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Miscanthus Establishment and Survival

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Abstract
Rising costs of petroleum fuels and increased awareness of the adverse effects of greenhouse gases have spurred interest in renewable fuels and other 'green' products. Recent legislation has set goals of approximately 20 billion gallons of renewable fuel produced from non-corn starch sources by the year 2022. These driving forces have increased interest in dedicated bioenergy crops. Among perennial grasses, which have received an exceptional amount of attention as dedicated energy crops, one stands out: Miscanthus (Miscanthus × giganteus).

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Miscanthus Establishment and Survival

RFR-A1083

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Introduction

Rising costs of petroleum fuels and increased awareness of the adverse effects of greenhouse gases have spurred interest in renewable fuels and other 'green' products. Recent legislation has set goals of approximately 20 billion gallons of renewable fuel produced from non-corn starch sources by the year 2022. These driving forces have increased interest in dedicated bioenergy crops. Among perennial grasses, which have received an exceptional amount of attention as dedicated energy crops, one stands out: Miscanthus (*Miscanthus* × *giganteus*).

Miscanthus is an introduced species native to Eastern Asia. The main interest in Miscanthus lies in its impressive yields: trials at the University of Illinois show Miscanthus can yield three-fold more than switchgrass, with expected commercial yields of 10 dry tons/acre. However, this naturally occurring triploid hybrid variety is sterile and produces no viable seed. Though it hinders cheap planting, a lack of seed is desirable from an ecological standpoint as there is little chance of Miscanthus becoming invasive or weedy.

Without viable seeds, propagation and establishment of large-scale plantations of Miscanthus is challenging. Current practice is to dig rhizomes from existing plantations and replant them in new fields. This is disruptive to the parent stand, and the tillage required releases soil carbon. Another method of planting Miscanthus uses live plants, known as "plugs," generated in greenhouses. Though this method may be advantageous, some evidence indicates plug plants have a decreased survival rate due presumably to a smaller rhizome system in the first season.

To address these issues and gauge the success of Miscanthus plantations in Iowa, a field study was established in 2009 at three locations in Iowa: the Northwest Research Farm, Sutherland, IA; the Armstrong Research Farm, Lewis, IA; and the Hinds Research Farm, Ames, IA. The goals of this project are to: 1) evaluate the relative establishment success of rhizomes and plugs; 2) evaluate the relative winter survival of rhizomes and plugs; and 3) evaluate the relative growth and yield of plants generated from rhizomes and plugs.

Materials and Methods

At each site, eight 40 ft × 40 ft plots were established in a completely randomized design with four replicates in late spring 2009. Plots were either established using plugs (Figure 1) or rhizomes (Figure 2). Plants were arranged in an equal spacing grid with 30 in. within and between rows. Plug plots were watered regularly for the first two weeks of establishment or until new shoots emerged from the original transplant.

Weed control was done using a one-row cultivator, hand weeding, and herbicides [2,4-D (Amine 400, pbi/Gordon Corp, Kansas City, MO) and Pendimethalin (Prowl®, BASF, Florham Park, NJ)].

Results and Discussion

In 2010, yields ranged from 9.1 to 13 dry tons/acre (Figure 3). Mean yields from each site were not significantly different ($P > 0.05$). Also at each site, yields of rhizome plots and plug plots did not differ significantly ($P > 0.05$). A trend of increasing yields moving from South to North did exist, but as shown above, was not significant ($P > 0.05$).

Yields from 2010 were increased from the first year, and are expected to continue to rise. The expected peak yields of Miscanthus come in the third or fourth year, which will be 2011 and 2012, respectively. Yields found in this study have been comparable with yields found in Illinois studies. It is likely that Iowa yields in the third year and beyond will be similar to those found in the Illinois trials.

These results are further evidence that Miscanthus is a good candidate to be a dedicated energy crop for Iowa.

Figure 1. Greenhouse grown plug of *M.* × *giganteus*.

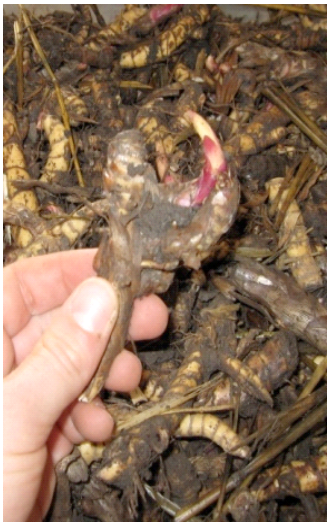

Figure 2. Field dug rhizomes of *M.* × *giganteus*.

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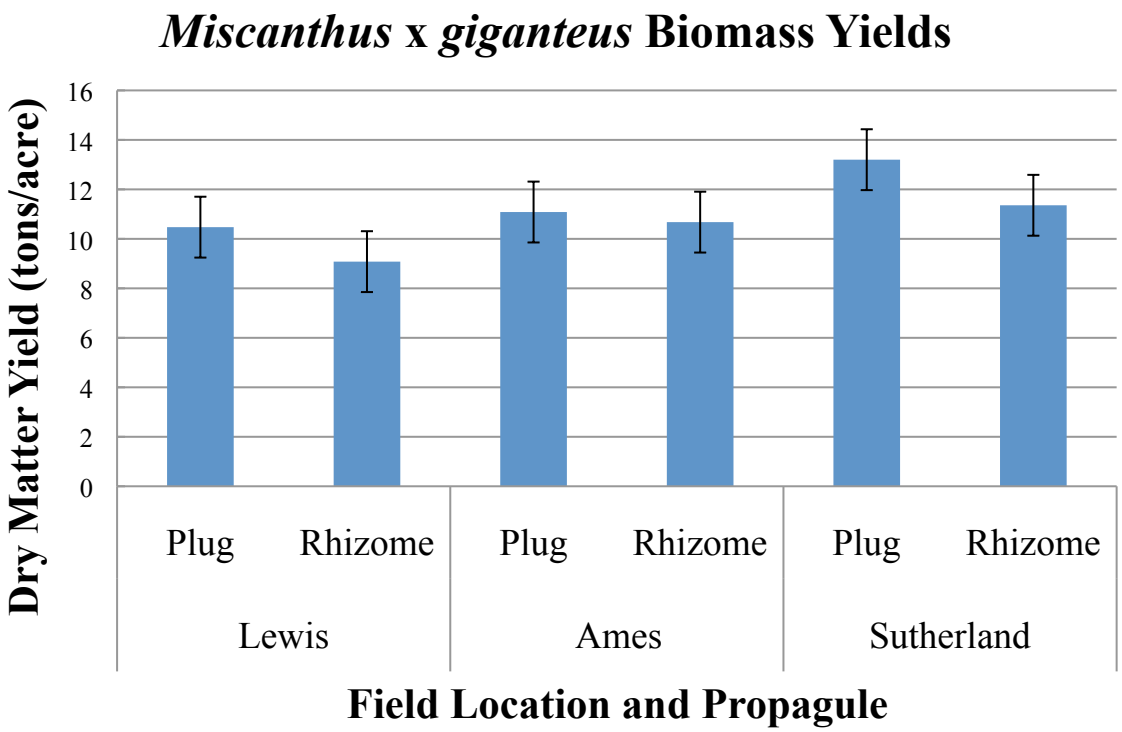

Figure 3. Field dry matter yields of *M.* × *giganteus*. Means are the average of four plots and error bars are the standard error of the means.