ALTERNATIVES FOR VINEYARD REPLANT AND GRAPEVINE NURSERIES

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"Replant disorder" is a general term for the decline in vigor in a newly replanted vineyard as compared to vines planted in "non-vineyard" soil. There can be various factors contributing to replant disorder, which undoubtedly vary among sites. The current practice for replanting grapes into a vineyard with a known soilborne pest problem is to fumigate with either methyl bromide or 1, 3-dichloropropene (1,3-D). Importation and manufacture of methyl bromide will be phased out by 2005 in compliance with the U.S. Clean Air Act and the Montreal Protocol. Use of 1,3-D, or Telone, is limited in California by township caps. Our search for alternative treatments includes new application methods for currently registered compounds, unregistered materials, plant resistance, and cultural practices.

An existing "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 plot was 3 rows wide and 7 vines long and replicated 5 times in a randomized complete block design. Telone/vapam treatments were applied in early January, 1998. Methyl bromide and methyl iodide 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 year results of this study were reported at last year's Methyl Bromide Conference. This paper reports data from the 2nd year of this trial.

Soil samples were collected to a depth of 24 inches in May 1999, October, 1999, and April, 2000. There were no detectable plant parasitic nematodes in any of the plots treated with methyl bromide (MB), methyl iodide (MI), or the telone/vapam (T/V) combinations until April 2000, and then only at extremely low levels (Table 2). Nematode populations for the rest of the treatments are given in Table 2. The telone/vapam combinations and methyl iodide have controlled the nematode populations as well as methyl bromide to date. The 18 month fallow treatments reduced the number of rootknot nematodes detected in May 1999. This advantage was not detected in the Fall, 99 sampling, but was again present in Spring, 2000 samples from Thompson Seedless vines. An 18 month fallow results in a loss of use (and income) of the vineyard for an additional year, but also removes the actively growing vine and upper roots as biological factors in the ecosystem for that year. The use of rootknot resistant rootstocks reduced the population level of rootknot, but not citrus, nematodes. 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 February, 2000, caliper measurements of the vine trunk were made. Thompson seedless vines were larger in MB than in the untreated, 18 month fallow (18F), 18F+Cover Crop (18F+CC), and MI plots. Vines in the T/V combinations were intermediate in size, not significantly different from either group. Merlot/Teleki vines were larger in the untreated plots than in the 18F, MB, or MI. The Merlot/Harmony vines were significantly larger in the MB and T/V combinations than in the 18F+CC plots. Data on plant growth and nematode populations will be collected for at least five years in order to determine the impact of the treatments not only on vegetative plant growth, but also on fruit yield and quality. Our first evaluation of fruit yield and quality will occur this fall.

Nursery Study. Soil fumigation with methyl bromide has commonly been used prior to planting grapevine field nurseries to meet the requirements of the California Department of Food and Agriculture's (CDFA) Nursery Stock Nematode Control Program. Growers of perennial nursery crops will need an alternative to methyl bromide in order to continue to produce clean planting material and meet CDFA's requirements following the ban on methyl bromide.

In the spring of 2000, a grape nursery study was initiated. No field sites with existing plant parasitic nematode populations were available, so muslin bags filled with soil containing rootknot and citrus nematodes were buried in a previously fumigated field at the USDA research station in Parlier, CA. Bags were buried at depths of 1, 3, and 5 feet. Plots were set out in a randomized complete block design with 4 replications per treatment. The treatments were:

- untreated control
- methyl bromide at 400 lbs/acre (treated control), tarped
- shanked methyl iodide (200 lbs/acre)+chloropicrin (200 lbs/acre) , tarped
- drip applied Telone II EC (44 gal./acre or 390 lbs/acre of 1,3-D), tarped
- drip applied methyl iodide (200 lbs/acre)+chloropicrin (200 lbs/acre), tarped
- drip applied methyl iodide (100 lbs/acre)+chloropicrin (100 lbs/acre), tarped
- drip applied propargyl bromide - (100 lbs/acre), tarped
- drip applied propargyl bromide (200 lbs/acre), tarped

Drip tapes were laid on the top of the plant bed and beds were covered with plastic prior to application of the materials. All dripped applied treatments were applied in 3 inches of water over a 9-hour period.

Nematode Control. The nematode bags were recovered 2 weeks after treatment. Soil was placed on baermann funnels to recover only live nematodes. No live nematodes were recovered at any depth in the shanked treatments. All dripped treatments gave excellent control at the 1 ft. depth. At the 3 ft. level, fewer than 5 nematodes were recovered in the high rate of propargyl bromide and both rates of methyl iodide/chloropicrin compared to 160 nematodes in the untreated control. Effective control at the 5 ft. level was achieved only with the low and high rates of methyl iodide/chloropicrin. The soil was fairly dry when the treatment began, and it is likely that the 3 inches of water was insufficient to move the other materials down to the 5 ft. level. Further tests will be conducted to determine if control at the 5 ft depth improves when materials are applied in greater volumes of water.

Phytotoxicity. Canes of Cabernet Sauvignon and Freedom were planted at weekly intervals beginning one week after treatment and continuing for 4 weeks. Number of actively growing vines was recorded approximately 2 months after treatment. There were no significant differences between the percent live vines of Cabernet in shank fumigated plots and untreated controls at any planting date. Freedom vines planted 3 weeks after treatment in plots treated with shank applied methyl iodide/chloropicrin, had significantly fewer live vines than the untreated control or methyl bromide fumigated plots. There were no significant differences between Freedom vines in the untreated control and shank fumigated plots at any other planting date. There were fewer live Cabernet vines in the telone and high rate of propargyl bromide plots planted one week after treatment compared to the methyl bromide and untreated control plots. Freedom suffered more phytotoxicity when planted one week after treatment in the low rate of dripped methyl iodide/chloropicrin and the high rate of propargyl bromide than in the untreated control or methyl bromide plots. There were no significant differences in percent live vines among dripped treatments and the untreated control and methyl bromide plots for either grape variety for plots planted 2, 3 or 4 weeks after treatment. Quality and marketability of the vines will be evaluated at harvest this winter in accordance with standard nursery practices.

Weed Control. Approximately seven weeks after planting, weeds were removed from a one ft. wide swath on each side of the plant row. Weeds were air-dried for 2 weeks and weighed. All treatments except the low rate of methyl iodide/chloropicrin had significantly fewer weeds than the untreated control and were not different from the control achieved with methyl bromide.

This study will be repeated next year at a field site with existing populations of plant parasitic nematodes.

Table 1. Treatments applied to a "Thompson Seedless" replant field.

Treatment 1 - untreated control
Treatment 2 - 18 month fallow
Treatment 3 - 18 month 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 methyl iodide (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 - same as #6 except the Telone was applied in 100 mm of water;
Treatment 8 - same as #6, but with an 18 month fallow
Treatment 9 - same as #7 but with an 18 month fallow

Table 2. Nematode populations per 150cc soil sampled May 1999, October 1999, and April 2000 in the grape replant trial, mean of 5 replications. Means for each nematode genus/rootstock combination followed by the same letter are not significantly different at the *P* = .05 level.

Thompson Seedless - own rooted

Treatment	***Meloidogyne sp.***			***Criconemella sp.***			***Tylenchulus sp.***			***Xiphinema sp.***			***Paratylenchus sp.***		
	May 99	**Oct. 99**	**Apr 00**	**May 99**	**Oct. 99**	**Apr 00**	**May 99**	**Oct. 99**	**Apr 00**	**May 99**	**Oct. 99**	**Apr 00**	**May 99**	**Oct. 99**	**Apr 00**
Untreated Control	126.0a	374.0a	475.2a	9.2a	0.8b	1.8a	225.6a	302.0a	1416.0a	3.2a	9.2a	8.4	34.0a	3.0a	0.0b
18 Month Fallow	62.4b	304.0a	278.4b	6.8ab	2.4b	6.6a	293.2a	282.0a	840.0b	0.8a	5.6ab	4.2	23.6a	8.0a	0.
18 Month Fallow plus cover crop	36.4bc	235.0ab	146.4bc	8.4a	7.2a	3.6a	268.0a	288.0a	628.8bc	2.4a	4.8ab	4.8	15.2a	2.0a	2.
Methyl Bromide (400lbs/acre)	0.0c	0.0b	0.0c	0.0b	0.0b	0.0a	0.0b	0.0b	1.2c	0.0a	0.0b	0.0	0.0a	0.0a	0.
Methyl Iodide (400lbs/acre)	0.0c	0.0b	3.0c	0.0b	0.0b	0.0a	0.0b	0.0b	0.0c	0.0a	0.0b	0.0	0.0a	0.0a	0.
Telone II EC (in 60mm water)+Vapam	0.0c	0.0b	0.0c	0.0b	0.0b	0.0a	0.0b	0.0b	0.0c	0.0a	0.0b	0.0	0.0a	0.0a	0.
Telone II EC (in 100mm water)+Vapam	0.0c	0.0b	0.0c	0.0b	0.0b	0.0a	0.0b	0.0b	0.0c	0.0a	0.0b	0.0	0.0a	0.0a	0.

Merlot/Teleki 5C

Treatment	*Meloidogyne sp.*			*Criconemella sp.*			*Tylenchulus sp.*			*Xiphinema sp.*			*Paratylenchus sp.*		
	May 99	**Oct. 99**	**Apr 00**	**May 99**	**Oct. 99**	**Apr 00**	**May 99**	**Oct. 99**	**Apr 00**	**May 99**	**Oct. 99**	**Apr 00**	**May 99**	**Oct. 99**	**Apr 00**
Untreated Control	28.0a	92.8ab	123.6a	1.6b	5.2ab	13.	253.6a	314.0a	589.8b	0.0	24.4a	4.2ab	10.0	2.	0.
18 Month Fallow	17.6ab	97.2ab	91.2ab	4.4ab	2.0b	1.	267.2a	394.0a	1096.8a	4.4	28.8a	4.8a	8.8	2.	0.
18 Month Fallow plus cover crop	1.6b	130.0a	26.4b	8.4a	8.4ab	13.	166.0ab	166.0ab	322.2bc	0.0	2.8b	3.0abc	28.8	4.	0.
Methyl Bromide (400lbs/acre)	0.0c	0.0b	0.0b	0.0b	0.0b	0.	0.0b	0.0b	1.2c	0.0	0.0b	0.0c	0.0	0.	0.
Methyl Iodide (400lbs/acre)	0.0c	0.0b	0.0b	0.0b	0.0b	0.	0.0b	0.0b	0.0c	0.0	0.0b	0.0c	0.0	0.	0.
Telone II EC (in 60mm water)+Vapam	0.0c	0.0b	0.0b	0.0b	0.0b	0.	0.0b	0.0b	0.0c	0.0	0.0b	0.3bc	0.0	0.	0.
Telone II EC (in 100mm water)+Vapam	0.0c	0.0b	0.0b	0.0b	0.0b	0.	0.0b	0.0b	0.6c	0.0	0.0b	0.0c	0.0	0.	0.

Merlot/Harmony

Treatment	*Meloidogyne sp.*			*Criconemella sp.*			*Tylenchulus sp.*			*Xiphinema sp.*			*Paratylenchus sp.*		
	May 99	**Oct. 99**	**Apr 00**	**May 99**	**Oct. 99**	**Apr 00**	**May 99**	**Oct. 99**	**Apr 00**	**May 99**	**Oct. 99**	**Apr 00**	**May 99**	**Oct. 99**	**Apr 00**
Untreated Control	29.2	19.2ab	25.8a	5.6a	4.4a	2	272.4a	705.0a	1392.0ab	1.6ab	31.2a	7.8ab	18.0a	2.0a	0.0a
18 Month Fallow	2.4	64.8a	1.2b	3.6a	1.2a	2	166.8a	682.0a	2210.4a	0.4b	5.6ab	1.2b	8.4ab	0.0a	0.0a
18 Month Fallow plus cover crop	25.6	14.4ab	14.4ab	0.8b	1.6a	1	212.4a	451.0ab	854.4bc	2.8a	8.4ab	10.2a	5.2b	0.0a	0.6a
Methyl Bromide (400lbs/acre)	0.0	0.0b	0.0b	0.0b	0.0b	0	0.0b	0.0b	0.0c	0.0b	0.0b	0.0b	0.0b	0.0a	0.0a
Methyl Iodide (400lbs/acre)	0.0	0.0b	0.0b	0.0b	0.0b	0	0.0b	0.0b	0.0c	0.0b	0.0b	0.0b	0.0b	0.0a	0.0a
Telone II EC (in 60mm water)+Vapam	0.0	0.0b	0.0b	0.0b	0.0b	0	0.0b	0.0b	1.2c	0.0b	0.0b	0.0b	0.0b	0.0a	0.0a
Telone II EC (in 100mm water)+Vapam	0.0	0.0b	0.3b	0.0b	0.0b	0	0.0b	0.0b	0.6c	0.0b	0.0b	0.0b	0.0b	0.0a	0.0a