BROADCAST vs IN-ROW APPLICATION OF 1,3-D PLUS CHLOROPICRIN AS AN ALTERNATIVE FOR TOMATO FUMIGANTS

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Tomato (*Lycopersicon esculentum* Mill.) was grown during the Spring of 1999 and 2000 to evaluate the effect of method of application of 1,3- dichloropropene(1,3-D) + 17% and 35% chloropicrin (pic) on fruit production and pest control. In past work, application of 1,3-D + pic injected into beds combined with pebulate provided good control of plant-parasitic nematodes, soil fungi, and nutsedge in polyethylene mulched tomato. Because of label restrictions on use of 1,3-D, all personnel in the field during its application must wear protective clothing including a full-face respirator, spray suit, rubber gloves and boots. With the high air temperatures that typically occur during the time treatments are applied, use of such equipment is very uncomfortable for workers and will reduce the use of this alternative. If effective applications of 1,3-D can be made in a broadcast placement, with bedding and mulch application occurring after a few days, use of these protective materials will not be needed. Thus, studies were conducted to compare the application of 1,3-D by broadcast with in-row placement.

Studies were conducted at the Gainesville Horticultural Unit on a Millhopper fine sand site that was 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. In spring 1999, 1,3-D + 17% pic at 168 L·ha^{-1}, 1,3-D + 35% pic at 168 L·ha^{-1}, and metam-Na at 295 L·ha^{-1} +1,3-D at 112 L·ha^{-1} were applied broadcast (1.8 m) and compared with in-row (0.9 m) treatments of MBr-pic (67-33% at 390 kg·ha^{-1} and 1,3-D + 35% pic at 336 L on polyethylene mulched tomato. Pebulate at 4.4 kg·ha^{-1} was applied with all treatments except MBr-pic. Broadcast fumigants were injected 25 cm deep with shanks spaced 0.3 m apart into1.8 m wide areas except metam-Na and pebulate were sprayed over the soil surface (1.8 m) and incorporated 10 cm deep on 18 February. On 2 March, 0.9 m beds were formed with a bed-press and the in-row treatments applied 0.25 m deep with 3 shanks spaced 0.3 m apart before mulch application.

In spring 2000, 1,3-D + 17%pic at 196 L·ha^{-1}, 1,3-D + 35%pic at 243 L·ha^{-1} and metam-Na at 295 L·ha^{-1} were applied broadcast on 2 March and compared with in-row treatments of MBr-Pic (67-33%) at 390 kg·ha^{-1} and 1,3-D + 35% pic at 336 L with pebulate at 4.4 kg·ha^{-1}. Black polyethylene mulch was applied with the in-row fumigant treatments. On 13 March, the 1.8 m broadcast treated area was pressed into the 0.9 m bed area. In contrast to 1999, pebulate was applied in-row on 13 March for the broadcast fumigant treatments and the in-row treatments except with MBr-pic, tilled 10 cm deep, and mulch applied. A complete fertilizer was applied before bedding and a N-K fertilizer was applied through the drip-irrigation system weekly for 10 applications. Counts of purple and yellow nutsedge seedlings that grew through the mulch were counted at the middle and end of the season. Treatments were arranged in a randomized

complete-block design 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 on 24 March 1999 and on 16 March 2000. Fruit were harvest at the mature green stage and graded into marketable and cull fruit. After fruit were harvested, 10 tomato plants were dug, and roots were rated for the presence of root-knot nematodes.

In spring1999, tomato fruit yield (Table 1) with 1,3-D + 17%, 1,3-D + 35%pic, and metam-Na +1,3-D applied broadcast were statistically similar to that with in-row treatments of MBr-Pic and 1,3-D + 35%pic. Root gall was not as severe at this site as in past work. Root gall ratings were highest with the check, statistically similar with broadcast applications of 1,3-D +17%pic and with metam Na + 1,3-D as the check and significantly lower than with the check with broadcast 1,3-D +35%pic, and in-row treatments of methyl bromide and 1,3-D + 35%pic.. Broadcast applications of pebulate and the bed preparation before planting resulted in very poor nutsedge control. Nutsedge control with MBr -Pic and in row application of pebulate with 1,3-D + 35%pic was acceptable. Apparently, with the broadcast application of pebulate two-weeks before bedding and mulch application, herbicide activity was reduced.

In spring 2000 (Table 2), tomato fruit yields with all fumigant treatments were statistically similar and higher than with the untreated tomato. Nematode root galls were effectively controlled with all fumigant treatments applied broadcast or in row except metam-Na. With the latter treatment, root gall ratings were similar to that with the untreated tomato. Nutsedge control was obtained with all treatments that contained MBr-Pic and pebulate. In-row application of fumigants was more effective than broadcast application as in the spring of 1999 with broadcast fumigant and pebulate treatments.

Application of 1,3-D + pic and metam-Na broadcast and then pressed into a bed provided pest control that was comparable to in-row 1,3-D or with MBr -Pic. Nematode root gall ratings were somewhat poorer with metam-Na than with 1,3-D but were significantly better than with the untreated tomato. In past work, application of metam-Na at 295 $L \cdot ha^{-1}$ in-row was not effective. However, in the present study with 295 $L \cdot ha^{-1}$ metam-Na applied broadcast and pressed into a bed, pest control was more comparable to that with MBr-Pic. With the treatment of 1.8 m area and bedded into 0.9 m beds, the fumigant was concentrated and activity was enhanced. These studies indicate that broadcast application of 1,3-D + pic was as effective as in-row applications. Broadcast applications of metam-Na broadcast were apparently more effective than in-row applications in past studies, probably due to a concentration of the fumigant in the bed under the mulch. Application of pebulate in-row as in spring 2000 was more effective than broadcast application as in spring 1999 in control of nutsedge.

Table 1. Effect of fumigant treatments on fruit yield, plant vigor, and nutsedge counts in tomato. Gainesville, FL. Spring 1999

Treatment	Rate/ha	Yield mt.ha	Root gall rating[x]	Nutsedge (plants/m^2) 11May	22 June
Untreated		27.4b[y]	46a	181a	950a
Methyl bromide /Pic (67/33 in row application)	390 kg	51.3a	5b	12b	80c
1,3-D + 17%pic + pebulate BC[z]	168 L + 4.4 kg	43.8a	29ab	190a	630b
1,3-D + 35%pic + pebulate BC[z]	168 L + 4.4 kg	46.0a	13b	121a	980a
Metam-Na + 1,3-D + pebulate BC[z]	295 L + 112 L + 4.4 kg	50.5a	24ab	102a	520b
1,3-D + 35%pic + pebulate (in -row app.)	336 L	53.8a	4b	2b	50c

[z]Application broadcast in 1.8 m area, rototilled 25cm deep, and formed into 0.9 m beds 2-weeks later

[y]Mean separation by Duncan's multiple range test, 5% level.

[x]Root-knot gall indices 0-10 = no galls, ..., 10 = 1005 of root system galled.

Table 2. Effect of fumigant treatments on fruit yield, plant vigor, and nutsedge counts in tomato. Gainesville, FL. Spring 2000

Treatment	Rate/ha	Yield mt.ha	Root gall[W] rating	Nutsedge (plants/m^2) 17 Apr	26 June
Untreated		27.8b[x]	66.7a	49a	75a
Methyl bromide /Pic (67/33 in row application)	390 kg	46.1a	7.3c	1c	3c
1,3-D + 17% pic BC[z]+ pebulate[y]	196 L + 4.4 kg	55.4a	8.0c	17b	37b
1,3-D + 35% pic BC[z]+ pebulate [y]	243 L + 4.4 kg	54.0a	0.7c	6c	17bc
Metam-Na BC[z]+ pebulate[y]	295 L + 4.4 kg	41.8ab	41.0b	6c	9c
1,3-D + 35% pic + pebulate (in -row app.)	336 L	40.3ab	2.7c	3c	5b

application broadcast in 1.8 m area, rototilled 25cm deep, and formed into 0.9 m beds 2-weeks later

[y]Pebulate applied in-row and rototilled 10cm deep just before mulch application.
[x] Mean separation by Duncan's multiple range test, 5% level.

[W]Root-knot gall indices 0-10 = no galls, ..., 10 = 1005 of root system galled.