STOCKPLANT MANIPULATION TO ENHANCE ROOTING AND NURSERY SURVIVAL OF WALNUT CUTTINGS

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ABSTRACT

The main objective of this first year’s work was to propagate plants from tissue-cultured shoots and stem cuttings to establish cutting stockblocks at Burchell Nursery in Oakdale which will be used for experiments in subsequent years on manipulation of stockplants to enhance rooting and survival of cuttings. Our aim was to establish 100 plants from cuttings of each of four clones. This work was pursued using proprietary tissue culture techniques, semi-hardwood cuttings for Paradox clones, and layering of English clones grafted on black walnut seedlings. An inventory on November 20, 1999 showed that the following plants are established in the stockblocks at Burchell Nursery: 53 'Chandler', 31 'Vina', 17 Paradox 'Vlach', 8 Paradox '84-121' from tissue culture, and 87 'Vlach' from semi-hardwood cuttings. In addition, 112 Paradox '84-121' plants from semi-hardwood cuttings and 26 'Chandler' and 6 'Vina' from layered cuttings have been established in one-gallon containers. These plants will be planted in the stockblocks in the spring of 2000. Because of the poor rooting of 'Chandler' and 'Vina' by layering, we will plant grafted trees of these clones in the stockblocks to use in subsequent stockplant manipulation experiments. Tissue culture derived plants of all four clones are available for planting in the spring of 2000 to supplement those established in the stockblocks in 1999. A small experiment showed that newly planted Paradox 'Bowman Kuhn' cuttings can be severely pruned to soil level and survive to produce several shoots that can be used for making semi-hardwood cuttings. We also found that 8000 ppm potassium IBA can be used without injury to treat cuttings with etiolated bases.

OBJECTIVES

The overall goal of this project is to develop methods for rooting and nursery survival of walnut cuttings at a commercially acceptable level. We are pursuing this goal by establishing cutting stockblocks from tissue culture derived plantlets and cuttings so we can test the influence of 1) stockplant source (tissue culture vs. cuttings) 2) coppicing (severe pruning to soil level) and 3) stooling (etiolation) on rooting and nursery survival of rooted cuttings. Because stock-blocks for cuttings did not exist, the objective of work in the first year was the propagation and establishment of four clones (2 Paradox and 2 English) in stockblocks at Burchell Nursery in Oakdale.

PROCEDURES

Tissue culture derived plantlets were multiplied and rooted from January to March using proprietary procedures at a tissue culture laboratory in Salinas. After rooting in vitro, they were planted in containers, acclimated and grown in a greenhouse in Salinas. During April to June 1999, they were planted in two replicates in the stockblocks at Burchell Nursery with protection from half-gallon milk cartons. They received conventional nursery growing practices during summer and fall. 'Vlach' plants derived from cuttings were produced from semi-hardwood
cuttings rooted in 1997 and grown in the nursery during 1998. They were transplanted bareroot to stockblocks during April 1999 and received conventional nursery growing practices during summer and fall.

Paradox '84-121' plants were produced using semi-hardwood cuttings taken from the Paradox Clonal block at UC Davis on July 14 and 16. They were treated with 8000 ppm potassium indolebutyric acid (K-IBA) as a quickdip and stuck in individual solid-block medium (sponges). They were rooted under intermittent mist with bottom heat at 30°C (85°F) in a Pomology greenhouse at UC Davis. On September 26, rooted cuttings were transplanted to one-gallon containers and hardened off under long interval mist for one week in a greenhouse in Environmental Horticulture at UC Davis. Surviving plants were transferred to a lathhouse on November 11. An effort to root 'Chandler' and 'Vina' cuttings involved using layering of the two clones grafted on black walnut seedlings. Shoots were grown under etiolated (absence of light) conditions by growing them in tar paper cylinders. The resulting etiolated shoots were girdled by entirely removing a 2-cm piece of bark. The girdled portion of the stem was immediately treated with 5000 ppm IBA in lanolin paste. The treated area was covered with a damp mixture of peat:perlite (50:50 v/v). Both etiolated cuttings from just above the girdle, and cuttings from the green part of the shoot several inches above the girdle, were taken during the period of August 21 to September 8 and rooted in individual containers under intermittent mist with bottom heat at 25°C (78°F). Half of the etiolated and girdled cuttings were treated with 8000 ppm potassium IBA as a quickdip and half were not treated. All of the green cuttings from the apical part of the girdled shoots were treated with 8000 ppm potassium IBA. Rooted cuttings were planted in one gallon containers on November 5.

RESULTS AND DISCUSSION

As shown in the plot map (Figure 1), 100 tissue culture derived plants of each of the four clones and 100 cutting derived plants of 'Vlach' were planted as two replicates to establish the stockblocks at Burchell Nursery. Survival and growth to 12 inches or more for the tissue culture derived plants was quite low. Percent survival and growth for the four clones were as follows: 'Chandler' 53, 'Vina' 31, 'Vlach' 17 and Paradox '84-121' 8. This low survival rate may be due to the direct transplanting from the greenhouse to the field without an intervening cold treatment to break dormancy of quiescent buds. Additional tissue culture derived plants have been produced for planting in the spring of 2000 to supplement those already established. These plants will be given a cold treatment of 5 weeks or more before planting to enhance survival and growth. In contrast to the tissue culture derived plants, the semi-hardwood cutting derived plants survived quite well after bareroot transplanting with an 87% survival rate.

The rooting percentage for Paradox '84-121' semi-hardwood cuttings (32%) was about half of the best previous results but can probably be attributed to previously observed year-to-year variation in rooting ability of walnut cuttings. Of 197 cuttings that rooted, 112 have survived in one gallon containers. These will be planted in the stockblocks at Burchell Nursery in the spring of 2000. To assure that sufficient plants of Paradox '84-121' are available for our stockblock, hardwood cuttings will be propagated during December 1999.
The rooting results with 'Chandler' and 'Vina' cuttings were disappointing in that only about 8% of 'Chandler' and 1% of 'Vina' cuttings rooted. However, this is not too surprising in that English walnut clones are known to be very difficult to root. What was surprising was that the layering treatment was not effective in that only one 'Chandler' and one 'Vina' shoot produced roots before making cuttings. This may be due to rapid healing over of the girdle under the conditions used. For 'Chandler', rooting was as good for cuttings from the apical, green portion of girdled shoots, as for cuttings from just above the girdle (12%). In an effort to enhance rooting of layered English shoots, experiments will be carried out using greenhouse-grown stockplants during the coming year. Because of the poor rooting of 'Vina' and 'Chandler' cuttings, the stockblocks at Burchell Nursery will be planted with 'Vina' and 'Chandler' grafted on black walnut seedlings in the spring of 2000 for use in our stock plant manipulation experiments.

A small experiment to determine whether young plants can survive severe pruning (coppicing) showed that newly planted Paradox 'Bowman Kuhn' cuttings can be severely pruned to near soil level and survive to produce several shoots that can be used in making semi-hardwood cuttings. We also found that 8000 ppm potassium IBA can be used without injury to treat cuttings with etiolated bases.

We also made a few semi-hardwood cuttings from eight genotypes selected for vigor from the Paradox Diversity Study. Rooting percentages were low even though the stockplants from which the cuttings were taken were quite young. Three plants of BW216 and four plants of MX199 have survived and are growing in one-gallon containers.
Figure 1. Plot Map of the stockblock layout and experimental design at Burchell Nursery, Oakdale, CA. Each group is 50' long and will have 50 stock plants. The detailed view shows the planting pattern and spacing. All trees will be coppiced and those on the north side of the rows will be light grown (controls) while trees on the south side of the rows will be stooled (etiolated). The plot was established April-June 1999.

<table>
<thead>
<tr>
<th>Control</th>
<th>Open</th>
<th>Vlach</th>
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<tbody>
<tr>
<td>121 (4)</td>
<td>Vina (17)</td>
<td>Chandler (15)</td>
</tr>
<tr>
<td>121 (4)</td>
<td>Vina (14)</td>
<td>Chandler (38)</td>
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STOCK PLANTS FROM TISSUE CULTURE

<table>
<thead>
<tr>
<th>Control</th>
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<tbody>
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<td>Vlach (38)</td>
<td></td>
</tr>
<tr>
<td>Vlach (49)</td>
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STOCK PLANTS FROM CUTTINGS

Note: Numbers in brackets refer to the number of plants out of 50 planted that have grown 12" tall or more as of 11/19/99

PLANTING DETAIL