STRAWBERRY RESPONSE TO 1,3-D, CHLOROPICRIN, AND METHAM SODIUM APPLIED BY DRIP IRRIGATION SYSTEMS

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Past research has shown that soil fumigants 1,3-dichloropropene (1,3-D) in combination with chloropicrin (Telone C35®) and chloropicrin alone are potential alternatives to MeBr for strawberry production in California. These fumigants, when injected through shanks into flat fields or preformed beds and immediately covered with polyethylene films (as methyl bromide is applied), result in adequate control of most pests and strawberry yields 85 to 100% of those achieved with methyl bromide. Metham Sodium (Vapam®) which gives off the fumigant MITC, has also been tested for efficacy on strawberries. Mixed results are generally attributed to the difficulty of evenly distributing the material throughout the soil. Vapam may be beneficial in combination with other fumigants (esp. chloropicrin).

Emulsified formulations of Telone C35 and chloropicrin can be applied with irrigation water through the drip irrigation systems that are used to irrigate strawberries. This would reduce application costs and may reduce hazzards associated with emissions. Metham sodium is soluble and can also be applied through the drip system. The Water Management Research Laboratory is carrying out field studies to determine application procedures to maximize efficacy and minimize human and environmental risk associated with drip application of these materials. This report will describe the efficacy in terms of strawberry yields based on two years of trials on two fields. A companion report (Ajwa and Trout) describes direct monitoring of fumigant distribution in the soil.

Methods

The fumigants were applied in October to field plots located near Salinas (USDA-ARS Spence Farm) and Watsonville (Monterey Bay Academy), California, through 2 drip lines in the 32" wide beds. The Salinas site and the 1997 Watsonville site had not been fumigated or planted to strawberries in the past 20+ years. Variables included fumigant (Telone C35, Vapam, or chloropicrin), application rates (full and 60%), the amount of water applied as carrier for the fumigant (15, 25, or 35 mm), and combinations of fumigants (see companion paper for more detail). The treatments were compared to standard MeBr/Cloropicrin (65/35) and standard Telone C35 shank applications, and non-fumigated plots.

Results

The accompanying table shows the wide variety in the results, indicative of the range of pest pressures and responses from year-to-year and site-to-site. Fresh market yields with no fumigation varied from 28 to 98% of the MeBr standard. At the Watsonville site, verticillium was a major problem in 1997, resulting in substantial yield reductions with all treatments including some damage to the MeBr standard and shank applied Telone plots. The drip-applied fumigants were not able to control the verticillium (note the full Telone rates were 75% of maximum). As a result, rates were raised to the maximum rates in 1998. However, in 1998, verticillium pressures were less, and even reduced Telone rates gave good results. At Salinas in 1997, a variation in cultural practices (planting and mulching dates) made it difficult to confidently compare the drip treatments to the MeBr standard. Yields were also low on this plot. At Salinas in 1998, all treatments, including the non-treated control, showed little pest pressure and yields were relatively uniform for all treatments.

Conclusions

- Drip-applied Telone C35 may be able to produce yields comparable to MeBr/Chloropicrin.
- Shank-applied Telone C35 produced yields comparable to the MeBr standard.
- Drip-applied Vapam tended to produce lower yields than Telone C35.
- The data are not sufficient to determine the optimum amount of carrier water to apply.

Future Work

- Continue research to determine optimum drip application rates (minimum rate for consistent efficacy) and conditions (soil water content and amount of water carrier) for all three fumigants alone and in combination.
- Test the impact of virtually impermeable films on rates and efficacy.
- Demonstrate drip-applied Telone C35 on grower fields to determine efficacy under a wide range of conditions, determine effective, safe application techniques, and establish costs and grower acceptance.
- Work with the State and manufacturer to determine human and environmental risks, and establish usage regulations.

Strawberry Fresh Market Yield relative to Yield with Standard MeBr Shank Injection (%[1])

Trmt No.	Fumigant	Rates[2] 1997/98	Water *(mm)*	Watsonville 1997	Watsonville 1998	Salinas 1997	Salinas 1998
1	none			28	50	49 / 72[3]	98
2	MeBr/Chlor-shank	325/425		100	100	100	100
3	Telone C35-shank (65/35)	425/425		101	100		98
4	Telone C35	320/425	15	48	97	71	110
5	Telone C35	320/425	25	62	92	87	110
6	Telone C35	/425	35		110		112
7	Telone C35	190/255	25	45	95	68	115
16	Telone C35	/255	35				113
17	Telone C35	190/255	25+	52		78	114
15	Telone C35 + Vapam	/425 /75	35				109
11	Telone C35 + Vapam	190/255 50/50	25	77	73[4]	80	103
8	Vapam	/75	25		70		110
9	Vapam	75/75	35	58	79[4]	80	98
10	Vapam	50/50	25	41	67	74	103
13	Vapam	/75	15				99
12	Vapam + Chloropicrin	/160 /50	25		51[4]		106
14	Chloropicrin	/160	25				102

[1] To convert to trays/ac, multiply Watsonville 1997 by 40, Watsonville 1998 by 46, Salinas 1997 by 10, and Salinas 1998 by 18. Average of 3 or 4 (Watsonville 98) replications.

[2] Telone C35, MeBr/Chloropicrin and Chloropicrin rates are in pounds/acre of active ingredients. Vapam rates are in gal/ac of the 42% formulation. All rates are on a bed area basis; for application rates on a gross field area basis, (comparable to flat fumigation) multiply by 0.6.

[3] Two non-treated controls were used. Due to cultural practice differences (planting/tarping dates), the first is most comparable to treatments 4 - 17, while the second is most comparable to treatment 2 (MeBr).

[4]Application rate was inadvertently reduced by 30%