ON-GOING PERFORMANCE OF VINEYARD REPLANT TRIALS INITIATED IN 1998-2000

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"Replant disorder" is a general term for the lack of vigor in a newly replanted vineyard as compared to vines planted in "non-vineyard" soil. Fumigation with methyl bromide prior to replanting can alleviate the problem, but the methyl bromide phase-out is impacting cost and availability of this control strategy. Fumigation with 1,3-D (Telone) has also been used to control replant disorder. California's township caps restricts the availability of this option in some areas of the state. Additional alternatives are needed to insure the health and vigor of replanted vineyards. Field trials to evaluate potential alternatives for perennial crops must determine efficacy of pathogen control not only at the time of planting the new vineyard, but must assess the on-going performance of the methyl bromide alternatives during the early growth and fruiting years.

Chemical, Genetic, and Cultural Control Field Trial – 1998.
A 65-year-old "Thompson Seedless" vineyard, located at the USDA Parlier, CA research station was selected for a grape replant field trial. The treatments are described in Table 1. Each treatment was replicated 5 times in a randomized complete block design. Vines were removed from the 1-year fallow plots in fall, 1996. All other vines were removed in fall, 1997. Telone/Vapam treatments were applied in early January, 1998. Methyl bromide and iodomethane treatments were applied in late April, 1998. In July of 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. The rootstocks vary in levels of resistance to nematodes, which are thought to play a role in replant disorder. First and second year results of this study were reported at the 1999 and 2000 Methyl Bromide Conferences (Schneider et al., 1999; Schneider, et al., 2000). This paper reports data from the 2001 growing season.

Soil samples were collected to a depth of 24 inches from each treatment/rootstock combination in June, 2001 and processed by sugar flotation-centrifugation. Nematode populations are given in Table 2. To date, the Telone/Vapam combinations and iodomethane have controlled both the rootknot (*Meloidogyne spp.*) and citrus *Tylenchulus semipentrans*) nematode populations as well as methyl bromide. Although not significant, nematode populations appear to be increasing more quickly 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. The reduction in rootknot nematode populations observed in previous years in the 1-year fallow and 1-year fallow + cover crop treatments, while still present, is no longer statistically significant in Thompson seedless and Harmony plots. Untreated control and 1-year fallow + cover crop plots planted to the Harmony rootstock had significantly lower rootknot nematode populations than plots planted to Thompson seedless or Teleki 5C. Both Teleki 5C and Harmony supported lower rootknot nematode populations in the 1-year fallow treatment. Harmony supported the highest populations of citrus nematode and Teleki 5C the lowest. The difference was significant for both untreated and 1-year fallow plots. No significant difference between rootstocks was observed for either nematode population in any of the chemical treatments. Resistant rootstocks can be effective, but are more expensive than own-rooted vines and often not resistant to the diversity of pests that is encountered in a replant situation.

In January, 2001, caliper measurements of the vine trunk above the graft union were made. Thompson seedless vines in the methyl bromide and all Telone/Vapam combinations were larger than vines grown in the untreated, the 1-year fallow, and the 1-year fallow+cover crop plots. Vines grown in the iodomethane plots were intermediate in size. Merlot vines grown on Teleki 5C rootstock were largest in the plots treated with Telone delivered in 60 mm water and smallest in the 1-year fallow, methyl bromide, and iodomethane. Merlot vines grown on Harmony rootstock were largest in the plots treated with methyl bromide and Telone delivered in 60 mm water, intermediate in the plots treated with iodomethane, Telone delivered in 100 mm water, and 1-year fallow, and smallest in the untreated control and the 1-year fallow+cover crop.

Thompson seedless vines were harvested in August, 2001. Yield (kg berries/vine) in the plots treated with methyl bromide, Telone delivered in 60 mm water+1-year fallow, and Telone delivered in 100 mm water was significantly greater than in plots treated with 1-year fallow + cover crop. All other treatments were intermediate. Brix (soluable solids) levels were greatest in the Telone/Vapam combinations and least in the untreated control and 1-year fallow+cover crop, but the differences were not statistically significant. The merlot berries will be harvested in September. In addition to yield and brix, the effect of the treatments on the quality of the wine made from the berries will also be evaluated.

Grape Long-term Fallow Trial – 2000

A 65-year-old "Thompson Seedless" vineyard, located at the USDA Parlier, CA research station was selected for the grape long term fallow trial. Vines were removed in Fall, 1996 (3-year fallow plots); Fall, 1997 (2-year fallow plots); Fall, 1998 (1-year fallow plots); and Fall, 1999 (untreated control plots). Plots were laid out in a randomized complete block design with 5 replications of each treatment. Volunteer grape plants in the fallowed plots were removed by hand over the course of the fallow periods. Soil samples were collected in spring, 2000 with a bucket auger in one-foot increments down to a depth of 5 feet. Samples were processed by sugar flotation/centrifugation. The 1-year fallow significantly reduced the rootknot nematode population in the top 24 inches of the soil profile (Figure 1a). Rootknot populations in the 24-36" zone were reduced by a 2-year fallow, and in the 36-48" zone by a 3-year fallow. Rootknot populations in the 48-60" zone were low and not significantly affected by any treatments in this trial. Citrus nematode populations in the top 12 inches of the soil were significantly reduced by 1-year fallow (Figure 1b). Citrus nematodes in the deeper soil zones were not significantly reduced by any fallow treatment in this trial.

In June of 2000, each plot was planted with three grape variety/rootstock combinations; own-rooted Thompson Seedless, Thompson Seedless on Harmony rootstock, and Thompson Seedless on Teleki 5C rootstock. The rootstocks vary in levels of resistance to nematodes, which are thought to play a role in replant disorder. In June, 2001, soil samples were collected to a depth of 24" from each treatment/rootstock combination and processed with sugar flotation/centrifugation. Rootknot nematode populations in plots subjected to a 2 or 3 year fallow and planted to Thompson Seedless were significantly lower than populations in the untreated control plots. There were no significant differences in rootknot nematode populations across fallow treatments in plots planted to Harmony or Teleki 5C rootstocks. Citrus nematode populations in plots subjected to a 1-year or greater fallow and planted to Thompson Seedless and Teleki 5C were significantly lower than populations in the untreated plots. The Harmony rootstock supported the highest populations of the citrus nematode, as was seen in the field trial reported above. Only the 2-year fallow significantly affected the citrus nematode populations on Harmony rootstock.

Conclusions

Three years after treatment and re-planting of a 65-year old vineyard infested with significant plant parasitic nematode populations, drip-applied Telone II EC and shank-applied iodomethane continue to give control of the rootknot and citrus nematode populations that is equivalent to that obtained with methyl bromide. Although nematodes are beginning to appear in the chemically treated plots, the populations are still very low compared to the untreated control. The Harmony rootstock continues to support only minimal populations of the rootknot nematode, even in the untreated plots, but supports higher populations of the citrus nematode than either Thompson Seedless or Teleki 5C. Iodomethane and the Telone/Vapam combinations appear to be good alternatives to methyl bromide for vineyard replant when both rootknot and citrus nematode are present, at least for the first 3 years after establishment of a replanted vineyard. If only rootknot nematode is present, the Harmony rootstock is a good alternative – alone or in combination with chemical controls, but citrus nematode populations will increase on Harmony if it is used without any chemical control.

The long-term fallow field trial is only one year old, and thus the performance of the fallow treatments over the early years of a new vineyard is not yet known. The feasibility of fallow treatments will depend on the kind of nematodes present in the vineyard, the cost of leaving the vineyard fallow for a sufficient period of time to reduce the nematode populations, the rootstock used in the replanted vineyard, and the availability of other management options.

References

Schneider, S. M., H. Ajwa, T. Trout and J. Sims. 1999. Grape replant disorder – field tests of some potential alternatives. Proc. Ann. Intl. Research conference on Methyl Bromide Alternatives and Emissions reductions. Nov. 1-4, 1999. San Diego, CA pp. 50-1 to 50-4.

Schneider, S. M., H. Ajwa, T. Trout and J. Sims. 2000. Alternatives for vineyard replant and grapevine nurseries. Proc. Ann. Intl. Research conference on Methyl Bromide Alternatives and Emissions reductions. Nov. 6-9, 2000. Orlando, FL pp. 14-1 to 14-5.

Table 1. Treatments applied to a vineyard replant field.

Treatment 1 - untreated control
Treatment 2 – 1-year fallow
Treatment 3 – 1-year fallow plus a sorghum-sudangrass hybrid cover crop
Treatment 4 - a shanked application of methyl bromide (400 lbs/acre = 28 gal/acre), tarped (the treated control)
Treatment 5 - a shanked application of iodomethane (400 lbs/acre = 21 gal/acre), tarped
Treatment 6 - combination application of Telone II 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
Treatment 7 - Telone II EC in 60 mm water + Vapam + 1-year fallow
Treatment 8 - Telone II EC in 100 mm water + Vapam
Treatment 9 - Telone II EC in 100 mm water + Vapam + 1-year fallow

Table 2. Nematode populations per 100cc soil sampled June 2001, mean of 5 replications. Drip treatments were applied in January, 1998. Shank treatments were applied in April, 1998. 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	103.7 a	71.7 a	1.0 a	972.8 a	334.1 a	1216.0 a
1-year Fallow	85.8 a	27.7 b	0.0 a	661.1 a	291.8 a	1562.9 a
1-year Fallow plus cover crop	50.7 a	16.2 b	2.2 a	573.4 a	275.2 a	921.6 a
Methyl Bromide (400lbs/acre)	2.9 b	0.0 c	0.0 a	0.5 bc	2.2 b	108.2 b
Iodomethane (400lbs/acre)	7.8 b	0.0 c	0.0 a	12.2 bc	3.0 b	58.7 b
Telone II EC (in 60mm water)+ Vapam	0.2 b	0.0 c	4.5 a	1.1 bc	0.5 b	49.9 b
Telone II EC (in 60mm water)+ Vapam + 1-year fallow	0.2 b	0.0 c	0.0 a	0.0 c	0.0 b	5.6 b
Telone II EC (in 100mm water)+ Vapam	33.9 b	0.0 c	0.0 a	37.4 b	15.4 b	4.5 b

Telone II EC (in 100mm water)+ Vapam + 1-year fallow	21.8 b	0.0 c	0.0 a	7.5 bc	1.1 b	59.5 b

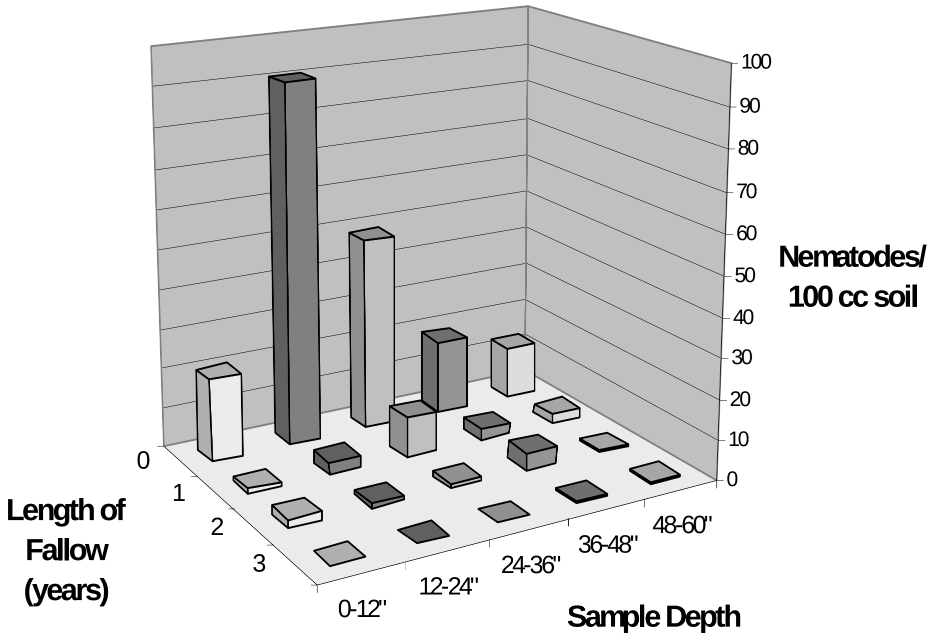

Figure 1a. Effect of varying the length of the fallow period on the rootknot nematode populations throughout the top 5 feet of soil.

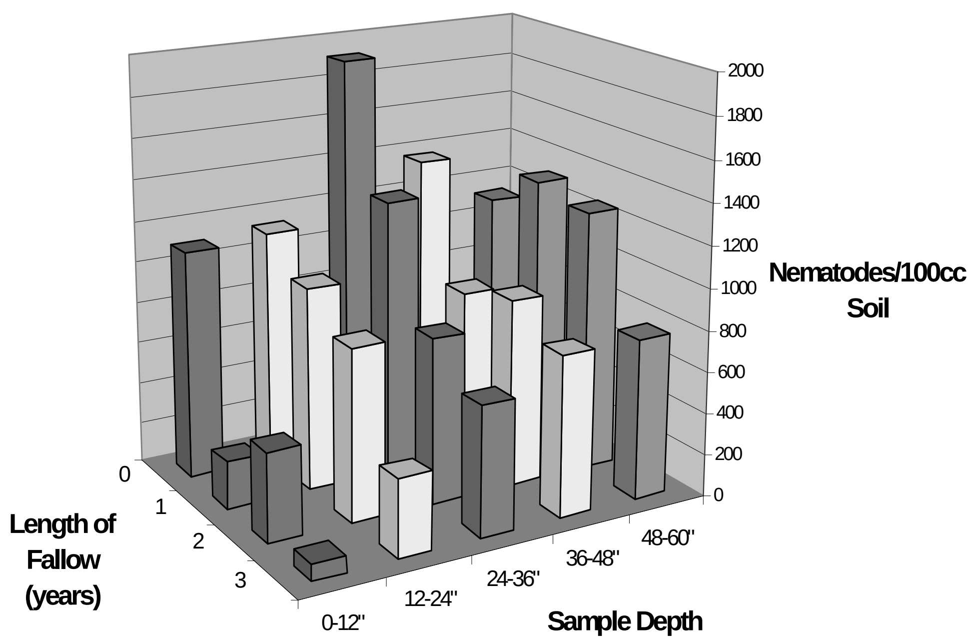

Figure 1b. Effect of varying the length of the fallow period on the citrus nematode populations throughout the top 5 feet of soil.