Characterization of Nematode Species on the High Plains and in West Texas and Development of Appropriate Cultural Practices to Reduce Impact on Wine Grape Production

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Abstract
Meloidogyne incognita, (Southern Root-Knot Nematode) is widely distributed in coarse textured or sandy soils on the High Plains and in West Texas. When grapes are grown on soil where Upland cotton, (*Gossypium hirsutum*) has previously been grown, the risk of nematode infestation is increased. *Meloidogyne incognita* is one of several *Meloidogyne* species (*M. arenaria, M. hapla, M. javanica*) (T. Faske 2009 personal communication) and other nematodes that attack grapevines (*Vitis vinifera*) resulting in decreased water and nutrient uptake which in turn reduces yield, and can lead to vine decline and eventually death. This abstract is meant to describe research that is currently in progress as well as a plan for future research.

Introduction
Meloidogyne incognita as well as other *Meloidogyne spp.* have been broadly surveyed on the High Plains and in parts of West Texas where their presence can have serious adverse affects on cotton, peanut and potato production. The effect of nematodes on *Vitis vinifera* has been scrutinized for more than 75 years, but nematode species and strains that may affect grapes have not been adequately characterized on the High Plains or in West Texas.
Nematodes, especially, *Meloidogyne incognita* seriously affect yields and the overall health of the vine. In addition to the direct effects of infestation, some nematodes can be responsible for vectoring fan leaf viruses and yellow vein virus in grapes (Flaherty et al., 1992).
Now that non-fumigant nematicides have been taken off of the market, grape growers will, in the future, need to rely on resistant rootstocks and best cultural practices. Unfortunately, "there are few resistant rootstocks, and their resistance is often directed at a single species or strain of a given nematode species." (Walker 2002). In order to make informed decisions in choosing rootstocks and siting future plantings, growers need the following information;

1. What nematode species/strains most frequently affect grapevines in their area?
2. Do the current Root-Knot nematode resistant rootstocks provide protection against the species/strains that are most often found on the High Plains and in West Texas?
3. Will the nematode-resistant rootstocks, developed at UC Davis, have any efficacy against these strains?

Materials and Methods

1. Collections can be made in both the early summer after some moisture has been introduced into the soil and in the fall, post-harvest, as both of these times the vines are experiencing a growth flush and are producing tiny white roots. Early summer samples merely give an indication of presence or not, but require the collection of many more samples than in the fall to avoid getting a false negative. Fall collections, post-harvest, give the highest number as nematodes as they have had time to complete several life cycles. Other species are more likely to be present in significant number at this time as well.
5. Samples should be taken where there are fresh, tiny white roots. Samples should be dug near the tap root and 12-16" deep. However, 6" may be deep enough in some soils.
6. Different species of nematodes occur at different soil depths, so sample depth should be consistent.

7. One sample is 10-12 cores taken from individual vines then mixed together. One quart of soil is then removed and placed in a plastic zip-type bag, sealed and put in a cooler.
8. Care must be taken when transporting nematodes from the field to the laboratory that the samples do not freeze or become too hot.
9. Samples are placed in bags previously labeled with a code for the vineyard name and/or location, the date, and a code for where in the vineyard the samples were taken. These codes refer back to a master file that contains the full vineyard name and location, NRCS soil survey aerial photo and description of the soil types, what was previously farmed at this location, any unique situations, and a diagram of the vineyard showing where the samples were taken and the code.
10. Samples are stored in a refrigerator in the lab until they are counted, within two weeks of collection. One quart of soil is required for a proper count of juveniles and eggs.
11. Above 1,000 juveniles or eggs is considered damaging.

Scanning electron micrograph of a second-stage root-knot nematode juvenile (J2) propped up against a human hair (Jon Eisenback)

Results and Discussion

Current studies show the highest percentage of infestations of Root-Knot nematodes in vineyards occur where row crops have been previously planted (Figures 1 and 2).

Future work will continue to examine prevalence in the vineyards in the study areas as well as to further characterize the species and subspecies that most frequently affect grape vines on the High Plains and in West Texas. Research planned by Travis Faske, Pathologist at Tarleton State University in Stephenville, plans to address the efficacy of both existing and newly released rootstocks as they become available.

Applications of Research

1. With the characterization of the species and subspecies of nematodes that affect West Texas and High Plains vineyards, and the subsequent determination of the effectiveness of available rootstocks to resist these pests, decisions regarding rootstock choice can be based on stronger evidence of effectiveness.
2. Availability of this information will allow for cost-benefit optimization for dealing with nematodes in affected vineyards taking into account the ability to combine nematode control with other pest management strategies, potentially reducing overall management costs.
3. Determination if previously unaffected vineyards can remain that way through sanitation and careful cultural practices.

References
Flaherty, D., et al., (1992). Grape Pest Management, University of California, Division of Agriculture and Natural Resources. 281-283.
Walker, A (2002). Developing Rootstocks to Combat Nematodes in California Vineyards. FMPS Grape Program Newsletter. October 2002. 15-16.

Figure 1. West Texas Root Knot Nematode Survey – Fall 2007

Vineyard	Eggs/500cc soil	Juveniles/500cc soil
Cathedral Mountain Vineyard	Too rocky, no sample	
Dolores Mountain Vineyard Landscaping and native vegetation	27,600	1,200
Luz de Estrella Native vegetation	0	0
Mont Sec - New Block	0	0
Mont Sec - NW Block	6,240	600
Mont Sec – NE Block	10,080	0
Mont Sec – SW Block	840	0
Mont Sec – SE Block Row crops	3,120	600
Zin Valle – South Block	8,400	200
Zin Valle – North Block Clean, sandy soil trucked in to replace native soil	0	0

Figure 2. Southern High Plains Root Knot Nematode Survey - Fall 2008

Vineyard	Eggs/500cc soil	Juveniles/500cc soil
Hughlett-Bogar – A	1,560	2,400
Hughlett-Bogar – B	1,440	600
Hughlett-Bogar – C	120	600
Hughlett-Bogar – D Row crops - cotton	7,560	1,300
Delaney – East Block	0	0
Delaney – West Block Native grassland	0	100
New Home Probably row crops	720	1200 300 spiral nematodes
Shofner – South Block Cotton	360	2,000
Shofner – North Block Ostrich pen	240	100 700 dagger nematodes