

Forest Types of Michigan

Hybrid Poplar and Hybrid Willow

MSU Forestry Extension Team

These fast-growing hybrids have been researched for decades to capture accelerated growth and vigor that can be achieved through breeding programs. Potential commercial applications include fiber for pulp production, roundwood for solid wood and engineered wood products, and feedstock for heat, power, chemicals and liquid fuel. Genetic stock from the genera *Populus* (poplar) and *Salix* (willow) comes from locations around the world. Breeding has used traditional methods — genetic engineering has not yet been employed to produce a genetically modified organism (GMO). Poplars are relatives of our native aspens and cottonwood. Willows grow best on upland soils rather than the wetlands inhabited by our native shrub willows.



Main advantages to hybrids are control over fiber characteristics and production rates that are several times higher than that of natural forests (thereby using less land). Hybrids can also be planted close to processing mills, thus reducing feedstock transportation costs. The only recent commercial production system in the Great Lakes states was in Minnesota to supply fiber to a pulp and paper mill. The mill and related operations ceased in 2012 after a fire at the mill. There are commercial hybrid plantations in the South and the far western United States, and several countries around the world use intensively managed hybrids, including eucalyptus, for wood supply. Hybrid willow is a major heat and power feedstock in some countries, such as Sweden.

Considerations in Choosing Hybrid Poplar Versus Hybrid Willow

Issue	Hybrid Poplar	Hybrid Willow
Soil requirements, < 7.5 pH	same as willow	same as poplar
Fencing against deer	usually necessary	not as necessary as poplar
Planting stock availability	restricted	one source
Planting density	700-1300 stems/acre	6000 + stems/acre
Rotation length	6-10 years	3 years*
Pest vulnerability**	more vulnerable than willow	less vulnerable than poplar
Product diversification	energy, pulpwood, saw bolts	energy only
Harvest	Traditional or specialized	Specialized machinery
Re-plant after	each rotation	8 + rotations
Establishment cost	high	very high

* Rotation length following mowing after first growing season

** Variable due to different pests and differences among clones.

Before landowners undertake a commercial planting of these hybrids, they need to put together a complete business plan that includes an assessment of local markets for harvested products. These plantations are expensive to establish, and those costs may need to be carried for up to a decade.¹ Optimum management and careful hybrid selection will maximize fiber production and give a quicker return on the investment. In addition to available nearby markets and product specifications (shape, size, chips, roundwood, acceptance of bark and leaves, etc.), landowners need to investigate planting and harvesting technologies.

The Trees

The performance of various hybrids will vary depending on the soil and the region of the state where they are planted. There is no single best recommendation for all areas and conditions. Research on matching clones and sites is being conducted at locations around the state by Michigan State University and Michigan Technological University scientists. It's important to establish the best performing hybrids for a particular site for financial reasons and resistance to pests. For this research, hybrid poplar stock has been obtained from either the University of Minnesota Natural Resources Research Institute² near Duluth or from a private grower near Grand Rapids. Hybrid willow stock has been obtained from the State University of New York³ and from Cornell University.⁴



Researchers observing 1-year-old hybrid willow

Management and Silviculture⁵

Plantations of fast-growing species are called short rotation culture (SRC) plantations. The optimum growing sites for these SRC plantations are

often retired farmlands with productive soils. Existing vegetation must be eliminated and fields prepared much as farmers prepare to plant annual agricultural crops. Trees are planted at 700 to 1,300 stems per acre for hybrid poplar and around

6,000 stems per acre for hybrid willow. Access lanes must be planned for cultural treatments and future harvest. Planting stock consists of sticks, or scions, that are 8 to 10 inches long. Hybrid willow might be obtained in whips up to 10 feet long that will need to be cut before planting.

Weed control will be necessary until the hybrid stands are dense enough to shade out competing vegetation. Early growth is very sensitive to competition for both light and nutrients. Lack of weed control will result in reduced production or plantation failure.



5-year-old hybrid poplar

The hybrid poplar rotation — the time from planting to harvest — will likely be six to seven years, although genetic stock is always improving. Poplar can be regenerated by replanting; improved varieties have resprouting ability. Hybrid willow rotations are every three years, after a non-commercial cutting after the first year. Fiber production of 3.5 to 4 dry tons per acre per year⁶ can be expected under good conditions. Natural forests produce about .5 dry ton per acre per year.

Tree Health Issues

A variety of pests can afflict both hybrid poplar and hybrid willow, including deer, a number of insects and several pathogens. Risks by particular pest species will vary from region to region. In some cases, preventive and/or control measures will be necessary. Integrated pest management techniques and appropriate clone selection should be incorporated into the establishment and management of these SRC plantations. Fencing — which is a significant expense — may be required to exclude deer for two to three years.

Wildlife Habitat

Wildlife use of these SRC plantations in Michigan has not been well-studied. Conversion from old farm fields to habitat with vertical structure will discriminate against one suite of species in favor of another. Shade cast by a fully occupied SRC plantation will minimize understory and herbaceous development. Tree cover, shade and reduced windspeeds will provide shelter and nesting habitat for a variety of bird species during the growing season.

¹ See MSU Extension hybrid poplar financial model at http://msue.anr.msu.edu/news/making_bioenergy_crops_pay.

² See information on Minnesota's hybrid poplar improvement research at: www.nrri.umn.edu.

³ See information on the State University of New York's woody biomass program at: www.esf.edu/willow/.

⁴ See information on willow energy development in New York at: willow.cals.cornell.edu

⁵ Hybrid poplar and hybrid willow research is ongoing. The most recent and comprehensive management recommendations can be obtained from the MSU Forest Biomass Innovation Center (<http://agbioresearch.msu.edu/fbic>). An SRC plantation manual is expected to be completed in 2014.

⁶ Miller, R., and B. Bender. 2008. Growth and Yield of Poplar in the Central Upper Peninsula of Michigan. Michigan State University AgBioResearch Forest Biomass Innovation Center. Available at <http://agbioresearch.msu.edu/fbic>.

Landowner Tips

- Develop a business plan.
- Assess soil conditions and fertility.
- Plan for intensive site preparation.
- Select planting stock to suit site and market.
- Use recommended planting techniques and spacing.
- Control competing vegetation.
- Monitor for and manage pests.
- Consider technology for harvesting and processing.
- Incorporate a regeneration schedule in any plan.
- Research bioenergy cost-share programs.

See the Michigan Society of American Foresters' publication, *Forest Management Guidelines for Michigan*, on their website: <http://michigansaf.org>.

National Firewise Program: www.firewise.org.

MICHIGAN STATE
UNIVERSITY

Extension

MSU is an affirmative-action, equal-opportunity employer, committed to achieving

excellence through a diverse workforce and inclusive culture that encourages all people to reach their full potential. Michigan State University Extension programs and materials are open to all without regard to race, color, national origin, gender, gender identity, religion, age, height, weight, disability, political beliefs, sexual orientation, marital status, family status or veteran status. Issued in furtherance of MSU Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Margaret A. Bethel, Interim Director, MSU Extension, East Lansing, MI 48824. This information is for educational purposes only. Reference to commercial products or trade names does not imply endorsement by MSU Extension or bias against those not mentioned.