



# SHRUB WILLOW

Fact Sheet Series

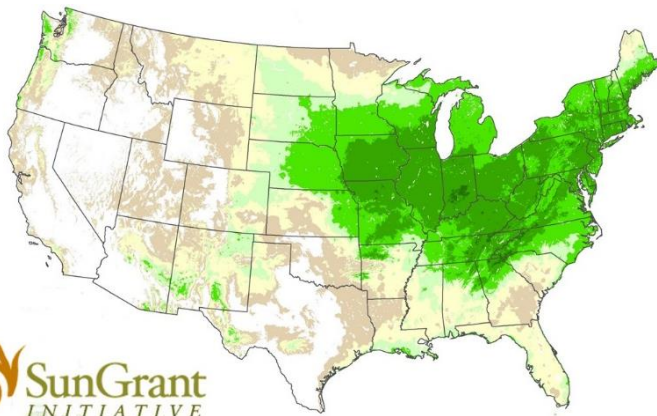


Renewable Energy • Rural Development • Environmental Benefits

## Site Selection for Willow Bioenergy Crops

### Site Selection

Shrub willow cultivars developed for bioenergy can produce four to five dry tons (8-10 green tons) of harvestable biomass per acre annually (harvested every three to four years) on a variety of sites. These willow cultivars have a wide geographic range (based primarily on climatic factors of temperature and precipitation) that extends across much of the eastern and central U.S. and into southern Canada. Site conditions within this range can impact willow yield, operations and profitability. Willow can be grown on a wide range of sites including marginal lands, but with potential tradeoffs in plant productivity and the level of operational challenges. Other considerations for willow site selection include the slope of the land, size and layout of the fields, accessibility, and proximity to the biomass end user.



*Willow can produce 4-5 dry tons of biomass annually across a wide geographic range (green areas on map)*

### Soil Characteristics

Soil is an important factor for any crop. Shrub willow can be grown in a variety of soils, but some basic criteria must be met. Soils that do not meet these criteria will inhibit plant survival and growth, and can impact the use of agricultural equipment. Soil characteristics can change within and between fields on a farm, so analysis of the entire land area under consideration for willow is recommended.

**Soil drainage classification** can be poorly drained to moderately well drained. Soils that are very poorly drained are generally not suitable for willow in most cases, as very wet soil conditions can inhibit plant growth and cause operational difficulties. Excessively well drained soils are also not recommended because willow is vulnerable to drought.

**Soil texture classification** of sandy clay, silty clay and loams are all generally acceptable. Sands and heavy clays may have associated drainage problems and are therefore not recommended.

**Soil pH** between 6.5 and 7.0 is optimal for nutrient uptake. Soils outside this range will limit the availability of phosphorous and other nutrients, but willow has been grown successfully on sites with soil pH 5.5-8.0. Soil pH can be adjusted to some degree by the use of amendments such as lime and sulfur.



*With proper site selection and site preparation, willow can be grown on a wide variety of sites and soil types.*

**Soil depth** to the root restricting layer (bedrock, hardpan, or seasonal water table) is recommended to be 24 inches or more to provide sufficient rooting volume, available water and nutrients.

**Soil fertility** should be at least moderate or the soil may require fertilizers or organic amendments during the site preparation phase (see fact sheets on site preparation and nutrient management).



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### Marginal Lands

Willow can be grown on marginal lands, but in general, as with most crops, higher quality soils will likely produce higher biomass yields with fewer inputs and fewer operational challenges. Marginal lands, by definition, have one or more biophysical characteristics that limits the productivity and economic viability of traditional annual crops on those lands. Willow is less affected than other crops by some of these limitations, such as wetter soils, but some site limitations may still reduce productivity and operational efficiency in willow plantings.



*With the right land and cultural practices, willow can produce 30 green tons of biomass per acre at harvest*

The land use history, soil tilth and overall condition of the site should be considered in the decision to plant willow. These baseline conditions dictate the work and investment necessary to properly prepare the soil for planting. Sites that have been idle, compacted, overgrown with brush, etc. will require more work and investment to be made suitable for planting (see fact sheet on site preparation). Some sites may also require rock-picking, removal of hedgerows, new access roads or other site improvements. Despite these challenges, marginal lands may be a feasible option for willow in some cases to make use of idle lands and fields that are generally too wet for other crops, if operational and plant productivity challenges can be overcome.

### Other Site Considerations

Transporting feedstock to an end user is often a large percentage of delivered biomass costs, around 20-25%. Fields should generally be located less than 50 miles (one-way) to the biomass end user. The logistics of trucking harvested biomass should be considered, such as site access, load limits, seasonal access roads, height restrictions, etc.

The size and layout of willow fields is also important. The minimum recommended field size is 25 acres, and the preferred project size (group of nearby fields) is 100 acres or more. Larger, rectangular-shaped fields enable longer continuous runs of machinery and higher efficiencies. When renting specialized machinery, fixed costs are reduced in larger projects by spreading the costs of machine transport and use across a larger number of acres. Headlands thirty feet wide or more must be maintained on both ends of the willow rows if using a forage harvester system, but other unplanted areas should be minimized in order to maximize crop production (see fact sheet on headlands and planted area). Slope of the land should be 10% or less.

Each site is unique and should be considered on an individual basis, but following these general guidelines for site assessment and selection can make willow plantings more productive, and make operations more efficient and profitable. Please contact us directly for more information and assistance with individual site assessments.

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