



Utilizing Small Grain Cover Crops to Enhance Switchgrass Establishment in the Southeast



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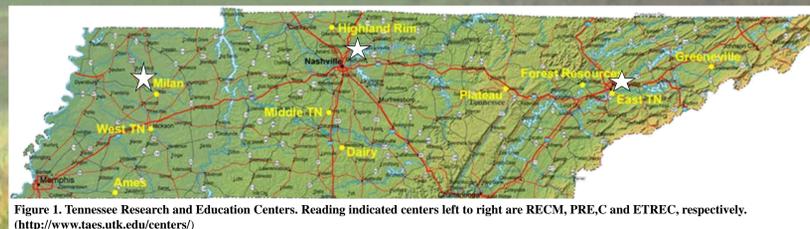


Figure 1. Tennessee Research and Education Centers. Reading indicated centers left to right are RECM, PRE, C and ETREC, respectively. (<http://www.taes.utk.edu/centers/>)

Introduction

Switchgrass (*Panicum virgatum* L.) is anticipated to become a major crop for the emerging cellulosic biofuel industry. However, one major obstacle for large-scale production is consistent stand establishment. Use of small grain cover crops prior to planting may off-set lost production, suppress weeds, and conserve soil, but possible allelopathic effects may preclude their use. Dormant-season planting may prove beneficial in switchgrass establishment by providing in-situ stratification. Such information is needed to enhance establishment and cellulosic production in the Southeast.

Objective

The objective of this study was to evaluate the efficacy of winter annuals and seeding dates on yield and density of switchgrass.

Materials & Methods

- No-till, drilled plots (11.6 m²) were established in 2009 and 2010 in different locales on the Research and Education Centers (RECs) at Milan (RECM), Highland Rim (HRREC), and East Tennessee (ETREC) (Figure 1) on a Grenada silt loam, Mountview silt loam, and Corryton-Townley complex soil, respectively.
- Winter annual small grain cover crops evaluated: wheat (*Triticum aestivum* L.), cereal rye (*Secale cereale*), barley (*Hordeum vulgare* L.), oats (*Avena sativa*), and a fallow control.
- Four planting dates (cv. 'Alamo'): approximately 15 Mar (dormant), 1 May, and 10 June each year.
- Experimental design: split-block with three replications; small grains were the whole plot and seeding dates the split plot.
- Second year stands received 67 kg N ha⁻¹.
- Plots were sprayed with 0.38 L ha⁻¹ glyphosate (N-phosphonomethyl glycine) in April.
- Data were analyzed with PROC GLM and means separated by Tukeys (HSD within location), or Fishers (LSD combined years and locations).

Measured Variables

- Dry matter (DM) yield and moisture content were determined between 15 Oct and 1 Nov in 2010 & 2011 during the 2nd year, post-establishment.
- Switchgrass stand densities was measured with a Vogel grid (Vogel and Masters, 2010) during the dormant-season per annum.

Results

- Seedling density at the end of the planting year varied but was generally unaffected, and in some cases benefited from dormant-season planting ($P < 0.05$) (Figs. 1-3).
- For the small grains, results were less consistent, but overall, grain crop did not affect switchgrass density (Fig. 5) with the exception of one location and year (data not shown).
- With respect to yields (end of second growing-season), seeding date had no effect on DM accumulation (Fig. 8).
- None of the small grains significantly affected biomass yield in any year or location combination (Fig. 9).

Summary

- Our research indicates that small grain cover crops did not result in allelopathic effects that were detrimental to switchgrass establishment or yield. Winter small grains may prove to be a promising management practice in the Southeast, while providing cool-season forage (or grain) during the establishment year. These strategies are being tested over more soil types, climates, and years to verify results.

Literature Cited

Vogel K.P. and R.A. Masters. 2001. Frequency grid—a simple tool for measuring grassland establishment. *Journal of Range Management*. 1 54: 653–655.

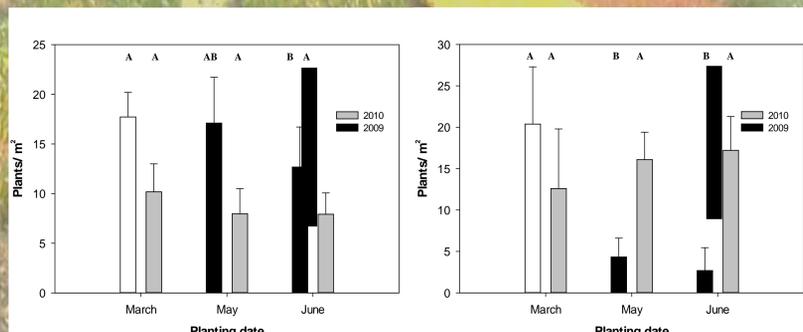


Figure 2. Switchgrass density by seeding date (combined across small grain treatment) at the RECM in 2009 & 2010. Different letters indicate a significant difference, compared within year ($P \leq 0.05$; HSD=4.95 & HSD=2.40, respectively). Vertical bars are +/- one standard deviation.

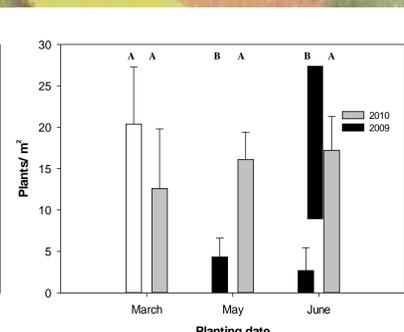


Figure 3. Switchgrass density by seeding date (combined across small grain treatment) at the HRREC in 2009 & 2010. Different letters indicate a significant difference, compared within year ($P \leq 0.05$; HSD=8.09 & HSD=3.78, respectively). Vertical bars are +/- one standard deviation.

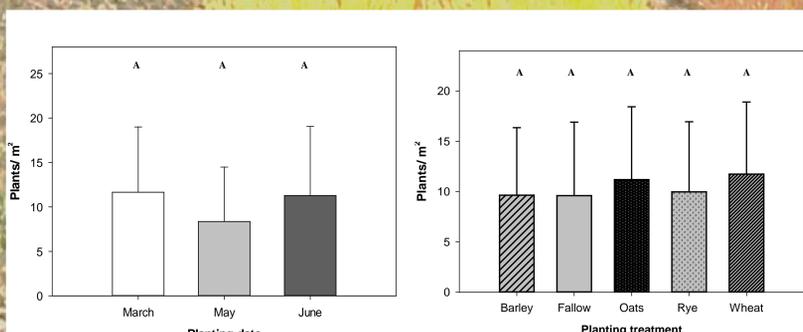


Figure 4. Switchgrass density for seeding date combined across all years and locations. Different letters indicate a significant difference ($P \leq 0.05$; LSD=3.37). Vertical bars are +/- one standard deviation.

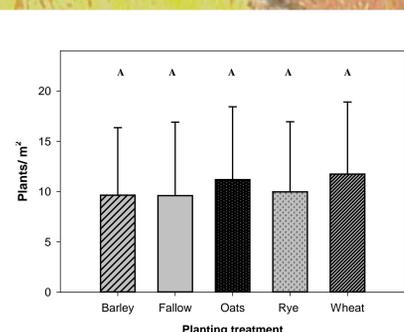


Figure 5. Switchgrass density by planting treatment combined across all years and locations. Different letters indicate a significant difference ($P \leq 0.05$; LSD=4.35). Vertical bars are +/- one standard deviation.

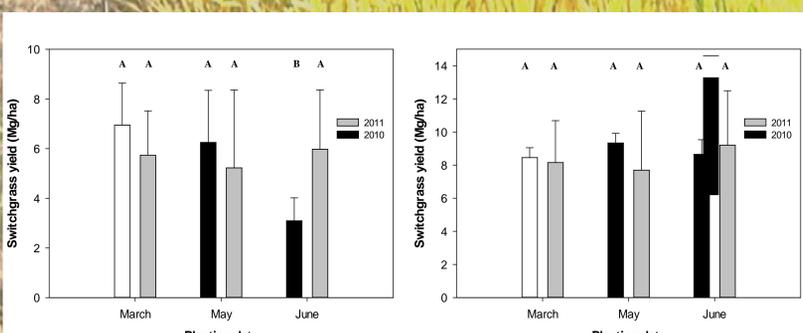


Figure 6. Switchgrass DM yield by seeding date (combined across small grain treatment) at the ETREC in 2010 & 2011. Different letters indicate a significant difference, compared within year ($P \leq 0.05$; HSD=1.62 & HSD=9.85, respectively). Vertical bars are +/- one standard deviation.

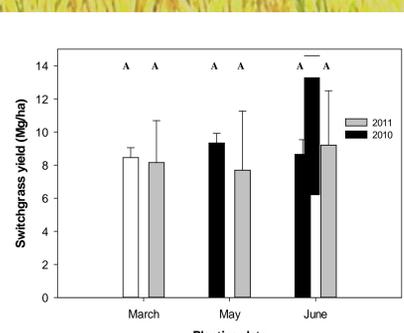


Figure 7. Switchgrass DM yield by seeding date (combined across small grain treatment) at the RECM in 2010 & 2011. Different letters indicate a significant difference, compared within year ($P \leq 0.05$; HSD=1.46 & HSD=3.08, respectively). Vertical bars are +/- one standard deviation.

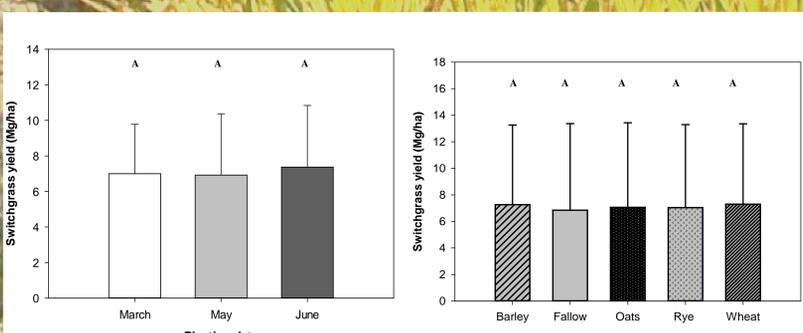


Figure 8. Switchgrass DM yield for seeding date combined across all years and locations. Different letters indicate a significant difference ($P \leq 0.05$; LSD=1.39). Vertical bars are +/- one standard deviation.

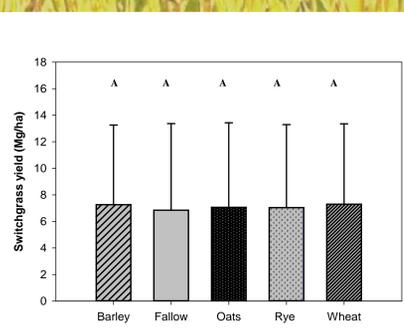


Figure 9. Switchgrass DM yield by planting treatment combined across all years and locations. Different letters indicate a significant difference ($P \leq 0.05$; LSD=1.79). Vertical bars are +/- one standard deviation.