

## FACILITATING ADOPTION OF ALTERNATIVES TO METHYL BROMIDE IN CALIFORNIA STRAWBERRIES

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**Summary.** The main goal of this project is to facilitate the adoption of methyl bromide (MB) alternative fumigants and to evaluate novel soil disinfestation methods with heat and non-fumigant chemicals for management of key pests in California strawberries. This project will demonstrate which combinations of fumigants applied at reduced rates under impermeable and semi-permeable tarps can sustain strawberry production in commercial fields. The combined strategy of reduced fumigant rates and increased retention may allow for continued use of alternative fumigants despite increasingly stringent regulations on fumigant use. This project will test and demonstrate non-fumigant methods to control key soil pests by steam, non-fumigant chemicals, and natural products. The ultimate goal of this research is to optimize and demonstrate cost-effective treatments that control soil pests and allow profitable California strawberry production to continue without pre-plant soil fumigation by MB.

The specific objectives and progress to date:

1. Evaluate reduced rates of alternative fumigants applied by drip fumigation under VIF and SIF in combination with metam sodium (sequential application).

Field trials were initiated at MBA in Watsonville, CA Oct 15, 2007 and Salinas, CA on Oct. 24, 2007. Treatments included were Pic at 150 lb/A, Inline at 200 lb/A, Pic60 EC at 150 lb/A, Midas at 150 lb/A, MBPic at 150 lb/A and an untreated control. These treatments were tarped with three different films: HDPE, VIF and SIF (semi-impermeable film). Viability of pathogen samples from these trials is currently being analyzed. Weed control results indicate that drip applied low rate (150 lb/A) treatments of chloropicrin and Midas in combination with VIF controlled weeds.

2. Conduct on-farm demonstration trials in buffer zones (60 to 300 ft) using reduced rates of fumigant applied by drip fumigation under VIF.

Demonstrations were initiated at Mandalay Berry, Oxnard, CA, Mar Vista Berry, and DB Specialty in Santa Maria, CA, Rod Koda, and Miguel Ramos at Watsonville, CA and with Juan Perez in Salinas, CA. Yield assessments are under way at Salinas and Santa Maria and were completed at Oxnard.

3. Determine relative fumigant retention under tarps for treatments used in objective 2.

Drip fumigation evaluations were conducted by Husein Ajwa at Mandalay Berry Farm in Oxnard and Rancho Tinijintas in Salinas. These evaluations showed that chloropicrin, iodomethane, and 1,3-D concentrations were at least two folds greater under VIF than standard PE tarp for five days after drip application.

Flat fumigation evaluations were conducted by Steve Fennimore at Mar Vista Berry, Santa Maria, CA in Sept. 2007 and with Juan Perez in Salinas, CA in Oct. 2007. Totally impermeable film (TIF) was evaluated and found to glue well (fumigation by TriCal) and to have excellent fumigant retention properties. The TIF increased the retention of 1,3-D, methyl iodide and MB compared to standard film.

4. The trial objective was to evaluate several non-fumigant treatments for control of soil pests and yield compared to MBPic.

Trials were initiated at Salinas, CA and Watsonville, CA.

The Salinas trial was initiated on Oct. 24, 2007 at the USDA-ARS research facility on Spence Rd. near Salinas, CA. Treatments were repeated four times and arranged in a randomized complete block design. Plots were one 52-in bed wide by 40 ft. The treatments included: steam (158°F for 30 min. at 6 inches), muscador 2000 lb/A, steam plus 150 lb/A Agro Thrive, control, stabilized urea at 300 lb/A, furfural at 600 lb/A, AG3 (NP) at 75 GPA, MBPic 350 lb/A, fludioxamil plus Ridomil at 1 pt. + 0.5 lb/A, and Brassica seed meal at 2000 lb/A. Fruit harvesting began on April 18 and is still in progress. Analysis of variance (ANOVA) and mean separation LSD with P= 0.05 was performed on all data.

Field studies were initiated in Watsonville at MBA Oct. 11, 2007. The trial design and treatments were the same as at Salinas. Two strawberry varieties were included at Watsonville, a Verticillium sensitive variety 'Ventana' and a more Verticillium tolerant variety, 'Albion'. Fruit harvest began April 17, 2008 at continues to the present.

Results. Treatments which controlled weeds were steam, steam + AgroThrive, and MBPic (Tables 1 and 2). Weed control results with furfural were good at Salinas and poor at Watsonville. The reason for this furfural inconsistency is unknown. Treatments at Salinas which had yields similar to MBPic were Steam + AgroThrive, and furfural. At Watsonville there are no significant yield differences to date. The treatments with highest yield in Albion were Furfural , MBPic, Brassica meal and Steam, and the treatments with the highest yield in Ventana were steam, Brassica meal, MBPic and Steam + Agrothrive.

Table 1. Weed densities and fruit yields at the Salinas non fume trial

Treatment	Rate/ description	Weed densities No. (1,000/Acre)	Crop Injury ---0 to 10----	Fruit yields g/plant
1. Steam	70° C 30 min.	25 c	0.0	319.7 bcd
2. Muscodor	2000 lb/A	242 ab	0.4	232.0 d
3. Steam + AgroThrive	70° C 30 min + 150lb/A.	8 c	0.0	439.6 ab
4. Control	0	251 ab	0.8	261.8 cd
5. Stabilized Urea <sup>1</sup>	300 lbs/A	347 a	0.6	263.3 cd
6. Furfural	600 lbs/A	31 c	0.0	415.9 abc
7. AG3 (NP)	75 GPA	238 ab	0.4	242.1 d
8. MBPic 67:33	350 lbs/A	22 c	2.3	581.6 a
9. Fludio.+Ridomil	1 pint +0.5 lb/A	177 b	0.5	266.1 cd
10 Brassica meal	2000 lb/A	160 b	0.0	322.2 bcd
LSD (P=.05)		112	2.1	170.5
Treatment Prob.		<0.0001	0.55	0.0044

<sup>1</sup> Tarped with black mulch

Table 2. Weed densities and fruit yields at Watsonville, CA non fume trial

Treatment	Rate/ description	Weed densities No. (1,000/Acre)	Albion ----- g/plant -----	Ventana
1. Untreated	0	1,322 a	542.6	699.3
2. MBPic 67:33	350 lb/A	49 d	784.2	877.4
3. Steam	70°C 30 min.	29 d	775.0	1017.3
4. Muscodor	2000 lb/A	261 cd	518.7	629.4
5. Brassica meal	2000 lb/A	822 b	743.3	996.8
6. Furfural	600 lbs/A	702 bc	872.7	640.0
7. Fludio. + Ridomil	1 pint + 0.5 lb/A	432 bcd	572.3	863.5
8. Stabilized Urea <sup>1</sup>	300 lbs/A	374 bcd	619.8	651.0
9. Steam + AgroThrive	70°C 30 min. + 150 lb/A	12 d	648.1	889.9
10. AG3 (NP)	75 GPA	776 b	418.8	598.9
LSD (P=.05)		500	298.0	351.0
Treatment Prob.		0.0001	0.094	0.128

- Demonstrate to growers the performance of key alternative fumigants so that they can make informed decisions during the transition to alternative fumigants.

Field days were held at Santa Maria on April 9, 2008, in Oxnard on April 30, 2008 and in Salinas on June, 10, 2008.