Genetic Improvement of Prairie Junegrass

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Objective:

1. Determine the genetic potential of native prairie junegrass (*Koeleria macrantha)* germplasm for use as low-input turfgrass.

Start Date: 2007
Project Duration: 4 years
Total Funding: $40,000

Grass species that are native to North America should be better able to cope with our environment and could lead to overall reductions in inputs such as fertilizers, pesticides, and water. Prairie junegrass (*Koeleria macrantha*), which is native to the Great Plains of the United States, has shown the potential to be successfully used as a turfgrass in low-input environments. The species is widely distributed throughout much of the western United States, and it can also be found throughout much of Europe and Asia.

Prairie junegrass has several attributes that would make it a useful low-input turfgrass in Minnesota, including tolerance of droughty and alkaline soils, tolerance of sandy areas, survival of low- and high-temperature extremes, and reduced growth rate. 'Barkoel' was the first cultivar of this species specifically developed for use as a turfgrass. However, this cultivar was developed with ecotypes from Europe. We are proposing the development of a cultivar primarily derived from germplasm native to North America.

Developing a high-quality turfgrass is not, by itself, adequate. In order to be used by consumers, an economically viable turfgrass cultivar must be able to produce sufficient quantities of seed. Non-selected populations of the species can produce seed for 4-5 years. Collections of natural ecotypes made in 2005 suggest that individual genotypes may possess the ability to be highly productive. However, it is unknown if it can produce economically adequate amounts of seed.

We have collected native prairie junegrass germplasm from Minnesota, South Dakota, North Dakota, Colorado, and Nebraska. These germplasm collections have been established in breeding nurseries, and in some cases, experienced one cycle of selection. We have established several spaced-plant evaluations that will be used to determine the genetic variation present in our populations for various turfgrass and seed production characteristics.

The USDA National Plant Germplasm Resources Network (NPGRN) maintains a number of accessions of *Koeleria macrantha* originating from locations throughout world. We completed research trials that evaluated the turfgrass quality characteristics of 48 USDA-NPGS accessions. Under low-input management, accessions varied greatly for overall turf performance with several accessions showing acceptable turf quality and mowing quality at two research locations in Minnesota (Becker and St. Paul). Conversely, factors such as summer dormancy, leaf rust incidence, and leaf shredding played a role in decreased quality of several other accessions. Most of the accessions that exhibited superior turf quality originated from Asia and Europe.

Concurrent research trials found that native germplasm collected in the United States does not typically possess the turfgrass quality characteristics necessary for a useful cultivar. However, the native germplasm does provide some other low-input characteristics that can be useful in cultivar development such as slow vertical growth rate, adequate seed production, early spring green-up, ability to survive severe water deficit, and resistance to some important turfgrass diseases. In particular, we found that germplasm collected in Minnesota showed improved resistance to leaf rust.

Koeleria macrantha *accessions differing in seedhead morphology.*


Turf plot evaluations of Koeleria macrantha *accessions and breeding material in St. Paul, MN showing differences in color retention during a summer stress period.*

These studies have shown that the characteristics necessary for a low-input turfgrass cultivar of this species do exist in available germplasm. Ultimately, a combination of native and nonnative populations will need to be used in our breeding program. Combining the higher turfgrass quality of the nonnative collections with the superior seed production potential and greater stress tolerance of the native germplasm should result in a cultivar that can be used effectively throughout the northern United States on low-input turf areas such as golf course roughs.

Summary Points

- Nonnative germplasm generally exhibits superior turfgrass quality.
- Native germplasm has shown greater seed production potential and resistance to severe stresses common in low-input environments.
- Integration of traits from diverse germplasm should be effective in the development of a low-input cultivar.