Nitrogen and Harvest Management for Switchgrass Quantity and Quality

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focus on energy
Partnering with Wisconsin utilities

Objectives

Determine optimal nitrogen (N) fertilizer rate and harvesting timing for:

- Switchgrass yield
- Switchgrass quality for burning (e.g. low mineral concentrations)
- Energy content and energy yield

Conclusions

Switchgrass yield:

- Maximized with 112 kg ha^{-1} of N
- Maximized with mid-Autumn harvest

Switchgrass quality:

- Cl^- concentrations increase with an increase in N fertilizer application
- K^+ and Cl^- concentrations decrease with progressively later harvest timings

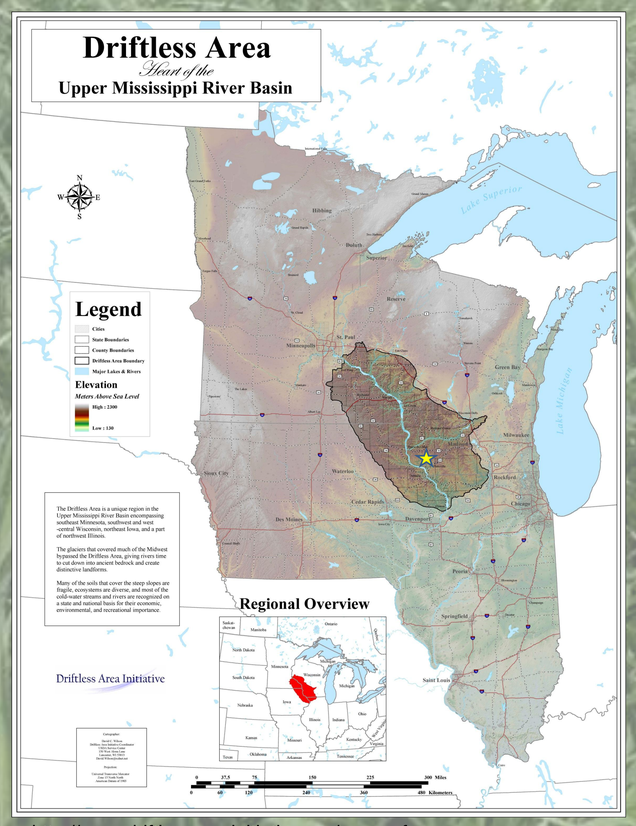
Energy:

- Application of N fertilizer increases energy content (MJ kg^{-1}) of switchgrass
- Later harvest timings increase energy content (MJ kg^{-1}) of switchgrass
- Energy yield trends followed dry matter yield trends

- **Trade-offs exist between switchgrass quantity and quality**
- **Growers and energy producers must work together to ensure production of a viable biomass resource.**

Experimental Design

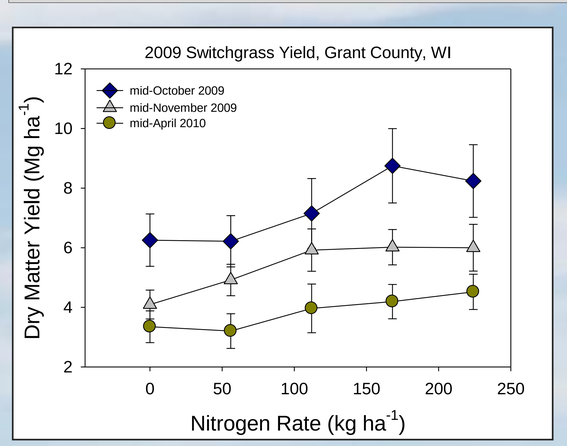
Experiment was conducted on four grower fields in Grant County, WI (Driftless Area) characterized by high sloping lands (marginal land for production)

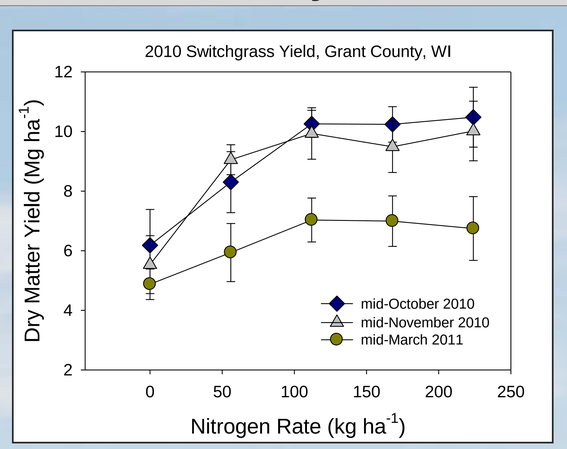


http://www.driftlessareainitiative.org/maps.cfm

- Fields were in corn-soybean production prior to switchgrass establishment in 2008
- Switchgrass planted in 2008, no harvest in fall of 2008, switchgrass was mowed and biomass was left on soil surface
- Five nitrogen fertilizer rates (as ammonium nitrate); three harvest timings
- Yield collected in 1 m^2 area and weeds were removed
- Potassium (K^+) and chloride (Cl^-) were used as indicators of switchgrass quality for burning
- High mineral concentrations can clog up boilers during combustion
- Energy was determined using the Bomb Calorimeter method and data is reported as energy content and energy yield

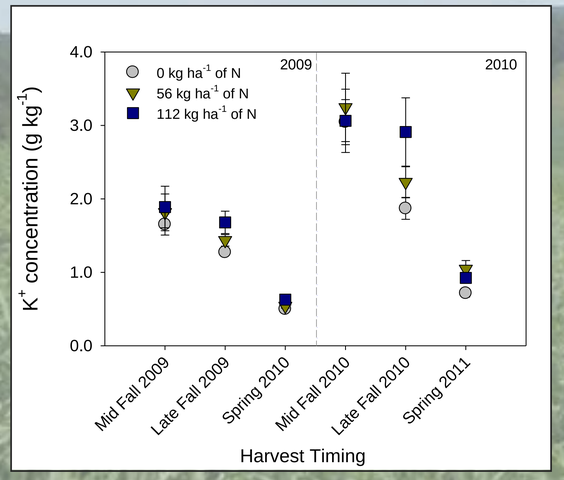
Switchgrass Yield, Grant County, WI

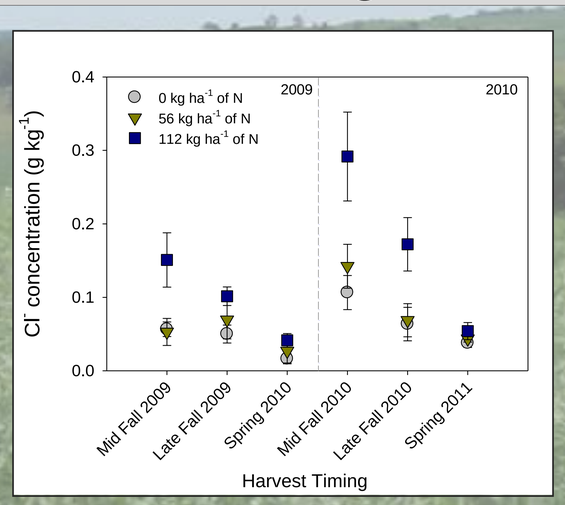




- 28% reduction in yield from fall harvest to spring harvest
- 6 Mg ha^{-1} yields with no N inputs, 26-63% increase with N application

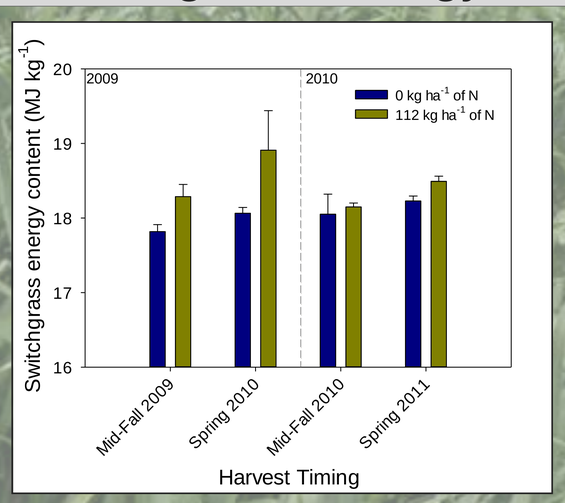
K^+ and Cl^- Concentration of Switchgrass

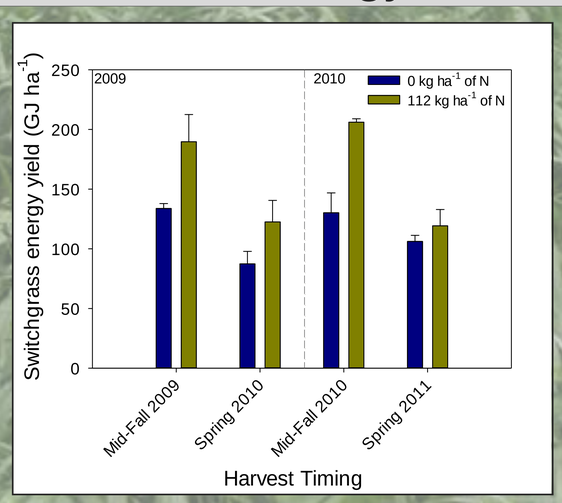




- K^+ concentrations less affected by N fertilizer rate compared to Cl^-
- Both K^+ and Cl^- were significantly decreased during the spring harvest
- Cl^- can cause corrosion on metal surfaces, but is less than the 1.0 g kg^{-1} threshold established by Obernberger et al. (2006)

Switchgrass Energy Content and Energy Yield





- Energy content increases with N application and later harvest, but energy yield is driven by DM yield