

# Giant *Miscanthus* Establishment

## Introduction

Giant *Miscanthus* (*Miscanthus x giganteus*), a warm-season perennial grass originating in Southeast Asia from two ornamental grasses, *M. sacchariflorus* and *M. sinensis*, is a popular candidate crop for biomass production in the Midwestern United States. This sterile hybrid is high yielding with many benefits to the land including soil stabilization and carbon sequestration. Vegetative propagation methods are necessary since giant *Miscanthus* does not produce viable seed.

## Field Preparation

A giant *Miscanthus* stand first begins with field seedbed preparation. To provide good soil to rhizome contact, the seedbed should be tilled to a 3- to 5-inch depth. Soil moisture is critical to proper establishment for early stage germination. If working with dry land, prepare your field just prior to planting for optimal soil moisture. Good soil contact is also critical, so conversely, don't till when the land is wet and clods will form. Nutrient (NPK) and lime applications should be made to the field as necessary before planting, following typical corn recommendations for the area. Giant *Miscanthus* does not have high nutrient requirements once established, but fields last for 20-30 years, so it is important that adequate nutrition be present at establishment.

## Timing

Currently, we only recommend spring planting of giant *Miscanthus* in the upper Midwest, and it should be timed similar to corn planting. When soil temperatures have reached 50° F and probability of a spring frost is low, it is time to plant. Though *Miscanthus* can be planted as late as June, late planting leaves less time for the plant to develop a strong rhizome system to see it through the winter. Do not plant after July 1 without irrigation.

## Choosing your plant material

At this time, there are two plant material options for starting a giant *Miscanthus* stand: rhizomes and small plants, commonly called 'plugs.'

## Rhizomes

Rhizomes (Fig. 1) are overwinter storage organs that can also be used to grow new plants, similar to potatoes. Traditionally, new giant *Miscanthus* fields have been propagated by digging rhizome segments from 'mother fields,' a labor intensive process best done on sandy soils with specialized equipment. Rhizomes can be harvested from a dormant field of giant *Miscanthus*, typically any



Figure 1. Rhizome segments. Photo credit: Heaton Lab.

time after the first frost in the fall and before the last one in the spring. If not immediately replanted in a new field, they should be kept moist and cool (37-40° F) in storage. Ideal rhizomes have two to three visible buds, are light colored, and firm (Fig. 1). Smaller rhizomes or those that are soft to the touch will likely have lower emergence.

## RHIZOME PLANTING

Specialized rhizome planters are becoming available in the United States, and are based on potato planting technology. Typical planting rates are around 5-15 acres/day, though they can be much higher in ideal conditions. Because rhizomes are not all the same, planting depth can vary. It doesn't matter what direction the rhizome faces, but it needs to be covered by 2 inches of soil. It is important that the rhizome is not sticking out of the ground, or it will quickly dry out. Rhizomes should be planted at a rate sufficient to achieve about 6,000 plants per acre. It is difficult to know how many rhizomes this requires, since rhizomes are usually planted by weight, not by number. It is important to work with a rhizome supplier and planter that can help you calibrate the planter to achieve recommended populations. In Iowa, it is reasonable to expect 20-30 percent of rhizomes will either not grow, or die in the first year, so overplant accordingly.

## Small plants ('plugs')

Alternatively, vegetative propagation can be used to generate new giant *Miscanthus* fields in the greenhouse from stem or rhizome cuttings (Fig. 2). This allows the use of smaller plant pieces that can be divided more often, generating more plants in a given period of time than traditional rhizome production. This method is more expensive, but generates a uniform plant similar to what you might buy in a 'six-pack' container from a garden center (approximately 2" x 2" root ball).



Figure 2. Micro-propagated plants, commonly called 'plugs.' Photo credit: Heaton Lab.

## PLUG PLANTING

These small plants can be planted directly into the field with existing transplanting equipment like what is used in the vegetable or tobacco industry. As with rhizomes, typical planting rates are around 5-15 acres/day, though they can be much higher in ideal conditions. Depending on rainfall, you can expect about 20-30 percent of small plants to die within two months of planting, so plant extra to achieve target populations of 6,000 plants per acre.

## Planting

As mentioned earlier, target populations for giant *Miscanthus* are about 6,000 plants per acre, and about 20-30 percent of plugs and rhizomes either die or don't emerge, so overplant accordingly. Target plant spacing is 30 inches between plants both within and between rows (30-inch grid). Following planting, ensure the soil has been packed around the plug or over the rhizome to provide good soil contact, by either having a press-wheel behind the planter (plugs) or rolling the field after planting (rhizome).

## Management

Management during the establishment year is critical to the survival of the giant *Miscanthus* stand. This is an expensive crop to establish, but done right, it should be productive with minimal inputs for the next 30 years, so take care of it the first year!

Management during the establishment year involves:

- **Adequate water supply.** This may be in Mother Nature's hands, but if it is possible to irrigate the crop during dry periods after planting, then do it. Rhizomes are a bit more tolerant of moisture stress, but small plants need water after planting to settle the soil around the roots. Most transplanting equipment includes a water tank to give the plant a few cups at planting.

- **Weed management.** Weed control is essential in the establishment year. Apply a pre-emergent herbicide at planting, and then control broadleaves as needed during the summer. Grass herbicides will not be safe on giant *Miscanthus*. Cultivation can also be effective, but take care not to damage emerging *Miscanthus* shoots. In 2013, only a few herbicides are labeled for giant *Miscanthus*. Harness® (Monsanto Co., acetochlor), Harness Xtra® (Monsanto Co., acetochlor + atrazine), Bicep® (Syngenta Co., metolachlor + atrazine), and 2,4-D can all be safely and legally used. Prowl® (BASF Corp., pendimethalin) products also worked well in research trials. Check with your local officials to understand herbicide restrictions in your area.

- **Nutrient needs.** As described under 'Field Preparation,' nutrients should be brought up to corn thresholds prior to planting. No additional fertilizer is necessary during the establishment year.

- **Harvest.** Don't harvest the first year of growth! Establishing *Miscanthus* does best when the first year's growth is left on the field over winter. If desired, you can mow or burn it in late spring the following year. Harvesting or burning prior to the first winter has been related to heavy plant losses in some environments.

Minimal inputs are needed following establishment. If weed pressure is heavy as the crop emerges in the second year, an herbicide application might be beneficial. As the stand matures, it will quickly outcompete weeds and an application should not be necessary in subsequent years.

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