EFFECT OF IRRIGATION TIMES ON WETTING PATTERNS IN MID-ATLANTIC VEGETABLE SOILS

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A number of products are being researched as alternatives to replace methyl bromide as a preplant soil treatment in vegetable crops. 1,3-dicloropropene + chloropicrin applied through tractor drawn shank equipment has provided nematode, disease, and weed control comparable to methyl bromide. Research evaluating an emulsified form of 1,3-dicloropropene alone or in combination with chloropicrin injected through the drip irrigation tape in plastic culture vegetables has been initiated. High levels of efficacy have been observed using this technique in the western United States. Erratic results have been observed in Mid-Atlantic tests. The soil textures in the western United States tend to be finer than the sandy soils typically found in Mid-Atlantic vegetable production areas. Inadequate distribution of the water throughout the bed with drip applications run for a relatively short time was identified as a possible reason for erratic performance in the sandy textured soils. The objective of the studies reported here were to evaluate the distribution of drip irrigation water in sandy soils when applied through one or two drip tapes at various irrigation times.

Four trials were conducted in 2001. Trials were conducted at the Edisto Research Station of Clemson University at Blackville, SC; Mitchell Wrenn Farm, Zebulon, North Carolina; and Curtis Smith Farm, Seven Springs, North Carolina. Soils were sandy or sandy loam at each location. Beds were formed using typical grower practices. The irrigation drip tape was placed in the bed at time of bed formation at 2.5 to 5 cm below the surface of the beds. The beds were 76 cm wide at each location. Plots were one row by 7.62 m. Distribution of the drip water was determined by addition of a blue agricultural marker dye from Pro Source One. Dye was injected into the irrigation flow at the rate of .23% using a Dosatron® at the first Blackville site and Mitchell Wrenn Farm. At the other two sites, the dye was injected at .45% in alternating 110-L batches of irrigation water held in a tank. The first test was installed May 30 at Blackville with irrigation run times of 1, 2, 3, 4, 5, 6, 7, and 8 hours using one and two drip tapes per bed. The second test was established on June 4 at the Mitchell Wrenn Farm with injection run times of 2, 4, 6, and 8 hours using one and two tapes per bed. The third test was conducted at the Curtis Smith Farm with a run time of four hours with only one tape per bed. The fourth test was conducted at Blackville with a 7 hour run time through a single tape per bed. Emitter spacing was 30.5 cm at all locations except at the second Blackville site where it was 46 cm. The drip tape flow rate was 1.7 L/min/30.5 m at 1.03 bar at each site. Observations were made the day after injection at the first Blackville site and the Mitchell Wrenn Farm site and two hours after injection at the Curtis Smith Farm and second Blackville site.

Wetted area of the bed was determined by digging into the bed and assessing the average size of the dye pattern along a plane between emitters, average width and depth of the pattern perpendicular to the bed at a plane that bisected the emitters, and a similarly oriented plane midway between emitters. A flat shovel was used to prepare a flat surface at the plane for assessment. To determine the size of the dye pattern, a plexiglas sheet scored with a 2.54 cm x 2.54 cm grid was placed along the plane for assessment and the squares counted. This method was employed at the first Blackville site and the Mitchell Wrenn Farm. A ruler was found to adequately serve the purpose of the large plexiglas sheet and was used to determine the average size of the dye patterns at the other two locations. The maximum width for water movement from emitters was 30.5 cm and 45 cm, respectively, for the tapes with 30.5 and 45 cm spaced emitters. The maximum distance the water could move perpendicularly to the tape was 38 cm for the single tape and 19 cm for the double tape arrangement. The average width of the dye pattern perpendicular to the tape at the emitter and midway between the emitter was averaged and multiplied by the average depth to determine the average area. This figure was then multiplied by the average distance of dye movement between emitters to determine the volume of soil wetted. The soil volume wetted was then divided by the total volume of soil available for wetting to a 51 cm depth to determine percent soil volume wetted. Measurements were made at a single location in each replicate.

A sampling of the results is presented in figure 1. These are the combined results of two locations. The wetted volume ranged from about 20% for a single drip tape at 2 hours to just over 50% at 8 hours. The same time period for two drip tapes yielded 54% and 90%, respectively. There appears to be a linear relationship between run time and percent wetting of the beds. Relating these data to the application of emulsified 1,3-dichloropropene, it appears that the complete wetting of the bed in these sandy soils with a single tape on a continuous irrigation cycle will require an excessive amount of time. The single tape arrangement appears to be inadequate if complete wetting of the bed is necessary to achieve excellent efficacy. Wetting of the bed with two drip tapes was more efficient with time and perhaps water.

Percent bed coverage averaged across two locations and across injection time with one versus two tapes, Blackville, SC and Zebulon, NC, 2001.