

BENTGRASS BREEDING — TEXAS STYLE

by **DR. MILT ENGELKE**

Turfgrass Breeder, Texas A&M University

THE YEAR WAS 1984, and the decision was made by the United States Golf Association Turfgrass Research Committee to support the development of heat-tolerant, pest-resistant bentgrasses for golf. Texas A&M University submitted a proposal to establish such a program, the primary objective being the development of bentgrasses that are better adapted to extreme environmental conditions, with special emphasis on genetic improvements in tolerance to temperature extremes, reduced moisture needs, traffic tolerance, and insect and disease resistance.

Bentgrass Research Inc. (BRI), a non-profit organization formed in 1982 to support bentgrass research in Texas, was committed to the cooperative efforts between Texas A&M and the USGA to develop new turfgrasses for Texas and the arid southwest. Contracts were signed between Texas A&M, BRI, and the USGA in early 1985. The program was initiated under the direction of Dr. M. C. Engelke, Turfgrass Breeder, Texas Agricultural Experiment Station, Dallas. In 1985, Virginia Lehman was assigned to the bentgrass breeding project as research associate and served in this capacity until receiving her Ph.D. in 1990.

Developing improved bentgrasses required an understanding of the problems associated with this species. The biological shortcomings of creeping bentgrass, and especially the predominant cultivar, Penn-cross, included: 1) lack of root persistence, 2) poor heat tolerance, 3) lack of traffic tolerance during high summer temperatures, and 4) susceptibility to various diseases and insects.

A closer analysis of the situation revealed a much simpler explanation. Creeping bent-

grass provides the most desirable putting surface in the United States. A rapid increase in the golfing population has increased the amount of play, placing more pressure (traffic) on the grass plant. The desire to use bentgrass in southern climates also has resulted in placing the grass in a marginal environment for a longer period of time. Rather than experiencing one to two weeks of high temperatures and high humidity typical of the upper Midwest, the grasses are required to survive and perform during three to four months of continuous high temperature stress.

Simply speaking, creeping bentgrass lacks heat tolerance. It is a cool-season grass that is marginally adapted to the sub-tropical climates of the southern United States. Creeping bentgrass survival is most often due to cultural practices that modify and reduce the environmental stress that affects plant growth.

As an example, Penn-cross creeping bentgrass lacks sufficient heat tolerance to maintain an actively growing, functional root system for a prolonged period. New root growth is severely retarded and root longevity is reduced in many creeping bentgrass cultivars when soil temperatures reach 85°F for several days. The result is a reduction in functional roots. When this occurs, the superintendent is forced to provide more frequent irrigation to sustain plant growth, and more frequent syringing to cool the plant, since the plant no longer has the ability to adequately transpire and cool itself.

A simple biological deficiency — lack of root heat tolerance — is further complicated by the cultural practices used to moderate the environment to sustain plant

growth. The frequent syringing and irrigation, coupled with moderately high nutrition levels and high temperatures, creates ideal conditions for disease development. To abate disease, timely and sophisticated fungicide prevention programs have been developed. The problem is not so much that the plant is susceptible to disease, but the required combination of cultural practices results in a disease-conducive environment.

The breeding program established its primary objectives to investigate creeping bentgrasses' limitations:

(1) Root persistence was approached by screening large populations of plants at prolonged high soil temperatures and selecting those plants that were able to maintain active growth for the longest period of time. The heat bench, developed in 1982 at Texas A&M Research Center — Dallas (TAMREC), provides the basic tool to identify plants that have good root heat tolerance.

(2) Root distribution in the soil profile influences the plant's ability to access soil moisture reserves. A deeper, more persistent root system reduces irrigation requirements and enables the plant to maintain active transpirational cooling, which aids in moderating the plant's internal temperature. Plants were identified for rate of root growth and distribution under greenhouse and field conditions. The plants were individually grown in a contained root environment to study relative root distribution and rate of root development.

(3) The impact of salinity on creeping bentgrass was evaluated by Dr. Ken Marcum, during his post-doctoral appointment. Several germplasm lines were screened for

relative salinity tolerance under greenhouse conditions.

(4) Identification of selections with disease resistance was a major concern of the project. In cooperation with Dr. Phil Colbaugh, plant pathologist, TAES-Dallas, thousands of bentgrass plants were screened for response to *Pythium* and *Rhizoctonia* blight. During the early years, the advanced germplasm populations were routinely screened for disease, and several resistant genotypes were identified. Many of these plants have since been included as parental lines of bentgrass cultivars currently being tested.

Beginning in 1988, turfgrass plots were established at multiple locations throughout the United States, providing considerable information on adaptability and performance. Over a period of four years, extensive observations provided a strong data base to support the release of two new creeping bentgrasses in 1993.

CATO creeping bentgrass was tested as SYN4-88 and has been licensed to Pickseed West, Tangent, Oregon. CATO was named in honor of the late Paul Cato, the founding father of Bentgrass Research Inc., past chairman of the Colonial National Invitational, and past president of Colonial Country Club, Fort Worth, Texas. Before Paul passed away in 1991, he established and evaluated turf plots with the grass that would eventually be named after him.

CATO has been planted on several golf courses throughout the southern United States, including Bentwater Golf Club, Montgomery, Texas (fall 1991); Pecan Orchard Golf Club, Grandbury, Texas (fall 1991); and Sherrill Park Golf Club, Richardson, Texas. CATO was placed in commercial production by Pickseed in the fall of 1993 and will be available in substantial quantities in the fall of 1994.

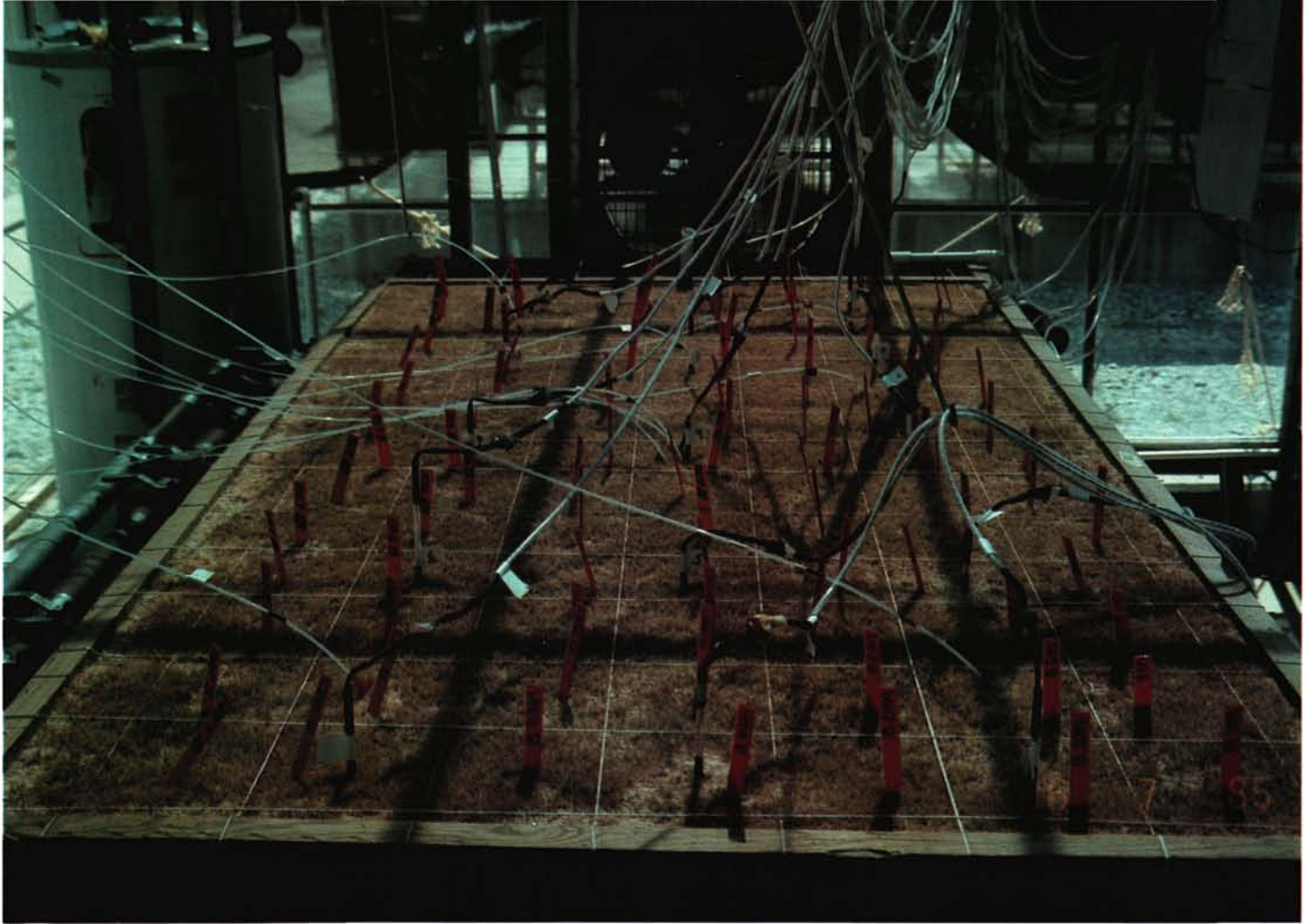
CRENSHAW creeping bentgrass was tested as SYN3-88 and has been licensed to Loft's Seed, Inc., Bound Brook, New Jersey. The variety was named after Ben Crenshaw, a Texas native who has a keen interest in the development of improved grasses and who followed the progress of SYN3-88 for several years. CRENSHAW has had substantial success on several golf courses in the southern United States, including Lakes Spivey, Jonesboro, Georgia (1991); Chapel Hill Golf Club, Douglasville, Georgia (1992); Bogey Hills Country Club, St. Charles, Missouri (1992); Sherrill Park Golf Club, Richardson, Texas (1992); Kirkwood Plantation Golf Club, Holly Springs, Mississippi (1992); and Chickasaw Country Club, Memphis, Tennessee (1992). CRENSHAW



Root distribution influences the ability of the turf to access soil moisture reserves. Slanted root tubes aid in studying root distribution and rate of development.

A heat bench was developed at the Texas A&M Research Center—Dallas as a screening tool to identify plants with good root heat tolerance.





Bentgrass disease resistance was a major concern in the breeding project. Thousands of plants were screened for resistance to Pythium and Rhizoctonia blight.

SHAW creeping bentgrass seed was commercially available in limited quantities in 1993, and substantial quantities should be available in 1994.

CATO and CRENSHAW have been blended for use at Preston Trails Country Club and Brookhollow Country Club, Dallas, Texas, and Riviera Country Club in Los Angeles with outstanding success.

To date, the success of the bentgrass breeding program is largely due to the close cooperative interaction among scientists, superintendents, extension personnel, and members of the turf industry. Dr. Virginia Lehman, presently a turfgrass breeder at Loft's Seed, Inc., received her Ph.D. degree working on the bentgrass program; Dr. Phil Colbaugh provided expertise in plant disease screening and testing at Texas A&M — Dallas; Dr. Jim Reinert, entomologist, provided leadership in assessing resistance to insects; and Dr. Bill Knoop was extensively involved in placing grasses at numerous golf courses across the southern United States. The close interaction of the research and extension turf team at Dallas was complemented by the Georgia Agriculture

Experiment Station program in Griffin, Georgia. Drs. Bob Carrow, Lee Burpee, and Gil Landry were extensively involved in the advanced testing and assessment of these grasses under high temperatures and humidity.

Excellent research plots have been established by several golf course superintendents across the United States. In total, 80 different courses have been involved in field testing and evaluating advanced selections. Excellent feedback was provided by many superintendents, and this information was used for substantiating the grasses' strengths and weaknesses. Honorable mention goes to superintendents Tom Diamond, Las Colinas Sports Club, for his continuous support as president of BRI; David Stone, The Honors Course, Ooltewah, Tennessee; and Reed Yenny, Mesa Verde Country Club, Costa Mesa, California. Special thanks also are extended to Dr. Gil Landry, Georgia Turf Extension Specialist, and Paul Vermeulen, USGA Green Section Agronomist, Lake Forest, California, for their considerable time and assistance in providing support and performance assessment of the trials in their areas.

There is no question that advances have been made in the development of bentgrass cultivars that are better adapted to marginal environmental conditions. I believe CATO and CRENSHAW, as well as other cultivars such as SR1020, PROVIDENCE, and PUTTER, are being recognized as superior turfgrasses for use in building new golf courses and renovating existing courses.

It must be recognized that incremental steps are being taken to identify and assemble genes for disease and insect resistance, heat tolerance, salinity tolerance, and, above all else, consumer acceptance. The steps manifested by the development and release of CATO and CRENSHAW are just the beginning, and are only a part of the scientific effort to bring an environmentally sensitive bentgrass to the golfing public. Small but significant spin-offs will be realized in the general reduction of labor, chemical resources, pesticides, and water use in the urban landscape. These reductions will occur through the incorporation of good science and an understanding of the biological processes involved in turfgrass growth as they relate to environmental adaptation.