NURSERY EXPERIENCE WITH CLONAL PROPAGATION OF A PARADOX HYBRID WALNUT BY STOOLING AND HARDWOOD CUTTINGS

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ABSTRACT
This project was part of the Burchell Nursery's 1995 Product Development Program. The rooting of walnut from cuttings has been a project of the nursery for many years. Being able to grow walnuts clonally from cuttings offers several advantages. The nursery could select a superior 'Paradox' hybrid clone for propagation so the variability of seedling rootstocks would be reduced. Having a solid block of 'Paradox' rather than 'Paradox' and black seedlings mixed together in the seedling rows would increase production efficiency. Clonal propagation could also provide the means to react quickly to the market when 'Paradox' seed is scarce. Rooting ranged between 10-70% for various lots of hardwood cuttings (18% overall). We obtained good survival of rooted cuttings lined out in the nursery (82%) between May 5 and June 14. Although stooled cuttings rooted at lower percentages than hardwood cuttings, their survival percentages were similar to that of hardwood cuttings.

PROCEDURES

Hardwood Cuttings. 'Paradox' hybrid hardwood cuttings were obtained from stooling beds at the Burchell Nursery, Inc. which were originally propagated from the 'Vlach Paradox' hybrid source in Modesto and established in 1991.

On January 27, 1995, 12,000 long hardwood cuttings (6" long) were harvested from the stool beds. All of the cuttings were dipped in a 4000 ppm IBA solution for 5 seconds. After the cuttings were dipped, they were stuck in individual plugs in trays containing 72 plugs. Each tray was then transferred to two different greenhouses. Greenhouse A had high humidity, a constant temperature of approximately 78°F, and intermittent mist. Greenhouse B had bottom heat between 78°F and 75°F, open walls and was hand-watered. As cuttings rooted, they were moved out of greenhouse A two to four months after original harvest and hardened off under shade prior to planting. Cuttings were left in greenhouse B until planting. All cuttings planted prior to August 16 were painted white to minimize sunburn.

Stooling. Our clonal source trees of the 'Vlach Paradox' were cut back to the ground so only the stump and a few low branches were left in January 1992. The branches were tied down to the ground and covered with sawdust. This procedure has been followed in each subsequent year. The buds on the branches grew through the sawdust and began to emerge in late March.

On May 5, 1995, when the new shoots were about 1/8" (10 mm) in diameter and between 6 to 12 inches tall, the new shoots were tied with a copper wire close to where they grew out from the tied-down branch. When all of the new shoots had been tied with a copper wire, they were covered with sawdust and kept moist with overhead sprinkler irrigation.

RESULTS AND DISCUSSION

Hardwood cuttings. Hardwood cuttings were planted out at five different times between May 5 and August 16. The first batch of 'Paradox' cuttings planted in May were checked periodically. We observed that the cuttings started off very slowly in the nursery row. Only 68% looked very good right after planting. After one month, 81% looked good and were growing well while after two months 84.8% of the 'Paradox' cuttings were growing well while the remaining appeared dead.

On June 14 the second batch of rooted hardwood cuttings had been in the field one month. Health of the plants was similar to that of the first batch. We also noticed that 'Paradox' cuttings from greenhouse A had been set back and grew very slowly or did not grow at all while cuttings from greenhouse B continued to grow right from the greenhouse and were not set back after transplanting. On July 11, 745 out of a batch of 1,207 (62%)
cuttings had rooted. Those that had not rooted were left under shade where more continued to root. Each time more ‘Paradox’ cuttings were planted in the field, they were painted white to protect them from sunburn.

On May 5, three months after the first batch of ‘Paradox’ cuttings were planted in the nursery row, 210 of the 244 plants had survived (86%). Two months after the second Paradox cuttings were planted 268 of 311 plants from greenhouse B had survived (86.1%) and 178 of 234 plants survived (76%) from greenhouse A. Only 253 out of 745 plants survived (33.95%) that were planted July 11 (Table 1). On August 16, six months after the cuttings were taken, 548 of the remaining 781 ‘Paradox’ cuttings had rooted (70.1%). Those rooted cuttings were planted in the nursery row on August 16 and the rest of the cuttings were discarded. There was a delay in planting so these cuttings were never painted white. It is not known if that had an affect on their survival.

Stooling. During the summer, stooled shoots were checked for rooting. All of the shoots that had been tied with copper wire were girdled and produced callus. Some of the girdled shoots were well covered with moist sawdust and rooted. However, rooting was very sporadic and for many cuttings, roots were not distributed around the callused base uniformly.

Shoots that had rooted were removed from the stool bed on January 27, 1995, and planted out in the nursery row January 31 after their roots had been trimmed. A total of 366 rooted ‘Paradox’ cuttings from the stool bed were planted. The cuttings ranged in size from 5/16" to 1" in diameter. None of the cuttings were treated with auxin during the stolling phase or after they were planted out in the nursery row. Many of the cuttings had either one or two long roots emerging from one side.

Most stooled cuttings survived in the field and grew early, but only cuttings with good balanced root systems survived through the summer whereas cuttings with just one or two long roots wilted and died. Of the 355 planted on January 31, 289 had survived by June 9 (81.4%).

On July 25, 274 of the surviving stooled cuttings were patch budded to Hartley. Not all of the cuttings were budded because some were still too small being only 5/16" in diameter. On September 18, 1995 161 plants were growing well (58.7%) and most of the buds had pushed shoots one to two feet long.

CONCLUSIONS
Some observations on the rooting of hardwood ‘Paradox’ hybrid cuttings can be made from this research. Comparison of results of rooting and survival of cuttings propagated in the two different greenhouses showed that there was an earlier rooting response in greenhouse A with high humidity and constant high bottom heat compared to greenhouse B which was exposed to ambient temperature except for bottom heat throughout the rooting phase. Cuttings in greenhouse A were kept very wet, almost saturated. The temperature in greenhouse A was also kept relatively high. In contrast, cuttings in greenhouse B were exposed to the temperature of the outside air around their tops and a temperature ranging between 75 °F and 78°F at their bases. Wounding of the cutting bases did not seem to increase rooting; only one cutting out of 122 wounded rooted and survived in the field.

Rooting walnuts in a stool bed with girdling as the only treatment is possible. One advantage in propagating walnuts by stooling is that they survive well in the field after transplanting (81%). Stool bed cuttings can also be June budded. The cuttings were large enough to bud in early June and this could lead to larger trees at the time of digging in December. Stooling walnuts requires more space for the beds. The major problem with stooling has been low rooting and a tendency for one-sided root systems. The application of auxin in the form of a paste or spray at the base of the shoots where they are girdled might enhance rooting and produce more vigorous root systems. More work will be needed to refine procedures to make stooling practical for nursery production.

Table 1 Rooting of hardwood cuttings in 1995 research trials at Burchell Nursery.
<table>
<thead>
<tr>
<th>Number Cut</th>
<th>Date Planted</th>
<th>Greenhouse Used</th>
<th>Number Planted</th>
<th>% Rooting</th>
<th>Number Surviving</th>
<th>% Surviving</th>
</tr>
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<tr>
<td>3,600</td>
<td>May 5</td>
<td>A</td>
<td>244</td>
<td>13.3%</td>
<td>210</td>
<td>86.1</td>
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<tr>
<td></td>
<td>June 14</td>
<td>A</td>
<td>234</td>
<td></td>
<td>178</td>
<td>76.1</td>
</tr>
<tr>
<td>7,992</td>
<td>June 14</td>
<td>B</td>
<td>311</td>
<td>20.1%</td>
<td>268</td>
<td>86.2</td>
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<tr>
<td></td>
<td>July 11</td>
<td>A&amp;B</td>
<td>745</td>
<td></td>
<td>253</td>
<td>34.0</td>
</tr>
<tr>
<td></td>
<td>Aug. 16</td>
<td>A&amp;B</td>
<td>548</td>
<td></td>
<td>78</td>
<td>14.2</td>
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<tr>
<td>1,592</td>
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<td>2,082</td>
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