EVALUATION OF MICROIRRIGATION WETTING PATTERNS IN POLYETHYLENE FILM MULCH BEDS

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Introduction

As methyl bromide is phased out of agricultural use more interest will be generated in the use of microirrigation systems to deliver plant heath products. This will be even more acute in multiple cropped plasticulture. Multiple crop use of polyethylene film mulched beds presents unique problems in pest control within the soil beds.

The research was conducted to investigate the parameters of water movement from microirrigation drip tapes that are commonly used in the Southeast for vegetable production. The water patterns in soil beds may dictate the usefulness of the microirrigation systems for plant health products delivery and define its delivery to the target.

Materials and Methods

This test was conducted at the University of Georgia's Coastal Plain Experiment Station, Tifton, Georgia. Soil type was a fuquay loamy sand (loamy, siliceous thermic Arenic Plinthic Paleudults, 88 % sand, 9.0% silt and 3.0% clay, 0.74 % organic water and pH 6.0). Soil beds (76 cm wide) were formed using a commercial tractor drawn bed shaper. Drip tape was installed just below the soil surface in the center of the bed as the polyethylene film mulch was applied.

Six different drip tapes were evaluated to determine the wetting pattern they produced in the soil beds. Tape specifications, pressure of operation and time of operation are outlined in table 1. Each of the treatments were allowed to operate so they each delivered 726.7 ③/30.5m of bed.

A blue spray indicator dye (Hi light^{R}) was injected into the system using a Milton injection pump at the beginning of the test and irrigated with water for the specified period of time. The beds were sliced open immediately below the emitter and half way between two emitters to expose the soil faces and areas encompassed by the dye, calculated using a grid scribed on a sheet of plexiglass. Four sites were excavated for each treatment of both below and between emitter, and the test was repeated three times.

Result and Discussions

Bed width covered and areas of bed cross sections encompassed by dye are presented in table 2. Maximum bed width covered on emitter was recorded for the 45.7 cm spaced emitters delivering 1.36 ③ph. However, that treatment had the least bed width coverage when measured between emitters. The greatest bed uniformity occurred with the 30 cm spaced emitters flowing 0.61 ③ph.

All of the tapes except the 10.2cm spaced emitters delivering 0.1067 ③ph/emitter were similar in cross sectional area of bed encompassed by the dye on the emitter. The areas encompassed by the dye between emitters were similar for all treatments except the tape with 45.7 cm spaced emitters delivering 1.36 ③ph, which was significantly less.

The least amount of uniformity of wetting occurred for the tapes with the 40.6 cm and 45.7 cm spaced drippers. There was a trend of uniformity to increase as the flow rate decreased and time of irrigation increased for the three 30 cm spaced dripper tapes.

The 726.7③/30.5m (192 gal/100ft) equates to about 2.9 cm of water and thus may represent the limit of water that a commercial grower may deliver through this irrigation system. Since this test was conducted on a 76 cm bed even the best scenerios only treated about 60% of the bed. Since lateral movement of water is limited on sandy soils, the use of two tapes, or the use of narrow beds may be required to get thorough and uniform bed coverage.

Table 1. Selected drip tapes used to evaluate soil wetting patterns

Treatment Number	Dripper Spacing (cm)	Flow rate (③ph/emitter)	Pressure (bar)	Irrigation Time (hrs)
1	45.7	1.36	0.83	7.9
2	40.1	0.91	0.83	10.5
3	30.5	0.60	0.83	12.0
4	30.5	0.90	0.83	7.9
5	10.2	0.40	0.69	6.0
6	30.5	1.14	0.69	6.5

(a) All tapes were operated at manufacture's recommended pressure. All treatments were operated to deliver water at 726.7③/30.5m (192 gal/100ft). One bar pressure = 14.5 psi.

Table 2. Evaluation of drip tapes for uniformity of water movement in soil beds as defined by dye injection

Treatment[1] Number	Bed width[2] covered (cm)		Difference in bed width coverage	Area of Bed cross sections cm^2		Difference in cross section area
	On Emitter	Between Emitter		On Emitter	Between Emitter	
1	56[a]	38[c]	18	1361[a]	1006[b]	355
2	53[a]	41[bc]	12	1368[a]	1155[a]	213
3	53[a]	48[a]	5	1297[a]	1265[a]	32
4	53[ab]	46[ab]	7	1348[a]	1168[a]	180
5	48[bc]	46[ab]	2	1226[b]	1161[a]	65
6	46[c]	41[bc]	5	1316[a]	1168[a]	148

(1) Each scenerio delivered water at 726.7③/30.5m (192 gal/100 ft) of bed.

(2) Width's or areas reported are defined by the movement of the dye in the soil. Each mean represents four sites for each treatment repeated 3 times.

(3) Means followed by the same letter are not significantly different from each other according to Duncan's Multiple Range test (P=0.05).