NON-FUMIGANT MANAGEMENT OF APPLE REPLANT DISEASE IN ORGANIC AND CONVENTIONAL SYSTEMS

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In Washington, apple replant disease is incited by a biological consortia of fungal and oomycete pathogens, and plant parasitic nematodes. Effective employment of an individual organic amendment for control of such a diverse biological complex seems improbable. However, for sites lacking significant lesion nematode populations, *Brassica napus* seed meal provided significant control of replant disease in field trials, but required post-plant application of mefenoxam due to the stimulatory impact of the amendment on resident populations of *Pythium* spp. (Mazzola and Mullinix, 2005). Given the breadth of glucosinolates produced by brassicaceae plant species and the corresponding biological activity of the resulting hydrolysis products, it is likely that an alternative seed meal exists which will not elicit the stimulatory effect on *Pythium* populations observed in response to *B. napus* seed meal amendment. Such a material would be of value in the management of this disease syndrome in organic production systems. Goals of the current study were to conduct field evaluations of brassicaceous seed meal amendments, or combinations thereof, for suppression replant disease in organic and conventional orchard systems.

A field trial was established at CV orchard, Orondo, WA in May 2005. All seed meal treatments when used in conjunction with a post-plant mefenoxam soil drench improved growth of Gala/M26 relative to the control. At 48 months post-planting, tree growth in soils amended with *Brassica juncea* or *Sinapis alba* seed meal and receiving the post-plant mefenoxam drench was equivalent to that attained in Telone-C17 fumigated soil. Mefenoxam alone failed to improve tree growth relative to the non-treated control. When seed meals were used independently, only *Sinapis alba* seed meal provided a growth response significantly greater than the non-treated control, but was inferior to pre-plant soil fumigation. Yields from these trees followed a similar pattern. All seed meal/mefenoxam treatments significantly improved fruit yield relative to the control and were equivalent to Telone-C17 fumigation (Figure 1). In the absence of mefenoxam treatment, only *S. alba* seed meal amendment improved fruit yields. *Pythium* spp. populations typically are elevated in response to *Brassica napus* or *S. alba* seed meal amendments (Mazzola and Mullinix, 2005; Mazzola et al., 2007), and thus the positive effect of mefenoxam treatment on growth of apple in these soils was anticipated. However, *B. juncea* seed meal amendment does not stimulate *Pythium* spp. soil populations or root infection (Mazzola et al., 2009), yet tree growth in these soils was dramatically enhanced by a mefenoxam soil drench. This occurred in response to suppression of root infection by *Phytophthora cambivora* and *Ph. megasperma*, which were detected in roots of every tree cultivated in *B. juncea* seed meal amended soil not receiving a post-plant mefenoxam application.

A field trial was established in the commercial RF orchard, Chelan, WA to assess the utility of a composite seed meal amendment for replant disease control in organic production systems. The composite seed meal treatment was formulated based upon the spectrum of activity towards the pathogen complex that incites replant disease and consisted of material from *B. juncea* and *B. napus*. Seed meal amendments were applied in April 2007 and the site was planted to Gala/M26 apple in June 2007. Seed meal amendment induced suppression of lesion nematode populations to a level equivalent to that attained in response to pre-plant soil fumigation with Telone-C17 (Figure 2). The composite seed meal also suppressed *Pythium* populations in a manner similar to that attained in fumigated orchard soil. At 24 months post-planting, tree growth in soils treated with the composite seed meal amendment was significantly greater than the non-treated control and equivalent to the fumigated check (Fig. 3).

These studies demonstrate that brassicaceous seed meal amendments have potential as a tool for the management of apple replant disease in both organic and conventional production systems. The mechanisms that function in disease suppression differ by seed meal type and will vary with the target pathogen (Mazzola et al., 2007). In addition, in certain instances, apple rootstock may interact with seed meal type to influence the degree of pathogen suppression (Mazzola et al., 2009). The rootstock utilized in these studies (M26) and is highly susceptible to the pathogen/parasite complex that incites replant disease in Washington (Mazzola et al., 2009). In addition, among commercial rootstocks M26 is perhaps the least capable of extracting the benefits from disease suppressive mechanisms induced via seed meal amendments. As such, the positive results obtained in terms of disease control and enhanced fruit yields are highly promising.

References:

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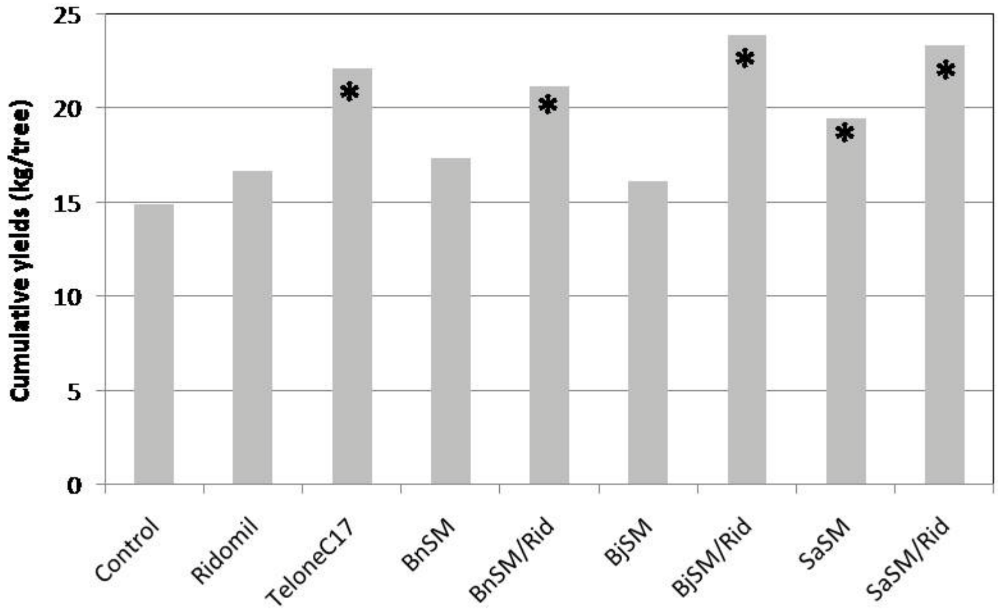

Figure 1. Cumulative yields from Gala/M26 apple established at the CV replant orchard site, Orondo, WA. Bars designated with an asterisk indicate a value significantly (*P*=0.05) different than the non-treated control.

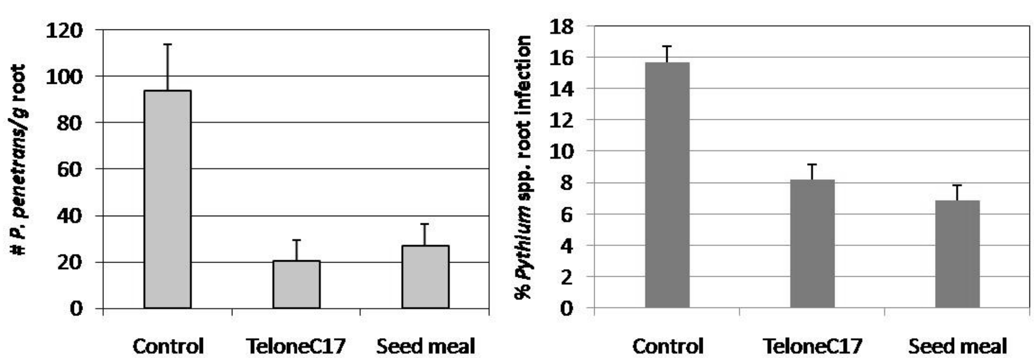

Figure 2. Effect of soil treatments on relative recovery of *Pratylenchus penetrans* (left panel) and *Pythium* spp. (right panel) from roots of Gala/M26 at the RF orchard, Chelan, WA.

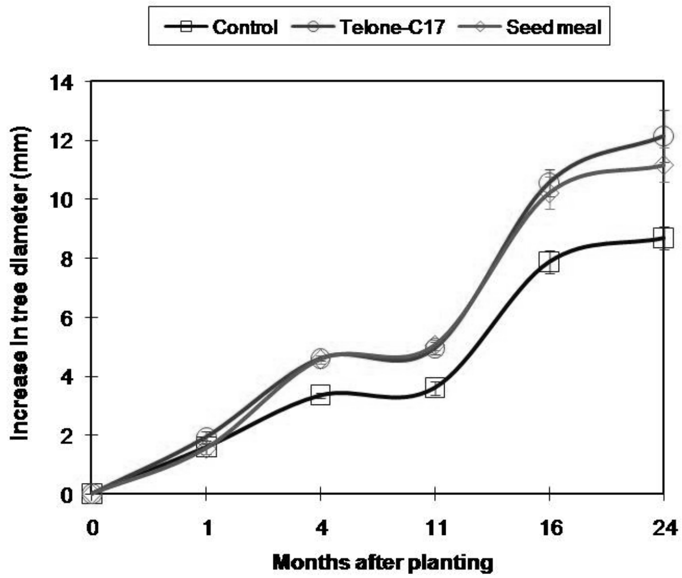

Figure 3. Effect of soil treatment on increase in trunk diameter of Gala/M26 apple at the RF organic orchard, Chelan, WA.