METHYL BROMIDE ALTERNATIVES BEING IDENTIFIED IN GEORGIA

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Introduction

It has become clear that the price and availability of methyl bromide (MB) will soon limit its use on Georgia farms. MB alternatives for many diseases and nematodes do exist; however, controlling weeds with these alternatives has been a struggle. Recent research has focused on nutsedge response to MB alternatives in conjunction with various types of mulch.

Materials and Methods

The experiment was conducted in the spring of 2006 at The University of Georgia Ponder Research Farm located near TyTy, Georgia. Soil was a sandy loam with 92% sand, 6% clay, and 2% silt with 1% organic matter. Treatments included five fumigant options applied under four mulches (Table 1).

Table 1. Five fumigant options applied under three mulches.

Fumigant options (broadcast rates reported for simplicity; fumigants applied in bed only)
1. MB: Methyl bromide plus chloropicrin (67:33, 350 lb/A) injected 8 in. by a super-bedder plastic layer.
2. MIDAS: Methyl iodide plus chloropicrin (50:50, 350 lb/A) injected 8 in. by a super-bedder plastic layer.
3. DMDS: Dimethyl disulfide plus chloropicrin (79:21, 75 gal/A) injected 8 in. by super-bedder plastic layer.
4. Telone II/chloropicrin/Vapam: Telone II (12 gal/A) injected 12 in. with a Yetter rig followed by chloropicrin (150 lb/A) injected 8 in. with a pre-bedder followed by Vapam (75 gal/A) injected 4 in. deep in the final bed top with the plastic layer.
5. No fumigant
Mulch options
Low density polyethylene (LDPE); 1.25 X 60 X 4000; black on black
Metalized Smooth; 1.25 X 60 X 4000; silver on black laid silver side up
Virtually Impermeable (VIF); 1.25 X 60 X 2400; black on black

Fumigants were applied on February 22, 2006 and 'Heritage' bell pepper was transplanted 20 days later. Plants were placed one foot apart down the row and 15 inches apart across the row with two rows on a 32 inch bed top. Pepper growth response was measured throughout the season. Purple nutsedge was uniformly distributed throughout the trial area and the numbers of nutsedge plants emerging through the mulch were counted bi-weekly for each plot. Jumbo pepper fruit were harvested five times by a farmer's harvesting crew. Fruit harvested were counted and weighed for each plot.

Results and Discussion

Nutsedge Response. Control by all MB alternatives was similar to that of MB applied under LDPE mulch except for the Telone II/chloropicrin/Vapam under LDPE mulch system (Table 2). In this alternative, nutsedge emergence occurred on the very edge of the bed shoulder suggesting a fumigant placement issue. This issue can likely be addressed with minor equipment modification which will occur prior to the fall 2006 trials.

Table 2. Number of purple nutsedge plants (20 sq ft) emerging through the mulch at first harvest.[1]

Fumigant Options[2]	Mulch types[2]		
	LDPE	Metalized	VIF
MB	0.5 a	0.0 a	0.3 a
MIDAS	0.8 a	0.3 a	0.8 a
DMDS	2.5 a	0.5 a	0.0 a
T2+Pic+Vapam	12.5 b	0 a	5 ab
No fumigant	84 d	76 d	54 c

[1] Values within the table followed by the same letter are not different at $P = 0.05$.
[2] Abbreviations: LDPE = low density polyethylene; VIF = virtually impermeable film; MB = methyl bromide plus chloropicrin; MIDAS = methyl iodide plus chloropicrin; DMDS = dimethyl disulfide plus chloropicrin; T2+Pic+Vapam = Telone II followed by chloropicrin followed by Vapam.

Visual Pepper Stunting. At 18 days after fumigating, plant holes were poked and pepper were hand transplanted 2 d later. Early-season pepper growth was slower with silver metalized mulch because of cooler soil temperatures (up to 14 degrees F cooler compared to black mulch at planting) (Table 3). Fumigant impact on plant growth was only noted with MIDAS under metalized mulch or VIF suggesting the fumigant had not dissipated from under these mulches.

Table 3. Visual pepper stunting at 40 d after planting from fumigants or mulch color.[1]

Fumigant Options[2]	Mulch types[2]		
	LDPE	Metalized	VIF
MB	0 a	7 b	0 a
MIDAS	0 a	30 c	60 d
DMDS	0 a	8 b	0 a
T2+Pic+Vapam	0 a	6 b	0 a
No fumigant	0 a	6 b	0 a

[1] Values within the table followed by the same letter are not different at $P = 0.05$.
[2] Abbreviations: LDPE = low density polyethylene; VIF = virtually impermeable film; MB = methyl bromide plus chloropicrin; MIDAS = methyl iodide plus chloropicrin; DMDS = dimethyl disulfide plus chloropicrin; T2+Pic+Vapam = Telone II followed by chloropicrin followed by Vapam.

Pepper Yield. All fumigant alternative systems, except for MIDAS under VIF, produced pepper yields equal to or greater than that of the standard MB under LDPE mulch (Table 4). Yields from MIDAS under VIF were less than those of MB because of early-season fumigant injury as noted in Table 2.

Table 4. Cumulative jumbo fruit number and weights from 20 plants per plot for harvest 1-5. [1]

Fumigant Options[2]	Number harvested fruit			Weight (lbs) harvested fruit		
	LDPE[2]	Metalized[2]	VIF[2]	LDPE	Metalized	VIF
MB	137 bc	153 ab	142 bc	54 cd	62 ab	54 cd
MIDAS	147 abc	144 bc	111 d	57 a-d	60 abc	44 e
DMDS	144 bc	156 a	147 abc	54 cd	60 abc	54 cd
T2+Pic+Vapam	152 ab	166 a	153 ab	58 a-d	63 a	55 b-d
No fumigant	135 bc	142 bc	130 cd	50 de	5 de	51 de

[1] Values within the table followed by the same letter are not different at $P = 0.05$.
[2] Abbreviations: LDPE = low density polyethylene; VIF = virtually impermeable film; MB = methyl bromide plus chloropicrin; MIDAS = methyl iodide plus chloropicrin; DMDS = dimethyl disulfide plus chloropicrin; T2+Pic+Vapam = Telone II followed by chloropicrin followed by Vapam.

Conclusions

All MB fumigant alternatives in this experiment have been effective in small plot research trials conducted during 2005 and 2006. Replicated large acreage on-farm experiments are currently in progress to further verify results from these small plot efforts. The large acreages studies began in the spring of 2006 and will continue through at least 2009. Preliminary results from the 2006 on-farm trials will be discussed during the presentation at the MB alternative conference.

Although we have been successful during 2005 and 2006 in adopting MB alternatives in small plots, numerous limitations and potential pitfalls must be addressed prior to wide-scale adoption. Several limitations are as follows:

1. Successful results from small plot research must be verified in large acreage on-farm trials.

2. Data is desperately needed addressing plant-back intervals after fumigating with these alternatives, especially when applied under VIF or metalized mulches.

3. Determining the efficacy of these fumigant alternatives on weeds other than nutsedge, as many other weeds such as pigweeds and morningglories are far more competitive than nutsedge.

4. Alteration of fumigant application equipment by each grower will be time consuming and costly. For our research effort alone, expenses exceeding $15,000 have occurred in equipment modification to improve fumigant applications.

5. Economic viability of alternative mulches, especially VIF and metalized mulch, needs to be addressed.

6. Availability of alternative mulches has been limited. Prior to broad acceptance of these mulches, growers require a reliable source and ready access to these mulches.

7. Issues associated with the integrity of alternative mulches during the installation process need to be better understood. Additionally, the life expectancy of these alternative mulches must be determined especially for growers who intend to grow 3 or 4 crops on a single fumigant/mulch implementation.

8. Development and registration of new herbicide tools for vegetable growers is critical. New weed issues will likely occur in these systems that rely solely on alternative fumigants for weed control. Herbicides will be necessary for management as new weed problems emerge.