MANAGING MELON SOILBORNE DISEASES IN MICHIGAN WITH MBR ALTERNATIVES

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Michigan is recognized for its agricultural diversity that includes many minor and specialty crops. Michigan growers are major suppliers of cucurbit (watermelon, muskmelon, cucumber, and squash) and solanaceous (eggplant, pepper, tomato) crops in the Midwest and plant approximately 52,000 acres annually.

Methyl bromide is a critically important tool for managing soilborne pathogens in Michigan's vegetable crops. Although growers practice integrated pest management (IPM), soilborne pathogens, including *Fusarium oxysporum* f.sp. *melonis*, are persistent in production fields and are especially difficult to control. As a result, some Michigan growers of fresh market tomatoes (700 acres), peppers (268 acres), eggplant (107 acres), and cucurbits (458 acres) have become reliant on methyl bromide as an important disease controlling tool. These industries are currently not prepared to survive without methyl bromide. Critical Use Exemptions (C.U.E.s) were submitted in 2002-2007 for extended use of methyl bromide in Michigan's solanaceous and cucurbit crops.

Methyl bromide is versatile and use patterns effectively suppress weeds and pathogens under the production conditions of the Midwest. Use of alternative fumigants can be difficult when soil conditions are unsuitable for applications during early spring or fall. Soil temperatures below 50°F compromise effective fumigation and 3-week aeration periods are proposed to avoid residual phytotoxicity by fumigants. In Midwest spring, soils can be too cold and too wet for efficient fumigation and planting operations do not always allow for sufficient aeration after fumigation. Because of the short plant-back interval of methyl bromide, crops can be transplanted as soon as spring soils reach an appropriate temperature. This allows access to early marketing opportunities. Profit earned in this early season represents a majority of a Michigan producer's annual profit; vegetables sold during mid-season are often a break-even exercise. However, it is necessary for growers to participate in both mid- and late-season markets so that they are viewed by brokers and buyers as a stable and reliable supplier of product.

Two different melon experiments (plastic film study and non-registered product) were established with a Michigan grower in a commercial field that has a history of *Fusarium*. Fumigant alternatives were compared to a standard rate of methyl bromide/chloropicrin currently used by growers for the registered and non-registered trials and reduced rates of fumigants were used in the film study. The objective of these trials was to determine if currently registered alternatives and an unregistered product provide adequate disease control with positive economic impacts under large scale field use.

A series of treatment blocks that were 9 beds wide by 750 ft long were used to test methyl bromide alternatives in a randomized complete block design. Each block was separated by a 10-ft wide harvest alley. In each block, two different treatments were applied to three adjacent beds on either side of the block. The center and outside beds of the 9-bed block were left untreated and used as a comparison for the two fumigant treatments. Each treatment was replicated three times for a total area of 0.75 acre for each fumigant tested and a total plot size of 4.5 acres. Methyl bromide/chloropicrin (MBr/pic), Midas 50/50, Telone C35, and straight chloropicrin were applied at the time of bed formation and plastic installation. After the appropriate off-gassing period for each fumigant had expired, planting holes were punched by a mechanical water wheel and transplants were hand planted by the grower's workforce. The crop was grown using normal practices for each crop and pesticides, irrigation, and fertilization was applied by the cooperating grower. Sections of rows 20-ft long were marked and used for weekly stand counts, vigor ratings, and yield assessments. Data from the plots were analyzed using SigmaStat version 3.1 using a 2-way ANOVA and the Fisher LSD multiple range test.

Vigor ratings from the film experiment indicate a decline in plant growth when fumigants were applied at reduced rates under the VIF (virtually impermeable film) compared to fumigants applied at full rates under LDPE (low density polyethylene film) (Table 1). This loss of vigor was noticeable on 12 Jun. At the time of harvest on 16 Jul, vigor ratings between the two types of film were similar. All fumigant treatments had statistically higher vigor than the paired untreated controls.

Disease pressure was noticeably higher in the treatment blocks that contained the Midas and MBr/pic treatments as the fumigated treatments had significantly higher yields than the untreated controls. Higher prices for melons prevailed the first 14 days of plot harvest. Yields for the treatments that were fumigated with chloropicrin (alone) or Telone C35 were significantly lower during the first 14 days of harvest. This resulted from these treatments having a longer plant-back interval that pushed back transplanting. Disease pressure was also reduced in the blocks containing Telone C35 or chloropicrin (alone) and resulted in higher yields for the untreated control plots. Regardless of film type, the MBr/pic and Midas treatments had the highest yields of marketable fruit for both total yield and yield for the first 14 days of harvest.

The second experiment compared Midas, MBr/pic, and an untreated control using full rates under LDPE. MBr/pic showed the best vine growth for both rating dates and the highest marketable yield during the first 14 days of harvest (Table 2). Plants in the Midas treatment showed some slight vigor loss early in the season, but then recovered to produce a total marketable yield comparable to MBr/pic.

Further work is underway in Michigan to better understand the use of alternatives and VIF with cold spring soils.

Table 1. Melon vigor and yield results for 2007 Michigan fumigant film study.

Treatment[z]	Rate/A	Vigor[y]		Marketable yield[x]	
		Jun 12	Jul 16	14 day[w]	Total
Midas LDPE............	300 lb	1.0 a[v]	1.0 a	106.3 a	112.0 a
Untreated (Midas)...	--	1.0 a	2.3 b	25.1 b	32.3 cd
Midas VIF...............	175 lb	3.0 cd	1.0 a	98.5 a	105.9 ab
MBr/pic LDPE........	350 lb	1.0 a	1.0 a	84.8 a	119.7 a
Untreated (MBr/pic)	--	1.3 ab	3.3 c	29.2 b	29.2 d
MBr/pic VIF............	250 lb	2.7 abc	1.0 a	74.4 a	126.8 a
Chloropicrin LDPE .	25 gal	2.7 abc	1.0 a	11.6 b	96.4 ab
Untreated (Pic)........	--	1.0 a	2.7 bc	86.1 a	90.9 ab
Chloropicrin VIF.....	20 gal	3.3 cd	1.3 a	11.6 b	80.5 abc
Telone C35 LDPE...	35 gal	2.3 abc	1.3 a	0.0 b	77.0 abcd
Untreated (C35)	--	1.0 a	2.3 b	96.8 a	96.8 ab
Telone C35 VIF	20 gal	4.7 d	1.3 a	4.2 b	56.4 bcd

[z]Fumigants applied under either VIF (virtually impermeable film) or LDPE (low density polyethylene film).
[y]Vigor rating based on visual growth on 1 to 10 scale; where 1=no stunting and full vine growth, 5= moderate plant stunting and limited vine growth, 10=complete plant death.
[x]Yield of fruit of marketable size (120 to 80 count melons).
[w]Fruit that were mature during first two weeks of harvest and first market.
[v]Data in columns with a letter in common were not significantly different, Fisher LSD (*P*=0.05)

Table 2. Melon vigor and yield results for 2007 Michigan non-registered fumigant study.

Treatment	Rate/A	Vigor[z]		Marketable yield[y]	
		Jun 12	Jul 16	14 day[x]	Total
Midas LDPE............	300 lb	3.0 b[w]	1.3 a	137.9 a	164.7 a
MBr/pic LDPE........	350 lb	1.0 a	1.0 a	143.4 a	158.5 a
Untreated LDPE......	--	5.3 c	3.3 b	87.1 b	94.1 b

[z]Vigor rating based on visual growth on 1 to 10 scale; where 1=no stunting and full vine growth, 5= moderate plant stunting and limited vine growth, 10=complete plant death.
[y]Yield of fruit of marketable size (120 to 80 count melons).
[x]Fruit that were mature during first two weeks of harvest and first market.
[w]Data in columns with a letter in common were not significantly different, Fisher LSD (*P*=0.05)