

REDUCING 1,3-DICHLOROPROPENE AND CHLOROPICRIN EMISSIONS WITH SUBSURFACE DRIP AND VIRTUALLY IMPERMEABLE FILM

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Drip-application of fumigants is an effective fumigation practice for strawberry production in raised beds (Ajwa and Trout, 2004). Field studies have shown a 30% emission reduction of 1,3-dichloropropene (1,3-D) when applied by drip irrigation compared to shank injection at 20 cm depth (Wang et al., 2001). The emission reduction with drip application could be further enhanced by covering the field plots with a virtually impermeable film (VIF) after the drip application (Papiernik et al. 2004). Covering the soil surface with a VIF for 10 or more days after fumigation reduced methyl bromide emissions to less than 3% of the total amount applied (Wang et al. 1997). In a more recent study, Gao et al. (2008) achieved an enhanced reduction of 1,3-D and chloropicrin (CP) emission using a combination of subsurface drip application (20 cm depth) followed by covering the soil surface with a high density polyethylene film or water seal.

Many grape growers in central California contract commercial fumigators to shank-inject 1,3-D and CP to control soil-borne pests during vineyard replant. The application depth is typically 45 cm and the soil surface is not covered with a plastic tarp. Potential 1,3-D emission losses have not been studied under this cropping system. The objective of this study was to quantify the emission rates when fumigants were delivered through a subsurface drip irrigation system followed by covering the soil with a VIF.

Methods: As part of an ongoing methyl bromide alternatives project, four treatments are used in this study to compare the effect of subsurface drip with shank injection on reducing emissions (Table 1).

Table 1. Summary of fumigation treatments[†]

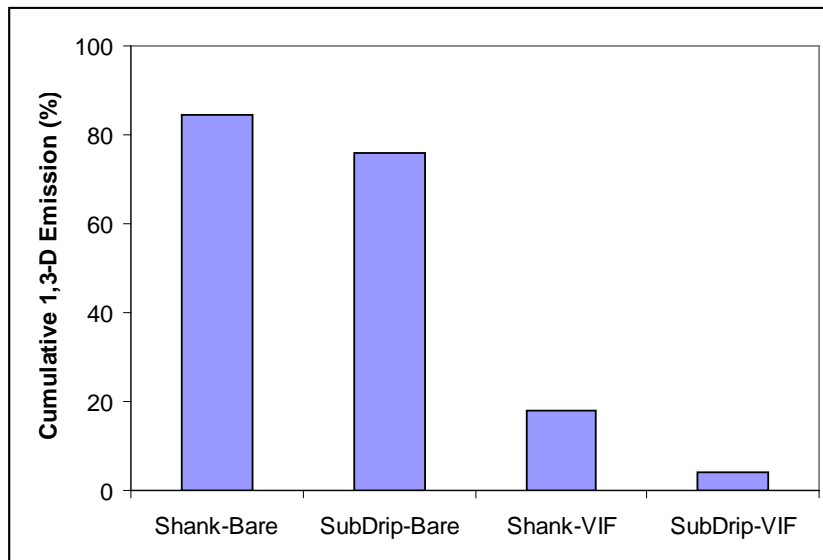
Treatment no.	Chemical	Depth (cm)	Application	Surface Cover
1	Telone C35	45	Shank	Bare soil
2	Telone C35	45	Shank	VIF
3	InLine	50	Subsurface drip	Bare soil
4	InLine	50	Subsurface drip	VIF

[†] The application rate was the same for all treatments (305 kg/ha), VIF is virtually impermeable film (Hytibar), Telone® C35 contains 61.1% 1,3-dichloropropene (1,3-D), 34.7% chloropicrin (CP), and 4.2% inert ingredients, and InLine® contains 60.8% 1,3-D, 33.3% CP, and 5.9% inert ingredients.

Fumigant emissions were measured with flux chambers because of the relatively small size of each experimental treatment plot. Emission samples were collected every 3 hr for the first 3 days after fumigation, and every 6 hr for the next 9 days. With three replications, a total of 720 emission samples were collected.

Results and implications: Applying fumigants with subsurface drip at 50 cm depth without VIF cover generated similar cumulative 1,3-D emissions to shank application at 45 cm depth (Figure 1). The VIF tarp significantly reduced fumigant emissions in both the shank and the subsurface drip application treatments.

Figure 1. Cumulative fumigant emissions under different treatments



Many grape orchards are irrigated using surface drip-irrigation systems, so application of fumigants using subsurface drip is likely a viable practice. After the fumigation, these drip lines can be used for irrigation of the grape orchard. However, fumigation with subsurface drip provided insignificant benefit in reducing emissions when the application depth is 45 to 50 cm. Covering the soil surface with a VIF after fumigation produced consistently low emissions.

References:

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