DMDS OR THE 3-WAY: WHICH IS MORE EFFECTIVE IN GEORGIA?

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Introduction

Methyl bromide (MB) alternatives were used on nearly 25 and 50% of Georgia's fumigated plasticulture acreage in 2007 and 2008, respectively. To date, most growers have been adopting a 3-WAY system using Telone II, chloropicrin, and metam sodium. Dimethyl disulfide is nearing registration and will likely be available for growers during 2009. Dimethyl disulfide mixtures with chloropicrin (DMDS) were compared to the 3-WAY to determine its potential use as a MB alternative by Georgia growers.

Materials and Methods

Two experiments were conducted near TyTy, GA during the spring of 2008. Fumigants were applied during mid-February in sandy loam soils (88 to 92% sand) that were near 100% field capacity with soil temperatures ranging from 55 to 60 degrees F at the fumigant injection point. 'Heritage' bell pepper was transplanted four to five weeks after fumigation.

The first experiment compared the 3-WAY applied under standard low density polyethylene (LDPE) mulch to three formulations of DMDS, each applied at four rates under Blockade mulch (Table 1). An additional treatment of DMDS applied under LDPE mulch was included for comparison. Treatments were replicated four times and plot size was one mulched bed with two rows of pepper by 40 feet in length.

A second large acreage on-farm experiment compared 60, 50, and 40 gallon/A of DMDS (79% dimethyl disulfide; 21% chloropicrin) applied under Blockade mulch to the 3-WAY applied under LDPE mulch. Fumigants were applied with the grower's equipment following their typical production practices. Individual plots were 0.31 acres in size with the four treatments replicated four times.

At both locations, pepper heights, pepper stand, and weed emergence, including weeds emerging in the plant hole or penetrating the mulch, were measured throughout the season. The entire plot for each experiment was harvested for four consecutive weeks using the grower's harvesting crew. The formulation study was harvested only for X-Large and Jumbo fruit (USDA Grades). The on-farm study was harvested according to normal grower practices, with fruit from each plot processed through the packing-house identical to the grower's standard process. Number of boxes for each fruit size for each plot was counted. Nematode gall ratings were made after final harvest was concluded.

Results and Discussion

DMDS Formulation and Rate Experiment: The 3-WAY provided 98% large crabgrass (*Digitaria sanguinalis*) control at 7 weeks after planting (WAP) (Table 1). Only DMDS 79:21 at 50 and 60 gallon/A provided greater than 85% large crabgrass control. DMDS 79:21 at 60 gallon/A applied under Blockade mulch was 59% more effective than the same rate of DMDS applied under LDPE mulch. In contrast to large crabgrass, all fumigant programs provided excellent control of purple nutsedge (*Cyperus rotundus*).

Pepper heights and stand were not impacted by treatments (data not shown). However, yield differences were noted (Table 1). The 3-WAY produced 5105 lbs of pepper fruit/A when combined over all four harvest dates. DMDS 79:21 at 50 or 40 gallon/A and DMDS 90:10 at 60 gallon/A produced similar yield to the 3-WAY; although, numerically, these yields were at least 11% lower than those in the 3-WAY. Lower pepper production in the DMDS systems was likely a response large crabgrass competition and reduction in harvesting efficiency.

Table 1. Percent late-season large crabgrass and nutsedge control and pepper yield. [1]

Fumigant Option	Rate[4] (broadcast/A)	Mulch	Large crabgrass (% control) [1]	Purple nutsedge % (control) [1]	Jumbo/X-Large (4 harvests)
			7 WAP	5 WAP	lbs fruit/A
DMDS[2] 100%	60 GPA	Blockade	70 bcd	99 ab	3610 bcd
DMDS 100%	50 GPA	Blockade	53 def	97 bc	3020 cdef
DMDS 100%	40 GPA	Blockade	53 def	96 bc	2930 def
DMDS 100%	30 GPA	Blockade	36 f	98 abc	2775 def
DMDS:Pic 90:10	60 GPA	Blockade	72 bcd	99 ab	3800 abcd
DMDS:Pic 90:10	50 GPA	Blockade	63 def	99 ab	3180 cde
DMDS:Pic 90:10	40 GPA	Blockade	47 ef	99 ab	3180 cde
DMDS:Pic 90:10	30 GPA	Blockade	44 ef	98 ab	2840 def
DMDS:Pic 79:21	60 GPA	Blockade	92 ab	100 a	3665 bcd
DMDS:Pic 79:21	50 GPA	Blockade	86 abc	99 ab	4520 ab
DMDS:Pic 79:21	40 GPA	Blockade	65 cde	99 ab	4265 abc
DMDS:Pic 79:21	30 GPA	Blockade	50 def	99 ab	2920 def
DMDS:Pic 79:21	60 GPA	LDPE	33 f	90 c	1755 f
3-WAY[3]	10/150/75	LDPE	98 a	100 a	5105 a
None	--	Blockade	4 g	51 d	2145 ef

[1]Values within a column followed by the same letter are not different at $P = 0.05$. Weed control estimates compared to no fumigant and no mulch.
[2]DMDS = Dimethyl disulfide:chloropicrin (100:0, 90:10, 79:21) injected 8 inches below the bed top.
[3]3-WAY: Telone II shank injected 14 inches deep fb chloropicrin injected 8 inches deep fb Vapam injected 4 inches deep below the bed top.
[4]Rates are provided as broadcast for simplicity but were banded in the 32 inch wide bed.

On-Farm Experiment: Purple nutsedge, livid amaranth (*Amaranthus blitum*), and large crabgrass infested the on-farm trial. Nutsedge control was similar among treatments with a range of 90 to 150 plants per acre (data not shown). Livid amaranth control was similar with the 3-WAY and DMDS at 60 gallon/A

(Table 2). Reducing the rate of DMDS increased the amaranth infestations by at least 70%. Large crabgrass was present at only 19 plants per acre with the 3-WAY; however, large crabgrass infestations were 30- to 40-times worse in the DMDS systems.

Pepper stands, pepper heights, and nematode gall ratings did not differ among treatments (Table 2). However, there was a trend for more pepper plants with DMDS at 60 gallon/A and the 3-WAY when compared to lower rates of DMDS.

Table 2. Pepper growth and weed control with DMDS and the 3-WAY. [1]

Fumigant Options[2]	Plant Stand (#/A)	Plant Height (120 plant per plot avg.)	*Amaranth* (# plant/A)	Crabgrass[3] (# plant/A)	Nematode[4] (0-10)
DMDS 60 G	17,378 a	18.3 a	47 c	580 a	3.8 a
DMDS 50 G	16,408 a	17.5 a	80 b	700 a	6.0 a
DMDS 40 G	15,923 a	17.6 a	120 a	778 a	4.0 a
3-WAY	17,063 a	16.9 a	28 c	19 a	2.0 a

[1]Values within a column followed by the same letter are not different at $P = 0.05$.
[2]DMDS = dimethyl disulfide plus chloropicrin 79:21; 3-WAY = Telone II fb chloropicrin fb Vapam. DMDS injected 8 inches below the bed top; Telone II shank injected 14 inches deep; chloropicrin injected 8 inches deep; Vapam injected 4 inches deep below the bed top.
[3]Once grasses reached 3 inches in height, Select was applied over the trial area.
[4]Nematode gall ratings were evaluated with 0 = no galling and 10 = severe galling.

Treatments did not affect yield at any of the four individual harvests (data not shown). Similarly, no differences in yield were noted within size classes (jumbo, X-large, large, chopper, or suntan fruit) when combined over harvest date (Table 3). When combined over fruit classes and harvest dates, the 3-WAY produced statistically more fruit than the DMDS at 40 gallon/A system. Although not statistical, the 3-WAY also produced 6 to 10% more fruit than DMDS applied at 50 or 60 gallon/A.

Table 3. Pepper boxes per acre when combining yield over four harvests. [1]

Fumigant Options[2]	Harvests 1-4					
	Jumbo	X-Large	Large	Chopper	Suntan	All Marketable Fruit
DMDS 60 G	433 a	847 a	136 a	105 a	172 a	1693 a
DMDS 50 G	429 a	758 a	139 a	121 a	187 a	1635 ab
DMDS 40 G	365 a	754 a	136 a	102 a	158 a	1517 b
3-WAY	452 a	878 a	145 a	131 a	201 a	1808 a

[1] Values within a column followed by the same letter are not different at $P = 0.05$.
[2] DMDS = dimethyl disulfide plus chloropicrin 79:21; 3-WAY = Telone II fb chloropicrin fb Vapam.

For the DMDS systems to be adopted, herbicides must be implemented for the

control of grasses and *Amaranthus* sp. If these systems using herbicides have costs similar to the 3-WAY, DMDS systems will be adopted by Georgia growers because of its ease of application and because it is more consistently effective in controlling nutsedge, especially during fall fumigations.