METHYL BROMIDE ALTERNATIVES FOR PERENNIAL FIELD NURSERIES – 1ST AND 2ND YEAR PERFORMANCE

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Soil fumigation with methyl bromide has commonly been used prior to planting 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 following the ban on methyl bromide.

Rose Field Nursery Trial – Planted 2001. A rose nursery field trial was initiated in fall 2001 in Wasco, CA. The previous cotton crop, rootknot nematode resistant variety "Nemex", was removed in August 2001, shank treatments applied in September and drip treatments in Oct. Each treatment (Table 1) was replicated 6 times in a randomized complete block design. Dr. Huey rose rootstock was planted at the end of Nov. Details of nematode control at planting can be found in last year's MBAO proceedings. Soil samples were collected to a depth of 24" in March 2003 and processed by sugar flotation/centrifugation. Rootknot nematode populations in the untreated control, untarped Telone C35, and Iota (a biological material) plots are significantly higher than in plots treated with methyl bromide (Table 1). Weed control, evaluated spring 2003, was best in the methyl bromide plots and least in the Untreated, Iota, and metam sodium pots. Plant vigor was greatest in the methyl bromide, tarped Telone C35, InLine, and chloropicrin – high rate, and least in the untreated control plots.

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. High variability in the rootknot nematode population level, as shown by the population ranges, was observed in the untreated control, untarped Telone C35, and Iota plots. We will monitor nematode and fungal pathogen populations and evaluate plant quality at harvest in winter 2003.

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. Details of treatment application and nematode control at planting can be found in the 2002 MBAO proceedings. A diverse selection of trees, grapevines, raspberries, and blackberries was planted in March 2002 (Table 2). Vine and berry plants were harvested in Dec. 2002. Roots were chopped and placed in a mist chamber to extract root nematodes. Results are presented for the 3 most susceptible grape varieties (Table 3). Most treatments reduced rootknot populations from the levels observed in the untreated control. Telone C35, tarped and untarped, tarped MIDAS (30:70 and 50:50), and tarped chloropicrin resulted in nematode populations not significantly different from populations in the methyl bromide plots. Few rootknot nematodes were found in berry roots from any treatments. Trees are a 2-year crop and will be harvested in Dec. 2003.

Grapevine Field Nursery Trial – planted 2003. A 70-year-old, plant-parasitic-nematode-infested "Thompson Seedless" vineyard located at the USDA Parlier, CA research station was selected for a grape vine nursery field trial. Vines were removed in fall, 2002. Each treatment was replicated 6 times in a randomized complete block design. Shanked, tarped methyl bromide was applied in Oct. 2002. All other treatments (Table 4) were applied by drip fumigation in November, 2002. Broadcast drip treatments were applied in 3 inches of water over a period of 16 hours using moderate-flow drip tapes spaced 24 inches apart and buried at a depth of 8 inches, with the exception of one Agrizide treatment applied through drip tape buried at a depth of 2 inches. A metam sodium cap was applied through microsprays as an herbicide treatment on the InLine and MIDAS plots.

Soil samples were collected at planting in March 2003 in one-foot increments down to a depth of 5 feet. Samples were extracted using the baermann funnel to recover only live nematodes. The predominant plant parasitic nematode genera found in the samples were *Tylenchulus*, the citrus nematode, and *Meloidogyne*, the rootknot nematode. All treatments provided control equivalent to methyl bromide at planting (Table 4).

Thompson Seedless, Cabernet Sauvignon, and Freedom grapevine sticks were planted in April 2003 and will be harvested in Jan. 2004. Experimental rootstocks developed by D. Ramming were planted in the untreated control plots. These rootstocks have been shown to not support phylloxera development and were developed from parental lines exhibiting resistance to nematodes. This is the first field test of these rootstocks to determine resistance to nematodes and vineyard replant disorder. These plants will be harvested in Jan. 2004.

Conclusions

- MIDAS, tarped Telone C35, InLine, Telone EC, chloropicrin, and metam sodium achieved nematode control similar to methyl bromide at the beginning of the 2nd growing season in a rose field nursery, BUT performance of these materials at the end of the cropping cycle is not yet known, MIDAS is not yet registered, and use of 1,3-D is restricted in California by township caps.

- Tarped, shank-injected applications gave better control than untarped, shank-injected applications in a commercial vine nursery, but tarping represents an additional cost.
- New materials and new rootstocks evaluated here are potential tools in management of nematodes under nursery conditions without methyl bromide, but performance throughout the cropping cycle is not yet known.

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. Rootknot nematode populations per 100cc soil sampled at planting in a commercial rose trial March 2003, mean of 6 replications. Statistical analyses conducted on log transformed (log(n+1)) data. Data presented are the antilogs of the means, as well as the range of values. Means followed by the same letter are not significantly different at the P = .05 level.

Treatment	Mean	Range
Untreated	18.0 a	0-805
Methyl Bromide - 350 lb/acre, tarped - noble plow	0 c	0-0
MIDAS (30% Iodomethane 70% Chloropicrin) - 400 lb/acre, tarped - noble plow	0 c	0-0
Telone C35 - 48 gal/acre, tarped - noble plow	0.8 bc	0-32
Telone C35 - 48 gal/acre, untarped - telone rig	6.4 ab	0-354
Inline – 50 gal/acre, drip	0 c	0-0
Telone EC – 35 gal/acre, drip	0 c	0-0
Chloropicrin – 200 lb/acre, drip	0 c	0-0
Chloropicrin – 400 lb/acre, drip	0 c	0-0
Chloropicrin – 200 + 200 lb/acre, drip	0 c	0-0
MIDAS (30% Iodomethane 70% Chloropicrin) - 400 lb/acre, drip	0 c	0-0
MIDAS (50% Iodomethane 50% Chloropicrin) - 300 lb/acre, drip	0 c	0-0
Metam sodium – 75 gal/acre (42% a.i.), drip	0.5 bc	0-12
Iota (a bacterial suspension from FUSION 360, Turlock, CA)	10.8 a	0-213

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. 2002, 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	Cabernet Sauvignon	Zinfandel	Thompson Seedless
Untreated	420 a	214 a	278 a
Methyl Bromide, 500 lb/a,noble plow	0 c	0 d	0 e
Telone C35, 36 gpa, untarped, telone rig	0 c	0 d	3 cde
Telone C35, 42 gpa, tarped, noble plow	2 bc	0 d	0 e
Midas 30:70, 400 lb/a, untarped, deep shank	11 b	15 bc	102 ab
Midas 30:70, 425 lb/a, tarped, noble plow	0 c	0 d	0 e
Midas, 50:50, 375 lb/a, untarped, deep shank	14 b	25 ab	14 bcd
Midas, 50:50, 375 lb/a, tarped, noble plow	0 c	0 d	1 de
Chlorpicrin, 350 lb/a, untarped, telone rig	19 b	4 bcd	22 bc
Chloropicrin, 425 lb/a, tarped, noble plow	1 bc	1 cd	0 e

Table 4. Citrus nematode populations per 100cc soil sampled at planting March 2003, mean of 6 replications. Statistical analyses conducted on log transformed (ln(n+1)) data. Data presented are the antilogs of the means. Means for each depth followed by the same letter are not significantly different at the *P* = .05 level.

Treatment	0-12”	12-24”	24-36”	36-48”	48-60”
Untreated Control	60.3 a	78.6 a	181.6 a	78.3 a	10.0 a
Methyl Bromide, 400 lb/acre	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
MIDAS, drip (50% IM: 50% Pic), 240 lb/acre	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
MIDAS, drip (50% IM: 50% Pic), 300 lb/acre	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
InLine, 50 gal/acre	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
Agrizide, drip, 300 lb/acre, 2” deep drip tape	0.2 b	1.6 b	0.3 b	0.0 b	0.0 b
Agrizide, drip, 300 lb/acre, 10” deep drip tape	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b