Research *You Can Use*

Breeding and Evaluation of Kentucky Bluegrass, Tall Fescue, Fine Fescue, Perennial Ryegrass, and Bentgrass

Rutgers University continues to gather germplasm from around the world for tomorrow's turfgrass cultivars.

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OBJECTIVES

- Collect and evaluate useful turfgrass germplasm and associated endophytes.
- Continue population improvement programs to develop improved cool-season cultivars and breeding synthetics.
- Develop and utilize advanced technology to make current breeding programs more effective.

In 2007, more than 2,000 promising turfgrasses and associated endophytes were collected in southern Sardinia, Corsica, Lithuania, Hungary, and New England, USA. Many of these associated endophytes should be new, unique, and have properties to enhance turfgrass performance. More than 9,865 new turf evaluation plots, 92,000 plants in spaced-plant nurseries, and 30,000 mowed single-clone selections were established in 2007.

More than 154,000 seedlings from intra- and inter-specific crosses of Kentucky bluegrass were screened for promising hybrids under winter greenhouse conditions of short day lengths and cool temperatures. In addition, more than 48,000 tall fescues, 17,000 perennial ryegrasses, 9,000 bentgrasses, and 48,000 fine fescues were screened during the winter in greenhouses. The progenies of 200 new hybrid Kentucky bluegrasses were screened in spaced-plant nurseries to determine apomixis levels and other important turf and seed production characteristics.

The following crossing blocks were moved in the spring of 2007: 622 hard fescues, 422 strong creeping red fescues, 213 chewings fescues, 585 perennial ryegrasses, and 831 tall fescues. There were 12 velvet bentgrasses, 100 colonial bentgrasses, and 75 creeping bentgrasses

(Left) Dr. Reed Funk discusses one of several breeding projects at Rutgers University with members of the USGA's Turfgrass and Environmental Research Committee. (Right) Rutgers University has created a traffic machine with spikeless golf shoe soles for screening cool-season grasses for traffic tolerance.

Rutgers has made significant progress in incorporating gray leaf spot resistance in new perennial ryegrass cultivars.

moved into crossing blocks. The 30 new perennial ryegrasses identified in two different locations of the 2004 National Turfgrass Evaluation Trial in New Jersey have continued to display resistance to gray leaf spot (*Pyricularia grisea*) through 2007. These were developed in collaboration with other organizations since the fall of 2000, when the first severe epidemic occurred in Adelphia, New Jersey. We are making continuous progress with annual cycles of recurrent selection in perennial ryegrass for gray leaf spot, dollar spot (*Sclerotinia homoeocarpa*), red thread (*Latisaria fusiformis*), and crown rust (*Puccinia coronata*). Some of the newly released perennial ryegrasses this year are Calypso III, Stellar GL, Buena Vista, Soprano, Fiesta 4, Dasher 3, Attribute, Zoom, SR-4600, Integra II, Regal 5, Pacesetter, Keystone 2, Palmer V, Prelude GLS, Gator 3, Arrival, and Primary.

Promising new Kentucky bluegrasses and Texas × Kentucky bluegrass hybrids include Avid, Blueberry, Blue Note, Volt, Spitfire, Starburst, Concerto, Touché, Baroness, and Barnique.

Continued developments of turf-type tall fescue are being released with improved brown patch resistance. They include Traverse, Millennium SRP, Houndog 6, Fidelity, Rhambler, Coyote II, Finelawn Express, Falcon V, Shenandoah III, Monet, Cezanne, Van Gogh, Beagle I, Virtuoso, and SR-8650.

New fine fescue cultivars include Gotham Hard, Compass Chewings, Foxfire Chewings, Cardinal Chewings, SR-5130 Chewings, Spartan II hard, SR-5250 strong creeping, and SR-3150 hard.

In the bentgrass project, we are concentrating on identifying new sources of disease resistance. Approximately 32 creeping bentgrass clones were identified with improved dollar spot resistance. These clones will be utilized to develop new synthetic selections in the spring of 2008. Approximately 37 colonial bentgrass plants from 10 new sources were identified with improved brown patch resistance. Approximately 63 velvet bentgrass clones from 15 new sources were identified with improved brown patch and dollar spot resistance.

Collection trips from New Jersey, Pennsylvania, and New York in 2007 yielded 150 new bentgrass collections. These grasses were planted in a spaced-plant nursery in the fall of 2007. Future collection trips include a return trip to Massachusetts, Maryland, Virginia, North Carolina, and Georgia.

SUMMARY POINTS

- Continued progress was made in obtaining new sources of turfgrass germplasm from old turf areas in Europe. These sources are being used to enhance the Rutgers breeding program.
- Modified population backcrossing and continued cycles of phenotypic and genotypic selection, combined

CONNECTING THE DOTS

An interview with Dr. Bill Meyer, *Rutgers University, regarding Rutgers University's cool-season turfgrass breeding program.*

Q: *Rutgers University has established itself as the preeminent university in producing new cultivars of cool-season turfgrasses. Please provide us with some historical perspective on your program.*

A: Dr. C. Reed Funk started the breeding program in 1962 as the first full-time university turfgrass breeder. Before that time, Dr. Ralph Engel was interested and did some bentgrass breeding. Back in the 1940s, Dr. H. B. Sprague did some velvet bentgrass breeding. They had the cooperation of Dr. Phil Halisky in turf pathology.

Q: *In the history of the Rutgers turfgrass breeding program, are there specific accomplishments or cultivar releases that stand out above the rest?*

A: Manhattan perennial ryegrass was released in 1967 as the first improved variety. Rebel tall fescue was released as the first turf type variety in 1980. Adelphi was released as the first man-made hybrid Kentucky bluegrass, and Midnight Kentucky bluegrass was released as a landmark variety in 1980.

Q: *From a breeding standpoint, please tell us why it is necessary to travel the world over to collect turfgrass germplasm. What relationship does the source of germplasm variability have with the location of the perceived origin of the species?*

A: All of the important cool-season turfgrasses in the United States originated in Europe and parts of Asia. These grasses came to the U.S. with the settlers, and those surviving plants in old turf areas have been selected by breeders for varieties such as Manhattan. The effort to collect in Europe on a wide basis in the last 12 years was designed to broaden genetic resources available for variety development. By going to the areas of origin of these species, there should be greater genetic variation. For instance, so far, 16 new sources of resistance to gray leaf spot have been found in perennial ryegrass from recent European collections.

Q: *What are endophytes, what is their relationship with turfgrasses, and what is their significance in turfgrass stress tolerance?*

A: Endophytes are fungi that infect and grow symbiotically in the tissues of ryegrasses and fescues and move from generation to generation through seed transmission. They apparently co-evolved with the grasses in Europe and are usually put into new varieties through backcrossing the infected parents. When they are in grass plants, they provide resistance to above-ground feeding insects and have better heat tolerance.

Q: *How do endophytes infect grasses, and, more importantly, how and when do endophytes become resident in grass seed?*

A: The can be inoculated manually into grass plants, but usually they are put into varieties by maternal breeding techniques.

Q: *It is obvious that Rutgers has a huge field screening program, utilizing spaced-plant nurseries and other aspects of conventional breeding and selection techniques. To what extent have molecular genetics techniques been utilized to produce new Rutgers turfgrass cultivars?*

A: Thus far, the molecular techniques have been used to identify trait loci for stress resistance in bentgrasses, but so far all commercial releases have been from conventional screening and breeding.

Q: *As director of the Rutgers turfgrass breeding program, what do you see as the most critical traits necessary in new cool-season turfgrass cultivars?*

A: Drought, heat, wear, salt, and disease resistance.

Q: *Have there been significant shifts in the turfgrass industry that have necessitated changes in the direction of your breeding program (e.g., improvement of salt tolerance due to increased use of recycled water, etc.)?*

A: Salinity and wear tolerance breeding are new areas.

Q: *Has the Rutgers breeding program focused on transition issues of overseeded grasses? In other words, have you developed cultivars of perennial ryegrass, intermediate ryegrass,* Poa trivialis, *or other species that are specifically designed to transition better in overseeded bermudagrass?*

A: We have not worked on early-transition varieties.

Q: *What do you feel is the most important future development in the Rutgers turfgrass breeding program?*

A: Varieties with lower input requirements for maintenance.

Jeff Nus, Ph.D., *manager, Green Section Research.*

with increasing sources of genetic diversity in turfgrass germplasm and beneficial endophytes, enables significant improvements in the performance of new cultivars. Twenty new perennial ryegrasses with improved gray leaf spot resistance were released during 2007.

- Fifteen new and improved tall fescues were released in 2007.
- Substantial progress was made in developing intra- and inter-specific hybrids of Kentucky bluegrass. Ten promising Kentucky bluegrass cultivars were released in 2007, and three inter-specific hybrids from Kentucky bluegrass and Texas bluegrass were released.
- Seven new fine fescues for low-maintenance turf were released.
- Thirty-two creeping bentgrass clones were identified with dollar spot resistance. Thirty-seven colonial bentgrass clones were found with improved brown patch resistance. Sixty-three clones of velvet bentgrass were found with resistance to dollar spot and brown patch.

RELATED INFORMATION

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