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. Relate the distribution and abundance of potentially pathogenic species to viticultural practices and site characteristics.

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

4. Document seasonal changes in the abundance of potentially pathogenic species of plant-parasitic nematodes in order to identify optimum times for sampling.

Introduction

Several types of plant-parasitic nematodes (dagger, ring, root-knot and root-lesion nematodes) are potentially important pathogens of grapevines. 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. Large numbers of several potentially pathogenic nematodes, particularly ring (genus *Criconemella)* and dagger (genus *Xiphinema)* nematodes, were found in most of the samples. Relatively large populations of *Criconemella* and *Mphinema* were also found in many soil samples sent to the OSU Plant Disease Clinic from some Oregon vineyards in the early 1990's.

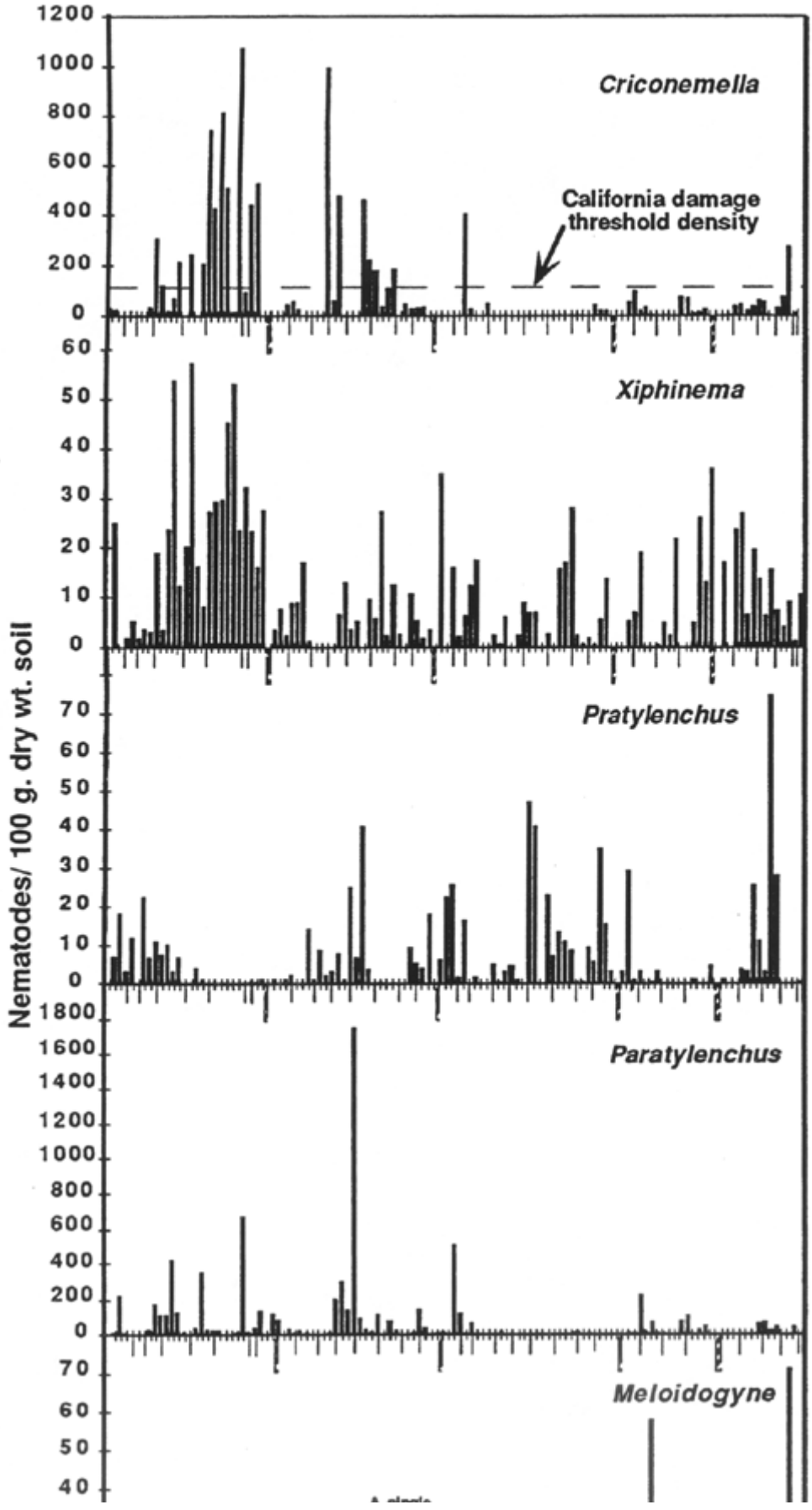
The ODA survey and samples sent to the Plant Disease Clinic suggested that *Criconemella* and *Mphinema* may be adversely affecting the health of grapevines in Oregon. However, those samples may present a biased view of the distribution and abundance of potentially pathogenic nematodes because they were limited primarily to vineyards already showing signs of some sort of damage. More detailed surveys are needed to obtain a more comprehensive view of the distribution of plant parasitic nematodes in Oregon vineyards, and to understand how nematode distribution is associated with site characteristics and viticultural practices. It is for this reason that our first two objectives are to carTy out a comprehensive survey of nematodes inhabiting Oregon vineyards and to relate nematode distribution and abundance to site characteristics and viticultural practices.

Our initial assessments of the potential for nematode damage are based on nematode population-damage thresholds established in California (McKenry 198 1). However, the California Damage Threshold Densities (CDfD) may not be relevant to the varieties, soils, climate and the nematode species or populations that occur in Oregon. Data on damage thresholds for the most common Oregon nematode species and grapevine varieties grown under Oregon conditions are badly needed. Interpretation of nematode damage thresholds also depends on accurate assessment of nematode population densities. Nematode populations fluctuate greatly within a year and accurately assessing nematode population densities depends, in turn, on knowledge of the dynamics of the populations. Our third objective is to use a nernaticide, Nemacur, to experimentally reduce populations of *Criconemella* and *Xiphinema* and determine if reduced nematode populations are correlated with improved vine growth. Our fourth objective is to monitor the seasonal population dynamics of these nematodes under Nemacur-treated and untreated vines to determine optimum times to recommend sampling.

Results and Discussion

Survey:
To assess nematode distribution and abundance throughout western Oregon, vineyards in 5 areas were sampled; Washington and Yarnhill counties (northern Willamette Valley), Polk and Marion counties (mid-Willamette Valley), Benton and Lane counties (southern Willamette Valley), Douglas County, and Jackson and Josephine counties (southern Oregon). A total of 34 vineyards were surveyed, with four to nine vineyards surveyed in each region. An effort also was made to select vineyards that represented the diversity of sites and management approaches found in each region. The survey was conducted in May and June of 1994. In each vineyard, two to six separate blocks of one to four acres, representing the cultivars and site characteristics of the vineyard, were sampled. In addition to nematode data, we also recorded data on previous crops, soil type, management practices, and the occurrence of other plant diseases for each block. The survey data were entered into a database to facilitate analysis of the relationships between nematode abundance and regional and site characteristics.

Five nematode genera known to cause economic damage in California vineyards were recovered. *Criconemella, Xiphinema, Prarylenchus* and *Pararylenchus* were recovered in over 85% of the vineyards, while 15% of vineyards had populations of *Meloidgyne* (Fig. 1). The distribution and abundance of each genus differed by region. *Criconemella* populations were greatest in the northern and mid-Willamette Valley. In 11 vineyards (33%), population densities exceeded the California damage threshold density (CDTD) of 50 nematodes/100 g soil (Fig. 2). The population densities of *Xiphinema* were similar in all regions and usually below the CDTD (Fig. 2). However, the samples were taken at a time when *Xiphinema* are known to be at low densities under blueberry and raspberry. Similarly, *Pratylenchus* and *Paratylenchus* were cosmopolitan and generally below the CDTD. The genus most damaging to grapes worldwide, *Meloidogyne,* was restricted to four vineyards in southern Oregon and Douglas County and one in the southern Willamette valley. In only two samples from a single vineyard did *Meloidogyne* populations exceed the CDTD.


Criconemella
California damage threshold density
Xiphinema
Pratylenchus
Paratylenchus
Meloidogyne
Nematodes/ 100 g. dry wt. soil

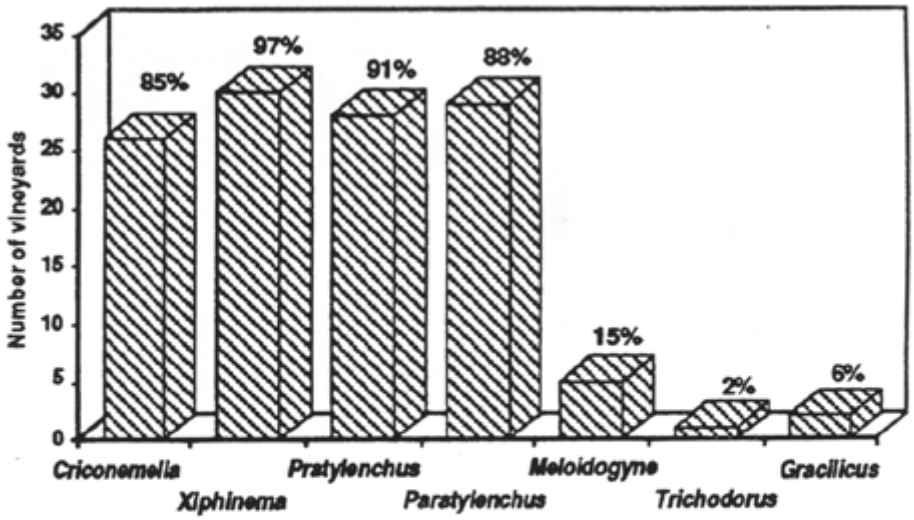


Fig. 1. Number and percent of Oregon vineyards sampled in which each genera of plant parasitic nematode was recovered. These genera have reported in Californian vineyards.

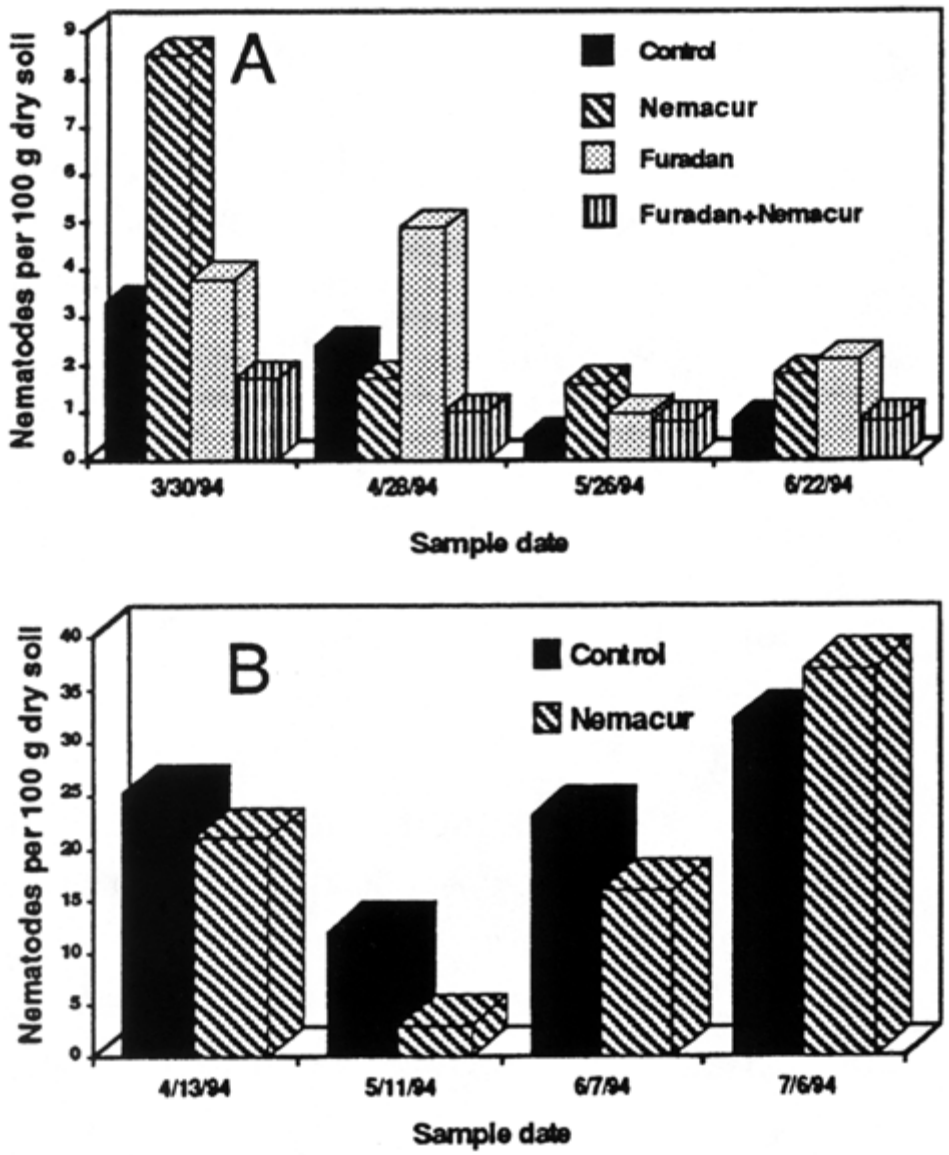


Fig. 3. *Criconemella* extracted by Baermann funnel from soil samples collected in nematicide plots.
A) Results from a vineyard in southern Oregon.
B) Results from a vineyard in the northern Willamette Valley.

Population dynamics in Nemacur-treated and untreated plots:

Experimental plots were established at two different locations, one in the northern Willamette Valley and one in southern Oregon. At each experimental site there are six replicate plots that were treated with Nemacur on March 30 (southern Oregon) or April 13 (northern Willamette Valley) of 1994, six plots treated in December of 1994, six plots to be treated in the spring of 1995, and twelve untreated plots.

Each plot consists of ten vines in a row. At one location spring Furadan-treated plots and plots treated with a spring-applied combination of Nemacur and Furadan were also included in the experimental design. Furadan is an insecticide/nematicide that is occasionally used for managing some nematode species in other crops, but there are currently no data available on the efficacy of Furadan against *Criconemella* in vineyards. Populations of plant-parasitic nematodes were assessed in these plots at monthly intervals, beginning at the time of the spring 1994 Nemacur applications. Measurements of vine vigor and yield will begin in the spring of 1995.

Data are currently available for nematode populations at the time of the spring Nemacur application and at the three subsequent monthly sample dates (Fig. 3). At both sites there were no significant differences between treated and untreated plots in *Criconemella* population densities at any post-application sample date. Although *Xiphinema* populations were present at both sites the populations were too small to give statistically reliable data. 'Based on previous research on the population dynamics of *Xiphinema* under blueberry and raspberry, the *Xiphinema* populations are expected to increase at later sample dates. It is currently too early to make any conclusions about the seasonal dynamics of populations of *Criconemella* or *Xiphinema* under grapevines.

Summary:

The survey data demonstrates that several genera of plant-parasitic nematodes that have the potential to damage grapevines occur throughout Oregon's vineyards. However, the survey was only a snapshot of nematode populations at a single point in time. To fully ascertain the impact of these nematodes in vineyards, their pathogenicity to Oregon varieties under Oregon conditions, and the dynamics of their populations over seasonal and year-to-year time scales, must also be understood. Research to demonstrate pathogenicity and document population dynamics of *Criconemella* and *Xiphinema* is ongoing.

McKenry, M. 1981. Nematodes. *in* Grape Pest Management, Flaherty et al. (eds.),

University of California Press.