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ORIGINAL ARTICLE

Cultural aspects and potential use of cupuassu in the Itacoatiara county, Amazonas State

Aspectos culturais e potencial de uso do cupuaçu no município de Itacoatiara, Estado do Amazonas

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Comercialização do cupuaçu
Práticas culturais do cupuaçuzeiro

ABSTRACT: Cultivating cupuassu is one of the most outstanding agricultural activities in the Amazon region due to the broad commercialization of its pulp both processed and "*in natura*". Cupuassu plays also a significant role in sustainable agroforestry systems and this enlarges its social and economical importance in the region. However, only the fruit pulp is used for economical purposes; the seed and the peel have found no significant commercial use till today. The objective of this work was to evaluate agronomical aspects of cupuassu plantings in 20 farms of the Itacoatiara municipality, a geopolitical unit of the Amazonas state. At the same time, the farmers knowledge concerning the uses and the economical possibilities of the seed and the peel was also evaluated. These data were garnered by means of a questionnaire the farmers were asked to reply. Fruit productivity of the 2009-2010 crop year in the evaluated farms was verified to be very low, this result being due essentially to the lack of soil fertilization and pests and diseases control practices. Witches broom disease was found in all the 20 farms; cupuassu fruit borer in 65%, and mistletoes in 20% of them. All the farmers sell both the seeds and pulp to cooperatives or intermediators (a negotiator acting as a link between parties) but most of them are not aware that the seed can be used for the production of butter and oil cake as well as where and how these products can be used.

RESUMO: *O cultivo do cupuaçuzeiro é uma das mais significativas atividades agrícolas da Amazônia, pela larga comercialização da polpa in natura ou processada, pelo alcance social e econômico, e pela sua participação em Sistemas Agroflorestais sustentáveis. Contudo, utiliza-se apenas a polpa do fruto, sendo os demais subprodutos, como a semente e a casca, pouco aproveitados. O objetivo deste trabalho foi verificar aspectos agronômicos dos plantios dessa frutífera em 20 Properties rurais de Itacoatiara, Amazonas, e se os produtores conhecem o uso e aproveitam adequadamente os subprodutos na comercialização do cupuaçu. Para tanto, foi aplicado um questionário aos proprietários rurais. As produtividades dos cupuaçuzeiros nas Properties rurais amostradas no município no ano agrícola de 2009-2010 mostraram-se muito baixas, devido à falta de adubação do solo e de controle de pragas e doenças. A vassoura-de-bruxa estava presente nos cultivos de todas as 20 Properties rurais, a broca-do-fruto em 65% e a erva-de-passarinho em 20% das mesmas. Todos os produtores rurais comercializam as sementes juntamente com a polpa, com a cooperativa ou o intermediário, sem, contudo, usufruir da utilização das mesmas para a produção de manteiga ou torta. A maioria dos produtores de cupuaçu desconhece o uso das sementes para a produção de manteiga ou torta e também não sabe em que esses produtos podem ser utilizados.*

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1 Introduction

The development of the Amazon region depends on how its possibilities are administered, rendering accordant ecological equilibrium and sustainable use of natural resources so as to result in substantial gain in life quality of its population, economical growth, technological advancement and its integration to the national and international economy (CAVALCANTI, 1997).

Globalization brought about changes in the social, economical, and political order and stimulated significant advancements in several sectors of Society both at the urban and the rural milieux. Agricultural as well as industrial business were strongly pressed to reach higher levels of competiveness in their productive chains mainly as to factors related with technology and processes management.

The recently implemented changes in the Economy and Society at the global level mainly those related with the environmental issue as part of the endeavor to guarantee the sustainability of the natural resources and the preservation of the Amazon ecosystems, led extractive lumberjacks and the traditional regional agriculture to a loss in competition power, specially in those areas far from large urban centers such as the Manaus Free Trade Zone.

Having this scenario in view, alternatives to counterbalance the negative effects of that dynamics are of necessity. That perspective encompasses the strategy of making use of the resources of the Amazon region biodiversity as an alternative of regional and local development by the strengthening of the productive chain of Amazon species starting at the agribusiness up to the final consumer of industrialized products.

The richness potential and the regional development policies were not enough to stimulate the economical growth of the state of Amazonas by the sustainable use of the existing biodiversity resources in the region since the productivity chain of the regional species commercially exploited is still rather limited with low aggregate value and attaching little benefit to the agents composing their links. This situation is found in Itacoatiara, in Amazonas state inland, one of the most important cupuassu producing counties and where productivity has been decreasing steadily during the last few years.

Cultivating Amazon local fruits is pointed as an important alternative for the economical growth of the region specially those species whose productive chain is more diversified and can offer various links within that chain.

In this contexture, the cultivation of cupuassu, a native fruit of the Amazon region, may be seen as one of the most significant agricultural activities of the region, justified by the broad commercialization of the fruit "in natura" or in an industrialized form (AGUIAR, 1988; SOUZA et al., 2009, 2010). The pulp, the main byproduct of the species commercial scale, is widely accepted by the market and can originate an ample range of industrial products which interest both the national and the international market. Although the pulp is used for the production of a rather high number of products (juice, popsicle, bonbon, candy, compote, crackers, cake, pudding, pies, jelly, etc.) the seeds and the peel are little commercially exploited. This posture weakens the production chain due to the wasting of the fruit byproducts – they are thrown away at the property by the farmers (AGUIAR, 1988; CARVALHO et al., 2000; SOUZA et al., 2009, 2010).

The objective of this work was to verify agronomical aspects of cupuassu cultivation in 20 rural properties in Itacoatiara, state of Amazonas, and if the farmers owing those properties were aware of the possibilities of economically exploiting the fruit byproducts other than the pulp.

2 Materials and Methods

The municipality of Itacoatiara is part of the state of Amazonas, its geographic coordinates being of 03° 08' 34'' of South latitude and 58° 26' 38'' of West longitude. Its area totals 8,910 km^2 and it is situated in the 8th Sub-Region of the state at the Mid-Amazon Region, bordering the municipalities of Itapiranga, Silves, Urucurituba, Boa Vista do Ramos, Maués, Nova Olinda do Norte, Autazes, Careiro, Manaus, and Rio Preto da Eva. Itacoatiara is accessible by land roads and by rivers. It is linked to Manaus (capital city of the state) by a stretch of 175 km of the AM 010 highway and of 201 km by fluvial transportation. The climate is tropical, rainy, with high relative humidity and a mean temperature of 27 °C (IDAM, 2010). The population is of 86,840 inhabitants of which 58,175 live in the urban area and 28,665 in the rural area (IBGE, 2010).

The explanatory study method was used to indentify the potential use of cupuassu at the industrial scale. Having that in mind, the aspects interfering in the process of making use of cupuassu by the cosmetic industry in Manaus were investigated.

Three segments of the cupuassu transformation chain in the cosmetic industry were analyzed: the rural properties producing cupuassu, the industries which process the cupuassu byproducts, and the companies which work with the final cosmetics companies which use cupuassu as raw material in their industrial processes.

At the rural level, a survey was carried out in 20 farms in which cupuassu was being cultivated in the 2009-2010 crop year viewing to ascertain the property organization level and its producing potential so as to find out how the cupuassu farmers understand the market potential for cupuassu seeds. In all the 20 analyzed farms, when this study was undertaken, the cupuassu plants had already reached the adult phase, were above three years old, and were producing fruits.

The study also considered the possibility of the plants being under attack of pests and/or diseases as well if the farmers were awaref the occurrence of these problems and if they were trying and had the technical competence to treat the plants to control those problems.

The forms of cupuassu commercialization were also observed so as to identify the buyers categories, that is, if they were cooperatives, commercial companies, or commission agents, the commercialization form, that is, as a wholesale business or as a retail procedure. The place where cupuassu is delivered to the buyer, that is, in the rural property or in a commercial enterprise was also investigated as well as the mean prices reached by the commercialized products. At that point, the favorable and unfavorable factors interfering in the commercialization process as well as the commercialized byproducts were also determined.

Fruit processing was also investigated, whether the farmers were carrying out or not and, in case they were, which kind of processing was in use, that is, peel and pulp removal, seed and placenta removal. If the fruit processing was artisanal or mechanized and if and how the product was stored, that is, in frigorific chambers or under uncontrolled environmental conditions, were also objectives of this study.

Another aspect under consideration was the way cupuassu is commercialized, that is, either the whole fruit "in natura" or just its pulp so as to understand which are the commercialized parts and which destiny is given to the seed which is the basic input for butter production. At this phase, the way by which the pulp is removed, that is, if manually or mechanically was also determined. The observation of that process permitted to evaluate the quality with which the seeds are obtained which are later submitted to a fermentation and drying process which precedes butter removal.

The details of the commercialization process were also examined so as to permit a better understanding of the way by which the seeds come to the processing industry.

Viewing the attainment of data concerning the mean percentages with which fruit and byproducts occur, a questionnaire was prepared asking the amount of commercialized pulp each harvest. This questionnaire permitted to verify that pulp was commercialized following two procedures : 1. some of the farmers made an artisanal removal of the pulp and sold just it; 2. the other farmers removed only the fruit coat thus selling together both the pulp and the seed. In this case, the buyers were intermediators, which, usually, were pulp removing companies. In the first case, the pulp weight was the real one, in kilograms. The seed, peel, and placenta weights were calculated with the help of the following formulae, taking in consideration the percentages indicated by Souza et al. (2009, 2010). With basis on the mean values presented by those authors, the following values were considered: SF (seed percentage in the fruit) = 15; PF (pulp percentage in the fruit) = 37.3; PIF (placenta percentage in the fruit) = 2.5; PeF (peel percentage in the fruit) : 45.2.

The following calculation procedures are valid when only the pulp is sold

1. a)Calculating seed weight (PS) :

$$SW = PW \times SF/(PF + SF) = PW \times 15/37.3 = PW \times 0.402$$

where: PW is the pulp weight.

1. b)Calculating peel weight (PeW)

$$PeW = PW \times PeF/(PF + PeF) = PW \times 45.2/37.3 = PW \times 1.212$$

1. c)Calculating placenta weight (PlW)

$$PlW = PW \times PIF/(PF + PIF) = PW \times 2.5/37.3 = PW \times 0.067$$

2. Representative calculations for the cases in which the pulp, the seed, and the placenta are sold together :

2. a)Calculating pulp weight (PW)

$$PW = (P + S + Pl) \times PF/(PF + SF + PIF) = (P + S + Pl) \times 37.3/54.8 = (P + S + Pl) \times 0.681$$

2. b)Calculating the placenta weight (PlW)

$$PlW = (P + S + Pl) \times PlF/(PF + SF + PIF) = PlW = (P + S + PI) \times 0.456$$

2. c)Calculating seed weight (PS)

$$PS = (P + S + Pl) \times SF/(PF + SF + PIF) = (P + S + Pl) \times 15.0/54.8 = (P + S + Pl) \times 0.274$$

2. d)Calculating peel weight (PeW)

$$PeW = (P + S + Pl) \times CF/(PF + SF + PIF) = (P + S + Pl) \times 45.2/54.8 = (P + S + Pl) \times 0.825$$

These formulae permitted to obtain the values found in Table 1 which refer to the production of cupuassu pulp, seed, and peel in the crop year of 2009-2010. Since the number of cupuassu trees producing fruits was known these calculations were also made per plant.

In the processing industry there was a demand for seeds and butter. It was verified a relation between the amount of seed demanded by the processing industry and that offered by the farmers. The quality of the seed entering the processing industry was also evaluated before it was used as raw material. Another evaluated aspect was that related to the assistantship the processing industry provided the farmers with viewing to qualify them for seed preparation, mainly as to the fermentation and drying processes which can be carried out in the property.

The commercialization levels were mensurated so as to evaluate the potential consumption of cupuassu butter and oil.

3 Results and Discussion

A great variation between farms was observed (Table 1). The size of the properties varied between 4 and 160 ha. The area cultivated with cupuassu varied between 1 and 25 ha; in terms of percentage of the property dedicated to cultivating cupuassu, the variation was between 1 (property 5) and 100% (properties 13 and 18).

The 20 properties had a total area of 904 ha of which 156 were cultivated with cupuassu this meaning a total of 74,980 fruit producing trees. The mean size of the properties, the area planted with cupuassu, the number of trees per hectare, and the number of trees producing fruits were, respectively, of 45.2 ha, 7.8 ha, 540 plants, and 3,749 trees per property.

The total production of all the 20 properties was of 72,740 kg of pulp (a mean of 3,637 kg/property), 29,260 kg of seeds (a mean of 1,463 kg/property), 86,800 kg of peel (a mean of 4,340 kg/property) and the following mean values of pulp, seed, and peel production per tree : 1.2 kg, 0.50 kg, and 1.38 kg.

When the cupuassu fields were planted, the farmers did not observe the technical recommendations for plant spacing and distribution – in all the studied properties, plant distribution had a quadrangular arrangement and spacing between 4 × 4 m to 5 × 5 m with densities between 625 and 400 plants per hectare, respectively. Property number 20 was the only one with a density of 500 plants per hectare. With basis on the plant spacing and the cultivated areas it was observed that the total number of cupuassu plants varied between a minimum of 625 in properties 5, 11 and 14 up to a maximum of 15,625 plants in property 1 (Table 1).

Spacing the cupuassu plants of 7 × 7 m and distributing them in accordance with an equilateral triangle in a density of 235 plants per hectare is thought to be the best one (SOUZA et al., 2009, 2010). The non-observance of those recommendations resulted in overcrowded plantings, which favor pests and diseases proliferation - these problems were detected in the

majority of the properties such as will be shown in this paper and rendered difficult the application of cultural practices viewing to keep the fields in proper conditions.

Pulp, seed, and peel productions were highly variable between properties mainly due to the differences in cultivated areas and number of plants.

According to studies by Souza et al. (2009, 2010), the mean percent values of pulp, seed, and peel and considering the placenta weight, are slightly different from those herein reported. The properties considered in this study produced a total of 72,226 kg of pulp, 29,045 kg of seed, 87,523 kg of peel, and 4,841 kg of placenta during the crop year of 2009-2010. Each property produced a mean of 9,682 fruits, 3,611 kg of pulp, 1,452 kg of seed, 4,376 kg of peel, and 242 kg of placenta, as shown in Table 1.

When analyzed, the data show that the amounts of pulp, seed, and peel produced per plant were the following:

Each tree produced a mean of 1.2 kg of pulp, 0.50 kg of seed, and 1.38 kg of peel, which are extremely low values. These values refer only to the commercialized fruits; those which were not commercialized are not included.

When the production per property is analyzed, it is verified that property number 8 was the one producing less pulp, seed, and peel. It had only 6 ha cultivated with cupuassu. It was followed by properties 5, which had only 1 ha, property 10 with 19 ha, and property 11, with 1 ha. The ones with the highest production of pulp, seed, and peel were properties 6 and 1, each one with a cupuassu area of 25 ha.

These data are showing that production is not related only to cultivated area; the factor productivity is also important to determine the total amount of fruit produced. This aspect is demonstrated by the productivity per plant which was highly variable as shown by the last three columns of Table 1.

Pulp weight varied between 0.05 kg/plant, in property 10, and 3.27 kg/plant, in property 14. Those of seed varied between 0.02 kg/plant, in property 10, and 1.32 kg/plant, in property 14, and those of peel varied between 0.06 kg/plant, in property 10, and 3.96 kg/plant, in property 14. These data are so showing that property 10 was the less productive and that of number 14 the most productive, probably as a result of differences in genetics, age of the plants, soil fertility, and the presence of pests and diseases, factors which have a great influence on plant productivity (SOUZA et al., 2009, 2010).

This supposition is based on research work data, such as those presented by Souza et al. (2009), who, when analyzing cupuassu production during six consecutive crop years, verified the mean productivity to be between 26 and 37 fruits per plant. Pulp productivity was between 10.3 and 15.6 kg/plant and that of fresh almonds between 3.7 and 7.0 kg/plant. These are productivity values considerably higher than those of the present study (Table 1), this being an indication that the studied properties analyzed in this work did not apply the cultural practices that guarantee higher yields.

The interviews with the farmers showed that they had never fertilized the soil where the cupuassu plants grew and never treated the plants against the pests fruit borer (*Conotrachelus* sp) (Coleoptera: Curculionidae) and mistletoe (*Struthantus flexicualis*) and the disease Witches broom (*Moniliophthora perniciosa* (Stahel) Aime & Phillips-Mora), the worst disease of cupuassu crops (CARVALHO et al., 2000).

All of the 20 cupuassu fields presented the disease Witches broom. In addition to that, properties 02, 10, 12, 13, 14, 15, 16, and 18 also presented plants attacked by fruit borer. Properties 01, 03, 06, 17, and 19 were also infested by mistletoe. The occurrence of all these problems together with the fact that the farmers had never fertilized the soil explain the low productivity levels found in the properties.

Just 35% of the farmers apply or have applied insecticide and fungicide products to control the mentioned pests and disease, although not in the necessary measure to eradicate them (Figure 1) since in the analyzed properties they were still detected (Table 1). The remaining 65% of the farmers do not under any circumstance try to control those problems and this accelerates the contamination process.

The questionnaire showed that only 45% of the farmers said they had the necessary knowledge to control pests and diseases in their cupuassu fields; the remaining 55% said that although they had cultivated cupuassu for a long time they had not the knowledge necessary to control those pests and diseases (Figure 2).

The interview also showed that 85% of the farmers had formed their cupuassu orchards by directly sowing the seeds in the field whereas 15% had had a previous phase in which seedlings or plantlets were grown in a nursery, these plantlets being opportunely transplanted to the field (Figure 3). The seeds used by the farmers were in 90% of the occasions produced by the farmer himself; in 10% of the occasions, the seed had been bought from third parties (Figure 4).

In that universe, 40% of the farmers had no type of quality control of the seeds; 60% of them made a type of control of the seed quality (Figure 5). Among the farmers, 65% of them stated to have knowledge about the procedures necessary for

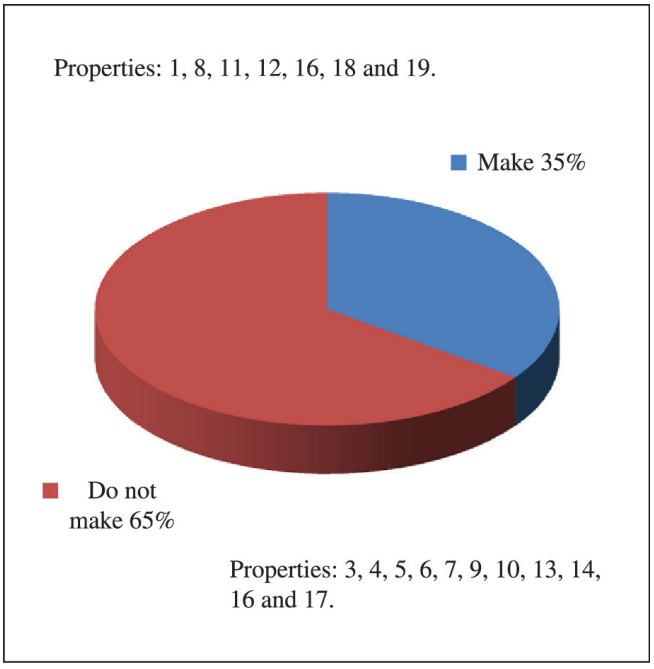

Figure 1. Control of pests and diseases in the cupuaçu fields.

Table 1. Characteristics of 20 farms located in Itacoatiara, state of Amazonas, producing cupuassu fruits during the crop year of 2009-2010.

F	FS (ha)	AWC (ha)	NCH (ha)	PTP/prop.	PP (kg)	SP (kg)	PeP (kg)	PPT (kg)	SPT (kg)	PePT (kg)	PD[(1)]
1	160	25	625	15,625	6,810	2,740	8,250	0.44	0.18	0.53	B,M,W
2	32	4	625	2,500	3,405	1,370	2,809	1.36	0.54	1.12	B,W
3	80	14	625	6,250	6,810	2,740	8,250	1.09	0.44	1.32	B,M,W
4	50	10	400	4,000	10,215	4.111	12,375	3.20	1.03	3.09	W
5	100	1	625	625	477	192	578	0.76	0.31	0.92	W
6	100	25	400	10,000	13,620	5,480	16,500	1.36	0.55	1.65	B,M,W
7	80	13	400	5,200	5,448	2,192	6,600	1.05	0.42	1.27	W
8	50	6	400	2,400	341	137	413	0.14	0.06	0.17	W
9	56	3	400	1,200	681	274	825	0.57	0.23	0.69	W
10	35	19	625	11,875	545	219	660	0.05	0.02	0.06	B,W
11	15	1	625	625	681	274	825	1.09	0.44	1.33	W
12	13	5	500	2,500	1,225	493	1,485	0.49	0.20	0.59	B,W
13	4	4	625	2,187	1,022	411	1,238	0.47	0.19	0.57	B,W
14	20	1	625	625	2,043	822	2,475	3.27	1.32	3.96	B,W
15	28	2	625	937	1,226	493	1,485	1.31	0.53	1.58	B,W
16	11	2	625	1,250	1,703	685	2,063	1.36	0.55	1.65	B,W
17	17	2	400	800	1,022	411	1,238	1.28	0.51	1.55	B,M,W
18	11	11	625	3,125	7,491	3,014	9,075	2.40	0.96	2.90	B,W
19	32	5	400	2,000	5,108	2,055	6,188	2.55	1.03	3.09	B,M,W
20	10	2	625	1,250	2,860	1,151	3,465	2.29	0.92	2.77	W
Totals	904	156	--	--	72,740	29,260	86,800	--	--	--	
Means	45.2	7.8	540	3,749	3,637	1,463	4,340	1.2	0.50	1.38	

F = farm number; FS = farm total size; AWC = area planted with cupuassu; NCH = number of cupuassu trees per hectare; PTP = number of producing trees per property; PP = pulp production; SP = seed production; PeP = peel production; PPT = pulp production per tree; SPT = seed production per tree; PePT = peel production per tree. (1) Presence of pests (B = fruit borer; M = mistletoe) and disease (W = Witches broom).

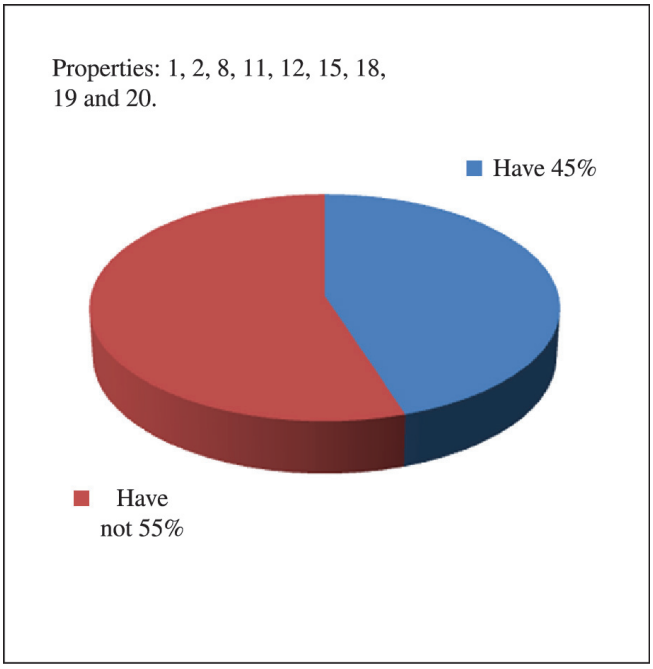

Figure 2. Know how to control pests and diseases.

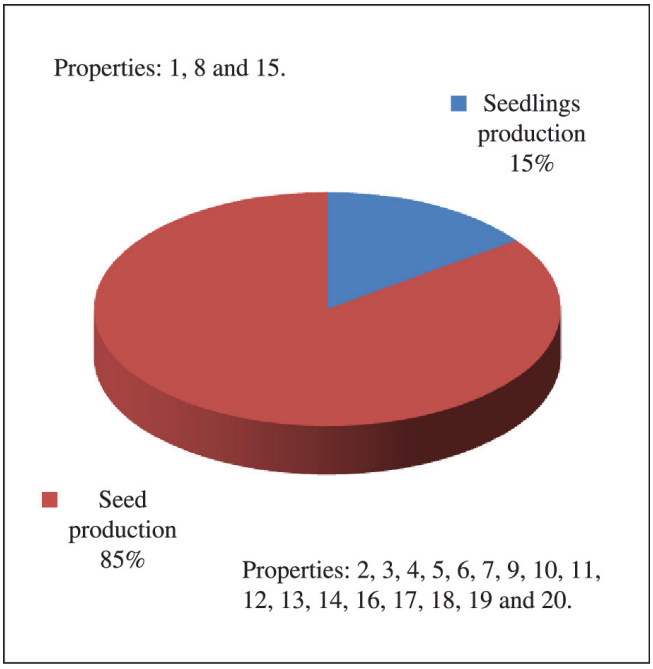

Figure 3. Process by which the fields were planted.

the formation of good quality fields; 35% of them declared to lack the knowledge necessary to have a field of good quality (Figure 6). The technique used by the farmers (60% of them) to get seeds of good quality consisted in the choosing of the best fruits from the healthiest trees. According to Carvalho et al. (2000) and Souza et al. (2010) this technique is usually enough to ensure seeds of good quality.

All the interviewed farmers sold their cupuassu yield of the crop year of 2009/2010 as pulp + seed + peel (Table 2). They handed the whole fruits to a cooperative (ASCOPE, located

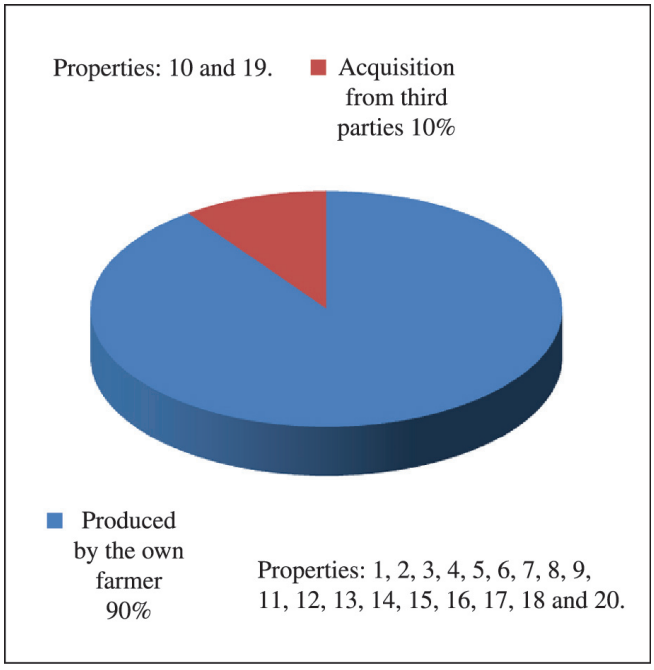

Figure 4. Seed origin.

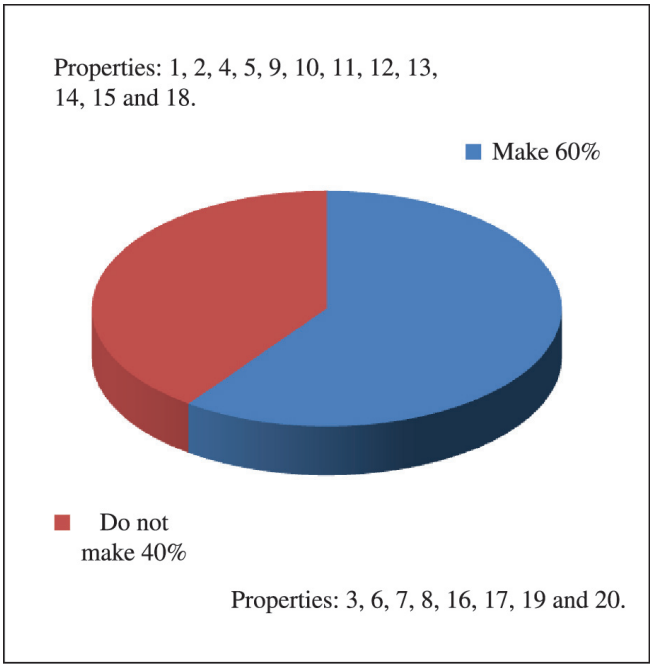

Figure 5. Seed quality control.

Table 2. Commercialization, processing, and storing of cupuassu fruits in Itacoatiara, state of Amazonas, in the crop year of 2009/2010.

Analyzed characteristics			N. of rural properties(1)
Cupuassu comercialization	Buyer Category	Cooperative (2)	10
		Companies (3)	2
		Intermediators (4)	8
	Commercialization types	Whole sale business	20
		Retail	0
	Product delivery address	Rural Property	20
		Buyer's property	0
Cupuassu processing types		Peel removal	10
		Pulp removal	0
		seed removal	0
Pulp removing process	Artisanal		10
	Mechanical (at the cooperative)		10
Fruit storage	Fruits *in natura*	Bags	10
	Pulp and seeds	Cooperative	Freezer chamber
		Rural proprietors	Freezers
Seed drying technique		Knows	3
		Does not know	17
Is aware of cupuassu seed byproducts		Butter/oil	4
		Cupuassu chocolate	8
		Oil cake	2
Byproducts consumers		Knows	1
		Does not know	19

(1) Total number of analyzed properties: 20; (2) Pay between R$1.20 and R$1.50 kg^{-1}; (3) Pay a mean of R$1.20 kg^{-1}; (4) Paybetween R$1.00 and R$2.00 kg^{-1}.

at Vila do Engenho, state of Amazonas) or, when the buyer was an intermediator, removing the peel while the cupuassu was still in the property and handing the pulp and the seeds to the buyer.

Only 40% of the farmers sold their production directly to intermediators at a mean price varying between R$1.00 and R$ 2.00 kg^{-1} (Table 2). Other 10% of them sold their cupuassu to commercial companies, usually in the food trade, at a mean price of R$ 1.20 kg^{-1}.

Half of the farmers sold their fruits *in natura* to the local cooperative. The cooperative made the separation between pulp, peel, seed, and placenta and paid the farmers all those byproducts a mean price between R$1.20 and R$1.50 kg^{-1}. This variation in the price paid by the cooperative is related to the beginning, middle, and end of the harvest period. At the beginning of the harvest the prices attained by the farmers are usually the highest of the period.

In all the sale negotiations made in Itacoatiara, the buyers were always interested only in the pulp but since the farmer did

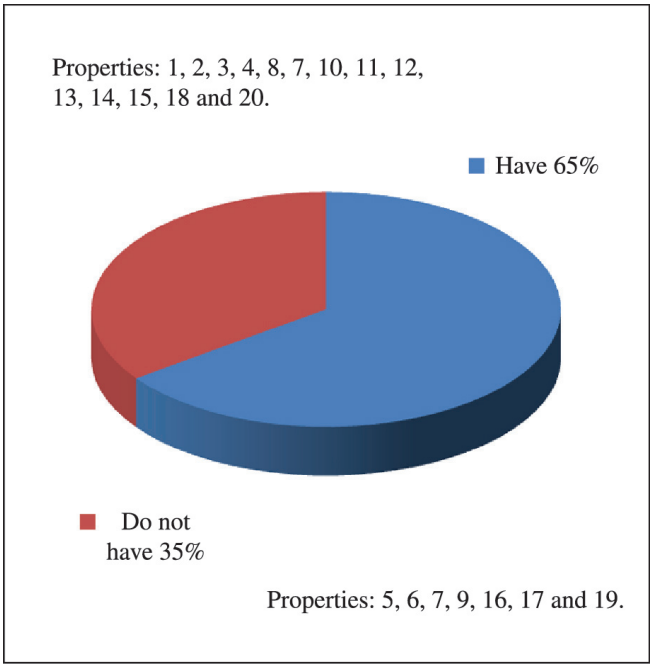

Figure 6. Know how to form good quality cupuaçu fields.

not remove the pulp, just the peel, the buyer always received pulp, seed, and placenta.

The commercialization form adopted by the farmers was always of the wholesale type – 100% of the bought cupuassu fruits were removed from the farms by the buyers. The buyer was thus totally responsible for the transportation of the fruits from the farm to his property (Table 2).

Half of the farmers usually wash the fruits and remove their peel before selling them. In those cases, pulp, seed, and placenta are placed inside 10 kilogram plastic bags which are put in freezers up to the moment an interested buyer shows up. This procedure may be hazardous to the conservation of the fruit quality, mainly the pulp loosing its organoleptic properties – the frozen pulp, when thawed, may extrude large amounts of juice due to the rupturing of the cells by the ice crystals formed during the pulp freezing. The other 50% make no fruit processing - all the needed processing is accomplished by the cooperative to which the fruits were sold. In Itacoatiara, no one of the interviewed farmers had any pulping equipment; when making the pulping of the fruits this was entirely accomplished by an artisanal process, that is, by cutting the fruits with a scissor.

When the entire fruits were delivered to the cooperative, their pulping was mechanically accomplished. When the product was sold to the cooperative, the entire fruits were packed in bags containing 15 to 20 fruits with a weight between 35 and 40 kg each bag which were stored in the harvest place with the cooperative having the incumbency of collecting and transporting them to their final destination.

Among the interviewed farmers, only 15% were acquainted with the processes of fermentation and drying of the seeds (Table 2). Among the 20 farmers, only 14 knew the byproducts of seed processing. Four of them knew that butter could be extracted from the cupuassu seed, eight knew what cupulate was and two had knowledge about oil cake. Only one knew who the final consumers of the those byproducts were and 19 of them had no idea of the final destination of butter and oil cake. This lack of more specific knowledge about cupuassu byproducts make the farmers totally dependent on the pulp commercialization and this leads to a reduction of possible profits. In addition to that, the difficulty in separating the seed from the pulp when it is manually performed, cause the seeds to become just a low value surcharge when the farmers are selling their production. The low prices attained by the pulp discourage the farmers to invest in soil management and in pests and diseases control thus giving origin to a vicious circle of gradual yield reductions up to the point when the farmers give up cultivating cupuassu.

4 Conclusions

Cupuassu productivity in the Itacoatiara county, a unit of the state of Amazonas, is very low due to lack of soil fertilization and the phytosanitary control of pests and diseases.

Witches broom was found in 100% of the visited rural properties. Fruit borer in 65% and mistletoe in 20% of them.

The majority of the farmers do not know the economical use of the cupuassu seeds.

None of the farmers commercialized the seed as a profit generator component.

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References

AGUIAR, J. P. L. Composição do chocolate de amêndoas de cupuaçu [*Theobroma grandiflorum* (Willd. ex. Spreng.) Schum.]. *Acta Amazonica*, v. 18, n. 1-2, p. 3-8, 1988.

CARVALHO, J. E. U.; MULLER, C. H.; BECHIMOL, R. L.; KATO, A. K.; ALVES, R. M. *O cultivo do cupuaçuzeiro (Theobroma grandiflorum (Willd ex Spreng Schum.) na Amazônia Brasileira*. Embrapa-CPATU: Belém, 2000. 147 p.

CAVALCANTI, C. *Meio Ambiente, Desenvolvimento Sustentável e Políticas Públicas*. São Paulo: Editora Cortez, 1997. 436 p.

INSTITUTO BRASILERO DE GEOGRAFIA E ESTATÍSTICA – IBGE. *Censo Demográfico 2010*. Disponível em: <http://www.ibge.gov.br/home/estatistica/populacao/censo2010/populacao_por_municipio.shtm>. Acesso em: ago. 2013.

INSTITUTO DE DESENVOLVIMENTO AGROPECUÁRIO DO ESTADO DO AMAZONAS – IDAM. 2010. Disponível em: <http://200.242.43.143/portal/sepror/programas_02.php?cod=125>. Acesso em: ago. 2013.

SOUZA, A. G. C.; ALVES, R. M.; SOUSA, N. R.; SOUZA, M. G. Domesticação e Melhoramento de cupuaçuzeiro. In: BOREM, A.; LOPES, M. T. G.; CLEMENT, C. R. (Org.). *Domesticação e Melhoramento - Espécies Amazônicas*. Viçosa: Editora UFV, 2009. p. 319-331.

SOUZA, A. G. C.; PAMPLONA, A. M. S. R.; SOUZA, M. G.; ALMEIDA, O. C. *Cupuaçu.* 1. Jaboticabal: Funep, 2010. v. 1, 32 p.