PERENNIAL CROP NURSERIES–
PERFORMANCE OF METHYL BROMIDE ALTERNATIVES IN THE FIELD

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Soil fumigation with methyl bromide has commonly been used prior to planting perennial field nurseries to insure a high quality product and to meet the California Code of Regulations that state that it is "mandatory that nursery stock for farm planting be commercially clean with respect to economically important nematodes" (CDFA, 1996). Historically, methyl bromide has been effectively used to comply with the nursery regulations. Growers of perennial nursery crops, such as trees, vines, and roses, will need alternatives to methyl bromide in order to continue to produce clean planting material and to meet CDFA's requirements.

Rose Field Nursery Trial – Planted 2001. A rose field nursery trial was initiated in fall 2001 in Wasco, CA. Each treatment (Table 1) was replicated 6 times in a randomized complete block design. Dr. Huey rose rootstock was planted Nov. 2001. Details of nematode control at planting and after the first growing season can be found in the 2002 and 2003 MBAO proceedings. Grafted roses are a 2-year crop. As expected, rootknot nematode populations that were reduced to nearly undetectable levels by the use of the rootknot resistant Nemex cotton prior to planting roses, reached detectable population levels prior to the beginning of the second growing season. At the end of the second growing season, plants were harvested and soil and root samples were collected. Root samples were processed in the mist chamber and soil samples were processed by sugar flotation/centrifugation. Rootknot nematode was found in the roots of plants grown in the untreated plots and in plots treated with MIDAS (30:70, 400 lb/acre, drip applied), untarped Telone C35, chloropicrin (200 lb/acre and split application), metam sodium, and Iota. Treatments resulting in nematode infested roots are not acceptable for certified nursery use. The largest plants were in plots treated with methyl bromide or tarped Telone C35. The smallest plants were in plots treated with Iota and chloropicrin (low rate and split rate).

Tree, Vine and Berry Field Nursery Trial. A field trial was initiated in fall 2001 in a commercial nursery in Visalia, CA. The previous corn crop was removed in September and treatments applied in October. Each treatment (Table 3) was replicated 4 times in a randomized complete block design. All treatments were applied by shank injection. A diverse selection of trees, grapevines, raspberries, and blackberries was planted in March 2002 (Table 2). Details of treatment application, nematode control at planting, and nematode control at harvest of the one-year grape crop can be found in the 2002 and 2003 MBAO proceedings. Trees were harvested Dec. 2003. Roots were chopped and placed in a mist chamber to extract root nematodes. Results are presented for the 3 tree crops (Table 3). All chemical treatments except tarped chloropicrin plots planted

to Wonderful Pomegranate resulted in nematode populations not significantly different from populations in the methyl bromide plots.

Grapevine Field Nursery Trial – planted 2003. A grapevine field nursery trial was initiated in 2002 in a 70-year-old, plant-parasitic-nematode-infested Thompson Seedless vineyard located at the USDA Parlier, CA research station. Each treatment was replicated 6 times in a randomized complete block design. All treatments (Table 4) were applied in Fall, 2002. Thompson Seedless, Cabernet Sauvignon, and Freedom grapevine sticks were planted in April 2003 and harvested in Dec. 2003. Roots were chopped and placed in a mist chamber to extract root nematodes. Citrus nematode was found in the roots of plants grown in the untreated plots for all three varieties/rootstocks and in the plots treated with azide applied through the 8-inch deep drip tape for Cabernet Sauvignon. Rootknot nematode was found at low levels, not significantly different from the methyl bromide plots, in plots treated with InLine and both rates of MIDAS for Cabernet Sauvignon and Freedom. Slightly higher populations were found in Thompson Seedless grown in plots treated with MIDAS (240 lb/acre), InLine, and azide delivered through the 2" deep drip tape. Significantly higher rootknot nematode populations were found in plants grown in the untreated plots and all other plots treated with sodium azide. Sodium azide does not appear to be an acceptable certified nursery treatment.

Conclusions

- MIDAS, tarped Telone C35, InLine, and Telone EC achieved nematode control similar to methyl bromide in a rose field nursery, but MIDAS is not yet registered, and use of 1,3-D (in Telone and InLine) is restricted in California by township caps.
- Shank-injected Telone C35 and MIDAS provided nematode control comparable to methyl bromide at harvest of a 2-year tree crop.
- Sodium azide did not provide adequate nematode control for certified nursery use in our trials.

References

California Dept. of Food and Agriculture. 1996. Approved treatment and handling procedures to ensure against nematode pest infestation of nursery stock. Nursery Inspection Procedures Manual, Item #12. 18 pp.

Table 1. Rose nursery trial initiated 2001.

Treatments
Untreated
Methyl Bromide - 350 lb/acre, tarped - noble plow
MIDAS (30% Iodomethane 70% Chloropicrin) - 400 lb/acre, tarped - noble plow
Telone C35 - 48 gal/acre, tarped - noble plow
Telone C35 - 48 gal/acre, untarped - telone rig
Inline – 50 gal/acre, drip
Telone EC – 35 gal/acre, drip
Chloropicrin – 200 lb/acre, drip
Chloropicrin – 400 lb/acre, drip
Chloropicrin – 200 + 200 lb/acre, drip
MIDAS (30% Iodomethane 70% Chloropicrin) - 400 lb/acre, drip
MIDAS (50% Iodomethane 50% Chloropicrin) - 300 lb/acre, drip
Metam sodium – 75 gal/acre (42% a.i.), drip
Iota (a bacterial suspension from FUSION 360, Turlock, CA)

Table 2. Crops evaluated in a commercial tree, grapevine, and berry field nursery trial.

Trees	Grapes	Berries
Common Apple	1103P	Amity Raspberry
Mazzard Cherry	Freedom	Brazos Blackberry
Mahaleb Cherry	Flame	Indian Summer Raspberry
Callery Pear	Thompson Seedless	Heritage Raspberry
Lotus Persimmon	Crimson Seedless	Kiowa Blackberry
Wonderful Pomegranate	Autumn Royal	
Lovell Peach	Cabernet Sauvignon	
Nemaguard Peach	Zinfandel	
Myrobalan Plum	Chardonnay	
Pecan seed		

Table 3. Rootknot nematode populations per 20g roots sampled at harvest Dec. 2003, mean of 4 replications, in a commercial nursery trial planted in 2002. Statistical analyses conducted on log transformed (log(n+1)) data. Data presented are the antilogs of the means. Means for each grape variety followed by the same letter are not significantly different at the $P = .05$ level**.**

Treatment	Lotus Persimmon		Myrobalan Plum		Wonderful Pomegranate	
Untreated	31	a	8	a	105	a
Methyl Bromide, 300 lb/acre, noble plow, tarp	0	b	0	b	0	c
Telone C35, 48 gal/acre, telone rig, untarped	0	b	0	b	0	c
Telone C35, 48 gal/acre, noble plow, tarped	0	b	0	b	1	c
Midas 30:70, 300 lb/acre, deep shank, untarp	1	b	1	b	3	bc
Midas 30:70, 300 lb/acre, noble plow, tarped	0	b	0	b	0	c
Midas, 50:50, 225 lb/acre, deep shank, untarp	0	b	0	b	0	c
Midas, 50:50, 225 lb/acre, noble plow, tarped	1	b	0	b	1	bc
Chloropicrin, 400 lb/acre, telone rig, untarped	1	b	0	b	2	bc
Chloropicrin, 400 lb/acre, noble plow, tarped	0	b	1	b	18	ab

Table 4. Treatments applied in Grapevine Field Nursery initiated in 2002.

Treatments
Untreated
Methyl Bromide, deep shank - 400 lb/acre (98:2), tarped
Sodium azide (Agrizide), drip tape at 8” - 300 lb/acre, water cap
Sodium azide (Agrizide), drip tape at 2” - 300 lb/acre, water cap
InLine, drip tape at 8” - 50 gal/acre, metam sodium cap
MIDAS (50% Iodomethane 50% Chloropicrin), drip tape at 8” - 240 lb/acre, metam sodium cap
MIDAS (50% Iodomethane 50% Chloropicrin), drip tape at 8” - 300 lb/acre, metam sodium cap