DYE TO PREDICT PESTICIDE MOVEMENT IN SOIL BEDS

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Alternatives to methyl bromide fumigation of soil in vegetable production will require the use of chemical combinations to eliminate soil pest targets. The application of plant health products in vegetable mulch systems is best accomplished by delivering the materials through microirrigation systems that are placed under the polyethylene film mulch as the beds are shaped. Very little is known about the distribution of plant health materials through microirrigation systems in field beds. It is assumed that the entire soil bed under the polyethylene film mulch is saturated with water during the irrigation and fertilization process. This assumption also leads us to believe that any plant health product introduced into the system would also be uniformly distributed in the soil bed. This work was initiated to further investigate the distribution of dye ladiened water in polyethylene film mulch soil beds.

Materials and Methods

The research was conducted at the University of Georgia Coastal Plain Experiment Station in Tifton, GA. Soil type was fuquay loamy sand (88% sand) with 0.74% organic matter. Beds were formed using a commercial tractor drawn bed former when the soil was near field capacity. Beds were formed using a bed shaper to finished size of 30, 24, or 18 inches depending on the test. Aqua - Traxx high flow (0.30 ghp @ 10psi) drip tape with emitters spaced at 12 inches was used through out the experiment.

A blue indicator spray dye, Hi Light® (Becker Underwood Ames, Iowa) was injected at the beginning of each treatment at the rate of 32 oz per 300 ft of bed over a 5 minute period while the drip tape was under pressure and continued to be irrigated with water for the times specified in each treatment.

After injection, irrigation and a drying period the beds were cut open perpendicular to the row exactly below an emitter or between an emitter to expose the soil face. A plexiglass sheet scribed with 1 inch squares was use to calculate the square inches encompassed by the blue dye.

Result and Discussion

Dye patterns produced in the soil for 18, 24 and 30 in the 4 hour irrigation schedule were identical in area (square inches); however, the patterns were some what different for each of the bed sizes (fig. 1). The 30 inch bed size tended to have an irregular pattern while both the 18 and 24 inch bed had a more symmetrical pattern in the soil.

In the 8 hr irrigation schedule the 18 and 24 inch beds had a greater encompassed area than the 30 inch bed. Also, the pattern on the 18 and 24 inch bed were more spherial than the pattern on the 30 inch bed.
The uniformity of the blue pattern and in the large encompassed area with the 18 and 24 inch beds is attributed to the fact that the soil in these beds was compacted tighter than the soil in the 30 inch bed. Compacted soil would tend the promote capillary action and reduce water channelling.

In the trial where a constant irrigation period was compared to pulsing of irrigation, differences in area were significant (fig 2). No differences were detected among treatments where plots were irrigated for just 6.5 hrs one time 13 hrs one time, or twice at 6.5 hr on day 1 and 3. However, if plots were irrigated 6.5 hrs for day 1,2, and 3 the area encompassed by the dye was greater than if plots were continuously irrigated for 19.5 hrs without interruption. Plots irrigated 2 consultive days for 6.5 hr had a greater area encompassed by dye than plots irrigated continuously for 13 hr or irrigated 6.5 hrs day 1 and 3.

Pulsing irrigation on two consecutive days maintains high soil moisture in the bed which appears to move the water profile laterally. If the soil were allowed to drain for one day between irrigation events the dye was not moved any further than the initial 6.5 hr irrigation. This suggests that the air space in the soil must be charged with water before the water front will move laterally, and result in a greater area of coverage.