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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. Relatively large populations of ring *(Criconemella)* and dagger *(Xiphinema)* nematodes have been recovered annually from many Oregon vineyard soil samples sent to the OSU Plant Disease Clinic or as part of a ODA survey in 1990. However, those samples may represent 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. Therefore, our first two objectives have been to conduct 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 have been based on nematode population-damage thresholds established in California (McKenry 19811). However, the California Damage Threshold Densities (CDTD) may not be relevant to the varieties, soils, climate and nematode species 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 knowledge of the dynamics of the populations is important to recommend sample times and interpret the densities recovered. Our third objective was 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 was to monitor the seasonal population dynamics of these nematodes under Nemacur-treated and untreated vines to determine optimum times to recommend sampling.

PROCEDURES

Survey:

In 1994 and 1995, a survey was conducted to ascertain the association of nematodes to vine health in Oregon vineyards. Seventy vineyards were surveyed in 5 regions of western Oregon; the northern Willamette Valley (Washington and Yarnhill counties), the mid-valley (Polk and Marion counties), the southern valley (Benton and Lane counties), Douglas County, and southern Oregon (Jackson and Josephine counties). Each year 4-9 vineyards were selected per region. Vineyards were partitioned into 2-6 two acre blocks by cultivar, age of the planting, crop history, and soil characteristics. The survey data have been entered in a database to facilitate analysis of the relationships between nematode abundance and regional and site characteristics.

Nemacur and Population Dynamics Studies

Experimental plots were established at two different locations, one in the northern Willamette Valley and one in southern Oregon. At each experimental site there were six replicate plots that were treated with Nemacur in spring of 1994 (March 30 in southern Oregon; April 13 in northern Willamette Valley), six plots treated in fall of 1994 (December 6 in southern Oregon; December 8 in northern Willamette Valley), six plots treated in the spring of 1995 (May 5 in southern Oregon, April 12 in Northern Willamette Valley), and twelve untreated plots. Each plot consisted of ten vines in a row. Populations of plant-parasitic nematodes were assessed in these plots at monthly intervals, beginning at the time of the spring 1994 Nemacur applications.

RESULTS AND DISCUSSION

Survey

Four plant-parasitic nematode species known to damage grapevines and reduce yield, were found. *Criconemella xenoplax* (the ring nematode) and *Xiphinema americanum* (the dagger nematode), were recovered from over 80% of the vineyards and in 37 and 41% of the vineyard, respectively, had densities that exceeded the 10-25% damage threshold densities established in California. Ring nematode was associated with areas of low vine vigor in a number of vineyards. The northern root-knot nematode *(Meloidogyne hapla)* was found in 10% of the vineyards and was above the California damage threshold in 9% of the vineyards. In one vineyard, high population densities of northern root-knot were found in a block which historically had low yields. The spiral nematode *(Helicotylenchus pseudorobustus)* was found at potentially damaging population densities in two vineyards in Jackson County. Other plant-parasitic nematodes found during the survey were *Pratylenchus, Paratylenchus, Paratrichodorus, Gracilacus,* and *Hemicyclophora.* These were at low population densities or were species not known to damage grapevines.

The distribution and abundance of each genus differed by region. Ring nematode populations were greatest in the northern and mid-valley, in vineyards greater than 10-yr-old, and at sites previously planted in Prunus orchards. In contrast, the distribution of dagger nematode was cosmopolitan and not related to vineyard age or previous cropping. Northern root-knot was only found in four vineyards in southern Oregon and Douglas County, and three vineyards in the Willamette Valley. No relationship between the abundance of these three nematode species and cultivar, soil type, or ground cover was

evident.

Nemacur and Population Dynamics Studies

Ring Nematodes

Ring nematodes appeared to have two population cycles through the year but the timing was slightly different at the two locations. Timing of peak and low densities in southern Oregon were later than those in northern Oregon during 1994 but the two sites appeared more synchronous in 1995. In northern Oregon, densities declined from April until June and then increased to reach a peak in August. Populations then declined rapidly to a low in September before increasing steadily to a higher peak in January Densities declined to a low in May and then increased to a peak in August before declining once again. At the southern Oregon site, populations reached a low in June, a peak in September, a second low in January, a smaller peak in March, a low during April-May and a larger peak in June.

Dagger Nematodes

Dagger nematodes were only recovered in sufficient numbers for analysis at the northern Willamette Valley site. Nematode density declined in abundance between April and June, 1994 remaining at low densities until October. Populations increased slowly until some time after January in one site and February in another site and then increased rapidly to reach peak densities in March at both sites. Numbers declined again until June, 1995 and then remained at a constant level until October, as in 1994, but at a higher density.

Effects of Nemacur on Ring and Dagger Nematodes

Nemacur applied in spring of 1994 appeared to have no effect on the population densities of ring nematodes at either location. Applications in fall 1994 and spring 1995 reduced the peak densities attained by ring nematodes in northern Oregon but had no effect at the southern Oregon location.

None of the application dates reduced populations of dagger nematodes.

CONCLUSIONS

Survey

We can conclude from this survey data that nematodes known to be parasitic on winegrapes, *Vitis vinifera,* were found in all Oregon vineyards sampled. Of the species found, ring and dagger nematodes appear to have the greatest potential to affect winegrape production in Oregon. Presently, we do not know what factors cause that potential to be expressed. The vineyards surveyed were representative of the Oregon industry, with most grapevines less than 20-yr-old. Therefore, the long term impact of plant parasitic nematodes on vineyard production and longevity is unknown.

Nemacur and Population Dynamics Studies

Population dynamics studies suggest that samples for ring nematodes are best taken in early summer (June-July) or in mid-winter (December-March). Optimum time for sampling dagger nematodes appears to be in February-March.

Nemacur applied as a surface spray and watered in does not appear to be effective at consistently

reducing populations of ring or dagger nematodes. Application through drip irrigation may be more effective but other control measures should also be investigated.

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