

# PERENNIAL BIOENERGY GROWING GUIDE

## MISCANTHUS

### Introduction

Farmers motivated to diversify their operations who have well-draining soils and struggle with sediment run off may benefit from the adoption of Miscanthus as a perennial bioenergy crop. Some species of Miscanthus (e.g., *sinensis*) are native to eastern Asia and highly invasive in the US. *Miscanthus x giganteus* is a sterile hybrid with a 15-to-20-year lifespan, making it the best variety for bioenergy feedstock production. This variety is a cross between *Miscanthus sinensis* and *Miscanthus sacchariflorus* and has three sets of chromosomes instead of the normal two. This prevents the normal pairing of chromosomes needed to form fertile pollen and ovules and makes it sterile. It has been grown in the European Union on a very large scale for over 20 years with no evidence of becoming invasive.

### Growing Considerations

Peak Miscanthus growth occurs between August and October. In the fall, Miscanthus undergoes senescence and translocates nutrients from the above-ground plant canopy to the roots. Delaying harvest until after senescence reduces drying time and improves the quality of the biomass.

However, waiting to harvest until after senescence also decreases harvestable yield by 20-40%. This means peak biomass yield of Miscanthus is in the fall. Harvests after this time is the best opportunity to maximize biomass yield.

### Planting

Planting rhizomes in tilled soil following soybeans is recommended to manage weeds and crop residue, and to maximize establishment of this long-term perennial crop. While tillage is not a recommended agricultural practice, it is beneficial to till before the one-time planting of Miscanthus as it will ensure good establishment for the crop's 20 year lifespan. If Miscanthus will be planted after a soybean harvest, a fall cover crop of small grains may be used to protect the soil over winter and provide weed suppression in the spring. The cover crop should be killed prior to planting Miscanthus in the spring. Soil should be finely tilled to a depth of at least 6 inches before planting. Specialized machinery for planting giant Miscanthus rhizomes is being developed but is not currently available in the U.S. Some types of vegetable transplanters are appropriate for both rhizomes and plugs, but there are considerations for each.

Research Miscanthus plots, UIUC Energy Farm

### Miscanthus Optimal Growing Conditions

#### Soil & Field Conditions

- Well-draining
- Silt & clay loams
- Flat to slightly rolling terrain with 0-12% slope

#### Equipment Needs

- Transplanter
- Forage harvester
- Baler
- Silage chopper (optional)

#### Nutrient Management

- N application - optional, but will increase yield. Application rates vary.



Miscanthus rhizomes, UIUC



Miscanthus, UIUC Energy Farm

For example, the rhizomes must be cleaned and sized to fit through the transplanter before planting. If planting plugs, it is critical to apply water at planting to ensure good survival. Rhizomes should be planted 2 to 4 inches deep and well covered. Plugs should be planted with the root ball below the soil surface. Both can be planted anytime after the frost-free date, typically early May in the Midwest.

Planting at conventional spacing with available equipment using 30 inches between and within the rows is recommended. Equal spacing around the plant gives better growth than planting at a higher rate within the row as is done with many annual crops. This spacing will also make it easier to include field cultivation as a weed control option.

Nutrient management for Miscanthus is optional, but beneficial to maximize yield. Application rates are typically 50-60 pounds per acre, but may vary depending on type of cultivar.

## Harvesting & Storage

Miscanthus can be harvested two years after planting. Unlike most crops, it is recommended to harvest Miscanthus in the winter due to low moisture content of the plant at that time.

### Miscanthus Harvesting Methods

#### Mowing and Baling

Miscanthus can be baled into round or square bales like corn stalks. Travel and transport can be greatly improved by baling this crop.

#### Silage Chopping

A silage harvester can harvest whole plant material after it dries in the field. Chopped material is blown into carts or trailers. A tractor trailer stationed at the edge of the field can transport to storage or to off taker.

It is important to note that Miscanthus is silica-rich, which increases the dulling of harvesting blades on foraging equipment. Sharpening blades every few hours throughout harvest is crucial for machinery maintenance. This means there is an increased need for equipment maintenance on harvesting equipment. Considerations such as this should factor into overall operational costs for producing Miscanthus.

The storage timeline for harvested bales of Miscanthus ranges from 30-90 days depending on the moisture content of biomass at time of harvest. The acceptable moisture content range for the desired end of the harvested Miscanthus will also influence storage time. Storage methods are at the discretion of the producer. Chopped material should be bagged or covered, and bales should be covered to maintain the quality of the harvested biomass.

#### NOTE:

University of Illinois recommends verifying that the material sold is actually Miscanthus to ensure the crop does not become an invasive liability. Miscanthus can be planted from rhizomes dug straight from a mother field or from greenhouse-grown plants, called plugs.

### Miscanthus Resource Directory



Scan Here

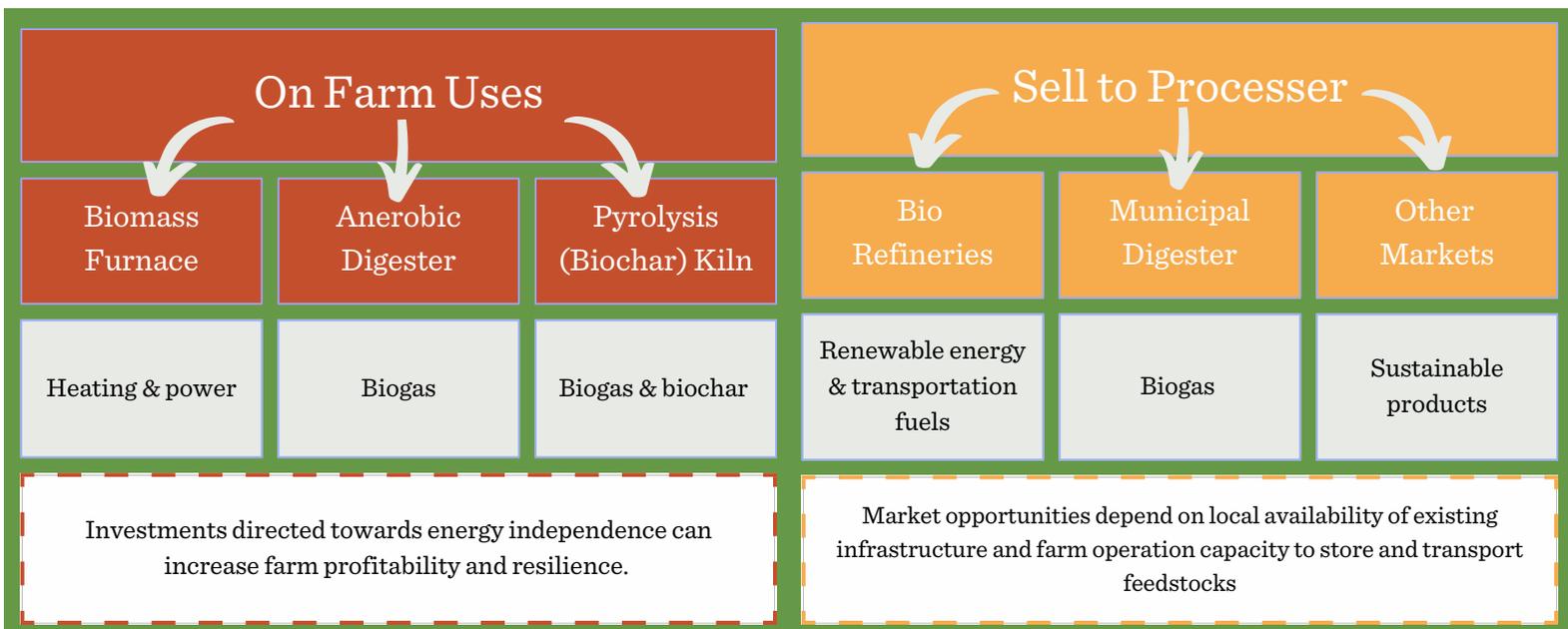
## Summary

The breakeven prices for profitable production of Miscanthus are calculated from the estimated cost of inputs, machinery, and land. The breakeven price for Miscanthus depends significantly on the quality of farmland being used for production. Miscanthus breakeven price can be as low as \$69-106 per ton dried material (DM) in Illinois if average quality land is used and \$49-\$80 per ton DM if marginal quality land is used.

Selling harvested biomass to an off taker may be the most profitable option to a majority of producers. If storage, transportation distance, and other logistics are significant barriers to adoption, on-farm processing and use to provide heat and power may be a more feasible end use for harvested biomass.

## END USES FOR BIOENERGY CROPS

Miscanthus feedstock can be used on- and off-farm to produce renewable energy & sustainable fuels.



Miscanthus Burning Biomass Heating System, UIUC Energy Farm



Biomass Heating

Anaerobic digester tanks, US EPA



Anaerobic Digester

## Sources

Heaton, E., Boersma, N., Caveny, J., Voight, T., & Dohleman, F. (2019, April 13). Miscanthus (*Miscanthus x giganteus*) for Biofuel Production. Farm Energy. Retrieved February 10, 2023.

For more information on this project or to discuss bioenergy cropping systems please contact Marlee Giacometti, AFT Midwest Program Associate, [mgiacometti@farmland.org](mailto:mgiacometti@farmland.org), 815-267-1326

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