

## HYBRID POPLAR & HYBRID WILLOW

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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 comes from locations around the world using species from the genera *Populus* (poplar) and *Salix* (willow). Breeding has used

traditional methods. Genetic engineering has not yet been employed to produce a “genetically modified organism”, commonly called a GMO. The poplars are relatives of our native aspens and cottonwood. The willows grow best on upland soils rather than not the wetland inhabiting native shrubs.

Main advantages to hybrids include placement close to consuming mills (reducing feedstock transportation costs), control of fiber characteristics, and fiber production rates several times higher than that of natural forests (thereby using less land). The only recent commercial production system in the Lake States was in Minnesota to supply fiber to a pulp and paper mill.

The mill and related operations ceased in 2012 due to a fire at the mill. Across the USA, there are commercial hybrid plantations in the south and far west. 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.

Before landowners undertake a commercial planting of these hybrids, a complete business plan is strongly recommended, including 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.<sup>1</sup> Optimum management and careful hybrid selection will maximize fiber production for a quicker return on investment. In addition to available nearby markets and product specifications (shape, size, chips, roundwood, acceptance of bark and leaves, etc.), planting and harvesting technologies must be investigated.

### The Trees

Various hybrids will perform differently on different soils and in different regions of the state. There is no single “best”

recommendation for all areas and conditions. Research on matching clones and sites is ongoing. It’s important to establish the best performing hybrids for a particular site for financial reasons, as well as resistance to pests. In Michigan, research is ongoing through Michigan State University and Michigan Technological University at locations throughout the state. Hybrid poplar stock has been obtained from either the University of Minnesota Natural Resources Research Institute<sup>2</sup> near Duluth or from a private grower near Grand Rapids. Hybrid willow stock has been obtained from the State University of New York<sup>3</sup> and from Cornell University.<sup>4</sup> Some of the research stock has been planted under license. Some clones are labeled using letters and numbers such as “NM-6”, which is one of the crosses between two poplar species *Populus nigra* and *Populus maximowiczii*. The “N” and the “M” come from the species name and “6” from a series

### 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.

of crosses. Alternatively, a hybrid may have a horticultural name such as “Onondaga” or “Tully Champion”.

### Management & Silviculture<sup>5</sup>

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, similar to an annual agricultural crop. Trees are planted at spacing regimes in the 700-1300 stems per acre for hybrid poplar and around 6000 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 8-10 inches long. Hybrid willow might be obtained in whips up to ten feet long that will need to be cut prior to planting.

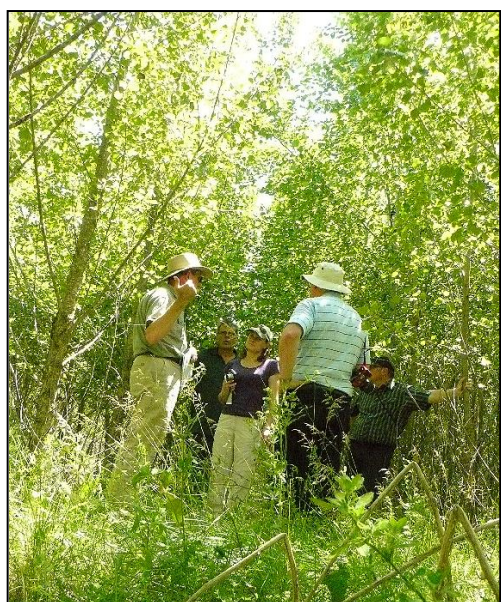
Weed control will be necessary until the hybrid stands are dense enough to shade out competing vegetation. Early growth is very sensitive to competition for both light and nutrients. Lack of weed control will result in reduced production or plantation failure.

Hybrid poplar rotations (time from planting to harvest) will likely be six to seven years, although genetic stock is always improving.

Poplar can be regenerated by replanting or 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 4.0 dry tons per acre per year<sup>6</sup> can be expected under good conditions. Natural forests produce about 0.5 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, preventative 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 may be required to exclude deer for two to three years, which is a significant expense.



*5 Year Old Hybrid Poplar*

### Wildlife Habitat

Wildlife use of these SRC plantations in Michigan has not been well studied. Conversion from old field habitat to that with vertical structure will discriminate against one suite of species in favor of another suite. 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.

### Landowner Tips

- Develop a business plan
- Assess soil conditions and fertility
- Intensive site preparation is necessary
- Select planting stock to suite site and market
- Use recommended planting techniques and spacing
- Vegetation competition control will be needed
- Monitor and manage pests
- Consider technology for harvesting and processing
- Incorporation regeneration schedule
- Research bioenergy cost-share programs



*Researchers Observing 1 Year Old Hybrid Willow*

<sup>1</sup> See MSU Extension hybrid poplar financial model at [[http://msue.anr.msu.edu/news/making\\_bioenergy\\_crops\\_pay](http://msue.anr.msu.edu/news/making_bioenergy_crops_pay)]

<sup>2</sup> <http://www.nri.umn.edu>

<sup>3</sup> <http://www.esf.edu/willow/>

<sup>4</sup> <http://willow.cals.cornell.edu>

<sup>5</sup> Hybrid poplar and hybrid willow research is ongoing. More complete, and the most recent, 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 2013.

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