

## Clonal Paradox Walnut Rootstocks and Pest Interactions Update

*Janine Hasey, UCCE Farm Advisor, Sutter/Yuba Counties*

*Michael Mockery, Extension Nematologist, UC Kearney Agricultural Research and Extension Center*

*Greg Browne, USDA Plant Pathologist, UC Davis*

*Dan Kluepfel, USDA Plant Pathologist, UC Davis*

The standard walnut rootstocks are seedling Paradox and seedling black. Paradox seedling, which is a hybrid seedling between a black walnut species (usually northern California black) and English walnut, has been the rootstock of choice because of its greater vigor and relative resistance to most species of *Phytophthora*, compared to northern California black rootstock. However, seedling Paradox is highly susceptible to crown gall disease caused by *Agrobacterium tumefaciens*. Because of this susceptibility, many growers have opted to use the black rootstock, which has less trouble with crown gall in spite of the lower vigor. Work is underway to develop hybrid walnut rootstocks with desirable vigor as well as good resistance to soilborne pathogens. In the meanwhile, growers may want to consider using clonal Paradox walnut rootstocks where one expects nematode problems or other site specific diseases such as *Phytophthora* or crown gall.

The first Paradox clone to be micropropagated was ‘Vlach’ which came from a vigorous Paradox tree in Stanislaus County and has been available since 1999. Two other clonal Paradox rootstocks, ‘VX211’ and ‘RX1’, were released in 2007 after years of evaluation for vigor, resistance to nematodes, crown gall, and *Phytophthora*. They were identified as superior seedlings from the UC/USDA-ARS Paradox Diversity Study; micropropagated (cloned) and retested for their traits of interest before their release. Long-term evaluations of these rootstocks are continuing in greenhouse and field studies.

Clonal Paradox rootstocks provide options in selecting a rootstock to manage site specific problems or issues in orchards. The table below is our current state of knowledge and provides a guide for selecting the most appropriate clonal Paradox rootstock for certain situations. It should be noted that none of these clonal rootstocks have high levels of resistance but show promise in being able to grow because of some level of resistance or tolerance to the specific disease causing agent. The listings for ‘RX1’ and ‘Vlach’ clonal rootstocks have been updated to reflect a range of low to moderate resistance to crown gall based on more recent screening studies. For nematodes, the first letter in the table designates the nematode’s ability to reproduce in the presence of the rootstock. Rootstocks designated as “susceptible” under the nematode headings will produce far fewer nematodes per gram of root than those designated as “highly susceptible”. The second part deals with the rootstock’s response to the nematode. Only “VX211” has some tree tolerance to nematodes.

These clonal Paradox rootstocks are readily available through the walnut nursery trade as individual plants often sold in containers or as nursery grafted or budded field grown trees. For more information on walnuts in the nursery trade, how they are propagated and understanding the terminology, a handout is available at your local UC Cooperative Extension office or on the web at <http://fruitsandnuts.ucdavis.edu>

**Vigor and responses to selected nematode and disease pathogens by available clonal Paradox walnut rootstocks <sup>1</sup>**

Trait of interest	'Vlach'	'VX211'	'RX1'
<b>Rootstock Vigor</b>	High vigor	High vigor	Moderate vigor
<b>Resistance to <i>Phytophthora citricola</i></b> (a cause of crown and root rot)	<b>LR</b>	<b>MR</b>	<b>MR</b>
<b>Resistance to <i>Phytophthora cinnamomi</i></b> (a cause of root and crown rot)	<b>LR</b>	<b>LR</b>	<b>MR</b>
	<b>LR - MR</b>	<b>LR</b>	<b>LR - MR</b>
	<b>LR = low resistance</b>	<b>MR = moderate resistance</b>	
<b>Root Knot Nematode</b>	<b>S-IT</b>	<b>S-ST</b>	<b>S-?</b>
<b>Root Lesion Nematode</b> ( <i>Pratylenchus vulnus</i> )	<b>HS-IT</b>	<b>S-ST<sup>2</sup></b>	<b>HS-IT</b>
	Nematode's ability to reproduce	<b>HS</b> = highly susceptible	
		<b>S</b> = susceptible	
	Tree response to nematode	<b>ST</b> = some tree tolerance to nematode presence	
		<b>IT</b> = tree intolerant to nematode presence, i.e. reduced tree vigor/health in presence of nematode	

<sup>1</sup>Based on data from ongoing UC and USDA-ARS trials

<sup>2</sup>Tolerance due to a post infection resistance mechanism