

***Tiarella cordifolia* (foamflower).** Foamflowers from low clumps of leaves with airy sprays of light pink or white flowers in late spring. *T. cordifolia* is a spreading species. Many of the newer cultivars are nonspreaders. Height: 15 to 30 cm (6 to 12 inch); spread: 30+ cm (12+ inch); Hardiness Zones 4 to 9; selections: 'Pink Brushes' maroon veining with quilted appearance [Source: Blooms of Bressingham] and 'Jeepers Creepers' with creeping fuzzy green leaves with a black pattern [Source: Terra Nova].

The Following Plants Will Tolerate Dry Shade: *Acanthus spinosus*, *Arum italicum* 'Marmoratum', *Cyclamen* species, *Epimedium* species, *Hedera helix*, *Iris foetidissima*, *Liriope muscari*, *Rubus tricolor*, *Symphytum grandiflorum*, and *Tellima grandiflora*.

Propagation of Oak Liners[®]

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INTRODUCTION

Oaks are relatively simple to propagate from seed. Problems generally occur with obtaining a uniform finished liner crop with a strong fibrous root system. At Mid Georgia Nursery we start oaks from seed, use air pruning and SpinoutW[®] and utilize multiple top prunings, thus producing a very uniform finished crop of 3-gal oaks in two growing seasons.

YEAR 1

Seed Treatment. Seed are first soaked in water overnight. The dead ones float and are removed, while the rest are dried off and placed in plastic bags for cold treatment. The bags of seed are then cold stratified in a refrigerator at 2°C (35°F). Cold stratification requirements vary between species. See Table 1 for stratification periods that we use. In the past, we have sown seed directly into pots in the fall and left them outside for "natural" winter stratification. However, the winters in Zone 7B have proven to be too inconsistent to depend on this method.

Establishment of Seedlings. The media used is a Graco blend of new pine bark, aged pine bark (not composted), and 6B gravel (5 : 4 : 1, by volume); 1.2 kg·m⁻³ (2 lb per yd) Step Hi Mag; and 4.8 kg·m⁻³ (8 lb per yd) dolomitic limestone. We have tried several types of small containers including Rootmaker and Anderson bands. Both work very well, but we currently use the 7 × 14 cm (2⁷/₈ × 5 inch) Anderson band for its more economical price and space utilization. Pots are placed in flats on benches in a heated greenhouse. The seed are planted from January to March depending on the stratification requirements. We like to have all stratified seed planted by early February, if possible. Planting is just deep enough to cover the seed with the radicle and acorn caps oriented sideways. The temperature is kept above 3°C (38°F) to encourage growth. Harrell's 15N-4P-9K, a 10-12 month controlled-release fertilizer with micronutrients and soluble potash is broadcast at the rate of 1/2 cup per flat. In the future we plan to incorporate this into the media.

Table 1. Number of days of cold stratification required for selected *Quercus* species.

<i>Quercus</i> species	Days required
<i>Q. acutissima</i>	90
<i>Q. alba</i>	0
<i>Q. bicolor</i>	90
<i>Q. lyrata</i>	60
<i>Q. macrocarpa</i>	60
<i>Q. michauxii</i>	60
<i>Q. texana</i> (syn. <i>Q. nuttallii</i>)	60
<i>Q. palustris</i>	60
<i>Q. phellos</i>	60
<i>Q. rubra</i>	60
<i>Q. shumardii</i>	100-120

Seedling root and shoot growth is monitored. The open bottoms of the Anderson bands allow the root system to be air-pruned. Within 3 months the seedlings are generally well-rooted and the tops range from 20 to 46 cm (8 to 18 inch) in height. At this time the seedlings are moved outside to a shade house to become acclimated for transplanting.

Finishing 1-Year Top. Seedlings are left in the shade house for 2 weeks prior to shifting-up. Plants are usually ready to be transplanted from April to June. To aid in transplanting, we made a 4-pronged stand made of steel that fits through the bottom of the Anderson bands to push the root ball out without having to pull it from the stem of the seedling. This helps keep the root ball intact and aids in transplant shock. The seedlings are shifted into 3-gal containers with Spinout® and placed close together in full sun. The media is the same blend used earlier with the addition of Harrell's 18N-4P-8K, a 9-month controlled-release fertilizer with micro-nutrients, incorporated into the media at the rate of 7.1 kg·m⁻³ (12 lbs. per yd³). The herbicide Regal O-O (Oxyfluoren and Oxadiazon) is broadcast on the surface of the cans and watered in thoroughly.

Water is monitored closely as the plants go through a shock period for a couple of weeks. Once the roots get established, the tops begin to take off. Usually from the end of July to mid-September when temperatures are in the 30+ °C (90+ °F) ranges, we add an extra water cycle in the afternoons to cool the plants down. From mid-September to early November the plants put on a good flush of growth and build up caliper. Most species obtain a height of 0.6 to 1.5 m (2 to 5 ft) during the first year's growth. The root systems will have extended to the edges of the container, but are not full enough to transplant. A fall herbicide treatment of Regal Kade (Prodiamine) is applied in early October.

At the end of November, we provide winter protection by surrounding the container beds with 1.3 cm × 0.6 m × 2.4 m (1/2 inch × 2 ft × 8 ft) sheets of foam insulation. This is reusable and a lot easier to work with than straw bales. When the plants are fully dormant (January), we winter prune to prepare them for the following season

of growth. All plants over 1.5 m (5 ft) are topped at 1.5 m (5 ft) leaving a 2.5 cm (1 inch) stub above the uppermost bud. Any branch within 10 cm (4 inch) of the terminal is removed. All lower branches below 20 cm (8 inch) are removed. All branches that are the same caliper as the trunk are removed. All clusters of branches of 3 or more are thinned to 2 branches. The remaining branches are trimmed back to 2.5 to 10 cm (1 to 4 inch) to form a very narrow pyramidal shape. The upper branches are trimmed to 2.5 cm (1 inch) graduating down to the lower ones at 10 cm (4 inch).

YEAR 2

Early 2-Year Top Work. From February to early March another dose of Harrell's 18N-4P-8K is applied by spoon feeding 70 g per plant. Regal O-O herbicide is also applied at this time. As new shoots emerge plants are spaced out to 0.5 m (20 inches) on center, with 0.6-m (2-ft) walkways every 3 m (10 ft), and 3.7 m (12 ft) spray isles every 12 m (40 ft). All plants are staked using 1.8-m or 2.1-m (6- or 7-ft) heavy bamboo.

Top work begins as the new shoots reach 7.6 to 15 cm (3 to 6 inches) in April. On trees that were topped or experienced any dieback, the uppermost new branch is taped to the remaining stub to form a new straight central leader. The masking tape we use is a good quality 3M product that holds up long enough to support the new leader until it is strong enough on its own. All trees that were not topped have the whorls of new branches around last year's terminal thinned so only two smaller branches remain with a strong central leader. We do whatever taping is necessary to get the trunk and new leader straight at this point because it will be impossible to fix later. The remaining branches near the leader have their terminals pinched to maintain a pyramidal form and ensure central leader domination.

Finishing 2-Year Top. Summer topping is needed when new leaders reach 0.5 m (20 inches) or more of growth. The leaders need to be topped 36 cm (14 inches) above last year's terminal leaving a 2.5 cm (1 inch) stub above the uppermost bud. By removing at least 15 cm (6 inches) of growth, another set of branches will be encouraged to develop. We never top plants below 1.5 m (5 ft). The branches are also pruned at this time to maintain a good pyramidal form. This topping and pruning makes the crop more uniform by slowing down the taller trees and allowing the smaller ones to catch up. It also promotes a better branching structure and height to caliper ratio.

As the new branches emerge around the pruned top, a new leader is selected and taped to the remaining stub just as we did in April. The branches are also pinched again to maintain the desired pyramidal shape. This summer topping and pruning process is repeated as needed up through early August. Some trees get topped a total of three times, while others are only topped once. We stop the pruning by early to mid-August because bud break can be very inconsistent afterwards.

As in the 1st year, water is increased in late summer by adding an afternoon irrigation cooling cycle to help keep the plants flushing well. Our biggest challenge toward the end of the summer is to keep the plants standing up because of the heavy top growth and wind. Future plans are to develop a trellis system to prevent this problem.

In late September we start working on inventory. All plants are graded by height in 30 cm (1 ft) increments. Colored tape is placed around the trunk of each tree with

a Max tapener to indicate size. Most plants grade out from 1.5 to 2.4 m (5 to 8 ft). Each species varies in their rate of growth but for the most part within a species, the plants finish out with only 2 sizes comprising the majority of the crop.

CONCLUSION

A superior crop of 3-gal oak liners can be established from seed in only 2 years by using diligent cultural practices. By using containers that root prune during the propagation phase and again during the finishing-out phase, we achieve a dense, well-branched, fibrous root system. By following a pruning program that includes winter topwork, multiple summer toppings, and branch trimmings, we achieve a well proportioned top with excellent branch structure and a very uniform crop. The result is a very consistent crop of oaks to plant in the field. The outstanding root system gives the plants an edge for years to come.

Hardwood Cuttings for Erosion Control®

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NATURE OF WORK

Reducing or preventing erosion in riparian areas requires minimal soil disturbance (Sauer, 1998.). One solution to this problem is to use live stakes which are "...woody plant cuttings capable of quickly rooting in the streamside environment. The cuttings need to be large and long enough to be tamped as stakes" which is usually 0.5 to 2 inches in diameter and 2 to 3 feet long. "Stakes are used on stream-banks of moderate slope (4 : 1) in original soil, not on fill." (USDA- Soil Conservation Service, 1984.)

The objectives were: (1) To evaluate the influence of IBA treatments on the percentage of stakes surviving in this challenging environment. (2) Determine which species are locally adapted to this technique. The site was Codorus loam along a spring fed stream located on the Mountain Horticultural Crops Research Station (MHCRS), Fletcher, North Carolina. (3) Evaluate how far from moist native soil adjacent to a stream that cuttings can be stuck before the soil dries out too much to allow a high enough percentage of cuttings to root and what influence does the slope of a streambank have on success. This test was conducted on similar soil but in an east-flowing stream adjacent so that cuttings could be stuck on north and south paired slopes. Soil was not tilled or fertilized nor was weed or other pest management implemented at any time during these tests.

Test 1. Stakes of *Alnus serrulata*, *Cornus amomum*, and *Salix nigra* were locally collected on 18 Dec. 2001 and kept moist. On 19 Dec. 2001 stakes were graded for uniformity and cut to length on a table saw. The bottom was pointed and the top cut perpendicular to the stem to facilitate soil penetration and to ensure that proper polarity of the cutting was maintained. Immediately after making a fresh cut, IBA treatments were applied. Treatments were a 1-sec dip of K-IBA/water solution at 0, 1250, 2500, or 5000 ppm IBA with five stakes per treatment and three replicates.

After IBA treatment, stakes were driven into the soil at the test site leaving at least 6 inches of the stake above the soil surface and at least one node below the soil