

CAN GEORGIA GROWERS REPLACE METHYL BROMIDE?

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Introduction

The price and availability of methyl bromide (MB) is limiting its use on Georgia farms. Replacing MB with an effective alternative is essential for sustainable vegetable production in Georgia. Thus, three MB alternatives were evaluated for their potential to effectively and economically replace MB in large acreage replicated experiments conducted on three Georgia farms.

Materials and Methods

The experiment was conducted in the spring of 2007 at Lewis Taylor Farms in Tift County, Southern Valley Produce in Colquitt County and, Coggins Farms in Echols County. All fumigants were applied with each grower's equipment after calibration by the authors. Fumigant treatments and their rates are provided in Tables 1 and 2.

Table 1. Four fumigant and film treatments.

1. MB: Methyl bromide plus chloropicrin (57:43) injected 8 inches below the bed top and covered with low density polyethylene (LDPE) film.
2. MIDAS: Methyl iodide plus chloropicrin (50:50) injected 8 inches below the bed top and covered with virtually impermeable film (VIF).
3. DMDS: Dimethyl disulfide plus chloropicrin (79:21) injected 8 inches below the bed top and covered with LDPE film.
4. Telone II/chloropicrin/Vapam: Telone II injected 12 inches followed by chloropicrin injected 8 inches followed by Vapam injected 4 inches below the bed top and covered with LDPE film.

Table 2. Fumigant rates at each location (broadcast rates provided, actually banded in the field).

	Location 1	Location 2	Location 3
MB	443	370	357
MIDAS	171	170	174
DMDS	76	74	71.3
Telone II	10	16	11
Chloropicrin	146	150	151
Vapam	75	75	75

Fumigants were applied on January 27, February 13, and February 19 and either 'Heritage' or 'Plato' bell pepper was transplanted in early march following typical grower practices. Individual plot size ranged from 0.127 acres up to 0.401 acres depending on location with each treatment being replicated four times. Pepper heights, pepper stand, and weed emergence, including weeds emerging in the plant hole or penetrating the mulch, were measured throughout the season.

Harvest occurred twice at one location, three times at another location, and four times at the final location. The entire plot was picked according to each grower's normal practice including using their harvesting crews. At each location after each harvest, fruit was processed through the packing house identical to each grower's standard process. The number of boxes for each fruit size for each plot was counted. After harvest, nematode samples from each plot were taken and sent to the University of Georgia to determine nematode infestation levels.

Results and Discussion

Weed Response.

Pitted morningglory, pink purslane, smallflower morningglory, yellow and purple nutsedge, and livid amaranth were present at two of three locations. No differences in control of purslane or morningglory species were noted. Nutsedge and amaranth were controlled similarly with MB, MIDAS, and the Telone/chloropicrin/Vapam system; however, at harvest there were 2.9 to 3.2 more nutsedge and 22 to 103 times more amaranth in the DMDS system than in the MB system (data not shown).

Nematode Response.

Root-Knot nematode was present at two of three locations. No statistical differences were noted among treatments; however, at one location control was more erratic with DMDS and the Telone/chloropicrin/Vapam system than with MIDAS or MB (data not shown).

Pepper Populations and Heights.

Pepper heights were taken from 120 plants in each plot at 3 to 4 weeks after transplanting. Fumigant systems did not impact pepper growth at any location. Additionally, treatments did not impact plant stand as the total number of plants in each plot was similar (data not shown).

Pepper Yield.

Yields for each pepper fruit size from harvest 1 and for cumulative harvests are presented as a percent of the MB treatment (Tables 3-5). Pepper yields ranged from 1300 to 2000 boxes per acre depending on the location. No differences in the number of culls or suntan fruit were noted at any harvest or location thus this

data is not provided.

The number of pepper boxes produced from the MIDAS system was similar to the MB system with the one exception of less choice fruit produced for cumulative harvests at location 2 (Table 4). At this same location, the MIDAS system produced 12% more jumbo fruit than MB and although this difference was not significant it may have caused the production of less choice fruit. When comparing the total number of jumbo, extra large, large and choice fruit produced among these two systems, the number of pepper boxes produced in the MIDAS system was 97% of that in the MB system.

DMDS was less effective than MB in controlling both nutsedge and amaranthus; thus, one would expect a negative impact of weeds on yield. Compared to the MB system, the DMDS system produced less jumbo, choice, and extra large fruit each at one location (Tables 3-5). Also, a tendency for lower yields was evident across all fruit sizes at location 1. When comparing the total number of jumbo, extra large, large and choice fruit produced among these two systems, the number of pepper boxes produced in the DMDS system was 92% of that in the MB system.

Telone II followed by chloropicrin followed by Vapam had the most significant impact on pepper yields and fruit structure when compared to MB. At two locations (similar trend at the third location), there were more jumbo fruit picked with this system than with MB. However, the Telone II/chloropicrin/Vapam system generally produced less extra large and large fruit when compared to MB. When comparing the total number of jumbo, extra large, large and choice fruit produced among these two systems, the number of pepper boxes produced in the Telone II/chloropicrin/Vapam system was 97% of that in the MB system.

Table 3. Pepper yield presented as a percent of the MB system for Location 1. ¹

Fumigant Options ²	Harvest 1 ³				Cumulative Harvests ⁴			
	Jumbo	X-Large	Large	Choice	Jumbo	X-Large	Large	Choice
MB	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
MIDAS	95 a	108 a	121 a	98 a	99 a	96 a	88 a	104 a
DMDS	75 b	100 a	121 a	88 a	85 b	88 a	85 a	94 a
T+P+V	107 a	105 a	56 a	114 a	110 a	85 a	84 a	107 a

¹ Values within a column followed by the same letter are not different at $P = 0.05$.

² Abbreviations: MB = methyl bromide plus chloropicrin; MIDAS = methyl iodide plus chloropicrin; DMDS = dimethyl disulfide plus chloropicrin; T+P+V = Telone II followed by chloropicrin followed by Vapam.

³ Percent MB fruit size: Jumbo (56%), X-Large (16%), Large (<1%), and Choice (27%).

⁴ Percent MB fruit size: Jumbo (14%), X-Large (32%), Large (27%), and Choice (26%).

Table 4. Pepper yield presented as a percent of the MB system for Location 2. ¹

Fumigant Options ²	Harvest 1 ³				Cumulative Harvests ⁴			
	Jumbo	X-Large	Large	Choice	Jumbo	X-Large	Large	Choice
MB	100 b	100 a	100 a	100 a	100 b	100 a	100 a	100 a
MIDAS	110 b	92 a	73 ab	85 a	112 ab	101 a	95 a	90 c
DMDS	104 b	95 a	88 a	103 a	100 b	97 a	98 a	94 bc
T+P+V	124 a	88 a	47 b	103 a	125 a	99 a	69 b	105 a

¹ Values within a column followed by the same letter are not different at $P = 0.05$.

² Abbreviations: MB = methyl bromide plus chloropicrin; MIDAS = methyl iodide plus chloropicrin; DMDS = dimethyl disulfide plus chloropicrin; T+P+V = Telone II followed by chloropicrin followed by Vapam.

³ Percent MB fruit size: Jumbo (25%), X-Large (52%), Large (6%), and Choice (17%).

⁴ Percent MB fruit size: Jumbo (17%), X-Large (54%), Large (9%), and Choice (20%).

Table 5. Pepper yield presented as a percent of the MB system for Location 3. ¹

Fumigant Options ²	Harvest 1 ³				Cumulative Harvests ⁴			
	Jumbo	X-Large	Large	Choice	Jumbo	X-Large	Large	Choice
MB	100 b	100 a	100 a	100 b	100 b	100 a	100 a	100 b
MIDAS	102 b	100 a	111 a	99 b	102 ab	92 a	87 a	94 b
DMDS	88 b	85 a	70 a	125 b	96 b	82 b	96 a	103 b
T+P+V	127 a	106 a	53 a	281 a	108 a	74 b	75 a	132 a

¹ Values within a column followed by the same letter are not different at $P = 0.05$.

² Abbreviations: MB = methyl bromide plus chloropicrin; MIDAS = methyl iodide plus chloropicrin; DMDS = dimethyl disulfide plus chloropicrin; T+P+V = Telone II followed by chloropicrin followed by Vapam.

³ Percent MB fruit size: Jumbo (64%), X-Large (23%), Large (4%), and Choice (9%).

⁴ Percent MB fruit size: Jumbo (60%), X-Large (23%), Large (7%), and Choice (10%).

Economic Returns.

As fumigant systems altered fruit sizes in these studies, the only way to truly determine if any of these alternatives are as effective as MB is to determine the value of the pepper crop by obtaining prices for each pepper fruit size and to also determine the costs of each fumigant program. Currently these values are being obtained and the returns for each of these fumigant systems will be provided

during the presentation at MBAO.