



SHRUB WILLOW

Fact Sheet
Series



Renewable Energy • Rural Development • Environmental Benefits

Introduction to Shrub Willow

Welcome

This fact sheet series has been adapted from the Willow Biomass Producers Handbook¹ and the latest research to provide the most up-to-date information in an easily accessible format. This series provides introductory information on producing and utilizing shrub willow biomass for bioenergy, bioproducts, bioremediation and other uses that can create opportunities for sustainable rural development and numerous environmental benefits. This series is for farmers, landowners, project developers, extension professionals, biomass end users and other stakeholders in the Northeast and other areas where shrub willow is being developed. We provide information on each stage of the crop lifecycle, offer cultural and best practice guidelines for optimal returns on investment, and explore the opportunities and challenges of growing willow for multiple uses.



Willow bioenergy crops early in the second growing season

This fact sheet series has been developed by the Willow Project at SUNY-ESF from ongoing research across North America and commercial willow production in New York State. These efforts have been conducted in cooperation with many university, non-profit and industry partners. This first introductory fact sheet in the series will explain willow for bioenergy and other uses, and describe some of the related environmental benefits.

¹Abrahamson LP, Volk TA, Smart LB and Cameron KD (2010). Willow Biomass Producer's Handbook. State University of New York College of Environmental Science and Forestry, Syracuse, NY.

Willow Bioenergy Crops

The primary use of shrub willow is the production of a bioenergy feedstock (woodchips). Willow is a short rotation woody crop harvested on a three or four year cycle. Willow yields about four to five dry tons of hardwood biomass per acre per year, or about 25 to 35 green tons (45% moisture content) per acre at each harvest. Willow is adapted to grow on a variety of sites including wetter soils and marginal lands. Growing willow on idle land can spur sustainable rural development in the production, transport and use of the crop, providing locally sourced energy and creating jobs. Shrub willow has many characteristics that make it ideal for bioenergy production and other uses. Tolerance of high planting density, rapid growth rates and other traits contribute to willow's ability to produce hardwood biomass ten to fifteen times faster than typical forests in the Northeast.



Willow bioenergy crops three years after planting

New willow plants are easily established from unrooted stem cuttings inserted into properly prepared ground. Plants quickly regrow from the remaining roots and cut stumps after each harvest, a practice called coppicing. One planting can produce seven or more harvests over 20 years with limited maintenance. The quality and variability of woodchip properties important for commercial bioenergy feedstocks such as chip size and moisture, ash, and energy content are similar to forest residues and suitable for current end uses and for mixing these two feedstocks.



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Environmental Benefits

Willow for biomass and other uses can provide many environmental benefits and ecosystem services:

- Willow creates a woodland ecosystem that contributes to wildlife habitat and biodiversity for birds and small mammals.



Willow provides wildlife habitat for many species

- Willow is one of the first species to flower in spring, providing early nectar for pollinators.
- Willow is a carbon-neutral fuel source that does not contribute to climate change as carbon sequestered above and belowground by the crop offsets all greenhouse gas emissions associated with crop production, transport and utilization.
- Willow has a high net energy ratio, an important metric when evaluating renewable energy sources. For every unit of energy invested in the crop, up to 45 units of energy are produced.
- Willow's dense canopy creates heavy shade and natural weed control, eliminating the need for herbicides once the crop is established.
- Willow's natural and cultivated disease and pest resistance also limits the need for pesticides.
- Willow's perennial root system reduces soil erosion and nutrient runoff compared to annual crops.

Other Uses for Shrub Willow

The same unique plant traits that make shrub willow ideal for bioenergy also make it useful for a range of other applications. Willow "living fences" can be used as windbreaks, visual/noise screens, or to trap blowing snow along roadways, which reduces the cost of snow plowing and improves road safety.



A shrub willow living fence keeps blowing snow off the

Willow is naturally adapted to wetter soils and can be used to stabilize stream banks, reducing the risk of flooding and providing a vegetated buffer to prevent pollutants and sediments from entering surface and groundwater. Willow can also be used to remediate former industrial sites and as an alternative landfill cap, adding to the social, economic and environmental benefits that multifunctional willow systems can provide.

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The Northeast Woody/Warm-Season Biomass Consortium

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This work was supported by the New York State Energy Research and Development Authority (NYSERDA), the US Department of Energy (USDOE) and the US Department of Agriculture National Institute of Food and Agriculture (USDA NIFA). No funding agencies, SUNY, nor any of their employees makes any warranty, express or implied, or assumes any legal responsibility for the completeness, accuracy, or usefulness of any information or process disclosed here.