

A technique for evaluating root and shoot competition in the field

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Competition from existing vegetation is a major factor limiting the survival of seedlings established by surface sowing and direct drilling methods, but the actual nature of the stresses on plants due to competition is not well understood. Various management techniques aimed at controlling this competition, including burning and heavy grazing, have been only partially successful (1). The reasons for this variable response have not always been apparent largely because the nature of the competition at which the control measures were directed was not known. A technique to measure the relative importance of root and shoot competition between the existing vegetation and establishing seedlings under field conditions was therefore developed (2).

The Technique

The effects of root competition on the growth of green panic (*Panicum maximum* var. *trichoglume*) seedlings in a tussock grassland of native speargrass (*Heteropogon contortus*) were measured by isolating the root systems of some seedlings by steel tubes that had been driven into the soil. This is an extension of the divided pot technique (3) for use under field conditions. The thin-walled (1.8 mm) tubes were driven into the soil when it was moist using a steel post dolly and adaptor. Each tube was left protruding 1 cm above the soil surface and so two vertical slots 0.9 cm deep were cut into the top of each tube to prevent the ponding of water. Steel rings 1 cm high, of the same diameter as the tubes, were placed on the soil surface to identify the control plants.

The effect of shoot competition was assessed by either clipping the native grasses to a height of 5 cm at regular intervals or leaving them unclipped. While clipping may have affected both shoot and root competition, it only increased seedling yields 8-fold compared to the 32-fold increase resulting from the removal of root competition.

The steel tubes successfully isolated the root systems of the seedlings from those of the native grasses provided they extended beyond the major zone of root activity of the grassland vegetation. For the low fertility granite soil used in these (2, 4) studies the major rooting zone was the top 10-15 cm of the soil. The volume of soil in the tubes appeared to limit the growth, after 21 days, of seedlings growing inside tubes of 7.5 cm diameter (2). Subsequently, 10 cm diameter tubes 25 cm deep were shown (4) to create conditions free of root interference, similar to those created by herbicides, for up to 28 days. This restriction in root distribution may limit the duration of experiments involving the larger-growing tropical species such as green panic but may be less important for smaller-growing temperate species.

The technique should be well suited to the study of competition for nutrients under field conditions and also enable a better understanding of the factors affecting seedling regeneration in mature swards. It should also enable the importance of above- and below-ground competition to be determined during such processes as weed invasion into pastures.

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3. Donald, C.M. (1958). *Aust. J. Agric. Res.* 2, 421-4337
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