EVALUATION OF SOIL FUMIGANT RETENTION UNDER VARIOUS SOLID-TARP APPLICATION METHODS

Dan O Chellemi, U.S. Horticultural Research Laboratory, USDA, ARS, Fort Pierce, FL
Bryan Unruh, West Florida Research & Education Center, University of Florida, Jay, FL
John Mirusso, Mirusso Enterprises Inc., Delray Beach, FL

Field trials were conducted in Fort Pierce, Florida on a commercial sod farm to investigate ways to improve the retention of soil fumigants during solid-tarp (broadcast) applications. The individual and combined benefits of soil preparation methods, application equipment and plastic tarps were evaluated. Soil was either freshly cultivated or sealed with a roller prior to applications. 1,3-dichloropropene (1,3-D) (Telone II®, Dow AgroSciences) was applied using a standard application rig comprised of swept back shanks and a low disturbance application rig that combined 30 inch vertical coulters, horizontal 'beaver tails' placed above the fumigant injection point and flanged soil compactors to minimize creation of air pathways in the soil profile. Soil was covered with a 1 mil low density polyethylene (LDPE) tarp ((Hendrix and Dail), or a 1 mil virtually impermeable film (VIF) (Bromostop, Bruno Rimimi LLC). The mass diffusion coefficients for 1,3-D (trans) were 8.83 cm per hr and 0.0048 cm per hr for the LDPE and VIF, respectively. Application rates ranged from 10 – 30 gal per 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.

Fumigant retention in soil was found to be significantly affected by the interaction of soil preparation and application equipment and by the application equipment and plastic type. Between 4 and 15 days after application, the lowest soil fumigant concentrations were observed when the fumigant was shank applied into cultivated soil and covered by LDPE. Retention of fumigants in soil was improved through the use of VIF. The results indicate that retention of fumigants in soil during solid-tarp applications can be improved using various combinations of application equipment and methods.

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*- 4 days	*p*-8 days	*p*-14 days
Soil prep	**0.01**	**0.07**	0.14
Equipment	**<0.01**	**0.01**	**<0.01**
Plastic	0.12	0.69	0.54
Soil prep * Equipment	<**0.01**	**0.01**	0.20
Equipment*Plastic	0.25	0.40	0.92
Soil prep*Plastic	0.69	0.34	0.57
3-way-interaction	0.70	0.63	0.80

Table 2. VOC readings* expressed in PPM

Soil prep	Equipment	Plastic	4 days	8 days	14 days
Cultivated	Shanked	LDPE**	463	117	41
Cultivated	Low disturbance	LDPE	602	159	121
Cultivated	Shanked	VIF***	494	225	88
Cultivated	Low disturbance	VIF	845	189	148
Rolled	Shanked	LDPE	382	122	66
Rolled	Low disturbance	LDPE	1095	438	218
Rolled	Shanked	VIF	411	140	71
Rolled	Low disturbance	VIF	1232	362	225

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