METHYL BROMIDE ALTERNATIVES FOR FLORICULTURE PRODUCTION IN A PROBLEM SITE

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Successful methyl bromide alternatives must manage a variety of pest problems in floriculture and vegetable production systems including weeds, plant-parasitic nematodes, and soil-borne diseases. Methods that may be successful in some situations may be challenged in sites with unusually heavy pest pressure. The objective of this study was to compare the performance of solarization and reduced-risk pesticides with that of methyl bromide fumigation in a location with unusually severe pressure from soil-borne pest problems. The test site in north-central Florida has a history of high root-knot nematode (*Meloidogyne incognita*) populations and disease epidemics due to *Pythium* spp. (Saha et al., 2005; 2007). The test crop used was snapdragon (*Antirrhinum majus*), an important floriculture crop in Florida that is very susceptible to root-knot nematodes and soil-borne diseases (McSorley et al., 2004).

An experiment was conducted in the 2006-07 season and repeated in 2007-08 to examine impacts of treatments on weeds, nematodes, soil-borne diseases, and yield. Five treatments were replicated five times in a randomized complete block design:

- Fumigation with 80:20 methyl bromide:chloropicrin
- Solarization during summer before planting
- Solarization + Kodiak® (product with *Bacillus subtilis*)
- Solarization + Biophos™ (product with dipotassium phosphonate and dipotassium phosphate)
- Non-treated control

Seedlings were transplanted in early October each year into small plots (6.1 m long x 0.76 m wide) on raised beds, with 216 plants per plot. Data were collected on weed coverage of plot area shortly after planting, but after that weeds were removed by hand and the time required for weeding each plot was recorded. Data were also collected on nematode population levels present in soil and galling on plant roots at termination of each experiment. Numbers of plants killed by soil-borne disease, diagnosed as *Pythium aphanidermatum*, were monitored throughout each season. Plant performance was evaluated by recording plant height, plant weight, and the number of marketable flower stems harvested per plot.

The major trends observed in the results are summarized (Table 1). Weeds were managed by all treatments involving solarization and by methyl bromide. The amount of time needed to weed plots was greatest ($P<0.05$) for untreated plots but did not differ ($P>0.10$) among methyl bromide and treatments involving solarization. Methyl bromide reduced ($P<0.05$) root-knot nematode galling relative to the control. Root galling in treatments involving solarization was generally intermediate, and did not differ ($P>0.10$) from either the methyl bromide or control treatments (Table 1). Methyl bromide reduced the number of dead plants compared to all other treatments in the first year. However, in the second year, when disease incidence was greater, the numbers of dead plants in control and methyl bromide plots were greater ($P<0.05$) than in plots that had been solarized (Table 1). However, plants that survived in the methyl-bromide-treated plots were larger than those in all other treatments, and as a result, marketable yield was greatest ($P<0.05$) in plots treated with methyl bromide. The addition of Kodiak® or Biophos™ to solarization did not improve nematode or pathogen control over the treatment with solarization alone.

Two areas of particular concern to growers are marketable yield and time needed to manage weeds. Since postplant herbicides are not available for snapdragons, growers typically hand-weed this crop. In the first year, it took 5.73 times as long to weed control plots compared to plots treated with methyl bromide, and 11.2 times as long to weed control plots in the second year (Table 2). Plots that were solarized produced only 38.0-47.7% as much flower yield as the methyl bromide plots in the first year, and only 29.9-35.5% as much in the second year (Table 2). Since all plots were hand-weeded, it is unlikely that weed management had much effect on yield. However, the disease complex between *M. incognita* and *P. aphanidermatum*, which increased in severity in the second year, was likely a major influence on crop yield. Although solarization treatments reduced plant mortality compared to methyl bromide, the plants that survived were larger in the plots treated with methyl bromide, and therefore produced more marketable yield.

References

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Table 1. Impact of methyl bromide and alternative treatments on weeds, galling due to root-knot nematodes, plants dead from soil-borne disease, plant weight, and flower yield of snapdragons grown in infested site.

Treatment	Weeds	Galling	Dead plants	Plant wt.	Yield
			2006-07 season		
Control	-	-	-	-	-
Solarized	+	+	-	-	-
Solar + Kodiak®	+	+/-	-	-	-
Solar + Biophos™	+	+/-	-	-	-
Methyl bromide	+	+	+	+	+
			2007-08 season		
Control	-	-	-	-	-
Solarized	+	+/-	+	-	-
Solar + Kodiak®	+	+/-	+	-	-
Solar + Biophos™	+	+/-	+	-	-
Methyl bromide	+	+	0	+	+

\+ Best treatment or statistically equal to best treatment
\- Worst treatment or statistically equal to worst treatment
+/- Intermediate; statistically equal to both best and worst treatments
0 Intermediate but statistically different from best and worst treatments

Table 2. Effect of alternative treatments on time needed to weed plots and on flower yield, expressed relative to performance of methyl bromide treatment.

	Weeding time		Flower yield	
	2006-07	2007-08	2006-07	2007-08
Control	5.73	11.20	24.7%	4.0%
Solarized	2.63	1.81	40.5%	33.3%
Solar + Kodiak®	2.23	1.74	47.7%	29.9%
Solar + Biophos™	2.31	2.05	38.0%	35.5%
Methyl bromide	1.00	1.00	100%	100%