THE MARRIAGE OF OBSERVATION AND RESEARCH FOR THE IMPROVEMENT OF WOODY PLANT INTRODUCTIONS

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How many new plants pass muster in the marketplace over the long haul? Forty percent, you say. I venture to estimate less than 5% withstand the test of time. In the fourth edition of the Dirr *Manual* 50 new *Malus* cultivars, 15 new *Spiraea* cultivars, and 10 new *Acer rubrum* selections are included. The question has been asked many times relative to what is known about the new plant's performance capabilities? In most instances, absolutely nothing. Let's take one of Father Fiala's 33 new *Malus* introductions and examine its attributes (2).

'Ballerina' is described as "small, upright rounded, heavily flowering tree to 15 ft high; leaves dark green, disease resistant; white buds opening to large, very cupped, white, single but showy blossoms; fruits, 2/5 to 1/2 in., bright yellow, persistent to hard frosts. Excellent tree for narrow places."

Does this information really tell one *anything* about geographical and cultural adaptability? Certainly not! In Athens, Georgia will this crabapple receive sufficient chilling hours to overcome bud rest? Although touted as disease-resistant, will this attribute hold true in the heat and humidity of Washington, D. C.? Will the plant be cold-hardy in Fargo, North Dakota, or heat-tolerant in Orlando, Florida? Actually, none of these questions can be answered.

Most new woody plant introductions have been discovered through casual or focused observation. Even the progeny from controlled breeding programs were selected more for aesthetics than any other characteristic. Dr. Donald Egolf, Dr. Elwin Orton, and Dr. Harold Pellett's programs have focused on beauty, but also disease-resistance and cold-hardiness.

No individual or program can determine all the desirable traits of a potential introduction; however, many important characteristics can be predetermined. The following are a few that might be applied to any new introduction:

- Cold tolerance (including acclimation, midwinter hardiness, and deacclimation).
- Heat tolerance.
- Drought tolerance.
- Salt tolerance.
- Air pollution tolerance.
- Wet soil tolerance.
- Acid and alkaline soil tolerances.
- Chilling hours—(Hours below 45 °F necessary to overcome bud rest; important for introductions selected from northern seed provenances that will be sold in southern markets).
- Insect and disease resistances.
- Propagability—(Dr. Egolf's latest crape myrtle introduction's include 'Wichita', a cultivar almost impossible to root in commercial quantities).
- Adaptability to container and/or field production systems.
- If field-grown, ease of transplanting.
- Branch flexuosity—(Sufficient so branches are not easily broken in shipping and handling).
- Rate of growth—(Ability to fill a container in an economic time frame, or produce larger caliper).
- Density of crown at a young age—(This is one reason for Bradford pear's salability as a young tree).
- Wound healing capacity.
- Thickness of bark.

The possible criteria are endless but the above examples stress the importance of asking questions about a new introduction's performance capabilities. In our program, we have several potential introductions that may be superior to anything on the market. Most were selected from established plants growing under Zone 8 (USDA) conditions (+10 to +20 °F). The lowest recorded temperature in Athens, Georgia was -3 °F and all plants discussed herein survived without injury. Our goal was to utilize laboratory techniques to determine the acclimation, midwinter hardiness, and deacclimation of the potential introductions. Previous work (1) indicated that laboratory data corresponded with the field cold hardiness of known *Acer rubrum* cultivars. All potential introductions will be laboratory tested. We believe the data will provide an early barometer of the northern geographical adaptability.

POTENTIAL INTRODUCTIONS

***Acer rubrum* 'Edna Davis', Edna Davis red maple.** A 30-year-old tree in Athens offers consistent orange-red to red fall color. This is a seedling of var. *drummondii*, the southern type. The dark

green leaves are smaller than 'October Glory' and 'Red Sunset'. The habit is medium pyramidal with branches uniformly and densely spaced throughout the canopy. Parent is 35 ft high and 25 ft wide. This selection may require less chilling hours than 'October Glory' which cannot be grown successfully in south Georgia. Cuttings root readily when treated with 5000 ppm K-IBA quick dip, and placed in perlite:peat (2:1 v/v) and mist. Cold hardiness tests will be conducted during 1989-1990.

***Nyssa sylvatica*, black tupelo.** As yet an unnamed clone with superb scarlet fall color. The leaves are larger than typical, more leathery, lustrous, and dark green. Habit is typical for the species. The parent female tree is 25 ft tall and 15 ft wide. Dr. J. C. Raulston has successfully March-grafted it on seedling understock.

***Ulmus parvifolia*, Chinese or lacebark elm (four selections).** **'Emerald Isle'** is a broad-spreading elm with a rounded crown resulting in a pleasing globe-shaped outline. It measured 30 ft high and 54 ft wide. At 3 ft from the soil line, the mature tree has a 30 in. diameter trunk and an 88 in. circumference.

The bark exfoliates 2 ft from the ground in a puzzle-like pattern, exposing light gray and gray-green to orangish brown colors. The bark is flecked with orangy brown, corky lenticels. The trunk's base develops a rough, blocky, gray-black bark.

The leathery, lustrous dark green (almost black) foliage is densely borne at the ends of the fine branches, creating a dense canopy. The leaves are more leathery and darker green than the typical phenotype. Fall coloration is bronze-brown and not really effective.

'Emerald Isle' showed no symptoms of leaf scorch during the 1986-88 summers, which have been the driest on record in the Southeast. The tree is also highly resistant to Dutch elm disease and elm leaf beetle.

The leaves are alternate and simple, 1 to 2 in. long and 1/2 to 7/8 in. wide. They are ovate to slightly obovate and lustrous dark green, almost black-green on the top and grey-green on the bottom. Leathery to touch, the leaves can be acute or obtuse. They are oblique and have simple rounded serrations. They are glabrous on both sides and exhibit 10 to 16 vein pairs. The petioles are 1/8 to 1/4 in. long, light green and pubescent. The cultivar's chestnut brown buds are ovoid, imbricate, slightly pubescent, 1/8 in. long and slightly divergent.

In the first year, the stems are fine-textured, terete, brown, and pubescent. By the second year, the stems turn gray-brown and glabrous with small orangy brown lenticels. The pith is small, solid, and brown.

'Emerald Vase' is an upright-spreading tree (Figure 1) with an outline similar to that of American elm. It measures 70 ft high and

59 ft wide. At 4 ft from the soil line, the mature tree has a 35 in. diameter trunk and a 110 in. circumference.

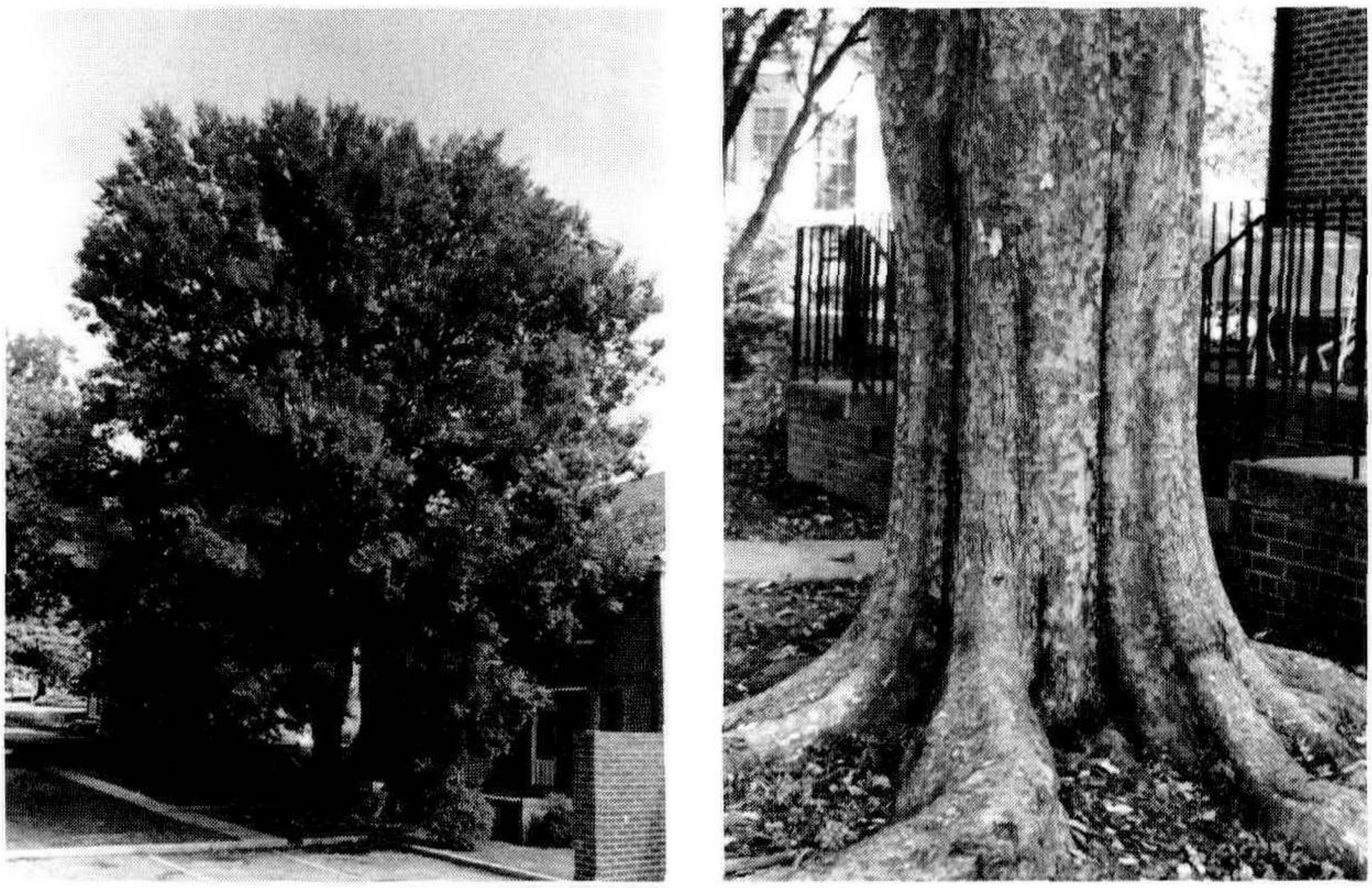

Figure 1. *Ulmus parvifolia* 'Emerald Vase'. *Left.* Note vase-shape of tree. *Right.* Bark exfoliates in a puzzle-like pattern.

The bark exfoliates in a puzzle-like pattern (Figure 1) exposing light gray, slate gray, gray-green, and orangy brown colors; it is flecked with burnt orange corkish lenticels. The exfoliation begins at the base of the trunk and continues upward to include upper branches 1 to 2 in. in diameter. Surface roots also exfoliate. Unlike the typically rounded trunk of the species, the trunk is irregularly fluted.

The lustrous rich green foliage is densely borne at the ends of the fine branches, creating a dense canopy. Leaf color and texture are typical of the species. Fall color is a subdued yellow. Despite the record drought conditions, no leaf scorch or dieback symptoms are evident. In addition, the parent tree is thriving in an 18 ft by 18 ft area surrounded by concrete. 'Emerald Vase' is also highly resistant to Dutch elm disease and elm leaf beetle. The leaves are alternate and simple, ¾ to 2 in. long and ⅜ to ¾ in. wide. They are ovate to slightly obovate, lustrous bright green on the top and gray-green on the bottom. They can be acute or obtuse, oblique, with simple serrations that are slightly more pointed than those on 'Emerald Isle'. The leaves are glabrous on both sides and show 11 to 16 vein pairs. The petioles are 1/8 or 1/4 in. long, light-green, and

pubescent. The chestnut brown buds are ovoid, imbricate, slightly pubescent, 1/8 in. long and slightly divergent.

During the first year, the stems are fine textured, terete, brown, and pubescent. In the second year they turn glabrous and gray-brown, with small orangy lenticels. The pith is small, solid, and brown.

Table 1 presents a cold hardiness profile for the two Emerald introductions. Although maximum cold hardiness of 'Emerald Isle' in December, 1988 and January, 1989 was -11°F, both introductions acclimate (harden) early in fall, and deacclimate (deharden) late in spring. They are the first of the introductions to drop leaves in fall and the latest to leaf out in spring.

Table 1. Lowest survival temperature in degrees F (LST)[1] of *Ulmus parvifolia* 'Emerald Isle' and 'Emerald Vase', collected from August 31, 1988 to May 16, 1989.

08-31-88	10-04-88	11-16-88	12-01-88	01-19-89	03-15-89	04-12-89	05-16-89
'Emerald Isle'							
16	16	10	-11	-11	-6	10	21
'Emerald Vase'							
16	16	16	-6	-6	0	16	16

[1] LST refers to the lowest temperature at which the plants were not injured; i e., on 12-1-88, 'Emerald Isle' survived -11°F but was killed at the next low temperature increment.

'Burgundy' is vigorous with a rounded outline and leathery, lustrous, dark-green leaves that turn wine-red in November. Parent tree is estimated at 7 to 8-years-old. Leaves persist into December in Athens, Georgia, and we suspect it will be less cold hardy than 'Emerald Isle' and 'Emerald Vase'. The bark is exfoliating with orange-brown inner bark. The mosaic, jigsaw-puzzle bark is not yet evident. Of all the selections this is the easiest to root, with 90/or greater success using June and July softwoods and a 5000 ppm K-IBA quick-dip.

The fourth, an unnamed clone from South Carolina is a splendid oval-rounded, billowy, cloud-like, rich green foliaged form with handsome exfoliating bark. Bark shows the exfoliating, jigsaw puzzle pattern in colors of gray, brown, and orange-brown on the mature trunk to 1 to 2 in. diameter branches. This is, perhaps, the handsomest form in an open-grown situation and offers a distinguished and refined canopy. Parent tree is 50 ft high and 40 ft wide. To date, it has been the most difficult to propagate.

***Magnolia grandiflora*, southern magnolia (three selections).** The devastating cold winters of 1976-77, 1977-78, and 1983-1985 provided a great screening for the southern magnolias in

Cincinnati's Spring Grove Cemetery and Arboretum. Several plants survived in fine form. Temperatures were -25 °F or lower on two separate occasions. We are currently testing the survivors and are hopeful that observed field survival corresponds to laboratory values. Thomas Smith, Leonard Thomas, and Matthew Vehr of Spring Grove are cooperating on this project.

Spring Grove #16. This is the smallest (4 to 5 in. by 2 to 3 in.) and most handsome foliage form. Currently 25 ft high and 39 ft wide, 20 in. diameter at 5 ft; densely branched and foliaged. The leaves are the most lustrous dark green of the three selections with a brown indumentum (pubescence) on their undersides. The indumentum is the heaviest of the three selections.

Spring Grove #19. A dense broad pyramidal form with larger (6 to 7 in. by 3 to 4 in.) leaves than #16. The lustrous green leaves are moderately pubescent on the underside. Will be a better plant for restricted space. Parent plant is 32 ft high and 27 ft wide with a 16 in. truck diameter at 6 in.

Spring Grove #43. Slightly smaller than #19 with a similar habit and perhaps a darker green leaf with the least pubescence on the underside. From a distance too similar to #19 to be distinguishable. Currently, 22 ft high and 19 ft wide with two trunks joined at ground level; one 7.4 in., the other 8.3 in.

All selections have been propagated from August firm-wood cuttings using a 10,000 ppm NAA-50% alcohol 5-sec dip, perlite, and mist. Rooting takes 6 to 10 weeks. [Fortunately the best form (#16) is the easiest to root.]

***Hydrangea quercifolia*, oakleaf hydrangea.**

'Alice' is a large flowered form with 14 in. long inflorescences and sterile florets covering the fertile flowers creating a dense inflorescence. Parent plant is 10 ft high. The leaves are larger than typical but the plant is growing in a shady environment. Fall color is a pleasing wine-red.

'Alison' is a cultivar that initially we did not believe was as good as 'Alice' but the flowers are held upright and the sterile florets are dense and cover the bulk of the fertile flowers. Inflorescences range from 6 to 8 in. long. Fall color is wine-red. The habit is broad-mounded and the parent plant about 8 to 10 ft high and 12 to 15 ft wide.

June to August cuttings are successfully rooted with 3000 to 5000 ppm K-IBA-quick-dip, perlite, or perlite:peat (2:1, v/v), mist. Plants, when transplanted to a one-gallon container, will be full and dense by September-October of the same propagating season, especially those rooted early in the season.

Cornus mas. An unnamed clone of this species was selected by the Spring Grove Cemetery Arboretum and horticulturists for its tree-like habit, non-suckering nature, and more leathery lustrous

dark-green foliage. Parent tree is 15½ ft high and 23½ ft wide with a 7.4 in. trunk diameter at 6 in. The species is adaptable to extremes of soil and climate. This new selection might be a good small street or container tree. Currently being cold hardiness tested.

The plants discussed may prove exceptional, or fall in the vast wasteland now occupied by former promising introductions. Numerous factors contribute to the success of a particular introduction. The bonding of observation and research permits a much earlier assessment of a plant's potential than the traditional trial and error method. In the future, we estimate that laboratory research tests will have a profound impact on whether a plant is released.

LITERATURE CITED

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2 Spongberg, S A. 1989 Cultivar name registration at the Arnold Arboretum, 1987 and 1988 *HortScience* 24:433-434.