ADDRESSING PRACTICAL LIMITATIONS TO THE ADOPTION OF ANAEROBIC SOIL DISINFESTATION

Erin N. Rosskopf*[1], Jason Hong[1], Nancy Kokalis-Burelle[1], Monica Ozores-Hampton[2], Francesco DiGioia[2], Xin Zhao[3], Zack Black[3], Zhifeng Gao[3], Chris Wilson[3], John Thomas[3], Kelly Monaghan[3], Mickie Swisher[3], Haichao Guo[3], Joji Muramoto[4], Carol Shennan[4], Utsala Shrestha[5], and David M. Butler[5]

[1]USDA-ARS, US Horticultural Research Laboratory, Fort Pierce, FL, USA; [2]University of Florida, Immokalee, FL USA; [3]University of Florida, Gainesville, FL, USA; [4]University of California, Santa Cruz, CA, USA; and [5]University of Tennessee, Knoxville, TN, USA

Summary

Anaerobic soil disinfestation (ASD, aka. Biological Soil Disinfestation) is a non-chemical alternative to soil fumigation. The process involves the incorporation of a labile carbon source combined with impermeable film and soil saturation through irrigation. ASD application can manage a broad-spectrum of soilborne pests (Butler et al., 2012) and amendments can be manipulated to optimize management of specific targets (Hewavitharana, et al., 2014). A great deal of work has been done to determine the mechanisms of ASD efficacy and the system has been proven to be effective for pest control, but there are still limitations that must be overcome in order for growers to adopt the approach; therefore a number of trials have been undertaken to address grower concerns.

For Florida specialty crop producers, concern has been expressed regarding the use of composted broiler litter, food safety audits, and the incorporation of animal manure into their production system. Two approaches have been taken to address these issues. The first was to test all inputs prior to utilization, and throughout the production season, using multiple techniques to determine if a representative organism could be detected at any time, including in harvested fruit. The second approach was to determine if alternative inputs result in similar levels of anaerobicity and pest control. Alternative nitrogen sources tested included composted algae, mustard meal, chitin, soy meal and corn gluten.

Original work in Florida combined ASD with soil solarization, which resulted in high levels of anaerobicity and excellent weed control. Due to high soil temperatures, the use of clear plastic then required a second application of an opaque film for crop production. This adds significant expense that growers cannot afford to absorb. To determine if effective levels of anaerobicity and, particularly weed control, could be accomplished without the use of solarization, numerous types of polyethylene films, including virtually impermeable and totally impermeable films have been tested for both fall and spring field preparation.

In addition, work has been conducted to determine levels of nitrous oxide produced during ASD treatment as well as leachates associated with broiler litter and irrigation application. This work, combined with research to determine the minimal

water input necessary for adequate anaerobicity, should allow for the customization of ASD applications that take into account regional and site-specific needs.

Butler, D.M., Kokalis-Burelle, N., Muramoto, J., Shennan, C., McCollum, T.G., and Rosskopf, E.N. 2012. Impact of anaerobic soil disinfestation combined with soil solarization on plant–parasitic nematodes and introduced inoculum of soilborne plant pathogens in raised-bed vegetable production. Crop Protection 39:33-40.

Hewavitharana, S.S., Ruddell, D., and Mazzola, M. 2014. Carbon source-dependent antifungal and nematicidal volatiles derived during anaerobic soil disinfestation. European Journal of Plant Pathology 140.1: 39-52.