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An analysis of the effects of field-soil disturbance treatments on arbuscular mycorrhizal fungi.

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Abstract

In soil and root ecosystems the partitioning of carbon is ubiquitously affected by interactions with heterotrophic rhizosphere micro organisms, including the potentially mutually beneficial (+,+) arbuscular mycorrhizal (AM) fungi. However, the existence and sustainable management of AM fungi is threatened by prolonged and or intensive disturbances of soil. Therefore this study set out to explore the relationships between plants, soil fungi and soil disturbance treatments. A containerised bioassay of maize seedlings was used to assess root inhabitation of arbuscular mycorrhizal fungi from samples of Manawatu silt loam pasture field soils, methods were adapted from Brundrett *et al* (1996).

Development of a rapid method to visualise the AM fungal inhabited maize seedling roots was enhanced by an alternative light source on an Olympus SZIII dissection microscope. A 100W-equivalent fluorescent light tube produced less heat, but provided approximately five-fold more illumination than the original 20W Olympus incandescent light bulb.

It was found that propagation of maize seedlings during mid to late winter and greenhouse environments with relatively limited light day-length and irradiance levels may have resulted in *'parasitic'* (+,-) soil-fungal interactions, or reduced growth of maize seedling plant biomass. Soil fungal parasitism of plant growth was attributed to mutual competition (-,-) for carbon photosynthate resources shared between soil fungi and plant host symbionts.

In addition, a Venn-diagram model is proposed with three entities depicting fungal and plant population interactions that include mutual costs and benefits derived from bi-directional exchange of mineral and carbon nutrients as follows; *mutualism* and *proto-cooperation* (+,+); *neutralism* (0,0); and *competition* (-,-). Intersecting sets of these entities depict a three-way continuum of population interactions; *parasitism* or *predation* (+,-), and prey or host *escape* (-,+); *amensalism* (0,- or -,0); and *commensalism* (0,+ or +,0).

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