EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA - EMBRAPA
CENTRO DE PESQUISA AGROFLORESTAL DA AMAZONIA OCIDENTAL-CPAA

1996 ANNUAL REPORT

PRESIDENT FIGUEIREDO PROJECT

EMBRAPA/UFAM/INPA JOINT PROJECT

FINANCED BY THE ROCKEFELLER FOUNDATION

UFAM - UNIVERSIDADE DO AMAZONAS
INPA - INSTITUTO DE PESQUISAS DA AMAZONIA

MANAUS - AMAZONAS - BRAZIL

PRESIDENTE FIGUEIREDO PROJECT

1996 ANNUAL REPORT

Title: On-farm testing of Agroforestry Alternatives to Slash and Burn Cultivation by Migrant Small Farmers at Presidente Figueiredo -Amazonas.

1. Introduction

The on-farm Agroforestry alternatives research project was initiated in 1992 with the survey of information regarding the small farmers production unites in five municipalities of the Amazonas state and it is being developed at Presidente Figueiredo municipality. The project uses a participatory approach and its major objective is to define a methodology that facilitate research development and adoption of technologies by small scale farmers of slash and burn agriculture.

This is a joint project with the University of the Amazonas, INPA and the State Extension Services with the farmers of the communities as the major actors in the process.

The characteristics of the farming systems in the areas are closely related with the existence of many powerful limiting factors of diverse nature: agro-ecological, socio-economical and so forth such as low soil fertility level, low prices of the traditional farming products, lack of a credit police suitable for the small scale farmers and lack of adequate infrastructure of transport and commercialization for their products as well as adequate information at their disposal.

Therefore the technical proposal was based in the diagnostic survey previously conducted in the areas and considering the strategies used by farmers to adapt its practices to those limiting factors. The project then used a participatory approach to create conditions over which farmers could incorporate the technical results into their production systems.

2. The concepts used

The proposals were structured considering the concept of the research and development and using a farming systems approach. In this regard some research results were organized in an agroforestry system proposal which was discussed with farmers and implemented in their farm lands.

The concept of farming systems involves evaluation of technologies recommended by research, analyses of the intervention within the farmers production systems and formulation of new proposals for the farmers involved and also their neighbors.

In this context the project aimed, besides technologies testing, to implement a training program that would capacitate farmers to improve their working conditions in addition to improve their production systems, so a more efficient land use system would be the farmers purpose.

By using the participatory approach it was necessary to take into consideration the farmers characteristics and their goals to formulate new proposals. In this context all new decisions of what to plant were discussed first with farmers to then be implemented. But farmers do decide what should be done and the research team through the observation and based on the reality facing the farmers organize their ideas and then suggest a better technical adaptation to each farmers conditions.

Initially, based on the diagnostic survey, the project proposals was to install at farmers land two agroforestry systems, that had been discussed in meetings with the communities. The systems consisted of crops arrangements in which annuals, that is, cassava (*Manihot esculenta),* cowpea beans (*Vigna unguiculata)*, and rice *(Oriza sativa*) varieties, perennials as cupuaçu (*Theobroma grandiflorum*), pupunha (*Bactris gasipaes*), ingá (*Inga edulis);*and semi-perennials crops such as banana (*Musa spp*) were growing in the same piece of land. Based also in the problems detected in the diagnostic phase some testes considering soil management were implemented.

Despite the trend for a more intensified agriculture and the majority of the farmers were small scale producers and besides the Amazonian environment the research team in the project recognized that some traditional practices should be kept in the systems since some are adapted to the local conditions and have helped them to sustainably manage their plots and meet their subsistence needs, without depending on the external environment such as mechanization, chemical fertilizers and so on.

As the project is also a methodology research process some research results needed to be obtained. So, six cassava (*Manihot esculenta)* and three rice *(Oriza sativa*) varieties were tested in the space between the trees species in the first year. On the second year evaluation the number of cassava varieties were reduced to four. Rice was subsequently substituted by cow-pea.

The systems were tested on the first year with three treatments: with NPK + organic matter; without NPK and with leguminous cover crop. On the second year the treatments were: NPK + organic matter; with P and with P + leguminous cover crop. The fertilizer consisted of 22.5 kg/ha of N, 17.68 kg/ha of P and 33.37 kg/ha of K and 5 liters of chicken manure per plant.

3. The follow out process

To understand the global aspects of the systems implemented in the farmers land a process of following up was set up which consisted of observation of plants arrangements,

data collecting on growth, production and acceptance of the systems by farmers. The data on plants production were taken in a parcel that was selected as the sample for each treatment in observation

The data were collected mainly on technical and socio-economical levels and the variables refers primarily to crops production (rice and beans grain yield, cassava flower and bananas yield), soil fertility improvement, nature of the cultural practices, labor and inputs spent. Other variables that may include farmers satisfaction are measured only by observation of farmers intentions.

3.1. Information return to farmers

Farmers and researchers are responsible for the data collecting and after the information is processed by the researchers team, the results are presented individually to the farmer or collectively discussed with farmers in the communities. A visit to the agroforestry systems areas of other farmers from the communities involved and other communities in the municipality were and are then organized. As part of the Research and Development process and the establishment of a real partnership among researches and farmers, the needs for ways to improve the communities capability are then discussed and courses are organized.

Meetings have been organized by the own communities in the association level and the results obtained in the on-farm research project are discussed. The objective is to bring information and to move the others farmers into the process of improving their production systems as well as to bring them into a more effective community organization. In this regard farmers are already talking and using similar crops arrangements in new plots to be developed. They are also showing the interest of neighbors farmers in using the process.

The researchers are unable up to now to identify or quantify the impact of this project in improving the agriculture systems at Presidente Figueiredo municipality communities, since there is not yet a good way of measuring these effects. However it is visible what is occurring in the area over the years this program is in development.

4. Technical and economical results

The land use system of farmers in the upland ecosystem and particularly in the settlement areas are quite similar and very few variation may occur. Therefore the initial agroforestry systems tested were equal and had the same species components, except the own crop differentiation incorporated by the farmers own decision.

In the 1995 annual report some of the technical and economical results and social considerations presented deal primarily with the trials evaluation by farmers. These evaluation focus mainly on the opinions, preferences and ideas farmers expressed about the project and yield obtained with the systems in test.

The 1996 annual report emphasizes the researchers evaluation of the project. Some technical results regarding crops production in the systems in areas of three collaborator farmers including total costs (inputs and labor) and income generated in the system are presented in Tables 1, 2 and 3.

As observed on Table 1 the results of cassava tuber production in the trials was very high (range from 13,900 to 24,100 kg/ha with NPK, first crop) considering the average yield in the state of Amazonas that riches just 10,000 to a maximum of 12,000 kg of tuber per hectare. On the other hand the fertilizer application had a positive effect on yield of any of the varieties tested even when just a small dosage of P-phosphorus were applied. However the farmers evaluation of the varieties in test was not what researchers were expecting. The farmers preference and acceptability of new varieties lied not on the same values as researchers. While researchers preference focus on high tuber yields, above ground growth to better fit as a component of an agroforestry system, farmers preference lied on profitability regarding flower production and consumption aspect, such as color of flower produced and much less on tuber yield.

On the second cassava crop the tuber production decreased significantly to approximately a third or even fourth of the first year yield (Table 3). This was due primarily to a decrease in area planted with cassava as the sowing occurs only in the alleys and not in the whole area as in the first year and secondly, the increase in problems with the crop such as reducing the rooting of cassava cuttings due possibly to higher insects incidence.

The cow-pea beans as shown by the results increased considerably with fertilizer treatment even with just a small amount of P-phosphorus application and it shows a strong evidence to be a good crop to grow in the central part of the alleys, as in association or in rotation for food production. There was not reduction of cow-pea yields over the years even after the third crop.

The high response of bananas fruit trees to fertilizer application (4,800 to 5,600 kg/ha with fertilizer) showed not only to researchers but also to farmers the importance of a minimum use of a technology to improve crop productivity and profitability as more marketable product with consumption characteristics was produced. The results showed also that just a judicious amount of P-phosphorus is enough to produce a higher yield of banana fruit (6.273; 3.433 and 2.538 kg/ha with NPK+ MO; P; and P + leguminous, respectively) in the first year crop as is shown on the results of the third area, the farmer P_3 (Table 1).

Production costs (labor and inputs) and income generated with the agroforestry systems in test that are presented in Table 2 for farmers P_1 and P_2 show return over the years when fertilizer was applied (US$ 330.00/costs and US$ 762.00/income). In addition when we analyze the production of the third farmer that had equal plants arrangement in the agroforestry system and where all plants had received a judicious amount of NPK+ MO or P-phosphorus the yields obtained in the system for the first year was relevant when compared with the others farmers. Production was represented by rice, beans, cassava and

bananas fruit. The costs of labor and inputs in this case were not so different from the one spent on the other two farmers.

TABLE 1. - Average yield of crops in the systems up to the second year growth in areas of farmers P_1, P_2 and P_3 (1st year), in three soil management.

CROPS*	SOIL MANAGEMENT								
	NPK			P			P + Leguminous		
	P_1	P_2	P_3[2]	P_1	P_2	P_3	P_1	P_2	P_3
	kg/ha								
RICE[1]									
Ita 257	-	-	1.308	-	-	2.175	-	-	1.296
Xingu	-	-	706	-	-	2.975	-	-	2.362
Guarani	-	-	2.631	-	-	2.225	-	-	2.750
Araguaia	-	-	1.400	-	-	2.637	-	-	1.987
COW-PEA	686	724	840	105	155	672	89	72	671
CASSAVA									
IM 065	18.525	14.154	20.720	5.314	9.530	12.947	9.310	8.348	19.883
IM 180	18.314	14.659	22.840	5.133	4.875	6.989	12.815	22.267	19.258
Milagrosa[3]	-	-	7.742	-	-	12.109	-	-	13.281
Mãe Joana	14.725	13.948	5.400	4.313	6.590	8.083	6.440	10.090	9.883
Embrapa 8	24.121	22.594	8.500	10.564	12.083	12.853	8.840	13.551	7.611
BANANA	4.853	5.694	6.273	325	509	3.433	158	570	2.538

* Values of cassava and cow-pea yield for the first year crop.
1. No rice production on the first year, in areas of farmers P_1 and P_2.
2. Yield in the first year of planting, including bananas.
3. Farmers variety. They did not plant as planned.

TABLE 2. Costs (labor and inputs) and income generated in the systems, areas of farmers P_1 and P_2 in three soil management, three years after planting.[1]

DISCRIMINATION	SOIL MANAGEMENT						TOTAL	
	NPK		P		P+Leguminous			
	P_1	P_2	P_1	P_2	P_1	P_2	P_1	P_2
COSTS (labor and inputs)	330,5	330,5	244,5	244,5	256,9	256,9	831,9	831,9
INCOME[2]	761,5	755,4	148,3	196,5	116,4	241,3	1.026,2	1.193,2

1. Area size : 72m x 72m; values in US$.
2. Income from 2nd cassava crop and cow-pea on year 3 not included.

TABLE 3. - Average yield of cassava and cow-pea on the second and third year crop in areas of farmers P_1, P_2 and P_3, in three soil management.

CROPS	SOIL MANAGEMENT								
	NPK			P			P + Leguminous		
	P_1	P_2	P_3^+	P_1	P_2	P_3	P_1	P_2	P_3
	kg/ha								
COW-PEA									
year-2	564	732	635	361	370	1.040	487	387	440
year-3	807	822	*	850	602	*	515	945	*
CASSAVA			*			*			*
Mãe Joana	6.810	6.441	*	7.584	9.005	*	2.568	4.221	*
Embrapa 8	4.312	6.774	*	11.023	5.221	*	7.044	5.867	*

+ Year - 2, only.

Farmers innovation are also some of the important results to mention. They have selected already new alternatives as components for the systems. Vegetable production on the rows of the perennial plants grown on the time the staple food crop are not suitable to grow is one of them. Knowing the effect of the organic matter applied on crops particularly on bananas they started a compost production which they are planning in applying next year on crop fertilization.

With regard to this fact researchers are motivating the other farmers to prepare compost for their fields and they have been teaching them the process of preparing it, although farmers are already innovating. Instead of preparing a large pile of compost they are preferring to make small piles but spreading them on different places in the field close to where it is going to be used .

It is also researchers observation the crops arrangements farmers in the municipality are incorporating into their new plots that are been planted. The word-of-mouth communication that is occurring in the area which has generally been promoted by farmers are the major source of dissemination of the results of this project.

Therefore analysis and the identification of the progress on farmers technological improvements should be of great importance to incorporate new priorities into the arrangements of their systems. Also the evidences increasingly indicates that these systems are productive, ecologically sound, can be sustainable and tuned to the social and economical aspects.

5. Plan of action at community level

The improvement of a research and development process requires the involvement of farmers from the communities in the process of participatory technology development. With

regard to further action in the community level emphasis was given to return of field results and other common information to the various families of farmers in these and other communities through periodically meetings to discuss matters of common interest some of which can be new possibilities and opportunities.

After the first day visit of farmers from most communities of Presidente Figueiredo municipality to the project areas a few activities have been taken place. Four courses in agricultural practices have been given to the farmers last year with the support and the organization of SENAR (National Rural Education Service). The courses were: 1.Topical fruit production; 2. Grain and Oil production; 3. Agricultural pesticides and 4. Fertilizer application. After the strong participation of farmers, men and women in the courses activities, the farmers demanded other courses of interest which will be given later on this year. Two field day's visit had taken place in the areas at the end of last year and also two new meetings were organized by the two other communities.

A new area was implemented by the initiative of one farmer and he did involve already the other members of his community in the process of technology development. The plants components in his agroforestry system implemented was a little different from the other ones already been conducted. Besides cassava and cupuaçu which are the major species components he planted also acai (*Euterpe oleracea*) in the system. He is introducing pineapple in the alleys of the new area he is planting and he wants to introduce passion fruit in the alleys of the systems in test.

This farmer organized one meeting with the members of his community where he was able to discuss the knowledge his is accumulating with the project and he is going to try out new ideas in a new plot he is going to plant with a government loan. He is also encouraging and motivating the other members of the community to try those ideas and to participate in the process of a participatory technology development.

6. Conclusion

The on-farm test of agroforestry systems is one important device to be used in the process of research and development in which researchers, farmers and extension workers can, according to reality, observe, analyze and identify practices that are more suitable to farmers requirements and that permit a better performance of their farming system. This process on the other hand implies in a good information transfer among different production units and communities as well as the farmers acceptance of new technologies or ideas. In this context the responsibility farmers have in the management of his trials and setting their own innovation in the farming system make this a valuable and creative process of capability and opportunities to help farmers to choose their own solutions to their problems.

These preliminary results indicate that the proposed agroforestry systems designed has potential to enhance the diversity of food crops available to the family, increase income through higher productivity and maintain the integrity of natural resource basis, as farmers

are becoming aware that the systems proposed just tried to make some improvement on some traditional practices and plant components farmers already use.

The methodology in Presidente Figueiredo Project is occurring in a progressive manner and we believe that the procedures used are becoming more reliable as we see other farmers trying to incorporate these technologies into their farming systems. However we understand some of the difficult in involving others institutions into the process of participatory technology development and transfer, as the dissemination of results up to now have been relying primarily on word-of-mouth communication and it has generally been promoted by farmers instead the official extension service.

On the other hand, realistically we recognize that in the Amazonian environment the search for a sustainable agriculture models will have to combine traditional adapted local practices with some modern agriculture technology tuned with the ecology.

7. Research actions

The results of this project reveals several gaps in knowledge that requires the development of new research addressed to the farmers.

In this context and besides the suggested research themes such as soil fertility management, crops alternatives and plant components arrangement to permit higher production per unit area, two new research projects have started this year in the farmers areas which will be part of two Ph.D. thesis.

1. Ergonomy and labor requirement analysis for socio-economic assessment of agroforestry systems in Western Amazon. - Hubert Weidner, student of Kassel University at Witzenhausen-Germany.

2. Levels of solar radiation and soil fertility on growth and nutrients absorption of cupuaçu seedlings *(Theobroma grandiflorum* (Willd. ex Spreng.) Schum). - Gladys Ferreira de Sousa, student at INPA, Manaus-Brazil.

8. Publications

SOUSA, G.F. de; SOUSA, N.R.; GUIMARAES, RR; NORMANDO, M.C.; LOURENCO, J.N. de P. & SOUZA, A. das G.C. de. Avaliação de alternativas agroflorestais em pequenas propriedades no Estado do Amazonas. In: Congresso Brasileiro sobre Sistemas Agroflorestais, 1., 1994, Porto Velho, RO. **Anais**. Colombo: EMBRAPA-CNPF, 1994. v.2, p.479.

SOUSA, G.F. de; SOUSA, N.R.; LOURENCO, J.N. de P., NORMANDO, M.C.; SOUZA, A. das G.C. de. Manejo de solo em sistemas de produção para pequenos produtores de terra firme no estado do Amazonas. In: Reunião Brasileira de Manejo do Solo e da Água, 10.,

1994, Florianópolis, SC. **Resumo**. Florianópolis: SBCS/EPAGRI, 1994. p.188-189. resumo, 039.

SOUSA, G.F. de; SOUSA, N.R. & NUNES, J.S. Sistemas integrados de produção de fruteiras para pequenos produtores no Estado do Amazonas. In: **Resumos**. XIII Congresso Brasileiro de Fruticultura, vol. 3. Salvador, 1994.

SOUSA, G.F. de; GUIMARÃES, R. R.; SOUSA, N.R.; NORMANDO, M.C.& NUNES, J.S. Agrossistemas alternativos a agricultura migratória no Estado do Amazonas, Brasil. **Libro Resúmenes**: III Congresso Latinoamericano de Ecologia. Merida, Venezuela. 1995.

9. Institutions & Personnel

EMBRAPA: Gladys Ferreira de Sousa - Agronomy/Soil Fertility-Project Coordinator
Rosangela dos Reis Guimaraes - Farming Systems
Nelcimar Reis Sousa - Plant Breeding
João Carlos Matos - Microbiology
Jose Pereira Junior - Microbiology
Jasiel Sousa Nunes - Animal Production
Edgard Siza Tribuzi - Graduate Student Plant Management

UNIVERSITY Of AMAZONAS: Jose Ferreira - Weed Science

INPA: Luis Antonio de Oliveira - Nitrogen Fixation

EMATER: Aldair Oliveira - Local Extension Agent.

ROCKEFELLER FOUNDATION: Financial support

Annual crops growing on the alleys with banana, cupuaçu, pupunha and inga. The third cow-pea crop and there was no reduction in production.

Cupuaçu, Pupunha, Banana and Inga after cow-pea's third crop. Plants residues are been accumulating to make a compost pile.

Farmers innovation. Vegetable production on the alleys of perennial plants. Vegetable beds are being prepared. Farmers are adapting technologies.

Vegetable production on the alleys of perennial plants. With intercropped vegetables, farmers may improve soil fertility, soil conservation and pest management.

Compost production from crops residues. Collaborating farmer Senhor Miguel and his neighbor preparing a compost that will be applied on the fertilization of the plants in the systems.

Pile of compost in process of decomposition. It is an important nutrient source for crops in the systems of small farmers.

Collaborating farmer Senhora Cosma explaining to visitors about the project and the compost she prepared from crops residues which is an important nutrient source for small farmer crops. It will be applied on the fertilization of the plants in the systems.

Collaborating farmer Senhor Didi processing the cassava flour. Senhor David is giving him a "handy" during a visit to his property to discuss new proposals for the project, together with a researchers team.

Researchers and farmers in a visit to Senhor Didi's property to discuss new proposals and opportunities for the project.

Visitors to the project area. The EMBRAPA's Researcher and the collaborating farmer Sr Didi explaining the project to a group of visitors.

Researchers and farmers of a community in a meeting discussing results, new possibilities and problems to be solved. The research approach is helping to improve the agriculture land use systems of these small farmers.

REVOLVING FUNDS EXPENSES OCTOBER 01, 1995 to SEPTEMBER 30, 1996.

Expenditure Items	**BR R$**	**US$**
Average Exchange Rate: US$ 0,93 BR$		
Field Accommodation		
. Meals	3.619,49	3,891.92
. House Supplies	223,46	240.28
Field Equipment & Supplies		
. Seedlings.Manure.Medication.Feeding	116,00	124.73
. Equipments.Supplies	1.053,65	1,132.96
Project Vehicle		
. Parts & Services	2.552,00	2,744.09
. Fuel	67,60	72.69
Labor		
. Field Labor	5.271,30	5,668.08
. Graduate University Scholar	1.953,00	2,100.00
Miscellaneous		
. Postage.Mail	47,65	51.24
. Slide.Film Processing	360,33	387.45
. Training.Travel expenses	3.752,80	4,035.27
. Training.Supplies	345,86	371.89
. Report.Supplies	196,24	211.01
Total	**19.738,98**	**21,031.59**

	RECEIVED		**PAYMENTS**	
. Amount Received	BR R$	US$	BR R$	US$
. Amount Received	28.725,00	30,000.00	19.738,98	21,031.59
. Balance (Debit)			- 4.047,37	- 4,272.99
. Total payments			**23.786,35**	**25,304.58**
. Balance (Credit)	4.938,65	4,695.42		
Totals	**28.725,00**	**30,000.00**		