PHYTOTOXICITY OF DRIP-APPLIED 1,3-DICHLOROPROPENE ON VEGETABLES

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Traditionally, soil fumigants for pest control are applied with tractors via shank injection. However, where drip systems are installed fumigation through drip lines via irrigation water is a more convenient option. Drip fumigation increases a growers flexibility, reduces the potential for worker exposure and allows growers to continue using the same drip lines and plastic mulch for successive crops. Inline® is an emulsifiable version of Telone C-35 soil fungicide and nematicide, containing the active ingredient 1,3-D, plus 35% chloropicrin. Phytotoxicity of 1,3-D requires a waiting period between fumigation and planting of 1 week for each 10 gallons/acre, and in practice a 14-day interval is recommended. However, few data are available on what soil levels of 1,3-D actually cause phytotoxicity.

The objective of this study was to evaluate growth of three common vegetables, cucumber, pepper and tomato, in plastic mulch beds as affected by different levels of drip-applied 1,3-D (Inline). The test was conducted at the CPES research farm in Tifton, GA during the spring of 2002. Soil type is a Tifton sandy loam with 88% sand. Different rates (2, 4, 10, 20, 30 and 40 gallons/acre) of Inline were applied through a single drip tape and soil gas concentrations of 1,3-D were measured with a Gastec Precision Gas Detector System®.

Four days post application beds were planted with tomato, pepper and cucumber seedlings. Vegetables were visibly affected by residual 1,3-D in the soil and showed symptoms such as leaf chlorosis (cucumber and pepper), leaf bronzing (tomato) and stem browning (all crops). 1,3-D levels in the soil were negatively and linearly correlated with different plant growth parameters, in particular plant vigor (Table 1). The tested vegetables were ranked for their sensitivity to 1,3-D as follows: cucumber > tomato >

pepper. Little or no plant damage was observed for low 1,3-D levels (<10 ppm) but severe phytotoxicity was noted at the higher levels. The results indicate that 1,3-D gas levels in the soil are a good indicator of risk and extent of phytotoxicity that can be expected after fumigation with Telone® products. If 1,3-D has not been allowed to dissipate sufficiently, plants can be severely injured or killed.

Table 1.
Linear regressions between growth of cucumber, pepper and tomato and residual levels of 1,3-D in soil after drip fumigation in plastic mulch culture.

Plant growth parameters	Days after fumigation	Cucumber		Pepper		Tomato	
		R^2	*F*pr	R^2	*F*pr	R^2	*F*pr
Plant mortality	7	12.0	0.023	NV♣	-	NV♣	-
	14	25.9	0.001	13.8	0.017	13.7	0.017
	16	25.4	0.001	14.7	0.015	12.7	0.021
	25	33.5	0.0002	10.1	0.038	4.7	0.1134
	51	20.0	0.004	12.0	0.026	4.9	0.108
Plant vigor	9	48.5	<0.0001	35.1	<0.0001	57.5	<0.0001
	16	29.6	0.0004	32.3	0.0003	45.7	<0.0001
	30	21.7	0.003	47.5	<0.0001	36.0	0.0001
Plant height	25	NA♦	NA♦	13.8	0.018	49.9	<0.0001
Flower number	25	34.7	0.0001	NA♦	NA♦	40.2	<0.0001
Shoot weight	51	6.1	0.082	28.4	0.0007	17.9	0.007
Root weight	51	18.6	0.006	22.7	0.003	10.7	0.031

♣NV=no variability, all plants alive

♦NA=not applicable