STRAWBERRY YIELD AND WEED CONTROL WITH ALTERNATIVE FUMIGANTS APPLIED IN COMBINATION WITH METAM UNDER VARIOUS TARPS

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Earlier work suggested that Virtually Impermeable Film (VIF) may reduce fumigant emissions to the environment, enhance pest control efficacy and increase yield. Sequential application of metam sodium (metam) may also improve pest control and yield. Drip fumigation was conducted on beds tarped with VIF, Semi Impermeable Film (SIF) and standard high density polyethylene tarp (STD). Weed control efficacy and yield in plots treated with methyl bromide (Mb) alternative fumigants were compared to untreated control and drip-applied Mb. Most alternative fumigants provided good weed control and similar yield to plots treated with Mb. Midas provided equivalent or better weed control than Mb. Less permeable tarps did not improve weed control in plots treated with alternative fumigants.

METHODS

Experiments were conducted in a split-plot design at two locations: at the Monterey Bay Academy (MBA) near Watsonville and at "Spence farm," the USDA research plots near Salinas, California. The following fumigants were applied using drip fumigation: non-fumigated control; InLine™ at 300 lb/A; methyl bromide plus chloropicrin (MbPic 67:33) at 200, 250 and 300 lb/A; chloropicrin (Pic) at 200 lb/A; and Midas™ at 200 lb/A. Pre-plant drip fumigation was conducted under STD, SIF, and VIF tarps on Oct. 13, 2005, at MBA and on Nov. 2, 2005, at Spence farm.

A sequential application of metam at 171 and 100 lb ai/A was made to half of the beds at MBA and Spence, respectively. "Diamante" strawberry plants were transplanted on November 8, 2005, at MBA and November 29, 2005, at Spence. Prior to harvest the STD, SIF and VIF tarps were replaced with green tarp at MBA and clear STD tarp at Spence. Yield was evaluated from a 20-foot section and fruits were sorted into marketable and cull according to industry standards. Weed densities were evaluated for the entire plot (bed top only) on December 5, 2005, and February 23, 2006, at MBA, and December 20, 2005, and February 20, 2006, at Spence.

RESULTS

Plots treated with methyl bromide alternative fumigants had similar yields to plots treated with MbPic (Table 1) and provided similar weed control (Table 2). For most chemical treatments, sequential application of metam did not improve weed control or yield. No significant differences were found in weed control efficacy or yield under the different tarps. Metam, as a stand-alone treatment, provided similar weed control to other alternative fumigants, but had lower yields (Table 1). At MBA, all fumigants provided good control of annual bluegrass (*Poa annua*), one of the most common weeds in many California strawberry fields.

Benefits from sequential application of metam were visible only when reduced rates of soil fumigants were used, yet the rates used in this study were adequate to provide acceptable weed control and strawberry yields. Sequential application of metam improved yield and weed control only in plots fumigated with Pic or MbPic at 200 lb/A.

Table 1: Effect of fumigant, tarp type, and sequential application of metam sodium on total and marketable strawberry yields in Watsonville and Salinas.

Fumigant	Tarp	Watsonville (MBA)				Salinas (Spence)			
		Marketable yield		Total yield		Marketable yield		Total yield	
		No metam	With metam	No metam	With metam	No metam	With metam	No metam	With metam
		----------1000's lb/A----------							
Untreated	VIF	14.1	15.5	25.7	31.3*	11.6	8.6	18.0	16.9
MbPic 200 lb/A	VIF	21.7	20.7	38.6	40.5	12.7	13.1	22.0	22.4
MbPic 250 lb/A	VIF	22.5	21.6	43.0	42.4	13.6	14.6	24.2	24.3
MbPic 300 lb/A	VIF	20.7	22.0	41.0	41.0	15.3	13.3	24.3	23.2
InLine 300 lb/A	VIF	20.8	21.7	40.4	41.8	13.6	12.7	24.4	22.0
Midas 200 lb/A	VIF	18.1	18.5	35.6	37.7	16.3	15.4	26.1	25.7
Pic 200 lb/A	VIF	15.4	19.8*	30.5	39.0*	12.8	13.3	23.5	23.2
Untreated	SIF	15.4	15.1	25.5	29.6	9.9	10.4	16.3	19.4
MbPic 200 lb/A	SIF	22.0	19.2	37.7	37.7	12.3	13.1	22.0	22.4
MbPic 250 lb/A	SIF	21.0	19.8	39.2	38.2	14.5	14.6	23.8	25.6
MbPic 300 lb/A	SIF	22.3	20.2	39.1	37.7	12.0	13.7	20.9	23.2
InLine 300 lb/A	SIF	20.3	19.4	41.1	39.6	13.7	12.7	25.4	23.4
Midas 200 lb/A	SIF	18.8	18.5	38.3	30.3	14.5	16.6	24.5	25.8
Pic 200 lb/A	SIF	18.2	21.7	36.3	35.1	13.9	14.7	22.5	22.5
Untreated	STD	14.9	15.9	25.5	29.6	8.7	9.6	15.4	17.2
MbPic 200 lb/A	STD	19.8	19.3	37.7	37.7	13.8	13.0	24.5	23.3
MbPic 250 lb/A	STD	21.3	20.0	39.2	38.2	12.2	15.9	22.0	26.3
MbPic 300 lb/A	STD	19.6	19.4	39.1	37.7	12.5	14.1	21.6	23.5
InLine 300 lb/A	STD	21.7	20.7	41.1	39.6	12.8	13.1	24.1	23.5
Midas 200 lb/A	STD	18.7	16.8	38.3	30.2	15.6	12.5	26.5	24.1
Pic 200 lb/A	STD	18.7	18.1	36.3	35.1	13.7	14.6	23.1	24.4
ANOVA									
Fumigant		<0.001		<0.001		<0.001		<0.001	
Tarp		ns		ns		ns		ns	
Metam		ns		ns		ns		ns	
Metam*fume		ns		ns		ns		ns	

***** indicates significant difference due to the sequential application of metam (within row)

Table 2: Effect of fumigant, tarp type, and sequential application of metam sodium on total weed density in Watsonville and Salinas.

Fumigant	Tarp	Watsonville (MBA)				Salinas (Spence)	
		Annual bluegrass		Total weed		Total weed	
		Without metam	With metam	Without metam	With metam	Without metam	With metam
		----------1000's /A----------					
Untreated control	VIF	260.1	2.5*	423.0	7.8*	35.8	4.4*
MbPic 200 lb/A	VIF	0.0	0.0	4.8	2.8	10.1	4.1
MbPic 250 lb/A	VIF	0.3	0.8	6.8	4.0	6.7	6.0
MbPic 300 lb/A	VIF	0.0	1.0	8.0	5.8	13.1	3.7
InLine 300 lb/A	VIF	1.8	0.3	8.3	4.5	9.0	5.3
Midas 200 lb/A	VIF	0.0	4.5	5.5	11.8	8.8	6.9
Pic 200 lb/A	VIF	2.5	0.8	9.3	4.5*	9.8	5.5
Untreated control	SIF	85.9	17.6*	247.4	6.5*	37.3	4.4*
MbPic 200 lb/A	SIF	4.3	0.0	11.8	2.3	24.1	2.0*
MbPic 250 lb/A	SIF	15.1	0.0	10.0	2.8	6.4	4.1
MbPic 300 lb/A	SIF	10.1	0.0	10.3	1.8	10.7	3.4
InLine 300 lb/A	SIF	3.5	0.0	11.3	2.8	12.4	5.9
Midas 200 lb/A	SIF	12.6	0.3	5.6	8.3	16.5	6.4
Pic 200 lb/A	SIF	11.6	10.1	19.4	7.5	15.0	3.1
Untreated control	STD	336.1	7.5*	593.7	13.8*	45.6	4.7*
MbPic 200 lb/A	STD	0.8	0.8	11.1	2.5	10.2	2.4
MbPic 250 lb/A	STD	0.0	0.0	6.3	2.0	5.7	2.3
MbPic 300 lb/A	STD	0.0	2.0	8.0	3.5	9.5	2.3
InLine 300 lb/A	STD	10.1	0.3	23.1	6.3	11.9	6.0
Midas 200 lb/A	STD	1.5	7.3	8.8	16.6	8.3	7.9
Pic 200 lb/A	STD	15.1	3.0	25.9	9.8	9.8	6.6
ANOVA							
Fumigant		0.001		0.0002		<0.0001	
Tarp		ns		ns		ns	
Metam		0.03		0.02		<0.0001	
Metam*fume		0.001		0.0003		<0.0001	

***** indicates significant difference due to the sequential application of metam (within row)