RESULTS FROM 2000-01 USDA IR-4 MBA FIELD TRIALS IN CA AND FL STRAWBERRIES

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The field trials reported herein are part of a project of the USDA's IR-4 Program which began in 1998, to identify alternatives to methyl bromide for preplant soil fumigation in strawberries. During the 2000-01 strawberry growing season, four trials were conducted, two in California (Oxnard, Ventura Co., and Salinas, Monterey Co.) and two in Florida (both in Dover, Hillsborough Co.). This report summarizes the materials / methods and results from these field experiments.

Lists of the treatments evaluated at each of the field trial sites are provided in Table 1 (Ca) and Table 2 (Fl). Product names, target rates and application methods are outlined for each material tested. Several of the treatments comprise two or more products, applied separately or in combination. These combination treatments were designed in an effort to control the broad spectrum of soilborne pests, pathogens and weed seeds that are currently controlled by the industry standard, methyl bromide/chloropicrin (mb/pic). Each treatment was replicated four times in a randomized complete block design. The replicate plot size in California was a single bed (64 inch centers in the Oxnard test, 46 inch centers in the Salinas test), 150 ft. long; in Florida, the replicate plot size was a single bed (48 inch centers at both sites), 75 ft long. Strawberry varieties utilized in these tests were Camarosa (Oxnard and both Fl trials) and Diamante (Salinas).

Over the course of each field trial, treatments were evaluated for their effects on the following variables: (1) strawberry plant growth and vigor (using vigor ratings and plant diameter measurements), (2) control of weeds (utilizing both seeded and indigenous populations of various weed species), (3) control of the sting nematode (*B. longicaudatus*) in the Fl trials, and (4) strawberry marketable and cull fruit yields. Results from the marketable fruit yield evaluations will be highlighted in this presentation.

The season total marketable fruit yields from the two Ca trials (preliminary data through the end of July 2001 are provided for the Salinas trial) and the two Fl trials are reported in Tables 1 and 2, respectively, along with results from the statistical analyses of these data (ANOVA, DMRT @ $P \leq 0.05$). In the Oxnard trial, treatments which produced a mean yield statistically comparable to the mb/pic standard (67/33 at 300 lbs) were as follows: iodomethane/chloropicrin (60/40 at 295 lbs), chloropicrin EC alone (300 lbs),

InLine alone (32 gals), and combinations of Basamid + chloropicrin EC (at 200 lbs and 300 lbs, respectively), Basamid + Enzone + chloropicrin EC (at 200 lbs, 94 ozs / 100 gals irrigation water, and 200 lbs, respectively), metam sodium + InLine (at 37.5 gals and 32 gals, respectively), metam sodium + chloropicrin EC + Fosthiazate (at 37.5 gals, 200 lbs, and 4.5 lbs ai, respectively), metam soduim + chloropicrin EC + DiTera DF (at 37.5 gals, 200 lbs and 12 lbs – pre- and post-planting, respectively), and metam sodium + Propozone (at 37.5 gals and 100 gals, respectively). All rates noted above are given in quantities of product (or active ingredient, in the case of Fosthiazate) per treated acre. Metam sodium was used strictly for weed control on the bed-tops, in the combination treatments mentioned above; the chemical was applied as a broadcast spray in 1000 gallons of water carrier per treated acre, just prior to application of the polyethylene bed mulch. The marketable fruit yield data from the Salinas trial are preliminary (through July 2001), and the season-total yields will be provided at the time of the conference.

Results from the statistical analyses of the Chancey (Fl) trial marketable fruit yield data are comparable to those obtained from the Oxnard (Ca) trial. At the Duke (Fl) trial, all of the potential alternative soil fumigant treatments resulted in marketable fruit yields which were statistically comparable to that of the mb/pic standard, except the PlantPro 45B combination treatments which included both pre- and post-planting applications of PlantPro 45B. When only pre-planting applications of PlantPro 45B were used, as in Trt. #11 (Devrinol + PlantPro 45B + Fosthiazate), the strawberry plants responded with fruit yields which were statistically comparable to that of the mb/pic industry standard treatment.

Table 1. Treatment descriptions (products, rates and application methods) and mean marketable fruit yields from 2000-01 IR-4 MBA California strawberry field trials.

TRT No.	PRODUCT(S)	RATE[1]	APPLICATION METHOD	MARKETABLE YIELD[12] OXNARD		MARKETABLE YIELD[12] SALINAS	
1	Iodomethane / Chloropicrin (60/40)	295 lbs	Drip[2]	3596	ab	---	---
2	Iodomethane	175 lbs	Drip[2]	2724	de	---	---
3	Basamid + Enzone + Chloropicrin EC	300 lbs 300 gals 200 lbs	Broadcast / incorp. (split appl)[3] Bed-Shank[6] Drip[2]	3655	a	---	---
4	Basamid + Enzone + Chloropicrin EC	200 lbs 94 ozs / 100 gals 200 lbs	Broadcast / incorp.[4] Drip[2] Drip[2]	3776	a	---	---
5	Chloropicrin EC	300 lbs	Drip[2]	3603	ab	3848	a
6	Metam Sodium + InLine	37.5 gals 32 gals	Broadcast spray over bed top[5] Drip[2]	3558	ab	3857	a
7	InLine	32 gals	Drip[2]	3643	a	3788	a
8	Metam Sodium	50 gals	Drip[2]	2815	de	2767	bc
9	Metam Sodium + PlantPro 45B (1x)	37.5 gals 71 gals(pre) / 23.6 gals(post)	Broadcast spray over bed top[5] Drip[2 7]	2186	g	2642	c
10	Metam Sodium + PlantPro 45B (2x)	37.5 gals 142 gals(pre) / 47.3 gals(post)	Broadcast spray over bed top[5] Drip[2 7]	1677	h	2918	bc
11	Metam Sodium + PlantPro 45B + Fosthiazate 500 EC	37.5 gals 23.6 gals (pre) 4.5 lbs ai	Broadcast spray over bed top[5] Drip[2 8] Drip[2 8]	2536	ef	2850	bc
12	Metam Sodium + PlantPro 45B + Fosthiazate 500 EC	37.5 gals 23.6 gals (pre & post) 4.5 lbs ai	Broadcast spray over bed top[5] Drip[2 8] Drip[2 8]	2012	g	2618	c
13	Metam Sodium + Chloropicrin EC + Fosthiazate 500 EC	37.5 gals 200 lbs 4.5 lbs ai	Broadcast spray over bed top[5] Drip[2] Drip[2]	3582	ab	3872	a
14	Metam Sodium + Chloropicrin EC + DiTera DF	37.5 gals 200 lbs 12 lbs (pre & post)	Broadcast spray over bed top[5] Drip[2] Drip[9]	3572	ab	---	---
16	Basamid	400 lbs	Broadcast / incorp. (split appl)[3]	3026	cd	---	---
17	Basamid + Chloropicrin EC	200 lbs 300 lbs	Broadcast / incorp.[4] Drip[2]	3835	a	---	---
18	Basamid + InLine + Chloropicrin EC	250 lbs 10 gals 200 lbs	Broadcast / incorp.[4] Drip[2 10] Drip[2 10]	---	---	4238	a
19	Metam Sodium + Propozone (1x)	37.5 gals 50 gals	Broadcast spray over bed top[5] Drip[2]	3182	c	---	---
20	Metam Sodium + Propozone (2x)	37.5 gals 100 gals	Broadcast spray over bed top[5] Drip[2]	3268	bc	---	---
21	Metam Sodium + Messenger	37.5 gals 4.5 ozs	Broadcast spray over bed top[5] Foliar sprays (14-day interval)	2630	e	---	---
22	Metam Sodium + Rootshield	37.5 gals 120 lbs	Broadcast spray over bed top[5] Banded into planting slot	---	---	2967	bc
23	Metam Sodium + Help (ReZist + Stabilizer)	37.5 gals 1 pt each product	Broadcast spray over bed top[5] Foliar sprays (30-day interval)	2574	ef	2846	bc
24	Methyl Bromide / Chloropicrin (67 / 33)	300 lbs (Oxn) / 350 lbs (Sal)	Shank[11 13]	3555	ab	3220	b
25	Untreated Control	---	----	2265	fg	2636	c

Table 1, cont. (footnotes):

[1] Rates are given in quantities of product per treated acre, except for Fosthiazate which is given in lbs ai per treated acre.

[2] Drip-applied Iodomethane / Chloropicrin (60/40), Chloropicrin EC, Enzone (Trt. #4), InLine, Metam Sodium, Propozone, PlantPro 45B (preplant application in Trt. #'s 9 & 10 and tank-mix preplant applications with Fosthiazate in Trt. #'s 11 & 12), and Fosthiazate (Trt. #13) were applied using a target water carrier volume of 1.5". All drip applications were made using 2 drip lines per bed in Oxnard (except in Trt. #8, where 3 lines were used), and a single line per bed in Salinas.

[3] Basamid was applied in a split-application using a hand-held granular applicator. In Trt. #3, 175 lbs per treated acre were applied pre-listing / bedding and incorporated into the bed soil during the listing / shaping process, and the remaining 125 #'s were applied to the bed-top and incorporated with 1" of water. In Trt. #16, ½ of the 400 lbs was applied pre-bedding and ½ was applied post-bedding to the bed-top (also incorporated with 1" of water).

[4] Basamid in these treatments was applied strictly to the bed-tops, and incorporated with 1" of water.

[5] Metam sodium was used strictly to control weeds on the bed-top, and was applied as a bed-top broadcast spray using 1000 gpa of water carrier. Treated beds were tarped immediately following application.

[6] Enzone was applied at the Oxnard trial using 2 shanks per bed, approximately 12" deep and 12" apart.

[7] An additional 1" of water was applied 4 days pre-planting. A single post-planting application was made, using 1" of water carrier.

[8] The PlantPro 45B and Fosthiazate were applied as a tank-mix at the pre-transplanting application. A single post-planting application of PlantPro 45B was made to Trt. #12, using 1" of water.

[9] DiTera DF was applied at-planting using 1" of water. A single post-planting application was made approximately 4 weeks post-transplanting.

[10] InLine and Chloropicrin EC were injected simultaneously.

[11] Methyl bromide / Chloropicrin was flat-fume shanked at 300 lbs per acre at the Oxnard trial, and was bed-shanked at 350 lbs per treated acre (single shank per bed, ~12" deep) at the Salinas trial.

[12] Marketable fruit yield means within a column followed by the same letter are not significantly different (DMRT, $p \leq 0.05$). Yields given for the Salinas trial are totals through the end of July 2001. Treatments without yield means were not included at that particular trial site.

[13] The marketable fruit yield for Trt. #24 was estimated during the period 8 Apr. – 14 May 2001, as follows. The mean % of April yield produced from 4/8-28/01 (=0.8937) from all treatments (except #'s 11, 24 and 25), together with the actual yields through 4/7/01 for Trt. #24, were used to estimate the total April marketable yield for this treatment. Similarly, the mean % of May yield produced from 5/1-14/01 (=0.4633) from all treatments (except #'s 12 and 23-25), together with the actual yields from 5/15-31/01 for Trt. #24, were used to estimate the total May marketable yield for this treatment. This was done in an effort to approximate (as closely as possible) what the actual market fruit yield was for this treatment during April and May, as the replicate plots were over-picked by the commercial harvesting crew from 4/8-5/14/01.

Table 2. Treatment descriptions (products, rates and application methods) and mean marketable fruit yields from 2000-01 IR-4 MBA Florida strawberry field trials.

TRT No.	PRODUCT(S)	RATE[1]	APPLICATION METHOD	MARKETABLE YIELD[9] CHANCEY		MARKETABLE YIELD[9] DUKE	
1	Iodomethane / Chloropicrin (60/40)	295 lbs	Bed-Shank[2]	1624	ab	---	---
2	Iodomethane	175 lbs	Bed-Shank[2]	1438	a-d	---	---
3	Basamid + Enzone + Chloropicrin	300 lbs 300 gals 200 lbs	Broadcast / incorp. (split appl)[3] Bed-Shank[2] Bed-Shank[2]	1704	ab	1137	a
5	Metam Sodium + Chloropicrin	37.5 gals 300 lbs	Broadcast spray over bed-top[4] Bed-Shank[2]	1800	ab	1173	a
6	Metam Sodium + Telone C35	37.5 gals 35 gals	Broadcast spray over bed-top[4] Bed-Shank[2]	1944	a	1167	a
7	Telone C35	35 gals	Bed-Shank[2]	1940	a	1038	ab
8	Metam Sodium	37.5 gals	Broadcast spray / rototilled[5]	841	c-f	698	bc
9	Devrinol 50WG + PlantPro 45B (1x)	8 lbs 47.3 gals (pre) / 23.6 gals (post)	Broadcast spray / rototilled[6] Drip[7] [8]	461	f	90	d
10	Devrinol 50WG + PlantPro 45B (2x)	8 lbs 94.6 gals (pre) / 47.3 gals (post)	Broadcast spray / rototilled[6] Drip[7] [8]	328	f	434	cd
11	Devrinol 50WG + PlantPro 45B + Fosthiazate 500 EC	8 lbs 23.6 gals (pre) 4.5 lbs ai	Broadcast spray / rototilled[6] PP45 + Fosth. broadcast sprayed (tank-mix) / rototilled	776	def	1183	a
12	Devrinol 50WG + PlantPro 45B + Fosthiazate 500 EC	8 lbs 23.6 gals (pre & post) 4.5 lbs ai	Broadcast spray / rototilled[6] PP45 + Fosth. broadcast sprayed (tank-mix) / rototilled, foll by PP45 post-plt apps	396	f	497	c
13	Devrinol 50WG + Chloropicrin + Fosthiazate 500 EC	8 lbs 200 lbs 4.5 lbs ai	Broadcast spray / rototilled[6] Bed-Shank[2] Drip[7]	1495	abc	1094	ab
14	Metam Sodium + Chloropicrin + DiTera DF	37.5 gals 200 lbs 19.5 lbs (pre) & 12 lbs (post)	Broadcast spray over bed-top[4] Bed-Shank[2] Drip[7]	1704	ab	---	---
15	Basamid + Telone C35	300 lbs 35 gals	Broadcast / incorp. (split appl)[3] Bed-Shank[2]	1887	a	---	---
19	Metam Sodium + Propozone (1x)	37.5 gals 50 gals	Broadcast spray over bed-top[4] Bed-Shank[2]	876	c-f	---	---
20	Metam Sodium + Propozone (2x)	37.5 gals 100 gals	Broadcast spray over bed-top[4] Bed-Shank[2]	1151	b-e	---	---
23	Metam Sodium + Help (ReZist + Stabilizer)	37.5 gals 1 qt	Broadcast spray over bed-top[4] Foliar sprays (30-day interval)	899	c-f	815	abc
24	Methyl Bromide / Chloropicrin (67 / 33)	350 lbs	Bed-Shank[2]	1636	ab	1020	ab
25	Untreated Control	---	----	726	ef	932	ab

[1] Rates are given in quantities of product per treated acre, except for Fosthiazate which is given in lbs ai per treated acre.

[2] Bed-shank applications were made using 2 shanks per bed, 12" apart and ~12" deep (from the top of the bed).

[3] Basamid was applied in a split-application using a hand-held granular applicator. In Trt. #3, 175 lbs per treated acre were applied pre-listing / bedding and then rototill-incorporated; the remaining 125 #'s were applied to the bed-top and incorporated with 1" of water using microjet sprinklers.

[4] Metam sodium was used strictly to control weeds on the bed-top, and was applied as a bed-top broadcast spray in 150 gallons of water per treated acre to moist soil, immediately prior to laying plastic bed mulch.

[5] Metam sodium was applied as a broadcast spray over the 4-foot pre-bedded area, rototilled into the soil, and then beds were listed / shaped.

[6] Devrinol was applied as a broadcast spray over the 4-foot pre-bedded area, rototilled into the soil, and then beds were listed / shaped.

[7] Drip-applied PlantPro 45B, Fosthiazate, and DiTera were applied using 1.0-1.5" of irrigation water. All drip treatments were applied using 2 lines per bed. Lines were flushed for 15-30 minutes after each injection, depending upon the protocol requirements.

[8] For the PlantPro 45B preplant drip treatments, 1" of water was applied via drip irrigation several days before transplanting.

[9] Marketable fruit yield means within a column followed by the same letter are not significantly different (DMRT, $p \leq 0.05$). Treatments without yield means were not included at that particular trial site.