SOIL DISTRIBUTION AND EFFICACY OF ALTERNATIVE FUMIGANTS TO METHYL BROMIDE APPLIED BY DRIP IRRIGATION SYSTEMS

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Until non-chemical alternatives to Methyl Bromide are developed and field validated for the various crops and conditions, growers will want to use alternative fumigants. The soil fumigants 1,3-dichloropropene (1,3-D), methyl isothiocyanate (MITC), and chloropicrin are potential alternatives to MeBr. Soluble liquid formulations of these fumigants applied through drip irrigation systems to seed beds may enhance efficacy and reduce the amounts applied, and may reduce human and environmental risk. The application technique to deliver alternative fumigants to the target soil profile is the major factor in determining its efficacy and emissions. The objective of this study is to determine the distribution in soil and efficacy of 1,3-D, MITC, and Chloropicrin applied alone or in combination through drip irrigation systems.

Application Methods

Application of water soluble formulations are being tested in strawberry beds and on lands being prepared for replanting of perennial crops. In the strawberry beds, the fumigant is applied through two drip tubes in each tarped strawberry bed. Variables that were evaluated include initial soil water content, amount of water used to apply the fumigants, application of combinations of fumigants, number of drip lines, and "virtually" impermeable films (see Table 1 of the companion paper by the same authors). In perennial replant conditions, 1,3-D is being applied through subsurface drip tubes while water containing metham sodium is sprayed on the surface through microsprays to reduce 1,3-D emissions. The intent is to be able to use as much as possible of the irrigation system that will be used to irrigate the crop. This reduces both costs and plastic material requiring disposal.

Fumigant Distribution Monitoring

The soil gas concentrations of 1,3-D, MITC, and Chloropicrin in the Telone® C35 EC and Vapam® treatments were monitored beginning 24 hrs following application for seven to 14 days. In the strawberry beds, soil gas samples were collected from 20,40,60, 80, and 100 cm depth midway between the two drip lines and at the edge of the raised bed (76 cm top width). Soil samples were collected 14 days after the application. In the flat perennial replant fields, the sampling regime was similarly spaced between drip lines.

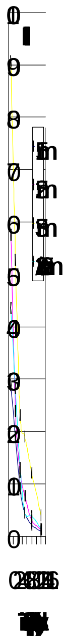
Results and Discussion

The concentrations of 1,3-D and chloropicrin from Telone® C35 EC in the soil gas were greatest after 24 to 36 hrs following application. The sampling detected only small concentrations of MITC in the soil gas. Figure 1 shows examples of monitored fumigant concentrations at two locations in strawberry beds. This experiment will be repeated and refined using automated sampling equipment to include earlier and shorter sampling intervals.

The results suggest that a minimum of 25 mm of water is needed to deliver chemicals to the edge of strawberry beds. The greatest distribution uniformity of fumigants across the bed was obtained with 35 mm of irrigation water. Only trace concentrations of fumigants were detected in the soil gas at depths below 60 cm. Minute amounts of fumigants were detected in the soil gas or soil samples after 14 days following application.

Initial results suggest that this application method of 1,3-D - Chloropicrin combinations can produce strawberry yields as good as with shank-applied MeBr-Chloropicrin (companion paper by Trout and Ajwa give more detailed strawberry yield results). Likewise, in perennial replant, the 1,3-D - Vapam combination succeeded in eliminating nematode populations.

Future Plans



We will continue to pursue application of fumigants through drip irrigation syst