



This grass has several unique attributes that make it attractive as a feedstock for renewable energy. These attributes include:

- Perennial
- Long Canopy duration
- Recycles Nutrients to the Roots
- Low Inputs
- No Known Pests/ Diseases
- Sterile, Non-Invasive
- Winter Standing
- Uses Existing Farm Equipment
- Easily Removed for Processing
- High Water Use Efficiency
- Clean Burning
- High Biomass Yield
- C4 Photosynthesis



*Miscanthus x giganteus* [center] at the Minnesota Landscape Arboretum

In England, miscanthus is being grown commercially and used to produce energy. The University of Illinois – Champaign has been conducting research for a number of years and a conversion facility is being considered there. Loren and Russell Forrest, Luverne, MN are cooperators on this grant. They have successfully established a few acres of miscanthus and are researching and developing methods for propagation and planting.

Miscanthus has been reported growing, and producing high or reasonably high yields on a wide range of soils – from sands to high organic matter soils. The annual fertilizer demand is low. This is due to good nutrient use efficiency and the plant’s capability to re-cycle large amounts of nutrients into the rhizomes during the latter part of the growing season. The leaves fall to the ground and predominantly remain in the field. Nutrient off-take when harvesting the stems is low as the nutrients are trans-located to the rhizomes in the fall. This not only retains the nutrients for the next year’s growth but, also, reduces pollutants in the emissions when the biomass is converted to energy. The first year the plants should not be harvested to provide winter protection for the young plants. Yield in the first year is only one to two tons per acre. From the second year onward the crop is harvested annually. Yields of 15 to 20 tons per acre have been achieved.

| Crop               | Biomass Yield      | Energy Yield            |
|--------------------|--------------------|-------------------------|
| Corn Stover        | 2 Tons/ Acre       | 30 Million BTU’s/ Acre  |
| CRP/ Natural Areas | 2-3 Tons/ Acre     | 30 – 45 M BTU’s/ Acre   |
| Switchgrass        | 4 – 6 Tons/ Acre   | 60 – 90 M BTU’s/ Acre   |
| Native Mixes       | 6 – 8 Tons/ Acre   | 90 – 105 M BTU’s/ Acre  |
| Miscanthus         | 15 – 20 Tons/ Acre | 225 – 300 M BTU’s/ Acre |



Loren Forrest and his miscanthus planting.



Corn



Native Prairie in southwest MN.



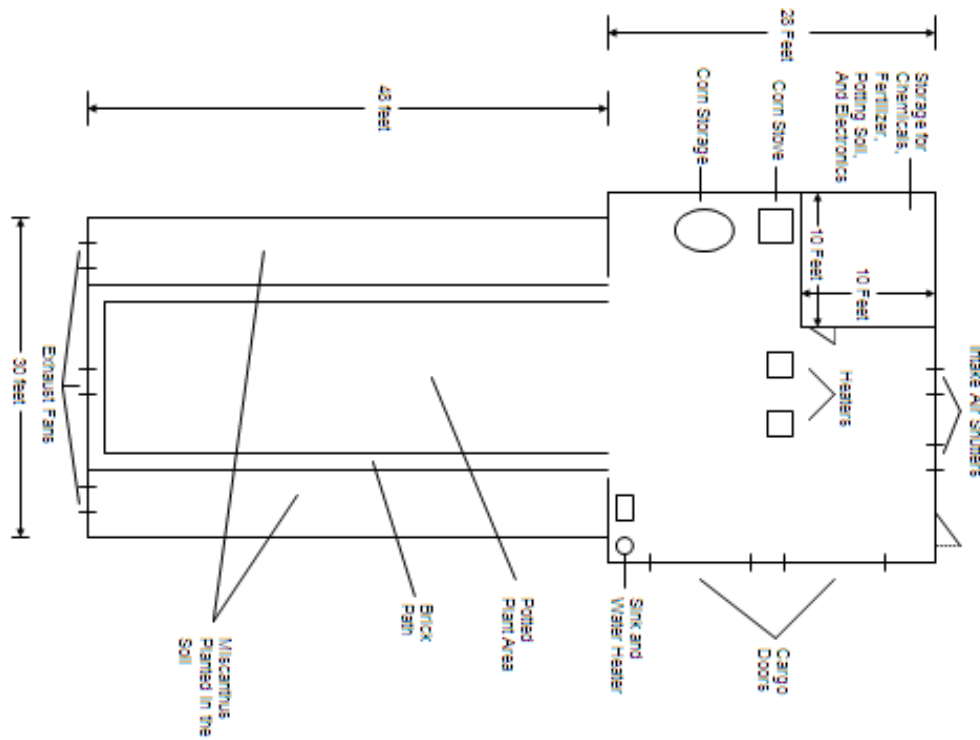
Switchgrass 'Northwind' Plot in Illinois.

### Technical Progress:

During the fall of 2005, the Forrest's were able to secure the necessary permits and laid the foundation for the greenhouse. The Forrest's property adjoins the City of Luverne in Rock County. Because of their close proximity to the city they were required to get permission from the Luverne City Administrator, which they did. No permits were required by Rock County. They ordered the greenhouse and it was delivered during the winter of 2006 to be established in the spring. The greenhouse was constructed and final approval was received on April 7, 2007 when the sprinkler system was finished.



Greenhouse prior to final completion.



Greenhouse Layout

The greenhouse is 30' x 48' with an attached storage structure that is 32' x 28'. The greenhouse is heated with a corn stove and has a gas furnace as a backup. Miscanthus plants have been established in the greenhouse portion and are being used for research and propagation. Necessary supplies have been procured for the plantings, maintenance, and propagation of miscanthus. Research on miscanthus is occurring in the greenhouse along with companion plantings in fields adjoining the greenhouse area. By the end of 2006, there were about three acres of miscanthus established on the Forrest farm.

Several outreach activities have occurred. On September 8, 2005 a field day was held on the Forrest farm with about 300 guests attending. The program contained discussions on renewable energy, miscanthus and a potential renewable energy plant to be built in the area. There were several speakers and a delicious meal served by the Forrest's. Tours of the miscanthus planting was provided for all attendees. At the March 13<sup>th</sup>, 2006 3<sup>rd</sup> Crop Meeting in Fairmont a program was presented on miscanthus as part of a day long program on renewable energy. September 8<sup>th</sup>, 2006 a second field day was held at the Forrest Farm, centered on miscanthus. The event was attended by several neighbors, a state legislator, and a few others from the broader area. Touring the miscanthus planting and discussing with Loren and Russell the work they have been doing was very enlightening and educational. They have a very practical approach and their work resonates well with the general public.

There have been numerous one on one outreach efforts by Loren Forrest as he visits with a wide variety of stakeholders in the development of his renewable energy facility, potentially using miscanthus. Rural Advantage also has discussed miscanthus as a viable bioenergy crop as they give presentations throughout Minnesota. There also

have been presentations by Rural Advantage to audiences in Colorado, Iowa and Missouri that included discussions on miscanthus.

There is growing interest in miscanthus across the region. Preliminary findings indicate that it can be grown successfully in Minnesota. There are some questions about survival the first winter, which appears to be able to be mitigated with a mulch covering. There is a limitation on rhizomes for cuttings and a need to figure out an efficient method for harvest, propagation, and planting of miscanthus at a commercial scale.

**Additional Milestones:** Even though the construction of the greenhouse was delayed, we were able to proceed with the other milestones and have been in process with Milestones 2 through 6. The Forrest's continue to develop their research site with additional plants from various locations in the United States. Their research planting is well maintained and interesting to view and see the progress of the plantings. They have begun their research on propagation, weed control, harvest, and maintenance. They have also begun some of the feasibility work and have been researching the planter development.

**Project Status:** Now that the greenhouse is finally completed we will be able to get on track with the milestones for the project and get caught up to the time frame we are in. We could not proceed with the Milestone completions until the first milestone was complete.

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