

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.

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## 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

Table 1. Percentage of stakes with living foliage on 4 Sept. 2002.

IBA (ppm)	Plant		
	<i>Alnus serrulata</i>	<i>Cornus amomum</i>	<i>Salix nigra</i>
0	0	100	100
1250	0	100	100
2500	0	87	93
5000	0	100	100

Table 2. Percentage of stakes with living foliage.

Plant	Date		
	27 April 2002	4 June 2002	4 Sept. 2002
<i>Acer negundo</i>	8	0	0
<i>Betula nigra</i>	72	47	14
<i>Physocarpus opulifolius</i>	94	94	86
<i>Platanus occidentalis</i>	53	56	33
<i>Sambucus canadensis</i>	53	56	25

Table 3. Percent of lives stakes with living foliage on 27 Aug. 2002.

Feet above stream	South Face			North Face		
	<i>Alnus serrulata</i>	<i>Cornus amomum</i>	<i>Salix nigra</i>	<i>Alnus serrulata</i>	<i>Cornus amomum</i>	<i>Salix nigra</i>
5	0	67	0	0	100	0
4	0	100	0	0	100	0
3	0	67	0	0	67	0
2	0	67	33	0	67	0
1	0	67	33	0	0	0

surface. Stakes were on 6-inch centers with treatments randomized within replicates. Replicates were parallel to the stream such that any soil moisture gradients due to flooding or drought would likely occur within replicates.

**Test 2.** Stakes of *Acer negundo*, *Betula nigra*, *Physocarpus opulifolius*, *Platanus occidentalis*, and *Sambucus canadensis* were prepared as described previously but not treated with IBA. Twelve stakes per replicate with three replicates were employed in the test. Otherwise procedures were similar.

**Test 3.** Procedures and species were the same as for Test 1. Cuttings were inserted into the embankment perpendicular to the slope on either side of the stream. The first cutting was inserted 1 ft above water level. The next cutting was inserted 2 feet above the water, the next 3 ft, then 4 and 5 ft above the water level of the stream. Different species cuttings were placed adjacent to the first, a foot apart. There were five cuttings of each plant at each elevation from the stream in each of three replicates. All cuttings were inserted on 20 Dec. 2001.

Survival was determined by bud break from these dormant deciduous shrub cuttings. Data was collected on 27 April 2002, again on 6 June 2002 and 4 Sept. 2002 for Tests 1 and 2, last data collection for test three was 27 August 2002.

## RESULTS AND DISCUSSION

**Test 1.** The percentage of plants with living foliage in June and September were lower than those in April suggesting that some buds broke without a root system to support growth so plants died. No significant difference in the number of stakes with living foliage existed due to treatments (Table 1).

**Test 2.** Many successive weeks without rain occurred during Summer 2002 at MHCRS. *Betula nigra*, *P. opulifolius*, *P. occidentalis*, and *S. canadensis* had 47% or greater stakes with living foliage on 4 June (Table 2). There was no living foliage on *A. negundo* at that date. By September survival had dropped dramatically, possibly due to drought.

**Test 3.** No *A. serrulata* survived. *Cornus amomum* survived in excellent percentages except immediately adjacent to the stream where cuttings were totally submerged during spring high water. *Salix nigra* survived only on the south facing slope at the two elevations closest to the stream (Table 3).

## SIGNIFICANCE TO THE INDUSTRY

- There was no benefit to treating live stakes with the concentrations of IBA used in this test. U.S.D.A.-recommended species *C. amomum* and *S. nigra* survived at greater than 50%. U.S.D.A.-recommended species *A. negundo* did not live.
- *Physocarpus opulifolius* survived in high percentages and should be added to suggested species lists for the region.
- *Betula nigra*, *P. occidentalis*, and *S. canadensis* survived in lower percentages, perhaps due to extended dry summer weather. *Alnus serrulata* did not survive.
- Of the three species evaluated for capacity to root in soils further from the stream, only *C. amomum* survived in acceptable percentages.

## LITERATURE CITED

- Sauer, L.J. 1998. The once and future forest. Island Press. Washington, DC. pp. 249- 251.  
USDA- Soil Conservation Service 1984. Engineering Field Handbook. Washington, D.C. U.S.D.A.. 8:7-11.