Using Seed Treatments and Priming to Extend the Switchgrass Planting Season

J. Crawford¹, A.G. Taylor², J.L. Hansen¹, R. Crawford³, G.C. Bergstrom⁴, and D.R. Viands¹

¹Dept. of Plant Breeding and Genetics, ²Dept. of Horticulture, ³Dept. of Plant Pathology and Plant-Microbe Biology
Cornell University, Ithaca, NY 14853

Introduction

Initial stand establishment is a major impediment to successful production of switchgrass. Marginal sites are the primary locations for switchgrass production, but in the Northeast, these are often have poorly drained soils, making spring plantings difficult. If planting is accomplished, young seedlings are often susceptible to damping-off and root rots in the cool and moist soil. Late planting provides additional time required for field preparation and soil warming, but may not allow enough time for seedling establishment prior to the first killing frost.

Both priming and seed treatments have been shown to improve establishment. Priming increases the speed and uniformity of germination in many crops (Taylor et al, 1998). High quality lots of each cultivar (circled) were selected and purchased for germination and purity by the NYS Seed Testing Laboratory (data below).

Seed Quality

Seed samples of three seed lots of 'Kanlow' and four seed lots of 'Blackwell' were treated in the lab with different seed treatments and seeding rates as the subplots. Soil moisture was maintained at 30% of total potential water during the planting window by increasing the rate of seedling establishment. However, the onset of winter and particularly the effect of the first killing frost on delicate switchgrass seedlings inherently limits this approach. Planting in late July and in August resulted in good plant stand establishment, but poor stands after the first winter.

Future Research

In the fall of 2013, surviving plots will be harvested for yield, and a simple economic analysis will be performed in order to determine whether increases in yield justify the additional costs imposed by advanced seed priming technologies. Producers may be willing to pay a small premium for treated seeds but not the larger premiums associated with primed seeds.

Literature Cited


Results

Several weeks after planting, seedlings per square foot were counted to assess initial establishment. Increasing seeding rates increased seedling density in all trials, but seed technologies only showed an effect in the July and August plantings (see plots below).

On October 25, 2012 observations were made on all trials to assess their condition going into the winter. Seedlings in the June trial were well established with many tillers. Blackwell seedlings in the July trial also had multiple tillers, but the Kanlow seedlings were much less advanced with very few seedlings producing any tillers. The first major frost occurred on October 13th, only 43 days after the August trial was planted. The August trial was a complete loss. (see images above).

On May 18, 2013, stand percentages were assessed using a frequency grid (Vogel and Masters 2001). The percent stand for the June, July, and August trials in Kanlow was 50%, 1%, and 0% and in Blackwell was 49%, 12%, and 0%, respectively. The percent stand in Blackwell seeded in July ranged from 5 to 30%, and was increased with seed technologies and seeding rate. Kanlow seeded in the July trial suffered from frost heaving and did not survive the winter (see plots above).

Effect of Weather

Weather had a substantial effect on seeding germination and stand establishment. The tables below show the temperature and precipitation averages, as well as their departures from normal and ranks relative to the past 118 years, for the 2012 growing season. Dry conditions, particularly in June and July, contributed to generally lower levels of seedling emergence observed in the June and July trials as compared to the August trial.

Future Research

In the fall of 2013, surviving plots will be harvested for yield, and a simple economic analysis will be performed in order to determine whether increases in yield justify the additional costs imposed by advanced seed priming technologies. Producers may be willing to pay a small premium for treated seeds but not the larger premiums associated with primed seeds.

Literature Cited


Conclusion

As the weather data above show, 2012 was an exceptional weather year for New York. When designing this experiment, we anticipated our normal wet spring. Instead, we had an extremely dry March that started the growing season with a precipitation deficit that remained throughout the growing season. In Blackwell, priming had little or no effect under dry conditions, but higher seedling emergence occurred when there was sufficient moisture, consistent with results obtained by Beckman et al. (1993). In Kanlow, priming had the largest effect on seedling emergence in the July seeding, when moisture was limiting, but this advantage did not allow the Kanlow seedlings to grow to a sufficiently mature stage to survive the winter. Priming and treating seeds may extend the planting window by increasing the rate of seeding establishment. However, the onset of winter and particularly the effect of the first killing frost on delicate switchgrass seedlings inherently limits this approach. Planting in late July and in August resulted in good plant stand establishment, but poor stands after the first winter.

Materials and Methods

By producing a range of different seed treatments and seeding rates as the subplots, we were able to assess the effect of both seed priming and seed treatment. Each selected seed lot was divided into four groups, each receiving a different seed treatment:

1. Control or no treatment
2. Gauch XT at 3.4 fl. Oz/100 lbs. (combination of Gauch, Raxil, and Allegiance)
3. Primed seed (proprietary treatment provided by Seed Dynamics Incorporated, Salinas, CA)
4. Seed primed and treated with Gauch XT

Seed treatments protect young seedlings from fungal pathogens that can slow growth or decrease plant stand. The objective of this project was to examine if these seed technologies can be used to increase the length of the switchgrass establishment season.

Seed Quality

Seed treatments and priming were shown to increase the length of the switchgrass establishment season. Increased seedling emergence due to seed treatments and priming were observed in the June and July trials, as compared to the August trial.