

Development of Seeded and Vegetatively Propagated Bermudagrass Varieties Improved in Turf Quality and Stress Tolerance

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Start Date: 2013
Project Duration: 3years
Total Funding: \$90,000



Turfgrass and Environmental Research Online
Volume 14, Number 3 | May—June 2015

Objectives:

1. Assemble, evaluate and maintain *Cynodon* germplasm with potential for contributing to the genetic improvement of the species for turf.
2. Develop and use simple sequence repeat markers.
3. Improve bermudagrass germplasm for seed production potential, turf performance traits, and stress tolerance.
4. Develop, evaluate and release seed- and vegetatively-propagated turf bermudagrass varieties.

Bermudagrasses [*Cynodon dactylon* (L.) Pers. and hybrids between *C. dactylon* and *C. transvaalensis* Burt-Davy] are extensively used for turf in the southern United States. In the transition zone, turf bermudagrass varieties with high quality and improved cold-hardiness have been increasingly used in recent years. For example, 'Latitude 36', 'NorthBridge', 'Patriot', 'Riviera', and 'Yukon' turf bermudagrass cultivars, developed and released by the Oklahoma State University turfgrass breeding program, have progressively been installed on golf courses and sports fields. The OSU breeding program continues to conduct research activities and experiments in 2014.

A large *Cynodon* germplasm working collection has been assembled and maintained by the OSU breeding program. However, only a limited number of bermudagrass accessions have been collected in the US. To increase genetic diversity of our germplasm, especially cold hardy materials, trips were made to collect naturalized bermudagrass plants in CO, IA, KS, MO, NE, and MN in the summer of 2014. We will continue to collect common bermudagrass germplasm in the northern states to assure the availability of cold hardy genetic diversity for present and future use in turf bermudagrass improvement.

Common bermudagrass (*C. dactylon*) has long been characterized as an outcrossing species, nonetheless reproductive behavior of plants in breeding populations was not available. One experiment was performed to quantify selfing and outcrossing rates of common bermudagrass plants grown in field environments conducive to interbreeding. Twenty five clonal common bermudagrass plants grown in a randomized complete block design with three replications at Stillwater and Perkins, OK were used in the study (Figure 1). Ten progeny from open-pollinated seed harvested from each field plot of the maternal plants were grown in a



Figure 1. A field nursery used to quantify selfing and outcrossing rates of common bermudagrass plants.



Figure 2. Elite common bermudagrass plants selected in breeding populations are grown in a greenhouse at Oklahoma State University.

greenhouse. DNA samples were isolated respectively from 1439 progeny from both sites along with the 25 seed parents. Eleven polymorphic simple sequence repeat (SSR) markers were chosen to identify breeding origin of the progeny by comparing SSR marker genotypes of the progeny with their respective maternal parents. Among the progeny examined, only two progeny plants were identified to be selfed, indicating an extremely high outcrossing rate of 99.86%. The finding of complete or near complete outcrossing behavior in this experiment should assist in breeding seeded common bermudagrass varieties.

Four common bermudagrass populations were continually evaluated for phenotypic traits of interest, primarily for seed yield components, i.e., seed set percentage and inflorescence prolificacy. A nursery of about 100 cold hardy plants has been evaluated for turf performance, seed yield and related traits since 2011 as part of a graduate student thesis project. Elite plants selected from the populations are grown now in a greenhouse and will be used in formation of new seed producing synthetics, which will be established in the field in 2015 (Figure 2). In summer 2014, a selection nursery was established with over 1,800 individual plants. From this nursery we will select superior plants combining turf quality, drought tolerance and seed yield traits over the next three years.

Both Latitude 36 and NorthBridge bermudagrasses have been exclusively licensed to the Sod Solutions

(<http://www.sodsolutions.com/>) for marketing and production since 2011. Latitude 36 and NorthBridge are currently produced on 33 and 31 sod farms, respectively in the US. The sod producers are located in CO, FL, GA, IN, KS, MD, MO, NC, OK, TX, TN and VA. The two cold hardy and high quality bermudagrasses were not only installed on golf facilities but also athletic fields. Highly visible installations on sports fields of the two new varieties include NorthBridge at the Kansas City Royals' Kauffman stadium and the Kansas City Chiefs' Arrowhead stadium; Latitude 36 at the TN Titans' LP stadium, the Washington Redskins' FedEx Field, the Philadelphia Eagles' Lincoln Financial stadium, and the Baltimore Ravens practice fields.

Summary

- Cold hardy bermudagrass germplasm was collected in some central and northern states.
- Common bermudagrass breeding populations were visually evaluated for phenotypic traits related to turf quality and seed yield.
- Molecular markers identified that common bermudagrass was complete or near completely outcrossing in the field.
- 'Latitude 36' and 'NorthBridge' turf bermudagrasses were produced and installed on golf courses and sports fields in the South and transition zone.