Genetic Improvement of Prairie Junegrass

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Objectives:

Determine the genetic potential of native prairie junegrass germplasm for use as low-input turfgrass.

Prairie junegrass (*Koeleria macrantha*) has shown the potential to be successfully used as a turfgrass in lower-input environments. The species is widely distributed throughout much of the western United States and can also be found throughout much of Europe and Asia. The species has several attributes that would make it a useful low-input turfgrass including drought tolerance, survival of low and high temperature extremes, and reduced vertical growth rate. We have evaluated material from our collection and material from the USDA National Plant Germplasm Resources Network (NPGS) and used those evaluations to assemble breeding nurseries (Figure 1).

Currently, there are a small number of cultivars that have been developed from germplasm collected in western and northern Europe; however, these cultivars are difficult to obtain and the seed quality is often not adequate. Germplasm from North America has greater seed production potential and resistance to important diseases, but does not possess acceptable turf quality. Most of this turf quality decline is due to shredded leaves from mowing and an early onset of summer dormancy during stress periods.

One significant barrier that we are currently addressing is ploidy level. Some of the highest turf quality material from Europe is tetraploid, while the high seed production, low quality material from North America is diploid. Additionally, we have observed significant rates of self-pollination in this species; these rates are much higher than we expected. In order to address this problem, we made a series of crosses as a first step toward integrating important traits into a single population and determining selfing rates of each type (Figure 2). Seed will be cleaned and planted into field evaluations in spring 2015. These plants will be assessed for both vegetative and reproductive characteristics.

Figure 1. Prairie junegrass breeding nursery.

We are currently investigating a new approach to dealing with the issue of poor mowing quality. Grasses have specialized silica cells that produce bodies that are distinguishable as silica bodies. Silica bodies can have many important physiological roles in plants such as

Figure 2. We are crossing tetraploid and diploid genotypes and also checking for selfing rates in both types. (photo credit: Changbin Chen)

decreased herbivory. These bodies could also be responsible for some of the differences we have observed in mowing quality between North American and European genotypes. It is likely that the both the quantity and spatial arrangement of these bodies are responsible for differences in mowing quality. We have taken a number of images of silica bodies in mature grass leaves and compared genotypes collected from a prairie in Minnesota and other parts of North America with NPGS collections from throughout the world (Figure 3). Our preliminary results suggest that the high turfgrass quality European material has lower silica body counts per unit leaf area. We cannot at this time make any conclusions about the role of silica bodies in performance of these grasses, but our preliminary data indicates higher quantities of silica bodies are associated with lower mowing quality. We are continuing to improve our methodology for quickly identifying and assessing these silica bodies and hope to be able to use this new methodology and knowledge in our breeding program.

Summary

- Non-native germplasm generally exhibits superior turfgrass quality but has lower seed production potential.
- We have made crosses between diploid native germplasm and tetraploid genotypes from Europe.
- Silica body imaging may lead to rapid screening of germplasm that can perform well under mowing.

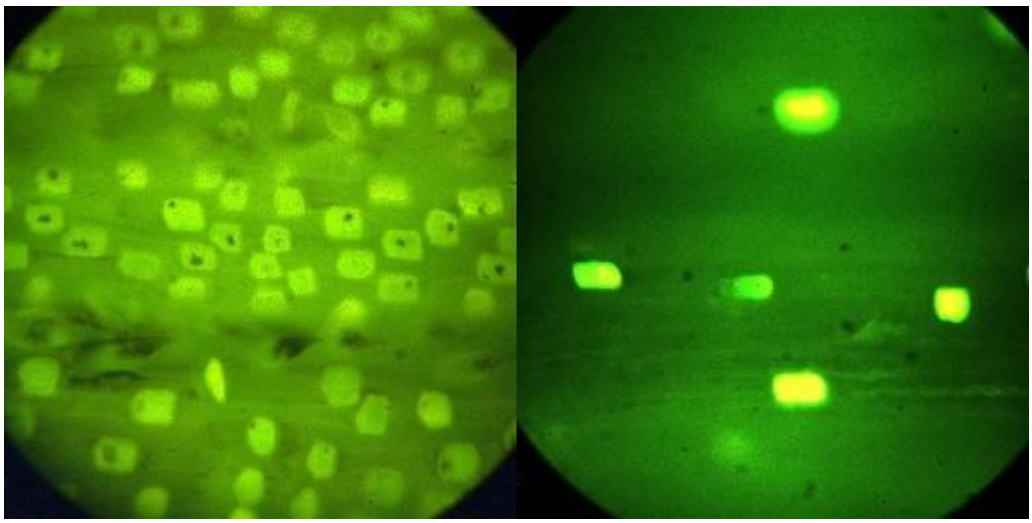

Figure 3. This image shows the silica body arrangement in leaves from *Koeleria macrantha* genotypes collected in Minnesota (left) and Ireland (right). (photo credit: Clemon Dabney III)