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Title: Evaluation of nematode resistant grape rootstock for managing *Mesocriconema xenoplax*.

Principal Investigators:

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Objectives:

To evaluate the impact of the ring nematode, *Mesocriconema xenoplax* on the physiology and productivity of phylloxera-resistant grape rootstocks as a basis for recommending rootstocks in the Pacific Northwest. Specific objectives for 2006:

Spring: Inoculate soil with AMF and *M. xenoplax*. Plant vines.

Growing season: Monitor plant growth, gas exchange, and plant-soil water relations. Collect leaf/petiole tissue for nutrient analysis.

Fall: Collect soil samples for analysis of nematode population densities and root growth. Analyze data and submit reports.

Experimental Procedures

The experiment was established in microplots (pot-n-pot system) at the OSU Woodhall Research Vineyard by planting Pinot noir vines grafted to 6 rootstocks in fumigated Jory soil. Beneficial, arbuscular mycorrhizal fungi (AMF) were added to all plots and half of the plots were infested with *M. xenoplax*. Vines were planted in early May, 2006 in a randomized block design and drip-irrigated to maintain volumetric soil water content above ~15% volumetric water content. Vines were thinned to one shoot on June 8, which was trained upright on a bamboo stake. Soil moisture was monitored weekly for most of the growing season by time domain reflectometry (TDR) using buriable waveguides installed in half of the plots. Growth of vines was assessed by periodic measurements of shoot length and leaf area was determined in early August. Since vines were kept well-watered throughout this growing season, measurements of plant water status (i.e., leaf water potential) were not made. However, gas exchange was monitored in mid-August one day before and one day after irrigating vines using a steady-state porometer. Leaf samples were collected at veraison to determine nutrient concentrations by combustion analysis and ICP-OES. Soil samples were collected this fall to estimate nematode populations, fine root length, and AMF colonization. Soil and nutrient analyses will be completed this winter.

Results and Discussion

All vines grew well this summer and developed at least 2 m of shoot length. Results from ANOVA indicated that the presence of ring nematodes in microplots did not influence shoot growth or gas exchange of vines, although differences between rootstocks were significant (Table 1). The total shoot length (main shoot plus laterals) of Pinot noir was initially (June 23) lower on 420A and 110R rootstocks compared to 1103P and 101-14. Later in the summer (August 2), shoot length of vines on 420A roots was significantly lower than vines on 1103P and 3309C roots. Leaf area (August 2) was also lower on 420A compared to 1103P and 3309C, with the other rootstocks (110R, 101-14, self) being intermediate. Interestingly, stomatal conductance on August 17 and 18 was highest in 420A and lowest in 3309C and 1103P vines, indicating a possible compensation for lower leaf area with higher gas exchange per unit of leaf area among rootstocks. Soil moisture content was not influenced by rootstock. Soil moisture was often significantly higher in the +nematode versus -nematode plots (main effect), suggesting that nematodes were reducing water use by vines. However, this effect was not

confirmed when additional TDR measurements using standard waveguides were taken from all microplots (buriable waveguides were installed in 3 of 6 reps). In addition, the effect of nematodes on soil moisture was not supported by aboveground measures of plant growth or gas exchange. We therefore consider the main effect of nematodes on soil water content observed with our buriable waveguides to be an artifact. Our analysis of the physiological responses of Pinot noir grafted to different rootstocks in the presence of ring nematodes will continue over the next few years.

Significance to Industry:

The ring nematode, *Mesocriconema xenoplax*, is distributed throughout vineyards in the Pacific Northwest and it can retard the establishment and reduce yield of young vines. The most cost-effective means to maintain vine productivity in nematode-infested soils is to plant vines on nematode-resistant rootstocks. In recent greenhouse studies, we identified several phylloxera-resistant rootstocks that are highly resistant to the ring nematodes. Evaluating the response of these resistant rootstocks and several other commonly planted rootstocks to ring nematodes will provide information necessary to better manage this soil-borne pest of grapevines.

Funding Sources:

NCSFR and CRIS base funds.

Research Impact:

The negative impact of ring nematodes on vine performance and productivity is not well understood. Large differences in susceptibility to ring nematodes have been demonstrated in different rootstocks under glasshouse conditions, but it is unclear how durable resistance will be under field conditions. In addition, ring nematodes have been shown to reduce fine root production and to specifically inhibit arbuscules (the site of nutrient transfer in mycorrhizas) in fine roots of grapevines, suggesting that vines lose both fine root function and mycorrhizal function. Knowledge of the how ring nematodes affect whole vine physiology, including effects on roots and AMF, may be used to develop management strategies that help mitigate its damage. These data can provide wine grape growers in the Pacific Northwest with additional criteria for selecting rootstocks for nematode-infested sites.

Citations:

None at this time.

Table 1. Effect of rootstock on Pinot noir grapevines established in microplots, May 2006.

Rootstock	Shoot Length (cm)				Leaf Area (m ²)	Stomatal Conductance (mmol m ⁻² s ⁻¹)	
	June 23	July 6	July 17	Aug 2	Aug 2	Aug 17	Aug 18
self-rooted	92 abc	111 ab	157	263 ab	0.38 ab	220 ab	270 ab
3309-C	86 bcd	107 ab	156	317 a	0.49 a	159 b	225 b
1103-P	96 ab	111 ab	168	328 a	0.47 a	201 ab	239 b
110-R	79 cd	96 b	143	271 ab	0.38 ab	239 ab	282 ab
101-14	106 a	125 a	172	254 ab	0.45 ab	233 ab	258 ab
420A	71 d	91 b	142	222 b	0.30 b	280 a	320 a
ANOVA p-value	<0.001	<0.001	0.072	0.007	0.009	0.003	0.016

Means within a column followed by the same letter are not significantly different (Tukey's @ 95% confidence).