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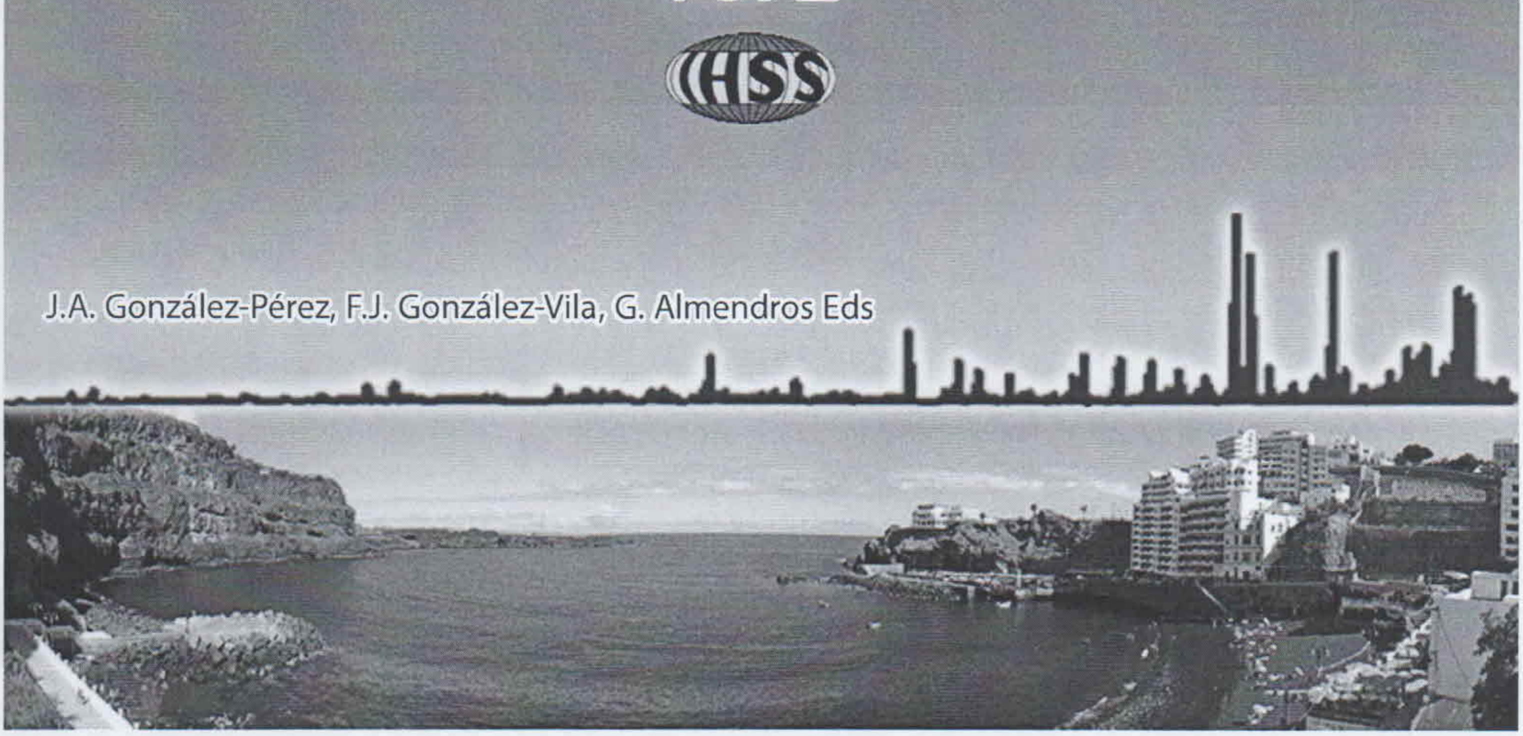

Application of Organic Composts of Agricultural and Urban Residues for Cultivation of *Ocimum Selloi* Benth

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1. Introduction

The most widely accepted definition about composting is that it is a controlled exothermic and biooxidative decomposition of organic materials by autochthonous microorganisms, resulting in a wet, warm and aerobic environment, with production of carbon dioxide, water, minerals and, a stabilized organic matter, defined as compost [1]. This is a homogeneous organic fertilizer, with several characteristics like odor, dark color, biochemical stability, complexation sites, etc, making improvements in physical, chemical and biological soil and thus, promoting the physiological development of cultivated species.

The humanity produces a lot of kinds of residues which can be use as raw material in composting production [2]. Pruning trees is a waste easily found in both rural and urban areas, and they are generally discarded. In the cities, this disposal may become a problem, because it increases the volume of produced waste, overloading quickly deposits or landfills. The orange peel is the main by-product of citrus industry, representing about 45% of the total weight of the fruit and it can becomes a major problem for industry, because it deteriorates very rapidly during storage. The filter cake is a residue from the ethanol industry and is obtained from the solid precipitate from the sugarcane juice clarification (to produce sugar or ethanol) and, the boiler ash. The bovine manure is a waste widely used *in natura* as organic fertilizer however; the composting process makes it more stable and enhances its fertilizing properties.

In general, the influence of organic composts in plant production and soil fertility requires more studies due to the complexity of agroecosystems. There are few studies concerning the production of medicinal plants, herbs and condiments, in order to obtain higher yield, quality and efficacy, in an organic production. The objective of this work was to evaluate the influence of different composts and selected doses, on the production of the medicine plant *Ocimum selloi* Benth in a tropical sandy soil, in comparison to mineral fertilizer. The studies showed differences between composts applied in the soil. Non-additional application of mineral fertilizers was done. The results were compared with the former ones observed by Fialho et al., 2010 [2], using chemical and spectroscopic methods to evaluate the compost humification.

2. Material and Methods

The methodology comprised the cultivation of Ocimum *selloi* Benth in a greenhouse in the region of São Carlos, São Paulo State, Brazil. A sandy soil (62% sand), treated with different organic composts at different doses, was collected at Canchin Farm in São Carlos - Brazil (21°57'47" S, 47°50'35" W). The experiment was completely randomized in a 4×3×3 design (four treatments in three different doses and three replications). The treatments were: (i) L1 – compost of tree pruning, (ii) L2 – compost produced with tree pruning and cattle manure, (iii) L3 - compost produced with tree pruning and orange peel and, (iv) L4 – compost produced with tree pruning and filter cake [2]. The organic composts were applied in three different equivalent doses: 5, 15 or 30 ton ha^{-1}. Non-additional application of mineral fertilizers was done. In addition, for comparison purposes, they were done three pots without compost application and other three ones treated with commercial fertilizer (mineral fertilizer). The experiment was set up in pots in a greenhouse. The composition of available macro- and microelements in the composts was done using a 3M HCl extract solution and quantification by ICP-AES.

Soil samples were sieved and then it was made the liming process to correct the pH, which were around 4.7. Each pot received 7 kg of soil. An automatic irrigation system of the vessels was used, which consists of a new drip system for plants, recently patented by Embrapa, which allows the application of water volume. The system controls the flow of water by automatic air pressure adjustment. The different composts were ground in a knife mill and then, according to the experiment, were mixed uniformly to the soil of the vessels in three different doses. They were selected 42 plants of the same age, with two months of germination and about the same size. The seedlings were so transplanted to vessels.

Leaves were collected after thee months of experiment. Immediately post-harvest samples were weighed to obtain fresh weight and so, they were dried in an oven with forced air at 60 °C until mass constant and were re-weighed to obtain dry weight. Dry samples of plant tissue were crushed and sent for fertility. Macro- and micronutrients content was determined using inductively coupled plasma atomic emission spectrometry (ICP-AES). The results of the fertility analysis, the heights and fresh weight of plants were investigated using Principal Component Analysis (PCA) [3].

3. Results and Discussion.

The obtained values of macro- and microelements in the composts are described in Table 1. Its remarkable the differences among the composts. The availability of the nutrients is strongly dependent of the raw materials. According to Fialho et al., 2010 [2], the CTC/C of these composts are different (L2 $\simeq$ L3 › L4 › L1), and so, the humification process release in part the nutrients. In the same article, authors using several spectral analyses (UV/Vis, FTIR and NMR) describe that samples L2, L3 and L4 reached humification; however, L1 show poor humification with high C content and lack of other elements, mainly N.

Table 1: Available macro- and microelements in the composts

Compost	N	P	K ($g\ kg^{-1}$)	Ca	Mg	Fe	Mn ($mg\ kg^{-1}$)	Cu	Zn
L1	12.1	6.3	8.8	10.2	4.3	6.0	232.0	45.0	155.0
L2	27.3	8.9	8.7	12.3	4.7	2.0	110.0	15.0	63.0
L3	20.6	20.2	8.2	18.0	4.2	17.0	892.0	40.0	121.0
L4	25.8	4.9	8.8	10.4	3.9	3.0	117.0	17.0	54.0

Macro and micronutrients in plant tissue (leaves), the values of heights and the values of dry leaves were analyzed to evaluate the performance of treatments (L1, L2, L3 and L4).

On Fig. 1, it was showed the results obtained with PCA analyses. Also in score plot of the Fig. 1-a showed the treatments were separated into two main clusters. The variables responsible for this separation were Mn an N (Fig. 1-b). It was possible to verify, with these same plots, the treatment called L2 and L3 were nearest to commercial treatment (mineral fertilizer) and in the L1 and L4 were nearest to reference samples. In this case, doses between 15 and 30 the compounds showed a tendency to influence sample differentiation.

The most evidence about these treatments was after 3 months of transplanting, the plants began to show yellowing of leaves, with the exception of treatment with mineral fertilizer (L2 and L3). The yellowing was due to possible nitrogen deficiency plants. The comparison of the performance of the treatments showed that the plants with best visual characteristics, such as color of the leaves, were treated with mineral fertilizer. Since plants regarding therapy L1 and L4 were respectively the first and second to began to yellowing, becoming visually similar plans relating to reference vessels.

These results were in agreement with the chemical investigations of Fialho *et al.*, 2010 [2] with the same samples. The results of the cited author showed that the compost L1 did not change its composition with respect to the starting material because it is a very fibrous material with high lignin content. Because of the decomposition of this material is hardy.

In addition, studies focusing on fertility, growth and plant development in bio-active species, further analysis of the soil and control soil with application of different compounds, will allow verifying the different content of humic acids. According to Orlov, 1998 [4], the increased content of humic acids may be an indicator of improving soil humus quality; or biological activity increase promoting the synthesis of more condensed humic substances.

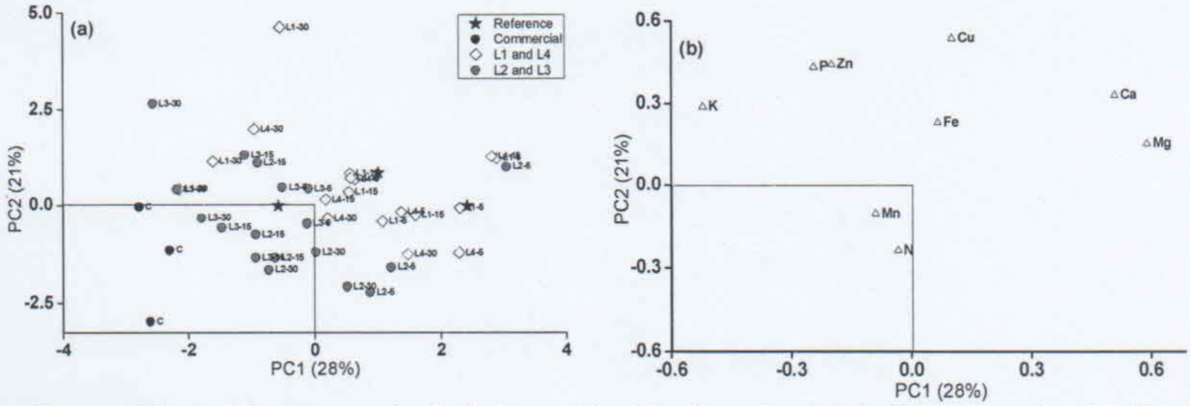

Figure 1: Principal Component Analysis: Score (a) and loading plots (b) for the data matrix, with 42 samples and 9 variables

4. Conclusions

The results of the analysis of fertility of plants using a computational resource/chemometric called Principal Component Analysis (PCA), and the experimental observations showed that the L2 and L3 treatments showed greater similarity to the treatment with mineral fertilizer, bringing greater benefits than the other (L1 and L4) when applied to the soil in question, regardless of the amount applied. These results agree to the former chemical and spectroscopic analyses made by Fialho in our research group [2].

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