# OPTIMIZING ASD FOR FLORIDA FRESH-MARKET TOMATO PRODUCTION

Francesco Di Gioia[1*], Monica Ozores-Hampton[1], Jason Hong[2], Nancy Kokalis-Burelle[2], Haichao Guo[3], Xin Zhao[3], Erin N. Rosskopf[2]

[1] University of Florida, Institute of Food and Agricultural Sciences, South West Florida Research and Education Center, Immokalee, FL 34142, [2] USDA-ARS, US Horticultural Research Laboratory, Fort Pierce, FL 34945, [3] Horticultural Sciences Department, University of Florida, Gainesville, FL 32611

**Background** Anaerobic soil disinfestation (ASD) is a non-chemical alternative to soil fumigation (SF), which exploits the anaerobic decomposition of organic amendment to control a range of soil-borne diseases, plant-parasitic nematodes and weeds. ASD is implemented saturating by irrigation soil mulched with oxygen impermeable film, after its amendment with a readily decomposable carbon (C) source. The selection of a homogeneous, locally available, low cost and easy to apply C source and its application rate are critical for the efficacy of ASD and its acceptance at commercial level. In Florida, molasses, a by-product of the sugarcane industry, and composted poultry litter (CPL) have been selected as effective C source and organic amendment, respectively. However, limited knowledge is available on their dose effect. Lower application rates of organic amendment may require the combined application of an herbicide to assure an adequate weed control. Therefore, there is need to evaluate potential interferences in case of combined application of ASD with an herbicide.

**Method** Two field studies were conducted at the University of Florida/Institute of Food Science and Agriculture/South West Florida Research and Education Center located in Immokalee, FL, in the spring (Exp-1) and fall-winter (Exp-2) season of 2015, to evaluate and compare the performances of ASD and SF in terms of weed and nematodes control, yield and quality of fresh-market tomato (*Solanum lycopersicum* L.). In Exp-1, Pic-Clor 60 (1,3-cichloropropene + chloropicrin) was used as a reference SF and compared with two ASD treatments applied using a mix of CPL at the rate of 22 Mg $ha^{-1}$, and molasses at two rates [13.9 (ASD1) and 27.7 $m^3$ $ha^{-1}$ (ASD2)]. In Exp-2, Pic-Clor 60 was compared with ASD1 (22 Mg $ha^{-1}$ of CPL and 13.9 $m^3$ $ha^{-1}$ of molasses) and ASD0.5 (11 Mg $ha^{-1}$ of CPL and 6.9 $m^3$ $ha^{-1}$ of molasses), combined or not with the application of the pre-emergence herbicide Sandea.

**Results** In Exp-1 ASD plots reached highly anaerobic conditions, and cumulative soil anaerobiosis was 167% higher in ASD2 than in ASD1 plots. Regardless the molasses rate, ASD assured a level of control of root-knot nematode (*Meloidogyne* spp.) similar to SF. SF assured a complete weed control, while both ASD treatments

assured an adequate, but not complete weed control. Total marketable yield was 49 Mg $ha^{-1}$ in SF plots, and was 19.7% and 26.7% higher in ASD1 and ASD2 plots, respectively. Fruit quality parameters were not influenced by soil treatments, except the fruit firmness, which was significantly higher in fruits deriving from ASD treated plots, than in those from SF soil.

In Exp-2 ASD plots reached highly anaerobic conditions regardless the CPL and molasses application rate, and the cumulative soil anaerobiosis was not influenced by the application of Sandea. Soil root-knot nematode population density was controlled similarly in ASD and SF plots until the end of the crop, and was not affected by the application of Sandea. SF and ASD1 plots assured an adequate and similar level of weed control both without and with the application of Sandea. ASD0.5 itself showed higher weed coverage throughout the crop season, and up to 30% at the end of the crop cycle. However, when combined with Sandea ASD0.5 assured the same level of weed control of SF and ASD1. Total marketable yield was not influenced by the herbicide application, and was on average 44.9 Mg $ha^{-1}$ in ASD0.5 and SF plots, whereas ASD1 produced on average 23.3% higher total marketable yield. Tomato fruit color, firmness, pH, total soluble solids, and dry matter content were influenced neither by ASD treatment nor by the herbicide application.

**Conclusions** Overall, the results of the two studies suggest that ASD applied using a mixture of CPL and molasses at the rate of 22 Mg $ha^{-1}$ and 13.9 $m^3$ $ha^{-1}$, respectively (ASD1), can be a sustainable alternative to SF as it provided a good level of weed and root-knot nematodes control, increased marketable yield and assured similar fruit quality of Florida fresh-market tomato. The second study demonstrated that is possible to halve both CPL and molasses rate, however, ASD should be combined with the application of an herbicide to ensure an adequate weed control.