

## Use of Sub Soil Enriched with Vermi Compost as a Potting Mixture for Cinnamon (*Cinnamomum zeylanicum* Blume) Seedlings

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### Introduction

True cinnamon, which is popularly termed as Ceylon Cinnamon, is a derivative from the bark of an aromatic perennial tree, *Cinnamomum zeylanicum* Blume, indigenous to Sri Lanka (Senarathne and Dayathilake, 2000). Cinnamon received more emphasis and the highest priority of the Export Agriculture Research Programme since it continued to be the major Export Agriculture Crop (EAC), exporting 13,515.7 mt which earned 13,378.64 million rupees of foreign exchange during 2011 (Source: Sri Lanka Customs, 2011).

One of the major problems in cinnamon nurseries is the limitations in obtaining raw materials for potting mixtures, especially top soils. Although top soil is a component in recommended nursery potting mixture, sub soil is used instead of top soil due to difficulties in obtaining top soil. When top soil is removed, it causes on site soil degradation. As a result of poor quality nursery mixtures without top soil, seedlings do not attend standard level required for transplanting due to low fertility level of sub soil used. Therefore, the present study was carried out to evaluate the possibility of substituting top soil by sub soil enriched with vermi compost as a potting mixture for cinnamon seedlings.

### Methodology

A pot experiment was carried out at the division of Soil and Plant Nutrition, Cinnamon Research Station, Palolpitiya, Thihagoda and in the WL2 agro ecological region. For the experiment seven different potting mixtures such as top soil: coir dust: cow dung: coarse sand (1:1:1:1) (T1) (control), sub soil: coir dust: cow dung: coarse sand (1:1:1:1) (T2), sub soil: vermi compost (10:1) (T3), sub soil: vermi compost (8:1) (T4), sub soil: vermi compost (6:1) (T5), sub soil: vermi compost (4:1) (T6) and sub soil: vermi compost (2:1) (T7) were used as different treatments with four replicates. The polythene bags (250 gauges) of 13X 20.5 cm were used to fill potting mixtures. Seeds were sown in the prepared bags. Eight seeds were grown per bag at same depth of 1 cm. Seeds were covered with a thin layer (1/2") of relevant nursery mixture.

Germination percentage was recorded from two weeks after planting up to seven weeks. Numbers of leaves per plant, plant height, shoot length, root length, shoot dry weight; root dry weight and root volume were recorded monthly up to three months. To determine soil physical and chemical properties, the top soil, sub soil, vermi-compost and initial potting mixtures were air dried and sieved through from 2 mm sieve and mixed. The pH was measured using pH meter fitted with a glass

electrode [soil: water, 1:2.5(v/v) ratio]. The EC was measured in EC Meter. Organic carbon was measured using Walkley and Black method (Walkley and Black, 1934). Total N was determined using Kjeldahl method and the available P was by the Olsen method (Olsen, 1954). In addition exchangeable K was measured using ammonium acetate extraction method.

Furthermore bulk density was determined using the core method and porosity was estimated using bulk density. Macro porosity was estimated by using as the amount of water drained from saturation to field capacity where field capacity was measured as the water content at negligible drainage after saturation. The data were analyzed using ANOVA with MSTAT-C statistical software package. Least significant difference (LSD;  $P = 0.05$ ) values was used for comparisons of treatment means.

### **Results and Discussion**

All the treatments achieved 50% germination, within the period of three weeks after planting (WAP). Throughout the period of data collection, the lowest germination percentage was shown by T2 potting mixture. At the 6th WAP, all the treatments showed over 90 % germination. Significantly greater ( $P < 0.05$ ) plant height was recorded in plants grown in potting mixture of topsoil: cow dung: coir dust: coarse sand (1:1:1:1) (T1) followed by potting mixtures sub soil: vermi compost (4:1) T6 and sub soil: vermi compost (2:1) T7 at 2nd month after planting (MAP). Significantly greater ( $P < 0.05$ ) plant height was recorded in plants grown in potting mixture of sub soil: vermi compost (2:1) T7 followed by potting mixture topsoil: cow dung: coir dust: coarse sand (1:1:1:1) (T1) at 3rd MAP. The lowest plant height was recorded with the plants containing subsoil: cow dung: coir dust: coarse sand (1:1:1:1) (T2) potting mixture.

The highest and lowest values of number of leaves per plant were shown in plants grown in potting mixture containing sub soil: vermi compost (2:1) T7 and sub soil: coarse sand: cow dung: coir dust (T2) respectively. Significantly higher ( $P < 0.05$ ) root volume of cinnamon seedlings was recorded in potting mixture containing topsoil: cow dung: coir dust: coarse sand (1:1:1:1) (T1) followed by potting mixture containing sub soil: vermi compost (2:1) T7. T7 potting mixture containing sub soil: vermi compost (2:1) had shown the highest shoot length and on the other hand plants grown in potting mixture containing sub soil: coarse sand: cow dung: coir dust T2 had shown the lowest shoot length.

Plants grown in potting mixture T6 and T7 recorded significantly higher dry shoot weight compared to the control (T1) at 2nd MAP. Cinnamon plants grown in potting mixture containing sub soil: vermi compost (2:1) T7 recorded significantly higher ( $P < 0.05$ ) shoot dry weight followed by plant grown in potting mixture of top soil: cow dung: coir dust: coarse sand (1:1:1:1) T1. Plants grown in potting mixture containing sub soil: cow dung: coir dust: coarse sand (1:1:1:1) T2 was recorded the lowest shoot dry weight at 2nd MAP and 3rd MAP.

Plants grown in potting mixture containing sub soil: vermi compost (2:1) T7 and sub soil: vermi compost (4:1) T6 were significantly higher root dry weight compared to the control (T1) at 2nd MAP. Significantly higher ( $p < 0.05$ ) dry root weights were recorded in cinnamon plants grown in potting mixture containing sub soil: vermi-compost (2:1) T7 and sub soil: vermi compost (4:1) T6 followed by plants grown in potting mixture of top soil: cow dung: coir dust: coarse sand (1:1:1:1) T1. The lowest dry root weight was recorded plants grown in potting mixture containing sub soil: cow dung: coir dust: coarse sand (1:1:1:1) T2.

In initial soil and vermi compost analysis the amount of Total N, Av. P, Ex. K, OM, pH and electrical conductivity (EC) in top soil were higher many times than sub soil. Vermi 3 compost had highest amount of Total N, Av.P, Ex. K, OM, pH and EC. Therefore mixing of vermi compost can enrich N, P, K, and OM of sub soil (Table 01).

Table 01: Chemical properties in soil and soil type

Soil Type	Parameter					
	Av. P (mg kg <sup>-1</sup> )	Ex. K (kg ha <sup>-1</sup> )	OM %	pH	EC (dS m <sup>-1</sup> )	
Top soil	0.50	54.53	387.08	5.744	5.78	0.07
Sub soil	0.33	3.32	133.60	0.929	4.96	0.03
Vermi compost	0.90	673.06	4139.85	40.585	6.57	0.56

In initial potting mix analysis, the highest amount of Av. P, Tot. N, Ex. K, OM, pH and EC was presented in sub soil: vermi compost (2:1) T7 potting mixture among the other potting mixtures. The lowest bulk density was noted in potting mixture consisted with sub soil; vermi compost (2:1) T7. Increased rates of vermi compost reduced the bulk density of potting mixtures. The highest porosity and macro porosity were recorded in T7 potting mixtures compare to other treatments.

The highest values for the growth parameters (plant height, shoot length, number of leaves per plant, dry shoot weight, dry root weight ) were shown in potting mixture consist with sub soil: vermi compost (2:1 by weight) T7. This might be due to the better physical and chemical properties of the potting mixture.

## Conclusion

The T7 treatment where sub soil+ vermi compost (2:1) was more favorable as potting mixture than others. The results revealed that T7 treatment can be used as a potting mixture for cinnamon nurseries instead of top soil: cow dung: coir dust: coarse sand (1:1:1:1) T1. As top soil is limiting, cinnamon growers can use sub soil enriched vermi compost as an alternative to top soils for nurseries.

**References**

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Table 01: Chemical properties in soil and soil type

Soil Type	Parameter				
	Tot. N %	Av. P (mg kg <sup>-1</sup> )	Ex. K (kg ha <sup>-1</sup> )	OM %	pH
Top soil	0.20	24.51	387.08	2.744	2.78
Sub soil	0.33	3.32	133.60	0.920	4.96
Vermi compost	0.90	673.06	4139.82	40.382	6.27

In initial potting mix analysis, the highest amount of Av. P, Tot. N, Ex. K, OM, pH and EC was recorded in sub soil; verm compost (2:1) T7 potting mixture among the other potting mixtures. The lowest bulk density was noted in potting mixture consisted with sub soil; verm compost (2:1) T7. Increased rates of verm compost reduced the bulk density of potting mixtures. The highest porosity and micro porosity were recorded in T7 potting mixtures compare to other treatments. The highest values for the growth parameters (plant height, shoot length, number of leaves per plant, dry shoot weight, dry root weight) were shown in potting mixture consist with sub soil; verm compost (2:1 by weight) T7. This might be due to the better physical and chemical properties of the potting mixture.

**Conclusion**

The T7 treatment where sub soil+ verm compost (2:1) was more favorable as potting mixture than others. The results revealed that T7 treatment can be used as a potting mixture for cinnamon nurseries instead of top soil, cow dung, cori dust, coarse sand (1:1:1) T1. As top soil is limiting, cinnamon growers can use sub soil enriched verm compost as an alternative to top soils for nurseries.