

NOTE

ROOT INVASION OF *PINUS RADIATA* LITTER
IN TRENCHED PLOTS

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ABSTRACT

Buried PVC cylinders were not effective in excluding tree roots from soil and litter in an unthinned *Pinus radiata* D. Don stand growing on pumice soil. Within 8 years roots had entered from a depth of 85 cm and were colonising the litter layer.

Keywords: roots; litter; mycorrhizas; trenching; *Pinus radiata*.

In 1976, nine PVC cylinders, each 1 m deep and 1 m in diameter, were buried between trees in two 2-year-old *Pinus radiata* D. Don stands in the Puruki-rua sub-catchment at Purukohukohu. The catchment lies in the Paeroa Range of the central North Island volcanic plateau. The trees had been established at 2.4×1.8 m spacing and were to remain free of silvicultural treatment throughout the rotation. The object of our experiment was the long-term study of accumulation of litter isolated from the influence of tree roots. The cylinders protruded 15 cm above the soil surface and formed a barrier to lateral growth of roots through the (future) litter layer and through the soil to a depth of 85 cm. At "control" sites (roots present), nine PVC rings, each 15 cm deep and 1 m in diameter, were laid on the soil surface to arrest physical movement of litter. In these rings accumulating litter would be subject to root penetration from the surface soil layers.

After 8 years, accumulated litter enclosed by six cylinders and six rings was removed and the oven-dry weight of the ignitable component was determined (Table 1). Although the mean value for deep cylinders was lower than that for rings, the results were variable and did not show a convincing treatment effect. During removal, mycorrhizal roots were encountered in the litter supposedly isolated from root influence by the deep cylinders. The amount of root material was not measured but was smaller in all the cylinders than in the litter confined by the rings. Excavation showed that roots had entered from below the 85-cm barrier and had grown upwards to explore the soil and litter layer confined by the cylinders.

We had not expected root interference from this depth. Earlier studies (Gadgil & Gadgil 1971, 1975) had shown that regular vertical cutting of plot margins to a depth

TABLE 1—Litter accumulation in a 10-year-old, untended, *Pinus radiata* stand at Purukohukohu

Litter confinement	Oven-dry weight of litter (corrected for loss-on-ignition) (kg/ha)	
	Mean	SD
Deep cylinders	10 990 ±	5645
Surface rings	12 239 ±	2526

of 30 cm in an unthinned 22-year-old *P. radiata* stand was sufficient to reduce root development considerably over a period of 1 year.

Trenching studies in which soil and litter volumes are isolated to a depth of 70 cm or less (e.g., Vitousek *et al.* 1982; Harmer & Alexander 1985) may not maintain treatment specifications, or expectations, over a long period. We cannot recommend a safe depth for trenching studies.

Our observation demonstrates an unexpected soil exploration strategy. The effect of gravity on root growth can clearly be secondary to the stimulus provided by substances present in previously uncolonised soil and forest floor litter.

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REFERENCES

- GADGIL, R. L.; GADGIL, P. D. 1971: Mycorrhiza and litter decomposition. *Nature* **233**: 133.
- 1975: Suppression of litter decomposition by mycorrhizal roots of *Pinus radiata*. *New Zealand Journal of Forestry Science* **5**: 33–41.
- HARMER, R.; ALEXANDER, I. J. 1985: Effects of root exclusion on nitrogen transformations and decomposition processes in spruce humus. Pp. 267–77 in Fitter, A. H.; Atkinson, D.; Read, D. J.; Usher, M. B. (Ed.) "Ecological Interactions in Soil: Plants, Microbes and Animals". Blackwell Scientific Publications, Oxford.
- VITOUSEK, P. M.; GOSZ, J. R.; GRIER, C. C.; MELILLO, J. M.; REINERS, W. A. 1982: A comparative analysis of potential nitrification and nitrate mobility in forest ecosystems. *Ecological Monographs* **52**: 155–77.