2010 WALNUT CLONAL PARADOX ROOTSTOCK TRIALS IN NORTHERN CALIFORNIA

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ABSTRACT

The California walnut industry utilizes two seedling rootstocks for commercial production, Northern California Black (Juglans hindsii) and Paradox hybrid seedling (Juglans hindsii x Juglans regia). Both rootstocks are open pollinated resulting in genetic variability. This genetic variation leads to non-uniformity in the field related to size, vigor, compatibility, and disease susceptibility. Due to superior vigor, better adaptability to marginal soils and greater tolerance to Phytophthora crown and root rot, Paradox is the preferred rootstock for Northern California. Recent technology has resulted in micropagation and commercial availability of three new clonal walnut rootstocks, RX1, VX211 and Vlach. Clonal rootstocks have several horticultural advantages. First, they can be selected for desirable attributes such as disease resistance, nematode tolerance and vigor giving farmers the opportunity to match rootstock selection with planting sites. Second, they will impart less genetic variability and be more predictable in the orchard. Disadvantages include the loss of genetic diversity in orchard plantings and additional expertise is required to micropropagate, nursery culture and graft to produce a commercially viable product.

OBJECTIVES

To evaluate the three newly released clonal paradox rootstocks and other test selections, two rootstock trials have been planted in Northern California, one in Tehama County and the other in Solano County. The Tehama County plot includes VX211, Vlach, RX1, and June budded Vlach with Paradox seedling as the control comparison. The Solano County plot evaluates five rootstocks includes Vlach, RX1, VX211, and Burbank with Paradox seedling as the control comparison. The trials will evaluate their growth characteristics, yield capability and possible disease tolerance.

PROCEDURES

Solano trial:
The rootstocks were clonal propagated by the UC Walnut Breeding Program and were grown for the first season at a commercial walnut rootstock nursery. The trial contains four clonal rootstocks; Vlach, RX1, VX211 and Burbank with Paradox seedling used as a control comparison. Vlach was the only variety that was not grown all in the same nursery and the same clonal propagation. The portion of Vlach that was grown in the same environment as the other is label Vlach 1 and the Vlach from the other nursery is labeled Vlach 2. Vlach 2 was grown for two seasons in the nursery while Vlach 1 was only grown one season in the nursery.

They were planted in the field on March 31, 2009 in a Solano County orchard containing yolo silty clay loam soil type. Planting space 24 x 18.5 feet in an offset design. Experimental design was randomized complete block design with 6 replications. Each plot contains 10 trees two rows wide with 5 trees in each row. Measurements of caliper were taken before planting and trees
were randomly mixed for each plot with the same ratio of small and large trees. Tulare variety was budded in August 2009 by a professional crew. In 2010, missed buds were rebudded in August. Replanted 5 trees on March 18, 2010 to replace trees that died in 2009 (3- RX1, 1-VX211, and 1-Vlach 1).

Water status of the trees measuring midday stem water potential was taken August 13, 2010. Data collected in December 2010 includes rootstock diameter at 13 inches above ground, scion diameter at 8 inches above graft union, tree survival, and bud-take.

**Tehama Trial:**
The Tehama County rootstock trial includes VX211, Vlach, RX1, June budded Vlach and paradox seedling as the control comparison. Rootstocks were micropropagated at Northern California Plant Lab and grown for one year in a commercial nursery.

Ungrafted rootstocks were planted on March 12, 2009 into fumigated class one Columbia loam soil at 14ft by 26ft. plot in a randomized complete block design with five rootstocks and five replicates. Microsprinklers are used for irrigation. Trees were budded in September 11, 2009 to the Howard variety. All buds froze in the 2009 December freeze. Rootstocks were then whip grafted to Howard on the first week of May 2010 by the grower. On July 20, 2010, the percent graft take was recorded.

Data were analyzed using ANOVA (SAS GML procedure).

**RESULTS AND DISCUSSION**

**Solano trial:**
The 2009 and 2010 results showed a significant difference in size among rootstocks for rootstock diameter measured13 inches (p value <0.0001) (Figure 1) and scion diameter 8 inches above graft union (p value = 0.0007) (Figure 2). VX211 had the largest the diameter in June of 2009. VX211 has continued to be the largest through 2010 and Vlach 2 with the second largest average diameter not significantly different from it. Vlach 1 is only slightly smaller than the VX211 and Vlach 2. The difference between the Vlach 1 and 2 may indicate the differences in time grown in the two nurseries or other difference in nursery environment. RX1 has the smallest average diameter with December 2010 measurements significantly smaller than all other rootstocks. Burbank and paradox seedling are in the lower average size diameter of the trial. Diameter of the scion 8 inches above the graft union is significantly larger on the Vlach 1 and 2. There are no significant differences between the scion diameters on the other rootstocks.

Midday water stem potential taken once in August showed no significant differences between rootstocks. Paradox seedling was at full water potential (baseline) and Vlach 1 and 2 were slightly wetter while Burbank, VX211, and RX1 were slightly drier than baseline.

Only two tree died in 2010, 1 Burbank and 1 VX211, both of which were weak since planting in 2009. RX1 had the highest bud failure at 29% of the August 2010 re-budded trees (total of 20 trees). The other rootstocks scored bud failure at 19% for Burbank, 14% for paradox seedling, 11% for VX211, and 3 and 7% for Vlach 1 and 2 respectively. This bud failure means that these scions once successfully budded in 2011 will be 3 years younger than the trees that were
successfully budded the first year. This may make it necessary to eliminate these trees from the long term comparison study.

Significant differences were found among blocks. These differences may be due to one or more factors. A few to consider would be the high temperatures at planting with the last blocks going in late in the day, differences between grafted bud survival, or soil difference across field.

**Tehama Trial:**
This year the bud and graft failure has reduced the ability for growth characteristics to be collected. The percent survival of the grafts shown in Table 1 shows a high percentage of graft failure. No statistical difference in graft failure between the four rootstocks but a large amount of variation was found between replicates. Numerically RX1 demonstrated the poorest graft take most likely because it was the smallest in diameter at grafting. We would have to conclude that based upon the limited data there are no graft incompatibility issues with these 3 clonal rootstocks.
Figure 1. Solano County trial clonal paradox rootstocks average diameter measurements taken at 13 inches above the ground in June 2009, January 2010, December 2010. Letters above bars indicate statistical differences using Duncan’s multiple range test.
Figure 2. Average diameters of ‘Tulare’ variety walnut scion at Solano County clonal paradox rootstock trial. Measurements were taken at 8 inches above the graft union in December 2010. Letters above bars indicate statistical differences using Duncan’s multiple range test.

Table 1. Tehama County clonal paradox trial’s graft survival rate recorded on July 20, 2010. Howard variety whip grafted on all rootstocks on the first week of May 2010. No significant differences between rootstock graft survival.

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Percent Graft Survival</th>
<th>Range of percent graft survival among replicates (low to high)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VX211</td>
<td>75.5%</td>
<td>61 to 89%</td>
</tr>
<tr>
<td>RX1</td>
<td>61.1%</td>
<td>50 to 72%</td>
</tr>
<tr>
<td>Vlach</td>
<td>76%</td>
<td>55 to 94%</td>
</tr>
<tr>
<td>Paradox seedling</td>
<td>80%</td>
<td>61 to 94%</td>
</tr>
</tbody>
</table>