ALTERNATIVE FUMIGANTS APPLIED WITH PE AND VIF MULCHES FOR TOMATO

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In-row application of 1,3- dichloropropene (1,3-D) + 17% and 35% chloropicrin (Pic) at 336 $L \cdot ha^{-1}$ + pebulate at 4.5 $kg \cdot ha^{-1}$ are effective alternative for methyl bromide-Pic (MBr-Pic) for polyethylene mulched tomato. However, the use of 1,3-D products will be limited by the worker protection provisions required in handling this material. In contrast to in-row applications, broadcast applications minimizes the impact of these worker protection provisions on1,3-D application. In past studies with tomato, pepper, and strawberry, metam-Na at the labeled rate of 295 $L \cdot ha^{-1}$ has not provided acceptable control of weeds, nematodes, and soil fungi. However, pest control has been adequate at 590 $L \cdot ha^{-1}$ in limited studies. Thus, a broadcast application rototilled and pressed into the bed area would concentrate metam-Na and should improve pest control. The experimental fumigant, iodomethane-Pic (MI) may be as effective as MBr-Pic. Volatility of all fumigants to the atmosphere is a concern. The development of high density polyethylene (HDPE) mulches that are virtually impermeable films (VIF) may reduce emission of fumigants and improve fumigant activity.

Tomato (*Lycopersicon esculentum* Mill.) was grown during Spring 2001 to evaluate the effect of application method of fumigants applied with low-density polyethylene (LDPE) and VIF mulches on production and pest control. Studies were conducted on a Millhopper fine sand site near Gainesville, FL that was naturally infested with purple and yellow nutsedge (*Cyperus rotundus* L. and *Cyperus esculentus* L.), root-knot nematode *[Meloidogyne incognita* (Kofoid &White) Chitwood], and soil pathogenic fungi. Broadcast applications of 1,3-D + 35% Pic at 243 $L \cdot ha^{-1}$ and 1,3-D at 168 $L \cdot ha^{-1}$ were injected 0.25 m deep with 6 shanks spaced 0.3 m apart on 1.8m plots on 8 Feb. On15 Feb., MBr-Pic (67-33%) and MI-Pic, each at 235 and 390 $kg \cdot ha^{-1}$, and 1,3-D + 35% Pic at 196 and 336 $L \cdot ha^{-1}$ were injected 0.25 m deep with 3 shanks spaced 0.3 m apart on 0.9 m beds, and metam-Na was sprayed onto 1.8 m plots, rototilled, and formed into 0.9 m wide beds. Beds (0.9 m) were formed and Pic at 311 $L \cdot ha^{-1}$ was injected into beds that had been broadcast treated with 1,3-D. Pebulate was applied on the bed and incorporated 0.1m at 4.5 $kg \cdot ha^{-1}$ with all treatments except MBr-Pic, MI-Pic, and the untreated control. One drip tubing line and 38.1µm (1.5 mil) black polyethylene (PE) or 35µm VIF (Industria Plastica Monregalese, Mondovi, Italy) mulches were applied on 15 Feb. On 28 Feb., metam-Na was applied at 295 $L \cdot ha^{-1}$ with 2 and 3 drip lines with 6 and 4 hours of water application, respectively. Treatments were arranged in a split-plot with 12 fumigant and 2 mulches with five replications in plots 1.8 m x 11.0 m. 'Florida 47' tomato seedlings were transplanted 0.45 m apart on the bed on13 Mar. Fruit were harvest at the mature green stage and graded into marketable and cull fruit. A complete fertilizer was applied before

bedding and additional N-K fertilizer was applied through the drip-irrigation system. Purple and yellow nutsedge plants that grew through the mulch were counted at the middle and end of the season. After fruit harvest, 10 tomato plants per plot were dug, and roots were rated for the presence of root-knot nematodes. Two plants per plot were taken for root disease identification. Roots were washed and 6 g of root tissue was plated onto two plates each of three selective media for isolation of *Fusarium oxysporum,* Pythium spp., and general fungi. Plated tissue included crown tissue, lateral roots, and fine roots. The incidence (%) of the fungal genera isolated was calculated.

Tomato seedlings sampled five weeks after transplanting were affected by fumigant and mulch treatment (Table 1). Interactions between fumigant and mulch were not significant, therefore main effects are presented. Plant size was significantly greater with all fumigant treatments than with no treatment. Plant were larger and similar with both rates of MBr-Pic and significantly smaller with all other fumigant treatments except MI-Pic at the lower rate of 235 $kg \cdot ha^{-1}$. The smallest plants were obtained with the in- row treatment of 1,3-D + 35% Pic at 196 $L \cdot ha^{-1}$ and the broadcast treatment of 1,3-D + 35% Pic at 243 $L \cdot ha^{-1}$. Overall, plant dry weights were 14 % smaller with the VIF mulch than with the PE mulch. This may indicate that the fumigants were held in the soil longer with the VIF and this resulted in some reduction in plant growth. Nutsedge counts made on 30 Mar. indicated excellent nutsedge control with all fumigants except with broadcast applied 1,3-D + 35% Pic + pebulate. The 1,3-D treatment applied broadcast with Pic and pebulate applied in the row provided excellent sedge control. At the 19 June sampling, nutsedge control was good with all treatments except with 1,3-D + 35% Pic and metam-Na applied broadcast, and with metam-Na applied with 2 drip lines. Mulch type had no effect on nutsedge counts. Root gall was not as severe at this site as in past work. The root gall ratings of 4.6 and 4.7 were highest with the check and with metam-Na applied broadcast, and lower and similar with all other fumigants (Table 1). The incidence of root *Fusarium oxysporum* was less than with the check all fumigants except with 1,3-D + 35% Pic in-row at 336 $L \cdot ha^{-1}$ and applied broadcast, and with metam-Na broadcast and applied with 2 drip tubes.

Tomato total fruit yields with all fumigant treatments were higher than with no treatment (Table 1). Fruit yields were highest with 1,3-D treatment applied broadcast with Pic and pebulate applied in the row, all MBr-Pic and MI-Pic treatments, in row applied 1,3-D + 35% Pic at 196 $L \cdot ha^{-1}$, and metam-Na applied with 3 drip lines. Fruit yields were significantly lower with broadcast applied 1,3-D + 35% Pic and broadcast metam-Na. Also, yields were significantly higher with PE than with VIF mulch.

In this study, neither yields or pest control was enhanced with VIF as compared to that with PE mulch. Loss of fumigant was probably reduced with VIF mulch compared with PE mulch but this was not measured. Also, pest control and yields were similar with the higher and lower rates of MBr-Pic and MI-Pic with both mulch types. Pest control and yields were lower with broadcast applied 1,3-D + 35% Pic than with in row applied 1,3-D + 35% Pic and with broadcast applied metam-Na.. Drip applied metam-Na applied with 3

drip tubes provided better pest control and fruit yield than with 2 drip lines or applied broadcast and rototilled in to the bed.

Table 1. Main effects of fumigant and mulch on plant vigor, nutsedge counts, nematode, and Fusarium root ratings, and fruit yield of 'Fla 47 Tomato". Gainesville, FL. Spring 2001. Interactions between fumigant and mulch were not significant.

Treatment	Rate/ha	Plant dw g 19 Apr.	Nutsedge no./m^2 30 Mar.	Nutsedge no./m^2 19 June	Root gall[u] 12 Jul	Root Fusarium[t] 26 June	Yield (mt/ha)
Untreated		13f	58a	215a	4.6a	22.3ab	20.0e
Methyl bromide /Pic (67/33)	235 kg	34a	0c	18cd	1.6bc	9.1de	62.7abc
Methyl bromide /Pic (67/33)	390 kg	33ab	0c	23cd	1.4bc	3.3e	67.0ab
Iodomethane /Pic (67/33)	235 kg	29bc	1.	20cd	0.3bc	5.8de	63.7ab
Iodomethane /Pic (67/33)	390 kg	27cd	0c	17cd	0.2c	4.9de	67.2ab
1,3-D + 35 % Pic[z]	196 L	21e	0c	11d	2.2b	8.1cde	61.7abc
1,3-D + 35 % Pic[z]	336 L	26cde	2c	21 cd	1.5bc	13.9bcd	55.2bcd
1,3-D + 35 % Pic[yz]	243 L	22de	38b	227a	1.8bc	18.9abc	42.8d
1,3-D[y] + Pic[z]	168L + 311kg	28bcd	2c	20cd	0.2c	8.1cde	69.8a
Metam-Na[yz]	295 L	27cd	12c	77b	4.7a	26.4a	46.3d
Metam-Na[z] - Drip[x]	295 L	25cde	5c	66bc	1.8bc	11.5bcde	50.2cd
Metam-Na[z] - Drip[w]	295 L	25cde	0 c	32cd	1.2bc	9.1de	67.7ab
Mulch film							
Polyethylene		28a	10	69	2.0	12.6	59.1a
VIF		24b	10	55	1.5	10.9	53.3b
Signif.		**	ns	ns	ns	ns	*

[z]Pebulate applied at 4.5 kg/ha.
[y]Treated broadcast.

[x]Treated thru (2) drip lines with 6 hours water.
[w]Treated thru (3) drip lines with 4 hours water.
[v]Mean separation Duncan's Multiple Range Test, 5 % level.
[u]Root ratings 0 (none) -10 (100 %).
[t]Incidence (%) of *Fusarium oxysporum*.