Evaluation of Native U.S. Trees at Purdue

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Apart from our growing awareness of the potential risks of some invasive species, another reason for utilizing natives in the landscape is their ability to tolerate variable water availability once established (Dunnett and Clayden, 2007). Drought events are increasing in frequency in the U.S. (Barnett et al., 2004) and the identification of native species that maintain their appearance in a formal landscape under water stress conditions is important for the landscape industry and consumers (Brand, 1992; Locket et al., 2002; Kjelgren et al., 2000).

Previously, we described the native shrub evaluation program at Purdue established in 2007 through the NC-7 program (Mickelbart et al., 2012). In this article, we describe native tree selections evaluated during the same time period. The objectives of the NC-7 (North Central project number 7) Regional Ornamental Plant Trials are to assess plant performance across a broad range of environments and climatic extremes and expand the range of useful landscape plants, while placing emphasis on detailed, long-term evaluations. The trials are one of the longest-running landscape plant evaluation networks in the U.S. Each year a small number of promising, new trees and shrubs are offered for testing to approximately 30 trial sites across 18 states. Plants selected for trial are acquired through plant explorations, seed or other propagule exchange, or direct donations from other institutions. Factors influencing plant selection include assessments of hardiness and aesthetics, ease of propagation and culture, naturalization potential, and specific interests of trial site cooperators. Introduced species are evaluated through this program, but a large number of the selections are native to the U.S.

Trees are established in mulched rows, fertilized minimally each year, and irrigated as needed to avoid stress, especially during establishment. Once established, plants are observed and evaluated throughout the seasons at one, five, and ten years after planting. In addition to making a 10-year commitment to evaluate the plants, our goal is to keep them growing for the foreseeable future for evaluation and as a demonstration plot for anyone who wants to see how a particular selection is performing in central Indiana.

This report provides descriptions on the NC-7 tree selections growing at the Purdue horticulture farm and their growth to date under the conditions described. Table 1 lists height and caliper measurements that were taken at the end of the 2012 growing season.

Common Hoptree or Wafer-ash (***Ptelea trifoliata* L.**) This small deciduous tree or large shrub is known as hoptree because of the distinct aroma of its samaras when crushed and is also commonly called wafer-ash because of those same samaras, which are notably coin shaped. In addition to smelling like hops, this plant also offers us another pleasant fragrance, a sweeter one given off in late spring by its flowers, which are typically either male or female (dioecious), but perfect flowers do occur infrequently. This species is one of few temperate woody members of the citrus family (Rutaceae) along with prickly ash (*Zanthoxylum*) and evodia (*Tetradium*). Hoptrees can reach 20 feet tall and can tolerate heavy shade, but perform best in full sun or light shade. They are more tolerant of drought than they are of flooding, and are typically found on well-drained soils. For butterfly gardeners, this species is also notable as a primary food plant for the giant swallowtail. The *Ptelea* trees in our trial lost their foliage due to the severe 2012 drought, but a mid-October vegetative growth flush and flowering occurred in response to September rain. We will monitor these trees to determine if this late growth flush results in reduced cold hardiness this winter.

Table 1. List of native trees planted at the Meigs Horticulture Farm in Tippecanoe Co., Indiana. Height and caliper measurements were collected on three plants of each species in June 2012.

Botanic name	Selection	Cultivar	Common name	Family	Source location	Year planted	Height (ft)	Caliper (in)	Hardiness
Taxodium distichum	Ames 29832		Bald Cypress	Cupressaceae	Oklahoma	2009	4′2″	1.8	5
Diospryros virginiana	Ames 29625		American persimmon	Enenaceae	Missouri	2011	3′0″	0.9	5b
Quercus macrocarpa	Ames 26202	‘Lippert’	Bur Oak	Fagaceae	Oklahoma	2007	6′7″	1.5	3
Quercus alba	Ames 27340		White Oak	Fagaceae	Nebraska	2008	5′10″	1.3	3b
Quercus bicolor	Ames 29669		Swamp White Oak	Fagaceae	Missouri	2011	3′0″	0.6	4a
Quercus bicolor	Ames 29670		Swamp White Oak	Fagaceae	Iowa	2011	4′0″	0.8	4a
Carya illinoinensis	Ames 29624		Pecan	Juglandaceae	Missouri	2011	2′0″	0.5	5a
Ptelea trifoliata	Ames 27328		Common Hoptree or Wafer-ash	Rutaceae	Iowa	2007	9′0″	2.5	4
Populus tremuloides	Ames 27970	‘NE-Arb’ Prairie Gold®	Quaking Aspen	Salicaceae	Nebraska	2009	6′8″	1.5	1

Figure 1a. Quercus alba *(white oak) in the NC-7 trials at Purdue University Meigs Farm in Tippecanoe County, Indiana (Photo taken July 18, 2012).*

Figure 1b. Quercus alba *(white oak) in the NC-7 trials at Purdue University Meigs Farm necrotic leaves after early- to mid-season drought (photo taken on October 11, 2012).*

White Oak (*Quercus alba* L.) This native, stately tree with the potential to reach 90 feet tall is becoming more popular as a landscape specimen. The distribution of *Q. alba* covers essentially the eastern half of the U.S. with the western limit creating a distinct line from Minnesota to Texas following a route similar to the Missouri River between Iowa and Nebraska. Noted for its popular wide-spreading crown (when open-grown), this species can be appreciated year-round. Spring brings forth new foliage that briefly displays pink or reddish tones. Before long, the appearance of yellowish catkins extending 2 to 4 inches creates an animated experience under gentle winds. At the end of the growing season, autumn leads to varying shades of bronze and red foliage, which soon senesce and expose the grayish bark. Semi-sweet acorns provide sustenance to numerous birds and mammals and can be used in bread.

The selection planted at Purdue (Ames 27340) (Figure 1a) was collected near Humboldt, Richardson County, Nebraska. This very rare population of white oak is potentially the largest in Nebraska in addition to being the westernmost population of its native range (Kaul et al., 2011). This population was targeted to determine if it would tolerate a wide range of conditions in the Great Plains, particularly west of the 100th meridian in Kansas, Nebraska, South Dakota, and North Dakota.

Initial observations of this selection at Purdue during the spring of 2012 noted superior leaf quality; however, late-summer observations during the 2012 drought resulted in leaf burning (Figure 1b), even in irrigated plots. There was virtually no fall color this year, as leaves turned brown or senesced. The combination of high temperatures and low humidity likely led to evapotranspiration rates that were higher than water being supplied, thus leading to visible damage.

'NE-Arb' Prairie Gold® Quaking Aspen (*Populus tremuloides* Michx.) Quaking aspen planted in the Midwest tend to have numerous problems, including canker and leaf diseases. They are often short-lived, even in the absence of serious diseases. In addition, they tend to sucker profusely. Many of these problems occur when a population is planted too far out of its zone of adaptation. *Populus tremuloides* is native to most of Canada into Alaska and east to the northeastern U.S., but also has populations scattered throughout the higher elevations of the Rocky Mountains. Quaking aspen collected from the Rockies and sold in the Midwest may not be adapted to grow in high summer humidity conditions, resulting in increased pressure by leaf diseases. Despite all the problems quaking aspen may have, homeowner requests for this species to use as a landscape specimen are common. Many desire this species' ability to make music by "quaking" under subtle winds and its bright yellow fall color, or just like the reminder of life in the mountains. The cultivar 'NE-Arb' was found by Alan Wilke of Wilke Landscapes in Columbus, Nebraska in the 1970s and

(Native Trees *continues on page 24.)*

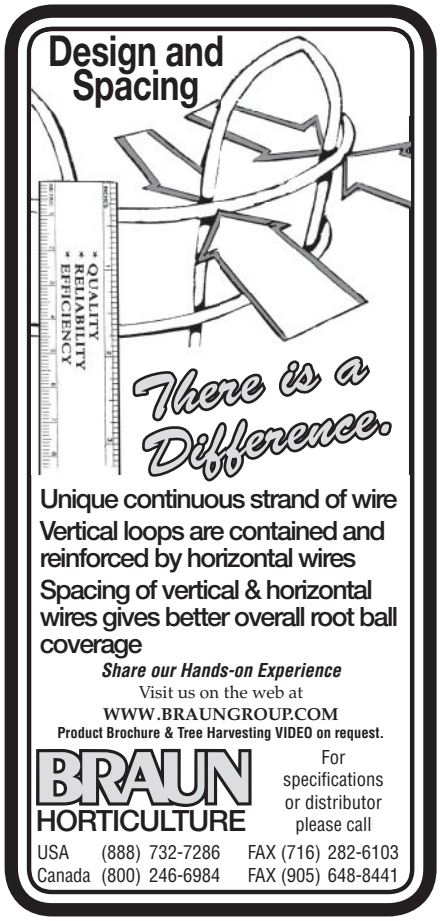

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Figure 2. Populus tremuloides *(quaking aspen) in the NC-7 trials at Purdue University Meigs Farm in Tippecanoe County, Indiana (photo taken July 18, 2012).*

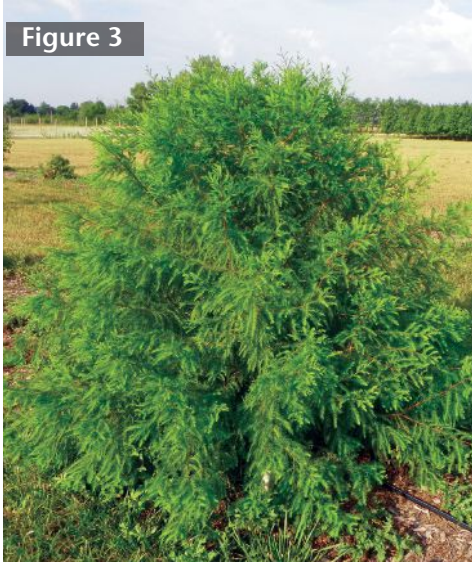

Figure 3. Taxodium distichum *(bald cypress) in the NC-7 trials at Purdue University Meigs Farm in Tippecanoe County, Indiana (photo taken October 11, 2012).*

is now being marketed under the trademark Prairie Gold® by J. Frank Schmidt. Cuttings were collected from the parent tree located in a pasture in the north portion of the Platte River Valley northeast of Columbus, Nebraska. It was selected for its resistance to leaf disease, especially under high humidity. This selection has bright yellow fall color with whitish bark. Prairie Gold® has a rapid growth rate (approximately 3 to 5 feet per year) under moist soil conditions and little to no trouble with iron chlorosis. Prairie Gold® has an upright, slender growth habit with an approximate mature size of 40 feet tall and 15 feet wide. Despite the significant drought in 2012 that resulted in damage to other species in the NC-7 trials, *P. tremuloides* exhibited no damage during or following the dry conditions (Figure 2). In 2012, this was also noted in southern Iowa, where *P. tremuloides* exhibited exceptional drought tolerance.

Bald Cypress (*Taxodium distichum* L. Rich.) Although this species is generally native to wetlands (even standing water), growth rates are often faster when it is grown in well-drained soils and it can, in fact, be quite drought tolerant. Even the young trees being evaluated at Purdue did not exhibit drought symptoms during the historic drought of 2012 (Figure 3). Current practices utilize this species in landscapes with anaerobic compacted soils similar to its natural habitat. Often used as a landscape specimen or street tree, bald cypress can reach 100 feet or more in height, but such size is uncommon in the Midwest. Generally the species attains a height of 50 feet in 20 to 25 years, but subsequent growth tends to slow sharply. The native range of this species is limited to the southeastern portion of the U.S., north along the Mississippi River to the southern tip of Illinois and Missouri. However, the potential planting range of this species is much greater. The selection planted at Purdue (Ames 29832) was collected by Steve Bieberich (Sunshine Farm & Nursery, Clinton, Oklahoma) as seeds along the Frio River, Real County, Texas, which represents the westernmost range of this species. The seeds were collected from specimens growing on extremely high pH soils, suggesting that this accession should be more tolerant to alkaline soils common in many parts of Indiana. Ornamental attributes include bronzy-red fall color and reddish-orange bark. In addition, the small, 1 to 3 inch diameter, round fruit-like cones provide winter interest and food for squirrels. Interest and curiosity is often generated in response to the production of "knees" or root projections, which are typically noted under flooded conditions. The trees being evaluated at Purdue were small when planted and have only reached a height of 4 feet in 4 years.

Pecan (*Carya illinoinensis* (Wangenh.) K. Koch) The native distribution of *C. illinoinensis* includes portions of the south-central U.S. and southern portions of the Midwest, stretching northward along the Mississippi River as far north as east-central Iowa. As the largest of the hickories, pecan is a long-lived, large (often greater than 100 feet tall) shade tree that typically inhabits floodplains and bottomlands. Prized for its sweet, edible nuts, pecan is not only a food source for humans, but also for many birds and mammals. The probable cold hardiness of this accession is Zone 5b, but it may be somewhat greater. However, specimens grown in areas that experience colder climates and shorter growing seasons may exhibit tip dieback in young seedlings, frost injury to catkins, or an inability for nuts to mature. Despite the potential lack of nut production in northern latitudes, this species can still be considered an excellent option as a shade tree. Since this species is adapted to slightly anaerobic soils, its tolerance to compacted, urban soils may be high. Additional positive characteristics include a dominant central leader and dark green leaves. Fall color is insignificant. The selection planted at Purdue (Ames 29624) was collected by Jeffrey D. Carstens in October 2008 as nuts from multiple specimens in Magnolia Hollow Conservation Area, located in Ste. Genevieve County, Missouri.

American Persimmon (*Diospyros virginiana* L.) One could say that the American persimmon is quite comparable to the American plum, *Prunus americana*. Commonalities include intense suckering, resulting in thickets, and fruits that are valuable to numerous creatures. Vigorous suckers quickly appear only following severe coppicing, timber harvesting, or fire. Fruits are unpalatable before ripening, but rapidly sweeten after frost. Meyer et al. (1970) indicated that intact fruits do not germinate and are therefore dependent on a variety of animals for dispersal and germination. Fruits are eaten by squirrel, fox, skunk, deer, coyote, raccoon, opossum, various birds, and humans (Glasgow, 1977). Fruit ripening and persistence is variable across and within populations (personal communication Scott Woodbury — Shaw Nature Reserve). Since this species is dioecious, obtaining both female and male plants is required for fruit production. Inconspicuous, tubular greenish-yellow flowers appear in early May. Fruits are

spherical to oblate, but variable in size (1 to as much as 2 inches in diameter) and color, changing from green to yellow-green to shades of yellow, orange, or even sometimes purplish. The most common habitats inhabited by *D. virginiana* include open pastures, fence lines, and forest edges. Ornamental characteristics include glossy, leathery leaves that can turn a vibrant yellow in the fall. Winter interest includes blocky bark, which is attractive and distinctive, especially on old specimens. This species has the potential to reach 70 to 80 feet in height under cultivation. The provenance of the accession being evaluated at Purdue is near the northern range of its native distribution (throughout the southeastern U.S.). The selection planted at Purdue (Ames 29625) was collected by Jeffrey D. Carstens in October 2008 as seeds from multiple specimens located in August A. Busch Memorial Conservation Area, located in St. Charles County, Missouri.

'Lippert' Bur Oak (*Quercus macrocarpa* Michx.) The stress tolerance and durability of bur oak throughout the North Central Region is widely recognized. Given the broad range of adaptation of this stately tree, it is a bit surprising that relatively little attention has been directed towards the selection of superior populations or those displaying special characteristics. Part of this may be due to its long generation cycle or to the fact that clonal propagation is difficult at best. The selection planted at Purdue (Ames 26202) was obtained in the fall of 2003 from John M. Row at the USDA-NRCS Plant Materials Center located in Manhattan, Kansas.

This accession, which has been given the name "Lippert" to recognize one of the original collectors, was originally collected from a wild population in Stillwater City Park, Payne County, Oklahoma, in 1970 by Dr. Robert D. Lippert and W.C. Young. It was evaluated as part of a test of four bur oak accessions conducted by the USDA-NRCS Plant Materials Center at Manhattan, Kansas, from 1972 to 1994. Results of that test indicated that it was a superior strain on the basis of growth rate, plant vigor, form, and seedling vigor. In nursery rows at the North Central Regional Plant Introduction Station, 10 to 20 percent of seedlings displayed a range of fall foliage color not typically seen in local bur oak populations, including clear yellow, gold, orange, salmon, and wine red. Probable hardiness of these accessions is to USDA Zone 4, perhaps colder, but this southern source may not harden as quickly in the fall as do populations from farther north.

Swamp White Oak (*Quercus bicolor* Willd.) *Quercus bicolor* is a species that continues to gain interest in the nursery trade. The native range of swamp white oak extends from central New York west to central Wisconsin, south to portions of Missouri and Illinois, east to portions of Kentucky. Generally found in bottomlands and floodplains, it is easy for one to assume that swamp white oak would perform the best in "swamp like" conditions. Surprisingly, this is not true. *Quercus bicolor* is actually a drought-tolerant species that can perform well in an upland situation. Among the oaks, its more fibrous root system seems to improve its overall success of transplanting, allowing it to exhibit good annual growth shortly afterward. This species can be easily spotted from a distance by the "bicolored" leaves (whitish undersides). It can also be verified up close by its elongated peduncles. Acorns are highly favored by squirrels, ducks, turkey, deer, and other animals because of their low tannin content resulting in a relatively sweet treat. Acorns generally ripen in early autumn, slightly earlier than most other oaks. *Quercus bicolor* is valuable for its light brown, close-grained, heavy, and hard wood. Sometimes mistaken for *Q. alba* wood, *Q. bicolor* is more often culled due to knottier wood, since its lower, lateral branches tend to persist longer than in *Q. alba*. Numerous hybrids of this species exist in the nursery trade (Dirr, 1998).

Two selections planted at Purdue, Ames 29669 and Ames 29670 were collected in October 2008 in Thousand Hills State Park (Adair County, Missouri) and Chichaqua Bottoms Greenbelt (Polk County, Iowa), respectively. Surprisingly, Ames 29669 was collected from the higher slopes of a gentle hill, while Ames 29670 was collected in a typical floodplain habitat. Initial observations of 2-year old liners noted somewhat similar fall colors (light brownish-orange, orangeish-red, reddish-brown shades) and similar levels of vigor.

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