PRODUCTIVITY AND ECONOMICS OF METHYL BROMIDE ALTERNATIVES FOR RASPBERRY NURSERY

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Introduction

Raspberry nurseries must produce disease-free plants to meet marketplace, certification, and export requirements. Nursery phytosanitary requirements are high, because even minor disease infestations in nurseries can cause severe epidemics in production fields. Nurseries prevent disease infestations by fumigating soil with Methyl Bromide (MB), under a quarantine/preshipment exemption, but there is increasing pressure to find alternatives. We conducted a series of research center and most recently, on-farm trials to investigate alternative fumigants and to demonstrate their use to raspberry nursery producers.

We previously reported that all alternative fumigant treatments in these trials successfully reduced perennial and annual weeds, although Pic Clor 60 and Telone C-35 did not manage volunteer potato as well as other treatments at Lynden (Zasada et al., http://mbao.org/2010/Proceedings/030WaltersTRBnurs.pdf). Root lesion nematodes (*Pratylenchus* spp.) were eliminated by all treatments, but nematodes persisted at one location, possibly surviving fumigation within plant residue. All of the treatments were at least as effective as MB:pic against *Phytophthora* and *Agrobacterium.* In some cases they were more effective than MB:pic against *Agrobacterium*. Here we compare the productivity and economics of these treatments in raspberry nurseries.

Methods

Trials were established September 2009 in Burlington and Lynden WA, and in Macdoel CA within commercial raspberry nurseries (Table 1). At Burlington and Lynden WA, treatments were replicated in randomized complete blocks (three in Burlington and five in Lynden), with each plot 10 ft x 70 ft. Treatments at Macdoel were applied to large (0.5 acre) blocks and were not replicated.

Trial plots were planted with the same variety as the surrounding nursery field (Meeker tissue culture plugs in Burlington, Meeker cut roots in Lynden, and cut roots of a proprietary variety in Macdoel) and were grown according to commercial nursery practices through the 2010 season.

Shoots at the Burlington and Lynden sites were removed and weighed prior to digging. Shoots were not weighed at the Macdoel site. Plants were dug and graded according to the standards of each cooperating nursery. The number and

weight of rooted #1 canes per plot was recorded. Remaining root material from each plot was weighed.

Results

Burlington, WA. All of the alternative fumigants produced plants with heavier shoots than MB:pic, but there were no differences in numbers or weights of canes or roots harvested from the plots. Estimated total returns less fumigation costs were higher in all of the other plots, compared with MB:pic (Table 1).

Lynden, WA. There were no significant differences among treatments for shoot weight, harvested cane number, cane weight, or root weight. Telone C-35-, using either conventional or VIF film, resulted in the highest total returns less fumigation costs (Table 1).

Macdoel, CA. MB:pic and MIDAS resulted in the highest numbers of canes per meter, followed by Telone C-35. Pic-Clor 60 resulted in the lowest number of canes per meter. Although statistical separation of means was not possible for this nonreplicated trial, means and standard errors are shown (Table 1). Similarly, total returns less fumigation costs were highest for MB:pic, followed by MIDAS, Telone C-35, and Pic-Clor 60.

Summary

Soil fumigation is a costly procedure that nurseries conduct to reduce the risk of a much costlier event: inadvertently distributing plants contaminated with soilborne disease or nematodes. The efficacy of a soil fumigant is, overall, more important than its cost. However, the choice of fumigant can significantly impact economics of raspberry nursery production.

- Telone C-35 at 433 lb/A was substantially less expensive than MB:pic, and provided comparable income to MB:pic in the Washington trials, although yields may have been slightly reduced in Macdoel CA. We previously reported that this treatment was at least as effective for disease and nematode control, especially when used with an impermeable (VIF or TIF) film.
- Pic-Clor 60 at 366 lb/A was less expensive than the other fumigants and performed well in the Washington trials, where it was used with a VIF film. It was less effective at Macdoel CA where it was used with an HDPE film.
- MIDAS 50:50 at 225-300 lb/A performed well in all three trials, but was the costliest material to apply.

Table 2. Nursery cane and root production, estimated income and fumigation costs, and income less fumigation costs relative to Methyl Bromide fumigation.

Treatment, rate (lb/A) and tarp type	Shoot weight (kg/m)	Canes[z] (no./m)	Root weight[y] (kg/m)	Estimated fumigation cost ($/A)	Income[x] less fumigation cost relative to MB:pic ($/A)
Burlington, WA					
Non-fumigated, V[x]	5.6 a[v]	21.5	1.5	$676	$7,468
Telone C-35, 433, V	7.2 ab	19.5	1.6	$2,173	$4,231
MIDAS 50:50, 225, V	6.6 bc	21.9	2.0	$3,389	$3,230
Pic-Clor 60, 366, V	7.1 bc	22.0	1.7	$2,337	$6,027
MB:pic, 67:33, 350, H	5.5 d	17.9	1.5	$2,814	
Lynden, WA					
Non-fumigated, V	2.1	20.6	0.32	$676	-$324
Telone C-35, 433, H	3.1	22.3	0.37	$1,750	$1,848
Telone C-35, 433, V	2.8	22.0	0.29	$2,173	-$320
MIDAS 50:50, 350, H	2.5	21.4	0.27	$4,826	-$4,160
MIDAS 50:50, 225, H	2.8	19.9	0.29	$3,811	-$3,713
MIDAS 50:50, 225, V	2.5	21.1	0.26	$3,389	-$4,500
Pic-Clor 60, 366, V	3.1	19.6	0.38	$2,337	-$2,208
MB:pic, 67:33, 350, H	2.7	23.2	0.24	$2,814	
Macdoel, CA					
Telone C-35, 433, H		19.4 $\pm$ 1.6	0	$1,915	-$4,052
MIDAS 50:50, 300, H		22.6 $\pm$ 1.4	0	$4,251	-$2,003
Pic-Clor 60, 427, H		17.1 $\pm$ 1.8	0	$1,915	-$7,488
MB:pic, 67:33, 400, H		23.2 $\pm$ 1.7	0	$3,101	

[z] Number one rooted canes as determined by cooperating nursery.

[y] Weight of roots remaining after number one canes were removed.

[x] Income estimates based upon wholesale price of $0.75/cane and $9.46/kg roots.

[w] H=high density polyethylene film; V=virtually impermeable film (Pliant Blockade XL).

[v] Within a trial (Burlington or Lynden), shoot weight, cane number, or root weight means in a column followed by the same letter or followed by no letter are not significantly different according to Fisher's Protected LSD ($P<0.05$).