VINEYARD REPLANT – PERFORMANCE OF METHYL BROMIDE ALTERNATIVES OVER TIME

S. Schneider*, T. Trout, USDA ARS, Parlier, CA 93648
G. Browne, USDA ARS, Davis, CA 95616,
H. Ajwa, UC Salinas, CA 93905, J. Sims, UC, Riverside, CA 92521

Alternatives to methyl bromide for perennial crops must demonstrate efficacy not only for the first growing season, but throughout 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, 2002 and 2003 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. Treatments are described in Table 1. 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. 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 2003 and processed by sugar flotation-centrifugation. Nematode populations are given in Table 2. After six growing seasons, the drip-applied Telone and shank-injected iodomethane continue to demonstrate control comparable to methyl bromide of both the rootknot (*Meloidogyne spp.*) and citrus (*Tylenchulus semipentrans*) nematode populations for most treatment/nematode/ rootstock combinations. Plots that were fallowed for a year prior to treatment with Telone, supported lower populations of both rootknot and citrus nematodes, in all but one case, as compared to Telone applied without the fallow. All chemical treatments resulted in populations of rootknot nematode that remain low, with the exception of plots planted to Thompson Seedless following treatment with iodomethane. Combination of any chemical treatment with Thompson Seedless or Teleki 5C resulted in populations of the citrus nematode that remained low with the exception of Thompson Seedless in plots treated with Telone in 100cc of water. The rootknot nematode populations on Harmony rootstock were below detectable levels for all treatments, as would be expected for this rootknot-nematode-resistant rootstock, but the citrus nematode populations were highest on Harmony.

Berries were harvested in September 2003. 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, Telone delivered in 60 mm water following a one-year fallow, or Telone delivered in 100 mm water and least in the fallow+cover crop plots. 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 2003 to a depth of 24” from each treatment/rootstock combination and processed with sugar flotation/centrifugation. After four growing seasons, both citrus and rootknot nematodes remained very low in all methyl bromide plots and in plots planted with the Harmony rootstock (Table 3). Nematode populations were not significantly different from the untreated controls for all other treatment/nematode/variety or rootstock combinations with the exception of lower citrus nematode populations on Teleki 5C following a 3-year fallow. The stair-step decrease of nematode population with each increasing year of fallow that was observed in previous years is now present only for the rootknot nematode on Thompson Seedless, however the difference is not significant.

Berries were harvested in August 2004. There was no significant difference in yield (kg/vine) between treatments in the own-rooted Thompson Seedless and the Thompson Seedless on Harmony. No data are available from the Thompson Seedless on Teleki 5C due to vine damage late in the 2003 season.

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 4) 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 2003 and processed by sugar flotation-centrifugation. Nematode populations after three growing seasons are given in Table 4. Nematode control comparable to methyl bromide was achieved on Thompson Seedless with MIDAS, InLine, and propargyl bromide. On the more resistant Freedom rootstock, MIDAS, propargyl bromide and InLine treatments controlled rootknot and citrus nematodes comparable to methyl bromide. Performance on the 1103P rootstock was similar to that on Freedom, except that the drip-applied chloropicrin was also comparable to methyl bromide.

Berries were harvested in August 2004. There was no significant difference in yield (kg/vine) between treatments in Merlot on 1103P, own-rooted Thompson Seedless, and Thompson Seedless on Freedom.

Conclusions

- Iodomethane, drip-applied Telone, 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.
- Rootknot nematode populations on Harmony rootstock are undetectable after 6 growing seasons, but populations of the citrus nematode are higher on Harmony than on either Thompson Seedless or Teleki 5C.
- Significant benefit in rootknot and citrus nematode population reduction from long-term fallow treatments for vineyard replant was no longer observed after four growing seasons.

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

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

Table 2. Nematode populations per 100cc soil sampled October 2003, mean of 5 replications, in a vineyard replant trial planted in 1998. Statistical analyses conducted on log transformed (log10(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	67 ab	71 a	0 a	862 a	269 a	1432 a
1-year Fallow	44 abcd	73 a	0 a	880 a	188 a	1597 a
1-year Fallow plus cover crop	126 a	84 a	0 a	530 a	351 a	1079 ab
Methyl Bromide (400lbs/acre)	5 cde	0 c	0 a	0 d	2 b	5 ef
Iodomethane (400lbs/acre)	63 abc	0 c	0 a	6 cd	4 b	115 bcd
Telone II EC (in 60mm H_20)	5 cde	0 c	0 a	20 bc	1 b	756 abc
Telone II EC (in 60mm H_20) +Fallow	2 e	7 b	0 a	0 d	8 b	0 f
Telone II EC (in 100mm H_20)	9 bcde	6 b	0 a	106 ab	2 b	93 cd
Telone II EC (in 100mm H_20) +Fallow	3 de	1 bc	0 a	2 cd	3 b	48 de

Table 3. Nematode populations per 100cc soil sampled October 2003, mean of 5 replications, in a vineyard replant trial evaluating long term fallow planted in 2000. Statistical analyses conducted on log transformed (log10(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	67 a	68 a	2 b	274 a	313 a	487 a
1-year Fallow	62 a	20 ab	0 c	248 a	187 a	860 a
2-Year Fallow	48 a	46 a	12 a	387 a	209 a	444 a
3-Year Fallow	32 a	23 ab	0 c	597 a	34 b	562 a
Methyl Bromide (400lbs/acre)	6 b	3 b	0 c	0 b	0 c	4 b

Table 4. Nematode populations per 100cc soil sampled October 2003, mean of 5 replications, in a vineyard replant trial planted in 2001. Statistical analyses conducted on log transformed (log10(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	**TS/ Freedom**	**Merlot/ 1103P**	**Thompson Seedless**	**TS/ Freedom**	**Merlot/ 1103P**
Untreated Control	217 a	25 a	10 abc	203 a	136 a	10 b
Methyl Bromide, 400 lb/acre, shank, tarped	0 f	0 c	0 d	0 d	0 c	0 d
Iodomethane, 240 lb/acre + chloropicrin, 240 lb/acre, shank, tarped	0 f	0 c	0 d	0 d	0 c	0 d
Propargyl Bromide, 200 lb/acre, shank, tarped	24 d	0 c	0 d	0 d	0 c	0 d
Herbicide cap (metam sodium) Vapam 26 gal/acre, microspray	130 ab	12 a	22 a	123 ab	15 b	79 a
InLine, 50 gal/acre, drip, + Vapam 26 gal/acre microspray	0 f	0 c	0 d	0 d	0 c	0.9 cd
Chloropicrin, 400 lb/acre, drip, Vapam 26 gal/acre microspray	42 cd	0 c	2 cd	4 c	8 b	1 bcd
Iodomethane, 240 lb/acre + chloropicrin, 240 lb/acre, drip, water microspray	2 e	0 c	0 d	0 d	0 c	0 d
Propargyl bromide, 180 lb/acre, drip, water microspray	0 f	0 c	0 d	0 d	0 c	0 d
Sodium azide, 300 lb/acre, drip, water microspray	75 bc	5 b	17 ab	48 b	1 c	5 bc
Sodium azide, 300 lb/acre, drip, tarped	223 a	20 a	5 bc	113 ab	71 a	1 bcd