

**Title: Effect of biofumigation and solarization on strawberry plant growth and yield under three different climatic conditions in Arkansas.**

**Progress Report**

**Grant Code SRSFC 2009-18**

**Research**

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**Objectives:**

The objectives of this project are: 1) to determine the effect of biofumigation and solarization on diseases (particularly anthracnose, leaf spots, and red stele), insects, nematodes, and weeds 2) to evaluate the effect of these practices on plant growth, yield, and fruit quality, and 3) to estimate the economic feasibility of these practices in a plasticulture system.

**Justification and Description:**

There are approximately 300 acres of plasticulture strawberries in Arkansas and acreage is increasing. Strawberry plasticulture is an annual hill training system in which 'green' strawberry transplants (freshly dug or plug plants) are planted in early fall (late September to early October, depending on location) in double rows at densities of 15,000 to 17,400 plants per acre. A standard practice is to produce the crop in raised beds that have been methyl bromide-fumigated and covered with black plastic mulch. The two most commonly planted cultivars across the southern U.S., including in Arkansas are 'Chandler' and 'Camarosa'. Improved crop growth and yield are expected to result from the use of methyl bromide as it controls all major soilborne plant pathogens of strawberry as well as certain insects, nematodes and weeds. However, the use of methyl bromide for pre-plant fumigation is being phased out because of its acute toxicity to humans and because it is an ozone depleting substance. Less harmful alternatives to fumigation with methyl bromide are needed, but these alternatives must be both efficacious in controlling soilborne pests, compatible with current production practices, and economically feasible.

Biofumigation is a term that describes the use of *Brassica* species such as canola and Indian mustard in rotation or as green manure crops to suppress soil-borne pests. Plant tissues of certain brassica species contain high levels of secondary metabolites called glucosinolates, which can be converted to isothiocyanates, thiocyanates, nitriles, or other compounds by enzymatic hydrolysis as they decompose in the soil (4). These compounds are volatile and can be toxic to many organisms including bacteria, fungi, nematodes, insects, and germinating seeds. Biofumigation (soil amendment) with brassicas has been studied for suppression of soilborne pathogens on several crops.

Solarization is another technique that is used for suppression of soilborne plant pathogens and other pests including, insects and weeds and weed seeds. The effectiveness of solarization when compared to chemical controls methods in strawberries vary according to location, time of year, and type of plastic being used.

**Methodologies:**

This research initiated at two sites in Arkansas. Site 1: Southwest Research and Extension Center (SWREC) - Hope in the southwestern part of the state and Site 2: UA Vegetable Research Station (UAVRS) - Kibler, located in Arkansas River Valley. At each site, the experiment was set up as a randomized complete block design with four replications of each treatment. Individual plots will be a single row 35 feet long. Five treatments were proposed to be included at each site:

**TRT 1-** Control: No pre-plant fumigation, solarization, or biofumigation.

**TRT 2-** Midas fumigation in early September following standard commercial application procedures.

**TRT 3-** Biofumigation: A cover crop of a canola (*Brassica napus annua* L) species known to be high in glucosinolates will be seeded the preceding fall (October-November), shredded and incorporated into the beds in the spring (April-May), and tarped with black plastic mulch and allowed to sit idle until planting in the fall.

**TRT 4- Solarization:** The rows where the strawberry plugs will be planted will be covered with clear plastic in June. Soil moisture will be maintained at near field capacity until planting time. Immediately prior to transplanting, the plastic will be spray painted black to moderate soil temperatures after planting.

**TRT 5.** Combination of biofumigation and solarization: A *B. napus* cover crop with high glucosinolate content will be seeded as in TRT 3, and shredded and incorporated into the beds in April-May. The beds will then be tarped with clear plastic and soil moisture maintained as in TRT 4 until transplanting time when the plastic will be painted black immediately prior to transplanting.

**Results:**

There are no results to report at this time since fruit yield and size, number of crowns, disease incidence and severity, arthropod damage, and weed presence and density will begin to be monitored during the 2010 growing season. A full report will be given to the SRSFC upon conclusion of this project.

**The following activities were conducted to satisfy the grant objectives:**

**SWREC-Hope, AR**

Site preparation began on 6-15-09 with the incorporation of 100 grams of 13-13-13 per plot. 'Seven Top' turnips were planted on plots for treatments 2 and 5. A one foot square biomass subsample was taken from each plot, dried and weighted, and turnips were tilled under on 8-21-09. Beds were made, and covered with black plastic, except for treatments 4 and 5 which were covered with clear plastic on 8-26-09.

One line of irrigation drip tape was laid under the plastic. Fertilizer (17-17-17) was incorporated at the time the beds were made at a rate of 250 pounds per acre or 230 grams per plot. Plastic on 4 and 5 were painted black at this time. No Midas was used in this test due to excessive soil moisture, unavailability of product, and the shortage of time for the fumigant to dissipate before planting.

Planting 'Camarosa' strawberries began on 10-12-09. Strawberries were planted on raised beds, staggered at 14 inch intervals. Fertilizer (20-20-20) was applied at a rate of 1200 grams/ 2 gallons of water thru drip lines on 11-23-09. Soil moisture and temperature monitors were put in place at the time of planting. All plots were sampled for fertility and nematodes.

**UAVRS Kibler, AR**

Site preparation began on 6-29-09. 'Seven Top' turnips were planted on plots for treatments 2 and 5. On 8-26-09, mustard meal was applied to plot 6 at the rate of 1000 pounds per acre. All plots received fertilizer (10-20-10) at a rate of 550 pounds per acre. Beds were formed, drip irrigation lines were laid, black and clear plastic were put down to cover the plots. Soil moisture and temperature sensors were put in place at this time.

'Chandler' strawberries were planted on 10-20-09 at the rate of 41 plants per plot. Clear plastic was sprayed with black latex paint on 11-06-09. No Midas was used on this

test because of excessive soil moisture, unavailability of product, and the shortage of time for the fumigant to dissipate before planting.

**Conclusions:**

No conclusions can be drawn at this time

**Impact statement:**

No impact statement can be drawn at this time

**Citations:**

No citations exist at this time.