DEVELOPMENT OF ANAEROBIC SOIL DISINFESTATION FOR FLORIDA VEGETABLE AND FLOWER PRODUCTION

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Anaerobic soil disinfestation (ASD) combines biological soil disinfestation (Blok *et al.*, 2000; Goud *et al.*, 2004) and soil reductive sterilization (Shinmura, 2004). The development of an ASD system for Florida incorporated soil solarization with clear plastic (Ginegar Plastic Products, Ltd. Israel) with the addition of a labile carbon source and flooding to create elevated soil temperatures and anaerobic soil conditions to stimulate microbial activity. In order to increase the water holding capacity of the sandy Florida soil, composted broiler litter (Boyd Brothers Inc., Branford, FL) was also incorporated into the system, as was the utilization of a local carbon source, heavy blackstrap molasses (Westway Feed Products, Inc., Clewiston, FL).

Two years of field trials have been conducted in a bell pepper, eggplant double crop using typical Florida raised-bed vegetable production system. Untreated (UTC) and methyl bromide (MeBr) controls were included in both years. Soil temperature, soil moisture, and soil anaerobicity were monitored continuously during the ASD treatment. Inoculum packets were introduced prior to ASD establishment to determine treatment impacts on survival of *Phytophthora capsici*. Soils were sampled before initialization of the experiment and periodically during the season to determine treatment impacts on soil pH, soil nutrients, soil physical properties, and nematodes. Following ASD treatment, bell peppers (*Capsicum annuum*) were planted in Sept. 2008 and eggplant (*Solanum melongena*) in Feb. 2009. Plots were regularly evaluated for treatment impacts on weed control, root galling caused by root-knot nematode, and crop growth and productivity.

Microplot trials were also conducted in two locations using a factorial combination of treatments consisting of composted poultry litter, three levels irrigation, and two types of clear solarization tarp (standard polyethylene clear, 15 µm (Polydak, Ginegar Plastic Products, Ltd.) or clear totally impermeable film, 35 µm (TIF; Mitsui Plastics, Inc.). Inoculum packets of *Sclerotium rolfsii* and *Verticillium albo-atrum*, root knot nematode eggs, and seeds of smooth pigweed (250 seeds m^{-2}), large crabgrass (2,000 seeds m^{-2}), and sicklepod (50 seeds m^{-2}) were added to the microplots prior to treatment initiation. Three soil cores (1.75-cm-internal diameter) were taken from each plot to a 30-cm depth (1) prior to ASD treatment, (2) immediately following ASD treatment prior to crop establishment, and (3) at the initiation of harvest. Soil cores were combined by plot, and a subsample was used to extract nematodes. Nematodes were identified as root-knot, other parasitic, or free-living and counted using an inverted microscope.

In the 2008 field trial, the cumulative redox potential was numerically greater in poultry litter amended plots (Butler et al., 2009) although not statistically significant. In 2009, the combination of litter and molasses resulted in a much higher redox potential than the solarization alone and overall all ASD treatments were numerically higher than the previous year. This increase may be indicative of a shift in the microbial community as well as the potential contribution of additional carbon resulting from root residues from the previous season. Soil heating resulting from the use of solarization was greater in 2008 than in 2009, but in both years, temperatures that would be lethal to nutsedge tubers were not reached. Most ASD treatments provided nutsedge control that was significantly better than solarization alone, but was not equivalent to MeBr. In a small greenhouse trial, yellow nutsedge tuber germination was reduced by approximately 40% using ASD treatment. Control of grass and broadleaf weeds with all combinations of litter and molasses was excellent when compared to the untreated check and was equivalent to, or better than MeBr. Introduced inoculum of *P. capsici* was controlled by all of the ASD treatment combinations applied in the field. Root-knot nematodes extracted from soil samples were highest in the non-irrigated treatments and the solarization under all irrigation regimes.

In microplot trials, introduced inoculum of *S. rolsfii* was controlled by treatments that included molasses or composted litter. Inoculum of *F. oxysporum* was only controlled in plots that received molasses. The impact of the addition of carbon source has lead to additional testing of effects of differing ASD levels on multiple pathogens, and greenhouse trials to test warm season cover crops as replacements for molasses. Tropical legumes, grasses, and brassica species are currently being evaluated.

Demonstration plots of ASD using the combination of clear solarization film, molasses, composted broiler litter, and irrigation of 2” have been established on one research farm, one Master Gardener farm, and three teaching gardens.

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