Evaluation and Propagation of Lacebark Elm Selections by Hardwood and Softwood Cuttings

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The many new cultivars of lacebark or Chinese elm that are being introduced require increased vegetative propagation of the species. Conventional softwood cuttings were used to propagate superior selections. IBA concentrations of 5,000 to 10,000 ppm produced 73% to 93% rooting of wood collected from two mature specimen trees in May and June. Hardwood cuttings taken in February from vigorous young trees rooted up to 100% at 10,000 ppm IBA and established well in the nursery. Rooted hardwood cuttings produced over twice the growth of softwood cuttings taken the same season. Many new selections are under evaluation.

INTRODUCTION

Although lacebark elm (*Ulmus parvifolia* Jacq.) is traditionally produced from seed collected from this autumn-flowering species, the recent surge in introduction of new cultivars necessitates vegetative methods of propagation. The growing popularity of this Asiatic species can be attributed to its wide geographic adaptation; heat and drought tolerance; resistance to elm leaf beetle and Dutch Elm Disease; and its picturesque, flaking bark.

Improved selections include the familiar, but somewhat tender 'Drake', hardy to zone 7; 'Dynasty', from the National Arboretum, selected for its distinct vase shape (Santamour, 1984); and 'King's Choice' (PP 5554), a vigorous type selected at Hamstead, Maryland.

Recent introductions include 'Aross Central Park', reflecting the location of the 100-year-old parent tree growing in New York City (Karnosky, 1988), and two patented selections, Athena™ and Allee ™ (originally named 'Emerald Isle' and 'Emerald Vase', respectively), from the University of Georgia (Dirr and Richards, 1989).

Some cultivars offer the added advantage of fall color, e.g. 'Burgundy' (Dirr, 1990) and 'Pathfinder', a disease-resistant, U.S.D.A. release with grayish-red fall foliage (Higginbotham, 1992). Some new hybrids also possess good insect and disease resistance. Most of these are under evaluation at the Kansas State University, Horticulture Research Center at Wichita, Kansas. Additional clones being evaluated resulted from superior specimens identified by nurserymen and from breeding and selection programs in other states.

Lacebark elm has been shown to root easily from softwood cuttings (Dirr and Frett, 1983; Hickman and Whitcomb, 1983), but limited success has resulted with use of hardwood cuttings. Several advantages are offered by the latter technique, including: (1) winter pruning wood can be utilized, (2) no mist system is required, (3) cuttings can be lined out the same season, and (4) the need for winter protection and storage of potted liners produced by softwood cuttings can be avoided.

MATERIALS AND METHODS

Softwood Cuttings. Availability often dictates time of sticking cuttings. Such was the case when the opportunity occurred to obtain cuttings from the champion Lacebark elm in Garden City, Kansas, and a large specimen tree on the Iowa State University campus, Ames, Iowa. Cuttings were first obtained from the large Garden City tree in late May, 1989 and given treatments of 5,000, 10,000, or 20,000 ppm IBA or Hormodin No. 3 (8,000 ppm). Untreated cuttings served as controls. The highest hormone treatment was not used in later experiments. Short terminal shoots from the Ames tree were provided by Jeff Isles, Extension Horticulturist at Iowa State University, in early June, 1992. Cuttings were prepared from 1-year wood, but occasionally 2-year wood was used to achieve 4- to 6-inch-long cuttings. After lower leaves were stripped, which caused some wounding, cuttings were given a quick dip in 2,500, 5,000, or 10,000 ppm liquid IBA on June 8 and stuck in perlite : peat (70 : 30, v/v) or 100% sand and placed under intermittent mist. Untreated cuttings served as controls. Rooting was evaluated and cuttings were potted on July 16, 1992.

Hardwood Cuttings. Various selections under evaluation at the Kansas State University, Horticulture Research Center, grown from northern seed sources that had shown superior growth and foliage characteristics plus excellent hardiness, were selected for propagation by hardwood cuttings and further evaluation. Terminal cuttings, approximately 6 to 8 in. in length, were taken on February 4, 1991 from several 3-year-old nursery grown trees during a regular pruning exercise. The vigorous growth produced in the previous season gave cuttings averaging approximately 0.35 cm in diameter at the base. Cuttings were untreated (control) or given a quick dip in 10,000 or 20,000 ppm liquid IBA prior to sticking in a perlite : peat medium (70 : 30 v/v) placed over bottom heat of 70°F. The cool greenhouse was maintained at 50°F night temperature, but often reached 80°F in the daytime. Cuttings were misted twice daily by hand and more frequently as leaves appeared. The experiment was repeated in 1992 with a similar group of plants, including 'Dynasty' as a standard.

RESULTS

Softwood Cuttings. In both cases with older trees from Garden City and Ames, softwood cuttings were successful in cloning these mature specimens. Up to 93% rooting occurred with the Garden City tree, but no improvement occurred above 10,000 ppm IBA (Table 1). Therefore, the highest treatment was dropped when propagating the Ames, Iowa tree. Also, the Ames cuttings were placed in 100% sand and perlite : peat (70 : 30, v/v), but because of a shortage of cuttings, the control group was omitted from the latter medium. Hormodin No. 3 (8,000 ppm IBA talc) did not appear to be as successful as liquid IBA. Media did not appreciably affect rooting of the Ames cuttings, although percentages were not as high as those for other cuttings rooted previously. Only 53% rooted in sand at 5,000 and 10,000 ppm IBA, but the percentage increased to 73% at the higher concentration in perlite : peat (Table 2).

Table 1. Rooting of softwood cuttings of lacebark elm from Garden City, Kansas[1]

IBA (ppm)	Rooting (%)	Quality rating[2]
0	51	2.0
5,000	87	3.0
10,000	93	4.0
20,000	83	4.3
Hormodin No. 3	82	2.5

[1] Stuck on May 31, 1989 in Sunshine No. 4, with intermittent mist 6 sec every 7 min.
[2]Rated on scale of 1 to 5 with 5 = most roots (mean of 20 cuttings per treatment).

Cuttings were potted on July 6 in Anderson Die 3-5/8-× 6-in. square containers in Metro-mix 510. Potted plants were grown inside the greenhouse until September, then acclimated outdoors in preparation for winter storage in an unheated polyhouse. Height of the Ames cuttings averaged 12.6 in. at the end of the season.

Table 2. Rooting of softwood cuttings of lacebark elm from Ames, Iowa[1] .

	Sand		Perlite:peat	
IBA (ppm)	Rooting (%)	Roots/rooted cutting	Rooting (%)	Roots/rooted cutting
0	7	1	omitted	omitted
2,500	47	17	53	7
5,000	53	13	40	9
10,000	53	13	73	10

[1] Stuck on June 8 and evaluated on July 16, 1992 (average of 15 cuttings per treatment).

Hardwood Cuttings. Rooting varied from 0% to 100%, depending on treatment, but most selections rooted quite well, especially at the 10,000 ppm IBA concentration. Of the 36 seedlings compared, only two showed improved rooting at the 20,000 ppm IBA concentration. Several rooted from 20% to 50% without hormone treatment, but percentage rooting and number of roots per rooted cutting were consistently best at 10,000 ppm. Cuttings with greater caliper seemed to root best, perhaps because of a greater supply of accumulated carbohydrates in stem tissue, but this trend was not consistent. Not all data are reported, but a representative example of five selections, including 'Dynasty', is shown in Table 3.

Cuttings were sufficiently rooted in 5 weeks to be lifted for potting on March 13. Liners were grown for 2 months in 3 - × 6-in. bands filled with sawdust : peat : sand (3 : 1 : 1, by volume) amended with Osmocote 17-6-10 plus minors at 8 lb/yd^3 plus

dolomite lime at 5 lb/yd^3. Plants were well enough established to line out in nursery rows on May 23, 1991, before the time to begin sticking softwood cuttings (Fig. 1). Additional fertilizer was supplied at the rate of 100 lb of nitrogen per acre using 13-13-13. Growth at the end of the first season ranged from 25 to 38 in. (Table 3). This is over twice the growth made by softwood cuttings, which have to be stored with winter protection for lining out the following spring.

Table 3. Rooting and growth of lacebark elm hardwood cuttings[1].

Elm clone	Source	IBA (ppm)	Rooting (%)	Roots/ cutting	Seasons growth (in.)
C-10	Expt. Sta. Colby, KS	0	0	0	
		10,000	100	4	33.0
		20,000	0	0	
Dynasty	National Arboretum Wash., DC	0	0	0	
		10,000	100	3	27.0
		20,000	20	2	
GC-41	Expt. Sta Garden City, KS	0	0	0	
		10,000	100	7	25.0
		20,000	0	0	
MA-34	Morton Arb. Lisle, IL	0	40	3	
		10,000	100	8	29.5
		20,000	100	6	
MR-17	Morton Residence Wichita, KS	0	0	0	
		10,000	60	4	38.0
		20,000	20	2	

[1]Stuck on February 4, evaluated and potted on March 13, and lined out in nursery rows on May 23, 1991. Growth was measured at the end of the first season.

DISCUSSION

It is recognized that numerous methods of vegetative propagation including budding, grafting, softwood and hardwood cuttings, and tissue culture for some cultivars, can be used to mass-produce this versatile tree. Individual cultivars may vary slightly in their hormone concentration requirement, but 10,000 ppm IBA appears optimum for hardwood cuttings. The technique has worked well on certain selections for 2 years and provides both an easy method and twice the growth of softwood cuttings. A full summer's growth produces plants 2 to 3 ft tall in the same season in which cuttings are taken and avoids the need for winter protection required by softwood cuttings.

Figure 1. Hardwood cutting of lacebark elm ready for lining out by the time softwood cuttings are stuck.

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