Impact of Spacing and Type of Planting Material on Dry Matter Percentage in Cinnamon Bark: At the Stage of First Harvest

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ABSTRACT

Cinnamomum verum J. Presl (cinnamon), is an evergreen aromatic plant with several uses and considered as a prominent spice throughout the world. Most familiar product of cinnamon is quills, produced by peeling and rolling the bark pieces in to a pipe like structure. Dry mater content in cinnamon bark is a determinant factor of income since weight of quills mainly depends on it. If the dry matter content in cinnamon bark can be increased, returns from cinnamon exports can be increased as well. Therefore, this study was aimed at identifying the effect of spacing and type of planting material on dry matter percentage in cinnamon bark at the stage of first harvest. Seedlings and vegetatively propagated plants of cinnamon variety Sri Gemunu were planted under three different spacings as 1.2×0.6 m with three plants per hill, 1.2×0.4 m with two plants per hill and 1.2×0.2 m with one plant per hill as two factor factorial RCBD at the Faculty of Agriculture, University of Ruhuna, Sri Lanka. First harvest was collected after two years from establishment and quills were produced with support of skilled cinnamon peelers. Weight of quills per plant was measured after air drying for three days and dry matter percentage in bark was determined by oven drying samples to a constant weight. The results revealed that the mean dry matter percentage in bark of cinnamon seedlings (37.84%) was significantly higher ($P<0.05$) than the mean dry matter percentage in bark of vegetatively propagated plants (31.69%). The mean quill weight per cinnamon seedling (45.93 g) was significantly higher ($P<0.05$) than the mean quill weight per vegetatively propagated plant (28.40 g). Interaction effect between spatial pattern and planting material was not significant for both bark dry matter percentage and weight of quills per plant. A moderate correlation between cinnamon bark dry matter percentage and quill weight was observed at the stage of first harvest ($r = 0.429$, $p = 0.036$) according to the Pearson's correlation test. Findings of the current study can be used for further studies.

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INTRODUCTION

Cinnamomum Verum J. Presl, commonly known as cinnamon, is a world recognized spice crop belongs to the family Lauraceae. Sri Lanka contributes to about 60 – 70 % international cinnamon trade (Rajapakshe, 2011), hence the largest cinnamon exporter in the world. However, the economic returns are much lower than potential because of the low productivity of cinnamon cultivations (Samaraweera, 2011).

Unlike most of the crops, cinnamon has a unique harvestable part, the bark. The bark is peeled from the stem and produce a pipe like product by connecting several parts of those bark pieces to make a quill of standard length, which is the main primary product of cinnamon. Price of the quills is determined mainly by the weight and the quality. Therefore, factors influencing quill weight and quality should be optimized to fetch a considerably higher market price.

Dry matter percentage in the bark is a major factor affecting the quill weight because moisture content is reduced to about 10% during the process. (Dayananda *et al*., 2003). Therefore, dry matter percentage in cinnamon bark should be enhanced in order to increase the quill weight. Hence, dry matter accumulation in the bark under different conditions should be studied to identify the optimum conditions for increasing dry matter percentage in cinnamon bark.

In perennial crops like cinnamon, dry matter accumulation in different plant parts vary with the age of the plant. To have an overall idea about the behavior of dry matter accumulation in bark throughout time, studies should be done from the stage of first harvest.

Therefore, current study was conducted to identify the influence of spacing and type of planting material on dry matter percentage in cinnamon bark at the stage of first harvest.

MATERIALS AND METHODS

The study was conducted at the Faculty of Agriculture, University of Ruhuna, Sri Lanka. The area belongs to the low county wet zone (WL_2) which receives more than 2,500 mm annual average rainfall. A flat land was selected and raised beds were prepared after initial land preparation.

Healthy seedlings and vegetatively propagated plants of cinnamon variety Sri Gemunu were established according to three special patterns as 1.2×0.6 m with three plants per hill, 1.2×0.4 m with two plants per hill and 1.2×0.2 m with one plant per hill. Four middle trees from the middle row from every treatment were used to take measurements.

All the plants were maintained according to the recommendations of the Department of Export Agriculture and after two years from the establishment, stems were harvested 10cm above ground level. The bark was peeled off with support of skilled cinnamon peelers and representative samples were taken from each harvested plant. Sample were sealed separately in polythene bags to prevent moisture loss and fresh weight was recorded as soon as possible. The samples were oven dried at 105 ^{0}C to a constant weight and dry weights were measured after cooling to room temperature in a desiccator. Following simple formula was used to calculate the dry matter percentage in bark samples.

Cinnamon quills were prepared separately for each plant by skilled peelers and weight of quills were measured after air drying for three days. Pearson's correlation test was used to determine the correlation between bark dry matter percentage and weight of quills at the stage of first harvest.

The experiment was conducted using two factor factorial (three spatial patterns and two planting material types) Randomized Complete Block Design (RCBD) with four replicates. Collected data were statistically analyzed using ANOVA and the means were separated by Duncan's Multiple Range Test (DMRT).

$$\text{Dry matter percentage in bark} = \frac{\text{Dry weight of the bark sample}}{\text{Fresh weight of the bark sample}} \times 100$$

RESULTS AND DISCUSSION

Mutual shading is a major factor affecting the bark yield of cinnamon grown under full sunlight as a mono crop. Changes occurred in light quantity and quality due to mutual shading affect the dry matter production and distribution of the plant (Pathiratna, 2007). Hence, dry matter percentage in bark can be affected by the mutual shading. Though mutual shading can be easily changed by altering the plant density, it also can be changed by altering the pattern of plant distribution (spatial pattern) without changing the plant number.

Genetic potential can be identified as another factor affecting the dry matter percentage in cinnamon bark. Though cinnamon is largely propagated by seeds, favorable characters can't be preserved due to the cross-pollinated nature of the plant. Hence, vegetative propagation has been introduced as a promising technique to protect the genetic potential of cinnamon plants.

The study was conducted to evaluate the impact of spatial pattern and planting material on dry matter percentage in cinnamon bark.

According to the results, the impact of interaction effect between spatial pattern and planting material was not significant ($p < 0.05$) for the bark dry matter percentage of cinnamon while the type of planting material showed a significant impact ($p < 0.05$) at the stage of first harvest (Figure 1).

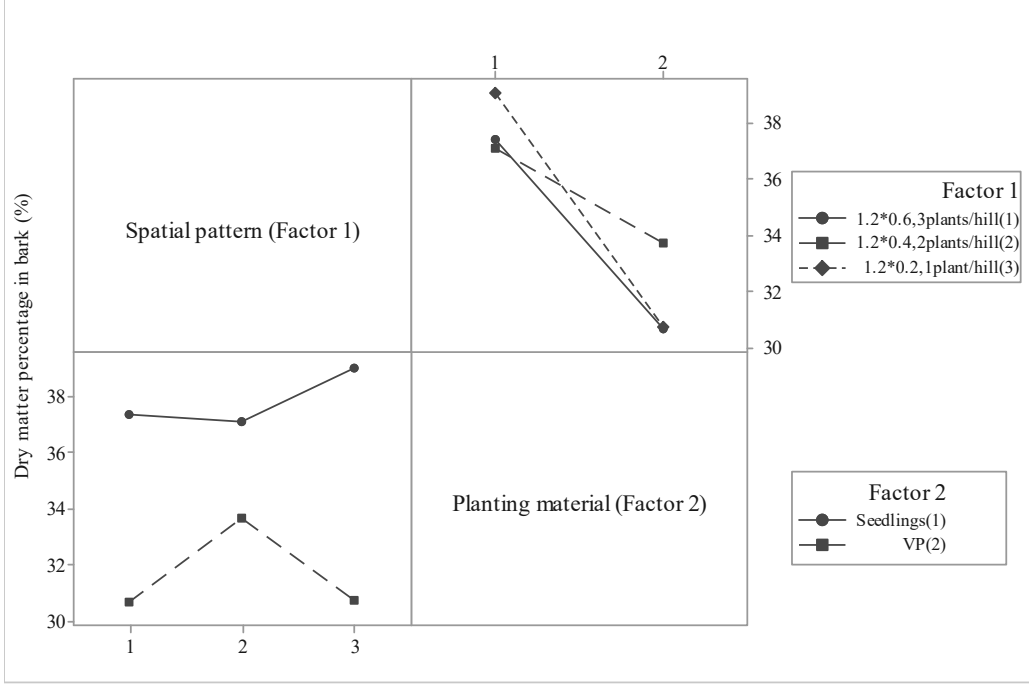

Figure 1: Interaction effect between spatial pattern and planning material for the dry matter percentage in Cinnamon Bark.

The results revealed that the mean dry matter percentage in bark of cinnamon seedlings (37.84%) was significantly higher ($P<0.05$) than the mean dry matter percentage in bark of vegetatively propagated plants (31.69%) (Figure 2).

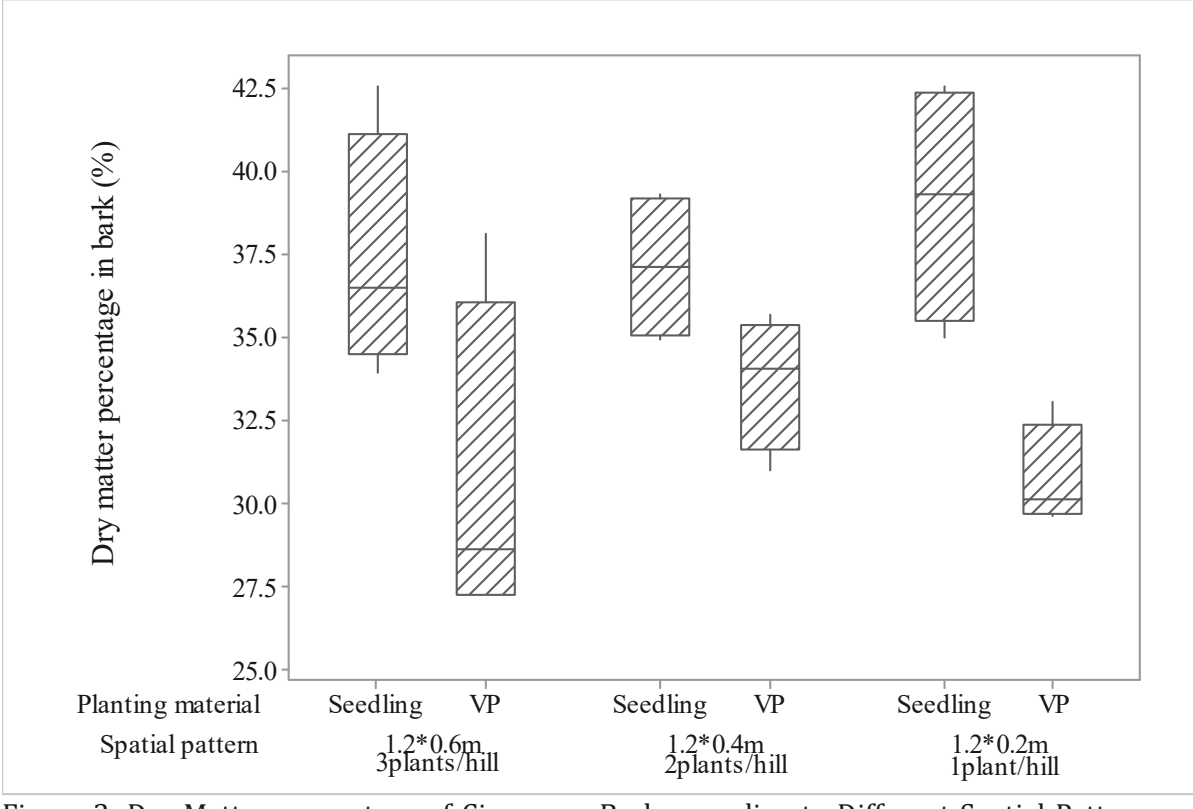

Figure 2: Dry Matter percentage of Cinnamon Bark according to Different Spatial Pattern and Planting Material Combinations.

When considering the results, though vegetatively propagated plants have a higher yield potential, seedlings tend to accumulate more dry matter content in the bark than vegetatively propagated plants at the stage of first harvest. Hence, it can be decided as vegetatively propagated plants require more time to reach the maximum potential yield than seedlings.

Dry matter percentage in bark directly influence the cinnamon yield as the main end product (cinnamon quills) been marketed after air drying which reduce the moisture level about to 10%. Therefore, the impact of spatial pattern and planting material on weight of quills produced per cinnamon plant was evaluated.

Same as the dry matter percentage, only the impact of planting material was significant for weight of quills per plant ($p < 0.05$). The mean quill weight per cinnamon seedling (45.93 g) was significantly higher than the mean quill weight per vegetatively propagated plant (28.40 g) according to the results (Figure 3).

Since both dry matter percentage and quill weight per plant were significantly higher in cinnamon seedlings while significantly lower in vegetatively propagated plants, the correlation between bark dry matter percentage and quill weight was evaluated (Figure 4). According to the Pearson's correlation test there was a moderate correlation between bark dry matter percentage and quill weight at the stage of first harvest ($r = 0.429$, $p = 0.036$).

Rate of dry matter accumulation in different plant parts vary with the age of the plant. Perennial crops allocate more dry matter

content to vegetative growth at early stages of life while focus on producing more reproductive organs at latter stages. When the dry matter percentage in bark vary with age, its influence over quill weight also can be varied. Hence the correlation between bark dry matter percentage and quill weight can be varied with the time.

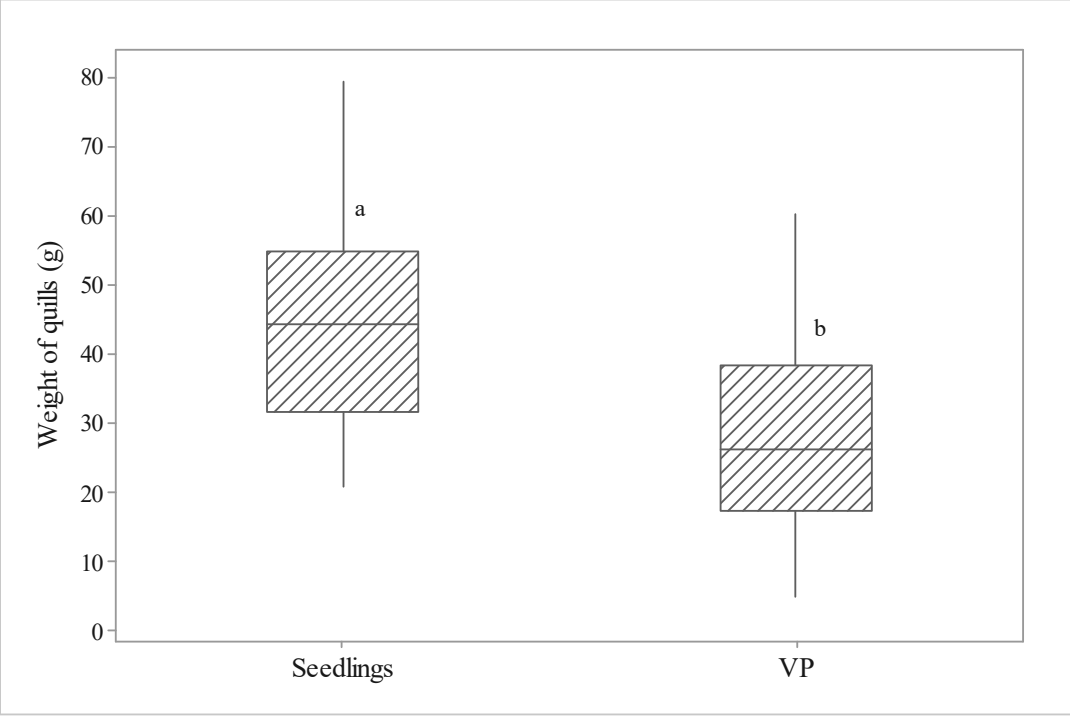

Figure 3: Impact of Planting Material on Weight of Quills per Cinnamon Plant.

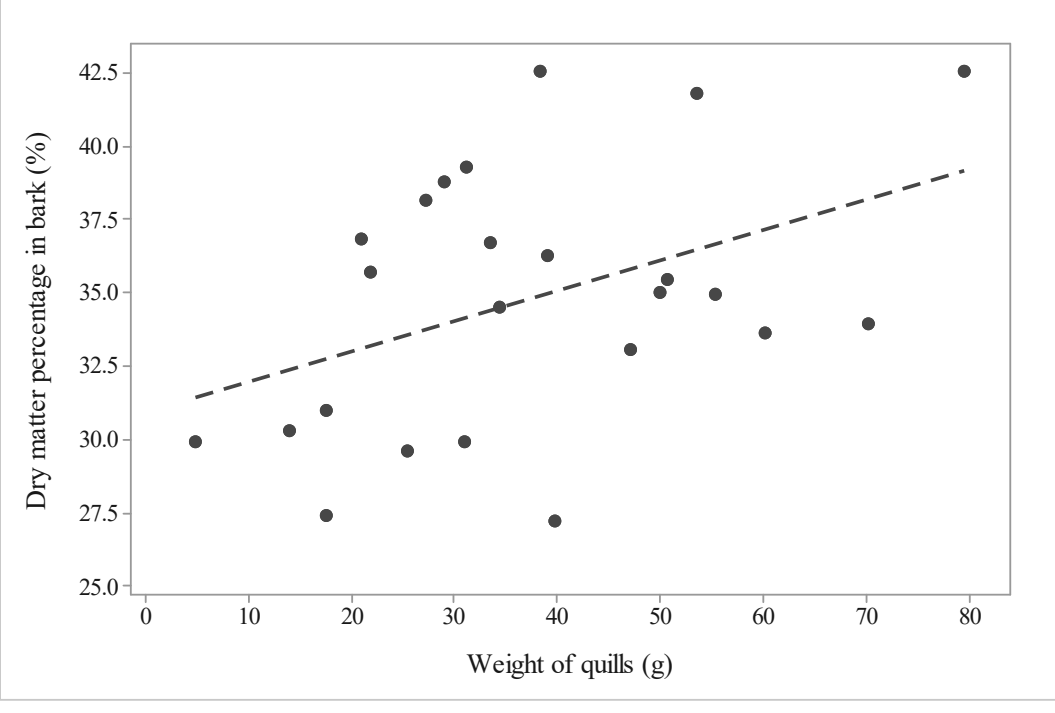

Figure 4: Correlation between Dry Matter percentage in Bark and Weight of Quills per Plant at the Stage of First Harvest.

CONCLUSION

The results revealed that, the type of planting material has a significant impact over bark dry matter percentage of cinnamon and weight of quills per plant at the stage of first harvest. At the same time influence over quill weight from bark dry matter content at the stage of first harvest is moderate and positive. Further studies should be conducted to find out the impact of spacing and type of planting material on dry matter percentage in cinnamon bark and influence over quill weight from bark dry matter content over time. Findings of the current study can be used for further productivity enhancement studies of cinnamon.

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