

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

Janine Hasey, Joe Grant, Bruce Lampinen, and Samuel Metcalf

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, but not significantly larger than own-rooted Vina. Both own-rooted cultivars and the Paradox rooted Chandler were not significantly different in size in 2004 and 2005. Both cultivars on Paradox rootstock had significantly more yield than did the own-rooted trees; Paradox rooted Chandler had the highest yield. The own-rooted Vina trees were found to be zinc deficient. 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 noted by late summer and were more severe in own-rooted trees which had higher levels of sodium and chloride. The growth rate continued to be faster for own-rooted trees at both sites.

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 2005, secondary scaffolds were selected and headed appropriately for tree and cultivar vigor. On April 4 and 11, and May 4, 2005, we took observational data on the presence or absence of catkins and female flowers. Leaves were collected on July 29, 2005, combining all replicates for analysis. On October 20 and 21, 2005, we took individual tree yields. Nut samples were pooled by treatment for quality. Tree trunk circumference was measured at leaf fall on November 21, 2005 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 on November 1, 2005 at 30 cm above the ground. The number of nuts on each tree was counted and leaves were collected and submitted for salt analysis on October 7, 2005.

RESULTS AND DISCUSSION

Sutter County - The Vina on Paradox trees were larger at planting and have remained the largest trees but were not significantly larger than own-rooted Vina in 2004 and 2005 (Table 1). Both own-rooted cultivars and the Chandler on Paradox were not significantly different in size in 2004 and 2005. Both of the own-rooted cultivars continued to have faster growth rates than did the Paradox rooted treatments. The Chandler own-rooted trees were 87 percent the circumference of the Chandler on Paradox trees initially, 99 percent in 2004, and 102 percent in 2005. The Vina own-rooted trees were 71 percent the circumference of the Vina on Paradox trees initially, 94 percent in 2004, and 96 percent in 2005, suggesting the own-rooted trees have caught up to those on Paradox. There has been no tree mortality but a few own-rooted trees were retrained in 2004 because of poor growth.

We observed catkins on Paradox rooted Chandler only and female flowers on the Paradox rooted and own-rooted Vinas in April 2004 and 2005. Both own-rooted cultivars were later leafing than Paradox rooted trees. Yield is shown in table 2. Both cultivars on Paradox rootstock had significantly more yield than did the own-rooted trees with Chandler having the highest yield. The Chandlers had far superior nut quality to the Vinas (Table 3). Some walnut blight was seen on the Vinas; trees have not been sprayed thus far.

Crown gall was observed on a few Paradox rooted trees. By mid-summer, some trees had low vigor, primarily own-rooted Vina. We excavated soil around one own-rooted Vina that had no new terminal growth and small, yellowing leaves. We found no evidence of root rot but many fibrous, shallow roots close to the trunk which were not seen in a healthy Paradox rooted Vina excavated for comparison.

Results of leaf analysis are shown in table 5. The own-rooted Vina, which were lacking in vigor by the fall, are zinc deficient. All other nutrients are in the adequate range.

San Joaquin County - The trunk circumference of Paradox rooted trees has not been significantly different compared to own-rooted Chandler trees since planting (Table 4). Paradox rooted trees had significantly more yield (nuts per tree) than did the own-rooted trees (Table 4). Four of the Paradox rooted trees died the first year but all the own-rooted trees have survived.

Leaf marginal burn symptomatic of salt toxicity was noted by late summer, with minor symptoms on Paradox rooted trees and more severe symptoms on own-rooted trees. Leaves from own -rooted trees had higher concentrations of sodium and chlorides than Paradox (Table 6). Boron was similar but in the excess range for both rootstocks.

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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 '04 to '05 |
|---------------------|---|---------|---------|---------|----------|---------------------|
| | 3/13/02 | 12/4/02 | 12/3/03 | 12/2/04 | 11/21/05 | |
| Chandler/PDX | 4.4 b | 9.9 b | 19.7 b | 32.4 b | 42.7 b | 31.8 |
| Chandler/OR | 3.9 c | 8.9 c | 17.9 c | 32.1 b | 43.4 b | 35.2 |
| Vina/PDX | 6.5 a | 11.7 a | 21.8 a | 35.1 a | 46.7 a | 33.1 |
| Vina/OR | 4.6 b | 9.3 c | 18.9 bc | 32.9 ab | 44.7 ab | 35.9 |

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

Table 2. 2004 (nuts/tree) and 2005 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) |
|---------------------|-----------------------|-----------------------|------------------------------|
| Chandler/PDX | 27.4 a | 618.7 a | 0.29 a |
| Chandler/OR | 5.3 b | 256.5 c | 0.11 c |
| Vina/PDX | 26.4 a | 507.5 b | 0.22 b |
| Vina/OR | 2.8 b | 181.3 c | 0.08 c |

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

Table 3. 2005 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 | 90.8 | 50.6 | 87 |
| Chandler/OR | 94.7 | 53.1 | 91 |
| Vina/PDX | 87.4 | 42.1 | 12 |
| Vina/OR | 82.7 | 41.7 | 26 |

Table 4. Trunk circumference and 2005 yield (nuts/tree) of own-rooted Chandler compared to Paradox rooted Chandler in San Joaquin County

| Rootstock | Trunk circumference (cm) 30 cm above ground | | | | | | Number nuts/tree |
|---------------------------------|---|--------------|------------------|------------------|------------------|---------------------|------------------|
| | 3/02 | 11/02 | 12/03 | 11/04 | 11/05 | % change '04 to '05 | 10/05 |
| Paradox | 4.9 | 9.6 | 18.5 | 26.3 | 33.7 | 21.8% | 72.7 |
| Own-rooted | 3.9 | 8.4 | 17.3 | 26.3 | 34.5 | 23.9% | 12.0 |
| Significance¹ | <i>0.006</i> | <i>0.001</i> | <i>NS (0.06)</i> | <i>NS (0.91)</i> | <i>NS (0.29)</i> | <i>NS (0.072)</i> | <i>0.0002</i> |

¹Probability of a significant difference, 2-way ANOVA

Table 5. Leaf analysis of own-rooted (OR) Chandler and Vina compared to Paradox rooted (PDX) Chandler and Vina in Sutter County (sampled 7/29/05)

| Rootstock | Nitrogen % | Potassium % | Calcium % | Magnesium % | Zinc ppm | Manganese ppm | Boron ppm |
|---------------------|------------|-------------|-----------|-------------|----------|---------------|-----------|
| Chandler/PDX | 3.09 | 1.75 | 2.33 | .46 | 31 | 218 | 139 |
| Chandler/OR | 3.28 | 1.75 | 2.14 | .64 | 23 | 172 | 219 |
| Vina/PDX | 2.92 | 1.81 | 2.29 | .45 | 22 | 190 | 121 |
| Vina/OR | 2.95 | 1.81 | 1.78 | .55 | 17 | 153 | 178 |

Table 6. Leaf analysis of own-rooted Chandler compared to Paradox rooted Chandler in San Joaquin County (sampled 10/7/05)

| Rootstock | Boron, ppm | Sodium, ppm | Chloride, % |
|--------------------|------------|-------------|-------------|
| Paradox | 409 | 94 | 0.68 |
| Self-rooted | 390 | 223 | 1.43 |