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Short communication

A modified line intersect technique to estimate root distribution of durian trees

(Teknik garis bersilang terubahsuai untuk mengukur taburan akar durian)

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Key words : line intersect, root length density, durian

Abstrak

Corak taburan akar durian yang berumur 3 tahun telah dikaji dengan menggunakan teknik garis bersilang terubahsuai. Keputusan mendapati bahawa lebih kurang 60% daripada jumlah kepadatan akar terletak di kawasan 60 cm dari pangkal pokok dan 0-30 cm dari permukaan tanah. Teknik ini didapati sesuai untuk perakaran cetek kerana kesukaran mengambil contoh tanah pada kedalaman lebih daripada 90 cm.

Abstract

The root distribution pattern of 3-year-old durian trees was estimated using the modified line intersect technique. Results showed that about 60% of the total root length density were located within 60 cm from the crown and 0-30 cm from the soil surface. This technique is practical for rooting depths of less than 90 cm due to difficulties in soil sampling at deeper soil depths.

Introduction

Information on root distribution patterns of durian (*Durio zibethinus* Murr.) is important for the formulation of efficient cultural practices such as irrigation and fertilizer management. Therefore, a significant effort has to be made to study and characterize the root distribution patterns of this crop. However, research information on root distribution patterns were relatively limited due to the difficulties involved in the studies. The basic problem is to find a suitable technique that permits the study of root system *in situ.*

Another drawback is that, most of the root studies thus far used root weight and number as indicators. Root weight and number may not signify the actual root activity which is directly related .to the surface area or total length of actively growing root portions (Reicosky et al. 1970). Therefore, root length may be a more appropriate indicator for estimating root distribution.

Newman (1966) derived a formula, $R = \pi NA/2H$, for estimating the total root length in an extracted sample. Root length (R) was measured by counting the number of intercepts (N) of roots in a regular area (A) with randomly located and oriented lines of total length (H). In principle, the longer the root, the more intercepts it made with the randomly arranged lines. Marsh (1971) modified Newman's (1966) formula and simplified the relationship to $R = 11N/14$ for a grid of indeterminate dimension,

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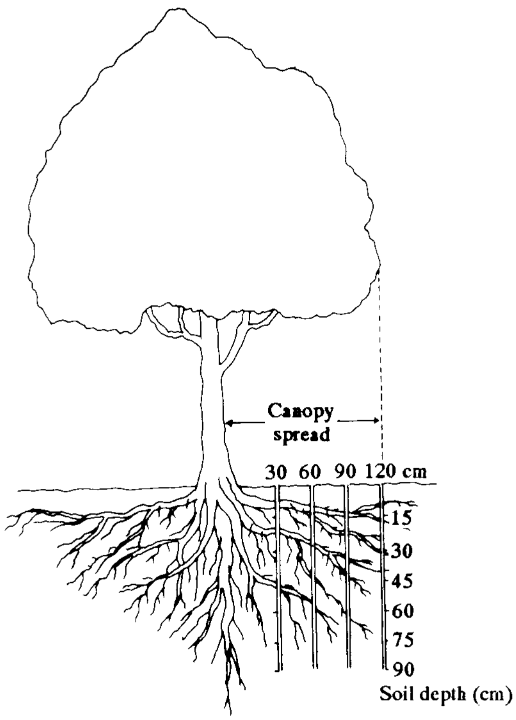

Figure 1. Locations of points relative to the crown of durian tree where root samples were taken at 15-cm depth increments

where *N* comprised all intercepts of roots with the vertical and horizontal grid lines. Later, Tennant (1975) tested and verified Marsh's (1971) formula. This study was conducted to determine the distribution of durian roots using the modified line intersect technique as described by Tennant (1975).

Materials and methods

Four durian trees of clone D 24 were randomly selected from a population of trees at MARDI Station, Seberang Perai. The trees were about 3 years and had a crown size of 23-27 cm. The planting distance is 10 m x 10 m and the soil type, sandy clay loam. For each selected tree, point intervals of 30 cm were marked from the crown to the end of the canopy perpendicular to the tree rows. At each of these points, core samples were taken at 15-cm soil depth increment until 90-cm depth using an aluminium tube of 5 cm in diameter *(Figure 1)*.

The samples (soil + roots) were then washed using a sieve to separate the roots from the soil. Live roots of less than 0.5 cm in diameter were collected and suspended on a fine nylon mesh. The evenly distributed roots on the nylon mesh were then placed over a plastic sheet with a 1-cm square grid lines. The number of times that the roots intersected the vertical and horizontal lines of the grid was then counted.

Root length was estimated by multiplying the total number of vertical and horizontal intersections by a conversion factor of 0.7857 (Tennant 1975). The root length per unit volume of soil or root length density (centimeters per cubic centimeter) was then estimated by dividing the root length by the volume of soil in each core sample.

Results and discussion

The root length density (RLD) per soil core was found to decrease in the horizontal direction from the crown and with soil depth *(Figure 2)*. It was noted that RLD was higher near the soil surface and decreased at deeper soil depths. Similarly, high RLD was found near the crown and became sparse as the distance from the crown increased towards the end of the canopy. It was estimated that about 60% of the total RLD were concentrated within 60 cm from the crown and 0-30 cm from the soil surface.

Similar results of higher root concentrations at the top of soil surface and near the crown were also observed in other crops. Pattern et al. (1988) found that 90% of RLD of blueberry were located within 0-45 cm from the soil surface. About 70% of root dry weight of apple were found within 0-30 cm soil depth. In cocoa, 60% of root number occupied the top 0-30 cm from the soil surface (Mohd. Noh 1985). Similar results of higher concentration of roots near the crown were also reported in

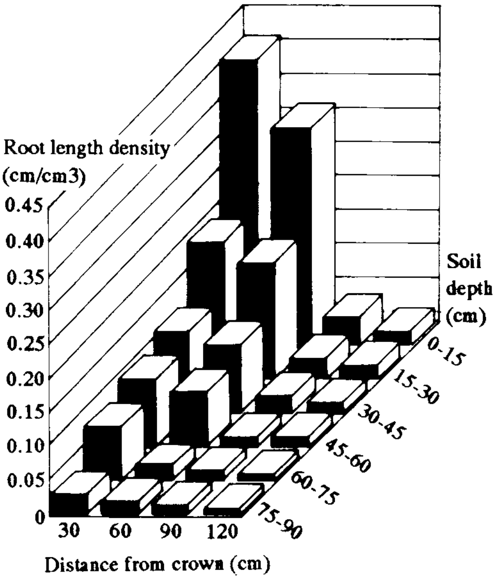

Figure 2. Vertical and horizontal root length density distribution of 3-year-old durian trees

blueberry (Pattern et al. 1988) and cocoa (Mohd. Noh 1985). In both blueberry and cocoa, there were logarithmic decreases in root density towards the end of canopy.

Conclusion

This study revealed that the modified line intersect technique can be used to estimate the root distribution of durian trees. Results showed that about 60% of the total RLD were located within 60 cm from the crown and 0-30 cm from the soil surface. The main problem encountered was soil sampling at deeper soil depths (more than 90 cm). As such, this technique is practical only for rooting depths of less than 90 cm.

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