

SUPERIOR SHADE TREE SELECTIONS FOR THE SOUTHEASTERN UNITED STATES

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Abstract. A 13-year study at the Auburn University Piedmont Substation has evaluated over 200 different trees. Data collected have included attrition, growth rate and ornamental characteristics. These data have provided information which nurserymen, landscapers and urban foresters use to select tree species and cultivars for residential and urban settings. Among trees showing superior performance in criteria used in the evaluation are *Acer rubrum* cultivars, *Betula nigra* 'Heritage', *Nyssa ogeche*, *Pistacia chinensis*, *Quercus prinus*, *Quercus lyrata*, *Quercus acutissima*, *Quercus shumardii* and *Taxodium distichum nutans*.

Evaluation of new, different and superior plants provides valuable information for consumers, landscape architects, designers, contractors, arborists, utility companies, urban foresters and commercial plant producers. In the past, consumer recommendations for trees to be planted were based on first-hand observation, nursery advertisements or popular literature. Differences in climate, soils and urban environment result in differential plant response in varying geographic regions.

Current tree evaluations exist in various locations across the United States, including Oregon, Kansas, Ohio, New York and Alabama. Results from these tree evaluations have demonstrated the need for regional tree evaluations. Hensley et al. (3) evaluated five tree species or cultivars at numerous sites across Kansas. Their research showed 'Caddo' sugar maple to have the best establishment and subsequent survival of the five selections. Fare et al. (1) reported consistent fall color with four of nine *Acer rubrum* cultivars evaluated over a four year period. One of the most widely recommended and planted red maple cultivars, 'Red Sunset', did not have consistently good fall color each year, although in other regions of the United States it does. In another report, Fare

et al. (2) observed that two ornamental pears ('Aristocrat' and 'Autumn Blaze') were highly susceptible to fireblight (*Erwinia amylovora*). 'Aristocrat' was planted in numbers in the early 1980s as a replacement for 'Bradford' pear due to 'Bradford' pear's structural problems. Of the ornamental pears evaluated, 'Bradford' was the least susceptible to fireblight.

The Auburn University shade tree project was initiated in December, 1980 with the planting of about 2,000 trees. Since that time additional plantings have been added. The project provides a side-by-side comparison of new cultivars, as well as other trees that have been overlooked in the nursery industry (4). The objective of the study is to provide information about the important characteristics and adaptability of some selected shade and ornamental trees for the southeastern United States.

Materials and Methods

Among the over 200 kinds of trees installed in the evaluation, initial plantings of *Acer rubrum* and *Acer rubrum* cultivars 'Armstrong', 'Bowhall', 'Scarlet Sentinel', 'Tilford', 'Schlesingeri', 'Gerling', 'Red Sunset' and 'Autumn Flame' (J. Frank Schmidt and Son Company; Boring, OR) and *Acer rubrum* 'Karpick' (Schichtel's Nursery; Orchard Park, NY); *Nyssa ogeche*, *Pistacia chinensis*, and *Taxodium distichum nutans* (Tom Dodd Nurseries; Semmes, AL); and *Quercus prinus*, *Quercus lyrata*, and *Quercus acutissima* (Warren County Nursery; McMinnville, TN) were made in December, 1980, at the Piedmont Substation in Camp Hill, Alabama. *Betula nigra* 'Heritage' (Tom Dodd Nurseries; Semmes, AL) was planted at that location in January, 1982. *Quercus shumardii* (Salter Tree

Farm; Madison, FL) was added to the study in January, 1984. Bareroot whips (1.0- to 1.2- meter) were planted in a Cecil gravelly sandy loam soil, at a spacing of 7.5 m within rows and 9 m between rows. A randomized complete block design with 3 replications of 3 trees each was used.

No supplemental irrigation was applied except at planting. A complete fertilizer (13N-5P-10.5K) is applied in early spring each year at 454 g nitrogen per 2.5 cm of caliper (measured 30 cm above the soil line). Soil tests were taken and in 1986, 4400 kg/ha of agricultural lime was applied. Weed control consisted of two applications per year of glyphosate or paraquat for postemergence weed control, and a spring application of oryzalin at 4.4 kg/ha for pre-emergence weed control. Herbicides are applied as directed sprays around the tree base (1.2 - 1.8 m in diameter). Selective pruning occurred predominantly during the dormant season. Basal suckers were removed.

Evaluation criteria were annual growth rate, natural attrition and aesthetic characteristics. Growth rate was determined by recording tree height, canopy spread and caliper annually.

Results and Discussion

The maples. Fall color and canopy form of the red maple cultivars in the shade tree project have been reported by Fare et al.(1). The most consistent fall color has been expressed in the cultivars 'Autumn Flame', 'Bowhall', 'Gerling' and 'Tilford'. Attrition was high in many of the cultivars during the first three years of the test due to bud union incompatibility. The only cultivar that had no trees die from bud union incompatibility was 'Red Sunset'.

Among the fastest growing red maples in the study have been the cultivars 'Armstrong', 'Scarlet Sentinel', 'Karpick' and 'Schlesingeri' (Table 1). Cultivars having broader canopy forms to this point in the evaluation include 'Autumn Flame' (4.3 m x 4.1 m), 'Red Sunset' (5.0 m x 4.8 m), 'Schlesingeri' (5.4 m x 5.6 m) and *Acer rubrum* species (5.0 m x 5.3 m). 'Karpick' and 'Armstrong' are more upright in growth habit, having canopy dimensions of 3.2 m x 3.6 m and 3.7 m x 3.6 m, respectively. The upright forms have not been susceptible to breakage in spite of the acute

branch angles and closely spaced branching pattern.

The oaks. Sawtooth oak (*Quercus acutissima*) has been one of the fastest-growing trees in the project at a rate of 112.8 cm per year (Table 1). The canopy form is a broad oval and somewhat open in character. It was described by one visitor to the project as, "...a good climbing tree", because of the uniform branch spacing on the trunk. The leaves are 10 to 15 cm long with bristle-toothed margins. Fall color is not an ornamental feature. It has shown some inconsistent yellow fall color with the norm being light brown leaves that are retained into late fall and even as late as immediately prior to leafing out in the spring. Some of the more juvenile foliage is typically held until late winter. All of the trees in the study have produced copious amounts of acorns. No significant pest problems have been observed.

Chestnut oak (*Quercus prinus*) has proven to be a fast-growing native oak, having a mean annual growth rate of 82.3 cm. The canopy form is oval. Branch distribution is uniform and has been structurally sturdy so far in the study. Fall color has been variable from red to yellow, not really a notable ornamental feature. Leaf drop is fairly uniform, routinely shedding by Late November. No significant pest problems have been observed.

Overcup oak (*Quercus lyrata*) is another one of the faster-growing oaks. It is native to the Southeastern United States and the 100% survival rate of the tree in this study testifies to its being well-adapted in the region. No pests of any significance have been observed in the study. The canopy is broadly rounded and very uniform. Trees have produced large quantities of acorns. Fall color is not a significant ornamental feature of this tree, however, leaf drop has tended to be uniform and condensed into a short time span, usually from mid- through late November.

Shumard oak (*Quercus shumardii*) is native from southern Michigan to northern Florida and from eastern Texas to North Carolina. Survival rate is 100% and although it has not been in the project since the beginning, this tree has been one of the best-performing red oaks in the study to date. Canopy form is oval and consistent from tree to tree. It has shown a fast rate of growth. Foliage

Table 1. Height and average annual height increases.

| Selection | 1981 | 1985 | 1989 | 1993 | Annual avg. ^z |
|--------------------------------|-------------|------|------|------|--------------------------|
| Maple | --- (m) --- | | | | --- (cm) --- |
| Species | 1.2 | 3.6 | 5.1 | 7.2 | 57.9 |
| Armstrong | 1.2 | 4.0 | 6.7 | 8.4 | 67.1 |
| Autumn Flame | 1.2 | 2.7 | 4.6 | 5.9 | 42.7 |
| Bowhall | 0.8 | 3.1 | 5.2 | 7.0 | 51.8 |
| Red Sunset | 1.1 | 3.4 | 5.4 | 6.3 | 48.8 |
| Gerling | 1.8 | 3.7 | 5.8 | 7.1 | 48.8 |
| Karpick | 2.4 | 5.2 | 7.2 | 10.2 | 76.2 |
| Scarlet Sentinel | 1.1 | 3.0 | 5.6 | 8.2 | 64.0 |
| Schlesingeri | 1.3 | 3.4 | 6.5 | 8.5 | 73.2 |
| Tilford | 1.9 | 3.4 | 5.6 | 6.9 | 45.7 |
| Oak | | | | | |
| <i>Quercus lyrata</i> | 0.8 | 3.9 | 7.0 | 9.3 | 67.1 |
| <i>Q. prinus</i> | 0.7 | 5.0 | 7.4 | 9.2 | 82.3 |
| <i>Q. acutissima</i> | 0.5 | 4.5 | 9.3 | 12.6 | 112.8 |
| <i>Q. shumardii</i> | -- | 1.5 | 5.2 | 9.0 | 88.4 |
| Others | | | | | |
| <i>Betula nigra</i> 'Heritage' | -- | 4.2 | 7.5 | 9.1 | 88.4 |
| <i>Nyssa ogeche</i> | 1.2 | 3.4 | 5.2 | 6.3 | 48.8 |
| <i>Pistacia chinensis</i> | 0.7 | 4.1 | 6.4 | 8.0 | 88.4 |
| <i>Taxodium distichum</i> | 1.3 | 5.0 | 8.1 | 10.5 | 88.4 |

z. Average annual height increases from 1981 through 1993.

color is dark green in the summer and fall color is consistently red. Leaf spot seems to be a regular feature of Shumard oak in the test, however, it has not seemed to impair tree growth or overall appearance. No other significant pests have been noted.

Other superior trees. 'Heritage' river birch (*Betula nigra* 'Heritage') was planted winter 1982. All of the trees in the study have a single trunk. Canopy form is an irregular oval to slightly pyramidal shape. Growth rate has been rapid, especially early in the study. Mean height more than doubled from year one to year three (Table 1). Bark characteristics of *Betula nigra* 'Heritage' differ from the native *Betula nigra* in that the bark of the cultivar exfoliates from the trunk and sizeable branches in larger sheets than the native. Also, the bark color is lighter in appearance in the former than the species.

After an initial attrition rate of 56% Ogeechee tupelo (*Nyssa ogeche*) has performed well in the

evaluation. The tree is native to low wet areas along the lower Coastal Plain which may account for the initial loss of trees since the study site is unlike the native habitat. Trees are uniform in size with a broadly rounded canopy, broader than tall with a height of 6.1 m and spread of 6.5 x 6.5 m. The 10- to 15-cm long obovate to elliptical leaves have a medium green summer coloration, consistently turning a deep red to burgundy in the fall. While the flowers are not ornamentally significant, they are highly attractive to pollinating insects. The fruit produced are fairly attractive and abundant four-cm long red to maroon drupes. The fruit are not persistent and under some trees create a carpet of fruit on the ground in the early fall.

Chinese pistache (*Pistacia chinensis*) has been one of the fastest growing trees in the test with a mean height increase of 88.4 cm per year. The canopy is less broad than tall giving the tree an oval form. Branch structure has been durable with absence of breakage or litter. Summer leaf color

has been medium green and fall coloration has shown some variation within the species, ranging from red to reddish-orange, but usually vivid. Leaf drop has been uniform and generally occurs from early through mid- November. No significant disease or insect problems have been observed.

Pondcypress (*Taxodium distichum nutans*) has a striking pyramidal form. It has been reported as difficult to transplant, however in this study a survival rate of about 78% was realized. Trees have been uniform in growth rate and form. Growth rate has been rapid at 88.4 cm per year which is faster than the other two cypresses in the test, *Taxodium mucronatum* (70.1 cm per year) and *Taxodium distichum* (51.8 cm per year). While usually associated with less dry site, tree performance to date suggests a greater tolerance of soil conditions than previously expected. No knees have formed among any of the trees in the study. Fine textured light to medium green summer foliage color, rust to burnt orange fall foliage color, fastigate form and reddish-gray bark have been aesthetically appealing attributes in this species.

While the trees presented have numerous superior attributes, some characteristics may make them undesirable for some landscape situations. All four of the oak species produce acorns which could be a disadvantage. Fruit produced by *Nyssa ogeche* could create litter problems as well, particularly in areas with significant pedestrian traffic. In addition, several of the trees develop a large canopy fairly quickly so in sites with restricted overhead space their use may be limited.

These and other trees will continue to be evaluated in this ongoing project.

Literature Cited

1. Fare, D.C., C.H. Gilliam, and H.G. Ponder. 1990. *Acer rubrum* cultivars for the south. J. Arboric. 16: 25-29.
2. Fare, D.C., C.H. Gilliam, and H.G. Ponder. 1991. *Fireblight susceptibility, growth and other characteristics in ornamental pears in Alabama*. J. Arboric. 17: 257-260.
3. Hensley, D.L., S.C. Wiest, J.A. Robbins, C.E. Long, J.C. Pair, and A.J. Schlegel. 1992. *Evaluation of trees for the central plains*. J. Arboric. 19: 49-54.
4. Williams, J.D., D.C. Fare, C.H. Gilliam, G.J. Keever, H.G. Ponder and J.T. Owen. 1993. *Shade trees for the Southeastern United States: An Auburn University Evaluation*. Alabama Agricultural Experiment Station, Auburn University, Alabama.

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Résumé. Une étude d'une durée de 13 ans à l'Université Auburn a évalué plus de 200 espèces ou cultivars d'arbres. Les données recueillies incluent la fréquence d'utilisation, le taux de croissance et les caractéristiques ornementales. Ces données ont fourni de l'information que les producteurs en pépinières, les architectes paysagistes et les forestiers urbains peuvent utiliser pour sélectionner des espèces d'arbres et des cultivars pour le cadre résidentiel et urbain. Les arbres montrant des performances supérieures sont les cultivars d'*Acer rubrum*, *Betula nigra* 'Heritage', *Nyssa ogeche*, *Pistacia chinensis*, *Quercus prinus*, *Quercus lyrata*, *Quercus acutissima*, *Quercus shumardii* et *Taxodium distichum nutans*.

Zusammenfassung. An der Auburn Universität wurden in einer 13 Jahre dauernden Studie über 200 Arten bzw. Kultivare von Bäumen bewertet. Die gesammelten Daten enthalten Angaben über Alterung, Wachstumsrate und ornamentale Charakteristiken. Diese Daten lieferten Informationen, die von Baumschulen, Landschaftsbauern und Stadforstleuten genutzt werden können, um Baumarten und ihre Kultivare für Standorte im urbanen Bereich auszuwählen. Folgende Baumarten zeigten eine besondere Eignung: *Acer rubrum* - Kultivare, *Betula nigra* 'Heritage', *Nyssa ogeche*, *Pistaccia chinensis*, *Quercus prinus*, *Quercus lyrata*, *Quercus acutissima*, *Quercus shumardii* und *Taxodium distichum nutans*.