CURRENT STATUS AND DISTRIBUTION OF PEST PROBLEMS AND IN SOUTHERN CALIFORNIA AND PRO'S AND CON'S OF DISINFETSTAION PRACTICES.

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Important strawberry pathogens and weeds.

Ventura County was the first area where both *Macrophomina phaseolina* and *Fusarium oxysporum f. sp. fragariae* were detected in California strawberry more than ten years ago. Since then, these fungal pathogens causing charcoal rot and Fusarium wilt, respectively, have been confirmed in all production regions of the state. In Ventura County, at least 16 fields have experienced plant collapse due to Fusarium and 8 due to Macrophomina and at least 3 fields had both pathogens. The distribution of these two key pathogens in production strawberries is most likely a lot wider among strawberry fields in Southern California, but has not been documented sufficiently due to lack of confirmation and underreporting. Soil fumigation and use of tolerant varieties coupled with crop termination prior to the onset of disease symptoms likely masked pathogen-infested fields. In the last ten years *Verticillium dahliae* and *Phytophthora fragariae* were isolated from declining strawberry plants only in 5 and 3 fields, respectively.

Yellow nutsedge, *Cyperus esculentus* is the most difficult weed to control since no currently available herbicides in strawberry control it and bed fumigation is only partially effective. Annually 15-20 fields in the County contain production-damaging nutsedge populations. In-season deposited wind-dispersed weeds are wide-spread and like nutsedge are not controlled due to lack of labor and selective herbicides. Weed interference and strawberry decline due to above-mentioned pathogens tend to be especially troublesome in organic and non-fumigated areas.

Conventional management

In Ventura County 60-80% of fields are pre-plant bed fumigated with drip lines at a cost of $1,300-1,800/acre, while 20-40% are flat fumigated with shanks at $3,000-3,800/acre. Impermeable films are used almost exclusively on all fumigated acreage. Even though flat fumigation, especially at high rates is considered (and shown by multiple studies) most efficacious for pathogen and weed control, it is not commonly used even in infested fields due to economic reasons. Chloropicrin (Pic) is predominant fumigant choice, followed by combination of Pic and 1,3-D. MITC generators are sometimes used as sequential fumigants. End-season fumigation via drip with MITC has been restricted due to buffer zones, and though beneficial in overall pest management is not commonly used.

In addition to soil fumigation, production in the presence of soil-borne pathogens is managed with use of resistant varieties (for Fusarium) and reliance on cool winter and spring for fresh market fruit production. In late spring and summer harvesting and crop management are no longer cost effective and, coupled with rapid increase in plant decline and weed interference prompt crop termination.

Organic management

Soil amendments such as cover crops or compost are common in organic strawberry systems, however, benefits of these treatment with regards to soil-borne pathogens have not been consistently quantified as effective. Organic growers rotate when possible but there is a very limited amount of certified ground /crop demand to do that effectively. About half of organic strawberry growers have been using anaerobic soil disinfestation with 7-9 tons/acre of rice bran as carbon source (ASD-rice). The ASD-rice costs $2,500-3,000/acre and is a major expense. Yield improvements of 50-80% compared to untreated soil and reduced costs of pre-plant fertilizer (N and P supplied by bran) offset the investment in rice bran and allow early production of higher-value organic fruit. Additionally, alternative carbon sources have been and continue to be extensively tested. ASD-rice controlled Verticillium wilt 60-100%, but Fusarium wilt control was highly affected by soil temperatures during ASD process, ranging from partial to none. Mortality due to charcoal rot was reduced 30-50% with ASD compared to untreated soil. It is considered that the anaerobic process itself and changes to soil chemical, microbiological and physical properties, often interdependent, play roles in improving strawberry performance in ASD-treated soil on par with plants in fumigated soil. Cumulative effects of ASD application over several seasons have been shown to be more beneficial to soil pathogen management compared to continuous drip fumigation over time.

Organic weed control is accomplished predominantly by use of black/opaque plastic mulch. Remaining weed control in planting holes is manual and is mechanical in furrows. Organic contact herbicide Suppress had good efficacy destroying above-ground parts of weeds but does not control perennials and is prohibitively expensive compared to black mulch or cultivation. Additionally, there are no control tools for yellow nutsedge that punctures any standard plastic film. Impermeable to nutsedge paper barriers have been used by some organic growers effectively, especially at high nutsedge densities, common in organic fields. These nutsedge barriers may cost $1,600-2,000/acre but can save even more in manual weeding costs, the only selective way to remove nutsedge from strawberry beds.

There is interest in using steam or superheated gas to treat soil but commercial applications have not been done in cost-effective manner yet.