Biomass production in cultivated *Pothomorphe peltata* Miq. (Piperaceae) as a function of harvest time in Manaus, Amazonas State, Brazil.

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ABSTRACT: Biomass production in cultivated *Pothomorphe peltata* Miq. (Piperaceae) as a function of harvest time in Manaus, Amazonas State, Brazil. *Pothomorphe peltata* Miq., commonly known in Brazil as caapeba, caapeba-do-norte and pariparoba, among others, is used popularly for the treatment of problems in the digestive tract, fevers, insufficient liver function due to its diuretic, stomach-aiding and carminative properties. Despite its importance in popular medicine, there have been practically no agronomic studies on this species. The aim of this study was to evaluate the influence of harvest time and plant age on biomass production for the native species *Pothomorphe peltata* in Manaus, Amazonas State, Brazil. Plants were produced from seed (September, 2003) in a greenhouse in plastic bags containing soil. Planting (December 22, 2003) was performed at Embrapa Amazônia Ocidental. The experimental design was in four randomized blocks, using a spacing of 1.0 m ´ 1.0 m. Plots of 4 plants in four replications were analyzed. On February 11th, April 12th (rainy season), June 12th and August 14th, 2004 (dry season), whole plants were harvested and the production of leaves, stems, flowers, roots and total production, number of leaves and flowers per plant, as well as the proportion of stem : leaf were evaluated. In almost all parts of the plants increase in biomass occurred as a function of plant age. An exception was leaves for which decreased biomass in the last evaluation period was observed. In this case, despite a general increase in the number of leaves with age, climactic conditions associated with the dry season favored the loss or shedding of mature leaves.

Key words: *Pothomorphe peltata* Miq., medicinal plant, harvest times.

INTRODUCTION

Supply of good-quality medicinal plant materials throughout the year requires adequate phytotechnical practices for each plant species. Factors affecting supply are seasonal climate, harvest time, regrowth capacity, absorption of nutrients present in the soil, drying, luminosity, among others. In Brazil, the majority of medicinal plants are still not cultivated and collection in diverse natural or urban locations remains the major method in use to obtain plant materials. A large number of native Brazilian species which are cultivated are only in the initial stages of domestication, having not been systematically investigated in agronomically relevant terms. Obviously, plant gathering does not involve the higher costs and greater labor involved in agriculture, but it produces degradation of ecosystems and leads to low quality and diversification of the plant materials obtained (Bustamante, 1993; Corrêa Jr. *et al*., 1996).

The Amazon is the largest tropical forest ecosystem and is considered the largest medicinal plant reserve in the world. As is widely known today, this ecosystem is being exploited in a disorderly and destructive manner which puts at risk the potential of genetic resources, especially medicinal forest plants. Only about 5 % of plants have been the object of scientific research (Matos, 1990), and most of the relevant research has been in botany, natural products chemistry and pharmacology, both in native as well as exotic species. Because they can alleviate pressures on ecosystems produced by disorganized plant extraction, agronomic studies on medicinal plant can lead to the supply of better quality plant materials on a large scale and in a sustainable fashion.

Among the more important native species found in the Amazon region, *Pothomorphe peltata* Miq., known locally by the names caapeba, caapeba-do-norte and pariparoba, is a biannual or perennial treelet which is used in popular medicine throughout Brazil, where mainly leaves and roots are used. This plant is used as a diuretic, antiepileptic and febrifuge, as well as in the treatment of liver disease, swelling and inflammation of the legs, erysipelas and Filariasis (Lorenzi e Matos, 2002).

A number of chemical studies have been performed on *P. peltata*. It produces small quantities of volatile oils which contain caryophyllene, (E)-

Recebido para publicação em agosto/2004
Aceito para publicação em julho/2006

nerolidol, á-humulene , germacrene D, caryophyllene oxide e heneicosane (Maia et al., 2001). Other secondary metabolites isolated from this species include steroids, pigments, mucilage and phenolic compounds 4-nerolidylcatecol and peltatols A-C, which present *in vitro* inhibition of HIV (Gustafson *et al*., 1992). A recent survey has shown that 4-nerolidylcatecol has proven cytotoxic, antitumor, antioxidant, antimalarial and skin protective properties against the effects of harmful sun rays (Pinto, 2002).

The aim of the present study was to determine the rate of biomass production and best harvest time for cultivated caapeba plantas in Manaus, Amazonas State, located in the western Brazilian Amazon.

MATERIAL AND METHOD

The experiment was conducted in the Experiment Area at Embrapa Amazônia Ocidental which is located at km 29 along the Amazonas State Highway AM–10. Soil collection was performed in September, 2003 and the analyses were performed at Embrapa´s Laboratory of Plant and Soil Analysis. To correct the acidity of the soil, 4 t / ha of lime was applied to the soil and incorporated by the use of grating, after removal of weeds and plowing of the area. At Embrapa´s Medicinal Plant Greenhouse, substrate was prepared using local soil + chicken manure (2:1). Seeds were previously collected from approximately one-year old plants in the Medicinal Plant Garden at CPPN/INPA, dried in the shade and on September 9, 2003, were distributed in black polyethylene bags containing this substrate. Germination occurred after 30 days and thinning / transfer of seedlings on November 2, left the most vigorous plant in each bag. Young plants were irrigated daily until planting, on December 22, 2003 (beginning of rainy season). The experiment was conducted in randomized blocks using 4 repetitions and 16 plants per repetition (the 4 central plants in each block represented the used area), at a spacing of 1.0 m x 1.0 m. The treatments were 4 harvest times, two during the rainy season (February, April) and two during the dry season (June, August), 2004), at 60 day intervals. At each harvest time, plants were triaged, dried at 65 ºC to constant weight in an oven, and the biomass of leaves, stems, roots, flowers as well as total plant biomass were evaluated. Data were submitted to variational analysis using the F Test and averages were ajusted using regression models.

RESULT AND DISCUSSION

The production of leaves increased until the third harvest period when it peaked at around 94.0 g / plant (Figure 1) and then decreased in the forth harvest period, at which time the plants were approximately one year old (germination on October 10, 2003). The reproductive phase began around 110 days after transplanting, representing at this time a production of 0.32 g / plant. At the next evaluation, biomass of reproductive parts was 59.75 g / plant. Stem and root production (Figures 3 and 5) increased throughout the 4 periods of evaluation, with the greatest contribution to overall biomass coming from the stems which reached 148.56 g / plant, while root production reached 43.06 g / plant. In the first two harvests, stem production was lower than that of leaves, with the plant directing reserves to these photosynthesizing structures during this period and then later increasing proportionately the biomass of the stems, which sustain the plant through lignified tissues (Metcalfe & Chalk, 1985; Cutter, 1986).

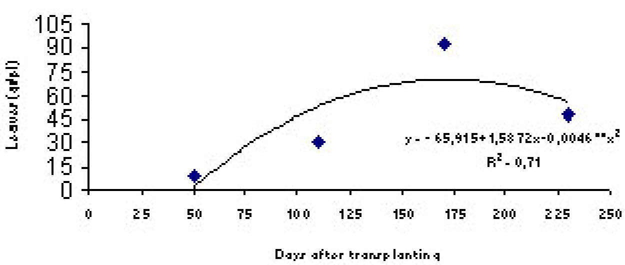

FIGURE 1. Caapeba leaf production as a function of plant age at harvest, in Manaus, Amazonas State, 2004.

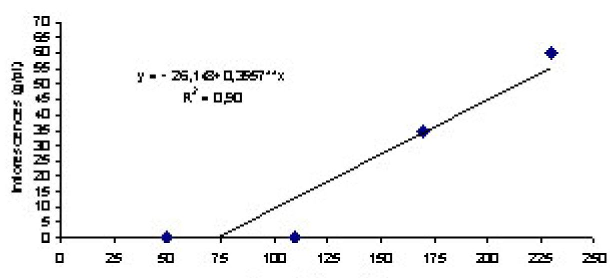

FIGURE 2. Caapeba flower production as a function of plant age at harvest, in Manaus, Amazonas State, 2004.

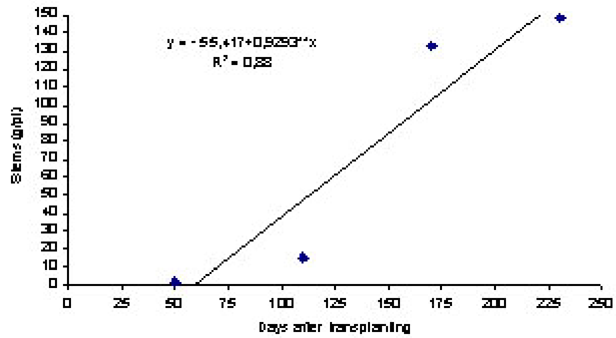

FIGURE 3. Caapeba stem production as a function of plant age at harvest, in Manaus, Amazonas State, 2004.

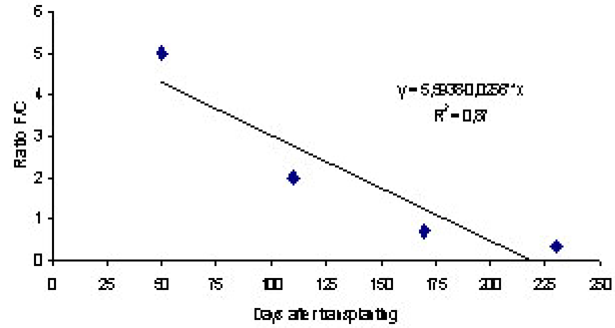

FIGURE 4. Caapeba Ratio Leaf/Stem as a function of plant age at harvest, in Manaus, Amazonas State, 2004.

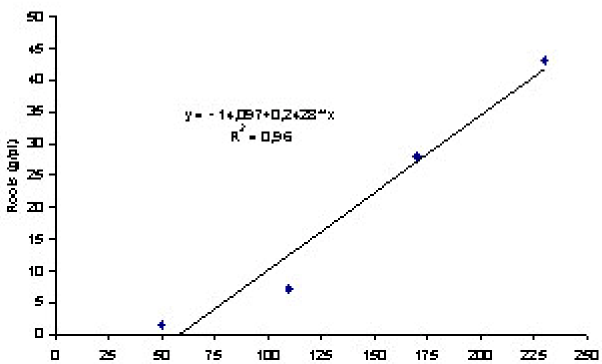

FIGURE 5. Caapeba root production as a function of plant age at harvest in Manaus, Amazonas State, 2004.

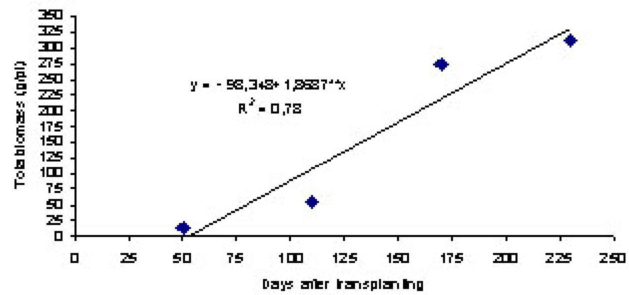

FIGURE 6. Caapeba total biomass production as a function of plant age at harvest, in Manaus, Amazonas State, 2004.

This relationship and timing of leaf and stem production is clearly evidenced by the leaf to stem proportion (Figure 4) which decreases as a function of plant age. It is interesting to note that in the first harvest the ratio of leaf to stem biomass was 5:1 and at 230 days after transplanting this proportion had dropped to 0.32:1. While the number of leaves and reproductive parts increased over time (Figure 7) there was a decrease in the production of per plant leaf biomass (48.01 g / plant) between the third and fourth harvests. This was due to the fact that the last evaluation (in the month of August) occurred in the middle of the dry period, and considering that the experiment did not rely on irrigation, it seems reasonable that these environmental conditions caused the shedding of mature leaves. It is interesting that despite this shedding of leaves, total plant biomass production (Figure 6) increased with plant age throughout the experiment, indicating that other plant parts were responsible for this general increase in biomass of the plants. A similar result was obtained by Cruz (1999) who found that the harvest age for mint (*Mentha x villosa*) was 120 days after transplanting, when this species presented the greatest production of dry biomass. In another study involving another species of mint (*Mentha arvensis*), Ram & Kumar (1997) obtained the greatest biomass production at 110 days after transplanting.

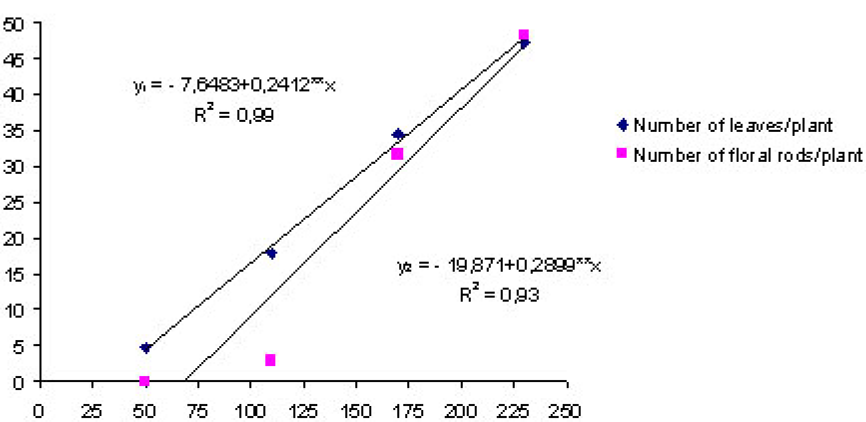

FIGURE 7. Number of leaves and floral rods in caapeba as a function of plant age at harvest in Manaus, Amazonas State, 2004.

In the conditions in which this experiment was conducted there was an increase in overall biomass of the plants, with a lower contribution of the leaves to overall biomass in the last harvest.

ACKNOWLEDGMENT

The authors proudly recognize the financial support of the Amazonas State Foundation for the Advancement of Research (FAPEAM) as well as stipends for A.C.S.P. and E.A.P. as well as a grant through the Bioamazonia/FEPAD/BASA Contract.

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