EFFECTS OF VAPAM APPLICATION ON METHYL ISOTHIOCYANATE DISTRIBUTION AND EFFICACY IN RAISED PLASTIC-MULCHED SOIL BEDS

Byron Candole*[1], Alexander Csinos[1] and Dong Wang[2], [1]Department of Plant Pathology, University of Georgia Coastal Plain Experiment Station, Tifton, GA 31793 and [2]USDA-ARS Water Management Research Laboratory, San Joaquin Valley Agricultural Sciences Center, Parlier, CA.

A field experiment was conducted in the spring of 2006 at the Black Shank Farm, Tifton, GA to determine the effect of two Vapam application methods on methyl isothiocyanate (MITC) distribution and efficacy in raised plastic-mulched beds of Fuquay loamy sand (loamy, siliceous, thermic Arenic Plinthic Paleudults). At 75 gallons per acre, Vapam (42% metam sodium) was either injected through the drip irrigation system (drip-applied) for 8 h or sprayed and then incorporated into the soil by means of a rototiller (sprayed-rototilled) 21 days before transplanting of BHN 640 tomato plants. Untreated and methyl bromide-treated plots were included as the controls. The treatments were arranged in a randomized complete block design with five replications. MITC were measured at three pre-selected sites of Vapam-treated beds: 0 cm = bed center at 10 cm below the emitter, and 20 cm and 30 cm (bed shoulder) away from the bed center. Higher MITC concentrations were observed in sprayed-rototilled beds than in drip-applied beds at 3-48 h after application and were observed to have peaked at 12 h and declined sharply at 24 h after application (Fig. 1). Differences in MITC concentrations among the three sites in sprayed-rototilled beds were significant at 3-12 h after application and non-significant at 24-240 h. On the other hand, the differences in MITC concentrations among the three sites in drip-applied plots were significant only at 3 h after application and non-significant at 12-240 h. Higher concentration x time (CT) values (10.0 – 113.6 µg h cm^{-3}) were observed in sprayed-rototilled beds than in drip-applied beds (0.1 -35.6 µg h cm^{-3}) (Fig. 2). The differences in CT values among the three sites were non-significant but there was a trend towards higher values towards the center of sprayed-rototilled beds. In drip-applied beds, the CT values were non-significant among the three sites at 3-48 h after application after which, the CT values at the bed shoulder was significantly lowest. Sprayed and rototilled Vapam was effective in reducing the survival of *P. capsici* at the three sites but not against *R. solani* at the bed shoulders. Drip-applied Vapam was not effective against *P. capsici* at the bed shoulder and *R. solani* at 20 cm away from the center and bed shoulder. Drip-applied Vapam's efficacy against *R. solani* and *P. capsici* diminished towards the bed shoulder. However, spray and rototill application of Vapam may have resulted in better distribution of the chemical in treated beds and therefore had the better chance of reducing pathogen survival at bed shoulders than drip-application. Lastly, there was a potential for better plant stand and higher tomato yield with sprayed and rototilled Vapam.

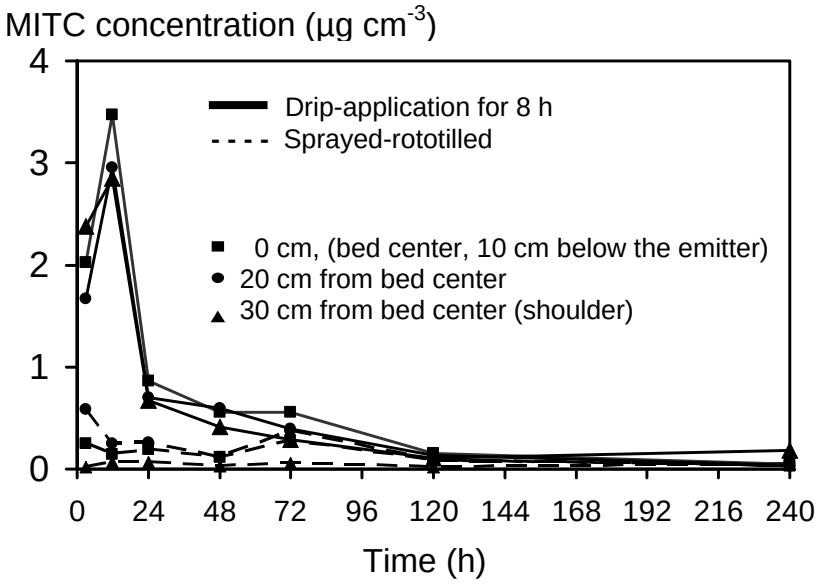

Figure 1. Methyl isothiocyanate concentrations in the soil atmospheres at three pre-selected sites in raised plastic-mulched beds that were drip-applied or sprayed and rototilled with Vapam.

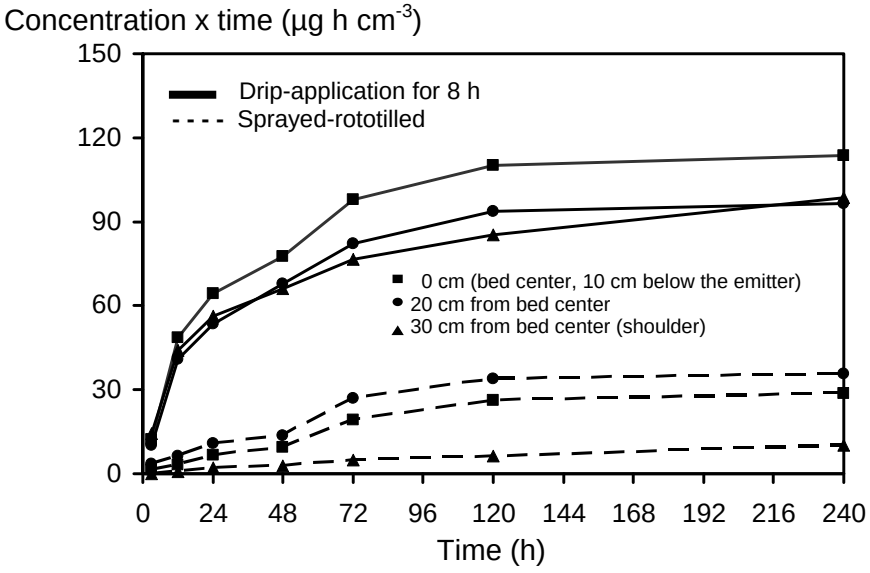

Figure 2. Methyl isothiocyanate concentration x time values in the soil atmospheres of three pre-selected sites in raised plastic-mulched beds that were drip-applied or sprayed and rototilled with Vapam.

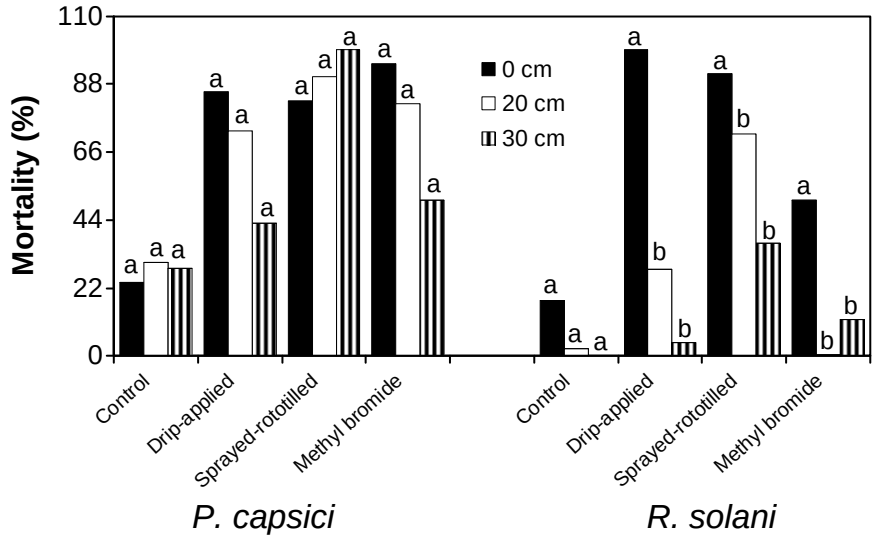

Figure 3. Mortality rates for *P. capsici* and *R. solani* in three pre-selected sites of beds (relative to the bed center or emitter) fumigated with Vapam at different methods of applications. Within a pathogen, bars or means from the three pre-selected sites within a treatment with the same letters are not significantly different by LSD at p=0.05.

Table 1. The effect of methods of Vapam application on stand count and fruit yield of BHN 640 tomato.

Treatment	Plant stand (%)	Marketable fruit yield (t/ha)
Control	65 a	39,342 a
Drip-applied	90 a	61,459 a
Sprayed-rototilled	97 a	90,439 a
Methyl bromide	85 a	64,296 a

In a column, means followed by the same letters are not significantly different by LSD at p = 0.05.