WILLOWPEDIA

Cornell University
College of Agriculture and Life Sciences

FACT SHEET

Demonstrating Yield of Shrub Willow Bioenergy Crops - Big Flats

Planting willow with an Egedal planter in Geneva, NY

Shrub willow is a sustainable bioenergy crop

Shrub willow, a new perennial crop that can be harvested on a three-year cycle, has the ability to provide wood chips as a source of heat, energy, bioproducts, and biofuels. These energy crops grow quickly, produce large numbers of small stems, require low inputs of fertilizer or pesticides, and vigorously resprout after every harvest for more than 20 years. 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. Other environmental benefits include a reduction in greenhouse gas emissions, because the CO_2 emitted by the conversion of willow biomass was captured by the plant during its growth. The use of natural gas, gasoline and coal releases significant amounts of CO_2, which is resulting in global climate change.

Third year growth at Big Flats

Shrub willow can be harvested for 20 years

Shrub willow is grown from dormant unrooted cuttings or "whips", which are planted mechanically in the spring, and the first harvest occurs 3-4 years later. Shrub willows can be harvested for over 20 years with no reduced yield. Weed control is critical during the first two years of growth, but after closing canopy, little additional maintenance is required. Shrub willow is best harvested during the winter months when the ground is frozen and the plants are dormant. New Holland and Claas have developed cutting headers designed to harvest and chip willow stems with a forage harvester. The chips are then blown into a trailer for transport to market. The wood chips are burned to generate renewable power and heat; the technology is also being developed to convert willow wood chips into transportation biofuels.

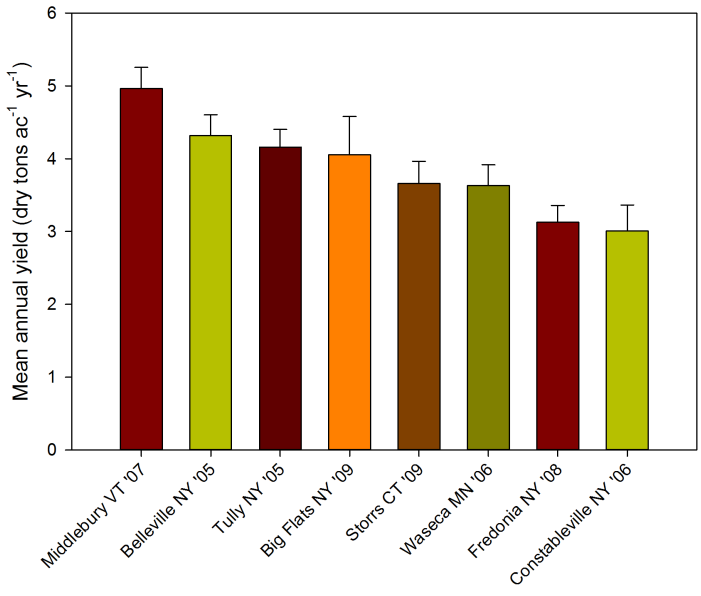
Controlled pollination of willow flowers

Breeding shrub willow for improved yield

As an emerging bioenergy crop that has only a very short history of agricultural cultivation, there is tremendous potential to generate new varieties of shrub willow (species of *Salix*) with improved yield, pest and disease resistance, and water and nutrient use efficiency through conventional breeding. The NYS Agricultural Experiment Station in Geneva is the focal point for willow breeding in North America. Cornell University researchers annually perform controlled pollinations involving elite parental lines chosen from a collection of over 500 willow accessions. Varieties with as high as 40% greater yield have been identified in replicated selection trials and are being tested in yield trials across a wide range of sites.

Big Flats yield trial

The USDA-NRCS Plant Materials Center hosts one of a number yield trials planted across the Northeast and upper Midwest. The goal is to test multiple cultivars in different soils and climates in order to understand what environmental variables affect yield and biomass quality and to find cultivars that are most adaptable to these regions. The Big Flats yield trial was hand planted in 2008 with funding support from the New York Farm Viability Institute at a density of ~6000 cuttings acre^{-1} and is maintained with funds from DOE. Stems were then cut back after the 2008 growing season to promote coppice regrowth, forming multiple stems per plant. The trial was then harvested after the 2011 growing season (three years growth), using a New Holland FX45 self-propelled forage harvester with a CRL header. Yield was greatest for 'SX61' at 6.2 dry tons ac^{-1} yr^{-1} and the mean yield across all cultivars was just over 4 dry tons ac^{-1} yr^{-1}. When yield of the 8 cultivars planted at Big Flats are compared to the same 8 planted at other sites in the yield trial network, mean yield at Big Flats is in the middle of the range (below).



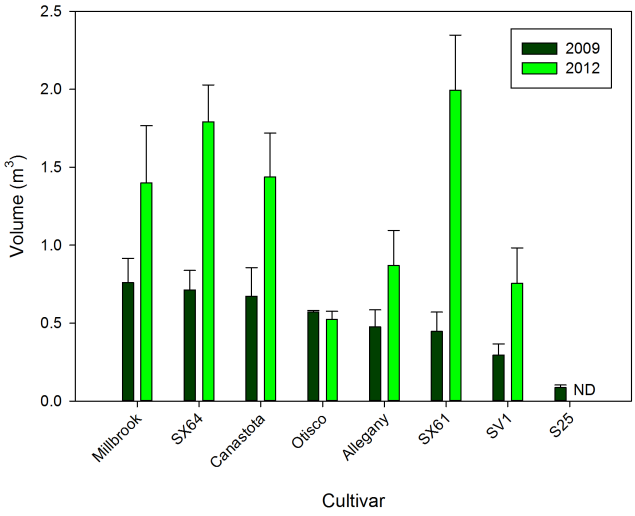
CONTACTS:

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; (716) 672-8493

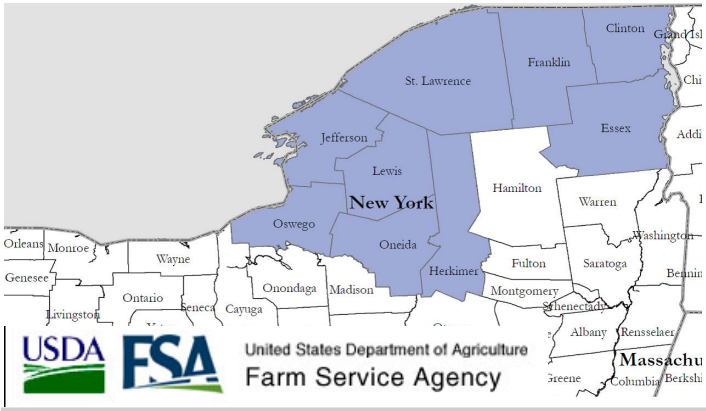
Paul Salon, Ph.D.: USDA-NRCS; paul.salon@ny.usda.gov; (315) 477-6535

The post-harvest regrowth in the Big Flats trial was measured after the 2012 season, one growing season after the first harvest. Height and diameter measurements were used to estimate volume of biomass for each cultivar. Measurements from the first year post-coppice (2009 season) and again after the 2012 growing season are compared below. Coppice regrowth was much greater after the first harvest compared with the initial coppice, with the exception of 'Otisco' and 'S25', which suffered from pest pressure and deer browse.



BCAP project area

Further support for the future production of biomass crops comes from the USDA Biomass Crop Assistance Program, which provides financial incentives from the FSA for farmers to plant and harvest bioenergy crops for heat, power, biobased products or advanced biofuels. The FSA has recently established its tenth new project area, which encompasses much of northern New York State (below), for the production of shrub willow.



Source: http://www.fsa.usda.gov/Internet/FSA_File/bcap_ny10.pdf

Cornell University College of Agriculture and Life Sciences New York State Agricultural Experiment Station

WILLOWPEDIA
http://willow.cals.cornell.edu

Cornell University Cooperative Extension

Cornell University is an equal opportunity, affirmative action employer and educator. Published July 2013 © Cornell University