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Project Title: Genetic Improvement of Prairie Junegrass

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Objective:

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

Start Date: 2007
Duration: ten years
Total Funding: $100,000

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 (consisting primarily of germplasm collected in the Great Plains of the U.S.) and material from the USDA National Plant Germplasm Resources Network (NPGS) and used those evaluations to assemble breeding nurseries.

We have identified several challenges facing turfgrass breeders: a) this species lacks high levels of seed production, which results in low availability and high costs for end users; b) mowing quality is often poor; c) slow growth rate can lead to poor establishment (Fig. 1); and d) leaf rust disease is prevalent in many unimproved accessions (Fig. 2). Our breeding program is continuing to select genotypes that are show improvement in these areas. We are beginning projects aimed to determine the environmental cues that are necessary for flowering of this grass, which may help us better understand how seed production might be increased. We are also interested in investigating how to make crosses between tetraploid and diploid types as a way to move traits across the reproductive barrier of differing ploidy levels.

In recent years, we have been attempting to learn more about the microbial communities that develop near the roots of low-input turfgrasses, including prairie junegrass. Research in other cropping systems has suggested that plant genotype can affect the makeup up soil microbial communities. In order to determine how the genotype of a prairie junegrass might affect the soil microbial community, we grew plants representing several accessions that been previously evaluated for seed production and turfgrass quality in our breeding program. Plants were grown in the greenhouse and maintained under typical growth conditions. Rhizoplane soil was collected form the root surface of individual plants representing each accession. DNA was isolated using MoBio Power Soil DNA Isolation Kit (MoBio Laboratories, Inc., Carlsbad, CA, USA) and quantified using the

Qubit dsDNA HS kit (Thermo Fisher Scientific, Waltham, MA, USA). Amplicon preparation and sequencing were performed by the University of Minneosta Genomics Center. The V5-V6 hypervariable regions of the 16S rDNA were PRC amplified using the BSF784/1046R primer set. Sequence data was then analyzed using appropriate statistical techniques. We found that there were significant differences among the accessions (Fig. 3). Combined with results we have found in related projects, we may pursue more of this research in hope of developing low-input turfgrass cultivars that can positively influence soil microbial communities, resulting in more resilient turfgrass systems.

We will continue to investigate this species with the hopes of eventually releasing a cultivar that provides a slow growing, drought-tolerant turf that can withstand the stresses common to cold climates.

Summary Points:

- Prairie junegrass has shown potential as a low-input turf for cold climates due to its tolerance of extreme temperatures, slow growth rate, drought tolerance.
- There are a number of barriers to widespread use of this species, including susceptibility to rust disease, slow establishment, and poor seed production.
- We have conducted research on the soil microbial communities associated with prairie junegrass and found that significant differences in these microbial communities.

Figure 1. Slow establishment of prairie junegrass can lead to high levels of weed invasion.

Figure 2. Leaf rust is a common problem on native accessions when grown as turf.

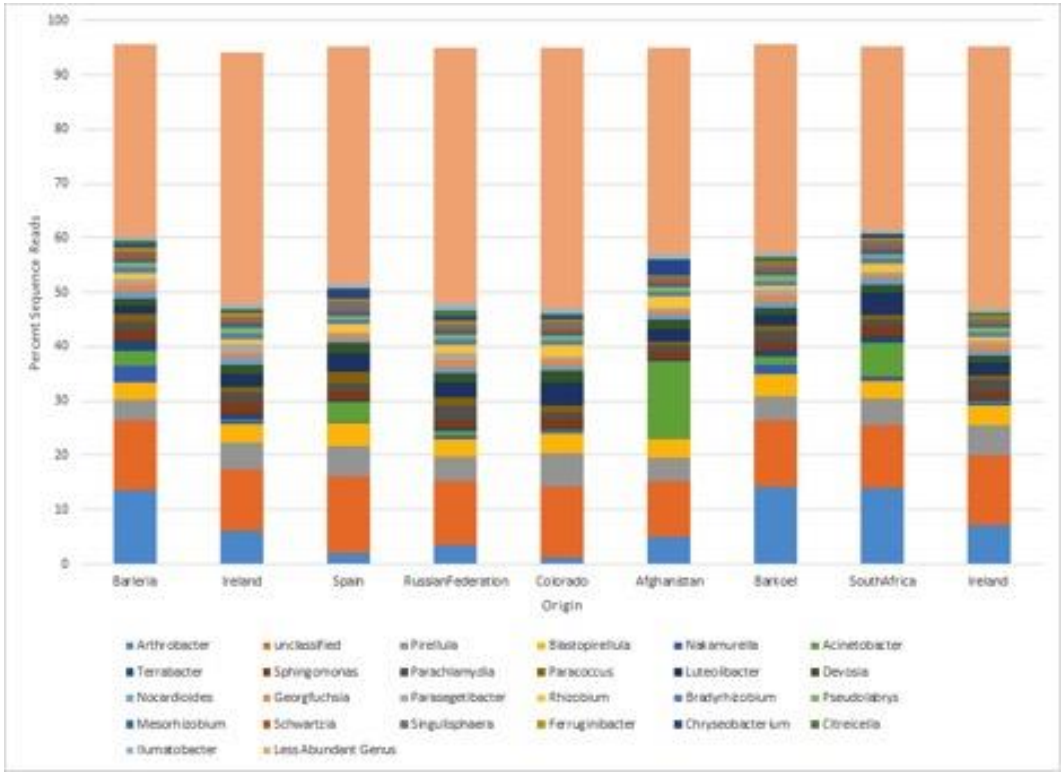

Figure 3. Distribution of taxonomic genus of Operational Taxonomic Units (OTUs) found to differ significantly by origin with Koeleria macrantha. The OTUs were found to vary significantly by using the Kruskal–Wallis test.