EVALUATION OF EIGHT PREPLAN-I- SOIL TREATMENTS FOR STRAWBERRY PRODUCTION IN SOUTHERN CALIFORNIA

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California produces about 75% of the fresh-market strawberries, and about 85% of the processed strawberries grown in the United Stares, with an annual farm gare value of about S500,000,000. Currently, the California strawberry industry relies on preplant soil fumigation with mixtures of methyl bromide (MeBr) and chloropicrin (aichloroninomethane) for control of soil-borne pathogens, nematodes and weeds. The proposed ban on the production and use of MeBr by the year 2001 is expected to have a negative impact on the California strawberry industry; without MeBr soil fumigation, control of soil-borne pests and weeds in fruiting fields may be more difficult, and the production of nematode- and pathogen-free planting stock could be problematic.

The developmenr of strawberry cultivars that are tolerant of (or resistant to) specific soil-borne pathogens and nematodes is often suggested as an alternative to methyl bromide soil fumigation. However, even in the absence of an identifiable pathogen or nematode problem, nonfumigation results in strawberry yield reductions of 30 to 50%. or greater. In such cases, the large increase-s in strawberry growth and yield that occur with soil fumigation result from the control of a highly variable complex of competitive, sublethal microorganisms. Although failure to control this complex of sublethal microorganisms will not result in crop failure *per* se, yield losses of 30% or greater could make strawberry production in many areas uneconomical. For this reason, modifications to current strawberry producdon systems may be the best approach for maintaining productivity of the California strawberry industry.

In 1992. a trial was conducted at the University of California South Coast Research and Extension Center in Irvine to evaluate the effects of the following soil treatments on fruit yield and weed control in strawberry: 1) Basamid applied at a rate of 400 lbs/acre, incorporated to 2" depth in preformed beds, then tarped with clear mulch for 6 weeks prior to planting; 2) chloropicrin applied at a rate of 100 lbs/acre, flat fumed; 3) Enzone applied at a rate of 388 gals/acre, injected through 2 drip lines on tarped beds: 4) MeBr/chloropicrin (MeBr/Pic) applied at a rate of 350 lbs/acre using a 2/1 ratio (flat fumed); 5) nonfumigated (control); 6) soil solarization (beds tarped with clear mulch for 8 weeks prior to planting); 7) solarization followed by metam sodium (beds tarped for 5 weeks, then metam sodium applied at a rare of 100 gallons per acre injected through 2 drip lines on tarped beds); 8) metam sodium applied at a rate of 100 gallons per acre, injected through 2 drip lines on tarped beds. The site used for this study had not been planted to strawberries for 20 years.

Fumigant materials were applied to plots consisting of three, 2-row beds (48" centers), each 90 feet long. For all bed treatments, slotted fertilizer and one drip irrigation line were placed in the beds prior to treatment application. To obtain a uniform wetting pattern when applying fumigant materials through the drip system, two drip lines per bed were used: these two lines were removed following application. Enzone, Vapam, chloropicrin, and MBPic were all applied at least 3 weeks prior to planting. There were two replications, for a total of six beds per treatment (approximately 0.05 acres/treatment).

Crowns of 'Chandler' and 'Oso Grande', obtained from a high elevation nursery, were planted on 13 October, 1992. Plant spacing was 16" in the row, for a total of 720 plants per fumigation treatment (360 plants for each cultivar). Fruit yields and mean fruit size per plot were determined at about weekly

intervals from January 29 until 28 May. Hand weeding was performed for all treatments at monthly intervals beginning 1 December, 1992, and ending 1 May, 1993.

There were no visual symptoms of soil-borne pathogens in any of the treatment plots, and no difference among treatments in the number of plants per treatment For plants grown with alternative soil fumigation treatments. yields ranged from 66% (Enzone) to 100% (chloropicrin) of the yield obtained with MeBr/Pic (Table 1). With the exception of chloropicrin, use of an alternative soil fumigant resulted in yield reductions of at least 15%. No alternative treatment was as effective as MeBr/Pic in controlling weeds. Weed control labor for alternative treatments ranged from 13 times (solar/metam sodium) to 3 times (nonfumigation) that of the labor required in the MeBr/Pic treatment (Table 2).

Even after a 20-year crop rotation out of strawberries, and thus in essentially "new" strawberry ground, preplant soil fumigation with MeBr/Pic or chloropicrin alone resulted in significantly higher yields. and in most cases, significantly larger fruit than the other materials tested. Although the experimental field used for this study was not a typical strawberry replant site, the results suggest that chloropicrin. possibly in combination with other materials, is one of the most promising alternative soil fumigants available at this time. Although we obtained satisfactory results with chloropicrin at a rate of 100 lbs/acre, previous work indicates that higher rates (300 lbs/acre or more) are needed for effective conuol of soil-borne pathogens using chloropicrin in a replant situation.

Table 1. Soil Fumieadon Treatment, Fruit Yield and Fruit Size

Treatment	Chandler Yield (Trays/a)[z]	Chandler Fruit size	Chandler % of MBPic Yield	Oso Grande Yield (Trays/a)	Oso Grande Fruit size (g)	Oso Grande % of MBPic Yield
Chloropicrin	2,303 ay	18.3 a	100	2,341 a	23.8 a	100
MeBr/Pic	2,290 a	18.3 a	100	2,316 a	23.0 a	100
Basamid	1,910 b	16.7 b	83	1,978 b	21.4 b	85
Solar/ metam sodium	1,895 b	16.5 b	83	1,833 b	21.5 b	80
Metam sodium	1.884 b	16.4 b	82	1,946 b	21.7 b	84
Solarization	1.852 b	17.2 ab	81	1,822 bc	23.0 a	79
Enzone	1,806 b	17.0 ab	79	1,523 d	21.4 b	66
Control	1,670 b	17.0 ab	73	1,604 cd	30.7 b	69

[z] One tray = 12 lbs. of tit

y Different letters indicate significant differences among treatments within columns (P = 0.05).

Table 2. Weed Control and Soil Fumieation Treatment

Treatment	Labor*
MeBr/Pic	5 hrs, 27 mins
Solar/metam sodium	7 hrs, 0 mins
Chloropicrin	7 hrs, 51 mins
Metam sodium	7 hrs, 57 mins
Basamid	8 hrs, 39 mins
Solarization	11 hrs, 06 mins
Enzone	11 hrs, 33 mins
Control	16 hrs, 21 mins

* Total labor required for weed control in a 0.05 acre plot during a 6-month period.