

## Miscanthus (*Miscanthus sp.*)

### **Species Description**

*Miscanthus* is a genus comprised of twelve perennial grass species that are native to Asia and were introduced to the United States as ornamental plants in the nineteenth century. This tall reed, or canelike plant, is a close relative to sugarcane and has the ability to withstand cold conditions and poor soils. Its growth potential and high yield make it a prime candidate for biomass production. Giant miscanthus (*Miscanthus giganteus*), the species most commonly used for bioenergy, is actually a sterile hybrid of two species, *Miscanthus sinensis* and *Miscanthus sacchariflorus*. Giant miscanthus can be pressed into fuel pellets or biomass logs for combustion and can be used for cellulosic biofuel production as a feedstock. Additionally, it has high lignocellulose yields in comparison to other biomass crops, which makes it desirable as a biomass feedstock.

The plant is drought-tolerant but fares better under wetter conditions and is actually ideal for soils that are too wet for other crops, such as corn or soybeans. Giant miscanthus's roots can grow deep below the ground surface, reaching down to 8 feet, and they break up hard soils and improve drainage. The hybridized giant miscanthus is sterile, so there are no concerns about invasiveness from seed. However, some other varieties of miscanthus can be invasive, so it is important to ensure that the giant miscanthus species is selected when looking for planting stock.

### **Geographic Distribution**

Giant miscanthus is not widely found across the United States currently. It has been used occasionally as an ornamental plant since the 1930s in the United States; however, it has been planted more widely in Europe. Based on how well it does in Europe (from Italy in the south to Denmark in the north) it is likely that giant miscanthus will be productive over a wide range of temperate regions including the southern US. It does not fare well in arid climates.

### **Production Process**

Giant miscanthus is planted using rhizomes (or root growths), rather than seed, which makes it more expensive to establish than other energy crops. Specialized equipment is needed for planting, due to the challenge of planting rhizomes. Rhizomes can be hard to find, but are becoming more widely available. Soils should be tested prior to planting as a pH between 6 to 8 is desirable. Typically, 6,000 plants per acre are planted in the late spring once there is no chance of another frost occurring. However, it is not recommended to plant later in the spring or early summer, as establishment would be negatively affected. Weed control is essential within the first year and may be needed in the second year. Once giant miscanthus is established, stands will usually be weed-free, as it crowds out all other plants in the field. Frost can kill the plants, especially in the first year; however, once a stand survives through the first winter, it will usually survive subsequent winters. Frost kill is less of a risk in the southern United States because of milder winter temperatures. Nitrogen fertilizers are not recommended as giant miscanthus has low nutrient requirements during establishment and does not show much response to nitrogen fertilization. Some studies have shown that nitrogen can be counterproductive to giant miscanthus establishment as it encourages greater weed growth.

### **Growth Rate**

A full crop can be expected after two to three growing seasons, and the first harvest can occur as soon as the second year. Conventional hay or silage harvesting equipment can be used. Giant miscanthus can be harvested annually for approximately 15-20 years. The plant reaches heights of up to 12 feet and can regrow from the rhizome each year. Giant miscanthus is typically harvested in the late winter or early spring to allow nutrients to translocate from the above ground portion of the plant, into the crown and rhizomes. These nutrients can then be used by the plant the following year.

### **Yield**

Biomass yields for giant miscanthus average as much as 8 to 12 tons per acre per year, making it among the highest-yielding perennial energy crops. However, there is not very much published data on giant miscanthus yields that are specific to the United States. Stalks can be as long as 9 feet at harvest, which makes for abundant biomass. The relationship between harvestable yields and fertilization is not clear. Productivity is typically higher on more fertile soils, but sites with poorer soils can still produce higher yields if other environmental conditions, such as temperature, are favorable. Giant miscanthus will grow on marginal sites, but, as with most crops, yields will be reduced on nutrient-poor lands; however, overall production can still be considered high in comparison to other perennial grasses. Some small research trials in the Midwestern United States suggest that giant miscanthus could yield more than twice the amount of biomass as switchgrass grown in the same area.

### **Conclusion**

Giant miscanthus has great potential in the southeastern United States as a biomass feedstock. Its fast growth rate and abundant biomass growth on all types of land make it a desirable bioenergy crop. There are some constraints for its establishment, such as difficulties in sourcing planting materials and in planting the rhizomes. Despite these challenges, the economic potential returns for giant miscanthus over 20 years are favorable compared to other energy crops.

Prepared by Leslie Boby, Bill Hubbard and Connor McDonald

### **Adapted from**

Jacobson, M. 2013. Renewable and Alternative Energy Fact Sheet: NewBio Energy Crop Profile: Giant Miscanthus. <http://extension.psu.edu/publications/ee0079/view>  
Sources:

### **Other sources**

eXtension Farm Energy COP. "Miscanthus (*Miscanthus x giganteus*) for Biofuel Production." [www.extension.org/pages/26625/miscanthus-miscanthus-x-giganteus-for-biofuel-production](http://www.extension.org/pages/26625/miscanthus-miscanthus-x-giganteus-for-biofuel-production)

Jacobson, M. 2013. Renewable and Alternative Energy Fact Sheet: NewBio Energy Crop Profile: Giant Miscanthus. <http://extension.psu.edu/publications/ee0079/view>

Williams, M.J. and Douglas, J. July 2011. Planting and Managing Giant Miscanthus as a Biomass Energy Crop. USDA NRCS Plant Materials Program, Technical Note No. 4.