

## Cutting-Grown *Quercus*: The Future

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### INTRODUCTION

*Quercus* species are commonly produced from seed. Seedlings are variable in growth rate, foliage qualities, and adaptability to soil, light, and space restrictions. Seedlings are also variable in their tolerance to insect and disease problems. Selections of *Quercus* species are usually vegetatively propagated by grafting or budding. This method of propagation has had mixed results due to incompatibility with seedling rootstocks or the limited supply of seedling rootstocks for grafting or budding. Growing cultivars of *Quercus* species from stem cuttings would overcome the scion to rootstock incompatibility problem.

**Scion to Rootstock Incompatibility.** Incompatibility of the scion to rootstock has been the greatest limiting factor in the successful propagation of cultivars of *Quercus* species for the nursery industry. Hybridization between oak groups (white oak, red oak, and black oak) has been suggested as a factor for some of the incompatibility of scion to rootstock. Dirr (1990) reported that *Q. palustris* 'Sovereign' was incompatible when grafted to seedlings produced from acorns of the original 'Sovereign' tree. If 'Sovereign' pin oak could have been produced from stem cuttings, it would be an industry standard today, due to its excellent ornamental qualities.

**Successful Stem-Cutting-Grown *Quercus*.** Some cultivars of *Quercus* species have been successfully propagated by stem cuttings. The late J.C. Raulston distributed a stem-cutting-grown cultivar of *Q. phillyreoides* 'Emerald Sentinel'. Tree Introductions, Inc. has a patented *Q. virginiana* 'QVTIA' PPAF Highrise<sup>®</sup> that is cutting grown. Ray Bracken Nursery, Inc. is introducing a hybrid *Q. palustris* × *Q. phellos* that can be grown from stem cuttings.

**Cultivar Selection.** Cultivar selection is the first step in developing the future of cutting-grown *Quercus*. Selection of cultivars of *Quercus* species for aesthetic qualities, insect and disease resistance, cold and heat tolerance, and adaptability to environmental stresses are characteristics that are used to evaluate all ornamental plant selections. However, when selecting cultivars of *Quercus* species for own-root production, the potential for good rooting is very critical. A necessary consideration is the selection of vigorously growing cultivars, which produce quality liners that will adapt and survive transplanting. Abundant development of mycorrhizae in and on the roots and root zone is also important to successful plant growth.

**Mycorrhizal Importance to Plant Growth.** Mycorrhizal fungi are very important for a plant's survival and adaptability to poor soil conditions. Mycorrhizal development on the roots of cutting-grown cultivars of *Quercus* species has varied between species and cultivars of species. The growth rate between cultivars lacking mycorrhizae and those with mycorrhizae development on their roots has shown some differences. The ability to survive environmental stresses may be enhanced by mycorrhizae. Those cultivars that quickly develop mycorrhizae in their root zone may better adapt to environmental stresses and have greater survival at all stages of plant production.

Mycorrhizal fungi have been reported to enhance rooting and growth in ericaceous plants and should be further studied in *Quercus* cultivars.

***Quercus* Cultivars That can be Rooted.** *Quercus* species cultivars rooted to date are: *Q. acuta*, *Q. georgiana*, *Q. germanea*, *Q. glauca* (2 cultivars), *Q. laurifolia* (2 cultivars), *Q. marilandica*, *Q. nuttallii*, *Q. palustris*, *Q. palustris* 'Sovereign', *Q. phellos* (4 cultivars), *Q. phillyreoides* 'Emerald Sentinel', *Q. virginiana* (6 cultivars). Hybrid oaks such as *Q. palustris* × *Q. imbricaria*, *Q. palustris* × *Q. phellos*, *Q. laurifolia* × *Q. virginiana*, and *Q. marilandica* × *Q. nigra* have also been successfully rooted. These *Quercus* species and cultivars have varied in their ease of rooting. Younger trees rooted in higher percentages than very old trees. Evergreen types of *Quercus* have rooted better than deciduous types. Those cultivars having active development of mycorrhizae have rooted and grown faster than those with poor mycorrhizae development. There are many exceptions to the above statements and each *Quercus* cultivar must be evaluated for rootability, growth after rooting, production of lining-out stock, and production of finished landscape-sized plants. There seems to be no direct link between tree characteristics and rootability, so choosing several cultivars of a *Quercus* species with desirable characteristics and then testing to evaluate rootability and other desirable traits will have to be done. It will require years of evaluation to develop *Quercus* cultivars which will be able to be grown from stem cuttings for lining-out stock and then to finished landscape-grade trees.

**Tips For Successful Rooting.** A *Quercus* hybrid, *Q. palustris* × *Q. phellos*, was used for the rooting study, due to its ease of rooting. Stem cuttings were taken in July using 10- to 15-cm (4- to 6-inch) segments of new growth where the terminal buds had matured and leaves were matured and well formed. Cuttings do not have to be tip cuttings. The condition of the wood in relation to starch and auxin build-up has the most to do with how well the cutting roots, survives, breaks bud, and grows. Cuttings should have three or more leaves. Large leaves may need to be reduced to allow sufficient air and light penetration around each cutting. Rooting media can be any material that drains well. Peat, perlite, and pine bark (1:1:1, by volume) or any combination of these materials will work. A rooting media of one part perlite and two parts ground pine bark was placed in rooting containers for the study. The containers were 606 deep cell packs. There were 36 cells, 5.7 cm (2.3 inches) wide and 7.6 cm (3 inches) deep. The cuttings should not be stuck any deeper than 50% of the container height.

**Environmental Conditions for Rooting *Quercus*.** Cuttings in propagation structures should be under 50% to 70% shade. The geographical region, time of year, and frequency of irrigation dictates the need and degree of shade necessary for success. Irrigation should be frequent enough to keep the foliage moist during daylight hours. Irrigation intervals will vary, but 60 sec every 15 min will be adequate. Temperatures of the rooting media will be close to air temperatures during summer propagation periods, however in cold weather, the minimum temperature of the rooting media should be 16°C or 60°F.

**Auxins.** Auxins are needed to root *Quercus* species and cultivars. Concentrations vary from 3000 to 20,000 ppm depending on the cultivar, age of stock plant, cutting location on the stem, time of year, and stage of growth that the plant is in. Generally

a 10,000 ppm potassium salt formulation of IBA has the best rooting response. Auxins stimulate the initiation of roots and result in higher rooting percentages. Rooting time varies from 2 weeks to 3 months and is dependent on several factors. *Quercus* cultivar traits, age of stock plants, stage of cutting growth, stored carbohydrates, plant nutrition, and rooting co-factors of the cutting under environmental conditions determine the success of the cutting's survival.

**Rooting of *Quercus palustris* × *Q. phellos* Hybrid Oak.** Cuttings taken in July began rooting in 2 weeks and all rooted within 6 weeks. Thirty-six cuttings in varying stages of growth and positions on the stem were cut 10 to 15 cm (4 to 6 inch) long. Cuttings were quick dipped for 5 sec in a water solution of 10,000 ppm of KIBA. Propagation media is ground pine bark and perlite (2 : 1, v/v), respectively. Deep 606 cell packs were filled with rooting media and watered to settle the media in the cell packs. Treated cuttings were stuck one to each cell. Intermittent mist was set at 60-sec intervals every 15 min from 9:00 to 19:00. After 6 weeks, 34 of the cuttings were viable and 31 showed rooting by the tug method. Of the rooted cuttings, half were in stages of new growth.

## CONCLUSION

- Rooting of *Quercus* species and cultivars is possible if cultivars are selected for rootability as well as desired ornamental characteristics.
- Experimentation by propagators allows the development of successful rooting techniques of *Quercus* species and cultivars.
- Each *Quercus* cultivar may need different conditions for successful rooting. Also, different conditions may be needed in producing quality liners for lining-out stock in the production of landscape-size trees.
- Several cultivars of *Quercus* are currently being produced from stem cuttings and the future own-rooted *Quercus* should become more common.

## LITERATURE CITED

Dirr, M.A. 1990. Manual of woody landscape plants. 4th ed. Stipes Pub. Champaign, Illinois.