Nitrogen and Harvest Impact on Biomass Yield of Established Switchgrass

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Introduction

- Driving forces in the search for cleaner burning fuels
  - Uncertainties of the supply of fossil fuels from finite resources
  - Negative environmental impacts of their use
- Herbaceous bioenergy crops considered as a viable fuel source
  - Capable of being produced and renewed from the landscapes
  - Perennial warm-season grasses are lignocellulosic herbaceous bioenergy feedstocks extensively studied, that have exhibited numerous beneficial attributes
- Critical management practices that affect on dry matter (DM) yield and the feedstock quality need further investigation
  - Nitrogen (N) fertilizer management – rate and timing
  - Harvest timing management
  - Interactions of N and harvest management

Objective

- Evaluating the influence of N fertility and harvest management on dry matter yield

Figure 1. Location of sites (A), harvesting of grass (B), and taking sub-samples (C)

Methods

Study sites

- The research was conducted in four fields in Missouri (Fig. 1A), each with a unique warm-season grass composition (Table 1).

Experimental Design

- Split-Plot Design with RCBD: main and sub-plot treatments were N and harvest date (Tables 2, 3).

Measurements

- A swath of grass was harvested with a sickle-bar mower and measured for the fresh weight (Fig. 1B).
- A representative sub-sample used for DM determination (Fig. 1C).

Site	Composition of Grass Stand
Gallatin	Big Bluestem (*Andropogon gerardii* Vitman)
De Witt	Big Bluestem and Switchgrass (*Panicum virgatum* L.)
Strasburg	Switchgrass
Green Ridge	Big Bluestem and Switchgrass

Table 1. Site locations and descriptions

N Treatment in the Spring (kg/ha)	N Treatment at Harvest 1 (kg/ha)
0	0
34	0
67	0
101	0
34	34
67	34
34	67
Legume	0

Table 2. N treatments

Harvest Treatment ID	Time of Harvest
A	June and September
B	June and November
C	September
D	November

Table 3. Harvest treatments

Results and Discussion

- Nitrogen × harvest date interaction was significant at Green Ridge and Strasburg (Fig. 2) with a trend for increasing DM yield with both harvests which include a November harvest.
- For De Witt, yields increased with N greater than 34 kg/ha were not significant but numerically greater (Fig. 3A).
- Dry matter yields of De Witt and Gallatin from harvest date were similar to Strasburg and Green Ridge where the greatest yield includes a November harvest (Fig 3B, 3C).

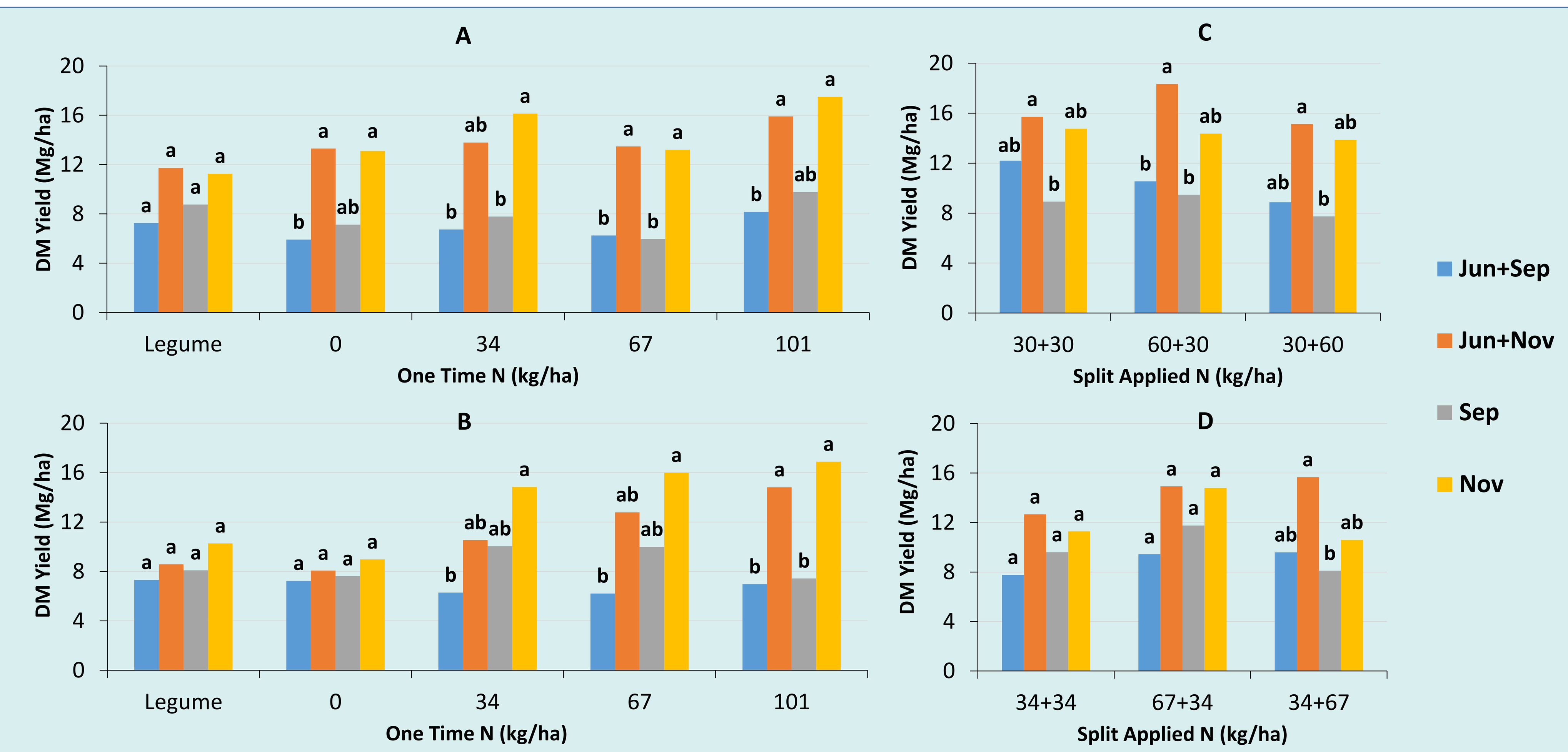

Figure 2. One time N × Harvest date interaction effect on DM yield at Green Ridge (A) and Strasburg (B) and split applied N × harvest date interaction at Green Ridge (C) and Strasburg (D). Bars with different letters denote significant differences among N treatments for DM yield, at α ≤ 0.05.

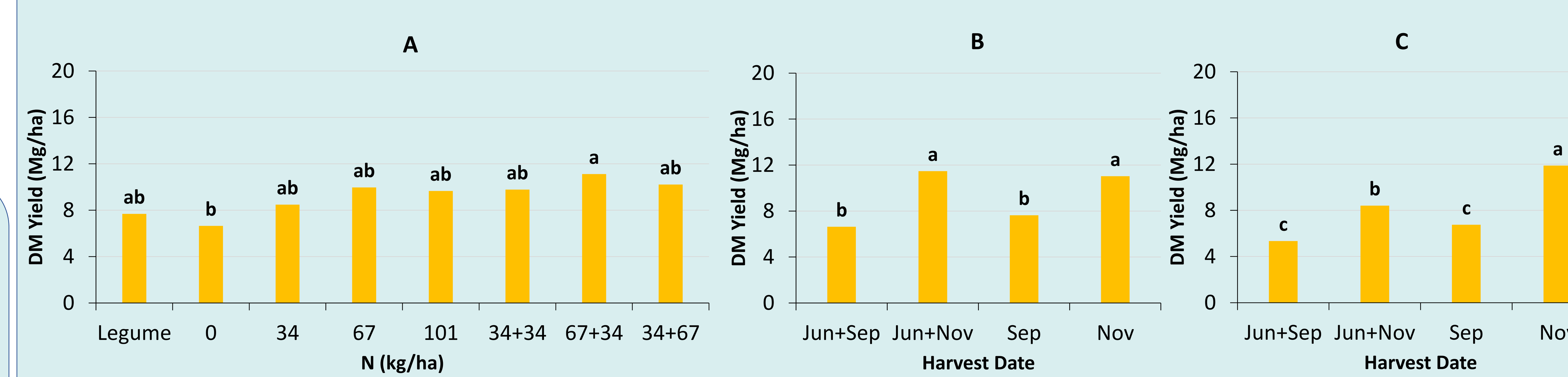

Figure 3. Main effects of N on DM yield at De Witt (A) and main effects of harvest date at De Witt (B) and Gallatin (C). Bars with different letters denote significant differences among N treatments for DM yield, at α ≤ 0.05.

Conclusions and Suggestions

- One harvest in late Fall and two harvests, one in mid Summer and the second in late Fall with split N application produced the greater yields.
- Samples from each treatment will be further analyzed for lignocellulosic characteristics in order to project the ethanol yield.
- Long term studies should be encouraged to obtain consistency of the results and for observation of the effects of managing perennial warm-season grasses for bioenergy on soil quality.
- Studying the soil and climatic conditions of the sites along with management practices would be helpful for providing clear explanations.