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—Scientific Note—

Evaluating Sunn Hemp Biomass as a Carbon Source for Anaerobic Soil Disinfestation in Organic Strawberry Production

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Anaerobic soil disinfestation (ASD) is an effective non-chemical alternative to manage soilborne pests and pathogens in a wide range of environmental conditions. ASD is initiated by incorporating a carbon source, application of water to fill soil pore spaces, and covering the soil with a gas impermeable film. Under anaerobic soil conditions, facultative and obligate anaerobic organisms utilize organic carbon resulting in reductive soil environments (Di Gioia et al., 2017; Shennan et al., 2018). While ASD has shown potential as a preplant strategy for managing soilborne pests and diseases, further research is warranted to optimize the ASD application technique, particularly in terms of carbon source used to stimulate soil microbial activity. To date, molasses as a byproduct of the Florida sugarcane industry has been used as a carbon source. The potential of alternative carbon sources, including cover crops, should be investigated to address grower concerns related to the cost of implementing ASD. The objective of this pilot study was to assess the effectiveness of sunn hemp (*Crotalaria juncea*) biomass as a carbon source for ASD in organic strawberry (*Fragaria ×ananassa*) production.

A field trial was conducted from Oct. 2018 to May 2019 on certified organic land at the University of Florida Plant Science Research and Education Unit (Citra, FL.) using a split plot design with four replications. Whole plots of soil treatment consisted of ASD with molasses (ASD+M), ASD with sunn hemp (ASD+SH), and non-ASD fallow control (Control). Two strawberry cultivars were included in the subplots: 'Florida Brilliance' and Sweet Sensation® 'Florida127'. The ASD treatment lasted 21 days, during which cumulative soil redox potential and soil pH were monitored continuously. Strawberry plants were transplanted into raised beds mulched with totally impermeable film on 17 Oct. 2018 in double rows with 40 plants in each experimental unit. Fruit was harvested twice a week from Dec. 2018 to May 2019. Marketable and non-marketable fruit number and weight were recorded. Overall, there was a low incidence of soilborne diseases.

The ASD+SH and ASD+M soil treatments achieved similar levels of cumulative soil redox potential which were higher than Control ($P = 0.06$) at the end of the 21-day treatment. The main effects of soil treatment and strawberry cultivar on marketable yield were evident, but there were no significant two-way interactions. Whole-season marketable fruit yield increased significantly by 26% and 16% under ASD+SH compared with ASD+M and Control, respectively. The differences in whole-season marketable fruit yield were mainly attributed to significant increases in marketable fruit yield during Jan., Feb., and Mar. 2019. The effect of strawberry cultivar on marketable fruit yield was inconsistent between Dec. 2018 and May 2019. During the early season harvest in Jan. and the peak harvest period in Mar., 'Florida Brilliance' produced significantly higher marketable fruit yield by 40% and 21% compared with 'Florida127', respectively. However, during the Apr. late season harvest, marketable fruit yield of 'Florida127' was 52% greater than 'Florida Brilliance'. By the end of the production season, marketable fruit yield did not differ between the two cultivars, but the number of fruit was significantly higher in 'Florida Brilliance' compared with 'Florida127'. The observed differences in marketable fruit yield between ASD+SH and ASD+M may be related to the contribution of sunn hemp residue. The low C:N ratio of sunn hemp leaves (13:1) may have resulted in rapid N mineralization during the early season, while sunn hemp stems (C:N 29:1) may have contributed to a longer-term nutrient pool and increased water holding capacity compared with ASD+M and Control plots. The marketable fruit yield differences between the two strawberry cultivars may be related to cultivar-specific traits and are in line with previous findings by Whitaker et al. (2019). The impacts of sunn hemp on soil redox potential and marketable fruit yield suggest the need for further evaluations of the potential of sunn hemp biomass as a carbon source for ASD application in organic strawberry production in Florida. Future research should optimize the seeding rate, growing period, and termination method of sunn hemp as a carbon source for ASD application, while taking into account the contribution of organic matter and mineral nutrients when determining organic strawberry fertility management.

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