IMPROVED RETENTION OF A SOIL FUMIGANT DURING SOLID-TARP APPLICATION

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A field trial was conducted in Fort Pierce, Florida in cooperation with a commercial sod producer to investigate ways to improve the retention of soil fumigants during solid-tarp (broadcast) applications. A 2 x 2 x 2 factorial experiment was conducted examining the individual and combined effects of soil preparation (cultivated vs sealed), application equipment (shanked vs low disturbance vertical coulters) and plastic permeability (LDPE vs VIF). Treatments were arranged in a randomized complete block design with 5 replications. Replicate plots were 11 ft x 100 ft. 1,3-dichloropropene (Telone II, Dow AgriSciences) was applied at 20 gal/acre (204 lbs/acre). Qualitative estimates of fumigant concentrations in the soil atmosphere following application were obtained using a hand held portable volatile organic compound meter (MiniRae 2000). Quantitative estimates were obtained by gas chromatograph/mass spectrometer analysis of 500 ml of soil air samples collected using Amberlite XAD-4 tube glass filters. Both soil air samples were collected at 0-5 inch depths. Quantitative estimates of fumigant concentrations in soil were obtained by gas chromatograph/mass spectrometer analysis of soil samples collected at 0.5 inch, 2.5 inch and 4.5 inch depths.

A second field trial was conducted to examine soil retention of 1,3-dichloropropene applied at various rates using optimum fumigation practices that included sealing the soil surface with a roller, minimizing soil disturbance during application through the use of a low disturbance vertical coulter application equipment, and immediately covering treated soil with a virtually impermeable film.

Five days after application, significant interactions between soil preparation and application equipment and between application equipment and plastic type on the retention of 1,3-dichloropropene in soil were observed (Table 1). Ten days after application, both equipment and plastic type had a significant effect on fumigant retention. The lowest soil concentration of 1,3-dichloropropene was observed when the fumigant was shank applied into cultivated soil and covered by LDPE (Table 2). The results indicate that retention of fumigants in soil during solid-tarp applications can be improved using various combinations of improved application practices.

Table 1. Analysis of Variance (ANOVA) of the effects of application methods on fumigant concentrations in the soil atmospheric. Measurements obtained with a portable VOC meter.

Effect	*p*-5 days	*p*-10 days	*p*-14 days
Soil prep	0.14	0.57	0.89
Equipment	**<0.01**	**<0.01**	0.91
Plastic	**<0.01**	**<0.01**	**<0.01**
Soil prep * Equipment	**0.03**	0.38	0.49
Equipment*Plastic	**0.03**	0.90	0.84
Soil prep*Plastic	0.40	0.11	0.48
3-way-interaction	0.43	0.63	0.69

Table 2. VOC readings* expressed in PPM

Soil prep	Equipment	Plastic	5 days	10 days	14 days
Cultivated	Shanked	LDPE**	154.6 ± 7.2	23.6 ± 4.1	7.2 ± 2.1
Cultivated	Yetter	LDPE	274.6 ± 25.9	58.55 ± 15.1	8.5 ± 1.5
Cultivated	Shanked	VIF***	321.3 ± 15.3	67.4 ± 3.9	22.1 ± 5.8
Cultivated	Yetter	VIF	331.3 ± 20.3	107.3 ± 15.7	24.5 ± 5.3
Rolled	Shanked	LDPE	169.2 ± 15.0	41.9 ± 8.3	10.6 ± 1.5
Rolled	Yetter	LDPE	344.8 ± 37.7	82.2 ± 10.3	9.9 ± 2.6
Rolled	Shanked	VIF	276.7 ± 25.7	56.9 ± 2.9	23.6 ± 7.5
Rolled	Yetter	VIF	399.4 ± 41.3	102.7 ± 49.3	19.5 ± 1.5

*VOC concentrations determined with a MiniRae 2000 hand held VOC meter calibrated to isobutylene.
**Cadillac film (Hendrix and Dail),
***Bromostop *(Bruno Rimimi LLC)