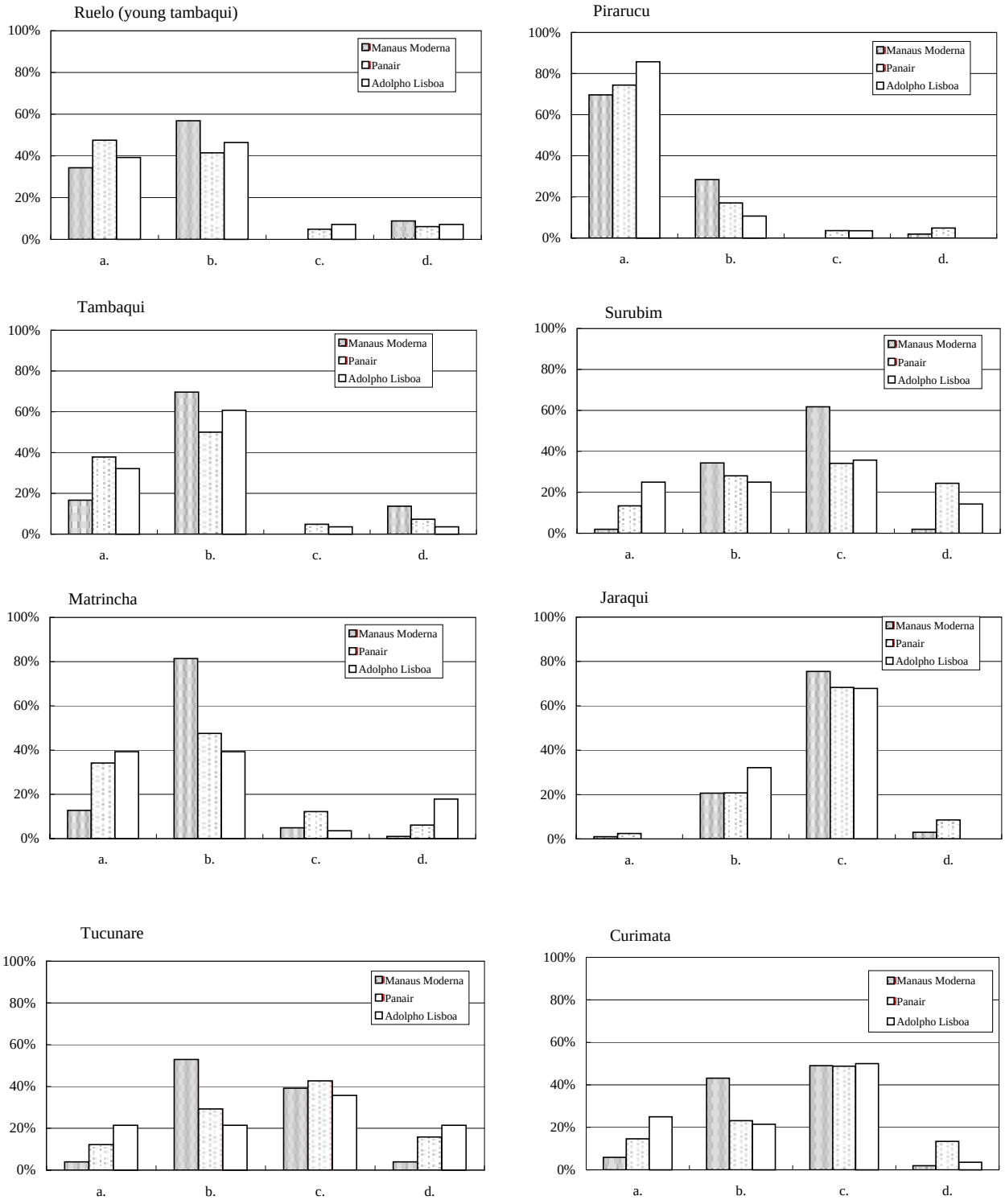
(2) Supermarket

At present, supermarkets such as DB, Carrefour, CO, Roma, Populares etc. are major clients of progressive fish farmers around Manaus (see, Section 7.1.5). Based on the offering price and volume from supermarket, fish farms decide the timing of harvest. Those fish farmers are often not familiar to fishery business like selling of fresh fishes. Hence, business with supermarkets is said to be convenient for them because large amount of fishes can be sold at once, although the price is slightly lower than that in fresh fish market. Fish farmers can adjust, to some extent, the species, size and amount of fish due to the market demand.

Consumers of supermarket show good evaluation about cultured fish quality because those fishes are reared under controlled feeding scheme (Dr. Rodrigo Roubach, Aquaculture Department, INPA, personal communication).

(3) Restaurants

In the restaurant of Manaus and other municipalities investigated, the most common fish species sold is tambaqui, then, pirarucu and tucunare. Other target species such as jaraqui and matrichna are not always available despite their abundance in fresh fish market. Surubim is also not popular in the menu except for some seafood restaurants.



Selection of answers
- a. I want to deal in this species throughout the year.
- b. I want to deal in this species during the months when wild fish catch is not sufficient.
- c. I do not want to deal in this species because there are abundant wild fish landing.
- d. I do not want to deal in this species because people do not want to buy it.

Figure 8.4.2-2 Opinion of Retailers on Cultured Fishers, if they are available.

Based on our brief interview survey to 10 seafood restaurants, only 3 had experience on selling cultured fishes such as tambaqui, matrincha and jaraqui. As in the case of fresh fish market, evaluation of cultured fish quality is not good comparing to natural fishes at present. Most of the 10 restaurants showed strong demand for pirarucu (cultured or not) and large-size tambaqui (wild).

8.4.3 Prospect of Potential Demands for Cultured Fish

(1) Estimation Method

Considering current natural fish resource condition, fish catches particularly for valuable species will not increase largely in near future. Therefore, in global view, all the potential fish demand can be considered as aquaculture demand. This is the basis of estimation in this study. The potential aquaculture demand was estimated based on the following equation.

Dt = D1 + D2 + D3+D4

- Dt: Potential aquaculture demand in the Amazonas State（as whole fish weight in 2000）
- D1: Fresh fish demand for Amazonas State
- D2: Frozen fish demand for Amazonas State
- D3: Frozen fish demand for outside the State
- D4: Frozen fish demand for export

Fish demand for self-consumption of rural communities is not included in this estimation. Following assumptions were employed for estimation.

- Quality and price of aquaculture fishes is the same as those of wild-caught fishes.
- Demand for each species is not substituted by other fish species.

Basic approaches for estimation were summarized in Table 8.4.3-1 by species.

Table 8.4.3-1 Basic approaches for estimation of aquaculture demand in the Amazonas State

<table>
<tr><td rowspan="2"></td><td rowspan="2">Characteristics of fish landing and marketing price</td><td colspan="2">Basic approaches for estimation of aquaculture demand</td></tr>
<tr><td>Fresh fish demand (D1)</td><td>Frozen fish demand (D2, D3, D4)</td></tr>
<tr><td>Tambaqui</td><td rowspan="3">Fish landing has been decreased largely due to damage of natural resources. Marketing price is not varied largely due to the season.</td><td rowspan="3">Based on difference of fish landing amount between past years with relatively good fishery resource condition and recent years.</td><td rowspan="5">Based on the production data of frigorificos and information obtained in this study</td></tr>
<tr><td>Pirarucu</td></tr>
<tr><td>Surubim</td></tr>
<tr><td>Matrincha</td><td rowspan="2">Fish landing amount fluctuates largely by season and by year. Marketing price tends to inverse propotion with the fish landing amount.</td><td rowspan="2">Based on deficit of monthly fish landing amount. Aquaculture demand is considered to exist up to the level of annual monthly average.</td></tr>
<tr><td>Jaraqui</td></tr>
</table>

(2) Fresh Fish Demand for Amazonas State（D1）

(a) Tambaqui, pirarucu and surubim

Fresh fish demand for those three species was estimated as the difference of fish landing amount between that in1979-83 when fishery resource conditions was relatively kept well and that in 1997-99 (Table 8.4.3-2). In this case, effect of population was considered, and amount of pirarucu and surubim was converted to

whole fish weight. Decreasing tendency of per capita fish consumption in Manaus (Section 5.6.6) is not considered because of relatively strong market demand for target species. D1 was estimated to be 14,337 ton for tambaqui, 4,477 ton for pirarucu and 506 ton for surubim.

Figure 8.4.3-2 Estimation of Fish Demand for Tambaqui, Pirarucu and Surubim in the Amazonas

Unit: ton

	Average annual fish landing (1979-83)		Average annual fish landing (1997-99)			Fresh fish demand (D1 in 2000)
	Major 8 sites	Amazonas State	Adorfo Lisboa	Amazonas State		Amazonas State (as whole fish weight)
	a	A=a/81%[*1)]	b	B=b/37%[*1)]		C= 1.94[*2)] x A - B （refer to [*4)] ）
Tambaqui	7,089	8,751	977	2,641		14,337
Pirarucu	810	1,000	N.A.	150	[*3)]	4,477
Surubim	253	312	N.A.	150	[*3)]	506

Source: Falabella (1994) for data 1979-83, FEPESCA/AM/RR for data 1997-99

Remark:

*1): Ratio of fish unloading estimated in this study based on the Table 5.4.4-1.

*2): Ratio of population, 1.45 million in 1980 and 2.81 million in 2000

*3): Suspected amount

*4): Since pirarucu and surubim are usually marketed as semi-processed form like "salted" or "fillet" in pirarucu and "without gut" in surubim, their landing amount should be smaller than original whole fish weight. In this study, their amount was converted to whole fish weight using condition factors of 40% for pirarucu and 90% for surubim

(b) Jaraqui and matrincha

As for reliable data on recent monthly fluctuation of fish landing, there are two available, one is the monitoring data for fishery resource study during 1994-96 at the Panair fish landing site (Batista of FUA, 1998) and the other is a series of fish landing data at the Adorfo Lisboa fish landing site monitored by FEPESCA/AM/RR, which has been shown in Figure 5.5.4.1. However, the data of the latter before 1998 were accidentally burned out and analysis of multiple years are difficult. Since fish landing tendency should not be difference in the year 1994-96 and 2000, data of Batista (1998) are applied in this study for further examinations.

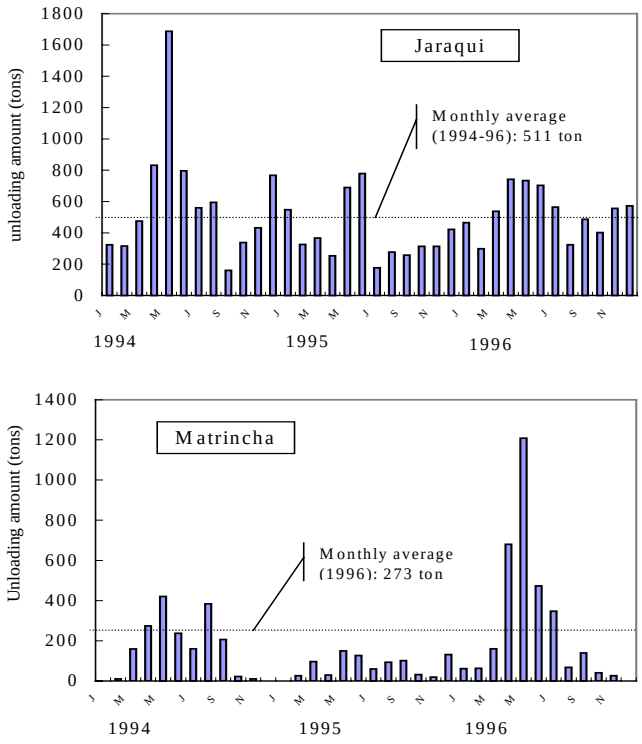


Figure 8.4.3-1 Monthly fluctuation of fish landing of jaraqui and matrincha at the Panair Fish Landing Place, Manaus in 1994-96.

Monthly fluctuation of fish landing of jaraqui and matrincha at the Panair fish landing place, Manaus is shown in Figure 8.4.3-1. During the three years period from 1994 to 1996, monthly average fish landing of jaraqui was calculated at 511 ton. The demand for this species was obtained by cumulating monthly difference up to this average during the lean months of the year. It is 1,163 ton for the portion of Panair fish landing site. In matrincha, there is large annual fluctuation as well as monthly fluctuation. Taking into consideration this species has higher value or demand than jaraqui in the market, monthly average of a single year 1996, when abundant landing was seen, namely 273 ton was applied as the standard for comparison (Figure 8.4.3-1). Then, the demand for matrincha is calculated at 1,890 ton for Panair portion.

Share of fish landing amount of the Panair in 1994-96 should be equal to that of the present Adorfo Lisboa fish landing site which was then under rehabilitation of facilities. Supposing its share was 38% of total fish landing of the Amazonas State (Table 5.5.4-1), fresh fish demand (D1) for jaraqui and matrincha was obtained as 3,060 ton and 4,974 ton, respectively.

(3) Frozen fish demand（D2, D3 and D4）

Frozen fish production and export data of the target species are converted to whole fish weight and shown in Table 8.4.3-3 (for original data, see Annex 8.4.3-1).

Figure 8.4.3-3 Production and Export of the Five Target species from Frigorificos of the Amazonas State

unit: ton

	1994	1995	1996	1997	1998
Production (for domestic market)					
Pirarucu	691	173	9	-	-
Surubim	1,073	727	793	1,116	627
Tambaqui	166	161	54	153	31
Matrincha	75	3	155	-	-
Jaraqui	185	10	146	47	15
International export					
Pirarucu	88	-	-	-	-
Surubim	-	-	9	-	-
Tambaqui	-	-	6	-	-

Source: Prepared based on Annex 8.4.3-1

Remark: Following weight ratio are applied for conversation from processed forms to whole fish

Whole fish：	100%	Fillet：	40%
Without gut：	90%	Salted：	30%
Cut in pieces：	70%		

In general, frozen fish production of target species tends to decrease or stagnant. However, as far as pirarucu and surubim are concerned, this is not due to low demand but decrease of their natural resources and legal control of fishing activity. Strong market demand for those species exist certainly as preferable white fillet outside the Amazonas State and in overseas. When interview to frigorificos, most of them answered that it is highly possible to increase shipping amount of those species by several times or up to their maximum freezing capacity if materials are available.

In the case of pirarucu, aquaculture is only the way to legalize the export because of

CITES. The possible locality of aquaculture development of this species will be restricted in the Amazon basin where the species inhabits. Under such situation, progressive fish farms together with associated frigorifico in the Amazonas and Para States had already started large-scale aquaculture of this species (see, Section 7.1.5).

Based on the above examinations, demand of frozen pirarucu is set to be 2000 ton for trading outside the State (about 3 times of the production level of 1994) (D3) and 1000 ton for export (D4). On the other hand, frozen pirarucu demand in Amazonas State (D2) must be lower than those. Considering that marketing ratio of frozen surubim inside the State is 15-45% of that for outside the State (Table 5.5.4-4), D2 for pirarucu is set for 600 ton at present.

Demand for surubim is low in the Amazonas State particularly in rural area due to taboo. On the other hand, in the neighboring Para State there is no such taboo and surubim is considered as one of esteemed white-meat fishes. In general large-size catfishes are preferred by many other states of Brazil and their demand may be higher than pirarucu. However, considering that aquaculture of this species has already been carried out in commercial scale in the vicinity of large consumption areas such as in the Mato Grosso Do Sur State, the potential demand for frozen cultured surubim from Amazonas State seems not to be high. One thousand ton, which is equivalent to frozen surubim production in 1997, is additionally appropriated as demand for frozen cultured surubim (D3), and 200 ton as 20% of the said volume for export (D4). D2 for surubim is set for 300 ton considering the marketing share for the State.

There is significant demand for frozen cultured tambaqui in Amazonas State, as the frigorifico Peixan is now exploring new market in supermarket (see, Section 7.1.5). However, this demand can be considered as effective demand which is shifted from the fresh fish demand. So, D2 for tambaqui is considered to be included in D1 at present. Since demand for trading outside the State seems to be not high. D3 is set at 200 ton, which is slightly higher than the former frozen tambaqui production (Table 8.4.3-3). Export demand (D4) is not considered for tambaqui.

Taking the same logic, D2 of matrincha and jaraqui is considered to be included in D1 at present. In those species, frozen fish demand can be compensated by natural fish catch at peak fishing month. Hence, no demand is counted for their D3 and D4.

(4) Total aquaculture demand in the Amazonas State（Dt）

(a) Year 2000

All the above examinations are summarized and shown as potential aquaculture demand in Table 8.4.3-4. Dt of the total of five target species is calculated to be 32,654 ton in 2000.

Table 8.4.3-4 Potential Aquaculture Demand for Five Target species in 2000

Unit: tons

	Demands for consumption in Amazonas State		Demand for trading outside the State	Demand for export	Total
	Fresh (D1)	Frozen (D2)	(D3)	(D4)	(Dt)
Tambaqui	14,337		200	0	14,537
Pirarucu	4,477	600	2,000	1,000	8,077
Surubim	506	300	1,000	200	2,006
Matrincha	4,974		0	0	4,974
Jaraqui	3,060		0	0	3,060
Total	28,254		3,200	1,200	32,654

(b) Year 2013

Dt in the year 2013 was estimated as follows.

Basically D1 was estimated by multiplying the D1 of 2000 with increasing rates of population namely 1.27 times for Amazonas state as a whole. In this case, it is significant to add increasing demand for surubim particularly in urban areas in which taboo for catfishes is going to fade out. As for surubim demand in D1 and D2, calculated amount based on increase of population was duplicated.

It is difficult to examine how increase or decrease about D3 and D4 in future. In this study, those demands were kept at the same amount as in year 2000.

Thus, Dt in year 2013 was calculated as 40,426 ton as shown in Table 8.4.3-5.

Table 8.4.3-5 Potential Aquaculture Demand for Five Target species in 2013

Unit: tons

	Demands for consumption in Amazonas State		Demand for trading outside the State	Demand for export	Total
	Fresh (D1)	Frozen (D2)	(D3)	(D4)	(Dt)
Tambaqui	18,208		200	0	18,408
Pirarucu	5,686	762	2,000	1,000	9,448
Surubim	779	462	1,000	200	2,441
Matrincha	6,317		0	0	6,317
Jaraqui	3,886		0	0	3,886
Total	36,100		3,200	1,200	40,500

CHAPTER IX LOGICAL FRAMEWORK APPROACH AND ANALYTIC OBSERVATION

Project cycle management method has been applied to this investigation, so as to enable the partner sides to meet their needs on planning and come to a mutual understanding with IDAM. Throughout investigation, participatory and logical frame approach could be executed by holding workshops for beneficiaries in 3 target municipalities and for IDAM. In consequence, problems relevant to Improving Rural People's Livelihood were identified and analyzed. Based on these results, overall project approaches, basic strategy were established and furthermore, each field such as agriculture, fishery, rural communities, marketing and environmental aspect was studied analytically, then problems relevant were analyzed.

9.1 Participation Analysis

In execution of Problem Analysis on overall aspects, two phase approaches were adopted; (i) Logical Framework Approach (LFA) Workshops with IDAM, (ii) CMDR Workshops in target municipalities. In the latter, the representatives of IDAM also participated.

Firstly, problem analysis was carried out between IDAM and the Study Team, afterwards these analysis as well as problems newly proposed were identified and analyzed in CMDR Workshops. By this process, wide range of participants from beneficiary farmers to related officials could have opportunities to express their views on their problems for the Project target.

The participants consist of the representatives of the partner agency (IDAM), the rural development planning staffs from the target municipalities, the representatives of farmer organizations involved in CMDR, and the beneficiaries. Details on the participants of these workshops are stated in Chapter 4.

9.2 Problem Analysis

9.2.1 Overall Aspects

Through these two phase works, problems on overall aspects were analyzed as the problem tree in Figure 9.2.1-1.

9.2.2 Agricultural Production

(1) Common Problems with Agricultural Production

The results of Interview survey to farmers and rural people concerned make problems for agricultural production clear. They have the common problems with agricultural production in each species (guarana, vegetables and Tropical Fruits).

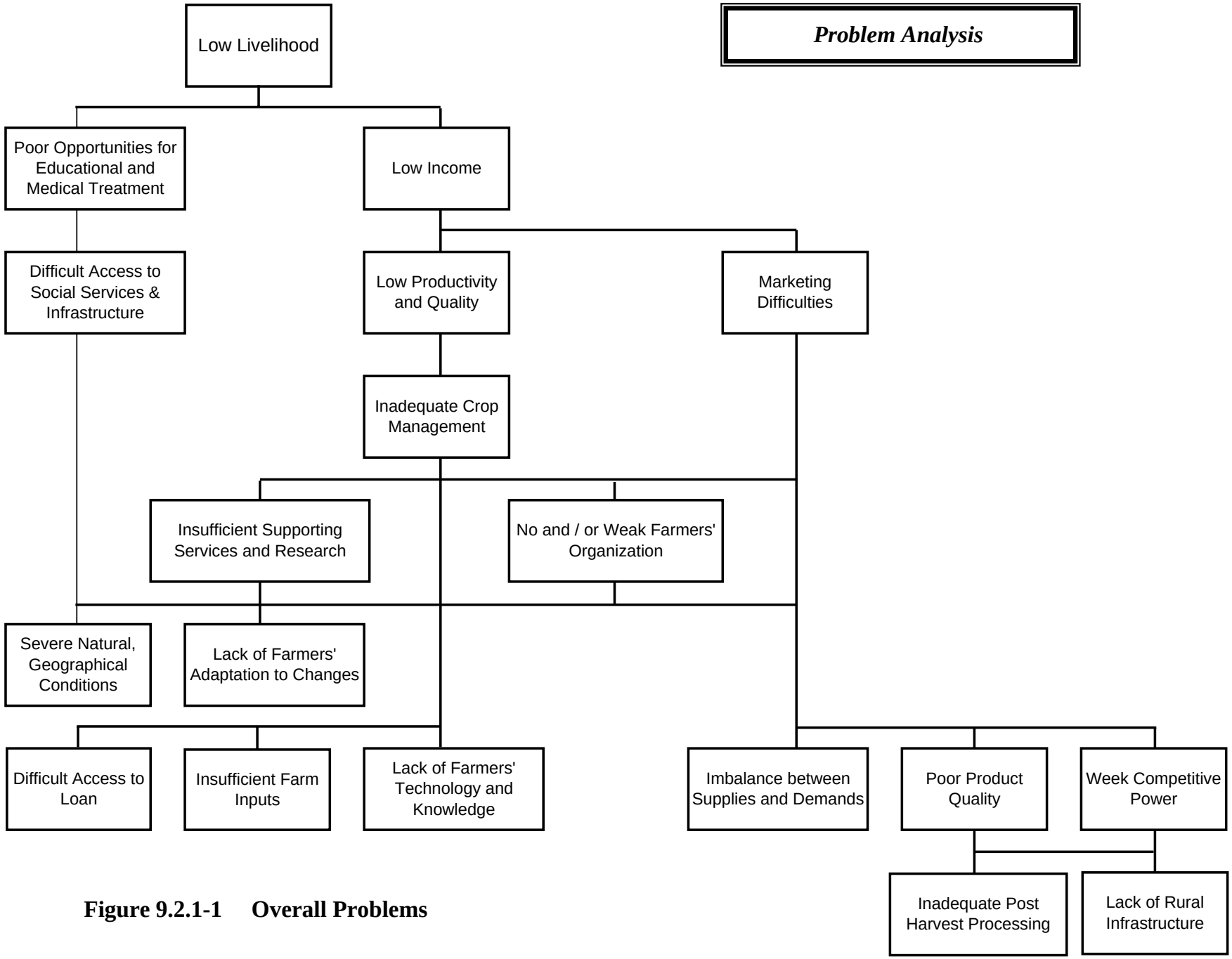


Figure 9.2.1-1 Overall Problems

In addition, the study team had internal workshops and carried out the problem analysis of agricultural production. The result of analysis is summarized in Figure 9.2.2-1.

(2) Guaraná

This section will synthesize and prioritize the production problems of the typical guarná farmer in Maués municipality. The key problems that were mentioned in the "existing conditions" section are now brought forward and expanded upon for further discussion. In Chapter 7, a variety of projects will be proposed for consideration by JICA/IDAM as practical, sustainable solutions to these problems.

(a) Competition from Other High Yield Areas in Brazil

Problem: *The small guarana farmers of Maués municipality are in danger of losing significant market share in guaraná to other more highly productive areas, especially those in Bahia State. Not only are yields higher in Bahia, but the farmers will accept lower prices than those of Maues farmers.*

Maués has been the traditional and leading producer of Brazil's highest quality guaraná for decades. But now that large companies such as PepsiCo and Coca Cola are making plans to market guaraná beverages worldwide, there is currently an urgency to get dependable supply bases lined up for long term supply of the raw material. Coca-Cola has chosen to establish it's own corporate farm in Presidente Figueredo. AmBev is quietly starting to develop sourcing strategies in other parts of Amazonas and Bahia. Two major plants producing export quality guaraná powder have established themselves not in Maués, but in Urucura (Amazonas) and Itubera (Bahia).

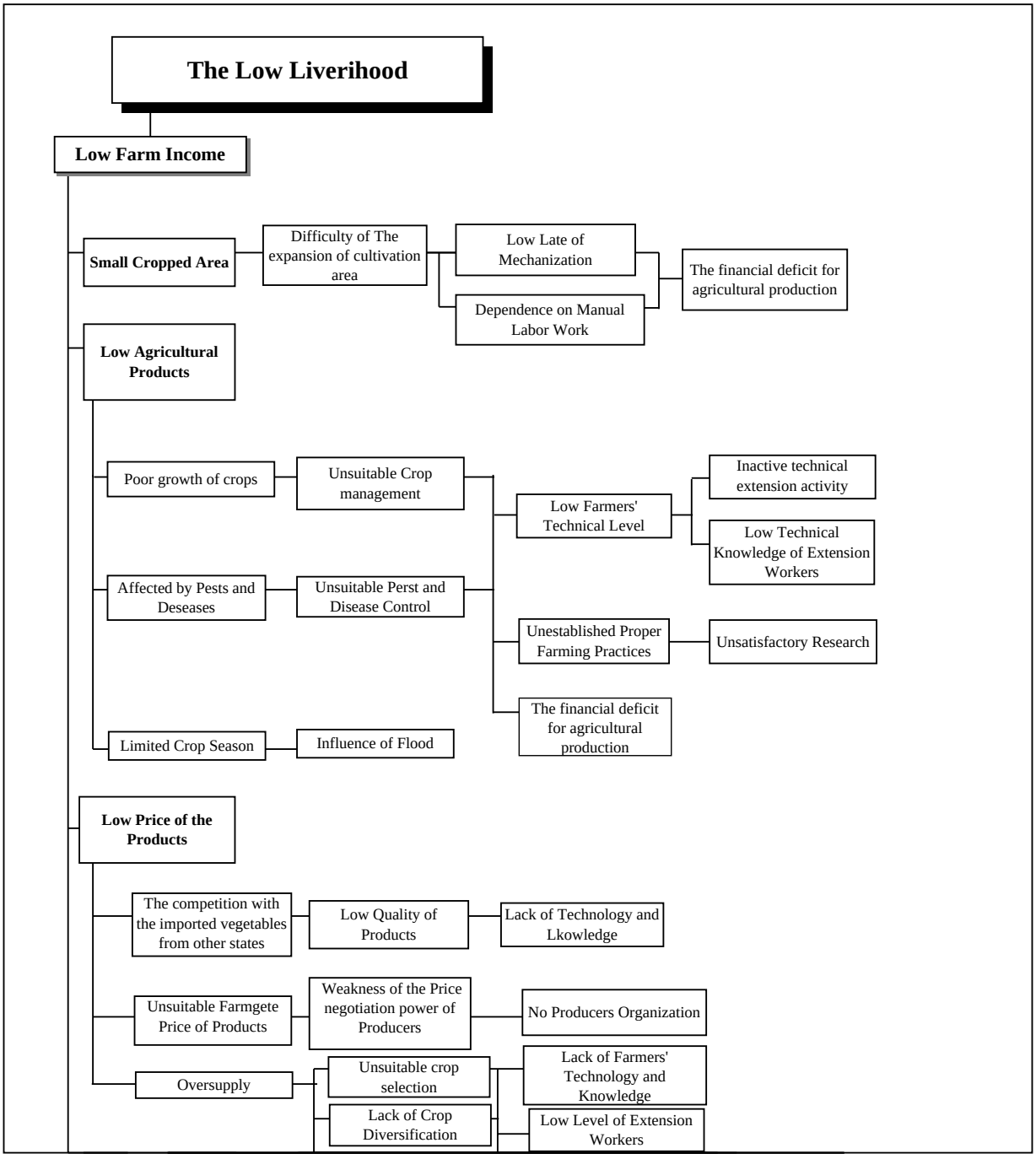
Why is Maués missing out on these opportunities. Large sophisticated companies are beginning to realize that the production system in Maués is too primitive, the environment is too harsh, the yields are too low, pricing is too high, and the farmers are not likely to adopt the necessary changes that will lead to sustainable high yields in the future.

Simply put, unless programs are put in place now to improve the yields of Maués, in the near future processors will choose to develop high quality supplies from other areas that are seen to promise more reliable delivery to large amounts of guarana. EMBRAPA has already identified 12 municipalities in Amazonas that might have even greater agronomic potential for guaraná than Maués.

Table 9.2.2-1 High Potential Investment Municipalities for Guaraná in Amazonas

Sub-Region	Municipality
12	Borba; Apui
14	Iranduba; Manacupuru; Coari; Rio Preta da Eva
15	Itacoatiara; Maués; Presidente Figueiredo
16	Parintins; Barreirinha, B. V. de Ramos; Urucara

Source: EMBRAPA, 2000


The Low Liverihood
Low Farm Income
Small Cropped Area
Difficulty of The expansion of cultivation area
Low Late of Mechanization
Dependence on Manual Labor Work
The financial deficit for agricultural production
Low Agricultural Products
Poor growth of crops
Unsuitable Crop management
Low Farmers' Technical Level
Inactive technical extension activity
Low Technical Knowledge of Extension Workers
Affected by Pests and Deseases
Unsuitable Perst and Disease Control
Unestablished Proper Farming Practices
Unsatisfactory Research
The financial deficit for agricultural production
Limited Crop Season
Influence of Flood
Low Price of the Products
The competition with the imported vegetables from other states
Low Quality of Products
Lack of Technology and Lkowledge
Unsuitable Farmgete Price of Products
Weakness of the Price negotiation power of Producers
No Producers Organization
Oversupply
Unsuitable crop selection
Lack of Crop Diversification
Lack of Farmers' Technology and Knowledge
Low Level of Extension Workers

Comparison of Productivity in Amazonas State vs. Bahia State

Problem: *Yields are higher in Bahia mainly due to more favorable natural conditions and several other factors which will be difficult for Amazonas to overcome.*

The following table presents a summary of the strengths, weaknesses, opportunities, and threats (SWOT) characterizing guarana productivity in Maues and Itubera, the most important guarana municipality of Bahia. A more detailed comparative discussion of guarana production in Bahia is presented in Table 9.2.2.2:

Table 9.2.2-2 SWOT (Strengths, Weaknesses, Opportunities, Threats) Analysis for Guarana Production in Maues, Amazonas vs. Itubera, Bahia

	Strengths	Weaknesses	Opportunities	Threats
AMAZONAS (Maues)	1. Has best processing quality (high caffeine, consistent low moisture, low impurities) 2. Appeal of "Amazonian" origin 3. Presence of largest processor (Ambev) 4. Presence of largest ag research agency (Embrapa) - has expt'l research sta. and nursery w/ breeding focused on Maues conditions 5. Over 10 high yielding clones already released specifically for Maues conditions	1. Infertile soils 2. Poorly distributed rainfall (2-3 months of drought stress) 3. Prolonged periods of high heat, RH, and rain 4. Very high level of pests and diseases 5. Inadequate transport system for crop and ag inputs 6. Farmers isolated, very difficult to find buyers when needed 7. Most farmers are very poor, (subsistence level) 8. Farmers reluctant to try new technologies due to high risk 9. Farmer associations very weak 10. Due to low yields (<100 kg/ha) farmers 11. Extension services very underfunded	1. Amazonas is focal point for int'l projects and investment due to interest in rain forest 2. Is only area where native Indians grow guarana 3. Development of private sector and village level seedling nurseries 4. Maues guarana not being properly promoted for its "Amazonian" origin & quality 5. Use CEPLAC expertise to develop mixed farming and agroforestry systems 6. Develop a central co-op to buy, process, market, and promote Maues guarana	1. Potential loss of market share due to low yields, high prices!! 2. Processors may move to other areas, or blend w/ cheap guarana 3. Many trees in decline since farmers don't have time or money for cultural practices 4. Embrapa clones, properly managed, result in high yield - but current supply is low, and they are too expensive. 5. Heavy dependence on Ambev and brokers 6. Ambev not too interested in improving small farmer livelihood 7. Farmers continue to plant in virgin forest instead of capoeira
BAHIA (Itubera)	1. More fertile soils 2. Soils well drained due to sloping topography 3. Rainfall is sufficient and uniformly distributed (drought stress is rare) 4. Temp and RH moderate, with frequent winds 5. Low incidence of pests and diseases 6. High yields (>600 kg/ha) 7. High diversification of guarana farms w/ other cash crops 8. Farmers moderately well organized 9. Farmers less reluctant to try new technologies 10. Good farm to market roads 11. Higher standard of living than Maues	1. Quality of guarana (caffeine, moisture, impurities) inferior to Maues 2. Economics of region volatile due to traditional focus on cacau 3. Traditionally low prices of ag goods in Bahia 4. Heavy reliance on brokers to make sales since very few processors in the region 5. Current lack of a breeding program to improve guarana for Bahia environment 6. Very few processors currently present	1. Cain market share due to high yields and low prices!! 2. Organic guarana production quite possible due to low pest pressure 3. Farmers always willing to accept relatively lower prices than in Maues 4. Quality of Maues is easily attainable if post harvest techniques (esp. roasting) changed 5. If quality can be improved, due to high yields/ low price environment, area is ideal for setup of processing plants and corporate farms	1. Local and state govt. not very supportive of farmers (fed. price for guarana not being enforced) 2. Amazonas State traditionally attracts more money for ag projects due to current popularity of rain forest 3. CEPLAC R&D agency highly capable and better funded than IDAM

Source: J ICA Study Team, 2000

Major Economic Concerns for Maues:

(b) Soil and climate

Problem: Maués climate is harsh, not ideal for guaraná.

To major adverse conditions of the Maués area are the high disease levels (due to the hot/humid environment) and the uneven pattern of rainfall and temperature (which disturbs flowering). The year round high humidity, the low rainfall during 3 months of the year, the acid soils - al these "harsh" conditions are always going to be present in Maués. Fortunately, plant breeding is helping to produce high yielding clones which are tolerant of these conditions. With the proper technology package, EMBRAPA has shown that yields of 400 kg/ha are possible in the villages with the improved clones. However, these packages have not yet been widely adopted by the small farmers, mainly due to their high cost.

(c) Seedling production

Problem: Poor farmer access to seedlings of improved clones due to high cost; poor acceptance of improved clones.

Although high yielding clones have been released through EMBRAPA research, the clones (R$ 2.5 per seedling) are still far too expensive for the average small farmer. Additionally, the point of sale in Maués (EMBRAPA nursery) is too difficult for the farmers to reach. Some private nurseries have been established, but these are basically providing seedlings under contract to large firms, not to the majority of small farmers. A system of independent nurseries, with no ties to EMBRAPA, should be promoted as a micro-enterprise activity near Maues. Seedling production should also be promoted at village level in those communities that are sufficiently well developed.

(d) Land preparation

Problem: Excessive, and needles clearing of virgin forest is taking place in rural Maués for crop expansion activities. Significant amounts of high value hardwood trees are being cut on an irrational basis. Hardwood that is felled rots instead of producing income.

Problem: Due to abundance of land, farmers are focused on expansion of new fields instead of efforts to recuperate older, unproductive fields.

Farmers are not aware of the long term, damaging implications of clear cutting the forest through slash and burn. They are also not aware of the benefits of mixed cropping vs. monoculture. Basically, they have very little appreciation for the concept of "sustainable agriculture". Farmers need to be convinced that in order to produce more guarana, they must focus primarily on reviving the yields of older unproductive trees - land clearing and planting of new areas with the improved

clones should be a secondary focus. Tree buyers need to be linked to the land clearing that does occur so that felled, high value trees can be used to generate income for the farmers.

(e) Planting

Problem: Lack of fertilizer and fertilizer mismanagement.

Problem: Lack of farmer interest and awareness of benefits of diversified agro-forestry model for guaraná.

Farmers need to be convinced that proper fertilization will result in yield increases that justify the initial high cost of the input. Most accept the fact that fertilizers help, but many believe the resulting difference in yield is minimal and that the practice does not pay for itself over time. Most all farmers need training in basic fertilizer management, including a low cost program to have their soils tested.

Farmers clearly prefer the practice of clear cutting when they plant new areas. They believe if everything is slashed and burned, weed control is easier and better yields will result. They have little experience with selective slash and burn techniques such as the "cabruca" system developed for the planting of new cacau areas. Such planting schemes are designed to retain significant parts of the original forest, promoting a highly sustainable agroecosystem through the interception of light and rainwater by species at different canopy heights.

(f) Cultural practices

Problem: Low yields due to farmer unwillingness to employ simple but effective cultural practices (fertilization, weed control, pruning) due to time constraints and lack of capital.

Problem: Maués is a natural breeding ground for guaraná pests and diseases which severely limit yields, whereas Bahia and new areas in Amazonas remain relatively free from pests. Disease control measures employing agrochemicals are highly ineffective in the tropical environment of Maues and are too expensive for most farmers.

The farmers feel that at current price levels, it is not advantageous to spend the time to properly weed and prune the plants, especially with older plants (greater than 8 years old). Research has shown that these two practices alone, with or without the application of fertilizer, can greatly improve the yield and longevity of older trees. Unfortunately, weeding and pruning are very time intensive activities. Depending on the size of the farm and the farm family, family labor cannot always cover the labor demand so hired help is required - but generally, the farmers do not have the capital to pay for such labor.

In the context of Maués, diseases and pests of guaraná will always be present in high

numbers. Agrochemicals do not work well, are expensive and toxic. Tolerant varieties (improved clones) and cultural practices are the only hope for the small farmer against anthracnosis and fusarium. Heavy thrips infestations will respond to chemical control if available and affordable.

Although research in the area of integrated pest management is lacking, environmentally sustainable practices such as biological control, canopy manipulation, and mulching need to be pursued in order to better control weeds and other pests without chemicals. Over the long term, the guarana agroecosystem in Maues would greatly benefit from the introduction of IPM programs and/or organic production.

(g) Damage by diseases and pests

Problem: *Since agricultural chemicals are expensive, small-scale farmers can hardly obtain them. The use of the seeding with resistance to disease and pest (improved clone species) together with cultivation technique will be effective to solve this problem.*

In the environment in Maues, guarana is always under the influence of diseases and damage by pests, and the damage to guarana is large. Agricultural chemicals are expensive, and they are poisonous as well. For solution to Anthracnose and rot disease, the use of the seeding with resistance to pests (improved clone seeding) together with cultivation technique will be the only hopeful method for small-scale farmers. If agricultural chemicals are usable and obtainable, thrips would be protected from infection.

Although the studies for consolidated management of pests are scarce, the demands on biological management technique, management on planting height, and continuous cultivation in consideration of environment such as malting are large, and the advanced technique on weeds and pests that does not rely on agricultural chemicals are attempted. For the long run, guarana agriculture's ecological system would be greatly benefited by the introduction of the IPM program and the production by organically grown agriculture.

(h) Harvest

Problem: *Scarcity and high price of farinha during guaraná harvest. Low availability of cash and foodstuffs during a period of intense labor.*

Maués farmers know how to harvest guaraná (they have, perhaps, the best technique in the world), but they become so involved in the harvest that other aspects of their life are put on hold. As a result, farinha processing in the villages grinds to a halt and there is little food to eat. Cash reserves are quickly exhausted buying food for the entire family (normally the entire family is participating in the harvest activities).

Farmers need a “savings plan” or access to more capital during harvest time. They can also be taught to more efficiently time their cassava plantings so that sufficient farinha can be processed just prior to periods of labor intensity.

(i) On-Farm Processing

Problem: Need to develop market linkages for buyers of value-added, specialty guaraná. Need to train farmers in alternative roasting techniques that may generate more income.

There is very little knowledge about the special roasting techniques used by indigenous groups (such as the Satere Indians) which already have demonstrated indigenous groups (such as the Satere Indians) which already have demonstrated success in producing exotic types of guaraná which obtain premium prices. If more average farmers could capture some of these exotic niche markets, more farm income would be generated in Maues.

(3) Vegetables

Major Problems

Although Varzea, the flood field, supplies fertile land to the farmers in Iranduba as useful resource, the productivity of vegetables stays at low level because of the various reasons in environment, society, economy, and technology. The reasons to prevent durable agriculture from developing are: (a) environment, (b) finance, (c) marketing, (d) social infrastructure, and (e) technology level. The problems which the farmers in Iranduba, especially vegetable farmers, are facing will be summarized below by category.

(a) Problems caused by topography/environment

Problem: Limitation of Production Activities during the Flood Season

The majority of the cultivated land in Varzea, the area for the survey, is in the flood field. This area is under the water for several months from the end of the rainy season through the beginning of the dry season. The cultivable period is short about 6 months to 8 months (around July to December) to restrict the farmers to obtain income from agriculture. During the flood season, the farmers become relying on fishing for their own food rather than for living. Moreover, the flood influences the farmers’ ordinary lives and economic activities, such as moving to other villages, and restricts these activities.

Problem: Poor transportation situation

Most of all small-scale farmers in Varzea live in remote areas and islands relying on transportation by small boats. Accordingly, they often face difficulty in purchasing agricultural investment materials and selling products. Moreover, the trades of the

products, in particular, heavily rely on the traders with the means of transportation, and the farmers are always under a handicap. Poor accessibility prevents the basic social welfare tasks from properly offering services and creates disparity.

(b) Funds/Finance

Problem: Inadequate Use of Fertilizer

When the farmers own certain amount of funds, they are able to purchase investment materials such as seeds, fertilizer, and agricultural chemicals. However, in reality, most of the farmers purchase seeds because they are cheap, and can afford only small amount of chemical or organic fertilizer because they are expensive. The lack of funds is most notable at the beginning of the cultivation period after the flood season. Many farmers need to obtain certain financing as initial investment to start agricultural production.

(c) Marketing

Problem: Marketing system for agricultural products is not well facilitated.

The fact that the marketing system for agricultural products is not well facilitated is a big problem for the surveyed areas. As the basic infrastructure for transportation like roads and water transports is not well facilitated, the farmers have great difficulty in making access to the market. Moreover, there is a very concerned problem that the spot price at farm for the agricultural products is extremely lower than the retail price. The farmers are not able to proceed with the negotiations with traders to their advantage because they cannot obtain market information relating to the price of the agricultural products and the balance between demand and supply, and also they are not organized.

Problem: Farmer organizations are not developed well.

Since most of the farmers are not organized in cooperatives or producer unions, they have practically no opportunities or abilities to make negotiations with traders. If farmer organizations exist in the surveyed areas, the activities concerning the spread of technology and marketing would be expected to be improved. Some farmer organizations are set up in the surveyed areas, but their organizational abilities are very weak and the members are not benefited from the organizations. Although many efforts have been made to establish and strengthen farmer organizations, most of the efforts have failed.

Problem: Vegetable processing are not well developed.

The vegetable processing industries such as drying, concentrating (tomato paste), or canning are still not developed. The consumers in Manaus, the major consuming place, consume vegetables as fresh, and tend to buy so-called brand products for processed vegetables.

(d) Social infrastructure

Problem: Basic infrastructure is not facilitated.

The basic social infrastructures needed for engaging in agriculture, such as roads, bridges, stores selling agricultural materials, simple warehouses, warehouses with coolers, distribution service for drinking water, are mostly not facilitated. Since collecting and processing facilities for vegetables are nearly non-existent, there is almost no chance to give added value to the product that the farmer makes for shipment.

Problem: Lack of packing materials for transportation

For the farmers in the surveyed areas, low-cost packing materials and the technology need to be introduced in order to minimize the wear and tear of the vegetables during transportation. Without such technology, the quality of vegetables declines all the more during transportation, and additional value cannot be added. At present, there is no place in the surveyed areas where the materials and technologies for packing are provided.

Problem: Low-level production technology

Most of the farmers in the surveyed areas have difficulty in importing appropriate technologies that will make the quantity and quality of their agricultural products improve and their agricultural income grow. At present, most of the farmers rely on the knowledge inherited from family members and close friends. The lack of technical knowledge is considered mainly as the result of the stagnant activities for spreading technologies that are unable to satisfy the needs of the farmers. The farmers need to gain the basic knowledge and technologies relating to fertilizing techniques and prevention and extermination of pests while they receive education on how sustainable agriculture in consideration of environment improves their living.

Problem: Inadequate activities to spread technologies

In spite of the fact that the various crops like fruits, cassava, vegetables, and guarana are cultivated in the surveyed areas, the consolidated technology package in consideration of the situation is not developed. The IDAM's county office who carries out the spread of technologies, has insufficient number of capable staff, insufficient facilities and equipment, tight operation budget for research and spread activities and insufficient number of staff who work for the spread of technologies. Moreover, their ability in collecting and managing statistical data is so poor that they cannot even supply chronologically correct information.

Problem: Lack of knowledge on simple processing

The farmers in Iranduba whose consumers are near have a room to find a new market in Iranduba by giving their products added value using simple post-harvest treatment

technology like packing. However, most small-scale farmers do not notice the business opportunities with super markets that can be possible by adding extra values to their products. The fact that the packing materials (trays and plastic packs) are expensive is another problem.

The strong points and the weak points of the Agriculture in Iranduba.

The Strong Points (Potential)

1. The farmer has the will which is going to learn agricultural technology.
2. Iranduba is located in the large consumer-place, Manaus suburbs.
3. Soil is fertile and is fit for farming.
4. The rich water resource is available.
5. IDAM field office is located in Iranduba town.
6. The research stations of EMBRAPA and INPA are located in the area.
7. The Manaus market share of the Iranduba Vegetables is low, and the room of remarkable development is left behind.
8. The organization (association) as a village organization is composed.
9. The administration system for supporting a farmer is established.

The Weak Points (Problem)

1. Since a farmer's educational level and a technical level as low, problem solution capability is low.
2. The farmer does not have own capital.
3. The farmers' organization is not functioning effectively or it is like a paper association.
    - The present condition is individual production and individual marketing.
    - Planned group production and marketing corresponding to the market situation cannot be performed.
    - Marketing of products is mainly operated by the middlemen.
4. The social infrastructure and marketing infrastructure including transportation are undeveloped.
5. The infrastructure for marketing is undeveloped.
6. Every year, it is influenced of a flood and farming is unstable.
7. The health supporting system has not been developed.
8. The support by administration is weak.
    - The research activity especially about the agriculture in Várzea falls behind.
    - Quality and quantity of human resources who can correspond to the farmers' needs are insufficient.
    - Cooperation of research organization and a extension agency is weak.
    - Finances have been tight (budget is insufficient).

The conditions of a success

1. A farmer's empowerment (problem solution by the farmer itself)

- Improvement of farmers technology and knowledge
- Strengthening of association/group activity
- Improvement of participatory approach by farmers
- Improvement in problem solution capability of farmers
- Improvement in group work capability

2. Improvement of the capability of a support organization (IDAM)
   - Promotion of activation of IDAM
   - Increase of working efficiency
   - Introduction of a target management system
3. Administration support reinforcement to the group activity and the cooperative enterprise by the association (farmer participation type enterprise)

(4) Tropical Fruits

In this section, the principal production problems for each of the tropical fruit crops are established. These problems arise from the existing conditions and constraints that were described in Chapter 5. Solutions to these problems will be proposed in Chapter 7.

(a) The Problem of Competition from Other States

In order to sustain the livelihood of fruit farmers in Itacoatiara over the long term, this project will have to address the threat of competition from fruit production areas in other States. The State that poses the greatest threat is Para State. All four of the target tropical fruits in Itacoatiara can be grown in neighboring Para State. In fact, the soils, climate, and rural infrastructure are generally better in many areas of Para State as compared to Itacoatiara. This permits higher productivity at cheaper cost, and facilitates market access.

Of utmost importance are basic differences in soil and climate between Itacoatiara and the fruit growing areas of Para State. Many of these highly productive areas are in the vicinity or Belem, the capital of Para State. One of the most productive is the region of Tome-Acu, which grows many tropical fruits for the Belem market and even has an established (and successful) processing cooperative known as CAMTA.

Figure 9.2.2-2 compares rainfall and temperature data between Itacoatiara and Belem. One can observe that the monthly maximum temperature are consistently higher thought the year in Itacoatiara, especially during the months of September and October. Rainfall is disuniform in both areas throughout the year, ranging from monthly lows near 50 mm and highs in excess of 400 mm. Importantly, the “low” rainfall months of July, August, and September are consistently worse, i.e. more dry, in Itacoatiara as opposed to Belem. In summary, low rainfall and high temperatures combine to cause a great deal of drought stress around the month of September in Itacoatiara, whereas the effects of drought are more moderate in Belem. This higher

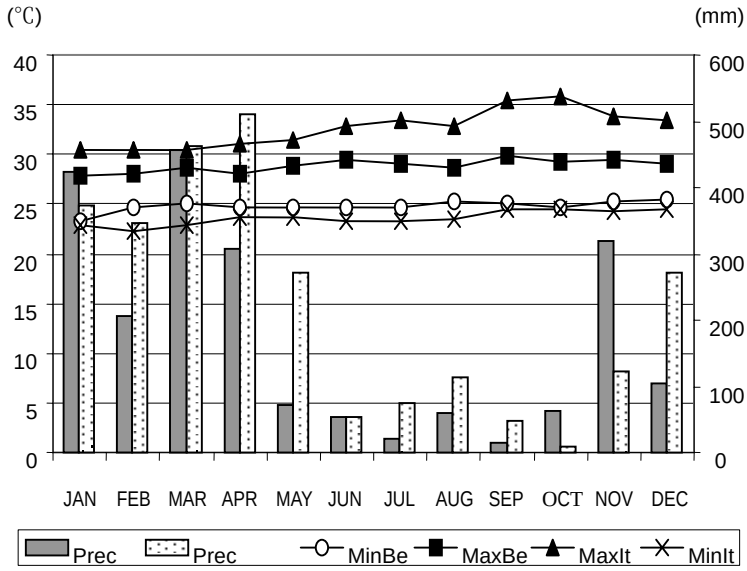


Figure 9.2.2-2 Rainfall and Temperature in Itacoatiara and Belem

drought stress environment may be responsible for problems with flowering, resulting in consistently lower yields of fruit crops in Itacoatiara.

As for soils that there are many more fertile soil areas for farmers to choose from in the Belem area as compared to Itacoatiara.

A complete list of strengths, weaknesses, opportunities and threats (SWOT Analysis) for Itacoatiara vs. other areas is summarized in Annex 9.2.2-1. Basically, Itacoatiara has certain strategic advantages in the production of cupuacu vs. any other areas in Brazil. As for the other fruits, there are many tropical and subtropical areas in other parts of Brazil with better soils and climate, which result in much higher productivity (e.g., maracuja or banana production in Bahia and Sao Paolo States). However, Itacoatiara still has the advantage of having the Amazonian name associated with its fruit, which may have implications in terms of better quality and more marketing appeal. So the primary threat comes from Para State, where yields for all these crops is as good or better than Itacoatiara. In summary, if Para State were to become the dominant player in cupuacu production, then it would quickly become the region in the Amazon of most interest for all tropical fruits. For that reason, it is extremely important for Amazonas State to maintain its strategic advantage in cupuacu production in municipalities such as Itacoatiara.

(b) Background Considerations for Tropical Fruits Problem Analysis

i) "On-Farm" and "Off-Farm" Problems

The analysis of existing conditions and constraints leads to an assessment of the main problems for tropical fruits production in the Itacoatiara area. In order to arrive at meaningful solutions, these problems can be categorized into "on-farm" and "off-farm" problems. On-farm problems are related to crop, soil and water management; therefore, they are more technical, more dependent on farmers, and most have relatively easy solutions. On the other hand, off-farm problems such as transportation, market, commercialization, processing, storage, etc are more complicated to solve because they have socioeconomic, financial and political components and implications that are beyond the control of the farmers.

Climatic and topographic related problems such as flooding, water excess and stress are more difficult to solve and involve infrastructural investment and more sophisticated technical knowledge and skills. Nevertheless these problems are the most important to solve because their solution, over time, will represent a less risky and more sustainable form of agriculture. Farmers in Iranduba, for instance, are using greenhouse-like structures to control excess rainfall for producing vegetables. In the same area, farmers use irrigation to insure vegetable and fruit production.

ii) Problems of low productivity vs. seasonality.

There are two main types of production problems: i) low crop productivity and ii) seasonality of production. Low crop productivity is related primarily to difficult natural conditions and poor crop management practices. Seasonality of production, on the other hand, is primarily related to natural factors such as rainfall distribution and monthly temperatures, which determine planting and harvest periods. Low productivity do not allow the farmers to have a reasonable income, on the other hand, seasonality of production creates a competition for inputs, hand labor, and machinery during planting and harvest periods.

Standard crop management practices like fertilization, disease control, weed control and other crop-related practices are known by farmers in the Itacoatiara area because of technical assistance of IDAM, however, for a variety of reasons (mainly economical) farmers do not use them. Basic soil and water management practices are not well known and not practiced.

iii) The importance of water management

Agricultural development in the wet tropics, mainly in the Amazon region, has been regarded as very difficult and often unfeasible. The main limiting factor for agricultural development in the region is excess water and non-uniform rainfall distribution.

<u>Recent examples.</u>

Just a few years ago, there was a program named PROVARZEAS that was intended to implement a series of actions to bring into production the varzea lands of the region. This program was discontinued for mostly political reason, but it indicates that the Brazilian government is aware of the importance of this kind of areas and that the Brazilian Government is aware of the importance of this kind of areas and that solutions for the excess water problem have been thought long time ago. Not too long ago there was a Brazilian institution named DNOS (Departamento Nacional de Obras de Saneamento) which objectives were to plan drainage and flooding works.

Regional experiences like Green house production and irrigation in Iranduba, irrigation of cupuaçu in Tomé-Açu, a Japanese settlement in Para State, and other indicates that farmers would accept such technologies if they were convinced of the economical convenience. Crop practices/budget recommendations by IDAM include irrigated banana and maracuja.

(c) Basic Tropical Fruit Production Problems

There are many constraints to tropical fruit production in Itacoatiara that limit productivity. It is difficult to classify or prioritize the types of production problems, which arise from these constraints. It was decided to group production problems into four basic categories: a) crop, soil and water management; b) technical assistance and organization; c) credit and market and d) infrastructure and services. The following is a general description of these problems.

i) Crop, soil and water management

There are climatic, topographic and soil limitations that impedes good production of the area and therefore its competitiveness with other regions of the country. Precipitation amount and distribution have, as was pointed out before, great influence in crop production and harvest time for cupuaçu, creating a problem of seasonal productivity and a period of low income for farmers. Soils of the area of Itacoatiara are poor in fertility, have low pH and high aluminum content indicting the need for fertilization and amendments. For several reasons, mainly economical, farmers do not use inputs and cultural practices are reduced to a minimum level. In crops like bananas and cupuaçu diseases are major problems.

ii) Technical assistance and organization

The lack of good transportation and facilities does not permit IDAM to give an adequate technical assistance. The municipality does not have enough personnel and facilities to attend very scattered communities. At the same time technicians need more is training to cover all technical aspects.

The lack of good and strong farmers organizations and cooperatives limit farmer’s to get reasonable for their products, organize commercialization and buy inputs at lower prices.

iii) Credit and market

Poor marketing organization, limited access to credit, low prices, and high cost of agricultural inputs, poor commercialization and presence of middleman are common problems. Farmers do not want to invest in the crops unless they are guaranteed a fair price. Besides it, poor marketing and commercialization organization prevent the farmers from getting better benefits.

iv) Infrastructure and services

Lack of good and reliable transportation limit the accessibility to markets and increase cost of transportation and inputs. Lack of processing facilities and electricity does not permit farmers to get added values for crops like cupuaçu and maracujá.

(d) Specific Tropical Fruit Production Problems

Specific production problems for each of the four tropical fruit crops and agroforestry and described in Tables 9.2.2-3.

Table 9.2.2-3 Summary of Constraints and Production Problems for Cupuaçu in Itacoatiara

Constraints	Major Problems	Potential Solutions	Research and Study Needs	Other needs
Diseases	Witches Broom disease is serious problem in the area. For economical reasons farmers do not control the disease. Even more advanced farmers, like ASCOP cooperative do not control diseases.	Technical assistance and training. Using present improved disease resistant clones. EMBRAPA is working on that but need more support. Improve present nurseries to produce and distribute seedlings.	Produce resistant clones. Improved control of diseases. Biological control of pest and diseases.	Improve market to get better prices to encourage farmer to use more crop inputs. Farmers Organization, FO, creation or improvement to implement training, technical assistance and to optimize resoueces.
Low fertility of soils	Cupuaçu is planted on Terra Firme Land wich has Oxisols soils that have low fertility, high aluminum content and low pH. Available soil data does not have enough information to make proper recommendations	Use generalized fertilization and amendment practices. Use green manure. Access to credit programs.	Study local soils. Evaluate best soil management practices. Study the utilization of green manure to improve soils.	Delimitate more adequate areas for the crop. Improve market to encourage farmers to use better practices. FO[1]
Crop Management	Due to economical reasons, farmers do not use most recommended practices like pruning and weed control	Technical assistance. Access to credit programs.	Evaluate and develop better management practices.	Improve market to encourage farmers to use better practices. FO
Water management	Excess water during wet season and water stress during dry months affect crop production and create seasonal production (seasonality) which affect prices in peak months.	Simple drainage practices like bedding could control excess water.	Evaluate the need for irrigation and drainage and its feasibility. Evaluate crop response to those practices. Evaluate water supply.	In the japanese colony of Tome-Acu, farmers are using irrigation, but it has not been evaluated yet. FO
Market	Market is one of the most important constrains for crop production. Uncertainty on prices and demand discourage farmers to plant the crop and to use better management practices.	Improve market information. Promote use of the crop products. Improve processing and provide storage facilities.	Study market fluctuations	FO. Cooperatives
Post Harvest	Processing of cupuaçu fruit is very rudimentary. Product quality is low. This affects market value. Processing s important to add value to production. Lack of electricity limit mechanical processing and cold storage.	Improve processing. Provide electricity. Technical assistance. Create more processing plants using improved ASCOP model.	Evaluate better ways to process the fruit and to preserve product.	ASCOP, the more successful cooperative in planting and processing cupuaçu still have problems for processing and storage. FO, Cooperatives
Infrastructure and services	River dynamics and isolation of communities limit farmers access to markets and services. Lack of good and reliable transportation increases production costs. Lack of electricity does not permit proper processing and storage. Lack of proper processing.	Improve transportation. Provide processing infrastructure. Provide electricity.	Study the transportation problem to plan the improvement of present infrastructure and to design new alternatives.	Infrastructure and services are major constraints.

[1] FO Applies to what was said previously

(e) The Agro-forestry approach

The slash and burn practice uses land for a period of three years, followed by a fallow period of several years for fertility recovery - and then the cycle is repeated. Theoretically, for a farmer to have an adequate income generation from for one hectare, with a 3-year use period and a 6-year recovery period, he will need to clear four hectares. This indicates a great deal of deforestation and soil erosion production will occur.

To prevent these losses, productivity has to be increased. The use of agrochemical is not the most recommended way, therefore there is a need for other solutions, and agroforestry is one of the best alternatives.

The Amazonas has a very high potential for agroforestry for several reasons. Although high precipitation generates an excess water problem, at the same time it ensures production of permanent crops, which sometimes is difficult is less humid regions. The great variety of plant species that can be used in agroforestry schemes is another advantage of the region. With agroforestry, farmers can have a diversified production for family, local and market uses while protecting the environment.

In the case of tropical fruits, there are several successful examples in the region, such as Peru and Bolivia. In Para State and Rondonia States there are some communities using agroforestry in a profitable manner. In the Itacoatiara area, IDAM is promoting it use.

Farmers of the area are using mixed crops with tropical fruit production. Pineapple and cupuaçu is common and sometimes manioc is also planned. This indicates that farmers could well accept the system. All four of the target crops (cupuaçu, açai, maracuja and bananas) could be used in agroforestry. Other high value species such as pupunha, mahogany, and loro are being used in the mixtures.

IDAM is promoting the use of agroforestry in Itacoatiara, but there have been very little resources allocated to the program and the institution does not have trained personnel on the subject. Other Brazilians institutions like EMBRAPA and INPA are involved in agroforestry through primarily through research and demonstration. It is suggested to give IDAM the necessary resources to partner with other institutions to carry out a comprehensive agroforestry program involving research, promotion and technical assistance.

9.2.3 Fishery and Aquaculture

In line with the scope of work of this study, problem analysis of fishery and aquaculture sector was focused on small-scale aquaculture as an alternative livelihood for small-scale farmers. On the other hand, other problems about fishery activity identified through the study are also described in this section.

(1) Aquaculture

Problem analysis was conducted through a series of discussion with counterparts. In this analysis, the core problem was specified as “aquaculture of small-scale farmers are not developed in the Amazonas State”. Based on the discussions, problem tree was prepared as shown in Figure 9.2.3-1.

Following four major problems are confirmed:

- Basic aquaculture technology is not disseminated
- There are significant number of suspended facilities
- Bank credit is difficult to obtain
- Supply of fish fry of potential species is not sufficient

Unlike the case of agriculture crops, marketing system was not recognized as a serious problem for restricting development of small-scale aquaculture at the moment. Given the present dawn stage of aquaculture in this locality, insufficiency of basic production techniques among small-scale operators was addressed as a fundamental problem to be solved urgently.

(2) Other fishery-related problems

Following problems are identified other than aquaculture:

<u>On fishing activity and fishery resources</u>

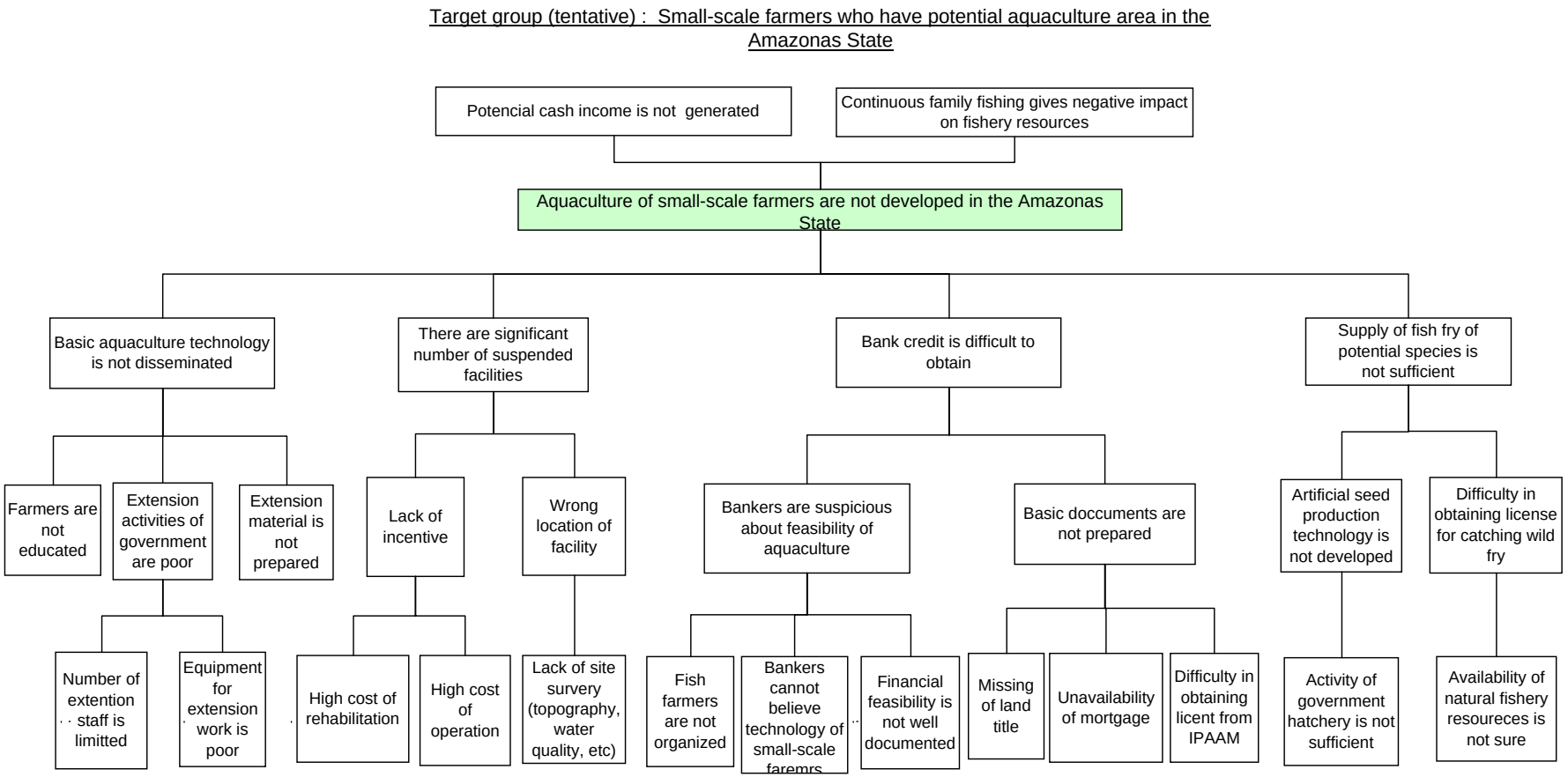
- Fish landing facilities such as fishing port are not developed.
- Fishery resources of the Amazon River basin tend to decrease because of over fishing and excess fishing pressure of non-resident anglers as well as deterioration of natural environment.
- Law enforcement against those illegal fishermen is difficult due to lacking of adequate inspection system.
- Reliable fishery statistics does not exist.

<u>On fish processing and marketing</u>

- Surplus fishes due to unbalance of catch and market demand are discharged to river in front of the unloading sites.
- Value added fish processing industry has not been developed.
- Freshness of fishes particularly for those for frozen-processing is sometimes not kept well.

<u>Others</u>

- There is no public organization which is responsible for overall fishery activity.
- Participation of multiple government organizations in this sector retrieves inefficiency of public services.



The study for improving Rural people's livelihoods through Agricultural Activities and Sounds Natural ResourcesManagement in the State of Amazonas

Japan International Cooperation Agency

Figure 9.2.3-1

Problem Tree on Aquaculture Sector of the Amazonas State

Among the above problems, proper utilization of fishery resources is considered as one of global issues in the Amazon River basin and tackled by many organizations using various fund sources as reviewed in Section 6.1.1. Discharge of over-caught fishes is another serious problems from the aspect of effective utilization of natural resources. However, no counter measure is enforced at present. Although details of fish discharge have not been investigated, it is important to examine the possibility of those fishes as a material of fish meal process

9.2.4 Processing and Distribution

(1) Guaraná

As was done in the previous section on "problem analysis" of guaraná production, the following section will describe the major problems of associated with guarana processing, distribution and marketing originally mentioned in the "existing conditions" section.

(a) Processing

Problem: Farmers not committed to concept of village-level processing for guaraná products; farmer's associations and co-operatives too weak to motivate farmers

In order to successfully establish small and micro businesses at the village level, each community needs a strong and well-organized farmer's association or co-operative that motivates its members. Secondly, there is a need to train the associations in business planning techniques, quality control, and marketing (as well as technical processing techniques). Following such "capacity building" activities, several pilot processing activities can be established in select communities.

Problem: Need for the initiation of new, small processing businesses in Maués, but market penetration is seen as excessively difficult

Problem: Processing in Maués is dominated by production of bars. Need product diversification to attract new buyers.

The processing and selling of bars in Maués, primarily to customers in Mato Grosso, is a profitable business - but currently, only for a select few. Much of the trade is clandestine and the buyers and their supply needs are not well known. The connections between Maués and Mato Grosso need to be made more transparent. If there is adequate demand, more small scale processing should be promoted in Maues in order to open up the market, improve competition, and improve product diversity. Products such as guarana-based energy drinks, instant powders, health foods, and cosmetics should be explored.

Problem: The relationship between Antarctica (AmBev) purchasing personnel and the farmers needs to be more transparent. More dialogue is needed.

AmBev needs to be encouraged to develop field-based programs in support of the

small farmer. Currently, AmBev does not have an intimate, supportive type of relationship with the growers. The relationship is rather cold and businesslike, and dominated by the tensions of many small growers facing one huge corporation. AmBev is seen by the farmers as too focused on controlling the market price, keeping it very low. The growers need to be convinced that AmBev is interested in investing in their future, that as AmBev guaraná products thrive in new international markets, so will the small farmer base of Maués participate in that success and growth. What is needed is a project where the farmers are treated more as partners instead of mere raw material suppliers.

(b) Distribution / Storage / Sales

Problem: Very poor river and land transport infrastructure to ship product to Maués

Problem: Farmers have no storage capacity in Maués prior to selling the guaraná, therefore, quick sales to brokers at low prices characterizes sales activity. Dependency upon brokers must be reduced.

Problem: The distribution chain for Maues guarana and guarana products is not well understood. Official government records of sales transactions are largely incomplete due to high levels of clandestine trading to avoid taxes.

In addition to increased community produce boats, farmers need a central facility in Maues where they can deposit their crop and receive a fair price. The facility should have some capacity to pick up their crop at village level, and through storage, should be able to sell high volumes of guarana and receive better pricing for individual farmers. This facility should also be linked to an overall, in-depth study of the sales and distribution pattern for Maues guarana.

(c) Promotion / Identity Preservation

Problem: Maues guarana and guarana products do not yet have a strong "identity" which would permit aggressive marketing efforts.

Problem: Aside from the case of AmBev, the market potential for Maues guarana (especially with respect to foreign buyers) has not been well developed.

Although it is already well recognized within the industry, the fact that Maues guarana is most always associated with a premium level of quality has not yet been fully exploited for the benefit of the small producers. A standards system needs to be developed which describes and quantifies the minimum requirements for "Maues quality guarana". Quality testing should be associated with a "logo" that becomes a registered trademark for guarana originating in Maues. Once Maues guarana has established its own identity through such activities, an aggressive international and domestic marketing campaign could be pursued to attract new contract buyers. Unless Maues guarana is better identified and promoted, its future may become

limited to sourcing by just a few multinational companies (such as AmBev/Pepsi-Cola, Coca-Cola). In order to sustain the future of the region, guarana farmers need contracts with multiple international buyers so that competition remains keen and pricing does not become dominated by a few large companies.

(2) Vegetables

The following analysis is focused on the processing, distribution, and marketing problems of the resource-poor farmers in Iranduba (Type I and Type II; refer to 5.3.2). These would be farmers similar to those visited by the RRAQS Team who have mainly Várzea plantings, small holdings (1-3 ha), no means of transport, and are highly dependent upon brokers. The major problems will be discussed with brief mention made concerning possible solutions.

(a) Processing

Problem: There are extremely limited opportunities to process vegetable crops in Iranduba

There are few opportunities for value-added processing because the Manaus market is primarily a consumer of fresh vegetables. There may be opportunities for farmers to directly supply higher end retailers (such as supermarkets and grocery stores) with "minimally processed" vegetables, but quality and appearance of the Iranduba produce would first have to be significantly improved. Additionally, most supermarkets require high volume supply chains so the produce from many small farms would have to be organized and aggregated in order to consistently meet volume requirements.

(b) Distribution

Problem: Severe shortage of proper packaging materials for Iranduba vegetables.

Currently, the small farmer doesn't know how or where to source proper packaging materials. There is a heavy reliance upon the acquisition of used materials from Manaus markets and these materials are usually deficient in strength and durability. The use of inadequate packaging materials results in significant losses in post harvest quality which restricts market access. Wood items seem to be very expensive so a possible solution maybe recyclable, reinforced cardboard materials. Local sources of affordable packaging materials need to be developed perhaps as micro-enterprises.

Problem: Lack of adequate transport services from Iranduba farms to the Manaus market.

Without some drastic improvement in transport options for the small farmers of the Várzea, they will never be able to break away from a high level of dependency on the brokers. Currently available transport means are dominated by brokers, thus lack of proper communal/public transport severely limits the farmer's choice as to how and when the produce can be sold. Additionally, limited transportation services result in high post harvest losses since many farmers with freshly harvested vegetables cannot

find transport to market on a timely basis.

Problem: Brokers have too much influence on the commercialization of the small farmer's vegetables.

In Iranduba, the brokers have the transport, control the price, have the cash, and have the knowledge of trends in the Manaus market. The farmers need their own Manaus-based "farmers market" where they can sell more directly to Manaus customers. In order to ensure sales, a "receiving station" should be set up in Iranduba to properly prepare the vegetables for sale at the farmers market. Preparation would include quality control, minimal processing, and aggregation of certain lots to satisfy high volume customers. Brokers would not be allowed to participate in the activities of these two facilities.

Problem: Significant post harvest losses in quantity and quality.

Most of the current post harvest losses are caused by an inadequate transport system for the farmers. Often times, the crop is ready at the field but there is no way to get it to market before a significant amount of loss occurs. In terms of quality aspects, many farmers have no idea of the standards set by consumers for vegetable quality. Furthermore, they are unaware of harvest and post harvest techniques to preserve quality. Training workshops in post harvest techniques are needed. Post harvest quality can be improved through proper production techniques as well as post harvest handling.

Problem: Lack of information about the distribution chain for vegetables in Manaus.

There is very little knowledge about the relative rates of consumption by various participants in the Manaus market. Little is known about the relative demand of supermarkets, market fairs, major wholesale operations, hotels, restaurants, etc. Additionally, very little is known about trends in consumer consumption. Farmers have no idea whether or not certain crops are falling out of favor or if there is sudden demand for new crops. Market surveys of the Manaus distribution chain and trends in consumer preference are needed.

(c) Identity Preservation and Promotion to Compete Against Imported Vegetables

Problem: There is no current effort to identify and promote Iranduba vegetables as distinct from imported vegetables.

Iranduba farmers would benefit from a promotional campaign to capitalize on the local freshness and quality of their vegetables. Local vegetables may also have far less levels of toxic pesticide residues compared to vegetables from Sao Paolo and elsewhere. The local pride of Manaus consumers needs to be tapped by such a campaign in order to give Iranduba vegetables a higher market share. Iranduba farmers need to engage in more direct marketing with Manaus consumers in order to gain their confidence.

Problem: *There is fierce competition from out-of-state suppliers and Manaus farmers.*

The major threat to the livelihood of Iranduba vegetable farmers are supplies from out of State, and supplies from producers in the immediate vicinity of metropolitan Manaus. Currently, the farmers have very little access to information about the activities and trends of the competition. As small farmers, they have much more pressing priorities to attend to in order to simply survive. Importantly, they need to know during which months of the year are supplies of the competitors weak (opportunity for Iranduba) and during which months is the outside supply strong (market will be flooded and prices low). Information on the volumes and pricing of their competition, supplied in a timely fashion, will affect decisions on when to aggressively promote their crops, as well as when to plant them.

(3) Tropical Fruits

The following will be a discussion of the general problems faced by the small fruit farmer of Itacoatiara in the areas of processing, distribution, and marketing.

(a) Processing

Problem: *Economic conditions are such that the farmer must have processing facilities in the area in order to making fruit farming economically viable.*

To state this problem another way, fruit farming (especially that of cupuaçu) is not very profitable or feasible unless farmers can easily deliver the raw material to a nearby, operative processing facility. The following table compares the profitability potential for a 3 ha cupuaçu farm, with and without the ability to sell easily to a local processor.

Table 9.2.4-1 Profitability Comparison (RS) for Current Cupuaçu Farming, Practices With and Without Presence of a Local, Operative Processing Plant

Years After Planting	# fruits/ plant	Yield * (kg/ pulp)	prod. Costs (R)	Sales (without plant)+	Sales (with plant)+	Profit (without plant)	Profit (with plant)	Profit Gain (with plant)
3	10	4,200	6,000**	1,008	2,064	(4,992)	(3,936)	1,056
4	15	6,300	1,200+*	1,512	3,096	(4,680)	(2,040)	2,640
5	20	8,400	1,200	2,016	4,128	(3,864)	888	4,752
6	30	12,600	1,200	3,024	6,192	(2,040)	5,880	7,920
7	40	16,800	1,200	4,032	8,256	1,208	12,936	11,728
8	45	18,900	1,200	4,536	9,288	4,128	21,024	16,896

* yield = 400gr pulp/fruit @ 200 tree/ha

** 6000 = combined cost of planting and maintenance for 3 ha after 3 yrs

+* 1200 = annual maintenance cost for 3ha, 4-8 yrs after planting

+ Sales w/o plant = 60% of production @ 0.7 R/kg pulp

++ Sales with plant = 95% of production @ 0.9 R/kg/pulp

Note: This model does not take into account the possible cost of loan financing for the initial planning, nor the possibility of inflation.

Source: IDAM Cupuaçu Project Report; conversations with farmers, EMBRAPA

This model assumes that the farmer who is not associated with a processing plant (such as ASCOPE) will only be able to sell 60% of his crop at an average price of 0.7 R$/kg pulp (price is low because sales are mainly to brokers). The farmer who has access to an operative plant should be able sell 95% of his crop at a price of about 0.9 R$/kg (based on ASCOPE experience). If production costs are constant, then the farmer without access to a plant (existing condition for most farmers) starts to make a profit (R$ 1,208) only in the 7th year, whereas the farmer who has access to a processing plant (ASCOPE member) starts to make a profit in the 5th year (R$ 888). By the end of the 8th year, the farmer with access to a plant has total profit gains in excess of R$ 44,000 compared tot he farmer without access to a plant - that would represent an average gain of about $15,000 per hectare per year.

Processing activities in Itacoatiara can be increased by (1) upgrading existing facilities in town and in the villages, and (2) building a series of new mini pulp processing factories in the villages. A central processing facility in Itacoatiara would serve the needs of many farmers who normally sell their fruits or crude pulp to brokers. In the villages, several pilot activities in selected communities should be pursued as model plants to prove that village-level processing can be profitable.

Problem: *"Home-made" fruit pulp form small farmer-based operations in Itacoatiara has a reputation for having poor quality (adulteration) and poor hygiene (microbial contamination).*

Highly contaminated frozen pulp is sourced from small farmers who use manual depulping operations, and routinely sold to customers in Manaus through unscrupulous brokers who don't pay any attention to the food hygiene condition of the pulp. The farmers are largely ignorant of how their handling of the pulp can result in microbial contamination which can have serious food safety implications for the consumer. Training workshops in food hygiene are needed at farm level, and the marketing of pulp through brokers must be reduced.

Problem: *Farmers often feel motivated to group together and form a processing venture, but they often lack the skills and capital to do it. Producer associations exist on paper but in reality they are non-functional.*

There is an urgent need to strengthen existing farmer's associations and co-operatives in Itacoatiara. If resources for improved crop technology and processing are soon to be brought to the region, the farmers must be better organized or else they won't be able to fully take advantage of the new resources.

(b) Distribution/Packaging

Problem: *The transportation infrastructure for small farmers in Itacoatiara is very weak.*

Problem: Lack of adequate packaging materials.

To quality of life of the farmers would be improved considerably if they had access to a fleet of trucks and boats dedicated to moving fruit from remote farm locations to the commercialization centers. The current system of random use of available (and inadequate) public transpiration is extremely inconvenient and encourages them to sell to brokers at low prices out of a sense of urgency and desperation.

Additionally, proper packaging material are virtually non-existent for the small farmers resulting in high levels of post harvest loss. Reliable packaging materials are especially needed to offer protection for bananas during transport to Manaus.

(c) Market Linkages

Problem: Lack of new market linkages

Farmers in the area continue to plant new areas of cupuaçu and pineapple even though market trends are unknown. A monoculture environment is being created, and virgin lands are being cleared needlessly. Land is being cleared faster than new buyers are being found.

Farmers, knowing the historic difficulties of trying to sell pulp during the peak season, continue to clear land and expand their fruit areas without having secured new buyers. Unless new markets are developed soon, the problems of oversupply and commercialization will only increase. Market linkages are needed to secure new growing contracts for fruits and/or processed pulp.

9.2.5 Marketing

(1) Underlying Conditions

Local farmers claim that marketing is a problem. But these remarks are often descriptions of phenomena not being able to sell their products at expected price. Consultants recognize, after survey of rural livelihood, that there are several key issues concerning marketing of agricultural products in the state of Amazonas.

Geographical Condition --- Distance of location and scarce people

Amazonas area is isolated by the river and dense rainforest. The transportation of people and goods are all influenced by this geographical condition in terms of quality control and market accessibility. areas where middleman comes around will be able to trade with them but most of the areas are so remote that even middlemen do not visit. Most of the farmers need to carry their own product by boat, and if lucky to have road accessible, they will hire trucks to carry out their crop. Itacoatiara and Maues have straight line distance of 175 km and 260 km each from Manaus, and the trip to Maues is 2 to 3 days by boat.

In any case the cost of transportation will reduce the profit margin of farmers.

When they sell to middlemen farmers do not have information of price, which create anticipation of being cheated. On the other hand, middlemen needs to bear transportation cost and loss of commodities during the sale. Therefore middlemen can offer a price lower than the market price, to which farmers are tempted to develop distrust. Even so people living in areas where middlemen come around are lucky. Most people carry products by themselves.

Trade is exercised in the form of man-to-man negotiation, and therefore even the price is listed actual price is determined according to the commodity or farmer. The amount traded is relatively small between farmers and traders, there is no systematic recognition of price or amount traded in each marketplace. Administrator in each marketplace is only to collect fees to operate there. Thus information concerning the trade in marketplace is not based on standardized system of measurement, and often hearsay spreads quickly rather than understanding the market trend. Price information is identified by the range of lower and upper limit rather than average.

(2) Lifestyle-1: Self-Reliance

Week association of farmers limits collective work, and for harvesting, they take fruits themselves and sell by themselves. They do not cooperate to stabilize the price nor improve their marketing position. This independent habit sometimes develops tendency to easy profiting by cheating buyers, charge high price when buyers are desperate, and sometimes even stealing others crop for marketing.

(3) Lifestyle-2: Self-sustainable

There has been a history of Indio that they live with abundant natural gift from both forest and river. People traditionally survived by the foodstuff in the forest such as nuts and fruits and also by fish from the river. Local people are in the cash-free self-sustainable lifestyle. In the situation that cash income is small for people in local towns, purchasing power is considered very limited.

Those who has time and money would carry products to Manaus and sell to traders at marketplace near harbor. But most others abandon harvesting their crop. The reason behind this phenomenon is that the farmers heard and tempted to harvest cupuasu as easy cash crop. The current situation of oversupply to local market is a result and is facing the time of adjustment. It is regrettable that the concept agro-forestry is not widely implemented in rural farms.

(4) Inherent Nature of Crop in the Tropical Rainforest

Tropical fruits are generally easy to deteriorate, for example cupuasu start rotting after a few days after harvesting. If farmers do not have proper transpiration means, it is difficult to bring products to processing plant.

When harvest season comes price of fruits falls dramatically at local market because

of oversupply. Farmers tend to let fruits lot in the field rather than carrying to market them in vein.

(5) Limitation of Supply Capacity

It might be possible to promote marketing by improvement of infrastructures such as road, boat, refrigerated warehouse and other distribution facilities. But considering the size of demand in southern states or outside of the country being so large that the production in the state of Amazonas can hardly meet the newly emerged demand. The harvested amount by each farmer is at most several tons and several tens of tons even when collected by cooperative. On the other hand demand is at least several hundreds of tons and most likely several thousand tons once one company would decides to use the fruit as a key ingredient of a new brand.

This is the reason why large users maintain plantation of their own and manage to produce their necessities such as AMBEV and Coca Cola (Reco Farma) runs plantation of guarana in Maues and in Presidente Figueirede. These plantation is remote from local farmers, and it is important to keep local farmers always in mind in time of the planning of local project for production and processing.

There needs to be improved in the following aspects such as fund increase with strengthening of human resources to supervise overall activities of farmers livelihood which include lack of marketing specialist and lack of institutional strengthening specialist.

(6) Lack of Quality Standard

Guarana traders often mention the quality and price, but the definition is not clear and the pricing system is also not clear. Farmers tend to keep their roasted seeds because the pricing is not fairly made between large buyers and small farmers. Prices sometimes dramatically change because of the competition among large buyers such as Coca-Cola and Antarctica. Current situation is stable in terms of production and demand, but there are many farmers who did not satisfy with the pricing of Antarctica.

(7) Intrinsic Problem for Marketing

Difficulty to sell agricultural products easily constitutes a mutual recognition that marketing is the problem. But marketing is a means of gaining cash income, not a purpose itself. What is important is to consider and design to improve quality of life without destroying the environment of tropical rainforest. Once this fragile environment is exposed to the international market economy, the irreversible change will permanently damage the foundation of people’s life.

It is not proper to apply market economy to this isolated forest area, because capitalism chase profit by exploiting natural resources and does not consider the

sustainability of the environment. The activity often leads to destroy nature, and what is worse, possible socio-economic impact on local people is to create gap between the rich and the poor, and leads to social instability

Considering the possible international market for Amazon products, it is a preposition that how to relate the preservation of rainforest with marketing.

(8) Marketing Problem and Potential for Each Crop

(a) Marketing of guarana

Problem: Unknown market potential Despite lots of rumor and hype, the true market potential for guaraná products outside of Brazil is unknown.

Almost certainly, the large multinational companies (PepsiCo, Coca-Cola) are currently undertaking sophisticated international marketing studies to determine worldwide demand for guaraná products. Unfortunately, they will never release these results to the public, so other market studies must be initiated through public sector funds.

Problem: Lack of proper sized processing company. Maués needs to attract the investment of more medium-size processing companies who can establish new market linkages between Maués and foreign (or domestic) buyers. There is a need to offer farmers more options in terms of points of direct sale. A market linkage effort is needed to find new buyers of guarana who are willing to offer contracts to the farmers.

(b) Marketing of Vegetable

Problem: Lack of information about the distribution of vegetables in Manaus.

There is little information about the amount traded by various players in Manaus such as supermarkets, marketplaces and major wholesalers. Also little is known about demand of hotels, restaurants and factories. As a result, market surveys are needed in order to understand demand and consumer trends.

Problem: Unfair trade balance between brokers and small farmers in Iranduba because of lack of information and transport on the side of farmers. In Iranduba, the brokers have the transport, dominate in determining the price, have the cash, and have the knowledge of trends in the Manaus market.

Problem: Risky market because of competition with out-of-state products. The small farmers of Iranduba are extremely ignorant of the activities and trends of their competition. There is little information available concerning the amount and price of vegetable imported from southern states.

(c) Marketing of Fruits

Problem: Lack of marketing planning

Farmers in the area continue to plant new areas of cupuaçu and pineapple even though market is saturated already. Farmers, knowing the difficulties of selling pulp during the peak season, continue to clear land and expand their fruit areas without having secured new buyers.

Problem: Poor quality control

By the time the fresh fruits arrive at the marketplace, there is considerable damage due to poor post harvest handling, resulting in more difficult condition to sell. Workshops in post harvest handling and technological development is needed.

Problem: Farmers need to learn how to trade their product and build confidence.

The rural farmers of Itacoatiara are reluctant to get in direct touch with the final consumer. Many years of tradition has kept them from the urban middle class customer. Projects such as PROVE in Brasilia have shown that the rural family farmer can learn to sell directly and successfully to the middle class consumer. Consumers would enjoy the "farm-fresh" taste, and farmers become confident for future sales which in turn will increase their income.

Based on the consideration above, it is possible to conceive potential market for each crop as described in the following table.

Table 9.2.5-1 Prospect of Potential Demands for Target Crop

	Domestic Market	External Market
Guarana	There are constant demand but the amount consumed within the same region is small compared to export.	Ambev, Coca cola, Pepsi and constantly looking for quality guarana in a large volume. Local processors export directly to international market. The possibility to find new market is growing but the quantity is still small.
Fruits		
Cupuasu	There are constant demand but the amount consumed within the same locality is limited. Manaus has a large consumer capacity and improved transportation infrastructure will increase the potential market.	Hygienic packaging of pulp may enlarge the market potentially. Technology of concentration and dehydration together with refrigerated warehouses will enhance the possibility to external market. Seeds also may open a new possibility of marketing when processing is properly conducted.
Asai	There are constant demand but the amount consumed within the same locality is limited. Manaus has a large consumer capacity and improved transportation infrastructure will increase the potential market.	Export to other state such as San Poulo and Rio de Janeiro is growing. In order to market in other countries, taste with sugar contents needs to be studied and careful research will be necessary.
Maracuja	Local demand is constant.	Competition with Asian passionfruits will make the marketing in northern countries difficult.
Banana	Constant demand as a staple food in the state of Amazonas.	International competition is very hard.
Vegetable	Leafy item are accepted well in local market. Competition with imported items in terms of quality and price.	There is no export to other states currently and possibility is very small to export outside.
Fish	Constant demand as a stable food in the state of Amazonas. People rely of cheap captured fish.	International market is being explored by introducing frozen fish. But the competition is hard.

9.2.6 Environment

(1) Current Environmental Problems Caused in Scheme Area

(a) Slash and Burn Agriculture

It is observed in the targeted project areas of Itacoatiara, Iranduba and Maues, that large-scale slush and burn agriculture of the tropical rain forest is conducted in Itacoatiara area. Basically, the administration and environmental management for the slash and burn agriculture is carried out by IPAAM and IBAMA in Amazonas State. The farmers who would like to engage in large-scale slash and burn agriculture have to obtain a license from IPAAM and IBAMA according to the environmental law.

Presently, in case a farmer plan to conduct farming by burning of forest exceeding more than 3 ha, he has to submit an application to IPAAM in order to obtain the necessary license. However, the EIA is not required for areas less 100 ha and based on the environmental law. In the Itacoatiara area, many large-scale farmers have burned tropical rain forest with 10 ha lots and engaged in the cultivation of pineapples. In this area it is observed that many tropical rain forest destructed by the slash and burn agriculture are carried out against law. On the other hand, IPAAM and IBAMA provided no management to small and medium scale slash and burn agriculture. Accordingly, this condition resulted to a situation wherein obtaining certain information and data regarding the lost area due to slash and burn agriculture have become very difficult.

(b) Small-scale Deforestation

The planning of wood extraction/deforestation of more than 2,000 ha in the Amazonas state requires a license and the applicants have to submit a forest management plan including EIA to IPAAM and IBAMA in order to obtain the necessary license. In case a farmer plan to conduct deforestation exceeding more than 3 ha, he has to submit an application to IPAAM in order to obtain the necessary license. However, the EIA is not required for areas less 100 ha. It is observed that many tropical rain forests with small-scale range are destructed against law. In the small-scale deforestation, this situation lead to the difficulty of obtaining certain information and data which reflect conditions of statistics records. In addition to the above, EIA required in forest management plan is not necessary in small-scale deforestation even if several plans are concentrated in the same region. No management and control by the government is conducted, and it is difficult to have accurate grasp of the environment impact caused by small-scale deforestation presently.

(c) Large-scale Deforestation

There are 4 big international wood extracting companies conducting large-scale

wood extraction in Itacoatiara. The area of the tropical rain forest covered by one of the biggest company is estimated at approximately 154,000 ha, and they have further development plan for wood extraction of additional 200,000 ha. In case of conducting the deforestation according to the approved forest management plan, it is foreseen that large-scale tropical rain forests of primary forest will disappear in the future. These international companies have carried out wood extraction according to the forest management plan previously approved by IPAAM and IBAMA basically. However it is told that wood extracting activities are not being strictly followed according to the approved conditions of license due to the shortage of manpower to conduct the necessary inspection. Work report is submitted to IBAMA through the municipality office. The operation of these large-scale companies is controlled by IPAAM and IBAMA. On the contrary, these large-scale companies provide job opportunity to local residents as worker. The biggest wood company hires approximately 1,000 local residents as a factory worker thereby providing positive impact to the regional economy.

(d) Firewood used to Brick Factories

There are 33 brick factories of building materials operating in Iranduba region. Almost all bricks required in the Manaus region, which has a population of 1.54 million are produced in this region. Firewood, waste oil, fuel gas and timbers from sawmill are used as fuels in this factory. Firewood from secondary forest are mainly used in factory. With the presence of these factories, the consumption of firewood in Manaus has become remarkably higher than the other municipality such as Itacoatiara and Maues. It is said that there are only a few natural forests for firewood resource remaining in the adjacent area of Iranduba presently. At the present stage, there was an on-going research being conducted by EMBRAPA intended to obtain a high efficiency out of wood. The cost for the utilization of gas and waste oil is higher than firewood, therefore it is foreseen that large-scale wood extraction in this region for firewood will continue. Data of wood extraction is shown in Table 9.2.6-1

Table 9.2.6-1 Data of Wood Extraction

Location	Fire wood (ton)	Fire wood Amount (R$)	Timber / Logging (ton)
Iranduba	22,000	155,000	2,000
Itacoatiara	19,000	82,000	5,000
Maues	17,000	49,000	1,000

Data Source: IBGE, Annual Brazilian statistics, 1996

(e) Evaluation of Current Environmental Problems

Environmental impact such as economic activity of local residents, fauna and flora, soil and land degradation/deterioration caused by above items are shown in Table 9.2.6-2. As for the small-scale slash and burn agriculture and deforestation are related to proposed scheme. Therefore, in order to preserve tropical rain forest, consideration shall be provided to farm land belong to small-scale farmers. The environmental

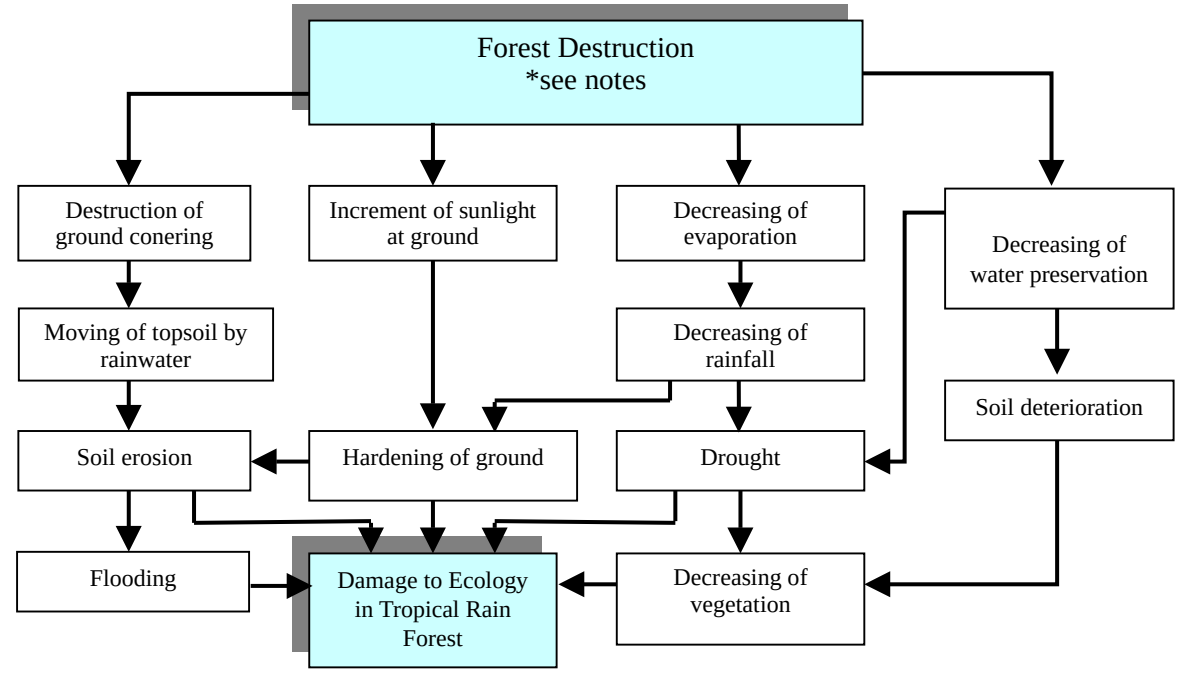
impact caused by forest destruction and problem analysis is shown in Figure 9.2.6-1.

Table 9.2.6-2 Environmental Element and Impact

Items	Small-scale Slush & Burn Agriculture	Small-scale Deforestation	Firewood for Brick Factory	Large-scale Deforestation
Economic Activity	P	P	P	P
Fauna and flora,	N	N	NN	NN
Soil	N	N	NN	NN
Land Degradation	N	N	NN	NN

P: Positive impact is expected,

N: Negative impact is expected, NN: High negative impact is expected



*Note: Road Construction, Increment of Immigrants, Expansion of Farm Lands, Slush and Burn Agriculture, Extraction of Woods

Figure 9.2.6-1 Impact of Forest Destruction and Problem Analysis

(2) Environmental Management

(a) Environmental Organization of IDAM

IDAM belongs to the Amazonas state government, and serve as a main organization for the agricultural field providing service and administrations since it was established in 1996. Presently, IDAM is comprised of two divisions such as; technical and administration and financial under the president director. There are three departments under the technical director and includes 14 management sections. However, there are no sections and personnel are officially assigned or in charge of environment matters and problems.

In addition, IDAM have 29 municipality offices in the Amazonas State and provides agricultural service and administration as a lower branch of the organization. Presently, several projects are on going by IDAM and environmental matters

including problems will be the responsibility of each section and personnel. Under this organization, it is not possible to proceed with unified management regarding to environment matters resulting to a lower efficiency of the administrations. The promotion of sustainable development in the agricultural field will be become more serious in the future that the establishment of organization and assignment of environmental section and in charged engineers is required to be addressed.

(b) Establishing Cooperation with Related Government Organization

Presently, Global environment protection such as repository of bioderversity, carbon sink, and protection of natural resources have given careful consideration to preserve the environment. In the agricultural project, environmental consideration is required. Many projects are implemented by PPG7 project according to the environmental policy established by the Brazilian Government. The purpose of PPG7 project is contained in the following basic policy of environment;

- Demonstrate that sustainable economic development and conservation of the environment can be pursued at the same time in tropical rain forest.
- Preserve the biodiversity of the tropical rain forest

For proceeding with the above policy, many subprojects are implemented at present stage. The result of this subproject has to be reflected in to farming projects and farming policy conducted by IDAM. Therefore, data and information collections regarding these items are indispensable to proceeding the administrations of IDAM. Those data belong to each project execution organization such as IBAMA, IPAAM, INPA, EMBRAPA etc. However, the present organization does not have the sufficient capability due to the shortage of manpower and organization. In addition to the above, cooperation with each concerned organization for promoting the activities of data collection is required.

9.2.7 Social Conditions and Farmers' Organization

(1) Existing farmer organizations do not function effectively as the focal point for spreading agricultural technologies.

Problem: *Almost no organization among the community-based farmer organizations is coping with cooperated agricultural labor as the focal point for spreading agricultural technologies. Also, women farmer organizations are not farming-oriented.*

Although some different types exist among the farmer organizations in the surveyed areas, all of them are composed with single sex. This situation can become an obstacle when forming a farmer group whose main purpose is to conduct joint framework. At present, farmers' mutual support systems such as exchange-labor system and joint work without charge are rare; the common practice is to hire agricultural laborers by paying wages. Also, framework is separated by sex. For

example, watering vegetables are done by family members, and most cases, on ducted by women and children before going to school.

(2) Influence caused by insufficient mutual support system

Problem: Influence can particularly be seen in the framework of the farmers who have no solvency because mutual support systems such as exchange labor system and joint labor are not sufficient.

This problem would result in delaying the framework that need labor force (cultivation, planting, harvesting,) as well as lowering the quality of crop management tasks such as weeding and protection and termination of pests. Although the farmers cultivating tropical fruits learn at the educational session that cropping of fruit trees and weeding surrounding weeds are effective to improve productivity, they do not own enough funds to conduct such work. Also, they lack farm management capabilities, particularly the knowledge on planning a planting scheme, and cannot distribute labor nor calculate cost. Accordingly, even if the mutual support systems like exchange labor and joint work are carried out, they would not be managed systematically in the group.

(3) Negative influence over grouping caused by egotism and seasonal or geographical isolation

Problem: The farmers in the surveyed areas are isolated seasonally or geographically. They tend to be self-reliant, and, in other words, they are individualists and egotistic.

They make self-reliance without depending on others as the basis of their lives. Considerable time and difficulties are expected to form mutually trusted organizations and make them functionally active. However, the start of grouping can be made through actually experiencing benefits of organization, such as the profit made from joint purchase of investment materials and equipment for vegetable farmers and the reduction or transportation cost made by joint shipment for fruit farmers.

Problem: Time and education/training are necessary to establish mutual trust among farmers and independence of organization.

It is comparatively easy to establish an organization when the members of the group believe in the same faith or they are blood-related. However, such factors of advantage to establish organizations do not exist in most of the communities in the surveyed areas. The community made by migration, an artificial action, does not own shared sense as a group. Most of the communities in the surveyed areas are this kind of communities. In Itagoatiara, the organization shared with religious beliefs had existed before, but disrupted now. In Iranduba and Maues, the supports

for forming organizations and activities had been made under the organization project, but they made no effective results.

Problem: They lack the analytical ability to solve the problem on their own without relying others.

The ability to point out problems were recognized among the participants of the PCM workshop that were conducted continuously during the surveyed period. However, they only listed various problems such as social, financial, and personal problems. They were able to prioritize the problems personally, but unable to explain systematically the causal and mutual relationships of the problems.

Problem: Similarly, the problems of the highest priority that the farmers at the PCM workshop identified were those relating to the farm management and farm economy that were intertwined with outside and inside factors, and at the same time, restrained by the limit of organizational activities. The existing local farmer organizations are poor at solving problems, and it indicates that the education/training to the organization is insufficient.

As the focal points for the support activities by the country government, the local farmer organizations (community associations) lack the knowledge and technologies to conduct the activities for local advancement, prioritize and plan the tasks, and become independent.

Problem: Existing farmer associations rely largely on support and services.

Farmer associations were not made with certain goals. They were rather formed for receiving support and services. Accordingly, the organizations that obtained "something" as their objective often cease their activities or dissolve them. It is necessary to steadily foster the organization by giving education/training for the technologies necessary to make detailed plans, try and error for improvement, and form and sustain the organization. However, no organizations that were formed and made activities in the order that existed in the surveyed areas. It will need a considerable time to create strong organizations in the surveyed areas.

Sagrado Coracao de Jesus in Itaquatiara is noted as the only exception. Since 1967, this community has received continuous support activities, effective leadership promotions, and education/training for the organization. As a result, the agricultural cooperative, ASCOPE, was formed in 1993 that is currently evaluated as the most successful agricultural cooperative in the state.

By analyzing the ASCOPE's activities, it became clear that it requires considerable length of time for an organization to gain trust from the society and establish their consolidated abilities for developing agricultural cooperatives in the surveyed areas.

Also, for the success of the organization, it is not enough to provide may technical and managerial supports. In order for agricultural cooperatives to become successful in developing, they need to obtain business skills such as the ability in building mutual trust among members, managerial ability, and the ability to construct liaison and marketing structures.

(4) Support activities are not responsive to the needs of the women in the farm.

Problem: Although the women in the farm play important roles in the region as well as at home, they are not considered to be strategically important for the support activities.

The support programs rarely aim for women and women's activities. As a result, while men tend to seek assistance from outside sources to solve their problems, administer and use them, women incline to use the resources close to them, and solve their problems internally.

(5) Restricted elements in organization, management, finance and policy that make influence over the organization of farmers.

Problem: The systems for sustaining and managing organizations are not provided.

The farmers are aware that certain problems are unable to be solved by family units or producer groups. They are also aware that they need to register formally as community associations in order to receive technical assistance and funds from the government. However, most of the community associations are not registered formally. Moreover, since they have not received educational training on structuring organizations and managing the organization afterwards, they lack democratic leadership and own only poor skills on organizational management. Their financial conditions are not healthy as well.

The following lists the major restricted elements identified in the workshops conducted during the surveyed period.

(i) Restricted elements on management

The major restricted elements were the lack of management skills and democratic leadership. The problem on how to attract the residents and farmers who do not participate in the associations to join was also raised as a major restriction.

(ii) Restricted elements on organization

The restricted elements on organization were seen in all communities, that would stem from the IDAM's insufficient educational training. IDAM also failed to provide any assistance in forming and registering community

associations such as how to hold meetings and elections, to store records, to form committees, and to enter in ledgers. Since the registration process itself is not complicated, the authorization was not identified as a restricted element.

(iii) Restricted elements on financial matters

The lack of trustworthy relationships in the communities as well as the lack of independence as an organization are the factors to invite difficulties to the organization. These are the restricted elements on financial matters commonly seen in all communities that the members do not pay their periodical dues.

(iv) Restricted elements on organizational policies

The association at the lowest level or close to the lowest level needs to first build mutual trust among members and establish strong organization before they conduct activities that require large amount of funds. The association should understand financial policies, and, if they already have such members who fall into financial crisis, they should establish default policies as an organization in order to avoid financial risks.

(v) Restricted elements on organization

The fact that the association is formed to receive grants and materials from the county government and not to solve problems is an important restricted element. Also, non-participation by women was raised as a problem.

(6) Major restricted elements for farmer associations

Various types of farmer associations exist in the surveyed areas. majority of the farmer associations are producer groups, community associations, registered regional associations, and non-registered regional associations at various development levels. The following two types of the farmer associations are concluded to be with potential to make great benefit for improving livelihood of villages if they decrease restricted elements on agricultural management and strengthen managerial capabilities.

Non-registered producer groups:

They cooperate each other on the exchange labor system in the group. They sometimes undertake the farm labor for the members only with supply of food. This type of groups is effective to improve cultivation techniques and quality as well as restricted elements on time and labor.

Community associations:

This type of organization owns functions to become a focal point for supporting farmers and facilitate in assisting supporters. Because they grasp the farmers' needs and act as liaison to the government for the support services in order to cope with the problems relating to management and market distribution. And they conduct their

activities with the aim to improve agriculture, and secure the financial resources though the social security system. Figure 9.2.7-1 shows the basic structure of the measures taken for strengthening the farmer associations. According to the analysis on the restriction elements, the major restriction element under the current condition is that the farmers themselves own only poor knowledge, techniques and abilities for forming community associations and conducting activities. The measures for strengthening community farmer associations will be made in taking this restriction element fully into account.

9.2.8 Capacity of Supporting Agency (IDAM)

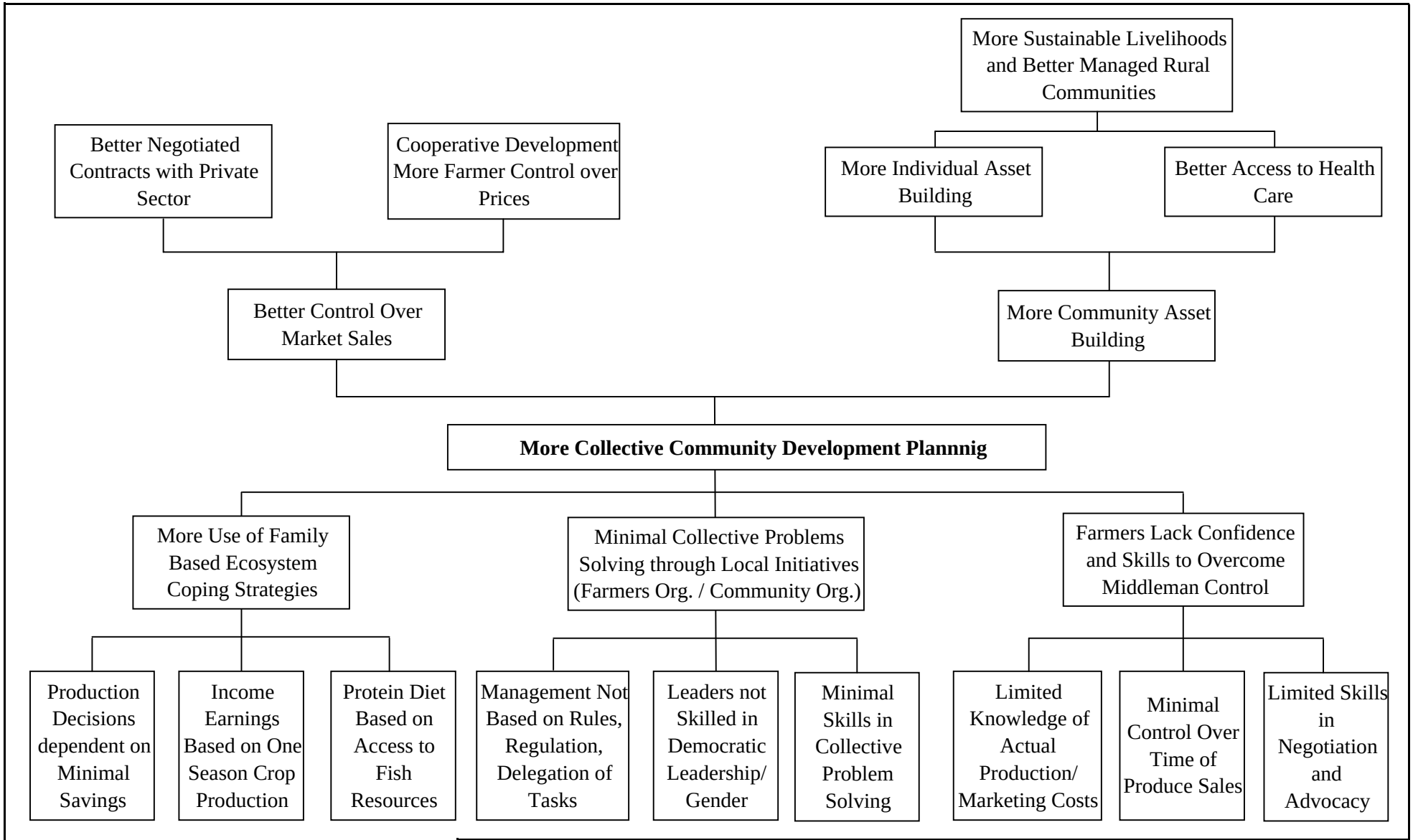
(1) Problems relating to agricultural promotion

The responsible agency for promoting activities in the state of Amazonas is IDAM. Particularly, the technical staff in the regional IDAM offices are the points of contact and the front-line workers for the promotion services. Although IDAM is important in promoting agriculture, the IDAM staff's technical level and communication ability with farmers are found unsatisfactory through the workshops conducted by the study group and the RRA survey as well as the interviews with farmers. Besides, they carry out uneven promotional activities that, as seen in Iranduba, they intensively teach a small group of progressive farmers and the farmers with ample funds the consolidated facility gardening technique using houses that is called plastic culture.

The lack of funds, the lack of capable staff, the limit of the ability as well as the poor condition of facilities and equipment for the IDAM regional offices, that carry out the actual promotional activities as the points of contact with farmers, are considered as the reasons for the poor results in the IDAM's promotional activities. Moreover, the structural problems stemmed from the IDAM's organization and their promotional systems are inevitably considered as the reasons as well. As a result, they concentrate in the activities that would easily produce effect and have already been budgeted or acquired loans.

The IDAM's current problems found out through the on-sight survey are summarized below:

1. The farmers for the IDAM's promotion (benefactors) are limited under the restrictions in geographical conditions and the IDAM's activity budget.
2. The sections that need to be strengthened, such as farmer associations and marketing, are weak. The staff who specialize in these areas are also scarce.
3. IDAM still falls behind in information technology systems.
5. The relationship with other related organizations and research institutions are weak.



The study for Improving Rural People's livelihoods through Agricultural Activities and Sounds Natural Resources Management in the State of Amazonas

Japan International Cooperation Agency (JICA)

Figure 9.2.7-1

Rationale for Development of Strengthening Famer Organization Approach

6. Although the educational and training are conducted, effect cannot be measured since the standard does not exist to judge if they contribute for fostering capable staff.
7. The numbers of the staff with high educational background Avery small among the staff in the technical field in the county offices. The level of education and training is also unsatisfactory.
8. The specialties of the technical staff are unbalanced. The staff is scarce in specializing regional development, social economics, farmer organizations, and fishery and cultivation.
9. The regional offices are small and shabby, and need to have repairs. Telephones, computers, and fax machines are equipped though not quite satisfactorily.
10. In comparison with the facilities for clerical work, those needed for transportation such as cars and boats are still more insufficient. The budget for fuel is also very limited. As a result, the staff's activities are very limited in number and distance.
11. The staff is regionally assigned. The system works well to effectively facilitate limited number of technical staff, but the responsible area for a staff is too large. Since the inter-disciplinary communications are insufficient among he staff, their knowledge is not shared well.
12. The results of the past field tests and the currently conducted EMBRAPA tests are not well utilized by IDAM or the farmers.
13. Because the basic information research on soil and the field tests on crops are particularly not fully conducted, the cultivation manuals and the guidelines for using agricultural chemicals in considering the regional characteristics are not prepared.
14. The face-to-face promotional activities are restricted. The teaching materials and the brochures for the farmers are prepared, but not in effective use.

9.3 Objective Analysis

9.3.1 Overall aspects

By reformulating all elements in the problem tree into positive, desirable conditions, the tree is transformed into objective tree shown in Figure 9.3.1-1.

In this development plan, three project approaches were elected as follow;

- Productivity and Quality Improvement Approach
- Marketing Improvement Approach
- Social Conditions Improvement Approach

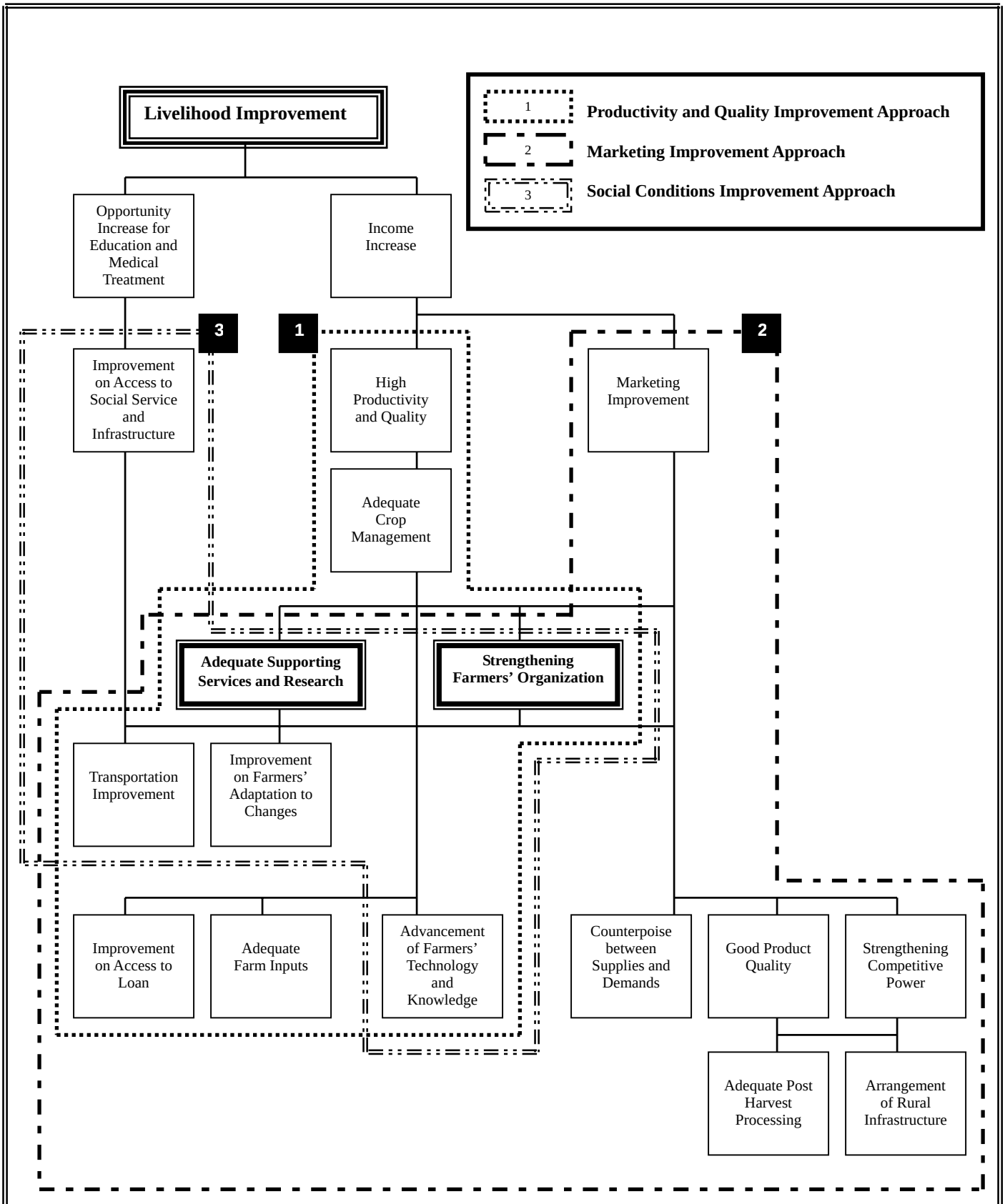


Figure 9.3-1 Overall Objective Analysis

CHAPTER X PROJECT APPROACH AND BASIC STRATEGY FOR PLANNING

10.1 Project Strategies

The following three project approaches were selected by the objective analysis shown in Chapter IX.

1. Productivity and quality improvement approach
2. Marketing improvement approach
3. Social conditions improvement approach

The above are the basic development strategies for improving the livelihood of the regional residents. The plan will be structured based on the development strategies.

10.1.1 Basic Development Strategies

The fundamental strategy of the plan for improving the livelihood is to improve agriculture (fishery) that directly connects to the main income source of the regional residents (farmers). In order not only to improve productivity and quality but also to market the products (gatherings) at the appropriate price, the plan aims to benefit the improvement plan by improving marketing capabilities on material things and non-material matters, in particular, and stabilizing and improving the farmer's economy with the multiplier effect of the improvement on the marketing capabilities.

10.1.2 Key Strategies and Components

Putting the basic strategy into practice would principally rely on farmers' endeavor and supporting services, especially IDAM's activities. These correspond to the articles of "Advancement of farmers' technology and knowledge", "Strengthening farmers' organizations" and "Adequate supporting service and research" involved in the objective tree. Sustainable rural development would be based on Development and improvement on both farmers' and IDAM's capacity, therefore capacity building of both sides is esteemed to be key strategy. Capacity building in key strategy is aimed not only at farmers but IDAM as the main agency, so planning focussed on this key strategy could be justifiable as high actualization plan. Through various field investigations, it is found that farmers have suffered from the vicious circle of poverty as below:

1. Materialistic poverty
2. Physical weakness
3. Vulnerability against outside influence and unexpected situation
4. Isolation
5. Powerlessness on politics and negotiations

The way to final goal for the Project would attribute to cutting the vicious circle of poverty and improving it. Under this viewpoint, the basic and key strategies above

could be envisaged coping with poverty circulation as the following table.

Figure 10.1.2-1 will represent the image of the fundamental structure of the plan.

Table 10.1.2-1 Measures for Plan's Basic Strategies against Causal Relationship Factors of Farmers' Poverty

Causal Relationship Factors of Poverty	Measures for Plan's Key Strategies
Materialistic poverty	Project approach 1 and 2
Physical weakness	By promoting approach 1 and 2, sufficient meals can be taken, and insufficient growth and malnutrition can be avoided. Approach 3 will also be taken
Vulnerability against outside influence and unexpected situation	By the fundamental strategy of organizing farmers and improving farmers' abilities, the sections for women and savings will be formed and the activities will be strengthened for the mutual assistance among farmers.
Isolation	By social facilities (lending boats, etc.) of the project approach, the improvement on transport conditions will be made to solve the isolation problem.

Source: JICA study Team, 2001

10.2 Agricultural Production on Target Crops

10.2.1 Guarana

(1) Overview

In preceding chapters, the major constraints to guarana production in Maues have been identified and the major problems related to these constraints have been described. In this chapter, the strategy for an integrated set of project activities designed to alleviate these problems will be presented in a summarized form. Project purpose, expected outputs, principal project activities, potential project collaborators will be described in limited detail. Further information such as indicators, means of verification, required inputs, and budgets will be presented in Chapter 12.

(2) The Critical Problem for Guarana Production in Maues

As has been previously mentioned, the major threat challenging the sustainable future of small farmer guarana production in Maues is low productivity (i.e., low yields). The present price conditions in the marketplace (R$ 4.0 - 5.0/kg), in combination with present yields (80 - 100 kg/ha) creates a situation where it is not economically feasible for these farmers to cultivate guarana. Indeed, they are losing money under current conditions of price and yield. Since changing the price environment is far beyond the control of the farmers (or this project), measures must be taken to increase yields to the level of 400 - 500 kg/ha. Yield improvement, in combination with improved market access, will make Maues farmers competitive with guarana farmers in higher yield areas (such as Bahia) which have fewer production constraints. Currently, yields are high in Bahia, and the farmers are willing to accept lower price levels (R$ 2.0 - 4.0). Such a combination of yield and price makes the Bahia environment extremely attractive to processors. Processors, however, remain interested in guarana from Maues due to its current superior levels

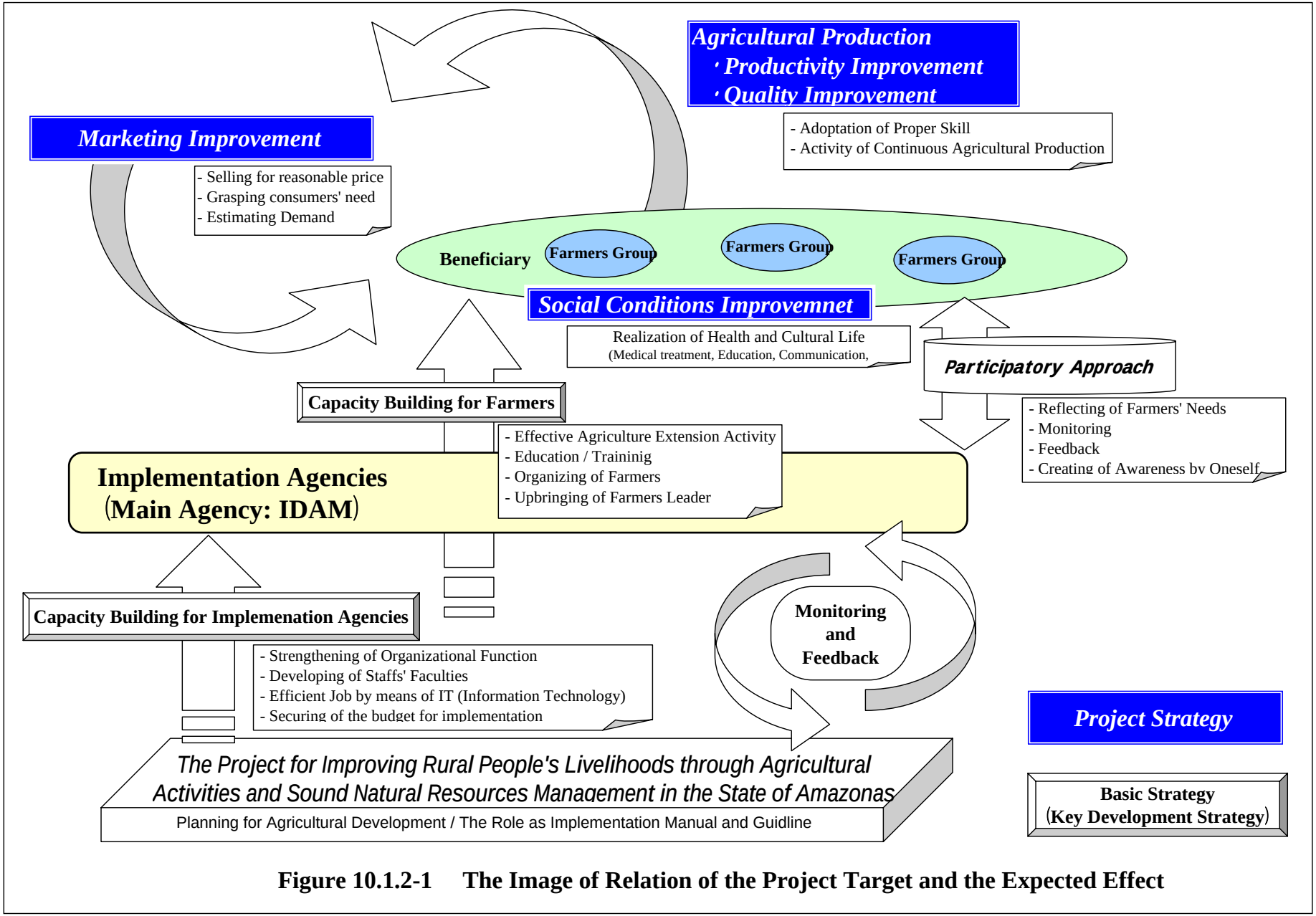


Figure 10.1.2-1 The Image of Relation of the Project Target and the Expected Effect

10 - 3

of quality - but quality in Bahia and other areas could be improved quickly and easily, leaving very limited rationale for processors to continue to source high priced guarana from Maues. Only with improved, sustainable yields, continued high quality, and increased market access does small farmer production of guarana in Maues have a bright future.

(3) Important Note on Environmental Sustainability

Although many measures will be taken to improve guarana yields, this Project does not seek an aggrressive expansion of existing areas through the planting of new guarana fields. On the contrary, this Project plans to promote productivity increases primarily through the improvement of yields in older, existing guarana orchards. It is envisioned that only those farmers who can demonstrate renovation activities in at least 5 ha of existing orchards will be allowed to use Project resources to plant one additional hectare of guarana per year with new improved seedlings and intensive management techniques. Such an approach will lead to improved environmental sustainability of crop lands in Maues.

Additionally, yield improvement will be pursued by two basic approaches, a conventional yield improvement package (PIP), and a package to maximize yields under optimum conditions of environmental preservation (ESGP). Both these approaches are described below.

(a) Productivity Improvement Project (PIP)

The major project designed to improve the yields of guarana farmers in Maues is called the “Productivity Improvement Project” (or PIP). PIP has five major subprojects, the proposed activities of which are briefly described below.

i) Input Supply Sub Project

Improve availability of improved seedling clones through expansion of private and public sector capacity. Improve access to fertilizers and some pesticides.

ii) Cultural Practices Sub Project

More training at community level in important areas such as site selection, planting techniques, weed control and pruning

iii) Recovery of Degenerated Trees Sub Project

Training in use of cultural practices to specifically improve the productivity of old orchards that are in decline. Promote “5+1” concept (for every 5 ha of old orchards that are renovated, 1 ha of new trees can be planted).

iv) Private Sector Participation Sub Project

Establish co-funded project to increase private sector participation in research and extension activities carried out by the public sector.

v) Research, Training, and Extension Support Sub Project

Creation of a general “fund” to support key activities in guarana research, training, and extension. A public/private sector steering committee should be formed to determine the highest priority areas for funding.

(b) Environmentally Sustainable Guarana Project (ESGP)

The purpose of the ESGP is two-fold. First, it is in the long term interest of the guarana agro-ecosystem to quickly implement environmentally friendly production practices so as to preserve the guarana plantations for future generations. Secondly, a trend needs to be established in crop diversification, not only to produce guarana efficiently within the context of a mixed species native forest, but also to find other high value perennial crops which can provide income generation in case of the failure of guarana. The ESGP has four major sub projects to accomplish these goals.

i) Sustainable Agro Forestry Sub Project

Create a series of demonstration farms to promote minimal land clearing techniques, and the mixed farming of guarana with other perennial species and annual species.

ii) Integrated Pest Management Sub Project

Through research to determine economic threshold levels or “ETL’s” for key pests/diseases, and training of farmers in pest identification and safe-handling of pesticides, minimize the importance and impact of pesticides in guarana production.

iii) Organic Guarana Sub Project

After analysis of market opportunities, create several pilot farms which produce “certified organically grown” guarana and develop linkages to buyers.

10.2.2 Vegetable

(1) The Points for Harmonizing Vegetable Production in Varzea and the Environment

The points of the improvement plan for vegetable cultivation in the environment of the Varzea will be summarized below.

(a) Reversal idea on the flood

Under the current condition, the flood heavily restricts the farmers in the length of their agricultural production. However, the flood also brings about the following results.

1. The flood brings rich soils. (The test on soil is necessary to obtain local chemical

characteristics.)

2. The flood processes fresh water that prevents pests and certain microorganisms (with liking for air) in the soil from activating, and crop damage from diseases. (Farmers are aware of this effect through their experience)
3. The flood creates fresh water condition to supply comfortable environment for certain aquatic vegetables. (Introduction of new crops needs to be studied)

As listed above, the ideas on the active use of the flood should be expanded in order to make the most of the flood. Basically, the flood will be accepted, and the cultivation of the appropriate crops for the environment (aquatic crops) during the flood season will be introduced as the core topic of the plan.

(b) Promoting environment preserving agriculture model

The introduction of the environment preserving agriculture model and the agriculture model in harmony with environment is the indispensable task. For this plan, the Integrated Pest Management (IPM), in particular, will be used as the key technology for drawing up a plan. The IPM main objective is to improve and strengthen the ability to pose and analyze problems by learning basic knowledge on agriculture and agricultural technologies. As its ultimate goal, IPM is also expected to realize the Low Investment Sustenance Agriculture (LISA) in order to benefit in improving convenience and profitability. On the view of effective promotional activities and farmer education, the plan will propose to make LISA to become widespread by conducting the promotional activities for the farmers and OJT (on-the Job training) for the supporting staff at the same time.

(2) Phasing

This improving plan is composed with various sectors and subprojects as seen in the key strategy and the development strategy plan. For the integrated improvement plan like this one, it is essential to make development programs based on the short, middle and long range views in line with the degree of the development on the human resources' abilities and with the difficulty and emergency of the project's objectives. It is also essential to pay attention to accomplish the plan according to the phases of the programs since this plan aims to cultivate available resources, such as materials, funds and capable people, in consideration with coordination in the composing factors (sector, subproject) and harmony with environment. Because this improvement plan puts special emphasis on development of capable people and the fundamental information and technologies are insufficient, the final date for accomplishing the goal is set at 10 years later, and the goal for the short term of 3 years and the middle term for 6 years are also set as a mile stone.

10.2.3 Tropical Fruits

(1) Proposed Project Areas

This section will deal only with measures to improve the productivity of tropical fruits, assuming that all other factors (such as processing, marketing) are being addressed in other sections of the report.

(a) Projects in Crop, Soil and Water Management

1. Promotion and use of better varieties and seedlings
2. Development of improved cultural practices
3. Soil management investigations
4. Promotion and use of fertilization and soil amendment
5. Water management investigations
6. Promotion, financing and utilization of water management techniques
7. Pilot project in water management

(b) Agroforestry

1. Investigation on the use of Agroforestry
2. Promotion and use of Agroforestry
3. Pilot project in Agroforestry

(c) Training and technical assistance

1. Training in Tropical Fruit Production
2. Improvement of technical assistance in tropical fruit production

(d) Complementary projects

1. Natural resources inventory and evaluation

10.2.4 Cultured Fishes (Aquaculture)

Basic approaches of aquaculture development for small-scale farmers are shown below.

(1) Valuing of Technical Development and Extension Activities

Through the workshops and logical frame approach employed in this study and examinations of market demand shown in Chapter VIII, basic problem restricting development of aquaculture among small-scale farmers can be concluded to be technical matters not marketing constraints. Small-scale farmers are now merely waiting financial support or repeating try and error about rearing fishes, while progressive operators have already achieved viable production systems and are seeking a timing of further investment in order to formulate their own integrated aquaculture business. All the progressive farmers interviewed suggested that there is few problem about selling of aquaculture products as far as the price is set at the level of wild-caught fishes at present, although technical improvement on quality of fish meat shall be a little problem to be solved.

Since potential demand for target species has been confirmed in this study, the master plan of aquaculture component focuses on technical development and extension activities.

(2) Introduction of Stock Enhancement Measures

Traditional small-scale fishing is usually the most important procurement activity in river side and lake side communities. Further more, about half of small-scale farmers are confirmed to engage in routine fishing activity. Their fish catch is primarily consumed by family and sold partly. From such aspect, it is believed that their livelihood can be improved by enhancement of fishery resource condition.

Natural fishery resource management and its inspection are mandated to IBAMA. IBAMA has been carried out various projects related to aquatic environment management by using available external fund and technical cooperation, most of which are linked with the PPG7 program. In recent years, researchers of INPA have started seed release and recapture experiments aiming at rehabilitation of tambaqui resources (Chapter IV). Although the search is underway, considering recent progress of sea farming technology in Japan and other foregoing countries, their approaches, namely extensive aquaculture or lake ranching program shall involve large potential for contributing improvement of livelihood of rural people.

IDAM, as only one public organization operating practical scale of hatchery in Amazonas State, should be able to participate in such lake ranching program as a major supplier of hatchery-bred fish fry. That program is included in this master plan.

(3) Direction of Aquaculture Development by Species

Taking into consideration target group of this plan is small-scale farmers, aquaculture development direction is set by species as follows:

Tambaqui： Aquaculture of tambaqui is most recommendable for small-scale farmers and encouraged in this plan through extension of technology and a series of other supportive menus. Tambaqui is also planned as a principal target species in lake ranching program.

Matrincha： Matrincha culture shall also be encouraged for target group as in tambaqui. Improvement of artificial seed production technique is the most important issue for this species.

Jaraqui： Jaraqui shall be considered as by-product of tambaqui and matrincha culture or food crop for self-consumption of small-scale operators, because market demand is not stable for cultured jaraqui now.

Pirarucu： Although there is very strong market demand for pirarucu, it seems difficult for small-scale farmers to participate in commercial scale aquaculture of this species due to lacking of finance as well as farm

management technology. On the other hand, it is true that some pirarucu are often reared in ponds of small-scale farmers, suggesting that the species can easily be grown out, if reared at low density. When artificial fry become available, pirarucu can be introduced as a source of emergency income or a social security crop. This species shall also be considered as a target species for net cage culture to be operated by fishermen's group using their surplus fish catch as feed.

Surubim： Since demand and marketing price of surubim are not high in Amazonas State, financial viability of aquaculture is negative at present. As far as the target group is small-scale farmers, priority of surubim shall be lowest among the five target species.

10.2.5 Other Important Projects for Future Consideration

(1) Fishery-related projects other than aquaculture

As discussed in Section 9.2.3 there are a lot of problems to be solved in fishery sector of the Amazonas State. Fundamental study on capture fishery activities including fishery resource management and fish marketing aspects is strongly required in near future. Outline of fishery-related projects, which are identified through the course of this study but not included in this plan that is focused on introduction of aquaculture for small-scale farmers, is shown in Annex 10.2.5-1.

10.3 Processing and Distribution

10.3.1 Overview

In preceding chapters, the major constraints to value-added processing and distribution of guarana, vegetables, and tropical fruits have been identified and the major problems resulting from these constraints were described. In this chapter, project solutions designed to alleviate these problems will be proposed and summarized. Activities of these projects will be described in more detail in Chapters 11 and 12.

Although the post harvest problems for the three target crops share some fundamental similarities (such as inadequate transport infrastructure, limited ability for processing operations, poor quality and hygiene of farm products, poor linkages to the market, etc.), the major project solutions proposed for each crop are distinctly different. In the case of guarana, a central farmer's co-operative is proposed as the principal intervention. In the case of tropical fruits, revival of an idle, private sector fruit processing company is judged to be of major importance. And in the case of vegetables, two facilities (one for crop reception, the other for crop marketing) linked by refrigerated transport are proposed as the major solution. It is important to note two critical factors which link all the solutions for improved post harvest handling of

these crops:

1) Farmer's associations at the community level need considerable strengthening if significant improvements in the post harvest processing/distribution chain are to be made.
2) In all three municipalities, farmers suffer from severe restrictions in the area of market access for their crops and for value added products. Information on changing market conditions is not readily available, and farmers have a great deal of difficulty finding reliable buyers.

10.3.2 Guarana

The following paragraphs summarize the project interventions proposed to improve the processing and distribution chain for small farmer production of guarana in Maues.

(1) Central Guarana Co-operative Project

A Central Cooperative will be established in Maues for the reception of guarana, fruit, and cassava from farmers in remote Maues communities. The Coop will receive, store, process, and market the crops, and any profits will be redistributed to the members.

(2) Guarana Processing Project

Community level processing activities will be promoted by the establishment of pilot plants in several Manaus communities. Processing activities in Maues town will also be promoted through the establishment of a training center (factory school) for guarana processing activities at the Central Coop.

(3) Guarana Distribution Project

A limited fleet of medium-sized guarana "support" boats will be purchased and maintained. The boats will assist in the pick-up of guarana and other crops in remote communities for transport to Maues town. These boats should also backhaul agro inputs and assist in the transport of IDAM staff for extension visits.

10.3.3 Vegetables

The following paragraphs summarize the project interventions proposed to improve the processing and distribution chain for small farmer production of vegetables in Iranduba.

(1) Integrated Receiving Center & Farmer's Market Sub Project

(a) Iranduba Receiving Center Sub-Project

A "Receiving and Processing Center" for vegetables will be established in Iranduba town center. Produce from the rural communities will be received, sorted, cleaned,

and packaged for transport to a "Farmer's Market" in Manaus. Some of these vegetables will be "minimally processed" for direct sale to retail clients such as supermarkets and hotels. The Center will be equipped with storage areas (including cold storage), processing areas, and a reefer truck for transport to Manaus. Farmers will receive payment at the Center, which can also be utilized for training activities.

(b) Manaus Farmer's Market Sub-Project

An "Iranduba Farmer's Market" will be established within the "Manaus Central Receiving Station" which is a planned facility by the Government of Amazonas. This will be a special selling area dedicated specifically to Iranduba produce. In addition to various booths or "selling spaces", the facility will have a marketing and promotional staff dedicated to promote the sale of Iranduba produce at various points throughout Manaus, especially to retail customers and through a network of "kiosks".

(2) Distribution Infrastructure Sub Project

A limited fleet of light boats and trucks will be purchased and maintained for the purpose of transporting produce from the remote Iranduba communities to the "Receiving and Processing Center" in Iranduba town.

(3) Packaging Materials Sub Project

A considerable amount of cheap, durable packaging materials for produce transport will be purchased for use in the rural communities of Iranduba. Additionally, efforts will be made to stimulate the local production of such materials by the private sector.

(4) Training and Extension Sub Project

A project will be initiated to train IDAM-Iranduba staff, Iranduba farmers, and staff at the "Receiving and Processing Center" in improved post harvest handling techniques, and principles of food quality and safety. The objective of the training is to reduce post harvest losses and improve post harvest quality to ensure better sales to Manaus customers.

10.3.4 Tropical Fruits

The following paragraphs summarize the project interventions proposed to improve the processing and distribution chain for small farmer production of tropical fruits in Itacoatiara.

(1) Central Fruits Processing Plant Sub Project

A medium size (5-8T frozen pulp/day) fruit processing facility in Itacoatiara, currently dormant, will be reactivated through creation of a business plan, staffing plan, and marketing plan. Operational expenses will be provided for 5 years, after which the plant must become self-sufficient. The plant will have one or more trucks to assist in the pick-up of fruit at farmers fields, and to transport frozen pulp to

Manaus. The plant will also serve as a municipal training center for fruit processing and food safety principles.

(2) ASCOPE Upgrade Sub Project

IDAM has approved funds to build and operate three small-scale (3T frozen pulp/day) fruit processing plants in the Itacoatiara municipality. One plant will be built at ASCOPE, the other at a site yet to be determined. Funds will be provided to support the IDAM-sponsored plants with operational expenses and training expenses. After 5 years of support, these plants are expected to be self-sufficient.

(3) Rural Pilot Plants Sub Project

Pilot plants to stimulate rural fruit processing activities will be established in three communities of Itacoatiara. Funds for the basic equipment and five years of operating, marketing, and training expenses will be provided. After 5 years of pilot activities, the communities will hopefully have successful small scale business operations underway with reliable market potential.

(4) Distribution Sub Project

Funds will be provided for the establishment and maintenance of a small fleet of light boats and trucks for the transport of fresh and processed produce from rural communities to processing centers in Itacoatiara center.

(5) Packaging Materials Sub Project

A considerable amount of cheap, durable packaging materials for produce transport will be purchased for use in the rural communities of Itacoatiara. Additionally, efforts will be made to stimulate the local production of such materials by the private sector.

(6) Training and Extension Sub Project

Funds will be provided for increased training and extension activities for Itacoatiara farmers, IDAM local staff, and staff of the processing plants in the areas of fruit processing and food quality. The emphasis will be on the improvement of food handling techniques to greatly improve food safety levels in processed foods from Itacoatiara.

10.3.5 Cultured Fish

As described in Section 10.2.4, project approach for aquaculture is valued on technical development and its extension. It is difficult to prepare the plan of processing, distribution and marketing of cultured fishes under the situation whether small-scale farmers can produce fishes constantly or not. Hence specific project regarding marketing of cultured fishes is not going to prepare in this plan. However, it is needless to say that a series of IDAM’s supports which are similar to those

proposed for vegetables and tropical fruits in this study, i.e., support on establishment of direct-sale farmer's markets, shall also be adopted for cultured fishes.

10.4 Marketing

Considering the potential demand and consumers' trend, IDAM is expected to form an organization so called Marketing Assistance Center in which market information is stored as database and various activities such as market outlook, planning and market research will be prepared.

(1) Price Stabilization by Market Information System

Under the current situation, it is difficult for rural farmers to obtain price information based on the supply-demand balance and consumer trend. IDAM is expected to establish a database of market information, and then to develop a capability to prepare an official market outlook of supply-demand for the coming few years. By this preparation of information, rural farmers will be able to understand their marketing possibility and income.

The market outlook will be properly reviewed and reflected in the planning of crop production and extension service. IDAM is expected to provide viable plan for better matching of supply and demand. Planning of crop production need to meet the future trend of demand, so that rural farmers will be able to realize the increase of income.

- Conduct market research study including baseline survey, consumer needs, preference and trend to be included in the market database
- Data base compilation of market information in terms of price and amount traded
- Market outlook consisting of price, supply and demand forecast
- Direction of production reflecting market needs

(2) Direct Sales Promotion

It is important for producers to have chance to market their products directly to consumers so that they realize market trend and needs. IDAM is expected to provide spaces and assistance to rural farmers for their spontaneous activities to market their products.

- Provide space for direct marketing so that rural farmers will obtain first hand information of consumer needs
- Market linkage service for rural farmers to introduce potential buyers

(3) Marketing Assistance

IDAM with cooperation with SEBRAE is expected to establish a Marketing Assistance Center which will help rural farmers to achieve efficient access to market by the following activities.

- Certification of standards and quality in collaboration with testing laboratory
- Promotion and identity preservation of quality as Amazon origin

(4) Marketing support by primary processing and distribution

Rural farmers will be able to market their crop when there are some processing and storage facilities to overcome the difficulties of transportation and sensitive nature of fruits. Following facilities will be expected to locate at rural villages in relation to farmers' organization. Facilities will support marketing of people and managed by the resident farmers' organization.

- Post harvesting and primary processing facilities
- Receiving and storage points for the harvested crops preferably with refrigeration capability
- Transportation support with boats and trucks

(5) Human resource and training

Initially, the marketing section can be set up inside the existing " Balcao de Agronegocios" in SEBRAE, and later, if efficient, it could be moved to IDAM. The market research team will prepare announcements and instructions to rural farmers. Rural farmers will be better oriented when there are proper staff to interpret market information and market planning.

At the same time, rural farmers are not instructed to understand market conditions in relation to transportation risk and left-over risk. As a result they tend to feel that they are cheated and exploited by traders. In order to overcome this situation, understanding of trading mechanism and up-to-date price information is necessary. In addition, organizational effort such as formation of marketing cooperative is considered as an important step toward effective marketing.

- Training of staff in the marketing section for the development of market research and planning
- Extension service for instruction of market mechanism and use of information to rural farmers
- Guidance to marketing cooperative in the process of strengthening of farmers' organization

10.5 Farmers' Organization

10.5.1 Introduction of the Approach for Strengthening Farmers' Organization

The effective farmers' organizations should be developed based on the following three objectives.

i) To make strategies for structuring necessary technologies and management abilities to increase productivity and profits of non-registered producer groups.

ii) To reduce restriction factors regarding production, farm management, and market distribution by farmer organizations, and to overcome major restriction factors to cope with unstable agricultural income.

iii) To make effective strategies to improve the IDAM's support programs for developing farms, farmers' organizations, and farmer cooperative union.

This plan will propose to implement the method that would step up the goals or introduce a new program in accordance with the reviews on the accomplishment, and to let the participating type support approach to be main frame. Accordingly, through the participation type support approach, the special skills such as organization, management and planning for farmers' organizations will be transferred Moreover, the elimination of the restriction factors for organization will be included in the consolidated program called the approach for strengthening farmers' organization. The approach's outline, major component factors, and concrete measures for improving the organization's management ability will be discussed below according to the development levels. It is desirable to have 10 years of support period when this plan is implemented.

(1) Changes on the Management Ability Levels of Farmers' Organizations on the Project

The development levels vary in the producer groups, the local farmers' associations, the registered and non-registered farmers' organizations in the surveyed areas. The organizational management ability and the ability to sustain and mange assets and equipment vary as well. For example, the considerable difference in ability was detected in the common activities of the riverside communities, i.e. the management and maintenance of the community boats that are disposed in the villages.

In the surveyed areas in Itacoatiara, many of the local resident organizations have received training offered by the NGO programs such as the Catholic Church's CEB and MEB, and acquired the knowledge and technologies on record keeping, committee organization, and delegation of responsibilities. It may not take 10 years for these communities to reach the level that enables them to start price negotiation on agricultural products by the system of agricultural cooperative unions and the contract cultivation systematically.

The goal of the method (approach) proposed here is to foster the farmers' organizations to reach such levels where the farmers themselves make the problem solution plan through the activities of the organization and put the plan into practice. The target groups are the organizations with poor problem solving ability or non-organized communities. The areas applicable for this approach will be followed below:

i) Undeveloped farmers' organizations in the Varzea in Iranduba

ii) Poor farmers cultivating tropical fruits in terra firme in Itacoatiara (particular the farmers who live along the Arare Rever)
iii) Poor farmers who do not live in Sautere in Maues (indigenous community)

(2) The Objectives and Goals of the Program

The objectives of the program are as follows:

i) Farmers to learn appropriate technologies
ii) Farmer's economic independence
iii) Restriction factors on farmer's lives to be alleviated

The major objectives of these programs will be accomplished by organizing farmers. In other words, the farmers' organizations will be strengthened in order to improve the managerial and technical abilities, to ease the restriction factors, and improve the farming activities and the livelihood of the farming areas.

The subprogram's three goals to accomplish these objectives will be followed below:

- To improve the technical support activities for farmers and the livelihood of farmers by widely spreading the proper technologies to stabilize and continue agriculture
- To encourage saving, and to increase confidence of farmers and of independence as organization by utilizing the saving as the fund for purchasing food and agricultural investment materials in the farmers' organizations and for employing laborers.
- To give farmers' organizations technical support to increase their management abilities and the farmers' abilities on problem analysis and solution and to develop such skills like management on organizational activities, operation, planning and finance that are advanced and expanded.

10.5.2 The Contents of the Program

The objectives of the proposed program are to reduce the restriction factors (on the major policies, program, operation, organization and technologies) that would negatively affect the activities of the farmer groups and the local farmer associations, and to vitalize and improve the activities of the organizations. The program and its contents and expected effects are described in the standard tables.

The program to accomplish goals:

1. Farmers' organization database program
2. Objective management program (monitoring and review)
3. Local farmer leader program
4. Local resident livelihood improvement activity program
5. Farmer finance improvement program
6. Saving promotion program
7. Gender program

10.6 Environmental Aspects

The project would be implemented in the Brazilian Amazon region, where the natural environment consists of humid tropical rain forest, growing on a relatively fragile tropical soils with many small, medium and large watercourses and natural lakes. The Brazilian Government has been moving toward greater control over the settlements and the use of land and natural resources in the Amazon region.

Basically, no IEE systems legally required in the Amazonas State at the present stage and it is obviously judged that EIA is neither necessary according to the clarification of requirement for the EIA, based on the environmental law issued by the Government (Resolution Conama No.001) in 1986. Moreover, the proposed agricultural project does not demand an EIA. However it is required to study the environmental impact that may be caused by the project such as impact on land utilization, characteristics of environment and local communities and economical effects. Also emphasis is required to preserve the ecology and promote the sustainable development in the agricultural field.

Proposed agricultural scheme involving the cultivation of vegetables, tropical fruits etc. envisaged by the JICA team does not require additional slash and burn agricultural field as the required agricultural area is similar in size as that of the existing conditions considered for small and medium -scale farmers. However, in order to proceed with the agricultural project smoothly in the targeted area of tropical rain forest in Amazon region, basic plan have to be drawn out based on the following basic philosophy to preserve the ecology and promote the sustainable development;

- Improvement of potential economic and social (health) conditions of the local residents in the scheme area along the Amazon floodplain
- Enhancement of protection of the humid tropical rain forest
- Improvement of basic infrastructures to benefit local residents daily life
- Sustainable partnerships among concerned organizations such as IDAM, IPAAM, IBAMA, EMBRAPA and communities.
- Improvement of knowledge in the field of agriculture in the region
- Improvement of public awareness regarding the environment and its protection

As for items of the existing environmental constraint and environmental consideration are shown in Table 10.6-1.

For the planning of agriculture project, it is required to establish an organization to be responsible for environmental management and monitoring to proceed environmental consideration. For this purpose, data and information collection for slash and burn agriculture and deforestation is needed. In addition, organization for the data and information collection for the subproject of PPG7 is recommended in addition to the above. Furthermore, it is recommended that public awareness on the environment and the proper utilization of the natural resources be taught to the local residents who live in the targeted project areas.

Table 10.6-1 Existing Environmental Constraint and Consideration (1/2)

Constraint	Environmental Consideration (in progress / proposed items)	Related Organization	Relation of Schemed Project	Note
1) The use of large amount of fertilizers and agricultural chemicals as the result of agricultural concentration	a. Establish methodology of efficient usage of fertilizers and agricultural chemicals by IPM (Integrated Pests Management) and others b. IDAM carry out technical assistance to farmers regarding to fertilizers and agricultural chemicals	IDAM EMBRAPA	a. Yes b. Yes	
2) Destruction of vegetation by slush and burn agriculture	a. Conduct efficient agricultural methods which can be reduce areas of slush and burn field, and IDAM carry out assistance for them. b. Extend services period of land utilization by agroforestry and planting of tropical fruits c. Improve knowledge of the farming productivity regarding to agriculture	IDAM EMBRAPA	a. Yes b. Yes c. Yes	Proposed agriculture has potential to minimize farm land by slush and burn agriculture for small-scale farmers
3) Surface soil erosion	a. Conduct efficient agricultural method which can be reduce areas of slush and burn field, and IDAM carry out assistance for them b. Decreasing woods destruction and deforestation c. Conduct farming method utilizing contour on gentle slope d. Decreasing the area of slush and burn fields	IDAM EMBRAPA	a. Yes b. Yes c. Yes d. Yes	
4) Local infectious diseases in tropical areas and diseases caused by drinking water	a. To get hygienic drinking water through water supply facilities which contained sterilizing system b. Improve land and water transportation network system of medical treatment for the local residents c. Proceed public enlightening movement regarding to hygienic and health and improve knowledge of them	State Gov't	a. No b. No c. No	There are several communities installed water supply facilities supported by the Government
5) Indiscriminate collection of forestry resources	a. Carry out strict management based on forest management plan prepared by wood companies and regulations prepared by b. Establish efficient extraction plan for the firewood which are used in brick factory in Iranduba c. Establish monitoring organization and conduct monitoring for the forest resources	IBAMA IPAAM	a. No b. No c. No	EMBRAPA start research of firewood to get with high efficiency, there are several company in which change fuel to gas
6) Decreasing of fishery resource	a. IBAMA and IDAM carry out technical assistance and environmental management to preserve fishery resource b. Introduce net fish preserve as a substitute for improvement of rural people's livelihoods, and IDAM provide assistance c. Establish monitoring organization and conduct monitoring for the fishery resources	IDAM IBAMA	a. Yes b. Yes c. Yes	The budget for fishery is substantially raised in 2001

Table 10.6-1 Existing Environmental Constraint and Consideration (2/2)

Constraint	Environmental Consideration (in progress / proposed items)	Related Organization	Relation of Schemed Project	Note
7) Extraction of forest resource (Woods, medical plants, fruits, Animals)	a. Carry out strict and certain management based on guidelines prepared by IBAMA and IPAAM and strengthening monitoring of these organization for the forest resources b. Establish management plan for extraction and collections of forest resources and carry out strict and certain management according to them c. Carry out strict management based on forest management plan prepared by large-scale wood extracting companies, and processing afforestation after deforestation according to guidelines	IDAM IBAMA IPAAM INPA	a. Yes b. Yes c. No	Established PRODEX in 1996 for supporting development of sustainable extractive activities through technologies and improving the productivity. It is expected that tendency of the deforestation in the Amazon region will be increasing in future
8) Preservation of bio-diversity	a. Expanding forest reserved area b. Decreasing slush and burn areas to preserve tropical rain forest c. Regarding to new project planned in future, the development plan shall be given consideration of result and zoning prepared by PPG7 project d. Establish monitoring organization and conduct monitoring for the natural resources	IDAM IBAMA IPAAM INPA	a. No b. Yes c. Yes d. Yes	Many environmental project are conducted by subproject of the PPG7 including zoning and survey of the ecology in the Amazon regions
9) Destruction of forest resource by construction of infrastructure	a. Prepare EIA report for the study of environmental impact caused by project, and processing study of environmental preservation plan and mitigation plan to minimize destruction of the forests b. Restrict development plan by imposing legal controls or upper plan	IBAMA IPAAM Gov't	a. No b. No	By the construction of Trans Amazonica Road, large-scale destruction of tropical rain forest is caused
10) Increment of immigrants	a. Control immigrants who move to restricted areas and over concentration in the area b. Establish monitoring organization and conduct monitoring for the immigrants c. Restrict development plan by imposing legal controls or upper plan	Gov't	a. No b. Yes c. Yes	Project is conducted by family workers of small farmers mainly, and immigration is not cause in this scheme
11) Expansion of farm land and large-scale stock farm	a. Prepare EIA report for the study of environmental impact caused by project, and processing study of environmental preservation plan and mitigation plan to minimize destruction of the forests b. Establish monitoring organization and conduct monitoring for expansion of farm land c. Restrict development plan by imposing legal controls or upper plan	IDAM IBAMA IPAAM INPA	a. No b. Yes c. Yes	

10.7 Strengthening the Functions of the Support Agency (IDAM)

The analysis of the problems concerning the support can show that the most fundamental factor is the stagnancy of the spread activities of IDAM. The results of the workshop by the Study Team, of the RRA, and of the interview with farmers can also show that the levels of the technology and communication with farmers of the field-level staff of IDAM are not sufficient. The following items can be cited as the factors.

- The lack of the budget and human resources of and the limits of the capacities of the municipality office of IDAM to conduct the actual spread activities directly in front of farmers.
- Poor conditions of the facilities and equipment

However, the existence of the structural problems due to the organization of IDAM and the spread system can not be ignored, either. Most of the support institutions in Amazonas State have suffered from the severe financial difficulties and the lack of the human resources. IDAM, which is the most important institution to support farmers, has also the same situation. The improvement of the functions of the support institutions is one of the main pillars in this project. However, in light of this situation, as the basic approach to realize such improvement, the measures, where the huge amount of investment in plant and equipment and the increase of the personnel are not needed, shall be worked out.

For example, it can be judged that the adoption of each of the following approaches or the combination of them is advisable in order to improve the support system.

- To improve the efficiency through the review of the system such as the efficient organization of the institution and the efficient operation system
- To improve and efficiently use the capacities of the human resources inside the institution
- To share the information through the use of IT technology to make the operation more efficient

In addition, as for the activities concerning the support, only the support institutions such as IDAM shall not be relied on. The farmers, which are the beneficiaries, for example, can be aggressively engaged in the spread projects and activities by IDAM, as the spread volunteers, too, which can lead to the fusion with the support activities with the participatory approach proposed in this plan. In the above-stated method, the establishment of the system, where “the agricultural and rural development with the sense of unity between farmers and support institutions” can be implemented, shall be targeted.

The research institutions such as EMBRAPA have greatly contributed to the collection and analysis of the basic information concerning the agricultural

production, which is the basic research to establish the spread technology with the consideration on the local characteristics. Therefore, IDAM will have to deepen the cooperative relations with such research institutions furthermore in the future. In order to use the limited budget most efficiently, it is necessary for IDAM to make efforts to complement the lack of the budget and human resources through the joint research with research institutions, etc. The technology needed for farmers is mainly the basic technology based on the practical use. Therefore, the spread of the basic technology and know-how concerning the actual agricultural management, including cultivating, the control of fertilizing, the prevention and extermination of diseases and harmful insects, the consideration on the environment, the household account book, and distribution, is required. It can be expected that the technology transfer of the above-stated basic technology to farmers can be effectively implemented, using the pilot farms positioned in villages and the field of hard-working farmers. In addition, with the use of the spread volunteer proposed as the information antenna from farmers, the results of such field-level research can penetrate the communities. The component of the program to improve the support system, which was worked out with the above-stated directions, shall be proposed as follows.

1. Reforms of the organization, operation, and rules of IDAM (Efficient organization, Increasing staff/expert, System to highly motivate)
2. Development of human resources (Developing and using human resources)
3. Building the support system (The technology can complement the lack of the budget and human resources. Farmers can participate in the spread activities)

CHAPTER XI PROJECT FUNDAMENTALS AND PROJECT DESIGN MATRIX

11.1 Prerequisite Project Fundamentals

11.1.1 Capacity Building of Implementation Agency (IDAM)

The strategy for the improvement of the capability of IDAM has three main components:

1. Reforms of the organization, operation, and rules of IDAM
   (This includes reorganization and increasing the number of divisions. It also includes additional staff, facilities, equipment, staff salary review and reform, and the financial resources to implement agreed reforms)
2. Development of human resources
   (This builds the capacity of staff through policy, program and project education and training programs, and staff incentives for effective implementation of project related activities)
3. Building the support system
   (The technology can complement the lack of the budget and human resources. Farmers can participate in the spread activities)

The contents of these components are described in detail as follows;

(1) Reforms of the Organization, Operation, and Rules of IDAM

The improvement of the functions of the organization including the reforms of the organization, thorough which the personnel can work more efficiently, can be considered as the key to realize the organization. In addition, through the reorganization of the departments inside the organization in accordance with the important and new needs for farmers, farmers' organization, and marketing, the smooth operation can become possible. On top of the above-stated, the aggressive introduction of the license system and the incentive system, which can highly motive the staff, can also revitalize the staff.

(2) Development of Human Resources

It can never be said that the educational background of the staff to be engaged in the spread activities in the municipality level is high. However, through the education and training, their abilities can be improved. The basic education and training method shall be the OJT method, where their abilities can be improved through not the training courses but the practice such as the growing test in the pilot farm jointly operated with research institutions and the joint farming with hard-working farmers. In addition, the basic education and training method shall also cover the areas including the below-stated areas, which can be considered necessary for the future spread activities. The areas are as follows; i) to organize, ii) to improve the marketing,

iii) to develop the community base, iv) to promote for farmers to organize, v) to grasp the needs of farmers through the participatory approach, vi) to work out participatory projects.

Up to the IDAM in the municipality level, the technical staff has been controlled in the vertically divided system, where each of the staff is classified in accordance with his or her expertise. However, in the spread system, where the staff is in charge of the area, each of the technical staff has dealt with the work as not the expert but the generalist. This method is available, from the viewpoint of the use of the limited human resources. However, it is also the fact that each of the staff is required to have the wide range of knowledge but his or her expertise, which can increase the burden of each of the staff. However, if each of the staff addresses the issue with the willingness to become a hard-working farmer, the method is absolutely possible. In addition, the lack of the knowledge and experience of an individual can be complemented technically, through the introduction of the knowledge-management system, which is proposed below, and the sharing of the information through the networking between the IDAM headquarters and each branch.

(3) Building the Support System

The basic strategy of the support system is to share the knowledge and experience with the use of “Network” and “IT”. Even in IDAM, the introduction of computers has been outstandingly progressing. The computers have already been installed not only in the headquarters but also in the municipality offices. However, the computers are stand-alone, and the networking has been lagging behind even in the headquarters. In addition, in the municipality, while the telephone lines have been provided, the lines have not been connected to the Internet yet. Therefore, it can be said that, as well as the provision of the broad-area network, the provision of LAN, too, has been lagging behind. It is essential for the institution such as IDAM, the main activities of which can intellectual, to share the information. Therefore, to share the information can be considered that the networking is the most efficient on the investment and should be implemented as soon as possible.

Another network is the community network. The system with the following functions shall be established.

- To select the farmer volunteers to support the spread activities by IDAM at the community level
- To use the farmer volunteers as the core medium to convey the information more efficiency.
- To give the instructions on the technical matters more smoothly.
- To promote the development of the group (organization) activities.

Some consideration, with which they can obtain some advantages of learning the

technology through the participation in the operation of a pilot farm, getting the supply of the necessary input through the test growing, etc., shall be given to the volunteers. The summary of the above-stated shall be shown in Table 11.1.1-1.

To assure effective extension service delivery capacity of IDAM, the strategic component was found to be organization reform. The Study Team met several times with IDAM headquarters to discuss proposals for reform that were feasible, operational within a short time frame, and provide immediate impact for facilitating institutional capacity building. For these discussions, both IDAM and the Study Team prepared proposals and placed preferred items on the agenda. The Study Team and IDAM headquarters staff took into account the following points in the formulation of the institutional capacity building organization plan:

1. The organization will be better equipped to address new needs, such as agribusiness, aquaculture, environmental preservation and farmer organization development.
2. The organization will improve its management of two important resources needed in extension --human resources and information and knowledge.
3. The organization will have the technical expertise to offer useful information to the State for policy development on rural agribusiness development and program development for improvement of rural livelihoods of small scale agricultural and extractivist families.
4. The organization will be in a better position to partner with other institutions and agencies involved in agribusiness, aquaculture, environmental preservation and farmer organization program development and technically report the effects of the application of decentralization and participatory management development policies on rural development and rural livelihoods within the State.

The organization presented in the Figure 11.1.1-1 was mutually agreed as the proposed organization reform during IDAM discussions. Discussions were also held regarding IDAM local office and staff reinforcement plans. Table 11.1.1-2 presents the mutually agreed plan for local office reinforcement.

11.1.2 Strengthening Farmers' Organization

Through strengthening farmers' organizations, the production resources in a community can be effectively used, and, the improvement of rural people's livelihood by the participation of the residents can be promoted.

(1) Farmers' Understanding on the Benefits from Establishing Organizations

Each farmer can share the benefits of the organization and have common properties, by becoming a member of an organization. It is important to let farmers understand such basic benefits from establishing organizations.

Table 11.1.1-1 Summary of the Plan to Improve the Support Institution

Project Name	Outline of Project Plan	Expected Effects	Implementation and Support Institution / Roles of Institutions	Note (Noted Points Preconditions)
1. Reforms of the organization, operation, and rules of IDAM	1. To strengthen the sections involved in the community development (Arrangement of fund personal) 2. To strengthen the sections involved in the marketing (Arrangement of fund personal) 3. To stipulate in the mid- and long-term plans of IDAM that the small-scale and poor farmers shall be prioritized in the spread activities of IDAM 4. To introduce the target control system and to compile the information of the personnel into the database 5. To introduce the system, where the beneficiary can evaluate the IDAM spread staff 6. To introduce the incentive system	- To ferment a sense of solidarity through the revitalization of the organization and with the common targets - To strengthen the system to support farmers - To motivate the staff furthermore and to raise the morale of the staff - To smoothly realize the plan	- They are the reforms of the organization, operation, and rules of IDAM, however, IDAM shall ask the upper organizations, and associated organizations (the spread institution in other areas) to corporate.	- The consensus among the inside of IDAM – among the staff – is required. Therefore, the committee, etc., shall be established to collect and analyze many opinions so that the plan can reflect those opinions. - The key to revitalize the organization is the realization of the appropriate environment in the workplace, including the establishment of the system where the personnel can comfortably work.
2. Development of human resources	1. To strengthen the education and training and to introduce the license system. 2. To work out and practice the education and training plan based on not training but OJT.	- To improve the abilities of the personnel. - Development of human resources	- As for the technical contents, ask for the cooperation of EMBRAPA, INPA, etc. - OJT-type education and training method shall be developed by IDAM, individually	- To make efforts to motive the staff through the preferential treatment for the individual with a license, etc., which can be linked to the reforms of the organization, operation, and rules of IDAM. - IDAM shall provide the chances and places for the education and training to prepare the environment where the staff can easily study by them.
3. Building the support system	1. To introduce the knowledge-management system with the use of IT 2. To build the computer network to link to IDAM municipality offices 3. To establish the system to support the spread activities by the volunteers at the unit of a community or an association (IDAM agricultural spread volunteer, IDAM community development volunteer)	- To make the spread activities more efficiently - To promote the sharing of the information - To ferment a sense of solidarity between farmers and IDAM	- The outside-specialized business shall develop, and maintain the system and conduct the trouble shooting in principle	- In order to establish the main infrastructure, the preparation of the appropriate environment for the network, the building of the database, and the installation of computers shall be implemented. However, the network shall not exist only for IDAM but shall be linked to other systems including the emergency medical system, the remote education, and the market information - It can be expected that IDAM agricultural spread volunteer (AEV) and IDAM community development volunteer (CDV) can become the key persons to act as the core of the community and unite the community. - From the viewpoint where not only IDAM but also farmers must be engaged in the activities aggressively, the establishment of the system with the AEV and the CDV can become the key persons.
Others				
1. To introduce IT for the expansion and improvement of the public service	1. To use the computer system to establish the medical network and the emergency medical system 2. To introduce the system for the education in the remote areas. (For school children and adults)	- To establish the infrastructure for the livelihood of the farmers in the areas - To improve the abilities of farmers through the education - To improve the mental conditions of farmers	- The cooperation with the local authorities, hospitals, and educational institutions is essential.	- To use the computers in the municipality offices of IDAM - The introduction must be examined in accordance with the degree of the progress of the establishment of the information infrastructure. - The emergency medical system shall be built, not only with the use of computer, but also from the comprehensive viewpoint.

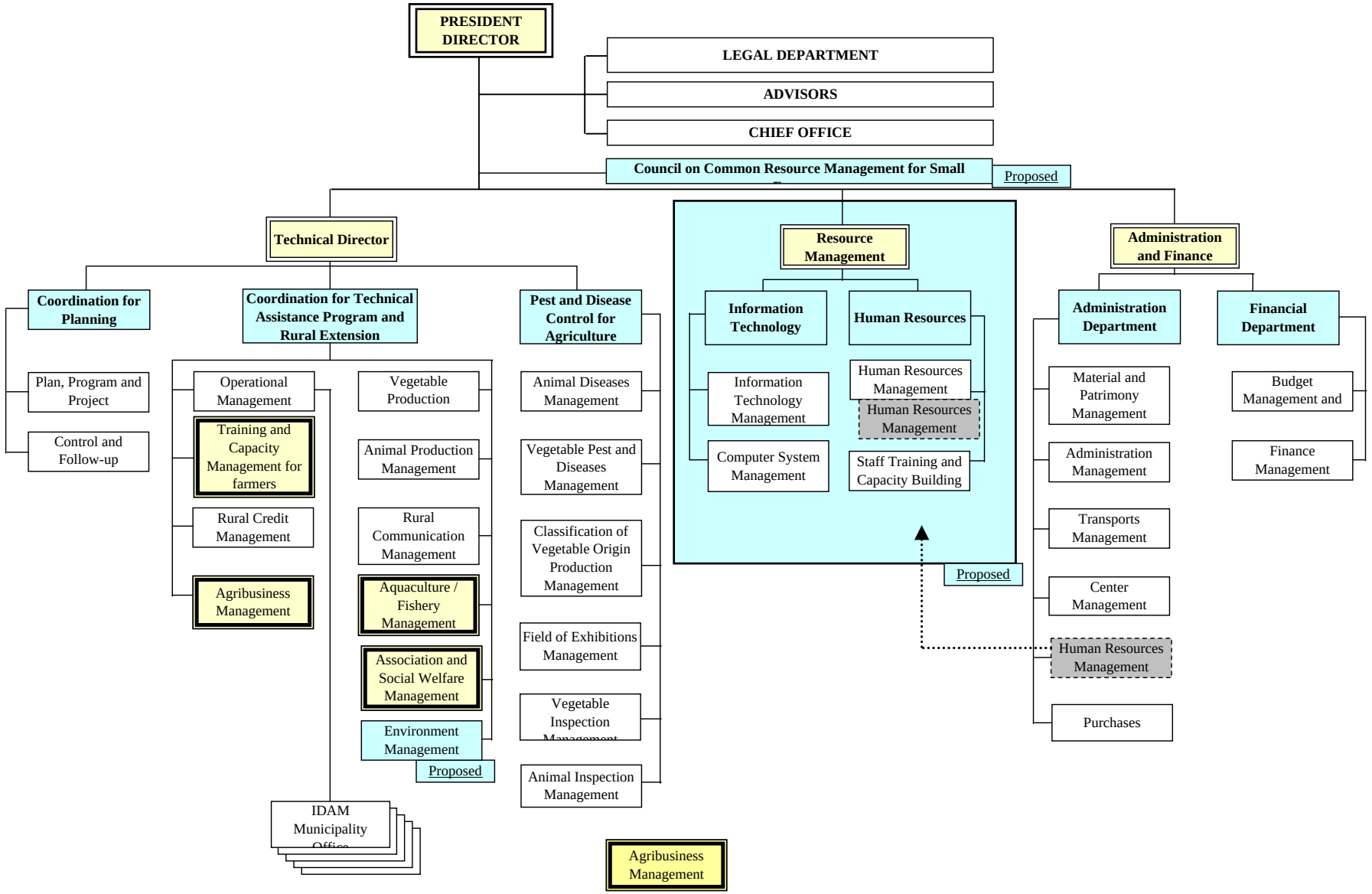


Figure 11.1.1-1 Proposed Organization Structure of IDAM of AMAZONAS

Table 11.1.1-2 Necessities of the Human Resources to the Local Units

IDAM original Plan

MUNICIPALITY	AGRONOMIST ENGINEER		FISHING ENGINEER		AGROPECUARY TECNICIST		ADMINISTRATIVE SUPPORT	
	EXISTENT	NECESSARY	EXISTENT	NECESSARY	EXISTENT	NECESSARY	EXISTENT	NECESSARY
IRANDUBA	2	4 (+2)	-	1 (+1)	9	10 (+1)	5	6 (+1)
ITACOATIARA	1	1 (+0)	-	1 (+1)	9	9 (+0)	5	7 (+2)
MAUÉS	0	1 (+1)	-	0 (+0)	5	6 (+1)	3	3 (+0)
TOTAL	3	6 (+3)	0	2 (+2)	23	25 (+2)	13	16 (+3)

Revised by Study team

MUNICIPALITY	AGRONOMIST ENGINEER		FISHING ENGINEER		AGROPECUARY TECNICIST		ADMINISTRATIVE SUPPORT	
	EXISTENT	NECESSARY	EXISTENT	NECESSARY	EXISTENT	NECESSARY	EXISTENT	NECESSARY
IRANDUBA	2	**2 (+0)**	-	1 (+1)	9	**9 (+0)**	5	6 (+1)
ITACOATIARA	1	1 (+0)	-	1 (+1)	9	**12 (+3)**	5	7 (+2)
MAUÉS	0	**1 (+1)**	-	**1 (+0)**	5	**7 (+2)**	3	3 (+0)
TOTAL	3	**4 (+1)**	0	**3 (+3)**	23	**28 (+5)**	13	16 (+3)

Proposed by Study Team

MUNICIPALITY	AGRI-BUSINESS		ORGANIZATION					
	EXISTENT	NECESSARY	EXISTENT	NECESSARY				
IRANDUBA	0	**1 (+1)**	0	**1 (+1)**				
ITACOATIARA	0	**1 (+1)**	0	**1 (+1)**				
MAUÉS	0	**1 (+1)**	0	**1 (+1)**				
TOTAL	0	**3 (+3)**	0	**3 (+3)**				

Comparizon Table of Workload of each Local Unit

MUNICIPALITY EXISTING	Number		Number Assisted		Covered Per Person (Excuding. Head)	
	Tech Staff	Exc. Head	Community	Farm Fam.	Community	Farm Fam.
IRANDUBA	11	10	39	790	3.9	79.0
ITACOATIARA	10	9	42	1,990	4.7	221.1
MAUÉS	5	4	19	1,095	4.8	273.8
					1.2	3.5 Average

PROPOSED (IDAM)	Number		Number Assisted		Covered Per Person (Excluding. Head)	
	Tech Staff	Exc. Head	Community	Farm Fam.		
IRANDUBA	14	13	39	790	3.0	60.8
ITACOATIARA	10	9	42	1,990	4.7	221.1
MAUÉS	7	6	19	1,095	3.2	182.5
	(+5)				1.6	3.6 Average

REVISED (Study team)	Number		Number Assisted		Covered Per Person (Excluding. Head)	
	Tech Staff	Exc. Head	Community	Farm Fam.		
IRANDUBA	11	10	39	790	3.9	79.0
ITACOATIARA	13	12	42	1,990	3.5	165.8
MAUÉS	7	6	19	1,095	3.2	182.5
	(+5)				1.2	2.3 Average

(2) Strengthen the Cooperation of the Residents in a Community under the Strong Leadership.

It is important that, based on the characteristics of each community, the flexible management of each community can be implemented.

(3) Prioritize the Support for Small-size Farmers in a Community.

In order to establish organizations, it is especially important to make efforts to let small-size farmers understand economic/legal benefits from establishing organizations through education. Moreover, to promote technology transfer through education is also possible. However, in order to realize such promotion, the pace of farmers should be fully taken into consideration so that they can keep up with the speed of the technology transfer.

(4) Coordinate the Development Plans of the Government with the Process to Strengthen Organizations.

An established organization, where farmers can work cooperatively, can basically become a social unit as the institutional framework based on the human relations and common benefits. And, those organizations can be recognized by the state government as the subjects for the aid, and can play the effective roles. Therefore, it is important that even the development plans of the government can be coordinated in a way where the plans can promote the progress of establishing organizations and can provide the aid in accordance with the progress.

(5) Use the Information and Experience of Each Community to Promote the Establishment of Organizations in a way where the Residents' Needs can be Satisfied.

Through holding the participatory seminars, farmers can share the information and experience on their own community to aggressively participate in the activities of the organization.

(6) Strengthen the Establishment of Organizations through the Group Training and Developing Leadership.

The training for the farmers inside a community in agricultural management and the training to develop the leadership, with which the community can be united, are important. Especially, through group training, farmers can introduce new techniques, while demonstrating the leadership to face risks on their own initiatives.

(7) Be in Conformity with IDAM's Supporting Policy for Farmers.

IDAM need to make their policy conformable to the development plans of the central government and under the aid of other countries. As the sustainable and environmental-preservation-type development plan, IDAM's aid policy should be coordinated with other farmer aid programs.

11.1.3 Adoption of Environment Friendly Agriculture and Fishery Development

(1) Agriculture

Basically, Study Team's recommendation aimed at improving the rural people's livelihoods through the cultivation of tropical fruit and Guarana is attainable with only minimum slash and burn activity by farmer. The main reasons for the choice of strategy is that requires expansion of the cultivation fields periodically due to the plant's long service life. Presently, the farming being carried out by targeted medium and small-scale farmers mainly depends on family labor. These situations of farming are completely different from those of large-scale farmers. In the case of proceeding with the cultivation of Guarana and tropical fruits, the fields of small-scale farmers will be utilized continuously for many years within the most productive period of plant life and thus will not require new slash and burn fields. In addition, the cultivation of tropical fruits with consideration of the environment as agroforestry, it is possible to reduce the environment impact affecting regional areas. It is also necessary to proceed with the Low Investment Agriculture in order to preserve the natural resource such as tropical rain forest. The proposed agricultural farming planned in the scheme area is to be carried out with consideration of environmentally sound method as follows:

- To promote agroforestry as countermeasures to soil erosion, harmful insects and diseases
- To establish agricultural methods which do not require extra reclamation accompanying with large-scale slash and burn fields
- To establish agricultural methods which do not require a large quantity of fertilizer and chemicals
- To use organic manure as environmentally sound fertilizer
- To use green manure and mulching like Kudzu in order to keep soil fertility and preserve erosion troubles
- To proceed technical training and environmentally sound agriculture by IDAM
- To organize farmers and fishermen association to follow environmental laws use sustainable development technologies, and engage in environmentally friendly productive and marketing activities.
- To establish agriculture method which does not pollute the natural water environment

It is foreseen that when proceeding the agriculture development by cultivation with the focus on continuous environmental consideration in the scheme area, the disappearance of the humid tropical rain forest will be progressively reduced resulting in the preservation of ecology in the tropical rain forest in the Amazon. For these purpose, IDAM is required to proceed an environmental management in cooperation with concerned government organization.

(2) Aquaculture

(a) Legalization of aquaculture activity

In order to operate fish farm including net cage culture, two kinds of license are necessary, one is aquaculture license to be issued by DPA of MAA, and the other is a series of environmental licenses to be issued by IPAAM.

In this plan proposed aquaculture activities shall be motivated to obtain all the above permissions by means of encouragement of farmer's organization and technical support of IDAM.

(b) Application of extensive or semi-intensive method

In order not to discharge highly polluted water to natural environment, biomass density of fish culture shall be kept lower. In this plan, target biomass density is set as less than 10 ton/ha/harvest (usually 3-6 ton) for fishponds and less than 70 kg/m^3/harvest for net cages.

(c) Exclusion of exogenous species

Tilapia and carp seem to be promising commodities in freshwater aquaculture to be able to apply in the Amazon basin. In fact tilapia culture has developed in the Rondonia State and juvenile tilapia bred in pond are confirmed to be a good food item for pirarucu culture in the Para State. However, in order to conserve indigenous aquatic ecosystem of the Amazon basin, exogenous species such as tilapia and carp are not introduced in this plan.

(d) Use of artificial fish fry

All the fish fry introduced in this plan are produced in captivity not being captured from wild in order not to give damage to natural fishery resources.

11.2 Project Design Matrix

11.2.1 Overall Plan

Basic plan for the study centers on how to bring the overall strategy of improving rural people's livelihood to fruition. The fundamentals of this plan are identified as: (i) improve productivity and quality of environment friendly agriculture and fishery which directly links to the main income source of rural people through making them environment friendly, (ii) improve marketing which forces farmers now to suffer low gross margins, and (iii) improve access to social security and quality of farmer resource management by forming farmer associations and learning to exercise their legal rights to social security.

Various investigations have been executed during the third fieldwork to learn how to cope with the constraints that could hinder achievement of these fundamentals. These

investigations included the development of lessons learnt from various types of experiences in the Amazon and applying these lessons to the development of the overall planning strategy. A prerequisite to achievement of the project plan is the strengthening of IDAM's capacity and the development of farmer organizations. In the third fieldwork, another prerequisite is providing access to information and legal services to improve social security and legal services for association development. Modification of the latter situation could contribute largely to improving their livelihood.

The agricultural productivity and quality improvement approach is presented according to specific agricultural production. The marketing improvement approach is described in each section specific to agricultural activity. The Social Conditions Improvement Approach is presented below.

This approach is designed to strengthen small scale farmers' organizations and to improve individual access to basic social services that reduce the vulnerability of poverty and difficulties of coping with sudden changes in their life situations like births, deaths, accidents, illness and snake bites. The objective is two-fold. First it will improve access and better management of material facilities and legal documents fundamental to the survival of subsistence farmers. Second will enable farmers to access pensions and form non-profit and for-profit associations. To meet the first objective, a series of direct support facilities will be provided to assist rural producers and extractivists living in isolated areas cope with their physical conditions. This will decrease time and transport costs to access medical and educational services or legal documents. Second, it will include institutional support to IDAM to strengthen its capacity to apply a resource management and participatory extension strategy to association development so that farmers will access technical information and gain knowledge about their personal legal rights and the legal obligations of farmers' associations, whether non-profit or for-profit.

The expected results for rural male and female producers and extractivists are that they have:

- Greater awareness of government social benefits that they are entitled to receive
- Better organization and protection of personal and organization documents to access benefits and make economic and social decisions to raise the quality of their life situation
- Reduced risks of survival in old age by information and knowledge how to secure rural pensions and death of spouse benefits
- Increased access to material facilities and legal services that reduce their transport costs and improve their social and economic opportunities and access to such services.

Main activities include material and technical support to each municipality and target

communities to help them access legal documents, have emergency medical care and school boats, two-way radios, mobile telephone units, school boats, snake bite kits, and safety boxes to keep documents. Mobile Municipality/Cartorio Boats and Mobile Municipality/Cartorio Van services will be provided in each municipality. Boat services will include sleeping services, computers, and equipment to enable Municipality legal officers and a Cartorio to process personal and association legal documents in distant rural areas. Financial support for this outreach service will be for a minimum of 5 years to increase the number of persons accessing birth certificates and documents that increase eligibility for rural pensions, maternity benefits, school entrance, registration of an association, and certificates required to engage in commerce or produce transport.

For target communities, boats will be equipped with life preservers, motors, and repair kits. Also provided will be stretchers (*macas*) to transport an ill or snake bitten person to boats or road vehicles, and snakebite kits. Boats will be used for school transport and emergency transport. Two-way radios and mobile telephone equipment and antennas will enable communities to decrease their isolation, call for emergency service, and increase market opportunities. IDAM staff will organize legal education in community based workshops and micro-region workshops. These workshops will provide information on what services are available, what documents are needed, how each document is to be completed, where to process them, and when it is appropriate to use them. Both male and female producers will be trained to ensure equal access to services and to socio-economic opportunities.

The PDM on overall plan is shown in Table 11.2.1-1.

11.2.2 Farmers' Organization

As stated in the preconditions of the above-stated project, in light of this Project, strengthening farmers' organizations is necessary and essential. The Project Design Matrix for strengthening farmers' organizations is shown in Table 11.2.2-1 The existing organizations can be grouped into two groups of informal (not official or not registered with administrative agencies) and formal (official or registered with administrative agencies) organizations. And each organization can vary in the contents of the activities, the conditions of organizations, the members, etc. Therefore, the plan appropriate for each organization will be worked out. Strengthening Farmers' Organization Project can roughly consist of the below three components.

1. Providing Local Leadership and Agribusiness Informal Group Extension Services
2. Providing Association Extension and Agribusiness Formal Development
3. Establishing Association and Agribusiness Policy/Program Support

The concrete plan for each component will be stated in Chapter 12. It is assumed that the project period will be 10 years from 2002 to 2012.

Table 11.2.1-1 Overall Project Design Matrix

Target Area：Iranduba, Itacoatiara, Maues　　Target Group: Small-scale Farmer　　Project Period: From 2002 to 2012　　(10years)

(Narrative Summary)	(Verifiable Indicator)	(Means of Verification)	(Important Assumption)
Overall Goal: Extending environment friendly agriculture beyond the target area	Strengthening farmers' organisations in neighbouring regions Increasing beneficiaries' income through the introduction of new technologies Decreasing slash and burn agriculture Extending environment friendly agriculture	Farmers' Organisations register book Farm economy monitoring S&B application to IBAMA Land cultivation (use) register	Government Policy for family farmers is unchanged
(Project Objective) Improving rural people's livelihoods through agricultural activities and sound natural resource management	Increasing farmers' income by 20% in 10 years with the increases of productivity by 10%, farm gate price by 20% and area of agro-forest by 60%	Agricultural Production Statistics Farm gate price Statistics Land use register Farm survey (Benchmark survey)	Manpower of and finances from IDAM are acquired (Securing of the staff and the budget of IDAM)
(Output): 1. IDAM's capacity as the supporting agency is strengthened. 2. Farmers' organisations are strengthened. 3. Environment friendly agriculture and fishery are extended 4. Balancing on supply and demands 5. Processing of target crops is improved. 6. Marketing is improved. 7. Access to social services is improved. 8. Access to social security is improved.	(Indicators of outputs) 1. IDAM's staff, vehicle, and vessel increase 2. Farmers' Organisation membership increase to 60% in 5 years 3.1 Agro-forest areas increase to 60 % in 10 years 3.2 Production of aquaculture increase to 200 tons/year in 10 years 3.3 Establishment of 3,900 facilities of hanging seed beds for vegetables, and Increased area of 124 ha for new vegetables 4. Access to market information more than 50 times per month 5. Establishment of 4 facilities for preliminary processing 6. Establishment of more than 10 facilities for producers market 7. Provision of 30 multipurpose vessels in the three municipalities	IDAM's annual report FO's register book Land use register Fishery statistics Farm gate price statistics & data base Processed agricultural products price statistics Market information data base Community register in INSS register book	INSS programs continue Market prices of the target crops are stabilised (are stable) Inflation does not abruptly occur Abnormal weather does not occur in the target (project) area
(Activities): 1.1 New technology extension program 1.2 Program for establishment of and education for Farmers' organisation 2.1 Regulation, financial management program 2.2 Credit access program 2.3 Leader training and activity program (Leadership program) 3.1 Environment friendly agriculture and fishery extension 3.2 Establishment of agriculture technique 4.1 Establishment of marketing database 4.2 Execution of marketable production plan 5.1 Plan of processing facilities and management 6.1 Plan of marketing improvement 7.1 Subsidy for transportation	(Inputs): [IDAM] 1. Organising project teams for farmers'organisations, vegetables, aquaculture, tropical fruits, marketing/processing, and project management 2. Establishment of project offices : provision of equipment for experiments, vehicles and vessels 3. Operation fund		Co-operation with relevant agencies and institutions The state government renders financial and personnel supports to the IDAM for its capacity building The state government supports IDAM from the finance and personnel aspects for its capacity building. （Pre-conditions） Communities in the target (project) area understand the rationality of the project, and positively promote it.

Table 11.2.2-1 PDM for Strengthening Farmers' Organizations in Amazonas State

Target Areas: Iranduba, Itacoatiara, Maues Target Group: Small-scale Farmers Project Period: From 2002 to 2012 (10 years)

Narative Summary	Verifiable Indicators	Means of Verification	Important Assumptions
(Overall Goal) Alleviating rural people's poverty and stepping up protection of natural environment	To strengthen farmers' organizations To increase the income through the introduction of new techniques To extend the environment friendly agriculture	Registry book of farmers' organizations Monitoring of farm economy Registry book for land use	- To continue the decentralization policy - To continue the family agriculture policy - To continue PPG7
(Project Purpose) To form and strengthen farmers' organizations as the core	The increase of the participants of farmers' organizations will be 60% in 5 years. The training for farmers will be implemented.	Registry book of farmers' organizations Annual report of IDAM	To continue Third Annual Program
(Outputs) 1. Farmers' organizations can be formed. 2. To establish trustworthy relationship and mutual cooperation between farmers and their awareness on environment	1. To train IDAM staff in being the extensionists /assistants to strengthen farmers' organizations 2. To improve the activities of agricultural production 3. To increase available boats 4. To increase pension beneficiaries through improving the method to receive pensions and the method to access pensions for the persons entitled to pensions	Annual report of IDAM Management record of farmers' organizations Annual report of IDAM Community registry book INNS registry book	The local infrastructure and social subsidies will be coordinated, based on the local program.
(Activities) - Identify local natural resources（Mapping） - Develop and train Young Farm Leaders - Train in savings mobilization strategies - Train producer group in the techniques on agricultural management and extension - Form multiple types of agribusiness associations - Establish resource partnerships for increasing adoption of improved technologies - Provide legal education and for-profit sustainable management entrepreneurial training - Training program for the management of funds and stores for residents in community（cantinas, etc） - Maintain IDAM/Municipality/Cartrio rural legal-aid boat and mobile van delivery services - Implement state policy on common resource management for community farmer association agribusiness growth - Train local residents in state policy on common resource management for community farmer association agribusiness growth - Improve producer and association planning and implementation of agribusiness investment projects	**(Inputs)** ［Outside IDAM］ 1) Specialists Farmers' Organizations, Vegetables, Fishery, Tropical Fruits, 2) Facilities and Materials Office equipment, Vehicle, Boat, Testing equipment /instruments 3) Training for counterpart 4) Monitoring of project 5) Related organizations, NGO [IDAM] 1) Establishment of Project Team Programs involved with the below items will be implemented. To form farmers' organizations, Training for farmers, Building of Market Database, Technical/Financial(Credit) Aid 2) Establishment of Project Office To procure the facilities and materials needed 3) Management Funds		To develop and improve IDAM staff in charge of extension of and aid for farmers' organizations

11.2.3 Environment

This project demands the execution of a sustainable agriculture in the tropical rain forest of the Amazon Region that will improve the rural people's livelihood. Table 11.2.3-1 shows Project Design Matrix (PDM) for this project. The overall goal of this project is aimed to preserve tropical rain forest and establish a sustainable agricultural activities in the Amazon Region and in order to attain this purpose, it is necessary to perform careful environmental assessment in the proposed projects not only to prevent damage to the ecology but also to preserve the natural biodiversity. In addition, this project also intends to reduce the environmental impact caused by agricultural cultivation of guarana, tropical fruits and fish culture to be conducted by targeted farmers. Basically, the following activities are required:

- Enforcement of IDAM organization for environment
- Collection of data and information
- Providing cooperation with PPG7 project
- Providing environmental consideration for IDAM project

In addition, great attention shall be directed to the present environmental problems in the targeted area and the expected environmental impact from the new projects to be prepared by IDAM in the future. In order to fulfill the reduction of the environmental impact and proceed with the agriculture activities with environment friendly conditions, IDAM has to carry out the implementation of environmental management. For proceeding with the implementation of the above conditions aimed at targeted areas by IDAM, the zoning work of EEZ project which is being carried out by PGAI at the present, have to be completed in Maues, Itacoatiara and Iranduba. Furthermore, INPA, EMBRAPA, IPAAM and IBAMA's support and cooperation are a matter of great importance to the project success. Enforcement of IDAM organization, continuation of PPG7 project and proceeding with the research for agriculture continuously with environmental consideration by EMBRAPA are required for the project. Main items of environmental consideration shall focus on the followings:

- Preservation of forest
- Preservation of forest resource
- Preservation of fishery resource
- Promotion of agroforestory
- Establishing a high performance agricultural methods
- Prevention of expansion of slash and burn field
- Establishment of a methodology for the efficient usage of fertilizer and agricultural chemicals
- Preserve soil erosion

In the agricultural development plan to be prepared by IDAM in the future, the result of PPG7 project shall be fully utilized in the project planned in the Amazon Region.

Table 11.2.3-1 Project Design Matrix (Environment)

Narrative Summary	Verifiable Indicator	Means of Verification	Important Assumption
(Overall Goal) Preserve tropical rain forest and establish sustainable agriculture in Amazon region.	- Prevent damage of ecology. - Preserve bioderversity.	Utilize result of PPG7 (Utilize data prepared by 17 subprojects of PPG7, transition to phase 2 was approved in the JSC meeting held on Jun, 2001).	Proceed activity of PPG7 (Utilize zoning data prepared by SPRN).
(Project Purpose) Reduce environmental impact caused by agriculture as Guarana, tropical fruits and fish culture conduct by targeted farmers.	- Establishment of high performance agricultural method for reducing slash and burn fields. - Preservation of fishery resource. - Establishment of methodology for efficient usage of fertilizer and agricultural chemicals. - Promotion of agroforestory. - Preservation of forest. - Prevention of expansion of slash and burn field. - Prevent soil erosion. - Preservation of forest resource.	- Statistics data of the slash and burn field prepared by IBAMA. - Statistics data of the deforestation prepared by IBAMA and INPE. - Statistics data of the forest management plan prepared by IPAAM. - Register book of lands and farmers.	- Regulation of forest reserved area based on law (Existing condition: 80%). Forest law No. 16 and No. 44 shall not to be changed. - Control immigrants who move to Amazon region by the Government. - Assistance of infrastructures by the Government in remote areas. - Prepare GIS map by subproject of PPG7 by INPA. - Improving monitoring organization.
(Output) - Establishment of farming system with consideration of environment for Guarana, tropical fruits and fish culture. - Improvement of environmental awareness.	- Provide environment consideration by targeted farmers for the project - Provide technical assistance by IDAM. - Implementation of monitoring. - Provide environment consideration by IDAM.	- Proceed environmental education (conduct seminars for improvement of environmental awareness by PPG7 and IDAM). - Connect existing database system prepared by NAPIA etc.	- Cooperation and assistance shall be provided by INPA, EMBRAPA, IPAAM, and IBAM. - Proceed EEZ projects conducted by PGAI. - Proceed development and research activities by EMBRAPA(Guarana and tropical fruits).
(Activities) - Enforcement of IDAM organization for environment. - Collection of data and information for environment. - Providing cooperation with PPG7. - Providing environment consideration for IDAM projects.	(Input) - Assignment of the person in charge and establishment of Section/Department for environment. - Collect data and information from INPA、EMBRAPA、IPAAM、IBAMA etc. - Utilization of the data obtained by PPG7, basic policy and guideline shall be reflected to proposed project. - Utilization of the data prepared by PPG7. - Project shall be planned with environmental considerations. - Connection to the existing common database system by IT - Proceeding environmental education and enlightenment of environment. - Carry out monitoring for slash and burn field and IDAM's projects - Carry out EIA for IDAM's projects		(Pre-conditions) - Continue PPG7 project. - Carry out enforcement of IDAM's organization based on recommendation prepared by JICA. - Continue proceeding of research for agriculture with consideration of environment by EMBRAP.

Collect data and information and utilize these data appropriately for the establishment of a development plan that is aimed in securing a high yielding agriculture. Proceeding of agriculture with environment friendly conditions through the utilization of the result of PPG7 and database system, and proceeding with the environmental education can minimize the environmental impact caused by the project. It is also very important that the livelihood of the targeted farmer

11.2.4 Agriculture

(1) Guarana

The basic plan proposed to increase guarana production had two fundamental components:

1. Guarana productivity improvement project, and
2. Environmentally sustainable guarana production project.

Table 11.2.4-1 presents the Project Design Matrices (PDM) for the "Guarana Productivity Improvement Project" and the "Environmentally Sustainable Guarana Production Project." The projects are designed to cover a 10 year timeframe. Activities are categorized in terms of when they should be considered for initiation, i.e., in the short term (S = year 1-2), medium term (M= year 3-5), or long term (L = year 6 and beyond). All these aspects will be explained in greater detail in Chapter XII.

(2) Vegetables

The small-scale farmers who lived in varzea in Iranduba is the target group of vegetable production improvement project. The concept of a improvement plan for vegetable production is presented in the Chapter 10. The basic concepts of the vegetable improvement plan are as follows.

i) Reversal idea on the flood
ii) Promoting environmental friendly type agriculture

The vegetable production improvement plan was formulated according to the concepts, and the plan consists of basic research and study project and introduction of the applicable agricultural technology project which have several sub-project. A priority project and priority extension projects should be carried out at the beginning of the project implementation. High priority should be given soil survey which covers the study area in Iranduba for the survey in this program. It is fundamental factor to grasp chemical and physical characteristics of soils in order to establish recommendable farming practices and decide applicable vegetables. Extension of Basic Production Technology and Agro-chemical information and applicable technology of agro-chemical application are selected as the priority extension projects. Especially, the situation about use of the agro-chemicals in the area cannot be overlooked.

Table 11.2.4-1(1) PDM for Guarana Productivity Improvement Project

Target Area: Maues Municipality Timeframe: 2002-2012 Target group: Small family farmers

NARRATIVE SUMMARY	VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Overall Goal: Improve the long term livelihood of small guarana farmers	- Maues guarana communities have better standard of living through more schools, health posts, transport services, improved family housing - Guarana farmers have less debt, healthier children, better household assets	- Data from IDAM, Mayor - Data from RRA's	Lack of natural disasters
Project Purpose: ① Improve income of small guarana farmers thru increased yields ② Ensure long term viability and competitiveness of small farmer guarana production	- Annual income of average farmer increases by at least 30% - Higher % of farmers free of debt - Higher % of farmers plant guarana	Data from IDAM, Mayor, Banks Data from RRA's Data showing Maues guarana farms becoming more economically viable than Bahia farms Data from project reports	Inflation is controlled Major processors remain in Amazonas Guarana pricing remains relatively stable
Outputs 1. More seedlings of improved clones arrive at remote farms and are planted properly. 2. More fertilizer arrives at remote farms and is utilized properly. 3. Farmers minimize use of agrochemicals. 4. Farmers plant only in appropriate areas using proper planting techniques. 5. Farmers have adequate time and money to properly weed and prune their plants. 6. Farmers focus more on yield improvement of older trees than expansion of new areas. 7. Farmers are made more aware of quality and volume requirements of processors. 8. Processors become more aware of constraints of farmers and accept them as long term partners. 9. Processors agree to play an increased role in guaranteeing sustainability of future supply/demand relationships with Maues small farmers. 10. Farmers benefit from increased research on cultural practices 11. Farmers benefit from increased IDAM visits to communities 12. Farmers benefit from increased training events in the communities	1-1 Seedling sales increase 1-2 Increased seedling germination rates 2-1 In off season, less fertilizer stored on the farm 3-1 In off season, less agrochemicals stored on the farm 3-2 Less pesticide poisonings, deaths 4-1 More capoeira utilized 4-2 Higher seedling germination rates 5-3 Higher % of hired help utilized 5-4 Lower % of weed infestations 6-1 Lower % of annual tree deaths, replacements 7-1 Increased direct sales to processors 7-2 Increased % of farm revenue from processors 8-1 Increased visits to farms by processors 9-1 Increased training events held by processors 10-1Farmers speak highly of research and extension staff	- Data from IDAM, Mayor, Banks - Data from RRA's - Data showing Maues guarana farms becoming more economically viable than Bahia farms - Data from project reports - Inteviews with processors	IDAM/Embrapa remain as viable, functioning entities
Activities (**S**hort, **M**edium, **L**ong Term) 1) Input Supply Sub-Project (w/IDAM) a. Expand Embrapa production capacity for improved seedling clones (S) b. Expand private sector nursery capacity (M) c. Improve mechanism for clone & fertilizer transport to remote areas (S) d. Improve ability to purchase clones, fertilizer, pesticides through donation and/or credit programs. (S) 2) Cultural Practices Sub-Project (w/IDAM,Embrapa) a. Training in site selection and planting techniques (S) b. Training in weed control (S) c. Training in pruning (S) d. Provide donation and/or credit programs to provide capital to hire labor for cultural practices (S) e. Training to improve timing of cassava production to provide better food security during period of cultural practices and harvest. 3) Recovery of Degenerated Trees Sub-Project (w/IDAM, Embrapa) a. Training in use of cultural practices to improve productivity of old trees (S) b. Provide donation and/or credit programs to generate capital for recovery activities (S) c. Promote "3+1" concept (for every 3 ha of old trees in recovery program, 1 ha of new trees can be planted). (S) 4) Private Sector Participation Sub-Project (w/Ambev, Coca Cola) a. Establish co-funded project (matching funds?) to increase private sector participation in research and extension activities carried out by public sector (S) b. Increase frequency of visits and exchanges between farmers and technical staff of processors (S) 5) Research, Training, Extension Improvement Fund Sub-Project (w/IDAM, Embrapa) a. Establish a public/private sector steering committee to determine priorities for funding. (S) b. Establish a funding mechanism and administration scheme. Initial focus on the following areas (S): c. Research (focus on demo farm trials) 1 – Cabruca system vs. slash & burn. (S) 2 – Mixed cropping with annual crops. (S) 3 – Sustainable agroforestry models. (S) 4 – Development of IPM approach. (M) 5 – Organic guarana production. (L) d. Training (focus on farmer field school approach) 1 – Focus: clonal selection, planting, cultural practices. (S) 2 – Processing techniques (at central coop). (M) e. Extension (increased emphasis on dev. of farmer leaders) 1 – Hire more extensionists, train them, improve their transport to clients and other projects 2 – Focus: cultural practices, crop budgeting, food security (timing of cassava harvests, etc.)	Inputs Funds for the following key goods and services: - Establishment of seedling nurseries - Fertilizer, agrochemicals - Transport of agrochemical - Labor capital for cultural practices - Establishment of RTE steering committee - Training events in communities - Expert consultations to communities - Salary of additional extension staff - Operational expenses for research projects - Expenses for travel of "farmer leaders" to other projects and communities		

Table 11.2.4-1 (2) Project Design Matrix for Environmentally Sustainable Guarana Production Project

Target Area: Maues Municipality Target Period: (2002-2012) Target Group: Small family farmers

NARRATIVE SUMMARY	VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Overall Goal: Promote environmentally sustainable production of guarana	Increase farm income (30% up) Increase in No. of farmers on environmental friendly agriculture	Data from IDAM , Mayor RRA data	Lack of natural disasters
Project Purpose: 1) Ensure long term viability of small farmer guarana production through preservation of guarana agroecosystem. 2) Promote ecological niche marketing of Maues guarana	1-1 Deforestation rates decrease 1-2 Maues becomes known as center of eco-friendly guarana production practices	- Data from IDAM, Mayor - Data from INPA - articles in popular press	- No natural disasters - Continued public interest in minimal use of pesticides
Outputs 1. Guarana monocultural plantings are decreased in favor of mixed cropping with annual and perennial species. 2. Rate of clearing of virgin forest for new guarana areas is decreased. 3. Where virgin forest is targeted for new guarana production, loss of original virgin forest vegetation is minimized. 4. Amounts of toxic agrochemicals used in guarana production are decreased. 5. Farmers become more knowledgeable about when and how to apply agrochemicals 6. Incidences of pesticide related injuries and death are reduced. 7. Opportunities for organic guarana production are identified and pursued.	1-1 Increase in no. of farms where guarana planted with 3 or more other perennial , commercial crops 2-1 No. of ha cleared and burned is decreased 3-1 No. of farms employing selective slash and burn increases 4-1 Less chemicals sold in Maues 4-2 Less chemicals present on farms 5-1 More trainings on agrochemical use 6-1 Fewer poisonings, deaths 7-1 Sales of organic guarana increase	- Data from IDAM, Mayor - INPA data - Data from agro supply stores - Project survey data	Farmers will have interest in IPM and organic production
Activities (**S**hort, **M**edium, **L**ong Term) 1) Sustainable Agro Forestry Sub-Project (w/CEPLAC, INPA) e. Strengthen Embrapa research activities (S) f. Initiate demo plots with annual crops and perennial tree species (S) g. Initiate demo plots comparing land clearing techniques (slash burn/cabruca/capoeira) 2) Integrated Pest Management Sub-Project (w/Embrapa) f. Strengthen Embrapa research in determining economic threshold levels for pests/diseases (S) g. Participatory training (Farmers Field Schools) in IPM concepts h. Training in pesticide safe use and handling (S) ③ Organic Guarana Sub-Project (w/CEPLAC, INPA) d. Initiate market study for potential buyers e. Select areas/farmers for participation in demo plots f. Initiate demo plots	Inputs Funds for the following basic goods and services: - Travel, operational, and professional expenses for CEPLAC staff from Bahia and Belem - Establishment of agro-forestry research and demo plots in Maues, Para, and Bahia - Travel, operational expenses for Embrapa research trials in IPM - Launch market research study for buyers of organic guarana - Expenses for establishment and maintenance of demo plots in agroforestry, IPM, and organic production - Budget for entertainment of visitors and other promotional work		Preconditions Pest populations remain at reasonable levels

It is necessary to carry out the extension on information and technology agro-chemical use quickly. The introduction of the applicable agricultural technology project includes the fundamental components that affect and relate most closely to the elimination of the prevention factor and improvement of conditions for the vegetable cultivation. It is expected that basic data is accumulated and farmer's knowledge and technology are upgraded through the implementation of these projects. IDAM should introduce new technology and new vegetables in cooperation with the University of Amazonas, EMBRAPA and INPA. The applicability of new technologies and crops should be verified through field work by IDAM extension staff in the pilot farms or trial fields. The Environmental Friendly Technologies consist of Environmental Preservation Type Technologies and Environmental Adaptation Technology.

Technologies to introduce should meet following requirements.

i) Environment friendly technology
ii) To be acceptable to farmers
iii) Low cost
iv) High adaptability with the varzea ecology

Furthermore, the technologies to introduce can also expect the following effects as well as contributing to the improvement in productivity of vegetables.

i) Curtailment of a production cost
ii) Improvement of safety and healthfulness of products
iii) Improvement of quality and safety of products
iv) Mitigation of the influence to environment

Table 11.2.4-2 shows PDM for development program of small scale vegetable farmers.

(3) Tropical Fruits

The basic plan proposed to increase tropical fruits production had five fundamental components:

1. Tropical fruits production by using of sustainable agroforestry system
2. Training for Integrated Pest Management (IPM) to farmers
3. Tropical fruits production by traditional organic farming (ROOTS permaculture)
4. Tropical fruits production by integrated farm (including livestock, home garden etc.)
5. Extension of cultivation

Table 11.2.4-3 presents the Project Design Matrices (PDM) for the improving productivity of tropical fruits. The projects are designed to cover a 10 years timeframe. All these aspects will be explained in greater detail in Chapter XII.

Table 11.2.4-2 PDM for Small-scale Agriculture Development in the Amazonas State

Target area: Iranduba Target group: Small-scale Family farmers Project period: from 2002 to 2012 (10 years)

Narrative summary	Variable indicators	Means of verification	Important assumptions
Overall goal: The small-farmers livelihoods is improved through development of environment friendly agriculture.	・No. of farmers who adopt new technologies ・No. of farmers who introduce new vegetables	・Data of DPA, IPAAM and IBAMA ・Data of IDAM	・Extremely worse weather (drought) conditions do not occur.
Project purpose: Environment friendly technology is developed for small-scale farmers in the target area.	・No of farms who adopt new technologies increased to 300. ・No of farmer who introduce new vegetables will reach 350. ・Agriculture related family income increase.	・IDAM Annual Report ・Data of IDAM, EMBRAPA and INPA ・Project monitoring and evaluation	・Agricultural products price is not be dropped largely.
Out put:			
1. Project planning and implementation ability of IDAM is strengthened.	1-1. No of trained IDAM's technical staff increase.	1-1. IDAM Annual Report	・Environmental condition for agriculture in Varzea is not worsen.
2. Environmental friendly basic technology for small-scale farmers is systematically available.	2-1. Adequate technology is verified practically.	2-1. Manual for rural extension 2-2. Manual for agriculture technology transfer	
3. Environmental friendly basic technology is extended to small-farmers.	3-1. No of farmers who adopt applicable use of agrochemical are increased. 3-2. No of IDAM-assisted farmers are increased	3-1. Project monitoring and evaluation 3-2. Report on technical training and field visit	・Good relation with relevant organization is maintained.
4. Accessibility to funding source is improved.	4-1. No of credit application increase. 4-2. No of approval case increase.	4-1. IDAM Annual Report 4-2. Report of Bank	
5. New technologies and new vegetables is introduced and extended.	5-1. No of Canteiras are increased. (300 families, 3,900 units) 5-2. No of farmers who grow new vegetables are increased. (350 families, 124 ha)	5-1, IDAM Annual Reports 5-2. IDAM Annual Report	
6. Farmers group activity is strengthened.	6-1. No of farmers group increase.	6-1. List of farmer's organization	
Activities: 1-1. Improve activity of IDAM through Information Technology 1-2. Train technical staff of IDAM 2-2. Conduct pilot farm (experimental farm) 2-3. Reinforcement of cooperation with other organization (EMBRAPA, EMATER, INPA) 3-1. Establish model farmers and Implement technology through model farms 3-2. Enhancement of support activity for small-scale farms 3-3. Carry out on-farm technical training 3-4. Held seminars on farming practices 4-1. Held seminars on bank credit for small-scale farmers 4-2. Support preparation of balance sheet 4-3. Mayors office support small-farmers who don't have document 5-1. Improve facility for processing, distribution and marketing 5-2. Enhancement of agro-business support activity of IDAM 6-1. Enhancement of support activity for community development of IDAM 6-2. Establishment of organizations for production and agro-business 7-1 Manage of PDCA cycle through the Project monitoring	**Input:** ［IDAM］ 6) Restructuring of IDAM and improvement of technical staff Agro-business, Community Development, Info. Technology in HQ and target LU 7) Facility and equipment Transportation and Computer network and information system IDAM headquarters, Local units, Pilot farm 8) Operation and maintenance cost of facilities and equipment [Outside IDAM] 1) Technology transfer and technical support (recruited due to necessity) Agriculture, Agro-business, Extension and training, Organization, Credit, Evaluation, Project Coordination, etc. 2) Cooperation with a related organization Joint Project with (EMBRAPA, EMATER, INPA etc.) 3) Facility and equipment a. Establishment of model farms - Input and equipment for model farm (IDAM volunteer) 4) Expense for capacity building of IDAM staff 5) Expense for seminar and workshop		・Trained IDAM staff work continuously. **Pre-conditions** Drastic policy change of government does not occur.

Table 11.2.4-3 Project Design Matrix for Improving of Tropical Fruits Production

Target Area: Itacoatiara Target Period: (2002-2012) Target Group: Small family farmers

NARRATIVE SUMMARY	VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Overall Goal: Improving farmer income and livelihood through environment friendly agriculture (tropical fruits production)	Increasing farmer's income	- Data of IDAM, SEBRAE - RRA survey	- Extremely worse weather (drought) conditions do not occur
Project Purpose: - Increasing total sales of tropical fruits products - Improving quality of tropical fruits - Increasing and Introducing agroforestry system for tropical fruits	- Deforestation rates decrease - Increasing sales of tropical fruits products	- Data from IDAM, Mayor - Data from INPA, EMBRAPA, CEPLAC - Data of Lab. for quality test. - Forestry data by remote sensing technology (INPA)	- Agricultural products price is not be dropped largely
Outputs - Improving tropical fruits productivity - Tropical fruits production by integrated farm - Tropical fruits production by Integrated Pest Management (IPM) - Tropical fruits production by traditional organic farmiong	- Increase in no. of farms where fruits are planted with more other perennial , commercial crops - Rate of clearing and burning of virgin forest is decreased - Biomass output increases, soil erosion decreases - Less chemicals present on farms	- Data from IDAM, Mayor - INPA data - Data from agro supply stores - Project survey data - Marketing data (by IDAM)	- Special pest and disease do not occur - Good relation with relevant organization is maintained
Activities - Tropical fruits production by using of sustainable agroforestry system - Training Integrated Pest Management (IPM) for farmers by EMBRAPA - Tropical fruits production by traditional organic farmiong - Tropical fruits production by integrated farm (livestock, etc.) - Pilot farm (model farm) are implemented, and the effort is extended to farmers	**Inputs** [IDAM] 1) Training and extension of agroforestry system for farmers 2) Training for tropical fruits production by organic fertilizer for farmers 3) Maintenance cost for existing or newly - established facilities. [EMBRAPA] 1) Technical training for farmers by technical staff 2) Providing improved (good) seedling for famers 3) Assistance for pilot farm including seminar, etc. ［Outside IDAM, EMBRAPA］ 1) Technical training for farmers by technical staff 2) Providing agricultural materials (inputs) 3) Assistance for research activities		**Preconditions** Domestic policy change of government does not occur

11.2.5 Aquaculture

Based on the examination of the problem analysis (Section 9.2.3) and basic project approach (Section 10.2.4), PDM for small-scale aquaculture development is prepared as shown in Table 11.2.5-1. Target areas are the three municipalities investigated in this study, and target group is set not only for family farmers but also for small-scale fishermen because of inclusion of net cage culture and lake ranching program as well as harragem culture development. Project period will be 10 years from 2002 to 2012. It is important for successful implementation of this project to strengthen IDAM's capability and to collaborate with other relevant government agencies.

11.2.6 Processing, Distribution and Marketing

(1) Processing and Distribution Improvement Plan

The three tables (Table 11.2.6-1 to 11.2.6-3) present the more detailed Project Design Matrices (PDM) for the three Processing and Distribution Improvement Projects. The projects are designed to cover a 10 year timeframe. Activities are categorized in terms of when they should be considered for initiation, i.e., in the short term (S = year 1-2), medium term (M= year 3-5), or long term (L = year 6 and beyond). All these aspects will be covered in greater detail in Chapter 12.

(2) Marketing Improvement Plan

Table 11.2.6-4 shows the Project Design Matrix (PDM) for the Marketing Improvement Plan. The project is designed to cover a 10 year timeframe. This Plan consists of five components as follows:

1. Setting up of market information system
2. Promotion of direct marketing
3. Certification of standard and quality of product
4. Marketing support by in areas in the number of primary processing facilities and distribution vehicles
5. Human resource development and training

Table 11.2.5-1 PDM for Small-scale Aquaculture Development in the Amazonas State

Target area: Iranduba, Itacoatiara, Maues Target group: Family farmers and small-scale fishermen Project period: from 2002 to 2012 (10 years)

Narrative summary	Variable indicators	Means of verification	Important assumptions
Overall goal: Environment friendly aquaculture is developed for small-scale farmers and fishermen in the Amazonas State.	・No of licensed fish farms increased ・No of lake ranching sites will be increased	・Data of DPA, IPAAM and IBAMA ・Fishery statistics (to be prepared)	・Extremely worse weather conditions like El Nino do not occur
Project purpose: Environment friendly aquaculture is developed for small-scale farmers and fishermen in the target area	・No of licensed fish farms increased to 500. ・Covering area of lake ranching program will be 750 ha. ・Aquaculture related family income increase.	・Data of DPA, IPAAM and IBAMA ・Project monitoring and evaluation	・Fish price is not be dropped largely.
Out put: 1. Project implementation ability of IDAM is strengthened. 2. Basic technology for small-scale operators is systematically available. 3. Basic technology is disseminated. 4. Accessibility to funding source is improved. 5. Seed production and distribution activities are strengthened. 6. Lake ranching program is introduced.	1-1. No of IDAM's fishery staff increase. 2-1. Adequate technology is verified practically. 3-1. Fish farmers are organized. 3-2. No of IDAM-assisted fish farms are increased 4-1. No of credit application increase. 4-2. No of approval case increase. 5-1. Production of tambaqui fry increased to 10 million per year. 5-2. Experimental seed production of new species are carried out. 6-1. Seed release is carried out. 6-2. Fish released and grown are recaptured.	1-1. Staff list of IDAM 2-1. Manual for pond culture 2-2. Manual for net cage culture 3-1. List of farmer's organization 3-2. Report on technical training 4-1. Inhouse report of IDAM 4-2. Report of Bank 5-1. Report of IDAM Balbina hatchery 5-2. Report of IDAM Balbina hatchery 6-1. Project monitoring and evaluation	・Environmental condition for aquaculture is not worsen. ・Good relation with relevant organization can be maintained.
Activities: 1-1. Recruit new fishery engineers to IDAM 1-2. Train fishery staff of IDAM 2-1. Establish model aquaculture farms 2-2. Conduct on-farm rearing experiment 3-1. Implement IEC activity on aquaculture and farmers organization 3-2. Support establishment of small-scale fish farms 3-3. Carry out on-farm technical training 3-4. Held seminars on aquaculture license 4-1. Held seminars on bank credit for small-scale operators 4.2. Support preparation of balance sheet 5-1. Improve facility of IDAM Balbina hatchery 5-2. Carry out stable production of tambaqui fry 5-3. Development of seed production for new species 5-4. Introduce developed seed production technology 6-1. Prepare plan of pilot seed release program 6-2. Implement seed production for release 7-1. Implement baseline study on freshwater aquaculture 7-2. Implement project monitoring and evaluation	**Input:** 〔IDAM〕 9)Aquaculture development task force team of IDAM Project manager, Hatchery staff, Extension managers in target area 10) Facility and equipment IDAM headquarters, Local units, IDAM Balbina hatchery 11) Operation cost of existing facilities [Outside IDAM] 6)Technical experts (procured due to necessity) Aquaculture technology, Extension and training, Organization, Credit, Evaluation, Project Coordination, etc. 7)Facility and equipment a. Equipment for strengthening IDAM's hatchery（rearing equipment, laboratory equipment, equipment for seed distribution, etc） b. Establishment of model aquaculture farms - Facility and equipment for barragem type farm - Facility and equipment for net cage type farm c. Equipment for quick site investigation（GPS, portable water checker, etc） 8)Expense for capacity building of IDAM staff 9)Expense for seminar		・Increased number of fishery staff of IDAM work continuously. **Pre-conditions** Drastic policy change does not occur.

Table 11.2.6-1 Project Design Matrix for Guarana Processing and Distribution Improvement Project

Target Area: Maues Municipality Timeframe: 2002-2012 Target group: small guarana farmers

NARRATIVE SUMMARY	VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Overall Goal: Improve the long term livelihood of small guarana farmers	- Maues guarana communities have better standard of living through more schools, health posts, transport services, improved family housing - Guarana farmers have less debt, healthier children, better household assets	- Data from IDAM, Mayor - Data from RRA's	- Lack of natural disasters
Project Purpose: Improve small farmer income through increased opportunities in value-added processing, improvement of existing distribution infrastructure and decreased dependence on selling to brokers and Ambev	- Annual income of average farmer increases by at least 30% - Higher % of farmers free of debt - Higher % of farmers plant guarana	- Data from IDAM, Mayor, Banks - Data from RRA's - Data showing Maues guarana farms becoming more economically viable than Bahia farms - Data from project reports	- Inflation is controlled - Major processors remain in Amazonas - Guarana pricing remains relatively stable
Outputs 1. Central Cooperative Sub-Project 1.1 Farmers have a central buying point where they can deposit their crop and receive the guaranteed federal minimum support price. Crop can be guarana, fruits , or cassava. 1.2 Farmers have an establishment which increases their negotiating power in the marketplace. 1.3 Farmers have a storage facility managed by the coop which can hold their guarana until prices improve. 1.4 Farmers have a facility which can buy ag inputs at bulk discount rates. 1.5 Farmers have a facility which can process their guarana, fruits, cassava into value-added products when expedient. 1.6 Farmers have a facility which offers a limited amount of boat transport service for delivery of their crop to Maues. 1.7 Farmers have a facility which looks out for their long term interests and promotes the regional and international sale of Maues guarana. 1.8 Farmers have a central facility which can serve as a meeting place, and training center for guarana-related activities. 2. Processing Sub-Project 2.1 Village-level processing activities are increased. 2.2 Processing activities in Maues town are increased. 2.3 Sales of processed guarana products from Maues are increased. 2.4 Improved quality of processed guarana products from Maues. 3. Distribution Sub-Project 3.1 Farmers have improved access to boat and land transport for delivery of crop and processed products to market. 3.2 Farmers have improved access to boat and land transport for delivery of agricultural inputs to their farms. 3.3 Distribution chain for guarana is made more transparent through study of "cadeia productive"	1-1 Number of transactions at Central Coop 1-2 Record of ag inputs purchased and delivered by Coop 1-3 Increases in annual membership of Central Coop 1-4 Increase in Coop profits distributed back to members 1-5 No. of new Coop customers in external markets 1-6 Log book for Coop boat service 1-7 No. of trainings at Coop 2-1 No. of sustainable village processing activities created 2-2 Sales of village level products increased 3-1 Fleet of boats purchased 3-2 Maintenance system for goats in place 3-3 Operational plan for boats in place 3-4 Increased levels of guarana arriving in Maues town for sale and processing 3-5 Distribution study completed	1-1 Central Coop records 1-2 Survey of farmers associations 1-3 Survey of brokers 2-1 Survey of farmers associations 2-2 Survey of processors 3-1 Survey of farners associations 3-2 IDAM survey 3-3 Project survey	-IDAM remains as viable, functioning entity -Mayor allocates land for Coop -Farmers associations sufficiently organized to take advantage of inputs and services
Activities (**S**hort, **M**edium, **L**ong Term) 1. Central Cooperative Sub-Project (w/SEBRAE, CTAA, CPATU) 1. Form steering committee for the coop. (S) 2. Establish funding and management scheme for the coop. (S) 3. Construct, staff, and initiate coop services. (M) 4. Establish boat transport services of the coop. (M) 5. Establish training and marketing arm of the coop. Link with logo campaign. (M) 6. Establish agro processing capacity of the coop. (L) 2. Processing Sub-Project (w/CTAA, CPATU) 1. Identify several target communities for the establishment of small-scale processing activities. (S) 2. Establish fund to stimulate village level processing (micro-credit, community grants). (S) 3. Establish small business loan and incentives program for processing startup activities in Maues. (S) 4. Establish training center (factory school) for guarana processing activities at Central Coop. Include food safety component. (S) 3. Distribution Sub-Project (w/IDAM Transport Project) 1. Identify network of target communities to be supported by an upgraded boat transport system. (S) 2. Establish funding mechanism to purchase and maintain a limited fleet of guarana "support" boats. Boats could also be used for transport of IDAM staff. (S) 3. Establish a management system to administer guarana boat services and maintenance. (S) 4. Purchase limited fleet of boats and initiate services. (M) 5. Arrange private sector buyout of fleet. (M/L) 6. Design, fund, and implement a distribution study for Maues-sourced guarana and guarana products. Focus on Mato Grosso and other important destinations. (S)	Inputs Sufficient funds for the following goods and services: - Purchase of land, construction materials, equipment, vehicles for Central Coop - 2 years of operating expenses for Coop - 2 years of salary for professional Coop management staff - Start up of 5 village level processing activities - Training activities for village processors - Establishment of "factory school" at Coop - Purchase fleet of light transport boats for remote communities - Operating and maintenance funds for boat fleet - Budget for sectoral study on guarana distribution -		Preconditions

Table 11.2.6-2 PDM for Vegetable Processing and Distribution

Target Area: Iranduba Municipality | Timeframe: 2002-2012 | Target group: small vegetable farmers (primarily varzea)

NARRATIVE SUMMARY	VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Overall Goal: Improve the long term livelihood of small vegetable farmers	- Varzea vegetable communities have better standard of living through more schools, health posts, transport services, improved family housing - Vegetable farmers have less debt, healthier children, better household assets	- Data from IDAM, Mayor - Data from RRA's	- Lack of natural disasters
Project Purpose: Improve small farmer livelihood through increased and improved post harvest infrastructure (transport, minimal processing, market access and promotion).	- Annual income of average farmer increases by at least 30% - Higher % of farmers free of debt - Higher % of farmers plant vegetables	- Data from IDAM, Mayor, Banks - Data from RRA's - Data showing Iranduba varzea farms becoming more economically viable, and more competitive with terra fime farms - Data from project reports	-Inflation is controlled -Manaus demand for processed vegetables remains stable -Pricing for vegetable products remains relatively stable
Outputs 1. One central produce receiving area established in Iranduba town. 2. One upgraded "farmers market" established in Manaus exclusively for Iranduba growers as a point of sale and market promotion. 3. Reduced dependence of Iranduba farmers on brokers. 4. Increased direct sales of high quality "minimally processed" vegetables to Manaus consumers. 5. Farm to market transport of produce is facilitated for remote farmers. 6. Post harvest quality of produce from Iranduba is improved. 7. Improved sales and reputation of Iranduba produce leads to increasing market share vs. imported produce.	1-1 Iranduba receiving facility established, staffed 2-1 Farmers market established in manuas, staffed, 3-1 Lower incidence of brokers in Iranduba vicinity 4-1 Increased number of contracts for "minimally processed" vegetables from Iranduba 5.1 More farmers and produce arriving from remote areas to Iranduba town 6-1 Less rejection of vegetables at points of sale in Manaus 7-1 Wholesale markets decrease orders for imports and buy more local produce	1-1 Farmers are arriving at Iranduba facility and using it 1-2 Mayors survey 2-1 Farmers and their representatives are arriving at Manaus farmers market and using it 2-2 On site survey of Manaus facility 3-1 Survey of brokers, traders, wholesale markets 4-1 Survey of retail consumers 5-1 RRA 5-2 Project surveys 6-1 Survey of wholesalers 6-2 Survey of importers, SEFAZ, MAG staff	- Mayors office permits establishment of Iranaduba receiving center - Manaus receiving Center permits establishment of Iranduba farmers market inside facility - Farmers associations sufficiently organized to participate in these programs
Activities (**S**hort, **M**edium, **L**ong Term) 1) Integrated Produce Receiving Center/Farmer's Market Sub-Project (w/ IDAM Manaus Cntral Supply Projec,t, Emater-DF, Sebrae) 1. Create a steering committee to design project approach and administration plan. (S) 2. Design funding mechanism to attract private sector interest in management of the faciltities. (S) 3. Ownership, management plan, farmer usage arrangements approved by steering committee. (S) 4. Construct facilities (Iranduba – receiving station with minimal processing and cold storage; Manaus – farmer's market with selling area, kiosks, promo area, storage). (M) 5. Facility start up after promo campaign. (M) 2) Distribution Infrastructure Sub-Project (w/IDAM Transport Project) 1. Establish funding mechanism to purchase a limited fleet of trucks and boats for produce pick up and delivery of ag inputs. (S) 2. Create steering committee to determine which communities are to be serviced by the produce support fleet, and to devise fee structure. (S) 3. Finalize fleet admin plan, purchase vehicles, initiate services. (S) 4. Arrange buyout of fleet system to private sector investors. (M/L) 3) Packaging Materials Sub-Project 1. Conduct survey of regional suppliers of suitable materials. (S). 2. Conduct feasibility study for viable local manufacture of needed materials vs. import. (S) 3. Establish funding mechanism for purchase of materials and/or startup of local microenterprise. (S) 4. Initiate sustainable supply of packaging materials. (S/M) 4) Training and Extension in Vegetable Post Harvest Handling Sub-Project (w/Emater-DF, Embrapa-H, SEBRAE) 1. Design a funding mechanism to finance enhanced training and extension activities in vegetable PHH. (S) 2. Organize site visits for outside training experts to determine best interventions. (S) 3. Design and launch training workshops for farmer agents, 4. IDAM, facility staff, producer associations, etc. (S/M)	Inputs Sufficient funds for the following basic goods and services: - Construction and start up of Iranduba Receiving Center, with reefer truck transport and cold storage facilities - Construction and start up of Iranduba farmers Market in Manaus - 2 yrs of operational funds for facilities in Iranduba and Manaus - Purchase of trucks and boats - Operational and maintenance costs of fleet for two years - Purchase of packaging materials for sufficient for 20 communities over 2 years - Training events in Iranduba and Manaus - Professional feesand travel expenses for Emater-DF, Embrapa-H, and SEBRAE		Preconditions

Table 11.2.6-3 PDM for Fruit Processing & Distibution

Target Area: Itacoatiara Municipality Timeframe: 2002-2012 Target group: Small fruit farmers

NARRATIVE SUMMARY	VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Overall Goal: Improve the long term livelihood of small tropical fruit farmers	- Fruit based communities have better standard of living through more schools, health posts, transport services, improved family housing - Fruit farmers have less debt, healthier children, better household assets	- Data from IDAM, Mayor - Data from RRA's	- Lack of natural disasters
Project Purpose: Improve small fruit farmer income through increased opportunities in value-added processing, improvement of existing distribution infrastructure and decreased dependence on selling to brokers	- Annual income of average farmer increases by at least 30% - Higher % of farmers free of debt - Higher % of farmers plant tropical fruits	- Data from IDAM, Mayor, Banks - Data from RRA's - Data showing Maues guarana farms becoming more economically viable than Bahia farms - Data from project reports	-Inflation is controlled - Manaus demand for processed fruit products remains stable - Pricing for fruit products remains relatively stable
Outputs 1. One central fruit processing agroindustry is established. 2. ASCOPE processing facility is upgraded and self sustaining as a model rural pilot plant. 3. Two additional rural pilot processing plants are established. 4. Sales of processed fruit products from Itacoatiara are increased. 5. Fleet of boats and trucks established to facilitate rural transport of crops and ag inputs. 6. Quality (especially hygiene) of processed fruit products from Itacoatiara is improved.	1-1 Central fruit plant is operational, economically viable, w/ client base 2-1 ASCOPE operational w/ improved products and new clients 3-1 Pilot plants established and locals are trained 4-1 Itacoatiara fruit pulp reputation and sales increase in Manaus 5-1 Boat/truck fleet established w/operational and maintenance programs 6-1 Improved pulp quality confirmed by lab tests	- Data from IDAM, Mayor - Survey of Ascope members - RRA's - Project surveys - Certified lab test results - Survey of retail customers in Manaus	- Professional mgmt team is hired to manage fruit plant - Rural communities maintain interest in processing - Mayors office approves of fruit plant start up plan - Road infrastructure between Itacoatiara and Manaus remains viable
Activities (**S**hort, **M**edium, **L**ong Term) 1) Central Processing Agro Industry Sub-Project (w/SEBRAE, CTAA) a. Create a steering committee to revive defunct agro processing company in Itacoatiara town. (S) b. Design funding mechanism to attract private sector interest in plant renovation and start up. (S) c. New ownership and management of plant is created and approved by steering committee. (S) d. Establishment of initial client base. (M) e. Plant start up and commercial production. (M) 2) ASCOPE Upgrade Pilot Plant Sub-Project (w/CTAA) a. Design upgraded processing facility (done) b. Initiate construction of new facility. (done) c. Provide electrical supply to site area. (S) d. Plant start-up and launch of new commercial product to satisfy existing client. (S) e. Establish new client base through marketing activities (M). 3) Rural Pilot Plants Sub-Project (w/CTAA) a. Create steering committee to select and target two rural communities as recipients of upgraded processing facilities. (S) b. Design pilot plants for new target communities. (S) c. Establish funding mechanism for pilot plant infrastructure. (S) d. Line up potential buyers of product. (M) e. Plant start-up and launch of commercial product. (M) 4) Distribution Sub-Project (w/IDAM Transport Project) a. Identify network of target communities to be supported by an upgraded system of boats and trucks. Vehicles will a) haul crop to wholesale markets or to processing plants in Itacoatiara region, b)backhaul ag inputs to farms, and c) haul selected crops and frozen crop to clients/markets in Manaus. (S) b. Establish funding mechanism to purchase and maintain a limited fleet of "support" boats and trucks. (S) c. Establish a management system to administer boat and truck distribution services. (S) d. Purchase limited fleet of boats and trucks. (M) 5) Packaging Materials Sub-Project a. Identify sources of suitable packaging materials and arrange for low cost supply. (S) b. Design incentive program to stimulate creation of local businesses willing to manufacture low cost packaging materials to Itacoatiara. (L) 6) Training and Extension in Fruit Processing Sub-Project (w/SEBRAE, CTAA) a. Design a funding mechanism to finance enhanced training and extension activities in fruit processing. (S) b. Organize site visits for outside training experts in GMP's and food hygiene. (S) c. Design training workshops for ASCOPE. (S) d. Design general training workshops for farmer agents from diverse rural communities, IDAM extensionists, existing fruit processors. (S). e. Design training workshops for the two communities targeted to receive pilot plants. (M) f. Design training workshops for the incoming staff of the central agroindustry. (M)	Inputs: Sufficient funds for the following basic goods and services: - Staff salaries and operating expenses for 2 yrs atf fruit plant - Marketing budget for fruit plant - Electification at Ascope - Training at Ascope and other plants - Fleet of boats and trucks purchased to support most rural communities - Operating and maintenance plan for fleet established - Purchase of low cost packaging materials to support remote farmers - Sufficient training budget for CTAA and SEBRAE staff		- No natural disasters

Table 11.2.6- 4 Project Design Matrix for Marketing Support

Target Area: Maues, Iranduba, Itacoatiara Municipalities **Target group** :Small-medium size coops, farmer associations, and agro-processors
Timeframe:2002-2012

NARRATIVE SUMMARY	VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Overall Goal: Improve the livelihood of small farmers by increase of income	- Target communities increase number of boats & trucks - Farmers increase income by 20 %	- Data from IDAM, SEBRAE - Data from Rapid Rural Appraisals	- Extreme drought does not occur
Project Purpose: 1. Increase of farmer's income through increase of sales 2. Improvement of quality 3. Increase of export of Amazonas products outside of the state	- Farmers' annual sales amount increases by 20% - Sales price does not fluctuate more than that of the wholesale price - Export amount of Cupuasu and Asai to outside the state reaches 800 tons each	- Data from IDAM, etc - Data showing increase of processing amount - Data showing increase of authentic products in major cities in southern states - Increased business for local testing labs; increased mail-out of samples for quality tests	- Inflation is controlled - Amazon origin is positively associated with unique & exotic image
Outputs 1. Setting up of Market Information System 2. Promotion of Direct marketing 3. Certification of standard and quality of product 4. Marketing support by in areas in the number of primary processing facilities and distribution vehicles 5. Human resource development and training	1-1 Farmers inquiry to Market Information System reaches 50 times a month. 1-2 Published Marketing research and market outlook, twice a year 2-1 Direct sales points added and become total of 10 in Manaus 2-2 Increase of introduction to buyers 3-1 Promotion of Amazon quality by lab testing & Increase to more than 20 testing job a year 3-2 Amazon Brand more than 5will be established and registered 4-1 Supply of collection, storage, primary processing and distribution facilities 5-1 Training of farmers and administrators	1-1 Inquiry of information to Market database compiled 1-2 Diversity of crop & extension of harvest time 2-1 Increase of farmers booth making direct sales 2-2 Number of introduction of buyers 3-1 Record of test operations in lab 3-2 Survey of recognition of brand, participants at trade shows 4-1 Increase of processing, storage, transportation facilities & capacity 5-1 Number of participants to training	- IDAM remains as viable, functioning entity - Direct sales-points are not condemned by other traders in the business
Activities 1-1 Market research for Base-line survey 1-2 Data base compilation of price, traded amount, quality of products and Prepare to provide real-time price information 1-3 Market outlook and advise for production based on supply and demand forecast 1-4 Indicate direction of production reflecting market needs 2-1 Provide sales space for farmers to sell their products directly to consumers and restaurants (w/Emater-DF, SEBRAE) 2-2 Establish market linkages between farmers and processors 3-1 Certification of Standards and Quality Testing system 3-2 Identity preservation and marketing campaign for Amazonas products 4-1 Provide additional facilities for collection, storage, primary processing and distribution (trucks and boats) 5-1 Staff training for market research (SEBRAE, IDAM) 5-2 Instruction of market mechanism and use of information to farmers	**Inputs** [IDAM] - Staffing and equipment for Marketing Research & Quality testing Lab - Training budget for Market Information system - Infrastructure for direct sales program - Funds for marketing campaign for Amazonas products [From other than IDAM] - Instructors for staff development, - Equipment for Marketing Research & Quality testing Lab - Training budget for Market Information system - Infrastructure for direct sales program		Drastic change of government policy does not occur