

2011 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.

Two long term trials were planted in 2009 in the Sacramento Valley to evaluate the potential of the new clonal paradox rootstocks. One in Tehama County is evaluating VX211, Vlach, RX1, and June budded Vlach. The second in Solano County is evaluating VX211, Vlach, RX1, and Burbank. Both trials included Paradox seedling as the control comparison. Results in 2011 found no significant differences between the clonal rootstocks for scion circumferences at either location. There was also no difference in tree height measured at the Solano trial. There was significant difference found between the clonal rootstock circumference measurements in the Solano trial with VX211 being largest and RX1 smallest though these differences did not translate to overall larger or smaller tree size.

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. The Solano County plot evaluates five rootstocks includes Vlach, RX1, VX211, and Burbank. Both trials planted 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 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 7 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).

Data collected in November 8, 2011 includes rootstock circumference (cm) at 13 inches above ground, scion circumference (cm) at 8 inches above graft union, and the height of tallest scaffold measured with laser impulse rangefinder (Laser Technology, Inc.) (Table 1). ANOVA (SAS 9.3 GML procedure, SAS Institute Inc.).

Tehama Trial

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

Seedling paradox were supplied by the same commercial nursery that cultured the clonal rootstocks. Ungrafted clonal rootstocks were planted in March 2009 into fumigated class one Columbia loam soil at a tree spacing of 14ft by 26ft. June budded trees on Vlach rootstock were nursery grafted to Howard and differ in that they were not field grafted giving those trees a size advantage. Clonal rootstocks were field budded in September 2009 to the Howard (*Juglans regia*) variety. Cold damage in December 2009 killed all the inserted buds and trees were whip grafted to Howard 5/1/2010. Microsprinklers are used for irrigation. The rootstock experiment is part of a larger commercial planting and is farmed commercially using conventional management.

Scion circumference measurements were taken on 5/16/11 and again on 11/16/11 to monitor tree growth and calculate the rate of scion enlargement (Table 2).

RESULTS

Solano

The Solano County trial grew very well this year. Only two trees died this year, a Burbank and a VX211. The ones that had to be re-budded August 2010 are now a year behind the rest of the trial and they were not included in this year's data analysis. Of the 55 re-budded trees, the number of each clonal rootstock were as follows, 19 RX1, 15 Burbank, 10 Paradox seedling, 8 VX211, 1 Vlach-1, and 2 Vlach-2.

The circumference of the rootstock is significantly different between the rootstocks ($p < .0001$). The Duncan's multiple range test shows that VX211 is significantly larger than all other rootstocks (Table 1). Paradox seedling, Burbank, Vlach-1 and Vlach-2 are in the middle with RX1 having the significantly smallest circumference. When comparing the circumference of the scion and the height among rootstocks no significant differences were found.

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 grafter bud survival, or soil difference across field.

Tehama

Scion circumference measurements were taken on 5/16/11 and again on 11/16/11 to monitor tree growth and calculate the rate of scion enlargement (Table 2). Even though RX1 started out as a smaller possibly less vigorous rootstock, there was no apparent difference in scion circumference or growth rate between VX211, RX1, Vlach or Paradox seedling..

DISCUSSION

In both trials the differences in size between clonal rootstocks seen in the first year of planting seems to be becoming smaller over the years. The difference seen in the circumference between the rootstock in the Solano trial are similar to the findings of the circumference measurements taken in December 2010 with VX211 being largest, RX1 being smallest and the others a similar size between the two. The scion circumference measurements in both trials show no differences among the rootstocks. This may be likely due to the fact that all the buds began to grow at the same time in spring of 2010 and the vigor difference between the rootstocks does not translate to the scion. This may be different if the trees were grown in other environments than those found in these two trials. This result is also found in the height measurements of the trees in the Solano trial where no differences are found. June bud/Vlach trees have a distinct size advantage mostly because they were grafted in the nursery and started scion growth in April 2009 compared to the field grafted scions starting growth in May 2010

Solano Trial:

| Rootstock Clone | Rootstock Circumference (cm) Nov 2011 | Scion Circumference (cm) Nov 2011 | Height (M) Nov 2011 |
|------------------------|--|--|----------------------------|
| VX211 | 27.98 ± 0.37 a | 19.54 ± 0.22 | 4.40 ± 0.04 |
| Paradox | 25.92 ± 0.30 b | 19.83 ± 0.23 | 4.31 ± 0.04 |
| Burbank | 25.55 ± 0.31 b | 19.50 ± 0.27 | 4.42 ± 0.04 |
| Vlach 1 | 25.42 ± 0.30 bc | 19.36 ± 0.26 | 4.32 ± 0.05 |
| Vlach 2 | 24.78 ± 0.37 c | 19.68 ± 0.32 | 4.39 ± 0.05 |
| RX1 | 22.20 ± 0.34 d | 19.78 ± 0.25 | 4.35 ± 0.04 |

Table 1. Solano County trial clonal paradox rootstocks average circumference (cm) of the rootstock at 13 inches above the ground, circumference (cm) of the Tulare scion 8 inches above graft union, and tree height (M) of the tallest scaffold. Significant differences were found in the circumference of the rootstock ($p < .0001$). No significant differences found between the scion circumference and tree height. (\pm SE) Letters indicate groups statistical difference using Duncan's multiple range test.

Tehama Trial:

| Rootstock | Scion Circumference (cm) 5/16/11 | Scion Circumference (cm) 11/16/11 | Growth rate (cm) |
|-------------------------|---|--|-------------------------|
| VX211 | 7.61 | 15.23 | 7.62 |
| June Bud/Vlach | 19.04 | 27.22 | 8.18 |
| RX1 | 7.60 | 14.96 | 7.36 |
| Vlach | 7.69 | 15.10 | 7.41 |
| Paradox Seedling | 7.59 | 14.81 | 7.22 |

Table 2. Scion circumference measurements (cm) for the Tehama County clonal walnut rootstock experiment. Trees were planted 3/12/09 and field budded to Howard September 11, 2009. All buds failed due to cold injury and trees were whip grafted to Howard 5/1/2010. Scion measurements were taken on 5/16/11 and 11/16/11. June bud/Vlach trees were nursery grafted giving them a size advantage over the field grafted trees.