Enriched Fallow Vegetation With Leguminous Trees: Possibilities to Improve the Slash-And-Burn Agriculture in Eastern Brazilian Amazonia[1]

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Traditional slash-and-burn agricultural in Eastern Brazilian Amazonia involves a cropping period of one to two years, followed by fallow periods from three to eight years. During the fallow period a spontaneous vegetation grows up maintaining the system's productivity through biomass and nutrient accumulation. Nowadays, fallow periods become shorter and there is not enough time for the soil to recover its fertility for the next cultivation cycle, resulting in a decrease of agricultural productivity. In order to allow short fallow periods the vegetation's vitality and its biomass accumulation has to be improved. Therefore, fast growing leguminous trees are planted in association with the annual crops maize and cassava.

In an on-farm experiment in Igarapé-Açu (Northeast of the State of Pará) the leguminous tree species *Acacia angustissima, Clitoria racemosa, Inga edulis*, and *Acacia mangium* were planted at 2,500 (spacing 2m x 2m) 5,000 (1m x 2m) and 10,000 (1m x 1m) plants per hectare in a completely randomized block design with four replications. The experimental area was slashed and burned in November 1994. In January and February 1995 maize and cassava were planted, respectively. The trees were introduced in June 1995 after maize harvest. Trees and cassava developed for eight months, sharing water, light, and nutrient resources, until cassava was harvested in February 1996. Thereafter, the planted trees and the fallow vegetation remained in the field as an enriched fallow, sharing resources. Results of the first 18 months of fallow will be presented, here.

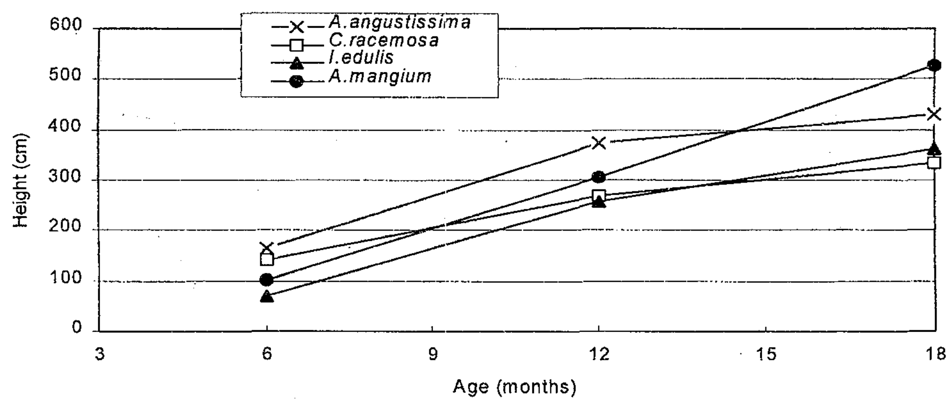

Figure 1

Above-ground biomass of fallow vegetation enriched with leguminous tree species *A. angustissima, C. racemosa, I. edulis* and *A. mangium* at 2500; 5000 and 10000 plants per hectare.

Cassava yield was not negatively influenced by the tree growth, neither were the planted trees affected by the crop. Survival rates of all tree species were over 90%. Shading by the cassava stand assured good establishment at transplanting and controlled tree growth to an acceptable extent during the cropping phase. After cassava harvest, the trees experienced a faster growth rate. After 18 months the growth pattern found for all planted species was still very similar, independent of their spacings (Figure 1).

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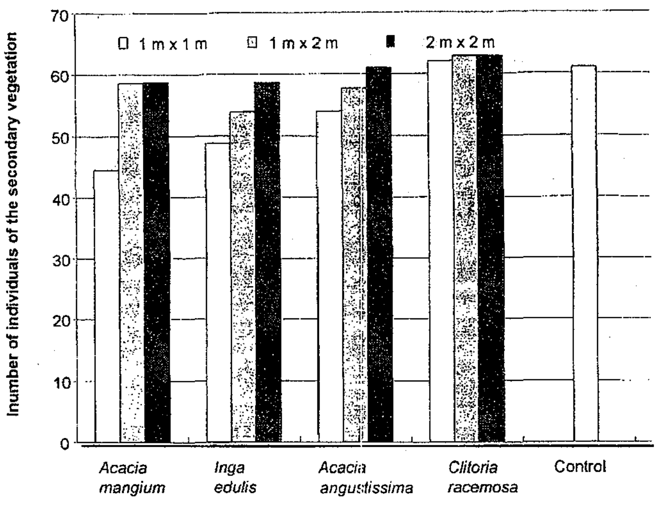

Figure 2
Number of secondary vegetation species observed in a fallow enriched with leguminous tree species at 12 months of age (Wetzel et al., 1998)

Different from many other regions, where biodiversity has already greatly vanished from fallow vegetations, an outstanding attribute still found in natural fallows of Eastern Pará is its considerable functional floral diversity, varying as a function of fallow length and preceding land management (Dantas, 1989; Denich, 1989; Salomão et al., 1996 and Baar, 1997). As a consequence, great concern during developing and testing of fallow enrichment techniques should be directed to the influence upon natural fallow species abundance and composition. The results of a respective assessment have shown that, in general, increasing tree spacing increases the number of individuals. The total number of species within the entire experiment was 274 species from 73 plant families. The lowest number of individuals was found in plots enriched with *A. mangium* (Wetzel 1997).

Species composition in the enriched fallow plots apparently was influenced by light quality (i.e. photosynthetic active radiation; phytochrome active radiation and blue active radiation). Greatest reduction of light passing through the canopy was obtained in the stands enriched with *A. mangium*, (Sá et al., 1997), which correlates with the findings of the diversity study.

The total aboveground biomass accumulated in enriched fallow vegetation was correlated to tree spacings (Figure 3). Increasing spacing decreased the biomass of the planted trees, but it increased the biomass of the natural secondary vegetation. For the same study region Nunez (1995) found 22, 45 and 68 t ha^{-1} of biomass in natural fallows of 1, 4 and 7 years of age, respectively, suggesting that the present results of more than 30 t ha^{-1} found for enriched fallows after 1½ years represents a substantial contribution by the enrichment trees varying with the utilized tree species and the planting density (Figure 3).

Above-ground biomass of fallow vegetation (*Capoeira*) and of the tree species *A. angustissima, C. racemosa, I. edulis* and *A. mangium* planted at different planting densities.

Although 10.000 trees per hectare lead to higher aboveground biomass with the planted trees, this density is not advisable, since it suppresses natural fallow vegetation considerably. Densities between 5000 and 2500 trees per hectare would be more favorable, due to a better synchronization of the growth of the planted trees with the fallow vegetation. Fast growing species should be planted in lower densities (e.g. 2500 trees per hectare), while slow growing species may be planted at higher densities (e.g. 5000 trees per hectare). Based on the performance of *A. mangium* after 1½ years, the aboveground biomass after 2½ years can be extrapolated to be roughly the equivalent to a 4 - 5 year-old secondary vegetation. Using a carbon factor of 0.45 (Woomer, 1997) the produced biomass would represent a carbon sink of 9 to10 t ha^{-1} $year^{-1}$.

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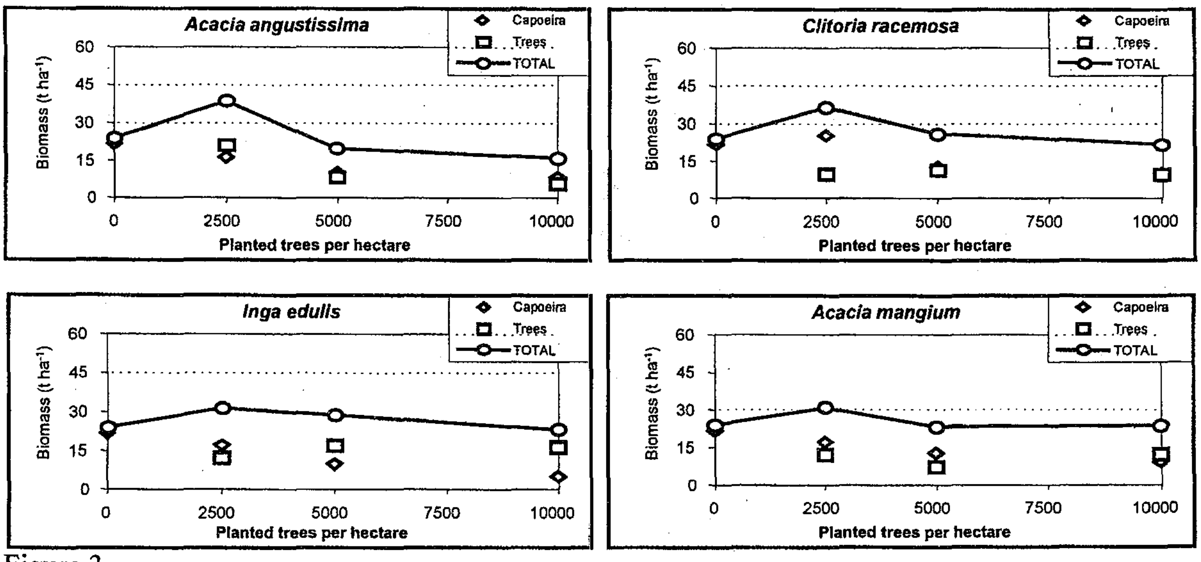

Figure 3

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