

GROWTH AND PERFORMANCE OF OWN-ROOTED ‘CHANDLER’ AND ‘VINA’ COMPARED TO PARADOX ROOTED TREES

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ABSTRACT

Two studies comparing own-rooted Chandler to nursery grafted Chandler on seedling Paradox rootstock were planted in Sutter and San Joaquin Counties in 2002. Additionally, own-rooted Vina is being compared to Paradox rooted Vina in Sutter County. The survival rate of own-rooted trees at both sites is 100 percent. The Paradox rooted Vina trees in Sutter County have remained the largest trees since planting. In 2006 the Vina on Paradox were significantly larger than the Vina own-rooted, Chandler own-rooted or Chandler on Paradox. In 2005, both cultivars on Paradox rootstock had significantly more yield than did the own-rooted trees; Paradox rooted Chandler had the highest yield. In 2006, the Vina on Paradox and Chandler on Paradox had the highest yields followed by Vina own-rooted and Chandler own-rooted. Both Chandler treatments had more light nuts compared to the Vina treatments. The own-rooted trees leaf out later and produce far fewer catkins than Paradox rooted trees. In San Joaquin County, there was no significant size difference between Paradox rooted and own-rooted Chandler trees since planting. The Paradox rooted trees produced significantly more yield as in Sutter County. Salt toxicity symptoms were observed by late summer and were more severe in own-rooted trees as in 2005.

OBJECTIVES

Compare long-term growth and yield performance of own-rooted Chandler and Vina (Sutter County only) with trees on seedling Paradox rootstock in two locations.

PROCEDURES

Sutter County - The study site is on Holillipah loamy sand. The site was previously planted in pistachios but had been fallow for several years. There were zero nematodes from a random sample of soil taken from the top foot in October 2000 prior to methyl bromide (MB) treatment. Soil was again sampled in 12” increments to 60” in April 2001 following a fall MB treatment. There were no nematodes found in soil or root samples.

The treatments compare own-rooted Chandler and Vina to nursery grafted Chandler and Vina on seedling Paradox rootstock. Six 6-tree replications of each rootstock were planted on March 12, 2002 in a randomized complete block design spaced at 25’ x 25’ and surrounded by buffer trees. Most of the nursery trees were ½” or 5/8” except the Vina on Paradox were ¾”. Trees are sprinkler irrigated. In 2006, tertiary scaffolds were selected and headed appropriately for tree and cultivar vigor. On April 18 and 27, and May 10 and 18, 2006, we took observational data on the presence or absence of catkins and female flowers. Soil samples were taken and combined from three vigorous trees from the middle of orchard and three poorly growing trees on west end near the old Serr orchard On April 6, 2006 and tested for nematodes. Trees were harvested on October 26, 2006 and nut samples were submitted for quality. Tree trunk circumference was measured at leaf fall on November 17, 2006 at 14 inches above the ground.

San Joaquin County - The study site is on Columbia fine sandy loam. The treatments compare own-rooted Chandler to nursery grafted Chandler on seedling Paradox rootstock. Five 8-tree replications of each rootstock, arranged in a single row within a newly planted commercial block, were planted on March 15, 2002 in a randomized complete block design. The planting is an 11' x 25' hedgerow with rows oriented E-W. Trees are furrow irrigated. Irrigation water at the site contains elevated levels of sodium, chloride, and boron. The orchard has a high water table and a tile drainage system is installed six feet below the soil surface. Tree trunk circumference was measured at 30 cm above the ground and trees were harvested on October 27, 2006.

RESULTS AND DISCUSSION

Sutter County - The Vina on Paradox trees were larger at planting and have remained the largest trees. They were not significantly larger than own-rooted Vina in 2004 and 2005 but were significantly larger in 2006 (Table 1). Both own-rooted cultivars and the Chandler on Paradox were not significantly different in size in 2004 through 2006. The growth rate was the same for both own-rooted and Paradox rooted Chandler. The Paradox-rooted Vina had a faster growth rate than did the own-rooted Vina which is opposite compared to previous years. The Chandler own-rooted trees were 87 percent the circumference of the Chandler on Paradox trees initially, 99 percent in 2004, 102 percent in 2005, and 101 percent in 2006. The Vina own-rooted trees were 71 percent the circumference of the Vina on Paradox trees initially, 94 percent in 2004, 96 percent in 2005 and 92 percent in 2006. Although the Chandler own-rooted trees have caught up with the Chandler on Paradox in terms of trunk circumference, the Vina own-rooted have not caught up with the Vina on Paradox. There has been no tree mortality but a few own-rooted trees were retrained in 2004 because of poor growth.

Yield is shown in Table 2. Both cultivars on Paradox rootstock had significantly more yield than did the own-rooted trees in 2005 and 2006. In 2005, Chandler on Paradox had the highest yield while in 2006, Vina on Paradox and Chandler on Paradox had similar yields. Own-rooted Chandler had the lowest yield in 2006. Walnut quality only varied for percent light nuts between the treatments; both Chandler own-rooted and Paradox rooted trees had substantially more light nuts compared to the Vina treatments (Table 3).

We observed leafing and flowering phenology on several dates in the spring (Table 4). Both own-rooted cultivars were later leafing and produced far fewer catkins than Paradox rooted trees, as has been observed in other trials with own-rooted trees. No catkins were seen on the own-rooted Chandler until May 18 when some trees had one catkin beneath them on the ground. The growth habit of own-rooted trees is more open with fewer branches whereas the Paradox rooted trees have more secondary and fruiting branches where the catkins were located.

Crown gall was observed on three Paradox rooted trees in 2006; none was seen on own-rooted trees. The same trees that had low vigor in 2005, primarily own-rooted Vina, continued to perform poorly in 2006. We found lesion nematode (*Pratylenchus vulnus*) in both the vigorous and poorly growing sites (Table 5). In 2001, one year prior to planting, there were no nematodes in the plot. Within 5 years, lesion nematodes have migrated to the middle of the plot in high numbers. It is likely the trees on the west end are growing more poorly due to competition from the nearby mature orchard; one buffer row may not be sufficient. Several own-rooted Vina also had an undiagnosed interveinal leaf necrosis symptom in 2006.

San Joaquin County - The trunk circumference of own-rooted Chandler trees was not significantly different compared to Paradox rooted trees (Table 6). Paradox rooted trees had significantly more yield than did the own-rooted trees (Table 7). Four of the Paradox rooted trees died the first year and one in 2005 but all the own-rooted trees have survived.

As in 2005, leaf marginal burn symptomatic of salt toxicity was noted by late summer, with minor symptoms on Paradox rooted trees and severe symptoms on own-rooted trees.

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Table 1. Trunk circumference of own-rooted (OR) Chandler and Vina compared to Paradox rooted (PDX) Chandler and Vina in Sutter County

Rootstock	Trunk circumference (cm) 14 inches above ground						% change 05-06
	3/13/02	12/4/02	12/3/03	12/2/04	11/21/05	11/17/06	
Chandler/PDX	4.4 b	9.9 b	19.7 b	32.4 b	42.7 b	48.1 b	12.6
Chandler/OR	3.9 c	8.9 c	17.9 c	32.1 b	43.4 b	48.6 b	12.0
Vina/PDX	6.5 a	11.7 a	21.8 a	35.1 a	46.7 a	53.3 a	15.2
Vina/OR	4.6 b	9.3 c	18.9 bc	32.9 ab	44.7 ab	48.9 b	9.4

Means followed by the same letter in a column are not significantly different (based on 95% confidence intervals).

Table 2. 2004-05 (nuts/tree) and 2005-06 yield of own-rooted (OR) Chandler and Vina compared to Paradox rooted (PDX) Chandler and Vina in Sutter County Trial

Rootstock	2004 (# nuts/tree)	2005 (# nuts/tree)	2005 Yield (dry ton/acre)	2006 Yield (dry ton/acre)
Chandler/PDX	27.4 a	618.7 a	0.29 a	1.18 a
Chandler/OR	5.3 b	256.5 c	0.11 c	0.47 c
Vina/PDX	26.4 a	507.5 b	0.22 b	1.21 a
Vina/OR	2.8 b	181.3 c	0.08 c	0.75 b

Means followed by the same letter in a column are not significantly different (based on 95% confidence intervals).

Table 3. 2006 walnut quality of own-rooted (OR) Chandler and Vina compared to Paradox rooted (PDX) Chandler and Vina in Sutter County Trial

Rootstock	% Large Sound	% Edible Yield	% Light
Chandler/PDX	94.7	48.0	91.5
Chandler/OR	89.7	49.0	93.8
Vina/PDX	90.7	45.5	48.2
Vina/OR	88.2	46.5	67.8

Table 4. 2006 phenology observations (numbers are on a per tree basis) of own-rooted (OR) Chandler and Vina compared to Paradox rooted (PDX) Chandler and Vina in Sutter County Trial

Rootstock	Catkins			Female Flowers			Leafing		
	4/18	4/27	5/10	4/18	4/27	5/10	4/18	4/27	5/10
Chandler/PDX	-	peak	On ground	-	1 st bloom	peak	-	yes	leafed
Chandler/OR	-	0	0	-	0	1 st bloom	-	5-6 days*	Much later
Vina/PDX	3-4 doz.	past	-	-	50%		yes	Leafed	-
Vina/OR	2-3	past	-	-	1-2 days later		1-2 days later	leafed	-

*Variation among own-rooted clones

Table 5. Nematode sample results comparing vigorous trees to poorly growing trees in 2006 in Sutter County Trial

Sample Site	<i>Pratylenchus vulnus</i> #/liter soil	<i>Pratylenchus vulnus</i> #/gram root
Vigorous (middle)	15,600	45.0
Poor growing (West end)	25,200	46.6

Table 6. Trunk circumference of own-rooted Chandler compared to Paradox rooted Chandler in San Joaquin County

Rootstock	Trunk circumference (cm) 30 cm above ground							
	3/02	11/02	12/03	11/04	11/05	% change '04 to '05	10/06	% change '05 to '06
Paradox	4.9	9.6	18.5	26.3	33.7	28.1%	40.3	19.8%
Own-rooted	3.9	8.4	17.3	26.3	34.5	31.5%	39.1	13.1%

Significance¹ 0.006 0.001 NS (0.06) NS (0.91) NS (0.29) NS (0.08) NS (0.09) NS (0.14)

¹Probability of a significant difference, 2-way ANOVA

²Change since prior year measurement

Table 7. 2005 and 2006 yield of own-rooted Chandler compared to Paradox rooted Chandler in San Joaquin County

Rootstock	Number nuts/tree	lbs/tree
	10/7/05	10/27/06
Paradox	72.7	4.4
Own-rooted	12.0	1.2

Significance¹ 0.0002 0.0002

¹Probability of a significant difference, 2-way ANOVA