

## Vesicular-arbuscular mycorrhizal symbiosis in coconut (*Cocos nucifera*) in relation to the root (wilt) disease and intercropping or mixed cropping

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Mycoplasma-like organisms are associated with the root (wilt) disease of coconut (*Cocos nucifera* Linn.) (Solomon *et al.*, 1983). Emphasis is now being given on developing suitable management practices to maintain the productivity of diseased palms. Vesicular-arbuscular mycorrhizal (VAM) association is important in the management of coconut palm due to its cultivation in less fertile tropical soils and absence of root hairs in the root-system. The present investigation was aimed to determine the distribution of VAM in root (wilt) diseased and healthy coconut palms and study the influence of inter- or mixed cropping on the endomycorrhizal symbiosis in coconut.

'West Coast Tall' coconut palms (25-30 years old) maintained at the institute were used to compare the VAM status of root (wilt) diseased and healthy palms. Ten palms with the disease index of 0-10% (apparently healthy) and 10 diseased palms with the index of 25-50% (middle stage of disease) were selected. Soil and root samples were collected at a lateral distance of 1 m from the bole of the palm from a depth of 0-25 cm. Palms only in the middle stage of root (wilt) disease were studied to get the information about the diseased palms. To study the effect of crop mixing on VAM symbiosis, 2 plots were selected which were under inter- or mixed cropping for more than 8 years. In plot I, fodder grass

hybrid napier was raised as intercrop in rows at 25 cm distance between the plants and 80 cm between the rows, and milch cows were also maintained as one of the components. In the other plot cacao (*Theobroma cacao* Linn. var. *forastero*) was cultivated under 2 planting patterns; single hedge with 1 row of cacao between coconut and double hedge with 2 rows of cacao in between coconuts. Samples were obtained from 3 depths (0-25, 25-50 and 50-100 cm) at a lateral distance of 1 m from coconut and 0.5 m from intercrops. Samples were collected for each soil depth from basins and interspaces of 6 coconut palms and intercrops in each treatment.

To study the effect of *in-situ* cultivation of green-manure crops in coconut basins, soil and root samples were collected from 4 coconut palms each under the treatment of tropical kudzu [*Pueraria phaseoloides* (Roxb.) Benth.], mimosa (*Mimosa invisa* Mart.) and calapo (*Calopogonium mucunoides* Desv.) along with a control in laterite soil. The green-manure crops were sown in June in basins and samples were collected at the age of 4 months. The number of mycorrhizal spores in soil was determined by wet sieving and decantation (Gerdeman and Nicolson, 1963). The percentage mycorrhizal infection of root was determined after clearing and staining (Phillips and Hayman, 1970).

The diseased palms harboured low population of VA-mycorrhizal spores (209/50 g soil) in their root region than the healthy palms (284/50 g soil). The

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extent of root colonization by VAM was also low (57.2%) in the diseased palms than in the healthy ones (72.8%). The root (wilt) disease therefore had significant adverse effect on the incidence of VAM in coconut palm. The variation on the endomycorrhizal symbiosis could be owing to physiological derangement and damage in the root-system in the root (wilt)-affected palms. Zaidi and Mukerji (1983) also reported low number of mycorrhizal spores in the rhizosphere of diseased plants than of the healthy plants.

Soil samples from coconut basins and interspaces from the plots intercropped with hybrid napier had higher spore counts in surface as well as in deep layers compared with those of monocropping and cacao-mixed plots (Fig. 1). Different modes of cultivation of cacao did not bring about any marked variation in the distribution of any spores in the coconut

basin. The spore populations were 72.3% less at 25–50 cm depth and 83.5% less at 50–100 cm in the coconut basins than at 0–25 cm (surface layer). The degree of mycorrhizal colonization in roots varied with the plant species. The intensity of infection was high in hybrid napier (82.1%) but low (58.7%) in cacao roots. The roots collected from 25–50 and 50–100 cm depths showed 56.0 and 69.1% less infection respectively compared with those from 0–25 cm layer in the coconut basin.

Spore counts varied from 321.2 to 358.8/50 g soil in the coconut basins under green-manure crops compared with 263.8 in the adjoining control plots without green-manure crops in the basins. Similarly, infection in coconut roots in the green-manure treatments was 73.1–78.1% compared with 67.9% in the control. *P. phaseoloides* and *C. mucunoides* were more efficient than *M. invisa* in

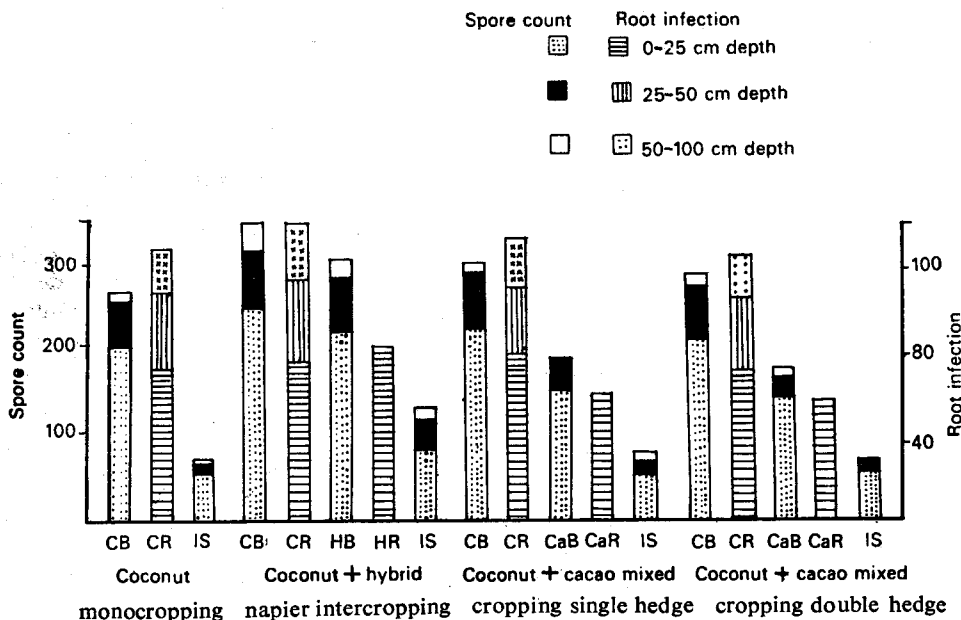


Fig. 1. Vertical distribution of vesicular-arbuscular mycorrhizae in coconut-based monocropping and intercropping or mixed-cropping systems. *Spore count*: CB, Coconut basin; HB, hybrid napier root zone; CaB, cacao basin; IS, interspace soil. Values presented are counts/50 g soil in each soil depth; *Root infection*: CR, coconut roots; HR, hybrid napier roots; CaR, cacao roots. The values presented are percentages of infection in roots in each soil depth

augmenting endomycorrhizal symbiosis in coconut. Ocampo *et al.* (1980) reported the influence of 1 crop on the mycorrhizal association of a neighbouring crop. Our study showed that the endomycorrhizal symbiosis of coconut is adversely affected by the root (wilt) disease. But cultivation of certain crops in the interspaces and basins of coconut palms could improve the mycorrhizal status of coconut.

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