

## FACT SHEET

## Improving the Yields of Shrub Willow Bioenergy Crops

*Planting using willow whips**Regrowth after coppice**Willow cutting header on a New Holland forage harvester***Shrub willow is a sustainable bioenergy crop**

Shrub willow is an emerging short-rotation woody crop that can be harvested repeatedly to provide wood chips as a source of heat, electricity, bioproducts and biofuels. These crops produce high yields, grow as a shrub with a large number of small stems, require low inputs of fertilizer or pesticides, and require little long-term maintenance. Shrub willows grow well on marginal agricultural land in the Northeast and upper Midwest, and could potentially return over 1 million acres of underutilized farmland in New York to productive cultivation, creating jobs and stimulating our economy. Using shrub willow wood chips for energy is carbon neutral, meaning the CO<sub>2</sub> emitted during combustion was captured by the plant as it was growing. Using willow biomass for energy is far better for the environment than natural gas, coal, or petroleum.

**Plant it once, it is productive for decades...**

Shrub willow can grow productively on poorly drained sites that are not suitable for food or feed crops. Planting machines cut up dormant, unrooted stems into pieces and push the cuttings into the soil, where they quickly root and put up shoots. The plants are cut back or coppiced after the first year, then they resprout and grow up to 25 feet tall over the next three seasons. Weed control is critical during the first two years of growth, but after closing canopy, there is little additional attention required. Harvesting is done in the winter while the plants are dormant and the ground is frozen. The plants resprout in the spring and can be harvested again every 3-4 years from then on, for more than 25 years.

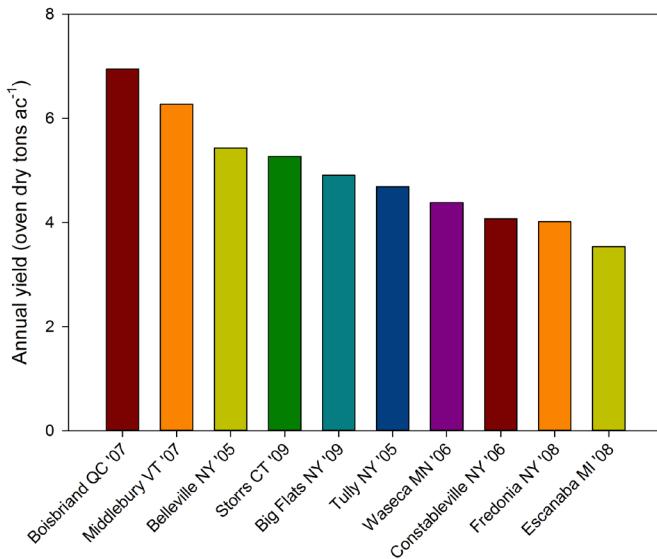
**Willow produces hardwood chips that have many uses**

New Holland and Claas have developed cut and chip harvesters that produce ~1" wood chips at ~45-50% moisture content. These can be burned directly in a power plant or large heating plant, but need to be dried to under 30% moisture content to burn in smaller wood chip boilers. The technology to convert willow wood chips into liquid fuels, either ethanol or gasoline replacements, is being developed and should be commercially viable soon. Willow chips also make very good landscaping mulch or bedding.

## Yield of current shrub willow cultivars

Many fast-growing cultivars of shrub willow have been bred and selected for conditions in North America. Depending on site quality, yields range from 4 to 7 dry tons per acre per year. Elite cultivars and commercial planting services are available through Double A Willow in Fredonia, NY ([www.doubleawillow.com](http://www.doubleawillow.com)).

Mean yield of the top five cultivars in each yield trial



## Commercially available willow cultivars

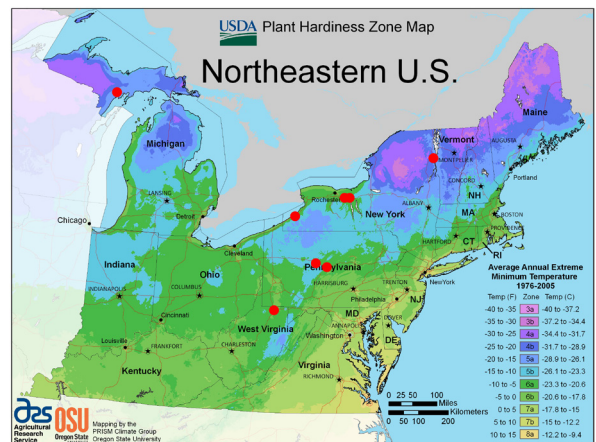
Diversity group	Species	Cultivar name
1	<i>Salix x dasyclados</i>	SV1
4	<i>S. eriocephala</i>	S25
5	<i>S. miyabeana</i>	SX61
		SX64
		SX67
		Canastota
		Sherburne
6a	<i>S. purpurea</i>	Fish Creek
6b	<i>S. koriyanagi x S. purpurea</i>	Allegany
		Onondaga
8	<i>S. viminalis x S. miyabeana</i>	Tully Champion
		Fabius
		Owasco
		Otisco
		Preble
9	<i>S. purpurea x S. miyabeana</i>	Oneida
		Millbrook

## Shrub willow breeding is funded by USDA grants



Controlled pollination of willow flowers

Shrub willow as a bioenergy crop has a short history of breeding, so there is huge potential to improve yield, pest and disease resistance, and nutrient use efficiency through conventional breeding. The USDA-National Institute of Food and Agriculture has funded researchers at Cornell University to breed new willow hybrids and test them in collaboration with colleagues in the NEWBio consortium at Penn State, West Virginia, Michigan State, and SUNY-ESF.



Yield trials with next generation willow cultivars

### CONTACTS:

**Larry Smart, Ph.D.:** Cornell University, Dept. of Horticulture, lbs33@cornell.edu; (315) 787-2490

**Dennis Rak:** Double A Willow, Fredonia, NY; [www.doubleawillow.com](http://www.doubleawillow.com); (716) 672-8493  
<http://willow.cals.cornell.edu>

