Severe Cutback of Stock Plant Influences Rooting in Shoots of *Quercus bicolor* and *Quercus macrocarpa*

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This experiment was conducted to determine the effect of severe stock plant cutback on rooting in two oak species *Quercus bicolor* and *Q. macrocarpa.* Field-grown plants were either cutback leaving a 0.04-m (1.6-inch) stump above soil level or left intact (not cutback) -1.7 m (66.9 inches) tall. Shoots arising from cutback treatments and intact plants were layered using a field layering technique and air layering, respectively. The rooting traits measured in this experiment were rooting percentage and the number of roots per shoot. Results showed significantly higher rooting percentages in layered propagules arising from severely cutback plants in both species (-77% in *Q. bicolor* and -70% in *Q. macrocarpa)* compared with air-layered shoots arising from intact plants (1% in *Q. bicolor* and 0% in *Q. macrocarpa).* Overall, pre-treatment etiolation increased rooting in shoots arising from cutback stock plants in both species.The results for the average number of roots per shoot mirrored that of rooting.

INTRODUCTION

The genus *Quercus* has some of the most spectacular shrubs and vigorous growing trees with desired genetic combinations that are of tremendous benefit to both nursery professionals and horticulturists. Unfortunately the difficulty involved in vegetatively propagating oaks has limited the availability of select hybrids and ecotypes with outstanding characteristics.

Lately, however, vegetative propagation of oaks has seen a promising turn of events with the development of a modified layering technique (Hawver and Bassuk, 2000; Amissah and Bassuk, 2004).

In woody plant species and more so in difficult-to-root plant species, rooting ability has been observed to decrease with increasing stock plant age. In oaks, the juvenile period, which is a period characterized by a plant's inability to flower or be induced to do so even under favorable environmental conditions, has been observed to last 20-30 years (Clark, 1983). However, the decline in rooting ability is noted long before the onset of flowering (end of the juvenile phase), which poses a challenge to the propagation of select woody plant species. This experiment was conducted to investigate the effect of severe cutback of stock plant on rooting in Q. *macrocarpa* and *Q. bicolor*

MATERIALS AND METHODS

Stock Plant Growing Condition and Environment. On 3 May 2004 field-grown 8-year-old *Q. bicolor* and *Q. macrocarpa* plants of seedling origin were either cutback leaving a 0.04-m (1.6-inch) stump above soil or left intact (for use as air layers). Upon evidence of bud swelling on the cutback stern, half the stumps were etiolated (grown in the dark by inverting a 4.5-gal pot covered with aluminum foil over the stump) and the other half left, uncovered, to grow in normal light.

TREATMENTS

Field Layering on Cutback Plants. Upon reaching a height of 0.08-0.1 m, shoots from both etiolated and light treatments had their lower 0.04-m portion painted with 10,000-ppm indole butyric acid (IBA) dissolved in 98% aqueous ethanol. After the IBA solution had dried, a bottomless pot was placed over the stock plant and a lightweight soilless mix (1 peat : 2 perlite, v/v) was filled in around the treated shoot bases. Treated plants were allowed to grow in the field for at least 3 months; during this time, the soilless mix around the treated shoots was kept moist with more soilless mix added as the shoots grew.

Air Layering of Intact Plants. The basal 0.05-m portion of softwood shoots arising from the top one-quarter section of intact plants (1.7 m tall) were painted with 10,000 ppm IBA dissolved in 98% aqueous ethanol. After the IBA solution had dried, a ball (-0.06 m in diameter) of moistened peat moss was placed in a 25-p.m-thick white polythene sheet of dimensions (0.18 m x 0.18 m) and secured around the treated section using twist ties. The experimental design used was a randomized complete block. Three hundred and seventy-one plants were used in this experiment (145 *Q. bicolor* and 226 *Q. macrocarpa).*

Parameters Studied. Three months after the last plant in the field had been treated, the bottomless pot and soilless mix were removed from around the plants and data measured on the number of shoots that rooted per pot as well as number of roots per rooted shoot. The same parameters were also taken for air-layered plants. Rooting data and number of roots per shoot were statistically analyzed using negative Binomial and Poisson regression models (PROC GENIVIOD) respectively, in SAS version 9.1.3 (2004).

RESULTS AND DISCUSSION

Rooting Results. Propagule origin and species had significant effects on rooting percentage with p values of ($p < 0.003$) and ($p < 0.020$), respectively. Rooting increased in cutback plants in both species compared with intact plants (Fig. 1). In addition, significant differences were found between cutback etiolated and cutback light treatments ($p < 0.001$) an indication that etiolation played an important role

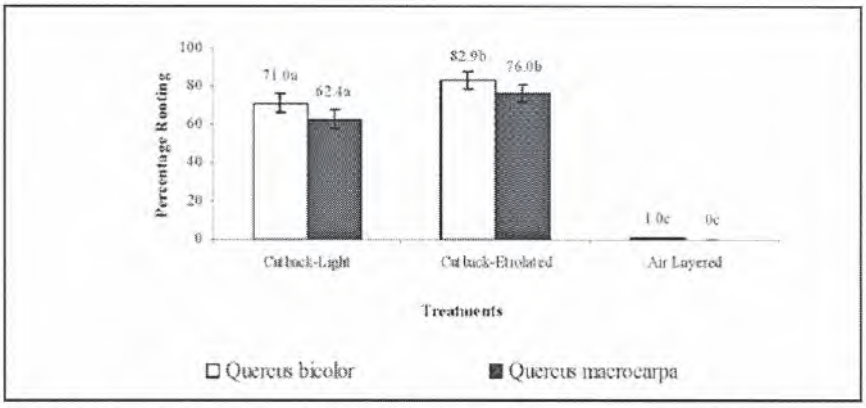

Figure 1. The effect of propagule origin on rooting in *Quercus bicolor* and *Q. macrocarpa.*

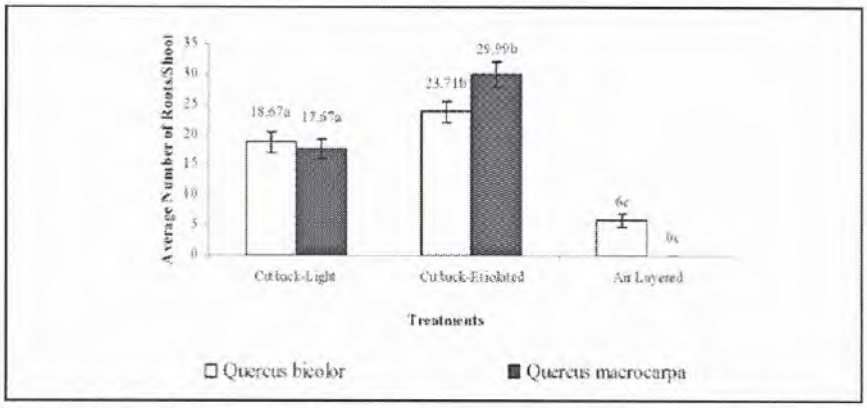

Figure 2. The effect of propagule origin on the average number of roots per shoot in *Quercus bicolor* and *Q. macrocarpa*.

in rooting. Overall rooting was better in *Q. bicolor* than in *Q. macrocarpa,* ($p < 0.01$). There was no interaction between the main effects, propagule origin, and species.

Number of Roots per Shoot (NRPS). The trend of results for NRPS mirrored that of rooting (Fig. 2). In addition, the NRPS was found to be higher in the cutback treatments (cutback-etiolated and cutback-light) than in intact air layered plants, $p < 0.001$.

CONCLUSION

Although the stock plants used were still in the juvenile phase of development, propagules arising from intact plants rooted poorly. Layered propagules arising from cutback stumps of *Q. bicolor* and *Q. macrocarpa* rooted better than air-layered propagules arising from distal parts of intact stock plants (~1.7 m tall). Etiolation as a pre-treatment aided rooting in cutback plants, which is consistent with the findings of Maynard and Bassuk, 1985.

Acknowledgements. The J. Frank Schmidt Charitable Foundation and International Society of Arboriculture TreeFund.

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