

Eastern Cottonwood and Hybrid Poplar

To many people in the South, the word “poplar” means yellow poplar, tulip poplar, or tulip tree. However, worldwide, “poplar” is understood to be a species of *Populus*, such as eastern cottonwood, which is found in Mississippi, or a hybrid between two *Populus* species. The genus name *Populus* was derived from a Roman expression, *arbor populi*, which means “the people’s tree,” because poplars were frequently planted along roadsides (Dickmann and Stuart 1983).

In North America alone there are about 10 species of *Populus* that inhabit a wide variety of sites. In the South, the primary *Populus* species is eastern cottonwood (*Populus deltoides* Bartr. Ex. Marsh.), which is found in large numbers along rivers and streams. Swamp cottonwood (*Populus heterophylla* L.) is also native to the southern United States.

The term “hybrid vigor” refers to the ability of an offspring to outgrow both parents, and in many situations hybrids have done just that. However, hybrids must be adapted to the intended sites, environmental conditions, and pests and diseases. In the Pacific Northwest, Northeast, and the north-central United States, hybrid poplars have demonstrated their superiority over the native *Populus* species. In the South, hybrid poplars have not fared as well because they are susceptible to *Septoria*, a leaf and stem disease that typically kills the tree within three to four years. Eastern cottonwood is resistant to *Septoria* and became the species of choice in the South for short-rotation pulpwood plantings in the 1960s and 1970s.

Unlike many forest species, *Populus* is easily propagated from dormant unrooted

cuttings, which allows for the development of clones. The USDA Forest Service Southern Hardwood Laboratory at Stoneville, MS developed a world-renowned program in eastern cottonwood genetics, silviculture, biometrics, and diseases and pests. Many pulp and paper companies used Stoneville’s clonal technology to establish, grow, and manage their own plantation programs. The eastern cottonwood clones developed at Stoneville are also being grown internationally, as far away as South Africa, China, and Brazil. Around the world, eastern cottonwood has been used as a parent in the majority of the hybrid poplar programs because it provides the rapid growth needed in the resulting hybrids.

Eastern Cottonwood in the South

Eastern cottonwood is among the fastest growing hardwood species in the world, growing best on highly fertile, moist alluvial soils (Garnett et al. 2008). In this environment cottonwood can easily grow 10 feet per year, reaching a maximum height of approximately 140 feet as a mature tree in 40 to 50 years. In Mississippi, eastern cottonwood is found in large, nearly pure stands along the Mississippi River. However, eastern cottonwood also grows well on soils near lakes and streams and fertile upland soils. Like all *Populus* species, eastern cottonwood and hybrid poplar are dioecious species, meaning that individual trees are either male or female trees.

Mature seed is dispersed from capsules during the late spring and early summer months. The seed is extremely



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small and is attached to cottony-like material that allows it to be carried by air or water for long distances. Seed dispersal occurs over a long period of time, allowing the species to take advantage of floods that open and moisten the ground for seed germination. When the seed lands on bare mineral soil, it germinates within 24 hours. The seedling begins to grow rapidly unless overtopped by weeds that block its sunlight. Eastern cottonwood can quickly occupy a disturbed site. Cottonwood and other *Populus* species are known as early-successional or “pioneer” species because they grow rapidly but are rather short-lived compared to oak and hickory. Eastern cottonwood is “shade intolerant,” meaning it needs full sunlight to survive and grow.

Hybrid Poplar

Hybrid poplars were planted in Europe as early as the 18th century (Heinze 2008). However, the first documented control hybridization was done in 1912 by A. Henry in England. In the 1920’s, Drs. E. J. Schreiner and A. B. Stout, in combination with the Oxford Paper Company and the New York Botanical Gardens, undertook an intensive hybridization effort. They made 99 full-sib crosses among 34 different poplar species and cultivars. Many clonal selections from these crosses are still used today in the United States and around the world.

Currently more hybrid poplars are planted in the United States than any native poplar species. These stands are located in the Northeast, north-central, and Pacific Northwest United States. However, at one time, considerable acreage was planted in the Lower Mississippi River Alluvial Valley (LMAV), which is the area from the confluence of the Mississippi and Ohio Rivers just South of Cairo, Illinois, to the Gulf of Mexico just South of New Orleans, Louisiana. Companies like Anderson-Tully, Chicago Mills, Crown Zellerbach, Diamond Match Company, Potlatch, International Paper, James River, and Westvaco planted eastern cottonwood in this area. Today, no timber company plants eastern cottonwood in the LMAV. However, this may change with the increased need for biomass to produce energy and biofuels.

Currently, biomass production research is being done at Mississippi State University to examine the growth rates of newly-developed hybrid poplar and eastern cottonwood clones for both bottomland and upland sites. While it is relatively easy to develop eastern cottonwood for bottomland sites, it has been difficult to identify a clone that exhibits rapid growth on upland sites. Most experts believe we are more likely to find hybrid poplar clones that are adapted to upland sites and appropriate for biomass production. Ideal selections will have a rapid growth rate and disease resistance.

cotton Eastern cottonwood can also be used as a nurse tree for developing oak stands on heavy clay soils. The USDA Forest Service Center for Bottomland Hardwood Research at Stoneville, MS, in cooperation with Crown Vantage, developed a system where eastern cottonwood plantations are established the first year and maintained by disking or mowing in year one and two. At the beginning of year three, oaks are planted between every other row of the eastern cottonwood. Because eastern cottonwood has a vertical leaf display, enough sunlight reaches the young oak seedling for development. In addition, the every-other-row design allows the cottonwood to be harvested for pulpwood at 10 to 12 while minimizing the damage to the developing oak seedlings. If the cottonwood is harvested during the dormant season, the re-growth, or coppice, could be allowed to develop for another 8 to 10 years for the second harvest.

Planting Stock

While seedlings can be used as planting stock for both eastern cottonwood and hybrid poplars, the typical planting stock is often unrooted dormant cuttings because cuttings allow for selected clones rather than lower-quality seedlings. In addition, unrooted cuttings are easier to handle and plant as long the cuttings are of the proper size. Eastern cottonwood cuttings planted on alluvial sites should be at least 18 inches long with a top cutting diameter of ½ to 1 inch. On the other hand, hybrid poplar cuttings can be just 9 to 12 inches long because they root quickly and are typically planted on field sites that do not receive extensive flooding during the fall and early growing season. The unrooted cuttings need to be soaked for 24 hours before being stored and again for a shorter time just before establishment to ensure that the cutting is fully hydrated. Cottonwood leaf beetles and June beetles can cause tremendous damage and mortality but can be controlled with Sevin XLR. The planting stock can also be soaked with Admire Pro at a rate of 12 ounces per 100 gallons of water; follow all warnings and directions on the product label.

Site Preparation

As with any hardwood species, site selection is critical. Eastern cottonwood grows best on sites with deep soils, no restrictive layers, high natural fertility, and good year-round moisture availability. Site preparation work is typically rather intense for eastern cottonwood and hybrid poplar because the planting stock needs a weed-free environment with no restrictive soil layers that might limit root growth. If perennial vines or weeds are present, a herbicide treatment prior to planting will be necessary. Annual herbaceous weeds that may be present can be eliminated by a disking followed by a sub-soiling to eliminate any type of

restrictive soil layer. Sub-soil the field in one direction and row-mark it perpendicular to the sub-soil trench. The resulting plantation will allow efficient disking in two directions to control weed competition.

Plantation Establishment

Planting unrooted eastern cottonwood clones or hybrid poplar clones is very simple when the site is properly prepared. However, if the sub-soiling is too shallow, planting becomes extremely difficult. Here are a few suggestions:

- To avoid breaking the cutting or removing the buds and bark, do not use anything to drive the cutting into the ground.
- If the soil is heavy, dry clay, make a hole with a planting dibble. Forcing the cuttings into the sub-soiled trench will remove bark from the lower portion of the cutting.

Once planted and before bud break, the area should be treated with Goal 2XL at a rate of 64 oz per acre. This will hold weeds for a short period of time during the spring and possibly into the early summer. After that, competition control has to be done mechanically. If trees grow taller than 8 feet in the first year, there is little need for competition control the second year. However, if the trees are less than 8 feet tall, Goal can be applied again the second year before bud break.

Growth

When selected eastern cottonwood clones are planted on fertile soils that have no restrictive layers and good year round moisture availability, they can reach heights of over 100 feet and diameters of greater than 12 inches at age 10 (Figure 1). This type of site can produce 16 to 18 green tons per acre every year. As site quality decreases, yields will also decrease, and nutrients such as nitrogen must be added.



Figure 1. Three-year-old eastern cottonwood stand (left) and a 10-year-old eastern cottonwood selection (right) on an unprotected alluvial site in the Lower Mississippi Alluvial Valley. Photos by Randall J. Rousseau

Conclusion

Eastern cottonwood and hybrid poplar are both known for their rapid growth rates. Currently, in the South genetically improved eastern cottonwood clones are far superior to hybrid poplars due to their resistance to Septoria stem canker. In most cases, this disease will result in mortality between the ages of one and five years. Although very little eastern cottonwood is currently being planted in the LMAV area, this may change as we look for the fastest growing trees to produce biomass in the shortest period of time. However, the selection of sites cannot be ignored when planting eastern cottonwood. In addition, the use of eastern cottonwood as a nurse tree for oak plantings as proven to be an excellent option. In this case, the landowner can garner income from the pulpwood production at year 10 from the eastern cottonwood while developing an oak stand under the eastern cottonwood stand.

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