Oregon Wine Advisory Board
Research Progress Report

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Pathogenicity and Management of Plant-Parasitic Nematodes on Vitis vinifera in Oregon Vineyards

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Background and Problem

Survey data compiled in 1995 showed that plant-pathogenic nematodes that cause yield loss in California and European vineyards are found in over 85% of Oregon vineyards. In over 37% of the samples collected, population densities of *Xiphinema wnericanwn* (dagger nematode) and *Criconenw1la xenoplax* (ring nematode) were greater than levels known to cause damage to grapes in California. However, high nematode densities were found in both areas of vigorous and stunted vines. Since nematode injury to mature perennial crops may becon-c evident only after a nurnber of years of parasitism, the potential losses from nematodes are unknown for the young winegrape industry in Oregon. Knowledge of the host-parasite relationship will be invaluable for assessing damage to grapevines and the long term impact of nematodes in Oregon vineyards. The relationship between nematode population densities and plant health also must be elucidated as a basis for interpreting nematode soil test results and advising growers.

Currently, the sole nernaticide registered in Oregon for the control of plant-parasitic nematodes on grape is Nemacur. This and other nonfurnigant nernaticides did not consistently reduce nematode population densities nor significantly improve plant health in field trials conducted in Oregon during 1994 and 1995. More efficacious nernaticides and/or better application techniques are needed to mitigate the damage caused by nematodes in established vineyards. In addition, the use of soil amendments, ground covers that are antagonistic to nematodes, and biocontrol agents may have promise for the control of plant-par-dsitic nematodes. Ilese techniques also will be compatible with an integrated production system. Since young plants are generally more susceptible to nematode damage, we expect to see damage to vines planted on nematode-infested sites. As the industry moves to resistant rootstocks and new varieties, it will be necessary to develop methods to rid the soil of plant pests and pathogens. Promising techniques such as soil solarization and crop rotation need to be evaluated along with finding new ways to utilize soil fumigants in vineyard soils.

Objectives

Determine the impact of *Criconemella xenoplax* on winegrape production in Oregon and develop methods to manage damage caused by plant-parasitic nematDdes.

Procedures

Greenhouse and microplot experiments. 'Mese studies will document the effects of nematode feeding on the physiology and morphology of vines in the greenhouse and microplots. In 1996, a population of *C. xenoplax* from a vineyard with vines of very low vigor was established in pure cultures on cherry and peach. After 9 months, the nematode population densities in the cultures have increased to high levels. This population will be used in pathogenicity studies that will begin in 1997.

Vineyard studies
Field plots were established at the OSU Woodhall vineyard in an area in which vines of low vigor correlated (R^2=0.44) with the population densities of *C. xenoplax.* The area was sampled for plant-parasitic nematodes, and pruning weights were collected from individual vines in March 1996 to establish baseline data at the start of the study. We installed a dip irrigation system that allowed us to compare the efficacy of broadcast and drip application of nernaticides in a randomized block design. In the spring and fall of 1996, Nemacur and two biological nernaticides; (DiTera, Abbott Labs., and Deny, CCT` Corp.) were applied in replicated, five-vine plots. To evaluate the effect of ground covers on nematodes, additional plots were maintained in native grass-weeds, or planted with either 'Good Bug Mix' or nimblewill, a perennial grass reported to be antagonistic to *C. xenoplax.* In October, the grapes were harvested and yield data was collected. The population densities of plant-parasitic nematodes also were quantified at this time. In 1997, a similar study will be established in a second Oregon vineyard.

Vineyard replant studies
These studies were established in a southern Oregon vineyard which had soil infested with *C. xenoplax* and *Agrobactefiwn vids.* In one study, replicated plots of five vines were fumigated with metarn sodimn, left fallow, solarized, or maintained as a nontreated control. Self-rooted Pinot Gris vines were planted in the fumigated and control plots in June 1995. Nematode population data were collected before the treatments were made and at harvest in 1995. During the winter of 1996, pruning weights were recorded for vines that were planted the previous June 1995. Vines were planted in the solarized and fallow plots in spring 1996 and will be evaluated in 1997. Nematode and growth plant data will be collected for three or more years to study the pattern of nematode reinfestaion and the response of the vines to nematode parasitism.

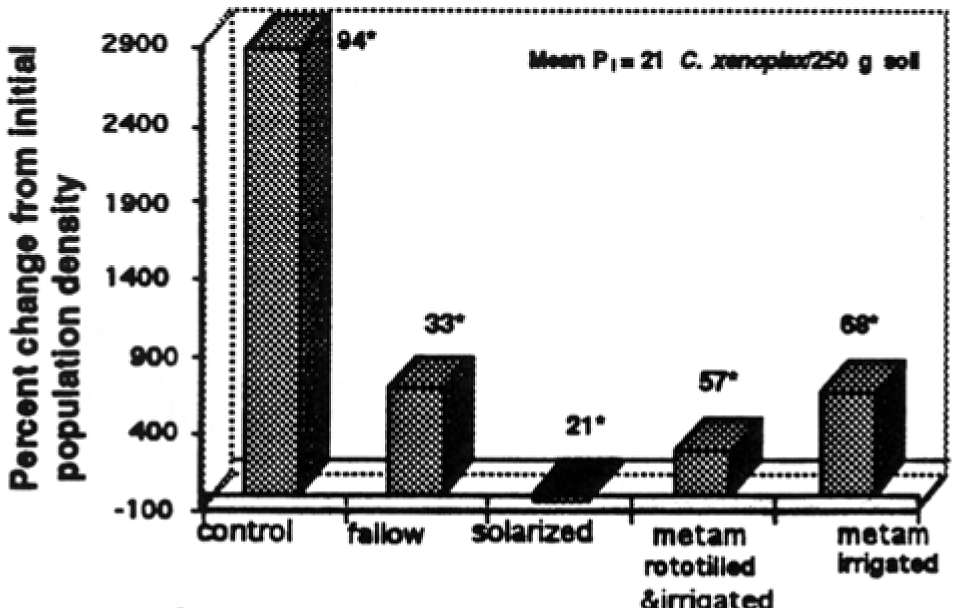
In a second study, one-year-old vines that were growing in *C. xenoplax* infested soil were solarized from July through September, 1996. A clear, 0.6 mil plastic film was laid on either side of the plant row, extending out 2 meters from the row. The film then was gathered and glued at the plant row, leaving only the vine protruding through the plastic. Finally, the edge of the plastic was buried to seal the surface of the plot. The experimental design was a randomized block with six replicated plots of five vines. Control plots were maintained weedfi-ee with application of herbicide and hand cultivation. Nematode data were collected before solarization and in October when the plastic was removed. To deterrnine the plant's response, pruning weights will be collected for vines in February 1997.

Results and discussion
Vineyard study. The portable drip irrigation system worked flawlessly and allowed us to treat plants with a precise quantity of nernaticide into the root zone. The broadcast applications of Nemacur wwew applied just before a heavy rainfall such that the nernaticide also should have been incorporated into the root zone. However, we did experience some difficulties establishing the ground covers. The dry weather encountered after seeding and minimal germination of the nimblewill. seed resulted in poor stands through the surnmer. Because of this, we will reseed the plots in spring 1997.

After one growing season, there was no significant effect of the treatments in *the* Woodhall vineyard. Population densities of plant-parasitic nematodes were low at the October, 1996 sampling, but the change in densities was independent of treatments. Similarly, there were no differences in cluster weight, yield per vine, clusters per vine, sugar per vine or brix between treatments. These results are not unexpected after a single application of nernaticide. With the biological nernaticides, the manufacture's label recommended multiple applications during the growing season. In 1997, we will apply these materials thrw times in the spring and twice in the fall. Similarly, Nemacur may require multiple applications over several years to obtain a growth response.

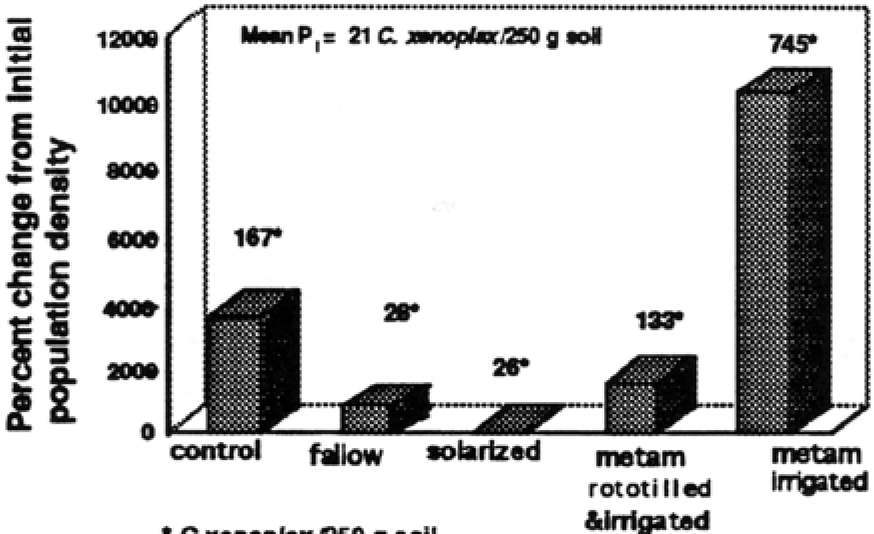
Replant studies. In the first study, the pruning weights of the vines in the fumigated plots were slightly greater but not significantly different form the control vines (fig. 1). The population densities of plant-parasitic nematodes were highly variable in the field before the treatments were applied. In September, 1995 (fig. 2) and November, 1996 (fig. 3), population densities of *C. xenoplax* were the lowest in the solarized plots, although differences between treatments were not significant In the second study, vines in the solarized plots appeared to have at least twice the cane growth of nonsolarized vines. Pruning weight data will be collected this winter. Population densities of *C. xenoplax* were significantly reduced in solarized soil (197/250 g soil) compared to control soil (1753/g soil) (fig 4). Plant health in both replant studies will be monitored for an additional 3 years.

Fig. 1. Southern Oregon vineyard replant study: Change in population densities of *C. xenoplax* from May to September, 1995.



* *C xenoplax* /250 g soil
Treatments were not significantly different

Fig. 2. Southern Oregon vineyard replant study: Change in population densities of *C. xenoplax* from May, 1995 to November, 1996.



* *C xenoplax* /250 g soil

Treatments were not significantly different

Fig. 3. Southern Oregon vineyard replant study: Pruning weights winter 1996.

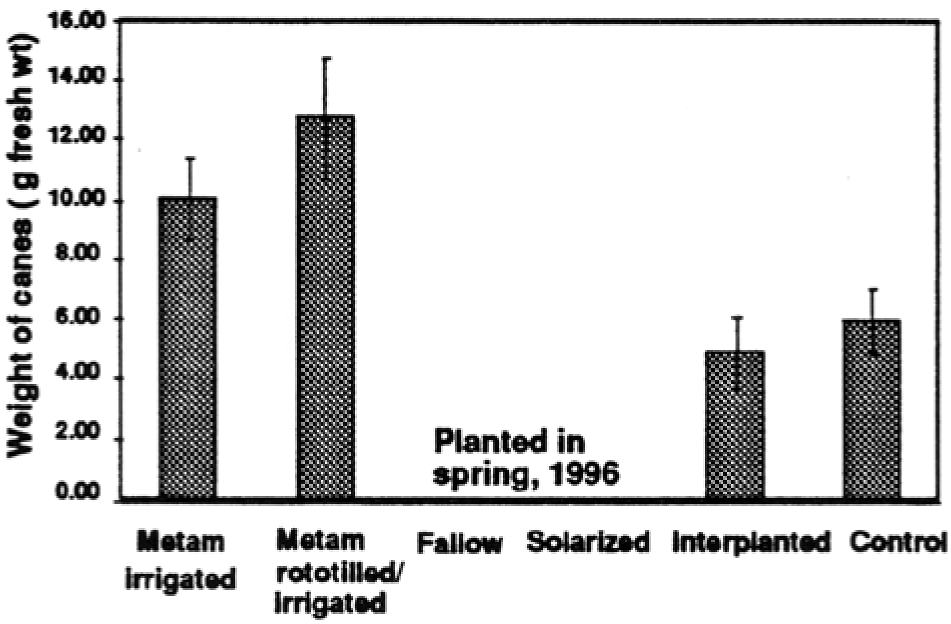
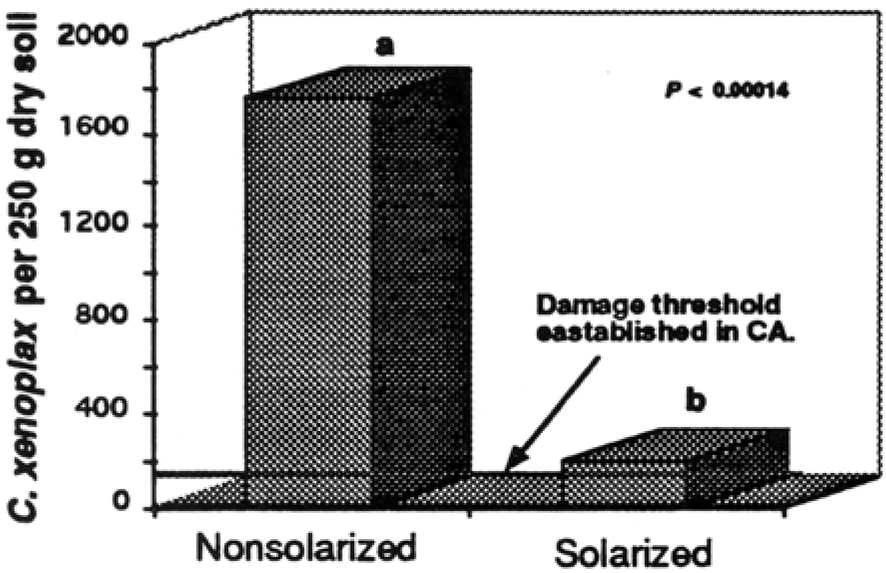


Fig. 4. 1996 Southern Oregon replant study: Solarization of one-year-old vines.



Conclusions. This past year we initiated several long term studies. Over the next four to five years these plots should provide data on the impact of *C. xenoplax* on vine vigor and yield. We expect that the studies at the Woodhall vineyard will iden* nematode management options that can be used in established vineyards. In replant situations, our data suggest that *C. xenoplax* can reduce the growth and vigor of young vines. When soils are infected with *C. xenoplax*, sanitation of the soil by furnigation or solarization may be justified before planting new vines.