# Oregon Wine Advisory Board
# Research Progress Report

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## Distribution and Population Dynamics of Plant-Parasitic Nematodes in Oregon Vineyards, and Their Effects on Vine Growth

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### OBJECTIVES

1. Survey Oregon vineyards for the presence, identity and abundance of plant parasitic nematodes.

2. Document seasonal changes in abundance of species of important plant parasites in order to identify optimum times for sampling.

3. Evaluate the efficacy of Nemacur for reducing populations of plant parasitic nematodes.

### INTRODUCTION

Several types of plant parasitic nematodes (dagger, ring, root-knot and lesion nematodes) are potentially important pathogens of grapes. Large numbers of these nematodes, particularly ring *(Criconemella)* and dagger *(Xiphinema)* nematodes, have been found in soil samples sent to the OSU Plant Disease Clinic from some Oregon vineyards over the last three years. As part of a survey for Phylloxera carried out by John Griesbach of the Oregon Department of Agriculture in 1990, soil from areas with weak vine growth were sampled for nematodes. Again, large populations of plant parasitic nematodes were found in most of the samples.

The population densities of nematodes found in these original samples from Oregon vineyards may be large enough to cause significant yield loss. Populations of ring, dagger and lesion (Prarylenchus) nematodes greater than 1000, 200 and 200 nematodes/quart of soil, respectively, are expected to cause significant (25%) yield loss in California (McKenry 1981). Of the 48 samples sent to the Plant Disease Clinic from 1990 to 1993, 5 had overthreshold populations of ring nematodes, 17 had over-threshold populations of dagger nematodes and 9 had over-threshold populations of lesion nematodes (Table 1). Of the 57 samples analyzed as part of the Phylloxera survey, 21 had over-threshold populations of ring nematodes, 23 had over-threshold populations of dagger nematodes and one had overthreshold populations of root-knot nematodes (Meloidogyne) (Table 2).

The action thresholds established for California are useful only as very general benchmarks for evaluating the population densities in Oregon. It is important to note that there are a number of reasons to believe that thresholds established for California may not be relevant for Oregon. The cooler and moister environmental conditions of Oregon may allow vines to withstand greater populations of nematodes. Oregon vineyards are also generally established on heavier soils than in California; nematode damage is usually worse on sandy soils. Species or strains of nematodes present in Oregon could also be less pathogenic than those in California. For example, the dagger nematode group is composed of several different species in the genus Xiphinema. The most common species, Xiphinema americanum, is composed of a number of subspecies that may vary in their pathogenicity.

Because action thresholds established in California may not be relevant to the environmental conditions and nematodes found in Oregon, it is important to conduct experiments to determine if high populations are indeed causing yield losses in Oregon. One of our objectives is to use a nematicide, Nemacur, to do such experiments. Compared to fumigation, Nemacur is relatively specific in its effects on nematodes. As a result, it is useful for experimentally reducing populations of nematodes and determining if vine growth improves in response to the reduced nematode populations.

The previous ODA survey and samples sent to the Plant Disease Clinic give us some idea of the nature of possible nematode problems in Oregon. However, they only give us a biased view of the distribution and abundance of important plant parasites because they are limited to vineyards already showing signs of some sort of damage. It is for this reason that one of our objectives is to carry out more detailed surveys of nematodes inhabiting Oregon vineyards. Another objective is to monitor seasonal changes in populations of nematodes. Nematode populations fluctuate greatly within a year. As a consequence, accurately assessing population densities depends on knowledge of when the populations are at peak densities.

## SIGNIFICANT ACCOMPLISHMENTS

Three blocks of vines were sampled extensively, each at four different times in 1993. Two of these vineyards had population densities of the ring nematode that were larger than the threshold populations established for California (Table 3). One of the vineyards also had populations of root-knot nematodes and lesion nematodes that exceeded the damage thresholds established for California.

Seven blocks of vines were sampled extensively in early 1994. Of these, five blocks had over-threshold populations of ring nematodes (Table 4). Five of the seven blocks also had over-threshold populations of the dagger nematode. The root-knot nematode was found in relatively low numbers in two of the blocks sampled.

The great frequency and abundance of ring nematodes in Oregon vineyards is unique. The ring nematodes are not the most common nematode pest of grapes in other grape-growing areas. There is little information on the damage ring nematodes cause to grapes and the action thresholds for ring nematodes are probably not based on as much data as the thresholds established for other nematodes. As a result, their accuracy may be questionable. These findings underscore the necessity of carrying out research that is specific to Oregon conditions.

Experimental plots have been established to examine the effects of Nemacur on populations of ring and dagger nematodes, and to determine if increased vine growth is correlated with the reduced nematode populations. These plots, established at two different locations, consist of five replicate nemacur-treated plots and nontreated plots. At one of the locations Furadan treated plots and plots treated with a combination of Nemacur and Furadan were also included in the experimental design. Furadan is an insecticide that may also affect nematodes. Because Furadan is often used for controlling root-weevils and other soil insects in vineyards, it is important to know how it affects nematodes. Populations of plant parasitic nematodes will be assessed in these plots at monthly intervals for the next two years. Unfortunately, no data are available yet.

Many of the nematodes in soil are not plant parasites and they play important roles in decomposition of organic matter and recycling of nutrients. We intend to assess the effects of Nemacur and Furadan on non-parasitic nematodes in order to gain insight into potential side effects of these pesticides on nutrient cycling processes.

Strategies for managing nematode population in vineyards are currently limited to chemical nernaticides. Recently, we have been carrying out research on the effects of certain cover crops on plant parasitic nematodes. Several crops have been identified that appear to suppress populations of the lesion nematode, Prarylenchus penetrans. We are currently carrying out greenhouse studies to determine the effects of these crops on dagger and ring nematodes. We intend to test the effectiveness of some of these crops, as between-row ground cover, for reducing populations of ring and dagger nematodes in vineyards. The following appendix describes some of the research on nernaticidal cover crops. The research was not supported by funds from the Wine Advisory Board or the Center for Applied Agricultural Research.

## LITERATURE CITED

McKenry, M. 1981. Nematodes in Grape Pest Management, Flaherty et al. (eds.), University of California Press.

Table 1. Summary of nematode populations in 48 soil samples sent to the OSU Plant Disease Clinic from Oregon vineyards in 1991-1993.

| Nematode | No. samples positive | range (number/quart) | No. samples > threshold[1] |
|---|---|---|---|
| *Criconemella* | 16 | 0 - 4,000 | 5 |
| *Xiphinema* | 27 | 0 - 1,730 | 17 |
| *Pratylenchus* | 24 | 0 - 13,200 | 9 |

[1]Thresholds are populations (per quart of soil) above which nematodes are expected to cause heavy damage to vines under California conditions (*Criconemella* = 1000; *Xiphinema* = 200; *Pratylenchus* = 200).

Table 2. Summary of nematode populations in 57 soil samples from 15 northwest Oregon vineyards in 1990. Data courtesy of John Griesbach, Oregon Department of Agriculture.

| Nematode | No. samples positive | range (number/quart) | No. samples < threshold[1] |
|---|---|---|---|
| *Criconemella* | 40 | 0 - 33,058 | 21 |
| *Xiphinema* | 47 | 0 - 5,520 | 23 |
| *Pratylenchus* | 2 | 0 - 48 | 0 |
| *Meloidogyne* | 2 | 0 - 560 | 1 |

[1]Thresholds are populations (per quart of soil) above which nematodes are expected to cause heavy damage to vines under California conditions (*Criconemella* = 1000; *Xiphinema* = 200; *Pratylenchus* = 200; *Meloidogyne* = 400).

Table 3. Summary of nematode populations (averaged over four sample dates) in three northwest Oregon vineyards in 1993.

| Nematode | Vineyard I | Vineyard II | Vineyard III |
|---|---|---|---|
| *Criconemella* | 585 | 2,895[1] | 4,440[1] |
| *Xiphinema* | 16 | 4 | 7 |
| *Pratylenchus* | 50 | 330[1] | 29 |
| *Meloidogyne* | 98 | 13,600[1] | 1 |

[1]Populations that exceed action thresholds established for California (see previous tables).

Table 4. Summary of nematode populations (averaged over four sample dates) in three northwest Oregon vineyards in 1993.

| **Area/Block** (n=number of vines sampled) | *Criconemella* Average number of nematodes/quart | *Xiphinema* Average number of nematodes/quart |
|---|---|---|
| **Dundee area** | | |
| Block 1 (n=12) | 18,120[1] | 960[1] |
| Block 2 (n=12) | 14,440[1] | 520[1] |
| Block 3 (n=6) | 2,176[1] | 720[1] |
| **Medford area** | | |
| Block 1 (n=12) | 9,060[1] | 30 |
| Block 2 (n=6) | 2,340[1] | 2,866[1] |
| Block 3 (n=12) | 920 | 113 |
| Block 4 (n=18) | 360 | 340[1] |

[1]Populations that exceed levels expected to cause heavy damage under California conditions.