Evaluation of growth of paricá (*Schizolobium amazonicum* Huber (Duck)) in differents agroforestry systems in northeast of Pará, Brazil

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Abstract
Paricá (*Schizolobium amazonicum* Huber (Ducke)), typical of Amazon, is a important tree in reforestation due to good conditions of adaptation to associations with other species and it possesses great wood industry potential, mainly for the recovery of degraded areas. In this work, different systems of handling have been compared as a function of environmental breeding, located on experimental farms northeastern of the Pará State, Brazil: Tailândia do Pará (areas with and without addition of wood residues) and Aurora do Pará (association of Paricá with Curauá (*Ananas erectifolius*)). The methodology was visits to the field to observe the Paricá development through the collection of data (height and diameter) and collection of soil samples under the cultures for determination of fertility. In Tailândia do Pará, the culture of Paricá with addition of wood residue presented trees with bigger height (12,00 m) and diameter at breast height (24,00 cm), after 4 years of plantation, in relation to the area without addition (10,3 m and 20,00 cm, respectively). In Aurora do Pará, the culture of Paricá in association with Curauá, also presented trees with bigger height (11,5 m) and diameter (25,74 cm) in relation to the culture without this association (9,5 m and 20,36 cm, respectively).

Key Words
Rrecuperation of degraded areas, reforestation of native species, Brazilian Amazon, soil management, associations with other species, wood industry potential.

Introduction

The Amazon region represents a very important part in the environmental area to the worldwide level, due to its large tropical nature reserve, and because of deforestation for commercial purposes, contributing to the destruction of natural resources (Kato 2003). Studies on the use of agroforestry systems in conservation of the environment are being conducted in several localities in the region (Cordeiro 1999; Rodrigues 2006) showing the major social and environmental benefits from reforestation with native species and management of secondary forest to maintain productivity without any change of the ecosystem. Among the species most studied in these systems is the forestry species Paricá (*Schizolobium amazonicum* Huber (Ducke)), typical of the Brazilian Amazon, with good conditions to adapt to associations with other species, and furthermore it is a species with great wood industry potential, mainly by the recuperation of degraded areas, so it is an important tree for use in reforestation (Cordeiro 1999; Monteiro 2004). Thus, this paper focuses on studies involving the development of the species Paricá (*Schizolobium amazonicum*) in different systems of soil management and its correlation with soil quality in the areas of study.

Methodology

The main data were collected in two experimental farms, in two locations in northeastern of Pará: *Tailândia do Pará* (planting Paricá (*Schizolobium amazonicum*) in areas with and without addition of wood waste), where the planting began in 1999, so that in the beginning of the present research the reforestation was already over 4 years old, and *Aurora do Pará* (association of Paricá with Curauá (*Ananás erectifolius*)), reforestation accounts also for more than 4 years of implementation, but under a management, more specialized, with technical assistance, rotation and association of forestry species. In order to compare the different managements in terms of environmental improvement, field visits were made with relevant environmental observations in both areas, by observing the development of Paricá (visually evaluated with measurement of height with graduated scale and diameter with a caliper) and collecting samples of soil under crops for determination of soil fertility.

Results

In Tailândia for the soil recovered with waste wood, the sand fraction which is the main component (440 and 500 g/kg of soil) decreased with depth (200 g/kg of soil), a content that characterize these soils of sandy clay loam texture. The soil with waste has a lower density than those without waste, ranging from 1.19 g/cm^3 and 1.51 g/cm^3, respectively, in the horizon A. The total porosity is significantly higher in the soil with waste, ranging from 49% in the horizon A of Paricá (*Schizolobium amazonicum*) with residue to 39% in the A horizon of the Paricá without waste. In planting of Paricá with residue also has higher level of C and sum of bases. In the field, we can observe that the area that received the material had an extraordinary development in relation to the growth of the paricá, visible even to the naked eye, compared with the area where not was covered with wood waste. With regard to plant growth in the culture of Paricá, we observed that in the area where cover of sawmill residue was placed the trees had larger diameter at breast height 4 years after planting, furthermore a greater percentage (20%) of trees survived. When comparing the distribution of diameter classes in the area where sawmill residue was not applied there was a predominance of two classes (15-20 cm and 20-25 cm, with more of the latter). Moreover, in the planting without residue application there is a major variation in the diameter class of trees (10-15 cm, 15- 20 cm , 20-25 cm) (Monteiro 2004). The addition of organic material to the soil by the slow decomposition of wood favored the development of the species Paricá (*Schizolobium amazonicum*), which through the addition and incorporation into the soil of new organic material, through the fall of leaves, twigs residues and of the root system of plants (light organic material) led to the creation of an favorable environment for better vegetal development, in relation to the area that was not recovered with of wood (Table 1).

Table 1. Values of h and DAP of the *Schizolobium parahyba* var *amazonicum* (Huber ex Ducke) Barneby (Paricá) in differents planting systems.

Site	Time (months)	planting systems	h(m) (average)	DAP(cm) (average)	Increment h(m)	Increment Dap(cm)
Aurora	48	Paricá with curauá	11.5	25.74	2.05	3.0
Aurora	48	Paricá without curauá	9.5	20.36	1. 8	2.22
Tailândia	48	Paricá with addition of wood waste	12.0	24.0	2.0	2.5
Tailândia	48	Paricá without addition of wood waste	10.3	20.0	1.5	1.0

In Aurora do Pará, the area presents differents planting systems, in association with the agricultural and forestry species that investigated for recovery of degraded areas (Table 1). Those systems are agroforestry by the association between Paricá (*Schizolobium amazonicum Huber* ex Ducke), Curauá (*Ananás erectifolius* L.B. Smith), Freijó (*Cordia goeldiana* Huber), Mogno (*Swietenia macrophylla* King), among others; presenting better development of *Schizolobium amazonicum*. Here, the soils are of the Yellow Latosoil type with sandy clay texture, low organic matter content and high leaching. Low values of pH and levels of N and P. As a method of investigation of the recuperation processes, indicators were used the changes in the morphostructural conditions of the soil profiles. In relation to the results of the company Tailaminas Plac, Tailândia do Pará, it was observed that the soils covered with wood waste presented profiles with better features such as color was darker, soil was sandy, and with good drainage, compared with soils without waste application.

It was observed that the two systems have differences due to management, because the Tramontina Farm have better results despite the system has less time of implementation that in Tailândia. Since Tailândia uses waste of litter empirically in monoculture using fertilization in cultures of Paricá (*Schizolobium amazonicum*), eucalyptus (*Eucalyptus* spp) and pupunha (*Bactris gasipaes*). The physical conditions are the same; both types of soils have low organic matter and nutrients, Yellow Latosols (Monteiro 2004; Cordeiro 2005). Even so Tailândia has a good development because the trees planted in the area under coverage of waste present major growth compared to plants in the original soil. Tramontina has a management, that is more specialized, and has also technical assistance, the difference in this system is that the fertilization was made in the beginning, but now they do not use fertilizer on their crops, only doing cleaning, rotation and association of species, since it is an agroforestry system, affecting of course the economic factor, Tailândia does not yet have the economic resources necessary for technological development of the system.

The Paricá (*Schizolobium amazonicum* Huber (Ducke)) is a viable native species for recuperation of disturbed areas and with a place in the wood market, nationally and internationally. Its rapid growth and adaptation to areas with low nutrient levels allows it to be optimum in agroforestry systems (Cordeiro 1999), being the second plant species used in reforestation in the state of Para (Cometti 2005). The species

Schizolobium amazonicum shows better results due to the influence of soil preparation, in this case the Tramontina farm, furthermore, by use of agroforestry practice and technical assistance. It presents an improvement of physical and chemical properties of soil and major response of trees in those areas with wood waste that shows that the Paricá responds to good management practices.

Conclusions

The Paricá (*Schizolobium amazonicum* Huber (Ducke)) is a viable native species for recuperation of disturbed areas and with a role in the wood market, nationally and internationally. Its rapid growth and adaptation to areas with low nutrient levels allow it to be optimum in agroforestry systems, being the second plant species used in reforestation in the state of Para. The species *Schizolobium amazonicum* shows better results in the treatments where influence soil preparation, in this case the Tramontina farm, furthermore, by agroforestry practice and technical assistance present. It presents an improvement of physical and chemical properties of soil and major development of the trees in those areas with wood waste that shows that the Paricá responds to good management practices.

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