ANAEROBIC SOIL DISINFESTATION USING A SUMMER COVER CROP OR CROP RESIDUES

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Anaerobic soil disinfestation (ASD) has been adopted by commercial-scale berry producers in California (CA) (Shennan et al., 2018). However, the ASD-treated acreage for strawberries and cane berries in CA and Baja California in 2017-18 was about 1,400 acres, similar to the previous season (Farm Fuel Inc., personal communication). The main obstacle to further adoption is the cost of rice bran, (the standard carbon source used) which has increased from $250 to $300/t over the last five years. Replicated experiments showed that ASD using a cover crop as a partial carbon source was as effective as the standard 9 t/ac rice bran ASD in controlling *Fusarium oxysporum* f. sp. *fragriae* and *Verticillium dahliae* under coastal CA conditions (Muramoto et al., in review). However, this approach must be tested at a larger scale to determine its feasibility for commercial-scale strawberry production. Here we report on demonstration trials using a cover crop or crop residues as a partial carbon source for ASD in CA.

<u>METHODS</u> Two non-replicated demonstration trials are in progress at organic strawberry fields in Watsonville, CA. Each trial consists of a standard ASD using rice bran 9 t/ac plot (ASD-RB), and ASD using cover crop (ASD-CC: Trial-1) or broccoli residues (ASD-BR: Trial-2) plot arranged side-by-side. For the ASD-CC and ASD-BR plots, the dry biomass of cover crop or broccoli residues was determined, and rice bran was added to the plot to attain a total biomass input of 9 t/ac. Plot size is 1 acre for both trials.

Trial-1 was established in a sandy loam field with no soil-borne disease history. Sudan grass was planted in June 2017, mowed at 1’ above the ground in late July and allowed to regrow until Aug. 29 in both ASD-RB and ASD-CC plots. The average dry biomass of Sudan grass was 1.4 t/ac. For the ASD-RB plot, the cover crop was mowed and disked on Aug. 29 and 30, and for the ASD-CC plot, the cover crop was mowed and temporarily removed from the field by a mower/shooter and a truck on Aug. 30. The mowed cover crop was piled outside of the field, and both plots were subsoiled, chiseled, and leveled. On Sep. 6, rice bran was broadcast with a compost spreader in both ASD-RB and ASD-CC plots at the target rates of 9 t/ac and 7.6 t/ac, respectively. The mowed cover crop was then spread onto the ASD-CC plot. Both plots were chiseled, beds listed, and drip tapes and tarp applied the following week and irrigated for ASD on Sep. 14 until Oct. 20. Strawberry (cv. Albion) was planted in Nov.
Trial-2 was established in a clay loam organic field with modest Verticillium wilt pressure. Open-Pollinated broccoli grown in an adjacent field was used as a partial carbon source for the ASD-BR plot. Unharvested broccoli was mowed and

transferred by a mower/shooter and a truck and spread onto the ASD-BR plot with a compost spreader on Sep. 19, 2017. Average broccoli dry biomass was 3 t/ac. Then rice bran was broadcast at the target rate of 9 t/ac and 6 t/ac for the ASD-RB plot and ASD-BR plot, respectively. After incorporating rice bran and broccoli residues, beds were listed, sprinkler irrigated, drip tapes and tarps applied. The ASD process was maintained from Sep. 29 to Oct. 16. A proprietary strawberry variety was planted in Nov.
Soil Eh and temperature were monitored at both plots during ASD treatment. Each plot was divided into four pseudo-replicates, and marketable fruit yield was measured at least weekly during the harvest period, and soil inorganic N (0”-12” depth) measured monthly through the season.

<u>RESULTS</u> Trial-1: Both ASD plots developed a strong anaerobic condition; cumulative Eh mV hrs below 200 mV was ASD-CC; 212,815 mV hrs and ASD-RB: 108,427 mV hrs. Soil inorganic N dynamics at both plots were generally similar across the two treatments, except nitrate from May to July was higher in ASD-RB (Fig. 1). Marketable yield was similar across both treatments (Fig. 2). Trial-2; Soil Eh indicated that both plots did not develop anaerobic conditions due to large air spaces created by large soil clods, a typical issue with ASD in high clay fields. Larger amounts of soil nitrate were detected in the ASD-BR plot compared to the ASD-RB plot over the first three months (Fig. 3). Marketable yield from the ASD-BR plot was lower due to greater mite pressure in May to June (Fig. 4). This may have been caused by the location of the ASD-BR plot close to a road where the mite damage was greater due to dust.

This approach’s pros and cons are;

- Potential to reduce the cost of ASD without affecting fruit yield, its disease control ability, and N provision
- It can be streamlined using typical farming practice for strawberries without requiring extra equipment (e.g., mower/shooter) if any ground preparation (e.g., ripping, chiseling and leveling) is done before planting the cover crop
- Not all strawberry growers can grow a summer cover crop
- Broccoli residue method needs a mower/shooter and requires either diversification of strawberry farms or cooperation with local vegetable growers to provide the residue

References

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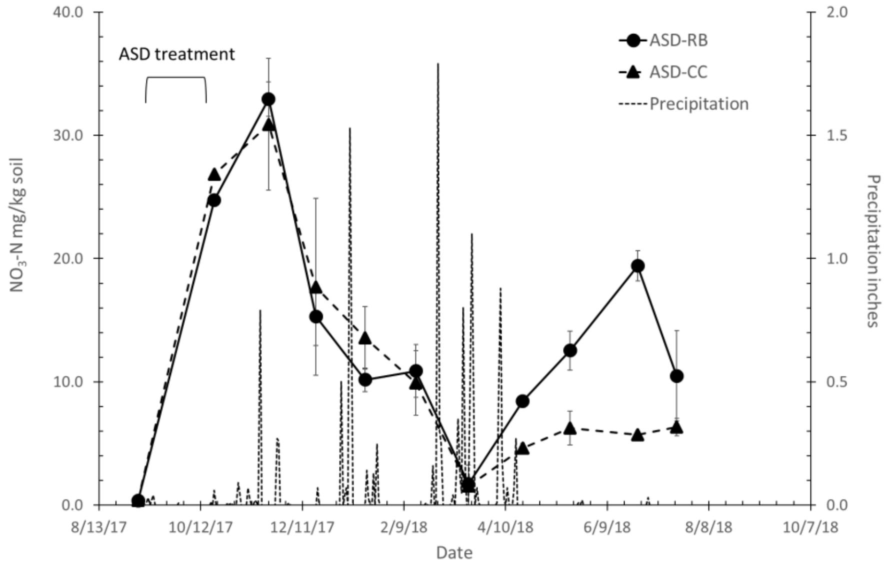

Figure 1. Soil nitrate dynamics in Trial-1, Watsonville, CA. Soil depth: 0”-12”. ASD-RB: ASD using rice bran 9 t/ac. ASD-CC: ASD using Sudan grass cover crop 1.4 t/ac + rice bran 7.6 t/ac. Mean ± SEM. Precipitation data from a CIMIS station (Watsonville West).

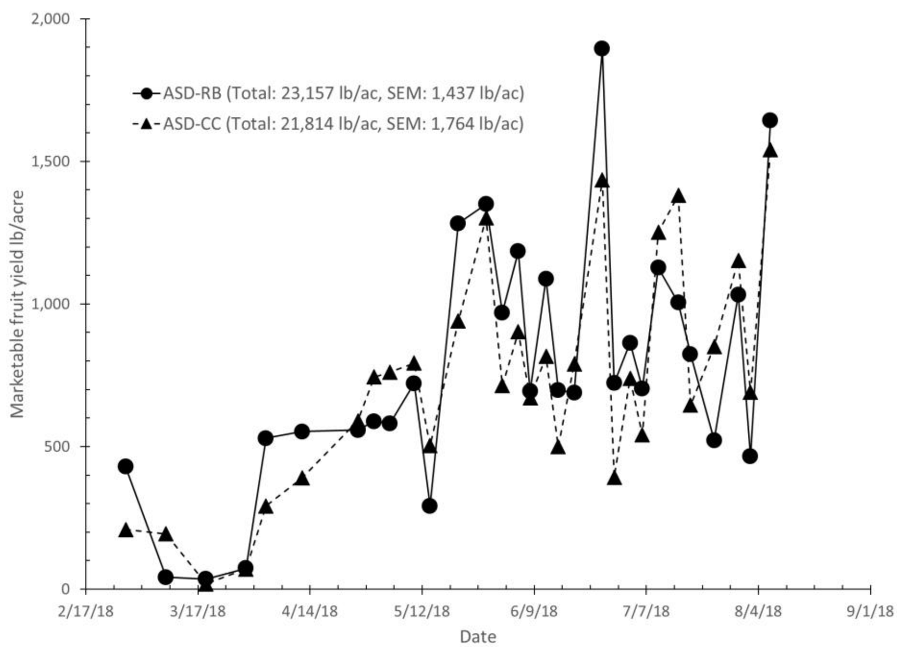

Figure 2. Changes in marketable fruit yield in Trial-1, Watsonville, CA. See Fig. 1 for the legend. Cumulative marketable yield (as of August 8); ASD-RB: 23,157 lb/ac, ASD-CC: 21,814 lb/ac.

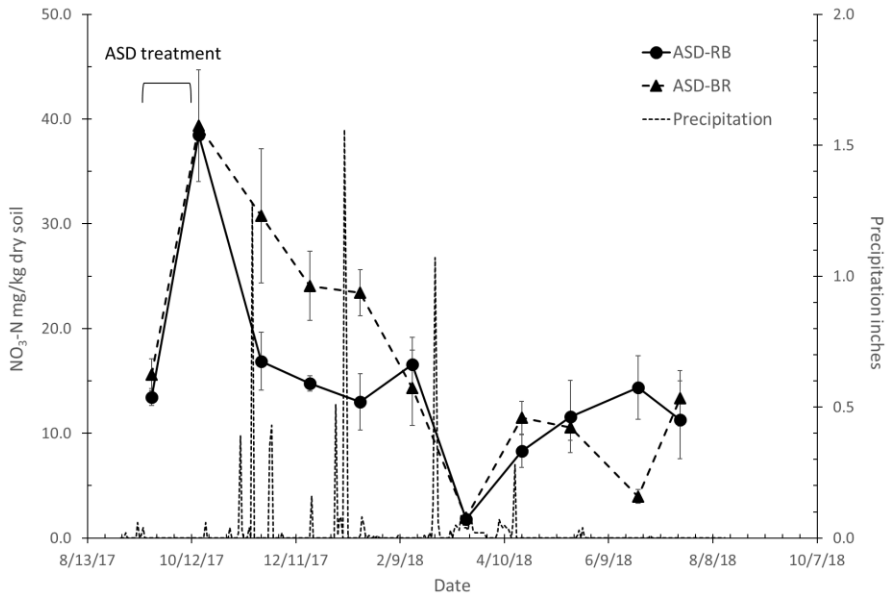

Figure 3. Soil nitrate dynamics in Trial-2, Watsonville, CA. Soil depth: 0”-12”. ASD-RB: ASD using rice bran 9 t/ac. ASD-BR: ASD using broccoli residues 3 t/ac + rice bran 6 t/ac. Mean ± SEM. Precipitation data from a CIMIS station (Pajaro).

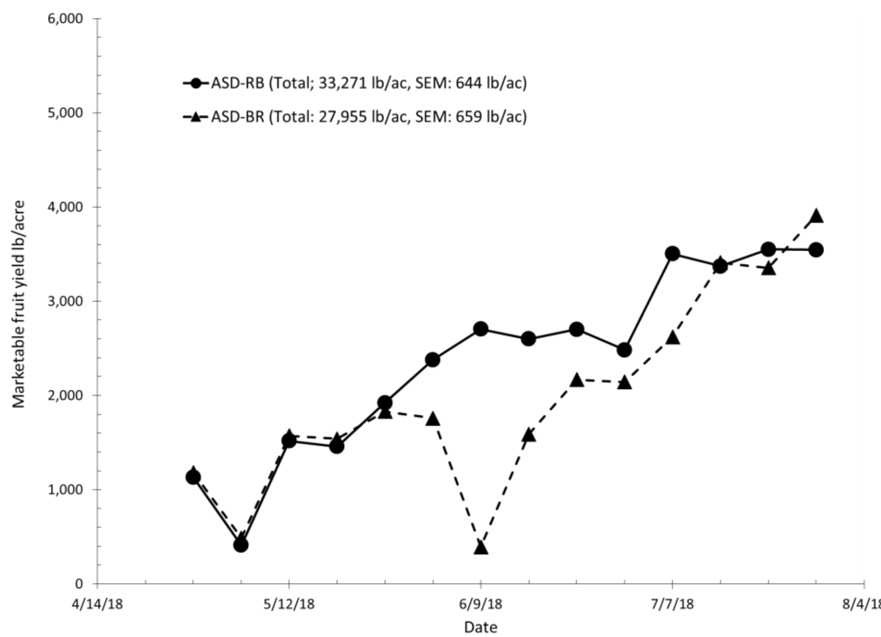

Figure 4. Changes in marketable fruit yield in Trial-2, Watsonville, CA. See Fig. 3 for the legend. Cumulative marketable yield (as of July 28); ASD-RB: 33,271 lb/ac, ASD-BR: 27,955 lb/ac.