Switchgrass Harvest Management

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Switchgrass (*Panicum virgatum* L.) is a C4 warm-season perennial grass native to the North American continent that has been identified by the Department of Energy as one of the most promising species in the development of energy crops. Two experiments were conducted at the University of Massachusetts Crops and Animal Research and Education Center to study the effect of nitrogen application and harvest management on yield of switchgrass.

Research Goals:

- To determine optimum N input required for obtaining a high yield.
- To determine time of harvesting effect on the long term yield of the switchgrass.
- To determine effect of cutting height on switchgrass re-growth in spring.
- To evaluate and select switchgrass varieties suited to Massachusetts.

Experiment I: Switchgrass variety evaluation:

Twelve varieties of switchgrass including Blackwell, NE28, Sunburst, Dacotah, Carthage, Forestburg, Cave-in-Rock, Shelter, Alamo, Pathfinder, WI-Ecotype, Shawnee were planted in 2006. A randomized complete block design with three replications was used. Plots were hand seeded mid-June at an adjusted rate based on germination stated on seed tag with a target of 20 plants/ft^2. Plots were rolled after seeding with a culti-packer roller. In 2007 and 2008 these plots were harvested in late August and their yields were recorded.

After two year of establishment 5 of those varieties were determined to grow more vigorously than others. These varieties included Blackwell, Carthage, Cave-In-Rock, Shawnee, and Shelter and these plots were used for further evaluation. In early June, 2009, the experimental plots were fertilized with Calcium Ammonium Nitrate at a rate of 120 lb/ac. Each plot was divided into three sections and harvested at different growth stages including: post-anthesis, after a killing frost, and in spring (fall, winter, spring). At the time of the harvest the yields were collected and data was expressed as dry weights. These samples were ground and analyzed for Total Nitrogen and Alkali-metals. Root cores were taken at the time of harvest, and are being analyzed for non-structural carbohydrates.

Experiment II: Nitrogen application rate and harvest management study:

Cave-in-Rock (upland variety) was used in this experiment. The field was established in 2007 in a similar manner to the method described above except a culti-packer seeder was used for seed distribution. In 2009 three N rates (0, 60, 120 lb/ac) were applied. Plots were harvested in fall, winter, and spring at two cutting heights of 3 and 6 inches. Measurements included: N uptake, biomass yield, alkali metals, and carbohydrate reserve in root structure.

Preliminary Results:

Yields for Cave-in-Rock study averaged across N levels and cutting height are shown below in Figure 1. The fall harvest had the highest yield; however, upon observation it was apparent that the fall harvest had a significantly larger percentage of weeds (av. 30.5%) in field plots. The winter and spring harvests are more consistent from year to year. However, collecting biomass in the spring may be difficult after harsh winter conditions.

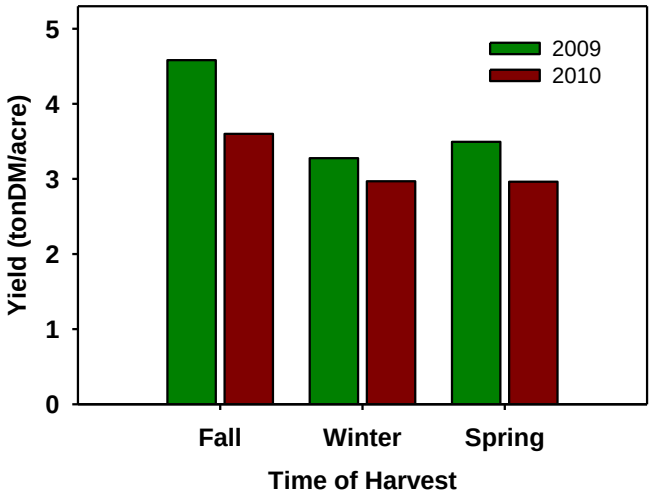

Figure 1. Yield of Cave-in-Rock switchgrass (Expt. II) for three times of harvest.

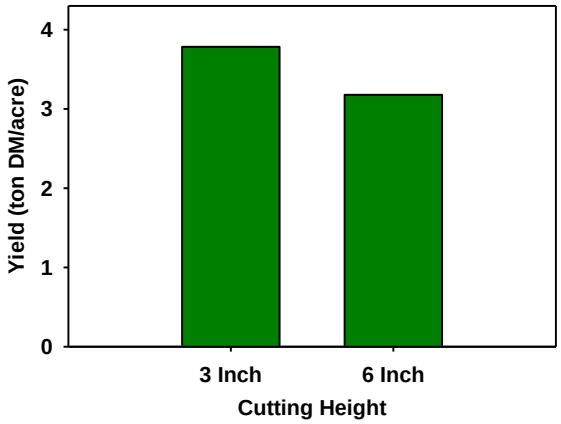

Figure 2. Yields averaged for 2009 and 2010, N rate, and time of harvest (Expt. II).

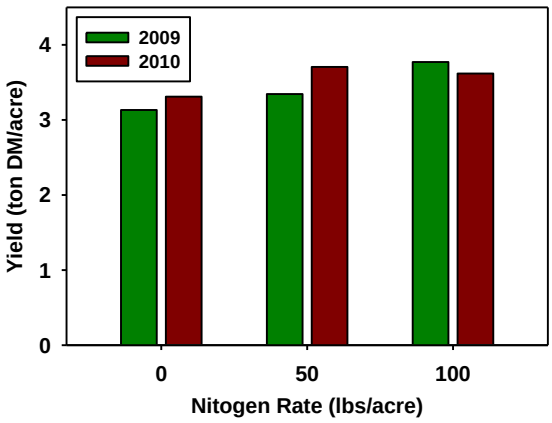

Figure 3. Yields averaged for 2009 and 2010, cutting height, and time of harvest (Expt. II).

A cutting height of 3 inches increased yield by 19% compared to 6 inches (Figure 2), and adding nitrogen marginally increased yields (Figure 3). Delaying harvest greatly reduced nitrogen content in harvested biomass (Figure 4) and presumably ash content. The latter is currently being analyzed. Nitrogen content of spring harvested switchgrass was similar to the level of the winter harvest (data not shown).

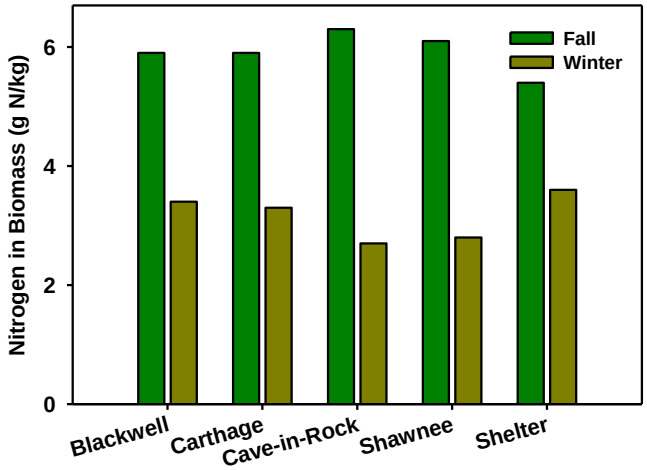

Figure 4. Total nitrogen in feedstock for fall and winter harvests of five switchgrass varieties (Expt. I).

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