AGROINDUSTRIAL WASTES IN THE PRODUCTION OF *CEDRELA FISSILLIS* VELL SEEDLINGS

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1 INTRODUCTION

The unsustainable use of renewable resources in Brazil is happening in a fast speed, causing the lost of entire ecosystems and reducing the stock of natural capital. Among these natural resources, native forest species stands out. They had once been present in great extensions in the Brazilian territory and currently many of them are being extinct. Vale do Ribeira concentrates one of the last and most preserved remaining of the Atlantic Forest in Brazil, which means that there is a demand in a short term of good quality forest seedlings for reforestation projects.

Agriculture in Vale do Ribeira, São Paulo, Brazil, has as its main products banana (*Musa* sp) and heart of palm (*Bactris gasipae* Kunth). These products are industrialized in the region, producing great quantities of waste which are dumped without any planning, what can be a source of pollution. Because the organic compounds obtained from composting of waste from banana and heart of palm agro industries (abundant materials in Vale do Ribeira) have considerable contents of organic matter, nutrients, and also high capacity of water retention, they have potential for being used as substrate on the production of native species seedlings.

Each species has its own requirements for its development. The substrate has a great influence on the germinative process because factors such as aeration, structure, water retention capacity, degree of infestation by pathogens, among others, differ among substrates, favoring or harming seed germination. Substrates have to keep a suitable proportion between water availability and aeration, and it should not be excessively moistened in order to avoid that a film of water involves the seed, restricting the entry of oxygen (Scalon et al., 1993). The choice of substrate has to be done taking into account the requirements of the seed, regarding its size, shape, etc.

Cedro (*Cedrela fissillis* Vell.) is a forest species from Meliaceae family, and it can be found from Rio Grande do Sul to Minas Gerais, mainly in semideciduous and Atlantic rainy forests (Lorenzi, 1992). It grows in primary forests and it has a quite faster growth than other native species, being much used in the recovery of degraded areas as a secondary starter species. The works on production of seedlings of these species are scarce

This work aimed at evaluating the performance of organic compounds obtained from composting of banana and heart of palm agroindustrial waste as substrate for production of Cedro Rosa (*Cedrela fissilis* Vell.) seedlings.

2 MATERIALS AND METHODS

The seeds for seedling production *Cedrella fissilis* Vell. (Cedro Rosa) was obtained from the nursery of Fundação Bradesco, Registro, São Paulo, Brazil. It was adopted a randomized block design with 12 treatments and ten repetitions. The substrates were prepared from combinations of organic compounds produced from industry wastes of palm (palm and royal palm), banana, ashes from boiler (used to heat the water used to prepare the hearts of palm) and the vermiculite medium texture. The combinations of materials for the composition of substrates: : T1 (100% CB); T2 (100% CPR); T3 (100% CP); T4 (70% CB + 20% ash + 10% vermiculite); T5 (60% CB + 20% ash + 20% vermiculite); T6 (50% CB + 20% ash + 30% vermiculite); T7 (70% CPR + 20% ash + 10% vermiculite); T8 (60% CPR + 20% ash + 20% vermiculite); T9 (50% CPR + 20% ash + 30% vermiculite); T10 (70% CP + 20% ash + 10%); T11 (60% CP + 20% ash + 20% vermiculite); T12 (50% CP + 20% ash + 30% vermiculite). **CB** - Compost-based agro-industry waste banana; **CPR** - Compost-based agribusiness waste palm heart (royal palm), **CP** - Compost-based agribusiness waste of palm (palm).

TABLE 1 **Chemical characteristics of materials used in the composition of the substrates.**

	pH	EC	N	P	K	Ca	Mg	Cu	Fe	Zn	Mn	OC	C/N
			----------		%	----------		----------mg.kg^{-1}----------					
CB	7.2	3.5	2.0	1.8	10.6	8.2	4.0	10	7500	42	234	128	11/1
CPR	7.7	3.7	9.9	2.6	12.9	7.9	4.6	24	1050	110	501	194	9/1
CP	7.1	3.5	2.4	2.8	14.5	8.8	4.4	21	900	84	321	211	10/1
Ash	8.8	3.4	3.0	59.0	27.0	3.0	3.0	-	-	-	-	-	12/1

CB - Compost-based agro-industry waste banana; **CPR** - Compost-based agribusiness waste palm heart (royal palm), **CP** - Compost-based agribusiness waste of palm (palm).**OC** – Organic carbon.

We used hard plastic tubes (50 cm^3 vv), containing different substrates, placed on support type plastic tray under shade with 40% capacity retention of light. Irrigation was performed manually and daily.

After 120 days were evaluated the following characteristics: Height of shoot (H) Diameter of the neck (D), dry matter of shoot (SDM). At the end of the experiment, the plants were separated into roots and shoots. The parties were dried in an oven with forced air at a temperature of 65 ° C, until constant weight. Data obtained were calculated on the dry matter of shoot (SDM), and the different levels of quality seedlings, which are the ratio of shoot height and stem diameter (H / D), the ratio of the height of the air / dry matter of shoot (M / DMAP).

After drying, the plant material was sent to the Laboratory of soil and plant analysis of UNESP to determine the macronutrients levels.

Data were subjected to analysis of variance and multiple comparisons using the statistical program SISVAR.

3 RESULTS AND DISCUSSION

3.1 Morphological parameters

For the variable plant height (H), observed that the compound T3 was higher than in the other, showing that for this variable, the introduction of the components of boiler ash and vermiculite mixture exerted a negative effect, ie, in the values significantly lower than other treatments. It adds that the time considered ideal for a seedling is planted in the field is 30 cm, so the seedlings evaluated, even in statistically superior treatments were not yet ready for planting. A similar result was also in 'to the variable stem diameter (D).

Also the relations between the morphological attributes that indicate the quality of seedlings were affected by the composition of substrates (Table 2). In this study, the aspect of the shoot / stem diameter (H / D) was higher in treatment T6. It is known that values of H / D ratio ranging between 5.4 and 8.1 are ideal, however, the smaller this value, the greater the ability of seedlings to survive and establish themselves in the field (Carneiro, 1983) Therefore, on this parameter, most of the seedlings showed satisfactory values, the exception of T2, T3 and T9.

TABLE 2 **Height (H), collar diameter (D), total dry biomass (BST) and ratio between height and shoot (H/BST) of the seedlings *Cedrella fissilis* Vell.**

Substrates	H	D	H/D	BST	H/BST
	cm	mm		g	
T1	21.3b	3.8b	5.6bc	2.1c	10.1b
T2	20.1b	4.7a	4.3c	3.2b	6.3d
T3	23.4a	5.1a	4.6c	4.6a	5.1d
T4	19.3b	3.7b	5.2bc	2.7bc	7.1c
T5	18.6bc	2.9bc	6.4b	2.2c	8.5c
T6	16.8c	2.2c	7.6a	1.3c	12.9b
T7	13.7d	2.2c	6.2ab	1.4c	9.8b
T8	12.9d	2.1c	6.1ab	0.9d	14.3a
T9	12.5d	2.5c	5.0c	0.9d	13.9a
T10	17.4c	2.4c	7.3a	2.0c	8.7c
T11	16.2c	2.4c	6.8ab	1.9c	8.5c
T12	16.7c	2.9bc	5.8b	1.8c	9.3bc
CV%	9.6	13.2	12.7	14.1	13.3

*Means followed by the same letter in columns do not differ by Tukey test (P> 0.05).

Index M / DMAP used to predict the potential for survival of the seedling in the field. Gomes (2001) states that the lower this index, the more lignified will change and better development in the field. In this study, the lowest rate was observed when the substrate was used T3.

3.2 Macronutrient Concentrations

The macronutrient content of the shoots of seedlings of *C. fissilis* Vell can be seen in Table 3.

Silva and Muniz (1995) in a paper that evaluated the nutritional needs of cedar seedlings, consider the following leaf as normal for this species: N - 34.5 (g kg-1), P - 3.3 (g kg $^{-1}$), K - 11.8 (g kg^{-1}), Ca - 15.0 (g kg^{-1}), Mg - 5.0 (g kg^{-1}). From the comparisons found in this study with the work of Silva and Muniz (1995), it was found that the levels of N found were considered below normal for all treatments. This may be explained by the pH of the substrate (between 7.0 and 8.0), considered high by Hanhn (2006), according to him, the high pH values compromise the availability of nutrients for seedlings.

TABLE 3 **Macronutrients concentration (g kg $^{-1}$) in *Cedrela fissilis* Vell. seedlings.**

Substrates	**Macronutrients concentration**					
	N	P	K	Ca	Mg	S
	g kg $^{-1}$					
T1	16.0c	3.2 a	33.0b	10.0c	3.5c	1.4a
T2	19.05b	2.1b	22.0c	15.0b	5.6bc	1.3a
T3	14.0c	1.8b	27.0bc	12.0c	5.5bc	1.3a
T4	23.0a	2.1b	26.0c	14.0b	6.9a	1.4a
T5	15.0c	2.1b	25.0c	15.0b	6.9a	1.2a
T6	20.0a	2.1b	21.0c	19.0a	7.7a	1.3a
T7	14.0c	1.7c	23.0c	12.0c	6.2b	1.1a
T8	12.0c	1.9c	24.0c	14.0b	6.6b	1.2a
T9	18.0b	3.2a	45.0a	6.0d	2.9c	1.5a
T10	14.0c	3.2a	34.0b	6.0d	2.8c	1.3a
T11	17.0c	2.4b	23.0c	16.0b	6.5b	1.4a
T12	19.0b	1.5c	30.0b	14.0b	6.3b	1.3a
CV%	10	12.2	13.6	13.1	12.5	8.2

*Means followed by the same letter in columns do not differ by Tukey test (P> 0.05).

Another hypothesis is that although the C / N ratio of substrates to be appropriate and within recommended levels, the N mineralized was not contained in time for the growth of seedlings. It is noteworthy that even with N content below what is considered ideal, the seedlings showed no visible symptoms of nutritional deficiency. The P concentrations in tissues were similar to those of N.

The K concentrations were in high values for all treatments above considered adequate (11.8 g kg^{-1}) for seedlings of cedar, with both the highest values were recorded in treatment T9 and T10 and T1. However, the treatments were observed where the highest values of K corresponded to lower levels of Ca and Mg. The effects of increasing doses of K on the decrease in the accumulation of nutrients, especially Ca and Mg, are widely reported in the literature. Malavolta et al. (1997) explain the behavior of the competitive effect on the absorption of Ca and Mg, since, during the process of root uptake, these nutrients used the same sites shippers.

We suggest other tests with more demanding and species tolerant to high salinity of the substrates.

4 CONCLUSION

Chemical composition of the substrate exerted great influence on growth parameters of seedlings of *Cedrela fissilis* Vell. And is supposedly the high concentration of K of the material and the low N supply factors responsible for the negative effects observed.

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