APPLICATION OF COMMERCIAL BIOCONTROL AGENTS IN FLORIDA'S VEGETABLE TRANSPLANT INDUSTRY

S. Nemec, USDA, ARS, 2120 Camden Road, Orlando, FL 32803; L. Datnoff, University of Florida, Everglades Research and Education Center, P.O. Box 8003, Belle Glade, FL 33430.

The recent introduction into the industry of a number of biological control microflora for control of plant diseases and the concomitant reduction in pesticides for disease control has served as a basis for an intensive evaluation of the effectiveness of biocontrol agents.

Since 1991 commercial formulations of microbial biocontrol agents representing six genera were used in field plots for control of Fusarium crown and root rot of tomato (FCRR) caused by *Fusarium oxysporum* f. sp. *radices lycopersici* and *Phytophthora capsici* crown and root rot of pepper. One experiment evaluated two microbial biocontrol genera for control of celery stalk rot caused by *Rhizoctonia solani* and root rot of celery caused by *Pythium* and *Fusarium* spp.

All biocontrol agents were incorporated into plug mixes and seed planted. Plant production in plug mixes is a standard industry practice in Florida. After 6-7 weeks, tomato and pepper were transplanted to the field; after about 9 weeks, celery was transplanted to the field. Twelve tomato and six pepper experiments were planted, all in sites where root rots have limited production.

FCRR occurred in only a few tests, and incidence was high enough in only two to obtain significant information. In one of these tests, *Glomus intraradices* (G.i.), *Streptomyces griseovirdis* (S.g.), and *Trichoderma harzianum* (T.h.) were used as treatments. Both percent disease incidence and severity of FCRR were significantly ($P = 0.05$) reduced in the *S. griseovirdis* and *T. harzianum* treatments alone and when combined with the *G. intraradices* treatment (G.i. + T.h.; and G.i. + T.h. + S.g.). Large and total number of fruit were greater than the control by as much as 26% in all treatments, but these values were not significantly different. In another experiment in which T.h., G.i, and T.h. + G.i. were used as treatments, G.i. and T.h. + G.i. significantly ($P = 0.05$) reduced disease incidence and severity of FCRR. These treatments also resulted in yield increases. Results from the pepper tests were inconclusive because no disease occurred in them. The treatments *Bacillus subtilis* and *G. intraradices* were used in the celery test; no treatment alone affected root rot nor *Rhizoctonia* petiole rot, but the combination of these treatments significantly ($P = 0.05$) reduced root rot.

In the establishment of vegetable seedlings in plug mixes in Speedling® flats, roots became well colonized by T.h., S.g., and *Bacillus*. Infection of roots by G.i. was about 50% in flats in all tests; however, the establishment of this fungus or other indigenous vesicular-arbuscular mycorrhizal fungi in roots that grew in field plot soils was only about 2%. Any biocontrol benefit derived from G.i. probably occurred early in the tests as a result of infection in the greenhouse, or later as a result of induced resistance from low levels of infection. The establishment of tomatoes, peppers, and other Florida vegetables in plug mixes in greenhouses offers a unique step in their production whereby biological control agents can be introduced to provide a level of increased resistance to root diseases in the field.