Nematology 204: Degree Days Assignment

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Comparison of several grape-producing regions of California with respect to the potential for reproduction of the root-knot nematode *Meloidogyne incognita* may have implications in viticulture. This root-knot nematode is most problematic in the establishment of young vines. Six different CIMIS stations representing roughly five viticultural regions of California were examined. Soil degree days from March 15 through October 15, 1996, roughly corresponding to bud break to leaf fall for grapevines in California, were calculated using the UCIPM server. Missing dates were substituted using the mean temperatures of the preceding and following dates. The base temperature for *M. incognita* was taken to be 10 C.

Degree days determined were as follows:

King City, CIMIS #113: 1811.80 degree days

Napa, CIMIS #109: 1864.9 degree days

Santa Maria, CIMIS #38: 2011.39 degree days

Davis, CIMIS #6: 2381.35 degree days

Lodi, CIMIS #42: 2244.5 degree days

Arvin, CIMIS # 125: 2992.1 degree days

Assuming, based on the information from the Nem. 204 WWW readings, that *M. incognita* requires 600 degree days per generation, the King City, Napa, and Santa Maria sites can anticipate approximately three generations of nematodes per season, the Davis and Lodi sites four generations of nematodes per season, and the Arvin site five generations of nematodes per season.

The management implications of this information are not clear, due to a lack of information on the threshold of root-knot nematodes which would cause damage to grapes. If such a threshold were recognized, then comparing numbers of root-knot nematode eggs or juveniles present in the soil prior to planting with expected degree days could aid in predicting potential nematode problems, and thus assist in rootstock selection and other nematode management decisions.

Some information can be derived from the degree days information. If we can conclude that more cycles of nematode reproduction will occur on a particular site (such as Arvin), we may decide to adopt a more vigorous rootstock (assuming that initial nematode population and nematode reproduction are constant across sites and rootstocks). A nematode resistant rootstock of greater vigor might be more suitable than a nematode resistant rootstock of lower vigor on the same site (presuming that each sustains some damage from nematodes and is not "immune," but is more resistant than a control rootstock). The more vigorous rootstock might compensate more (for whatever low level of feeding damage is sustained) than a lower vigor rootstock, resulting in greater scion vigor. Based on this narrowly described set of conditions, we might recommend that due to the expectation of a gradient of nematode generations from King City and Napa to Davis/Lodi and Santa Maria to Arvin, a gradient of resistant rootstocks based on vigor might well also be utilized. This naturally oversimplifies the rootstock decision, but does aid in site comparison.

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NEMATODE DEGREE DAYS

According to the weather data from Kern Co. (a noted potato growing region), there have been a total of 1456 degree days from January 1, to May 28, 1997. According to the Model on the www, the first generation time of the Columbia RKN takes an accumulation of 1000 degree days, and subsequent generations take 500-600. By this model, I could predict that nearly two generations could have taken place since the beginning of the year.

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Degree Day Assignment

I calculated the number of generations of nematodes that would be produced over a one year period in two different areas. I selected the minimum temperature of 5 degrees celcius, this was based on data available for Columbia nematode.

Monterey County (Arroyoseco weather station)

dates	accumulated degree days
Jan. 1- May 5	1091
May 7 - Oct. 3	1954
Oct. 5 - Oct. 24	227
Oct. 26 - Dec. 30	480
Total	3752 / 600 (degree days per 1 generation) =

6.25 generations per year

Siskiou County (Tulelake weather station)

dates	accumulated degree days
Jan 1- May 30	442
June 1 - June 4	50
June 6 - Oct. 3	1675
Oct. 5 - Oct. 24	120
Oct. 26 - Dec. 30	29
Total	2316 / 600(degree days per 1 generation) =

3.86 generations per year

It should be noted the the days with missing soil temperatures were not accounted for in these calculations. Data was based on the calendar year 1996 using CIMIS weather station information.

Upon comparing these two areas I am able to make my decision as to where I want to start up my beneficial nematode farm. I will locate this business in Monterey county because I will have more generations of nematodes per year.

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Comparison of Degree-Days data

I did a comparison of data for summer season (May 15, 1996 - Oct 15, 1996) for Fresno County and Yolo County. The DD calculated for Fresno is 2913.35 and Yolo is 2730.75 at 5 degrees C for Root-Knot Nema. The second DD calculated for Fresno is 2451.35 and Yolo is 2268.75 at 8 degrees C for Sugarbeet cyst nema..

Expected number of generations for following nemas:

Root-Knot nema (600DD):	Fresno	4.86 generations
[5* C]	Yolo	4.55 generations
Sugarbeet Cyst (450 DD):	Fresno	5.45 generations
(Heterodera schachtii)	Yolo	5.04 generations
[8* C]		

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Columbia root-knot nematode, (*Meloidogyne chitwoodi*) is a pest in potatoes. If a grower can predict when damage may occur, they can time harvest to maximize growth and minimize nematode damage. The UC IPM website was used to calculate degree days . Potatoes need a soil temperature of 45° F to germinate. Using mean soil temperatures from the Alturus weather station (CIMIS station #90), I was able to determine a rough planting time, April 20 1999. Using the single sine method and the lower developmental threshold of 41.0 F D.D. were then calculated from 5/20/99 - 6/19/99. Degree days were determined to be around 240, (temperatures for 4/27/99 and 5/18/99 were missing so I assigned 10 D.D. for both dates based on observed soil temperatures). Soil temperature averages were not available beyond 6/19/99. Consequently, air temperature averages were used to predict nematode development. This is not an accurate way to predict nematode development because degree day accumulation in the soil would proceed at a slower rate.

Degree day requirements for each stage of nematode development can be seen on page 2. The grower is not going to be able to avoid damage from 1st and 2nd generations however, 3rd generation damage could be avoided. The 3rd generation hatch is at 2700-2880 D.D. Based on air temperature averages 9/19/99 will be 2703 D.D. The grower would want to have the crop out of the ground prior to this date.