Published as:
van LEEUWEN, J.; MOTA, M.S.S.; ALFAIA, S.S.; GOMES, J.B.M.; COSTA, F.C.T.; PEREIRA, M.M.; CATIQUE, F.A.; DRESCH, P.M.; VIANA FILHO, P. 2000. Variability in farmer-managed agroforestry pilot (Manacapuru, AM, Brazil). Resumos expandidos, III Congresso Brasileiro de Sistemas Agroflorestais, novembro de 2000. Manaus, Embrapa: 403-404.

Variability in farmer-managed agroforestry pilot plots (Manacapuru, AM, Brazil).

Johannes VAN LEEUWEN[1], Maria do Socorro Souza da MOTA, Sonia Sena ALFAIA, João Batista Moreira GOMES, Fernanda Carla Tavares da COSTA, Márcio Martins PEREIRA Francisco Aparício CATIQUE, Patrícia Miranda DRESCH e Paulino VIANA FILHO.

Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus-AM

Unsatisfied with the limited practical results of traditional agroforestry research, the Agroforestry Unit of the National Institute for Amazonian Research (INPA) started a research program in which farmers have an active role. The central activity is the participatory design, installation, management and evaluation of on-farm pilot agroforestry plots in the North of Rondônia (upland agricultural settlements) and in the neighborhood of Manaus (upland and flood plain), Amazonas (Anônimo, 1999). Farmer participation from the outset should guarantee the development of agroforestry technology adapted to current farmers' possibilities and needs. This paper presents data from the oldest plots in this program, installed in 1992-1994 on eight peasant farms of an upland agricultural settlement created in 1986 in Manacapuru, a municipality close to Manaus (van Leeuwen *et al.,* 1994). The settlement practices traditional Amazonian agriculture, with a tendency of modernization stimulated by the presence of a large city - Manaus. Cassava (*Manihot esculenta*) is an important crop for all, grown for home consumption and sale. All farms have a home orchard and half have relatively large areas with the fruit crop *cupuaçu* (*Theobroma grandiflorum*). Very few have pasture and cattle. More details on land use are given by Van Leeuwen *et al.* (1994). Together with the farm family concerned, the land use of the farm was analyzed and an agroforestry proposal developed. Final decisions on design and management stay with the farmer, who also furnishes land and labor. The Agroforestry Unit provides technical advice and part of the planting material, and visits the plots to carry out observations and maintain contact with the farmer.

Thirty one species were considered, of which the following 24 were used (table 2): *abiu* (*Pouteria caimito*), *açai* (*Euterpe oleracea*), avocado (*Persea americana), bacabinha* (*Oenocarpus mapora* ssp. *mapora*), *bacuri* (*Platonia insignis*), *bacuri-coroa* (*Rheedia sp*.), *bacuripari-liso* (*Rheedia brasiliensis*), *biribá* (*Rollinia mucosa*), Brazil nut (*Bertholletia excelsa*), breadfruit (*Artocarpus altilis*), *cardeiro* (*Scleronema micranthum*), *cupuaçu* (*Theobroma grandiflorum*), *guaraná* (*Paullinia cupana* var. *sorbilis*), jackfruit (*Artocarpus integrifolia*), locust (*Hymenaea courbaril*), *jenipapo* (*Genipa americana*), mahogany (*Swietenia macrophylla*), mamey apple (*Mammea americana*), sweet orange (*Citrus sinensis), piquiá* (*Caryocar villosum*), *pitomba* (*Talisia esculenta*), pejibaye (*Bactris gasipaes*), *puruí-grande* (Borojoa sorbilis) and *sapotilha* (*Manilkara sapota*). The number of species per plot varied from 3 to 15 (mean 7,3). All farmers asked for fruit species, but only 2 included species which only produce timber. More interest was shown for timber trees which also produce fruit. The overall survival rate of the trees (the commercial perennial crops are not analyzed here) was good (77%). *Pitomba* did not develop well and was substituted. Species mean height after two years varied from 0.32 to 4.46 m. A*biu, açaí, biribá*, breadfruit, *jenipapo,* pejibaye, Brazil nut, *piquiá*, *cardeiro* and mahogany showed good height growth (above 1.70 m). Recent

[1] Eng. Flor., M.Sc., Núcleo Agroflorestal, Instituto Nacional de Pesquisas da Amazônia, INPA-CPCA, CP 478, Manaus-AM, CEP 69.011-970, e-mail: leeuwen@vivax.com.br

observations show that the majority of the species develop reasonably well. After 6-7 years the best growth is shown by Brazil nut, which also developed a straight bole. *Cardeiro* and *piquiá* have grown slower. *Cardeiro* presents high variability in form and *piquiá* started branching early. Good overall development is shown by the three palms: pejibaye, *açaí* and *bacabinha*. The performance of avocado, *abiu*, mahogany and *jenipapo* has been variable, which suggests that these species are more demanding in soil fertility.

Chemical soil analysis showed that all plots have nutrient-poor acid soil. Nevertheless development during the first two years of *açai*, pejibaye, *abiu* and Brazil nut (the four species present in most plots) varied widely between plots (for data see Mitja *et al*., this Congress), but no relation was encountered with soil chemical characteristics (Mota, 1997). Performance in the first two years was better in the plots installed after the elimination of primary forest than after secondary forest (Mota, 1997). The secondary forest occurs in areas with access by water, allowing agriculture before the creation of the settlement in 1986. It is likely that in these places agriculture has been practiced intermittently for a very long time. Two plots (38A and 38B) even border an area with *terra-preta-do-índio*, an anthropogenic soil type formed by Amerindian settlement of long duration. Tree growth was better in pineapple (*Ananas comosus)* fields than in cassava fields, probably due to the larger quantity of light the trees receive in pineapple fields (Mota, 1997).

The high variability in plot management was striking (table 1). If farmers can chose from a diversity of species, they make widely divergent choices. The area they dedicate in a year to agroforestry is not very large, but its size varies a lot (1,950-10,800 m^2, mean 4950 m^2). These areas are smaller and much less uniform than the standard of 1 or 2 hectares often used in agroforestry development projects. Different initial crops may be used. Sometimes a farmer will fail to plant the initial crop (farm 1). The trees may be introduced with the first crop (the best case, as crop presence guarantees maintenance) or much later. Duration of cropping and intensity of weeding varied widely. Farmers install the trees in fields destined to annual or semi-perennial crops. Those crops are not used to fill up the open spaces between the young trees, but the trees are planted in the available crop fields. The principal management decision is about the annual and semi-perennial crops.

The variability within a plot is often high. Variability was caused by differences in relief, border shaded by neighboring forest, patches invaded by *sapé* (*Imperata brasiliensis*) or by fire, and maintenance of useful trees which appear spontaneously [e.g.: *tucumã* (*Astrocaryum vulgare*), cashew (*Anacardium occidentale*), guava (*Psidium guayava*)]. The area of plot 32 was deforested and planted with pineapple in two different years. Often only part of a cassava field is harvested and replanted at once, resulting in a field of uneven cassava age.

Projects promoting agroforestry should consider the observed variability in farmers' preferences, conditions and management, and offer a variety of species and planting options.

BIBLIOGRAFIA CITADA

ANÔNIMO; 1999. **Desenvolvimento e avaliação de sistemas agroflorestais para a Amazônia**. In: Ministério da Ciência e Tecnologia, Secretaria de Desenvolvimento Científico 1999. Resultados (Fase Emergiencial e Fase 1), Programa Piloto para a Proteção das Florestas Tropicais do Brasil, Subprograma de Ciência e Tecnologia. Brasília, DF: MCT, SDC: 249-263.

MOTA, M. da S. S. da; 1997. **Desenvolvimento inicial de espécies arbóreas em sistemas agroflorestais no município de Manacapuru (AM).** Manaus: INPA, tese de mestrado, 91p.

VAN LEEUWEN J.; PEREIRA, M.M.; COSTA, F.C.T. da; CATIQUE F.A. 1994. **Transforming shifting cultivation fields into productive forests**. Anais, I Congresso Brasileiro sobre Sistemas Agroflorestais e I Encontro sobre Sistemas Agroflorestais nos Países do Mercosul, Porto Velho, RO, julho de 1994. Colombo, PR: EMBRAPA, vol.2: 431-438.

Table 1: General aspects of agroforestry pilot plots, Manacapuru, AM.

Plot number	1	6	7B	10	31	32	34	38A	38B
Farm number	1	6	7	10	31	32	34	38	38
Surface (m^2)	8,300	3,000	3,550	4,750	6,000	10,800	5,700	1,600	950
Original vegetation*	F	F	C	C	F	F	F	C	C
Date of installation	Apr-93	Feb-93	Mar-94	May-94	Mar-93	Feb-93	Feb-93	Apr-94	Mar-93
Initial crop**	-	c	c	c	p	p	c	c	c

* F = Primary forest. In most cases cleared within a year before planting the agroforestry plot, sometimes several years before. C = Area covered in recent times by well developed secondary forest (*capoeira)* of at least 20 years old. As these areas have access by water it is likely that they have been used intermittently for agriculture during a very long time.
** c = cassava; p = pineapple.

Table 2: Species composition (in number of trees) and tree development (height after two years, in m[1]) in pilot agroforestry plots, Manacapuru, AM.

Plot number	1	6	7B	10	31	32	34	38A	38B	Total	Height
Perennial crops											
Cupuaçu							324	106	68	**498**	
Guaraná						53				**53**	
Sweet orange (*laranja*)						52				**52**	
Fruit species											
Abiu	4		15	12	5	6	9			**51**	2.60
Açai	23	15	19	8	31	21	12	20	11	**160**	1.72
Avocado *(abacate)*	6	12								**18**	1.35
Bacabinha	10	10								**20**	0.32
Bacuri			7	8						**15**	0.87
Bacuri-coroa	4									**4**	1.45
Bacuripari-liso				6						**6**	0.85
Biribá		18								**18**	2.76
Breadfruit *(fruta-pão)*	13									**13**	1.87
Jackfruit *(jaca)*	4									**4**	1.35
Jenipapo		6			2					**8**	2.35
Mamey apple *(abricó)*	7									**7**	0.67
Pejibaye *(pupunha)*	7	25	34	42	31	28	16	23	11	**217**	1.98
Pitomba	1			6						**7**	[2]
Puruí-grande	5				5	5				**15**	0.73
Sapotilha				8						**8**	0.35
Fruit/timber species											
Brazil nut *(castanheira)*	12	12	6	8	22	57	7			**124**	2.13
Locust tree *(jatobá)*	3				1	6				**10**	1.00
Piquiá					1	3	8			**12**	4.46
Timber species											
Cardeiro	14	6								**20**	2.21
Mahogany *(mogno)*	11	6								**17**	3.22
Total	**124**	**110**	**81**	**98**	**98**	**231**	**376**	**149**	**90**	**1357**	

[1] Height is the mean of the mean plot heights.
[2] Plants showed poor adaptation and were substituted by another species.