EFFECT OF SOIL PHYSICAL PROPERTIES ON GROWTH AND ACTIVITY OF COCONUT (*Cocos nucifera* L.) ROOTS

By

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ABSTRACT

Soil physical properties were characterized in relation to growth and activity of coconut (*Cocos nucifera* L.) roots. Soil physical properties were found to be significantly related to coconut yield ($R^2 = 81.37$; $P < 0.01$). Multiple regression with cluster analysis of soil physical properties vs coconut yield enabled classification of soil series into three major groups namely (a) highly (b) moderately (c) less productive series. Soil physical limitations and favourable factors on coconut production were also identified.

Detailed study of soil physical aspects of Andigama and Madampe series with respect to coconut root growth showed that the gravel compacted with clay soil increased root diameter and led to a reduction in root penetration ability. High compaction also reduced the growth of coconut due to low availability and infiltration of water, aeration capacity and nutrient absorption efficiencies.

Study of soil strength of Andigama and Madampe series showed that penetrometer resistance less than 100 N/cm^2, promoted coconut root growth and proliferation.

Coconut root distribution in Andigama and Madampe series showed that 75%-80% of effective root growth of adult coconut palm was localized in a depth range of 20cm to 80 cm. About 5% of roots were beyond 100 cm depth. Neutron probe study also showed that roots localized within 20 cm to 80 cm depth range were more responsible for extraction of more water from the soil profile.

Evaluation of nutrient absorption efficiency of coconut seedlings using lithium as a non-radio active tracer showed that fine roots were more responsible for nutrient absorption than primary roots and absorption efficiency was positively correlated with clay content of soil profiles. However, gravel compacted with high clay in B horizon of Andigama series reduced the absorption efficiency. Translocation and accumulation of lithium was higher in leaves compared to petiole, and collar parts of coconut seedlings.

Soil physical constraints such as compaction, low availability of water and aeration, reduced the ATPase activity and starch-glucose conversion rate resulting in

a retardation of growth.

Scanning electron microscopic study on absorption cells and respiratory organs revealed that (a) soil physical and water stress reduced the cell volume per unit area of absorption zone and the number of openings of respiratory organs affecting water & nutrient absorption and air exchange process. (b) Gravel particles reduced the contact surface area of coconut roots with soil in root-soil interface. Soil physical and water stress were found to induce production of more inactive roots by suberization and dehydration processes.

Soil physical limitations such as moisture status were found to adversely affect the growth and development of coconut. The information generated can be used in formulating land suitability maps for coconut cultivation. Results of land suitability evaluation using soil physical parameters can assist in identifying high potential areas for coconut cultivation.

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