Reduced rates of MBR and C35 under LDPE and VIF for control of soil pests and pathogens

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Introduction

Growers depend on methyl bromide as part of the plastic mulch production system because it provides economical management of nematodes, most soilborne diseases, and weeds, especially yellow and purple nutsedge. The compound is injected into the soil in a preformed raised bed 6 to 8 inches deep killing nematodes, fungi, and weed seeds in the treated zone. The chemical rapidly dissipates allowing for a short re-entry period and planting 48 hours following application. Higher concentrations of chloropicrin extend the re-entry period and a longer waiting period before planting is needed. The relatively short re-entry period coupled with the high efficacy of methyl bromide-chloropicrin mixtures are strong arguments to support their continued use.

Methyl bromide has been identified as an ozone-depleting substance, and scheduled by the Montreal Protocol to be phased out in 2005, but critical use exemptions provide for continued use through 2007. Lower production levels have driven up the costs of methyl bromide during the past few years. The use of virtually impermeable film (VIF) technology coupled with lower rates of methyl bromide may serve to lower methyl bromide emissions from the soil, maintaining the same efficacy on soilborne pests and pathogens, as well as to reduce or eliminate emissions of methyl bromide from the mulched beds thereby allowing for its continued use by critical use exemptions. Telone C35 should be examined under the same system to provide an alternative to growers that have less of a nutsedge problem and are only interested in nematode and soilborne pathogen control. During the spring of 2004 we initiated experiments designed to test the efficacy of reduced rates of methyl bromide and Telone C35 in conjunction with VIF technology on tomato production.

Methods

Treatments were arranged in a split-plot design with four replicates. Fumigant treatments were the whole plots and mulch types (VIF and conventional polyethylene mulch [PE]) were the sub plots. Fumigants evaluated include methyl bromide (67% methyl bromide and 33% chloropicrin) at three rates 175, 263, and 350 lbs/A broadcast and Telone C35 (65% 1,3-D and 35% chloropicrin) at three rates 17.5, 26, and 35 gallons per acre broadcast. An untreated control was included for a total of seven treatments. Data collected included: 1) Number of nutsedge plants per replicate per m^2 (4 weeks after planting), 2) Marketable yield — tomato fruit from each treatment were graded (Kerian speed sizer) into x-large, large, medium, and cull fruit and each category weighed, and 3) Subjective root-knot nematode gall ratings were taken from the root systems of six plants

dug from each replicate. All data were subjected to ANOVA and means were separated by LSD.

Results and discussion

The interaction between fumigant treatments and much types regarding nutsedge counts was determined to be highly significant. For this reason, statistical comparisons were made only within mulch type. In general, plots treated with methyl bromide at all rates provided excellent control of nutsedges with the exception of methyl bromide applied at 175 lbs/A under PE mulch. Plots treated with Telone C35 at both the 26 and 35 GPA rate under VIF film provided adequate control of nutsedges. Other than the two highest rates of methyl bromide, only Telone C35 applied at a 35 GPA rate under PE film gave any reduction of nutsedges as compared to untreated plots (Table 1). These data suggest that all beds covered with VIF mulch had a greater reduction in the number of nutsedge plants as compared to beds covered with PE mulch except for treatments of methyl bromide at 263 and 350 lbs/A (Table 1).

When comparing marketable yields for treatments on VIF and PE mulch, the interaction between mulch types and treatments were not significant, thus data for the two mulch types were combined. All treatments had marketable yields significantly higher than untreated plots (Table 2). Reducing the rates of Telone C35 produced marketable yields significantly different than untreated plots but had lower yields than Telone C35 at 35 gal/A and all methyl bromide treatments (Table 2).

Regarding root-knot nematode galling the interaction between fumigant treatments and mulch types was determined to be highly significant, therefore comparisons were made only within mulch type. However, the data suggests that the use of VIF film enhanced nematicidal activity of all three rates of methyl bromide tested as compared to traditional PE mulch (Table 3). Plant nematode gall ratings were lower for C35 at 35 gal/A under VIF film as compared to traditional PE mulch (Table 3).

Table 1. Effects of mulch type and fumigant rates for control of nutsedge Citra, FL 2004.

Fumigant	Rate	Nutsedge plants per m^2	
		Mulch type	
		VIF[1]	PE[2]
Untreated		33.0 c	50.0 d
Methyl bromide	350 lbs/A	0.8 a	1.3 a
Methyl bromide	263 lbs/A	0.8 a	5.3 a
Methyl bromide	175 lbs/A	1.8 a	28.3 c
Telone C35	35 gal/A	5.8 b	11.8 b
Telone C35	26 gal/A	6.0 b	32.5 cd
Telone C35	17.5 gal/A	16.3 b	32.3 cd

[1]Virtually impermeable film 1.4 ml black on white.
[2]Standard polyethylene mulch 1.25 ml black embossed.

Table 2. Effects of mulch type and fumigant rates on marketable yield of tomato, Citra, FL 2004.

Treatment	Rate	Total marketable yield (lbs)[1]		
		VIF[2]	PE[3]	Total
Untreated		102.8	65.4	168.2 e
Methyl bromide	350 lbs/A	238.7	209.4	448.1 ab
Methyl bromide	263 lbs/A	199.6	215.1	415.0 abc
Methyl bromide	175 lbs/A	243.1	218.3	461.4 a
Telone C35	35 gal/A	211.5	192.0	403.5 bc
Telone C35	26 gal/A	203.4	167.3	370.7 c
Telone C35	17.5 gal/A	155.3	145.5	300.8 d

[1]Total marketable yield equals yields of x-large, large, and medium tomato fruit (Kerian Speed Sizer).
[2]Virtually impermeable film 1.4 ml black on white.
[3]Standard polyethylene mulch 1.25 ml black embossed.

Table 3. Effects of mulch type and fumigant rates on root-knot nematode galling of tomato roots, Citra, FL 2004.

Treatment	Rate	Gall rating[1]	
		VIF[2]	PE[3]
Untreated		28.1 b	35.0 a
Methyl bromide	350 lbs/A	0.2 d	2.6 c
Methyl bromide	263 lbs/A	0.8 d	3.2 c
Methyl bromide	175 lbs/A	2.7 d	10.9 b
Telone C35	35 gal/A	8.6 c	21.8 a
Telone C35	26 gal/A	17.5 bc	16.5 ab
Telone C35	17.5 gal/A	67.7 a	22.5 a

[1]Based on a 0 to 100 scale, where 0 = no galls, 10 = 10% of root system galled…. 100 = 100% of root system galled.

[2]Virtually impermeable film 1.4 ml black on white.

[3]Standard polyethylene mulch 1.25 ml black embossed.