

Osage-orange: A Pioneering Stewardship Species

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Osage-orange, a small tree with a number of unique characteristics, played an important role in the settlement of the prairies. One of the more significant contributions was in the use of the species for hedges. The thorny, low-spreading crowns provided excellent fencing when properly maintained. This use, plus its later use in shelterbelts exert a continuing influence on the environment of the Middle West and the Great Plains. Osage-orange grows well on a wide range of sites and is a good candidate for planting on mine spoils and other disturbed sites. A thornless variety does well in difficult urban conditions. Tree Planters' Notes 48(3/4): 81-86; 1997.

There have been a number of the stewardship program initiatives in the last few years that have been designed to encourage landowners and managers to practice management that stresses reforestation and a number of other land conservation issues. It is interesting to note that, well over 100 years ago, a tree species that is little considered today played an important role in converting the prairies into productive agricultural land communities. Although most of the trees that markedly influenced the early settlement and economy of the United States were harvested for export, ship building, and other specialized needs, the Osage-orange---*Maclura pomifera* (Raf.) Schneid.---was never used for lumber or fiber, but it still influenced the early development of the United States. The wood of the Osage-orange tree was used by Native Americans for their bows and arrows, and the trees were well known for their large, plum-, apple-, or orange-type fruit.

As settlers moved into areas where range cattle and sheep were allowed free rein, they needed to fence out these animals in order to begin farming. Because not enough wood was available on the prairie grasslands to build fences, the early settlers of the area had to rely on planted hedges, and Osage-orange trees proved to be excellent for this role. Together with the railroad, the steel plow, and the water-pumping windmill, the Osage-orange hedge (along with the later development of barbed wire) helped to make possible the agricultural settlement of the grasslands and sustained its productivity.

Early Species Distribution and Common Names

The wood of the Osage-orange tree was used by Native Americans for their bows and arrows and the tree was well known for its large fruit of the plum, apple, or orange type. The Osage-orange, called *bois d' arc* (bowwood) by the French explorers of interior North America, may be responsible for the mountains in Arkansas and Missouri being named "Ozark" (Steyermark 1963). A French trading post, established in that area in the 1700's, was named *Aux Arc* from the *bois d' arc* trees that were abundant nearby. The English name "Ozark" is probably a corruption of the French *Aux Arc*.

Thomas Jefferson advocated exploration of the western two-thirds of North America as early as 1783. After he became President, he sent 3 expeditions west: the M Lewis and W. Clark expedition started up the Missouri River in May 1804; the W. Dunbar and G. Hunter expedition traveled up the Red, Black, and Ouachita Rivers into Arkansas in October 1804; and the T. Freeman and P. Curtis expedition traveled up the Red River in May 1806. Each of these 3 American exploratory parties traveled northwest via a major river and discovered a number to new plants, including the Osage-orange. In each instance, the Osage-orange trees they saw were not naturally regenerated but had been planted. The report of the Freeman-Curtis expedition contains what may be the first botanical description of the Osage-orange to be printed in English (McKelvey 1995).

The Osage-orange tree that Freeman and Curtis saw was within a mile of the town of Natchitoches, LA. It was about 30 feet (9.7 m) tall, with a bole 7 to 8 feet (2 to 2.5 m) in circumference, and was bearing fruit. Similar trees, of natural origin, were said to be abundant along a nearby creek also called Bois d' Arc. Curtis believed that this tree represented a new genus, but he did not assign a name to it. Meriwether Lewis wrote to President Jefferson in March 1804 that he was sending some cuttings of the "Osage plum," or "Osage apple," for propagation. He explained that the "Osage apple" was native to the interior of North America and that the cuttings were from the garden of Pierre Chouteau in St. Louis, MO. Chouteau had obtained young plants at the Great Osage Village from a Native American of the

Osage Nation who said that he got them about 300 miles west of the village (McKelvey 1955), which was situated near the present-day town of Nevada, MO.

A British explorer, John Bradbury, traveled up the Missouri River in 1811 to the Arikara villages in what is now South Dakota. He described one of the bows used by the Arikara as being made from wood called *bois d' arc*. He felt that the wood came from the same tree species that Lewis had found in the garden of Pierre Chouteau in St. Louis, and said that the Arikara hunters called the tree "Osage-orange" (Bradbury 1817).

Josiah Gregg reported in 1844: "In many of the rich bottoms from the Canadian to Red River... is found the celebrated *bois d' arc*... usually corrupted in pronunciation to *bowdark*... It is one of the hardest, firmest, and most durable of timbers, and is much used by wagon-makers and millwrights, as well as by the wild Indians, who make bows of the younger growths" (Gregg 1844). Most authorities believe that the natural range of the species within historic times was confined to the Red River drainage of Texas, Oklahoma, and Arkansas and to the blackland prairies, post oak savannas, and Chisos Mountains of Texas (Burton 1973) (figure 1). Other authors include portions of Missouri, most of eastern Oklahoma, northwestern Louisiana (Morton 1963), and parts of Kansas (Britton 1908) in its natural range. The Osage-orange may be found in forests but usually is not

abundant (Ajilvsgi 1979). These conflicting reports may be accounted for in part by disjunct, still-changing distributions of the species.

Characteristics of the Osage-orange Tree

The Osage-orange is a short tree with a massive bole and a thorny, low-hanging, wide-spreading crown (figure 2). It averages about 30 feet (9.7 m) in height at maturity, but this is extremely variable (Harrar and Harrar 1962). Isolated trees on deep, fertile soils with ample moisture may grow to a height of 70 feet (21 m). Branchlets in full sunlight on young trees bear sharp, stout thorns (figure 3), and most trees are so well "armed" that it is difficult to measure or even approach them. As trees mature, new twigs high in the crown tend to be thornless, but the thorny lower branches are retained. The heartwood is very hard, heavy, strong, tough, resistant to abrasion, extremely durable in contact with the soil and immune to termites; it will shrink very little in drying. However, it is difficult to glue or machine and requires extraordinary care to prevent splitting.

The Osage-orange is easily propagated from seeds or cuttings (Williams and Hanks 1976), is characteristically deep rooted (Bunger and Thompson 1938), but thrives in shallow soils, tolerates alkaline soils, and is one of the most drought-enduring tree species in North America (Read 1964). Natural regeneration of Osage-orange is most abundant on overgrazed grasslands, around abandoned farmsteads, in ravines, and on disturbed sites.

The ripe fruit, 3 to 6 inches (7 to 15 cm) in diameter and often more than 2 pounds (.9 kg) in weight, resembles an orange (figure 3b). As soon as it ripens, the fruit falls to the ground and may be eaten by mammals. Some authors assert that it is inedible or unpalatable and is shunned by native wildlife (Robinson 1961); however, other writers state that fallen fruits are eaten by fox squirrels, raccoons, opossums, and blacktail deer. They also state that the seeds are eaten by squirrels, bobwhite quail, crossbills, and other birds (Harmon 1948; Vines 1960).

The Need for Hedges on the Prairies

The prairie lands of the Midwest and the Great Plains were acutely deficient in wood, water, and field stone. Wood shortage was second only to water shortage in retarding settlement of the Great Plains by farmers (McCallum and McCallum 1965). Actual availability of wood was reduced further by the use of rail fences and the pattern of settlement. The first English-speaking settlers took possession of the isolated pockets and streamside strips of timber, using most of the wood to con-



Figure 1— Map of the known natural range of Osage-orange in historical times. The range has been extended greatly by planting.



Figure 2— Mature Osage-orange trees typically have short, curved boles and low, widespread crowns. Even in closed stands on good sites, less than half the stems contain a straight log that is 10 feet (3 m) long, sound, and free of shake. This open-grown tree stood in a pasture near Bastrop, LA, in March 1971. (Photograph by James D. Burton.)

struct rail fences and temporary dwellings. Immigrants arriving later found no available timber. Unregulated grazing of the public lands by herds of cattle and feral hogs was widespread (Lewis 1941). Any land not enclosed was treated as commons, regardless of the ownership. The fencing problem of the 19th century was general and traumatic; its severity and the depth of feelings it engendered are difficult for late 20th-century Americans to imagine.

Farmers always were the primary fence builders; without fences, crop farming was impossible. Although no part of the United States was free of the vexing problem of fencing, the need for fences was most severe in the prairie regions because of free-roaming cattle and hogs. The cost of fencing was greater than the selling value of the land, and fence maintenance required about one-twelfth of the farmer's annual labor (Danhof 1944).

On the prairies, the most common type of fence was the board fence, made of pine timber from Wisconsin, Minnesota, and Michigan; the second most common was the mud fence, with an earthen wall about 3.5 feet (1 m) high, frequently augmented by one or more rails. A great variety of other temporary barriers were improvised, such as ditch-and-bank fences, sod fences, and hurdle fences (Meredith 1951), but none adequately protected the farms of the settlers. In the Edwards Plateau of Texas, many fields were protected by stone walls, which required a tremendous amount of labor to build (Hayter 1939).

Smooth wire was used as fencing by many farmers, but it was made of iron, which rusted rapidly and was

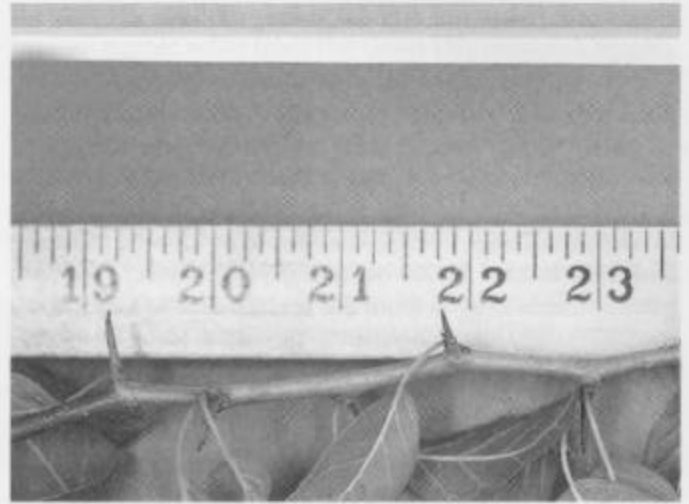


Figure 3—Thorns occur in the leaf axils on fast-growing 1-year-old shoots in full sunlight (scale in inches). (Photograph by James D. Burton.)

weak. However, there was still no wood for posts. In spite of repeated failures, farmers continued to try wire fences, but they also began to experiment with hedges.

Landowners in the East planted hedges as early as 1800 (Danhof 1944). The first plants used for hedges on a large scale were the hawthorns (*Crataegus* spp.), because they made notably successful fences on farms in England. In some United States localities, hawthorns and honeylocusts (*Gleditsia* spp.) made effective fences, but throughout most of the country south of latitude 40° N, Osage-orange was the overwhelming favorite.

Uses of Osage-orange

Development of hedges. The Osage-orange hedge was vigorously promoted, for different reasons, beginning in January 1841 by John S. Wright, editor of the Chicago periodical, "Prairie Farmer," and in 1847 by Professor Jonathan B. Turner of Illinois College, Jacksonville, IL. Wright was interested in scientific agriculture as the basis for an enlarged general economy. Turner wanted Illinois to establish public schools as the basis for an informed, active democracy, and only in sedentary agricultural communities could the population density ever be great enough for a public school system to be established (Carriel 1961). Both men were very convincing, and the resulting movement was described by contemporary observers as a "hedge mania." The Osage-orange hedge was endorsed by several agricultural societies and received legislative approval in some states as a legal fence (Danhof 1944).

It was also the only fence the average farmer could afford.

A thriving new industry came into existence. Nurseries in the South, principally Arkansas and Texas, shipped Osage-orange plants and seeds northward. Raising plants in one region to be transplanted several hundred miles away was an innovation (Danhof 1944). In 1868, the Osage-orange seed trade in Illinois, Indiana, and Ohio totaled 18,000 bushels (634,000 liters). The price of seeds ranged from \$8/bu in the 1840's to \$50 in the 1870's (\$5/lb in Illinois).

Entrepreneurs offered to plant and care for hedges at \$100/mile; this was much cheaper than the cost of any other kind of fence. In 1854, the Illinois Central Railroad began to hedge the right-of-way from Chicago to Cairo (Danhof 1944). Soon, other railroads began to hedge their rights-of-way. Land speculators planted hedges to increase the value of their land. In the spring of 1855, 9,000 miles (14,400 km) of Osage-orange hedges were planted. Farmers in Kansas planted 39,400 miles (63,000 km) of single-row hedges between the middle of the 19th and 20th centuries (Stoeckeler and Williams 1949). Osage-orange hedges were also planted in the East in many localities where wood had become expensive.

Osage-orange hedges flourished and endured. They not only fenced fields, protected crops, and restrained livestock, they also exerted more permanent effects upon the character and appearance of the landscape and the development of communities on the prairies. Many hundreds of miles of hedges, particularly in Missouri, Kansas, and Nebraska, remained well into the 1950's. Many Osage-orange hedges still exist untended today, a rectilinear pattern of artificial-looking, squatty trees with spreading crowns and shiny yellowish leaves on long, thorny branches (figure 4).

Living fences. As a living fence, Osage-orange was a notable success when well established and properly cared for. Although failures were more frequent than successes, it was still the best option available at the time. Well-informed proponents of hedging had from the beginning emphasized the care needed: site preparation, viable planting stock, proper planting, an artificial fence to protect the young Osage-orange hedge during the first 3 to 4 years, protection from prairie fires, cultivation for 3 years, and trimming every year. Cutting back to 5- to 6-foot (1.5- to 1.8-m) height forced additional branch development at the base of the plant. The long-tough, thorny branches were then interwoven to make an impenetrable wall, and all invading woody plants, principally hackberry (*Celtis* spp.), were removed. The width of the hedge usually was maintained at about 4 feet at the base and 2 to 3 feet at the top. Thus trimmed, a hedge excluded livestock but did not obstruct the view of the landscape.



Figure 4—Ripe fruit (scale in inches). (Photograph by James D. Burton.)

Farmers customarily clearcut the hedge every 10 to 16 years, obtaining about 400 posts/mile (1.6 km) of hedge. The stumps resprouted to grow new fences, and slash was piled over the stumps to protect new sprouts from browsing (particularly by sheep). The sprouts grew rapidly and soon formed a new hedge. Many prairie farmers had mixed feelings about their hedges, and the severe winters of 1855-56 and 1856-57 resulted in widespread damage to hedges in Ohio and Illinois. In 1856, the contractors abandoned the Chicago-to-Cairo fence of the Illinois Central Railroad (Danhof 1944).

Barbed wire was invented and developed independently and almost simultaneously by several different men, possibly with the mental image of the Osage-orange's thorny branches (figure 3) hanging on a smooth wire fence. These inventors were not northeastern industrialists---they were midwestern prairie farmers. When barbed wire became generally available (about 1880), the boom in the production of Osage-



Figure 5—Typical bole of an Osage-orange tree showing crookedness and defects common to the species. (Photograph by James D. Burton.)

orange seeds and seedlings ended. However, barbed wire still required posts, which the Osage-orange hedges provided.

Regular care of most Osage-orange hedges ceased with the advent of barbed wire. The neglected hedge trees then grew tall and developed spreading crowns, and roads with hedges on both sides became tunnels. Farmers then began to destroy the hedges because they spread and occupied much space. This destruction proceeded slowly at first but accelerated in the 1950's, when bulldozers, previously used in World War II, became available.

Shelterbelt plantings. Windbreak plantings in the United States began long before the dust storms of the 1930's. The earliest English-speaking settlers in Kansas planted Osage-orange windbreaks as well as hedges (Barnes 1960).

A Great Plains Shelterbelt program was proposed by President Franklin D. Roosevelt as a means to control

the runaway soil erosion and to provide early temporary economic relief from the Great Depression. Osage-orange figured prominently in the shelterbelts. In the southern and central Plains, south of the Platte River, Osage-orange was very successful; north of the Platte it suffered winter-kill. Along with bur oak (*Quercus macrocarpa* Michx.), Osage-orange survived better than any other broadleaf tree on upland sites. It was frequently planted in shrub rows but grew too tall for a shrub; it performed better where it could be used as a short tree (figure 5). The Osage-orange suffered less from insects and diseases than did most other species in the shelterbelt plantings.

Other uses. Osage-orange wood was in great demand for manufacturing rims, hubs, and spokes of wagon wheels in the Southwest, and the supply became scarce long before metal wheels replaced wooden ones. The rim of a wooden wheel is made of many segments called "felloes." Ten to twelve thousand wagons with Osage-orange wheel rims were being manufactured annually in the United States when a USDA Forest Service survey was made in 1911 (FPL1955). Only a small proportion of a typical Osage-orange log actually consists of sound, intact wood, but every piece of this wood was used. Pieces of wood too small to utilize as felloes were turned into insulator pins as a byproduct. The volume of Osage-orange wood used in the manufacture of felloes and insulator pins was about 20% of the annual cut.

Osage-orange hedges were planted in nearly all of the 48 conterminous states. These trees produced seeds abundantly and readily escaped from cultivation almost everywhere east of the Rocky Mountains and south of the Platte River and the Great Lakes, excluding the Appalachian Mountains.

For a time, the species was the basis of a domestic silk industry. Osage-orange belongs to the Mulberry family, and silkworms produced as much silk on Osage-orange leaves as on mulberry leaves in the United States, but the Osage-orange silk was said to be brittle, and the enterprise was not commercially successful (FPL 1955).

Osage-orange Today

Although the species contributed significantly to stabilizing and sustaining the agricultural economy of the prairie regions in the 19th and early 20th century, Osage-orange is relatively unimportant in agricultural economy of the United States today. Farmers on the Great Plains are still planting some single-row windbreaks, and trees have been used in reclamation plantings on strip-mined land (Ashby and Kolar 1977; Haywood and others 1993).

However, urban tree planters and landscape planners are using the Osage-orange, particularly the thornless, nonfruiting (male) line, because it is long lived, not too large, and seldom injured by ice or wind (Hightshoe 1978). Compared to other suitable trees, Osage-orange is rarely attacked by insects and diseases. Many miles of Osage-orange hedges still stand today in the Middle West and the Great Plains. No estimate of the mileage is known. Untended for many years, these hedges have grown to about 30 feet (9 m) in height with long limbs. They form a prominent component of the prairie landscape and constitute an important part of environment for game and nongame birds and mammals. We hope that these hedges will be characteristic of mid-America for many years to come as symbols of Osage-orange's historical role in the early development of the Great Plains and in establishing a stewardship ethic that is a model for current times.

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