FIELD EVALUATION OF NON-FUMIGANT PEST CONTROL FOR FLORIDA STRAWBERRY PRODUCTION

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A field experiment was designed to test the adaptability of anaerobic soil disinfestation (ASD) (Goud et al. 2004) to Florida strawberry production, and to compare it to a novel, non-fumigant chemical treatment previously tested in raised-bed vegetable production. The ASD approach developed for Florida has been successfully implemented by organic and transitional vegetable producers. This technique, which utilizes amendments to facilitate the development of anaerobic soil conditions combined with soil solarization, has provided excellent soilborne pest control in previous trials (Butler et al. 2009; Rosskopf et al., 2010). A newly developed material, referred to as "SPK", also has been tested for the production of vegetable crops and has proven efficacious against nematodes and plant pathogenic fungi, bacteria, and oomycetes. Data from laboratory, greenhouse and microplot trials looking at various rates of this material have been positive (Iriarte et al. 2007).

The first season strawberry field trial was established in October 2010 and included five treatments: an untreated check, two rates of SPK, InLine® (as a commercial standard, Dow AgroSciences, Indianapolis, IN), and ASD. Treatments were replicated four times. The In-Line and SPK applications were performed using a standard drip application system. The data collected included weed incidence, composition and weight, numbers of root-knot nematodes (*Meloidogyne* spp.) and sting nematodes (*Belonolaimus longicaudatus*) isolated from soil and roots, crop growth parameters, incidence of soilborne disease, soil quality parameters, crop yields, and generation of volatile organic compounds. In addition, pathogen packets, containing inoculum of *Fusarium oxysporum* and *Macrophomina phaseolina* were placed in beds either under the drip tape or in the bed middle. Two packets were inserted in each replicated plot. These were recovered, plated onto selective media, and survival quantified.
Generation of volatile organic compounds (VOCs) was monitored immediately after treatment, 24 hours, and one week after treatment. No VOCs were detected in any of the SPK-treated plots.

There was a significant interaction between treatment and packet placement with regard to the fungal inoculum that was placed in the beds prior to treatment. *Fusarium oxysporum* inoculum survival (expressed as log [(cfu/g)+1]) was significantly decreased by both In-Line and ASD treatments when compared to the untreated check regardless of packet placement. In SPK plots, higher mortality occurred in packets that were placed in the bed centers compared to those that were placed to the outside of drip lines toward the bed shoulder. For *M. phaseolina* inoculum, the higher rate of SPK was more effective than the lower rate, and the lowest number of colony forming units survived in the bed center with SPK rate 2 and In-Line. ASD, the non-chemical treatment, was equally effective at eliminating this pathogen in both packet placement locations (Fig. 1).

Parasitic nematode populations were much lower at this location than was anticipated. A site with a higher population of sting nematode has been identified for the repeat of this trial. Although the overall numbers were low, there was a significant difference between the number of sting nematodes in the untreated check and the treated plots immediately after treatment. At harvest, the population had dropped again and few, if any sting nematodes were found in any of the plots.

Strawberry fruit were harvested 23 times based on a 2-3 day schedule using standard commercial procedures. Total weight of fruit was numerically lowest in the UTC and ASD plots; however there were no statistically significant differences among any treatment.

Soil populations of *Fusarium* spp., *Fusarium oxysporum* (Foxy), and *Trichoderma* were monitored throughout the trial. Immediately following treatment application, populations of *Trichoderma* spp., a potentially beneficial fungus, were significantly increased in plots treated with SPK. Late season populations of *Trichoderma* remained high in both SPK treatments and increased in the ASD plots by harvest (Fig. 2). The increase in the native soil population of total *Fusarium* spp. and Foxy in the UTC, which did not occur in any of the other treatments, is particularly important. This resulted in an increase in disease incidence in the UTC, which was higher than all other treatments. Diseased plants were analyzed for causal agent and a mixed infection of Foxy and *M. phaseolina* was found to cause the mortality observed in the field.

REFERENCES

Butler, D.M., E.N. Rosskopf, N. Kokalis-Burelle, J. Muramoto, and C. Shennan. 2009. Field evaluation of anaerobic soil disinfestations in a bell pepper-eggplant double crop. Proc. Annual Int. Res. Conference on Methyl Bromide Alternatives and Emissions Reductions. MBAO, p. 43.1-43.4.

Goud, J.K.C., A.J. Termorshuizen, W.J. Blok, and A.H.C. van Bruggen. 2004. Long-term effect of biological soil disinfestation on Verticillium wilt. Plant Disease 88:688-694.

Iriarte, F.B., Rosskopf, E.N., He, Z., Lin, Y. 2007. In vitro inhibition of soilborne fungi by “SPK”, a novel pesticide. Proc. Annual Int. Res. Conference on Methyl Bromide Alternatives and Emissions Reductions. MBAO, p. 108.1-108.2.

Rosskopf, E.N., Butler, D.M., Kokalis-Burelle, N., Muramoto, J., and C. Shennan. 2010. Development of anaerobic soil disinfestation for Florida vegetable and flower production. Proc. Annual Int. Res. Conference on Methyl Bromide Alternatives and Emissions Reductions. MBAO, p. 84-1-84.2.

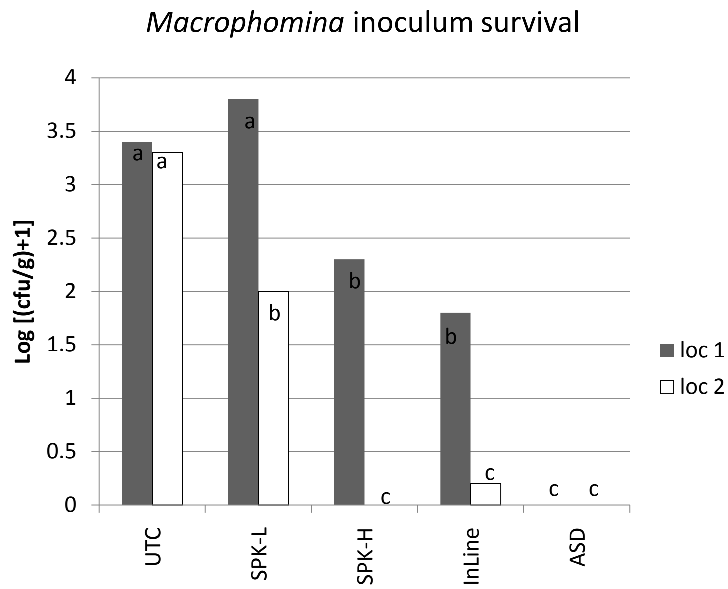

Figure 1. Survival of introduced inoculum of *Macrophomina phaseolina*. Packets were in the bed shoulder (loc 1) and at the bed center between the drip lines (loc 2). Survival is expressed as log [(fungal colony forming unit (cfu)/g soil) +1]. Bars with the same letter are not significantly different based on Fisher's protected LSD (0.05).

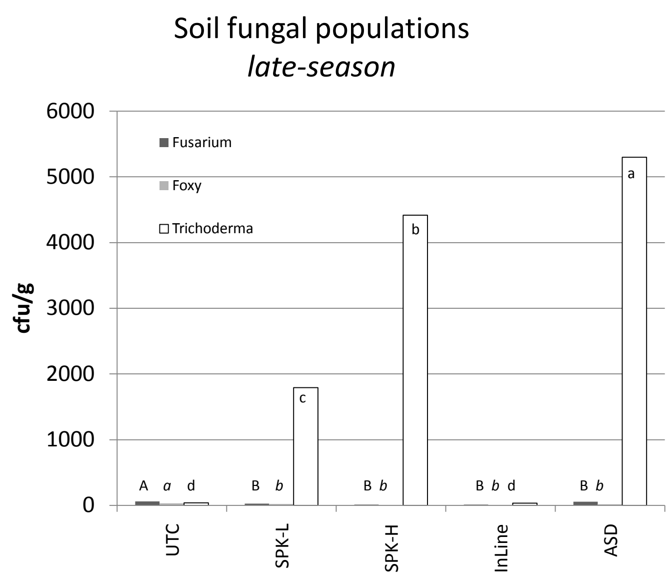

Figure 2. Late season native soil fungal populations expressed as colony forming units/g soil. Foxy represents *Fusarium oxysporum*. Bars within an organism category with the same letter are not significantly different based on Fisher's protected LSD (0.05).