VINEYARD REPLANT FIELD TRIALS

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Field evaluation of potential methyl bromide alternatives for perennial crops must determine not only efficacy of pathogen control at the time of planting the new vineyard, but also the efficacy of pest control and impact on crop growth and yield during the early growth and fruiting years. This paper reports the on-going performance of field trials planted in 1998, 2000, and 2001. Complete details on experimental design and previous years' data were reported at the 1999, 2000, 2001, and 2002 Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions.

Field Trial of Chemical, Genetic, and Cultural Alternatives for Vineyard Replant Disorder – Planted 1998. Drip applied treatments were applied in January, 1998 and shanked treatments in April, 1998 to a 65-year-old Thompson Seedless vineyard, following removal of the vines in fall, 1997. The treatments are described in Table 1. In July 1998, each plot was planted with three grape variety/rootstock combinations; own-rooted Thompson Seedless, Merlot on Harmony rootstock, and Merlot on Teleki 5C rootstock.

Soil samples were collected to a depth of 24 inches from each treatment/rootstock combination in October 2002 and processed by sugar flotation-centrifugation. Nematode populations are given in Table 2. After five growing seasons, the Telone/Vapam combinations and iodomethane have achieved control comparable to methyl bromide of both the rootknot (*Meloidogyne spp.*) and citrus (*Tylenchulus semipentrans*) nematode populations for all nematode/rootstock combinations. Nematode populations are higher on Thompson Seedless roots growing in plots treated with Telone delivered in 100 mm water than in plots treated with Telone delivered in 60 mm water. Plots that were fallowed for a year prior to treatment with Telone, supported lower populations of both rootknot and citrus nematodes as compared to Telone applied without the fallow. The rootknot nematode populations are low and there are no significant differences between the untreated control and methyl bromide on Thompson Seedless. Combination of any chemical treatment with either the Teleki 5C or Harmony rootstock resulted in populations of both rootknot and citrus nematodes that were below detectable levels. The rootknot nematode populations on Harmony rootstock were nearly undetectable for all treatments, as would be expected for a rootknot nematode resistant rootstock. The citrus nematode populations were highest on Harmony.

Vines were harvested in September 2002. Yield (kg berries/vine) in the Thompson Seedless plots treated with Telone delivered in 60 mm water following a one-year fallow was significantly greater than in plots treated with 1-year fallow + cover crop. All other treatments were intermediate. Merlot on Harmony had the greatest yield in

plots treated with iodomethane and least in the fallow+cover crop. There was no significant difference in yield of Merlot on Teleki 5C across treatments.

Long-term Fallow for Vineyard Replant Disorder Field Trial – Planted 2000. Vines were removed from a 65-year-old Thompson Seedless vineyard in fall, 1996, 1997, 1998, and 1999 (untreated control and methyl bromide plots). Plots were laid out in a randomized complete block design with 5 replications of each treatment, and planted in June of 2000 with own-rooted Thompson Seedless, Thompson Seedless on Harmony rootstock, and Thompson Seedless on Teleki 5C rootstock.

Soil samples were collected in October 2002 to a depth of 24" from each treatment/rootstock combination and processed with sugar flotation/centrifugation. After 3 growing seasons, citrus nematode populations on Thompson Seedless were significantly lower in plots treated with methyl bromide compared to all other treatments (Fig. 1). Rootknot populations on Thompson Seedless were highest in the untreated plots, lowest in the methyl bromide plots and decreased with each additional year of fallow. When compared to previous years, a stair-step decrease has been observed each year for the rootknot nematode, but was only present after the first growing season for citrus nematode. Initial yield data will be collected this fall.

Field Trial of Chemical Alternatives for Vineyard Replant Disorder – Planted 2001. Vines were removed from an 85-year-old, plant-parasitic-nematode-infested Thompson Seedless vineyard located at the USDA Parlier, CA research station in fall, 2000. All treatments (Table 3) were applied in mid April 2001. In June 2001 own-rooted Thompson Seedless, Thompson Seedless on Freedom, and Merlot on 1103P were planted.

Soil samples were collected to a depth of 24 inches from each treatment/rootstock combination in October 2002 and processed by sugar flotation-centrifugation. Nematode populations after two growing seasons are given in Table 4. Nematode control comparable to methyl bromide was achieved on Thompson Seedless with shank-injected MIDAS, and drip-applied InLine and propargyl bromide. On the more resistant Freedom rootstock, all treatments except the Untreated Control, the herbicide cap, and the Agrizide treatments were comparable to methyl bromide. Performance on the 1103P rootstock was similar to that on Freedom, except that the drip-applied chloropicrin, although better than the Untreated, was not as good as methyl bromide. Initial yield data will be collected this fall.

Conclusions

- Iodomethane, Telone/metam sodium combinations, and InLine appear to be good alternatives to methyl bromide for vineyard replant when both rootknot and citrus nematode are present. Iodomethane is not yet registered and use of 1,3-dichloropropene (in Telone and InLine) is restricted in California by township caps.
- The Harmony rootstock continues to support only minimal populations of the rootknot nematode, but supports higher populations of the citrus nematode than either Thompson Seedless or Teleki 5C.
- Efficacy of long-term fallow treatments for vineyard replant depends on nematode genera present but is not as effective as methyl bromide.

Table 1. Treatments applied in a 1998 vineyard replant trial.

1 - Untreated control
2 - Methyl bromide (400 lbs/acre = 28 gal/acre), shanked, tarped (the treated control)
3 - One-year fallow
4 - One-year fallow plus a sorghum-sudangrass hybrid cover crop
5 - Iodomethane (400 lbs/acre = 21 gal/acre), shanked, tarped
6 - Telone EC (35 gal/acre or 310 lbs/acre of 1,3-D) in 60 mm water through a buried drip tape plus Vapam (26 gal/acre of 42% metam sodium) through microsprinklers
7 - Telone EC (35 gal/acre or 310 lbs/acre of 1,3-D) in 100 mm water through a buried drip tape plus Vapam (26 gal/acre of 42% metam sodium) through microsprinklers
8 – One-year fallow followed by treatment #6
9 – One-year fallow followed by treatment #7

Table 2. Nematode populations per 100cc soil sampled October 2002, mean of 5 replications, in a vineyard replant trial planted in 1998. Statistical analyses conducted on log transformed (ln(n+1)) data. Data presented are the antilogs of the means. Means for each nematode genus/rootstock combination followed by the same letter are not significantly different at the $P = .05$ level

Treatment	***Meloidogyne sp.***			***Tylenchulus semipenetrans.***		
	Thompson Seedless	**Teleki 5C**	**Harmony**	**Thompson Seedless**	**Teleki 5C**	**Harmony**
Untreated Control	37 ab	45 a	0 a	604 a	252 ab	1433 a
1-year Fallow	26 ab	61 a	0 a	614 a	164 b	1450 a
1-year Fallow plus cover crop	82 a	59 a	0 a	362 ab	320 a	1042 b
Methyl Bromide (400lbs/acre)	6 abc	0 b	0 a	0 e	0 c	0 c
Iodomethane (400lbs/acre)	37 ab	0 b	0 a	4 de	0 c	0 c
Telone II EC (60mm H_20)	4 bc	0 b	0 a	11 cd	0 c	0 c
Telone II EC (60mm H_20)+Fallow	1 c	0 b	0 a	0 e	0 c	0 c
Telone II EC (100mm H_20)	18 abc	0 b	0 a	58 bc	0 c	0 c
Telone II EC (100mm H_20)+Fallow	3 bc	0 b	0 a	2 de	0 c	0 c

Table 3. Treatments applied to a 2001 grapevine replant trial.

Untreated Control
Methyl Bromide, 400 lbs/acre, shanked, tarped, the treated control
Shank MIDAS (Iodomethane + Chloropicrin, 240+240 lbs/acre)
Shank Propargyl Bromide - (200 lbs/acre)
Microspray Herbicide - Metam sodium (Vapam, 26 gal/acre)
Drip InLine (50 gal./acre) + Metam sodium (Vapam, 26 gpa) cap
Drip Chloropicrin (400 lbs/acre) + Metam sodium (Vapam, 26 gpa) cap
Drip MIDAS (Iodomethane + Chloropicrin, 240+240 lbs/acre), water cap
Drip Propargyl Bromide, (180 lbs/acre), water cap
Drip Agrizide (sodium azide, 300 lb/acre), water cap
Drip Agrizide (sodium azide, 300 lb/acre), tarped

Table 4. Rootknot nematode populations per 100cc soil sampled October 2002, mean of 5 replications, in a vineyard replant trial planted in 2001. Statistical analyses conducted on log transformed (ln(n+1)) data. Data presented are the antilogs of the means. Means for each nematode genus followed by the same letter are not significantly different at the $P = .05$ level.

Treatment	**Thompson Seedless (own-rooted)**	**Thompson Seedless/ Freedom**	**Merlot/ 1103P**
Untreated	128.1 a	22.8 a	18.3 a
Methyl Bromide	0 e	0 d	0 d
MIDAS – shank	0 e	0 d	0 d
Propargyl Bromide - shank	32.5 bc	0 d	0 d
Herbicide cap (metam sodium)	102.8 a	8.5 b	12.4 a
Drip InLine	0 e	0 d	0 d
Drip Chloropicrin	18.3 c	0 d	2.2 c
Drip MIDAS	1.9 d	0 d	0 d
Drip Propargyl Bromide	0 e	0 d	0 d
Drip Agrizide, water cap	67.2 ab	3.3 c	11.8 ab
Drip Agrizide, tarped	179.9 a	6.0 bc	3.8 bc

Figure 1a. Rootknot nematode populations in a vineyard replant long term fallow (1-year, 2-year, 3-year) trial planted in 2000, mean of 5 replications. Statistical analyses conducted on log transformed (log10(n+1)) data. Data presented are the antilogs of the means. Means for each nematode genus followed by the same letter are not significantly different at the $P = .05$ level.

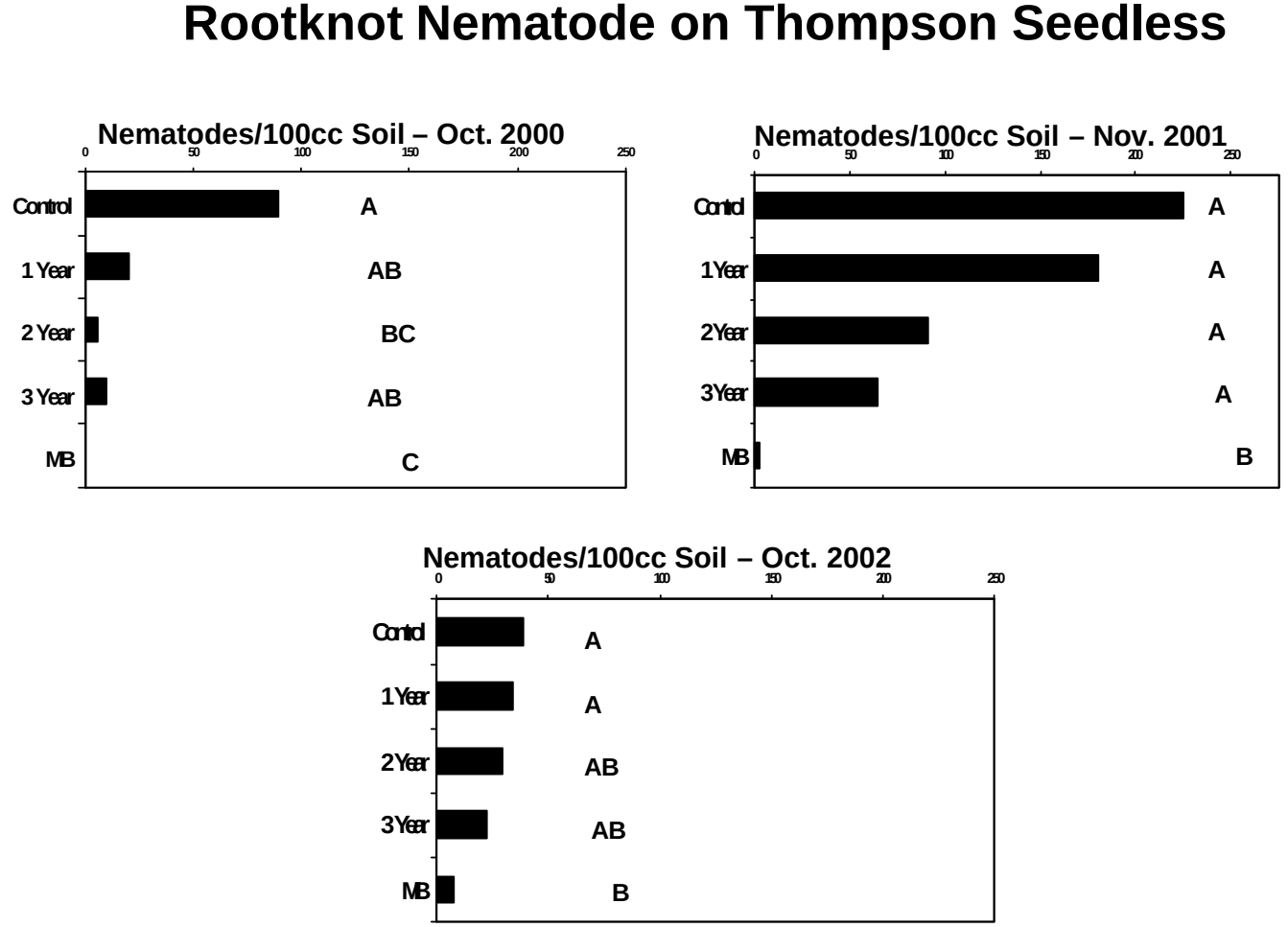

Figure 1b. Citrus nematode populations in a vineyard replant long term fallow (1-year, 2-year, 3-year) trial planted in 2000, mean of 5 replications. Statistical analyses conducted on log transformed (log10(n+1)) data. Data presented are the antilogs of the means. Means for each nematode genus followed by the same letter are not significantly different at the $P = .05$ level.