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SPACING AND MANURE IN FARMING *Heteropterys tomentosa*

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ABSTRACT

Heteropterys tomentosa A. Juss. is a species of the Cerrado of Brazil used as an aphrodisiac and for treating nervous debility. The aim of this study was to evaluate the influence of spacing (0.3m, 0.5m and 1.0m) and organic and phosphorus fertilization (with and without fertilization) in the development of *H. tomentosa* plants in cultivation conditions. The experimental design was a randomized block with four replications and 15 plants per plot. The characteristics number of leaves and branch, height of the major branch and base diameter were analysed. The greater spacing provided larger number of branches and the organic and phosphorus fertilization had no effect, showing that this species adapted to low soil fertility conditions.

Keywords: Cerrado, *Heteropterys tomentosa*, fertilizing, population

INTRODUCTION

The Cerrado is the second largest biome in plant diversity and covers about two million square kilometers, accounting for 23% of the Brazilian territory. It is one of the major hotspots for global biodiversity conservation. In the past 35 years more than half of its 2 million original km^2 were grown with pasture and annual crops and deforestation rates have historically been higher than the Amazon rainforest (Klink & Machado, 2005).

The vegetation beyond the fire is still subject to inordinate extraction of native species, many of which are medicinal, like the *Heteropterys tomentosa* A. Juss., which has been used in large scale due to its medicinal properties, compromising conservation of the species. This species is used for control of uric acid, as an aphrodisiac, to nervous debility, as tisane, for venereal

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diseases, ophthalmic ailments (cataract and conjunctivitis), for uterine ailments, as tonic for muscle strengthening and rashes on the skin (Coelho et al., 2011)

Among the management techniques that favor agricultural productivity are the spacing and fertilization. The spacing gives the plant enough floor space for its development and is related to the availability of nutrients, water and light (Cesar, 1977). Thus different answers for this factor may occur as a result of variability in the quality of the spot, especially with regard to the availability of water, nutrients and light. Reduced spacing tend to reduce the age of harvest of planted forests, as well as reducing some management practices, such as hoeing. However, these may hamper the operations and jeopardize future production due to the higher export of soil nutrients (Bolloni, 1983).

The major limitation to the use of native species in commercial plantations or floristic restoration programs is the lack of information on the nutritional and physiological requirements. Indicates evidence that the growth of many tropical tree species is limited by nutritional constraints soil (Dias et al., 1991).

Fertilization is one factor that determines different levels and compositions of active ingredients, but not reached conclusions to this situation in several previous work (Ming, 1994). Vieira et al., (2011) found *Campomanesia adamantium* response the fertilization with nitrogen and phosphorus with the increased number of branches.

Madueño-Box (1973) found that, even in soils with a high content of nutrients, medicinal plants, in general, have higher development in those who had more favorable physical characteristics for expansion of the root system, leading Mattos (1989) to suggest that medicinal plants have vocation to receive organic fertilizer.

In *Lippia alba* organic fertilization favored the production of biomass, but the concentration of essential oils was reduced with the increase of same (Ming, 1998). Otherwise, Scheffer (1998) found that the organic fertilizer in *Achillea millefolium* increased biomass and essential oil yield as a function of the applied dose.

The soil organic phosphorus in plant nutrition is often underestimated, probably due to the fact that most cultivated soils have most of the phosphorus in the inorganic form, and this due to the low content of organic matter thereof (Dalal, 1977). Soil organic matter is considered an important source of phosphorus for plants, containing: 15 to 86% total phosphorus found in soil (Dadal, 1977; Kiehl, 1985).In soils of tropical and subtropical regions, phosphorus is often a limiting element in plant nutrition, not only by the low concentration but also by adsorptive properties of soils (Peixoto et al., 1987).

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Native medicinal plants in Brazil, as *Lippia alba*, *Bauhinia forficata* and *Maytenus ilicifolia*, already have initial recommendations of cultivation (Correa Junior et al., 1994, Ming et al. 1998), but for *Heteropteris tomentosa* this information does not exist. This study aimed to evaluate the influence of spacing and organic and phosphorus fertilization in developing *Heteropteris tomentosa* plants growing in the field.

MATERIAL AND METHODS

The seeds of *Heteropteris tomentosa* were collected at the time of dispersion (August-September), in Santo Antônio do Leverger in Mato Grosso, in 2010. They were treated, packed in paper bags and stored in the FAMEV Seed Laboratory in climatic chamber with temperature of 18°C to 22°C until the experiments in December 2013**.**

The experiment was conducted at the Experimental Farm of the Federal University of Mato Grosso - UFMT in the municipality of Santo Antônio do Leverger - MT, with geographical coordinates 15º47'11 "south latitude and 56º04'17" west longitude and altitude of 178.87 m above sea level. The climate is classified as warm and sub-humid tropical. The soil was classified as Red Yellow Podzolk and their chemical and physical characteristics were determined in four samples consisting of the total area and are presented in Table 1.

Table 1. Chemical composition of the previous soil fertilization at the site of the experiment. Experimental Farm of the Federal University of Mato Grosso Santo Antônio do Leverger - MT.

Treatments	pH	H+Al	Al	Ca+Mg	Ca	Mg	K	P	M.O	Sand	Silt	Clay
	H_2O			$Cmol_c.dm^{-3}$				$mg.dm^{-3}$	$g.\ dm^{-3}$		$g.kg^{-1}$	
Surface	5.9	2.4	0.0	2.8	2.0	0.8	95	2.9	18.0	716	117	167
Depth(40 cm)	5.8	1.6	0.0	2.5	1.8	0.7	65	2,3	12.5	683	100	217

Soil preparation was performed by plowing, followed by a leveling harrowing. Fertilization was performed in the planting hole and consisted of 100 grams of superphosphate and five litters of cured bovine manure.

We used a randomized complete block in a factorial 2x3, with four replications, including treatments with and without fertilization and three spacing between plants: 0.3m; 0.5m and 1.0m. The experiment consisted of 24 experimental plots, each one consisting of 15 plants and the total 360 plants. Among the planting lines was used the spacing of 1m.

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Thus the spacings of 0.3; 0.5 and 1.0m therefore correspond to equivalent density of 33,333, 20,000 and 10,000 plants per hectare, respectively. Trees were planted with seedlings that were approximately 90 days old. The seeds were sown in December 2013 in plastic bags (2,85dm3) as substrate sand and black earth in proportion (1: 1). In the experiment installation seedlings were standardized by height.

The characteristics evaluated, nine months after planting were: height, stem base diameter of the largest branch, number of leaves and branches. All plants in each plot were evaluated, which provided for the spacing of 0.3m; 0.5m and 1.0m, a floor area per plot respectively 4,5m^2, 7,5m^2 and 15m^2.

For height and diameter of the base, evaluated the largest branch of the clump, and is considered the distance between the neck and the apical bud for the characteristic height. The data were tested for normality and homogeneity tests of variance. Analysis of variance by F test and the treatment means were compared by Tukey test at 5% probability was made.

RESULTS AND DISCUSSION

The analysis of variance of characteristics is studied in Table 2. The mean number of leaves, the largest branch height, number of branches, and base diameter of *H. tomentosa* plants to different spacings shown in Table 3, and submitted the fertilization conditions in Table 4.

Table 1. Summary of the number of leaves of the variance analysis, the largest branch height, number of branches and base diameter, determined after nine months of planting *Heteropteris tomentosa* submitted to different spacing and fertilization conditions.

Source of variation	G.L.	Mean Square			
		Number of leaves	Largest branch height	Number of branches	Diameter base
Blocks	3	164.4052	64.14991	0.4680388	0.04131857
Spacing	2	297.7317	121.4714	5.406323*	0.7511823
Fertilization	1	665.5140*	450.4391**	3.048310	3.081502**
Spacing x Fertilization	2	27.29716	1.185346	1.199566	0.1122285
Residue	15	89.57508	36.53492	1.253323	0.2632475
C.V. (%)		15.78	7.78	17.73	8.57

(**), (*)Significant at 1 and 5% probability, respectively, by F test

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Table 2. Mean values for the number of leaves, the largest branch height, number of branches, and base diameter, determined after nine months of planting *Heteropterys tomentosa* subjected to different spacing between plants.

Spacing (m)	Means[1]			
	Number of leaves	Number of branches	Largest branch height (m)	Diameter base (mm)
1.0 x 1.0	66.99 A	7.25 A	82.18 A	6.34 A
1.0 x 0.5	56.97 A	5.73 B	75.90 A	5.81 A
1.0 x 0.3	55.95 A	5.95 AB	75.05 A	5.80 A
C.V. (%)	15.78	17.73	7.78	8.57

[1]Means followed by the same capital letter in the column do not differ significantly by Tukey test at 5% probability.

Table 3. Mean values refer to number of sheets, the largest branch height, number of branches, and base diameter, determined after nine months of planting plants Heteropteris tomentosa under different fertilization conditions.

Fertilizing	Means[1]			
	Number of leaves	Number of branches	Largest branch height (m)	Diameter base (mm)
Não adubado	65.23 A	6.67 A	82.05 A	6.34 A
Adubado	54.70 B	5.95 A	73.38 B	5.62 B
C.V. (%)	15.78	17.73	7.78	8.57

[1]Means followed by the same capital letter in the column do not differ significantly by Tukey test at 5% probability.

There was a significant difference between the spacings for number of branches, but there were not for the number of leaves, the largest branch height and diameter of the base, the greater spacing provided larger number of branches. On the other hand, the fertilization condition influenced all characteristics except for the number of branches.

According Fishwick (1976) spacing has less influence on plant height, with varying behavior according to the quality of the location and age of evaluation. The statements of these authors agree with the results. On the other hand, the diameter growth is affected by a characteristic spacing within certain limits, being greater the greater the spacing (Couto et al., 1977), and used spacings not verified this behavior.

As for fertilization, it is noted that *H. tomenttosa* had better development in the absence of fertilization condition represented by the number of leaves, the largest branch height and base diameter, no significant differences in the number of branches.

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Similar results were obtained by Aguiar et al., (1997), with *Caesalpinia echinata* in cultivation in the field, which did not respond to phosphorus-based fertilizer and potassium for plant height characteristics and base diameter. These authors have given the lack of response of phosphate fertilizer to the original high fertility of the soil in this element, which showed levels above 19 mg/dm^3. Moreira et al. (1996) studied the initial growth of *Swartzia laevicarpa*, concluded that the growth of seedlings of this species was better in low fertility substrates without mineral fertilizer and have indicated that this species adapted to these soil types, as occurs under natural conditions.

The soil in which was conducted the experiment showed low fertility in both the surface and the depth of 40cm, and the best development in unfertilized soil indicates that *H. tomentosa*is a species adapted to these conditions, according to Moreira et. al (1996). According Ratter et al., (1977), the need to use more or less fertilizer, or not use it, should be based on accurate and reliable information, especially when it comes to a native Cerrado species, because this composition floristic there are species that occur only in acidic soils, others are restricted to calcareous soils and even indifferent to soil fertility.

CONCLUSIONS

It follows that the greater spacing provided larger number of branches in *H. tomentosa*, but the number of leaves, the largest branch height and base diameter are not affected by the spacing. The species is adapted to the Cerrado soil conditions, acids and low fertility, it did not respond to organic and phosphorus fertilization.

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