# USDA, ARS AREWIDE PROJECT-ANAEROBIC SOIL DISINFESTATION

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Anaerobic soil disinfestation (ASD) is an effective method for control of soilborne pathogens, nematodes, and many weed species. In the absence of pest pressure, ASD provides increased yields of multiple crop species. Utilization of ASD requires the application of organic amendments, such as composted broiler litter (CBL) applied to either pre-formed beds or flat ground to which a labile carbon source is added, covered with gas-impermeable film, and irrigated with two acre inches of water.

An Areawide project was established in order to address practical limitations to the adoption of ASD identified in previous work and to familiarize growers with the benefits of using an effective non-chemical approach to soil disinfestation. Initial research with ASD in Florida coupled this approach with soil solarization, which required a second plastic application of opaque film for crop production. Growers were reluctant to incorporate clear film, therefore studies were conducted to determine if gas impermeable opaque film could be used effectively. All of the trials conducted under the Areawide project utilized 0.03-mm black/white VaporSafe® Totally Impermeable Film (TIF™) from Raven Industries, Inc. (Sioux Falls, SD). In each trial, two drip irrigation lines (20 cm emitter spacing, 0.98 L/h emitter rate, Jain Irrigation Inc., Haines City, FL, USA) were installed under the mulch at approximately 2.5 cm below the soil surface. In order to saturate the soil air-filled pore space without flooding the bed, approximately 5 cm of water was applied. A conventionally managed tomato crop was produced in each trial.

In each experiment, a chemical fumigant standard, either Paladin™ (dimethyl disulfide 79%, chloropicrin 21%, 496 L/ha, Arkema, King of Prussia, PA, USA) or Pic-Clor 60 (chloropicrin 59.6% and 1,3-dichloropropene 39%, 224 kg/ha, Soil Chemical Corporation, Hollister, CA, USA) was included for comparison. All ASD treatments utilized composted poultry litter at 22 Mg/ha as an organic amendment. In the first pair of trials, the rate of molasses (standard, ASD 1.0, 13.9 $m^3$/ha), used as the source of labile carbon (C), was doubled (ASD 2.0, 27.7 $m^3$/ha) in order to determine if an excess of C resulted in increased anaerobicity under spring production temperatures. There was a significant increase in cumulative hours of anaerobicity under ASD 2.0. Yields from ASD-treated plots were 26.7% (ASD2.0) and 19.7% (ASD1.0) greater than those from the standard fumigant plots. Root knot nematode control was equal or better in ASD plots than the fumigated plots, but weed control was not as complete in ASD plots when compared to the fumigated beds (Di Gioia et al., 2016). With the addition of CPL and molasses, some concern was raised regarding the potential for nutrient leaching and emissions. In one location, more nitrous oxide was generated from ASD plots when compared to fumigation, but in a second location, there were no differences between emissions from any soil treatments. Addition of amendments resulted in increased availability of both phosphorous (P) and potassium (K) but no increased risk of N loss from the soil (Di Gioia et al, 2017). Farmers attending the associated focus group meetings identified reduced cost of ASD application and improved weed control as important for acceptance of the method, therefore, in the following season, the molasses rate was halved (ASD 0.5), compared to ASD1.0 and the herbicide halosulfuron-methyl (Sandea ®) was applied with all soil treatments in a split-plot design. Addition of the herbicide had no impact on soil anaerobicity and improved weed control in ASD plots. The ASD0.5 treatment resulted in yields similar to those collected from the fumigated plots, while ASD1.0-treated plots produced significantly more tomato fruit than the chemical fumigant (Guo et al., 2017). While the ASD0.5 treatment reduced the break-even price of application of ASD, due to the carbon source comprising the majority of the cost, the price of molasses has continued to increase. Although organic growers are currently using this approach to ASD, conventional growers require a less expensive carbon source. The current research is focused on identifying a waste-derived, inexpensive source of labile carbon.

References

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