SS AGR 292

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Production of Biofuel Crops in Florida: Miscanthus[1]

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Introduction

Miscanthus is a tall perennial grass species native to parts of Asia, Polynesia and Africa. It is currently grown in North America, including Florida, as an ornamental. *Miscanthus* is now mentioned as a biofuel crop because of its relatively high dry matter yields across a range of environmental and soil conditions. The *Miscanthus* genotype most commonly recommended for biofuel production is a sterile hybrid (*Miscanthus x giganteus*) believed to be a *M. sacchariflorus* x *M. sinensis* hybrid.

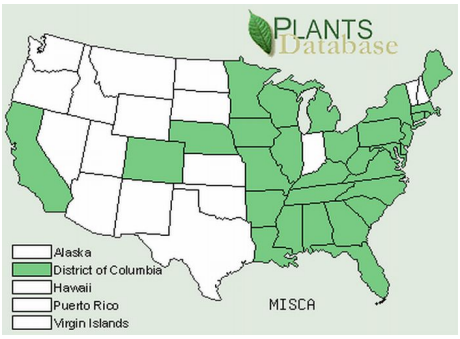

Figure 1. Occurence of *Miscanthus spp.* in the US.
Credits: http://plants.usda.gov/java/profile/?symbol=MISCA

Current Potential for Use as Biofuel

Miscanthus utilization in the biofuel industry is primarily for combustion in power plants – it has the desirable properties of low water and ash contents. Current research is focused on its potential as a biomass crop for direct combustion and for lignocellulosic conversion to ethanol.

Biology of Miscanthus x giganteus

Miscanthus x giganteus is an erect, warm-season grass that has a C_4 photosynthetic pathway. It is a very cold-tolerant warm season grass that will develop leaves at temperatures below 50 °F and has survived winters with temperatures below -10 °F. As a sterile hybrid that produces no seed, it must be propagated vegetatively. The general appearance of the plant is that of a loose bunchgrass, but it will spread slowly via short rhizomes (horizontal underground stems) that can form dense stands. Stems are 5 to 12 feet tall with very deep roots.

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Figure 2. Stand of *Miscanthus x giganteus* at peak growth in Illinois.

Production

Miscanthus x giganteus must be established vegetatively from rhizome pieces, which results in high establishment costs. Presently, no commercial mechanical planters are available in the U.S., but potato planters have been successfully modified for planting *Miscanthus x giganteus* rhizomes. Rhizomes should be planted approximately 4-inches deep and 3-feet apart within rows, and 3-feet between rows (approximately 4,840 rhizomes per acre). Weed control is critical for rapid establishment. Fertilization during establishment is not recommended because it only encourages weed growth. Maintenance fertilization (approx. 50-75 pounds of N per acre per year based on some European studies) is required after establishment. The top growth can be harvested in the second year after planting. Maximum yields should be obtained within 3 years on fertile sites. Replanting may be necessary after about 15 years. The crop requires about 25 inches of water per year to survive (but more to be highly productive), tolerates brackish water, and uses a minimal amount of nutrients from the soil. It can be harvested following maturity in the fall and before regrowth in the spring with a sugarcane harvester or a modified forage harvester.

Potential Yields

Miscanthus x giganteus has shown relatively high dry matter yields of 5 to15 tons per acre in nonirrigated studies after stand development (two to four years). Yields were limited on shallow, droughty, or waterlogged soils and at higher latitudes. In the Midwestern United States, it has been shown to produce two to three times the yield of Cave in Rock switchgrass across a range of soil and environmental conditions. There is no documented yield data for Florida.

Production Challenges

In Florida, less is known about *Miscanthus x giganteus* production than other potential biofuel crops such as sugarcane, sweet sorghum and elephantgrass (napiergrass), which have been more widely studied for biomass and agricultural production. For North Florida, an advantage of *Miscanthus x giganteus* compared to other warm-season grasses is its relative cold tolerance. However, plants are difficult to establish, as the planting must be done vegetatively from rhizomes. In addition, there are no established production practices for Florida. At present, there is no market in the U.S. for *Miscanthus x giganteus*, but as the lignocellulosic conversion to ethanol process advances and becomes more economically competitive, markets for biomass will no doubt develop.

Estimated Production Costs

There are no records of long term experiments in Florida with *Miscanthus x giganteus*, therefore production costs are not known.

Environmental Concerns

Total water use can be relatively high because of high overall biomass production. *Miscanthus* has been shown to increase soil carbon. Although *Miscanthus x giganteus* is sterile, it is non-native to the United States and there is some concern that it could escape and spread vegetatively with unknown consequences for native ecosystems.

Summary

Although much more research is needed on *Miscanthus x giganteus* production in the United States and Florida, it appears to offer the potential of high production with minimal known environmental impacts.

Sources of Additional Information

- Miscanthus – A Review of European Experience with a Novel Energy Crop. http://bioenergy.ornl.gov/reports/miscanthus/toc.html
- Miscanthus Research at the University of Illinois. http://miscanthus.uiuc.edu/
- Plants Profile – Miscanthus Anderss. http://plants.usda.gov

Bibliography

Clifton-Brown, J.C., J. Breuer, and M.B. Jones. 2007. Carbon mitigation by the energy crop, *Miscanthus*. Global Change Biology 13: 2296-2307.

Gibson, L. and S. Barnhart. 2007. Miscanthus hybrids for biomass production. Agronomy Department, Iowa State University, Ames, IA. Extension publication AG201. 2 pp.
(
http://www.extension.iastate.edu/Publications/AG201.pdf).

Heaton E., T. Voigt, and S.P. Long. 2004. A quantitative review comparing the yields of two candidate C4 perennial biomass crops in relation to nitrogen, temperature and water. Biomass and Bioenergy 27:21-30.