INTEGRATION OF BIOLOGICAL CONTROL FOR MANAGEMENT OF STRAWBERRY ROOT ROT

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INTRODUCTION: Black root rot is a complex disease of strawberry that can reduce plant vigor and productivity (Wing et al, 1994). Several pathogens, including *Rhizoctonia* and *Pythium*, are causal agents of this disease and may be introduced into transplant and field production systems on infested plant material (Abad et al. 2002; Martin, 2000). In addition, *Phytophthora* spp. cause crown rot, root rot, and plant death. In previous strawberry trials, we have routinely isolated several pathogens from root lesions both prior to planting and after field setting. Among the most frequently isolated pathogens were: *Phytophthora cactorum*, *Pythium irregulare*, *Rhizoctonia fragariae*, and *Fusarium* spp. (Ferguson et al. 2003). Pre-plant isolations from both bare-root plants and plugs produced from runner tips showed substantial levels of colonization with damaging soilborne pathogens. Although the use of “disease-free" plants, now made available by the NC certification program, should reduce foliar and fruit diseases, the impact of this program on the root rot complex will be minimal. Currently, management of strawberry root rots relies nearly exclusively on chemicals, particularly fumigation with methyl bromide. In trials conducted in the Southeastern states, up to 25% yield losses can occur if soil fumigation is not used compared to methyl bromide fumigation (Ferguson et al. 2001, 2002). Although we have made substantial progress in developing chemical and compost-based alternatives to MB (Ferguson et al. 2003; Fernandez et al 2000; Louws et al. 2000), infested transplants still present a serious risk to growers even if an alternative fumigant is adopted. Management practices that favor biocontrol activity and reduce the risk of root rot development during the growing season are needed.

The goal of this component of our research program is to develop and implement an IPM system for managing strawberry root rots with emphasis on biological approaches. *Trichoderma* species are well known for their biocontrol activity against soil borne pathogens. We have evaluated the effectiveness of two *Trichoderma* biocontrol strains in suppressing root rot and promoting plant growth and productivity on strawberry.

SUMMARY OF RESEARCH:
Trials were established in Plymouth, North Carolina, in 2002-03 and 2003-04. The experimental design was a split-plot with 4 replications (main plots=field soil treatments; split plot= transplant treatments). Strawberry runner tips were planted in treated potting mix and maintained in a greenhouse for 4 weeks to produce plug transplants. The potting mix was amended with *Trichoderma harzianum* strain T22 (Rootshield®), *Trichoderma hamatum* strain T382, and untreated. Plug transplants were established in field soil in October 2002 and 2003. Field treatments included: field soil amended with compost (cotton gin trash), compost inoculated with T382, fumigant (Telone-C35), and untreated.

In 2002, *T. hamatum* T382 increased plant growth (Fig 1A) but did not affect root rot severity. In 2003, both *Trichoderma* strains reduced root rot severity (Fig 1B). Both Trichoderma strains suppressed pathogens on transplant roots in 2002 (Table 1). Pathogen pressure was too low to detect effects on population density in 2003.

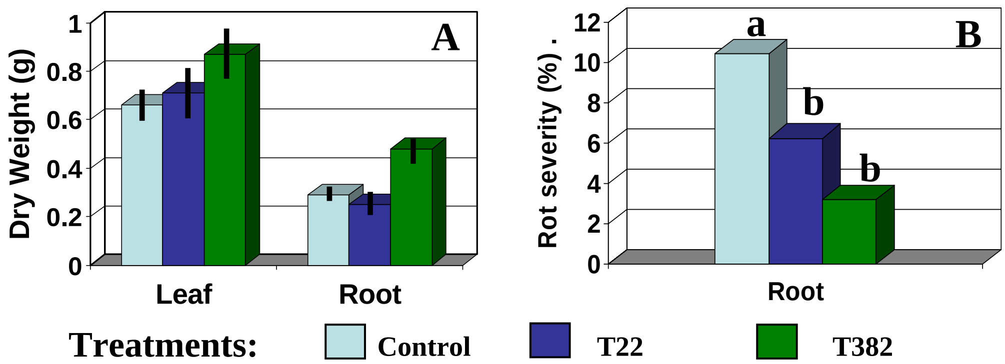

Figure 1. Effects of *Trichoderma* biocontrols on plant growth (A) and root rot (B) of 4-week-old plug transplants.

Results on transplants

Table 1. Percentage of roots of 4-week-old plug transplants from which each fungus was isolated.

Fungus	Diseased Roots			Healthy Roots		
	Control	T22	T382	Control	T22	T382
Trichoderma	36.8	70.0	27.8	41.3	81.8	59.1
Rhizoctonia	0.0	0.0	0.0	0.0	0.0	0.0
Fusarium	5.3	0.0	5.6	13.0	0.0	13.6
Phoma	5.3	0.0	0.0	8.7	0.0	0.0
Pythium spp	57.9	20.0	44.4	32.6	0.0	13.6
P. irregulare	21.6	0.0	11.1	15.2	0.0	4.5
Phytophthora cactorum	36.8	30.0	0.0	13.0	4.5	0.0

Frequency of isolations from untreated runner tips prior to planting was: *Rhizoctonia* (0%), *Fusarium* (50%), *Pythium* (10%), *Phytophthora* (7.5%) and *Trichoderma* (0%).

In the field, *T. hamatum* became established and maintained a stable population in the field throughout the growing season (Fig. 2). Transplant treatments had no significant effect during field production. Fumigation with Telone C35 decreased root rot and stimulated plant growth compared to the compost-based treatments (data not shown).

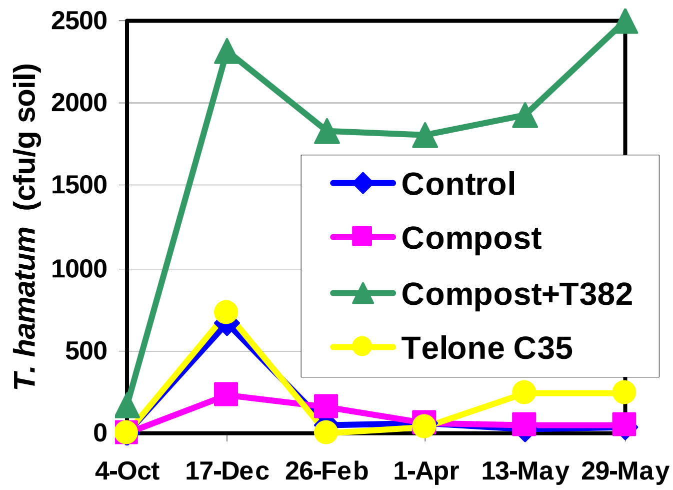

Figure 2: *T. hamatum* population in field soil in 2002-03.

CONCLUSIONS:

Important root pathogens were isolated from strawberry transplants, indicating the risk of pathogen dissemination due to planting into production fields. *Both T. hamatum* T382 and *T. harzianum* T22 reduced root rot severity, improved plant growth, and reduced pathogens on roots during transplant production. *Trichoderma* soil amendments may therefore be beneficial in greenhouse systems. However, transplant treatments effects did not persist in the field. This indicates the importance of effective soil treatments for root rot management in field production systems. *T. hamatum* T382 was successfully established and survived in compost-amended field soil throughout the NC strawberry production season. Although this biocontrol agent showed no beneficial effects in the field, this study reveals the potential use of compost as an effective system to introduce and support stable populations of biocontrol agents in field soil.

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