

1997
ANNUAL PROGRESS REPORT
Concerning
BREEDING AND DEVELOPMENT
OF BENTGRASS

Submitted by:

Dr. M. C. Engelke

Professor

Turfgrass Breeding, Genetics and Management

and

Ms. Jamie M. Mills

Research Assistant

Texas Agricultural Experiment Station - Dallas
Texas A&M University System

Jointly Sponsored by:

United States Golf Association

Bentgrass Research, Inc.

and

Texas Agricultural Experiment Station

1 December 1997

NOT FOR PUBLICATION

VOLUME 97-2B

003

INDEX
1997 RESEARCH REPORT
BREEDING AND DEVELOPMENT OF BENTGRASS

Executive Summary	2
I. Introduction	3
II. Professional and Technical Support Personnel	3
III. Status of Bentgrass Releases	3
IV. 1992 Series of Creeping Bentgrasses	3
V. Germplasm Library	4
VI. Greenhouse and Laboratory Progress	4
VII. Tables	7
VIII. Appendices	14
Appendix A. Century Creeping Bentgrass Release Document	
Appendix B. Imperial Creeping Bentgrass Release Document	

EXECUTIVE SUMMARY

1997 Annual Bentgrass Report

Principle Investigator: Dr. M. C. Engelke, Professor
Technical Support: Ms. Jamie Mills, Research Assistant

Research Period: November 1996 to February 1998

The bentgrass program has enjoyed a long run of financial support from Bentgrass Research, Inc (Fort Worth, TX) and the United States Golf Association. The program was initiated in 1985 with the primary objective of developing Creeping Bentgrass varieties targeted to reducing the cultural requirements for maintaining bentgrass under stressful environments. During the past 13 years we have had the opportunity to collect, evaluate, and hybridize several thousand individual plants. During this process, numerous young scientists evolved with the program making significant contributions along the way. Notably, Dr. Virginia Lehman received her Ph.D. working on the development of Crenshaw, Cato and Mariner and the 92 series germplasm. Dr. Lehman is presently the Director of Research for Loft Seed Co. Winston-Salem, N.C. Drs. Richard White and Bridgett Ruemmele aided in the development of stress tolerant germplasms. These plants were then used in the development of the 1992 Series leading to development of Century, and Imperial released in 1996 and Backspin to be released in 1998. Significant as the varieties are, the individual scientists involved in the program over the years are likewise making substantial contributions to the industry in their own right.

In the past 13 years we have developed six creeping bentgrass presently on the market, with an additional three varieties in the advanced stages of development waiting to be incorporated into an University/Industry cooperative agreement for further advancement. The initial series established in 1988 resulted in three varieties being released in 1993, which rather quickly make a mark in the industry. Crenshaw (Syn3-88) was licensed to Loft Seeds in 1993, CATO (Syn4-88) was licensed to Pickseed West in 1993, and Mariner (Syn1-88) a Seaside reselection released in 1996 was licensed to Pickseed West. The 1992 series followed the logical sequence of development with further improvements in heat tolerance, quality and adaptability resulted in the release in 1997 of Century (Syn92-1) and Imperial (Syn92-5) to E. F. Burlingham & Sons, Forest Grove, OR. Backspin (Syn92-2) has been optioned jointly to TMI and O.M. Scotts and will be submitted for release in the spring 1998. The 1996 series of which there are also three advanced lines includes Syn96-1, Syn96-2 and Syn96-3. Presently these are being tested at Bent Tree Country Club - GCSAA-NTEP-USGA green site and with the Little Course connected with the Legends of Tennessee in cooperation with Mr. Joe Kennedy. The 1996 series breeder seed has been placed in cold storage. No immediate plans exist for including these in the National trials or for further seed increase. Support from the United States Golf Association has been redirected resulting in a down sizing of the bentgrass at Texas A&M. The past 13 years have been an excellent period for all concerned and the resulting varieties and young scientist will attest to the success of the program. We greatly appreciated the opportunity to participate in the program and look forward to future improvements for the industry from the United States Golf Association research program.

**1997 ANNUAL RESEARCH REPORT
BREEDING AND DEVELOPMENT OF BENTGRASS**

Dr. M. C. Engelke and Ms. Jamie M. Mills

INTRODUCTION

The bentgrass-breeding program is a cooperative research project funded jointly by the Texas Agricultural Experiment Station (TAES), the United States Golf Association (USGA), and Bentgrass Research, Inc. (BRI). This project was initiated in April 1985. This report will highlight activities between November 1996 through November 1997.

**PROFESSIONAL and TECHNICAL
SUPPORT PERSONNEL**

Ms. Jamie Mills (Research Assistant) joined the turfgrass breeding program in June 1993, with 100% responsibility to the Bentgrass breeding program. She holds a B. S. degree in Horticulture from Texas A&M University.

Mr. Paul Hornberger (Greenhouse Technician) joined the program in February 1997, under the direction of Ms. Jamie Mills. He is a horticulture student, working part-time until he obtains his undergraduate degree.

Dr. James Reinert, Entomologist and Dr. Phil Colbaugh, Plant Pathologist, provide excellent interaction in screening germplasm for host plant resistance. Heritability studies and advanced selection procedures have been initiated with promising results for dollar spot resistance, with promise for selective insect tolerances.

**STATUS of BENTGRASS
RELEASES**

'Mariner' creeping bentgrass (formerly known as Syn1-88) was released on April 9, 1996 by the Texas A&M University System Plant Review. 'Mariner' has been licensed world wide to Pickseed West for production and marketing.

**1992 SERIES OF CREEPING
BENTGRASSES**

E. F. Burlingham entered into agreement with Texas A&M University to produce, market and distribute two creeping bentgrass cultivars developed through the turfgrass breeding program.

Century (Syn92-1) was released in 1996 and is a six-clone synthetic for which the parents were selected for uniformity in plant type and leaf color. Individual clones comprising this clone include: TAES 2831, 3153, 3250, 3307, 3794 and 3799. Sufficient seed was harvested 1993 to enter Century into the National Turf Evaluation Trials. Approximately 40 pounds of seed were harvested in 1994. E. F. Burlingham and Sons has placed Century into production with the initial seed harvest for commercial distribution occurring in 1997.

Imperial (Syn92-5) also released in 1996 is a seven-clone synthetic and is earlier and potentially one of the highest yielding of the experimental varieties under development. The variety is coarser textured with

intermediate to good genetic color. Individual clones comprising this clone include: TAES 2833, 2845, 2916, 2922, 3106, 3293 and 3307.

Sufficient seed was harvested 1993 to enter Imperial into the National Turf Evaluation Trials. Approximately 50 pounds of seed were harvested in 1994. E. F. Burlingham and Sons has placed Imperial into production with the initial seed harvest for commercial distribution occurring in 1997.

The third variety from the Syn92 Series is Backspin has been placed with an option agreement with O.M. Scotts and TMI. Backspin will be submitted to the Plant Review Committee for release in the spring 1998.

Backspin (Syn92-2) is a four-clone synthetic for which the parents were selected for disease resistance with special emphasis *Rhizoctonia* and *Pythium* type diseases. In 1990 this was recognized as population N (Table 4 and 5, 1990 annual report). This includes clones TAES 2859, 2916, 2922, and 3276. Backspin is a medium late maturity group with good seed production potential. Sufficient seed was harvested in 1993 to enter this experimental in the national turf trials and in 1994 approximately 40 pounds were produced. Backspin is moderately coarse textured with an intermediate leaf type.

GERMPLASM LIBRARY

The Bentgrass germplasm library inventory continues to be updated. Select hybrids from crosses and selections are entered into the library, and are further subjected to routine selection and screening tests to include root growth, salinity, shade, cold and heat tolerance along with insect and disease resistance.

1996 SERIES OF CREEPING BENTGRASSES

Currently a new series of bentgrasses are being evaluated in greenhouse and field studies. These experimental varieties were selected for their specific characters in disease resistance, texture and dark green color. Seed was produced in 1996 and 1997 of each of these experimental varieties. Only limited testing has been initiated.

Considering the redirection of the USGA Research Project, the Syn96 series is in jeopardy of being shelved due to the lack of funding to continue the development of these varieties. Specifically, the breeder seed presently available will be placed in cold storage for a limited period of time. Hopefully, a cooperative arrangement can be made with an Industry partner to option these grasses for entry into the 1998 bentgrass trials. The estimated cost for entry into the trials is \$6,000 US per variety.

A field trial was planted in September 1997 at Bent Tree Country Club. This regional trial was supported by the USGA and in cooperation with the Texas A&M University System and Keith Ihms, Superintendent at Bent Tree Country Club of Dallas. The experimental green measures 12,000ft² and was built in August 1997 to USGA specifications. This multi-use green is sectioned off into a bentgrass trial measuring 3,000ft², a bermudagrass trial measuring 1,500ft² that is not yet planted, with the remainder for a practice green.

The bentgrass trial was seeded 10 September 1997 in a randomized complete block design with 24 varieties in three replications. Notes were taken weekly to

monitor turfgrass establishment (Table 1.) after establishment biweekly notes for turf quality (Table 2.). Observations for emergence data showed faster germination by Imperial and Putter (1.2) followed by Backspin, Century, PennG-1, Penncross, Providence, Trueline and Viper (1.0) in 17 September observation. Cultivar slowest to germinate was Penn A-1 with no germination until 19 September. Significant differences in emergence data were seen through the first 10 days, and we concluded the fastest germination was observed for Imperial bentgrass (5.7).

Turf quality ratings began 6 October for the bentgrass trial at Bent Tree Country Club. Penncross (8.3), API-2 (8.2), Crenshaw, Providence and SR1020 (8.0) ranked highest although they were not significantly different.

As observed in 7 November note, Penncross, Syn96-3 and Trueline (8.0) ranked highest in significant ratings, with Penn A-1 (6.3) as the only variety not statistically different. Overall we observed, means values in turfgrass quality in Penncross (7.9), Syn96-3 (7.8), AP1-1 (7.7), SR1020 (7.6), Crenshaw and Trueline (7.5), and LCB-103 (7.4).

VEGETATIVE CREEPING BENTGRASS SELECTIONS

Assessment of genotype performance continues in the greenhouse, field and laboratory. Approximately 73 superior plants were selected from the breeder fields of the Syn92 series in Brooks and St. Paul, Oregon are being evaluated for vegetative growth characters, heat and salinity tolerance, root growth characters, turf quality and genetic color. Selections were narrowed from the original 73 to 31 selections. As of now, we have narrowed to a select set of seven which

are identified only as TAES4045, 4052, 4068, 4077, 4089, 4095, and 4100. Specialized color studies have also continued on this green in an effort to quantify color. See "Calibration of Visual and Electronic Color Ratings of Turf Performance Trials" section in this report.

Future studies will include disease and insect response as funding becomes available. Data presented (Table 3.) is the field trial turf quality evaluations. We observed consistent significant differences for these exceptional vegetative selections in turf quality. Highest mean observed was TAES4047 (7.4), 4073(7.3), 4094 and 4095(7.2). All means of 7.0 were found to be significant, where the lowest mean was 6.1 for TAES 4055.

1993 NTEP SAND-MODIFIED BENTGRASS GREEN

The National Turfgrass Evaluation Program Sand-Modified Bentgrass Green trial established in October 1993 identifies cultivars with significant improvements in environmental adaptability. The trial contains 30 entries, 14 experimental and 16 commercial cultivars. At TAES-Dallas, we have evaluated this field trial for several performance characteristics including; root lengths, turf density, disease resistance, scalp resistance, traffic and overall turf quality (Table 4.). Through these evaluations we have found stronger bentgrasses for golf greens which are more disease-resistant, durable and require less irrigation and fertilization.

A mowing height study in 1996 on the NTEP green was started to compare plots under 5/32" (Table 6.) and 7/64"(Table 5.) mowing height. The plots are mowed 3 days per week during the winter months and 5 days per week

during the summer with walking green mowers and artificial traffic imposed weekly during the summer.

Little observable differences among entries were noted. In general, better color was observed in the plots mowed at 5/32".

PHYTOTOXICITY STUDY

A phytotoxicity screening of Betasan and Tupersan began April 1997 at TAES-Dallas in a replicated block design with three replications in a bentgrass green trial. The study was conducted in conjunction with Gowan industries to evaluate the safety of Tupersan™ and Betasan™ products on bentgrasses mowed at greens height and to evaluate the efficacy of said products against crabgrass. Label rates were followed with appropriate treatments being applied to coincide with regular evaluations of the plots.

Treatments were applied with this format:

- 1) Control = Untreated area
- 2) Betasan 1 = 9.4 fluid oz./1000ft² (4/10/97)
- 3) Betasan 2 = 9.4 fluid oz./1000ft² (4/10/97)
followed by 6.45 fluid oz./1000ft² (8/21/97)
- 4) Tupersan 1 = 12 lb./ acre (4/10/97)
- 5) Tupersan 2 = 6 lb./ acre (4/10/97)
followed by 6 lb./ acre (5/13/97)

Applications were applied with a backpack sprayer using a fan nozzle tip. A 2'x5' frame was constructed to prevent overlapping of chemicals on neighboring plots. Treatments were applied at listed times shown in the above treatment schedule.

First treatment was applied on 10 April 1997. All four treatments showed some phytotoxicity after the initial application. One month later, as exhibited in 15 May note, we saw recovery in both Tupersan treatments,

while the Betasan plots showed phytotoxicity for a week longer than the Tupersan plots. Tupersan plots recovered within 1.5 months. The second treatment for Tupersan at 6lb/acre was applied on 13 May, and turf showed some phytotoxicity after application. We concluded the Tupersan at 6lb/acre showed less phytotoxicity than that of Tupersan at 12lb/acre.

Betasan treated areas showed phytotoxicity longer than Tupersan treated plots, but did recover within 2 months. Some relatively small differences in phytotoxicity were observed from June through August.

Analysis of variance was conducted to test treatment effect (Table 7.) and variety effect (Table 8.). No interaction between cultivars with treatment was observed, therefore all data was combined for all cultivars in the analysis. We included varietal data in table form, but observed no varietal differences.

CALIBRATION OF VISUAL AND ELECTRONIC COLOR RATINGS OF TURF PERFORMANCE TRIALS.

Industry has a problem in describing turfgrass color in trials without entering in personal bias. Utilizing experimental parental blocks on bentgrass greens, a study was undertaken to describe color both quantitatively and qualitatively. An objective method of classification that contains detailed and accurate information for individual or groups to make turfgrass selections is needed. A method, which is not, subjective to one's own preferences and perceptions, rather an objective assessment of color that describes color differences mathematically, which can yield quantitative notes for analysis and can be used throughout industry. This type of

system will aid industry in a better method of color classification. After extensive research, we found the tool that best suited our purpose was the MUNSELL Color Charts for Plant Tissues. These charts were originally created by Dr. S. A. Wilde and Dr. G. K. Voight, Professors of Soils at the University of Wisconsin.

This technique is advantageous in developing a standard system which is widely accepted, programmable, cost efficient, easy to distribute and narrows personal perception.

The components of color include:

- 1.) *Hue* the intermediate levels of color relative to red, yellow, green, blue and purple which are placed on different pages in the book. This makes field usage easier and narrows your field of vision for comparison.
- 2.) *Value* which indicates the degree of lightness to darkness or brilliance in color.
- 3.) *Chroma* or chromatic color indicates the saturation or degree from neutral gray. This component proved to be impossible for the human eye to detect because of our inability to see shades of color in the absorption rate.

We modified a Munsell page to contain three hues on a page, then laminated the page for durability. After this, cuts were made to the chart for viewing the sample. Utilizing this modified chart directly on the grass was a convenient way for chart usage.

To take this research of color to the next level, Texas A&M University REC in cooperation with Minolta Corporation tested the CR-310 Color Chromameter. The instrument was designed for field or laboratory usage with a

compact base and a moveable sensor. The chromameter was easy to calibrate and took accurate readings in only a few seconds as well as having a convenient print out and the capability to download the notes directly to a portable computer.

Our experiment was conducted on 21 August 1997 with the use of six raters who had a combined experience of over 35 years. We rated fifteen experimental parental blocks in 3 replications measuring 2' x 2'. The raters took a 1-9, 9 is darkest color and a Munsell chart rating. The CR-310 Chromameter followed after first two ratings were completed on same plots for comparison.

Notes were analyzed using a correlation between means. We saw that the instrument chroma and value were highly correlated, as well as the chart hue and value. None of the visual chroma readings showed significance due to our inability to assess chroma. Differences between varieties displayed how perception plays a large part in color perception. TAES 4089 showed no differences in color quality, but did display differences in chart and instrument readings. Cato bentgrass had differences in all ratings.

These findings concur that 1-9 ratings are too subjective for analysis and ineffective in assessing descriptive values. Munsell color charts are an effective and economical method for quantitatively measuring color in the turfgrass industry. With the different comparisons to the Munsell color charts, our objective measurements have little rater-induced variance. This classification method is based on objective and measurable components of color that could be the new standard for evaluating and designating color in turfgrasses.

Table 1. Bentgrass Emergence ratings¹ during 1997 at Bent Tree Country Club, Dallas, TX.

Entry	15Sep	17Sep	19Sep	22Sep	25Sep	Mean	TPI ³	Entry	15Sep	17Sep	19Sep	22Sep	25Sep	Mean	TPI ³
L-93	0.0	0.5	1.3	1.7a	4.7a	1.6	3	Century	0.0	1.0a	1.7a	2.0a	4.7a	1.9	5
Putter	0.3	1.2a	2.3a	2.3a	5.3a	2.3	5	Imperial	0.0	1.2a	2.7a	2.2a	5.7a	2.3	5
Cato	0.0	0.7a	1.7a	1.7a	4.7a	1.7	5	Penn A-1	0.0	0.0	0.3	0.7	2.3	0.7	1
Crenshaw	0.0	0.8a	1.7a	1.7a	4.0	1.6	4	Penn A-4	0.0	0.8a	1.7a	1.3	4.3a	1.6	4
LCB-103	0.0	0.7a	1.3	1.5a	4.3a	1.6	4	Penn G-6	0.0	0.8a	1.3	1.2	3.7	1.4	2
Penncross	0.0	1.0a	2.0a	2.0a	4.3a	1.9	5	Penn G-1	0.0	1.0a	1.7a	1.3	4.7a	1.7	4
Backspin	0.0	1.0a	1.7a	1.5a	4.3a	1.7	5	Syn 96-1	0.0	0.8a	1.3	1.3	3.7	1.4	2
Trueline	0.0	1.0a	2.0a	1.7a	4.3a	1.8	5	Syn 96-2	0.0	0.5	1.3	1.2	3.3	1.3	1
Providence	0.0	1.0a	1.7a	1.7a	3.3	1.5	4	Syn 96-3	0.0	0.8a	2.3a	1.7a	5.3a	2.0	5
SR1020	0.0	0.5	1.7a	1.7a	4.7a	1.7	4	API-1	0.0	0.5	1.7a	1.3	4.3a	1.6	3
SR1119	0.0	0.5	1.3	1.2	4.3a	1.5	2	API-2	0.0	0.2	1.3	1.3	3.7	1.3	1
Viper	0.0	1.0a	1.7a	2.2a	5.0a	2.0	5	API-3	0.0	0.2	1.0	1.0	3.7	1.2	1
MSD ²	ns	0.63	1.13	0.94	1.45	ns	5	MSD ²	ns	0.63	1.13	0.94	1.45	ns	5

¹ Emergence ratings were based on a tenth percent of growth within a plot.

² MSD is the least significant difference between means based on Fisher's mean separation ($p \leq 0.05$).

'a' indicates in the highest statistical group. 'ns' indicates means were not significant based on ANOVA *F*-test.

³ TPI is the turf performance index which is the number of times an entry was rated in the top statistical group (does not include mean).

10

Table 2. Bentgrass Turf Quality ratings¹ during 1997 at Bent Tree Country Club, Dallas, TX.

Entry	6Oct	15Oct	20Oct	27Oct	7Nov	Mean	TPI ³	Entry	6Oct	15Oct	20Oct	27Oct	7Nov	Mean	TPI ³
L-93	7.5	6.8a	7.7	7.0	6.7a	7.1	5	Century	7.5	7.2a	7.5	7.0	7.3a	7.3	5
Putter	7.7	7.0a	7.3	7.2	7.0a	7.2	5	Imperial	7.7	7.3a	7.2	7.2	6.7a	7.2	5
Cato	7.8	6.7a	7.2	7.2	6.7a	7.1	5	Penn A-1	6.7	5.8	7.0	6.8	6.3	6.5	3
Crenshaw	8.0	6.8a	7.7	7.5	7.7a	7.5a	5	Penn A-4	7.3	6.8a	7.5	7.5	7.3a	7.3	5
LCB-103	7.7	7.2a	7.3	7.7	7.3a	7.4a	5	Penn G-6	7.3	6.8a	7.3	7.3	7.3a	7.2	5
Penncross	8.3	7.3a	8.0	7.7	8.0a	7.9a	5	Penn G-1	7.3	6.7a	7.3	7.2	7.3a	7.2	5
Backspin	7.3	5.8	7.0	6.8	7.0a	6.8	4	Syn 96-1	7.0	6.2a	7.2	7.5	7.3a	7.0	5
Trueline	7.8	7.0a	7.3	7.3	8.0a	7.5a	5	Syn 96-2	6.8	6.5a	7.2	7.3	7.3a	7.0	5
Providence	8.0	6.7a	7.7	7.3	7.0a	7.3	5	Syn 96-3	7.8	7.7a	7.8	7.8	8.0a	7.8a	5
SR1020	8.0	6.8a	7.8	7.7	7.7a	7.6a	5	API-1	8.2	7.0a	7.7	7.8	7.7a	7.7a	5
SR1119	7.3	6.2a	7.5	7.3	6.7a	7.0	5	API-2	6.8	5.8	7.2	7.7	7.7a	7.0	4
Viper	7.8	6.3a	7.3	7.3	7.0a	7.2	5	API-3	6.7	5.7	6.8	7.2	7.0a	6.7	4
MSD ²	ns	1.7	ns	ns	1.4	0.5	5	MSD ²	ns	1.7	ns	ns	1.4	0.5	5

¹ Turf quality ratings were based on 1-9 scale, where 9 is the best and 5 is the minimum acceptable turf quality.

² MSD is the least significant difference between means based on Fisher's mean separation ($p \leq 0.05$).

'a' indicates in the highest statistical group. 'ns' indicates means were not significant based on ANOVA *F*-test.

³ TPI is the turf performance index which is the number of times an entry was rated in the top statistical group (does not include mean).

Table 3. Turf quality ratings¹ during 1997 for the bentgrass vegetative field trial at TAES-Dallas.

Entry	17Apr	1May	12Jun	25Jul	20Aug	24Sep	20Oct	Mean	Entry	17Apr	1May	12Jun	25Jul	20Aug	24Sep	20Oct	Mean
4039	5.8	7.0a	6.3a	6.7	5.3	6.2	6.5	6.3	4078	6.5	6.5	6.3a	7.3a	6.3a	6.8a	6.5	6.6
4040	6.3	7.0a	6.3a	7.3a	7.0a	6.5a	6.5	6.7	4079	7.0	7.3a	6.7	6.8	6.7	6.8	7.3	7.0a
4041	6.2	6.3	5.7	7.5a	6.0a	6.8a	6.8a	6.5	4080	7.0	7.8	7.0	6.8	6.0	7.2	7.0	7.0a
4042	7.2	7.5a	6.0a	6.7	5.7	6.3	6.2	6.5	4081	6.5	7.7	7.0	7.3	7.0	7.5	6.7	7.1a
4043	6.8	6.5	6.7a	6.7	5.3	6.0	6.0	6.3	4082	7.0	7.2	7.3	7.8	6.3	6.3	6.7	7.0a
4044	6.7	7.7a	6.0a	6.7	5.3	6.0	5.8	6.3	4083	6.7	7.0	7.0	7.2	6.0	6.7	6.5	6.7
4045	7.2	8.0a	7.0a	7.3a	6.3a	7.0a	7.0a	7.1a	4084	6.0	6.2	6.0	6.8	5.3	6.7	6.2	6.2
4046	6.5	7.7a	6.7a	6.8a	6.3a	7.0a	6.7a	6.8	4085	6.5	6.0	5.0	6.0	5.0	6.3	6.0	5.8
4047	7.3	7.7a	7.3a	7.5a	7.7a	7.5a	6.7a	7.4a	4086	7.0	7.2	7.0	6.8	6.0	6.5	6.8	6.8
4048	6.5	7.8a	7.0a	7.5a	6.3a	6.7a	7.0a	7.0a	4087	7.3	7.3	6.7	7.2	7.3	7.3	7.2	7.2a
4049	7.2	7.3a	7.0a	7.5a	6.7a	7.3a	6.7a	7.1a	4088	7.2	7.3	6.7	6.8	5.3	7.0	6.8	6.7
4050	6.5	6.7	6.3a	6.3	5.7	6.5a	6.3	6.3	4089	7.2	7.3	6.3	7.3	7.0	7.2	7.0	7.0a
4051	6.8	6.7	6.3a	7.0a	4.7	6.2	6.2	6.3	4090	7.0	7.3	6.3	7.0	6.3	7.0	6.7	6.8
4052	6.0	7.2a	6.3a	6.8a	4.7	6.5a	6.7a	6.3	4091	7.2	7.0	7.0	6.8	5.3	6.3	6.3	6.6
4053	6.5	7.3a	6.7a	7.0a	6.7a	7.0a	6.7a	6.8	4092	7.0	7.0	6.0	7.2	6.7	7.0	6.7	6.8
4054	6.3	7.3a	7.0a	7.0a	6.3a	7.0a	7.2a	6.9	4093	7.0	6.7	6.3	6.3	5.0	6.2	6.3	6.3
4055	6.2	6.5	5.7	6.5	5.3	6.5a	5.8	6.1	4094	7.5	7.3	6.7	7.3	7.7	7.2	7.0	7.2a
4056	7.0	7.0a	7.0a	7.2a	6.0a	6.7a	6.7a	6.8	4095	6.8	7.5	7.0	7.7	6.7	7.2	7.5	7.2a
4057	6.5	5.7	5.0	6.2	5.3	6.3	6.0	5.9	4096	7.2	7.0	6.7	7.0	6.3	6.8	7.0	6.9
4058	7.5	6.7	6.7a	7.2a	4.0	6.2	6.2	6.3	4097	7.0	6.7	6.3	6.8	4.3	6.2	5.8	6.2
4059	7.0	7.2a	7.0a	7.0a	5.3	7.0a	6.8a	6.8	4098	7.0	6.7	6.7	6.8	4.0	6.2	6.0	6.2
4060	7.0	7.3a	7.3a	6.7	5.3	6.3	6.2	6.6	4099	6.0	6.7	6.7	6.7	5.0	6.2	6.3	6.2
4061	6.5	7.5a	6.7a	7.2a	5.3	6.7a	6.2	6.6	4100	7.0	7.0	6.7	7.2	5.0	6.3	6.7	6.5
4062	6.8	6.5	6.3a	7.0a	6.0a	6.8a	7.0a	6.6	4101	7.0	7.3	6.3	6.8	6.7	6.8	6.2	6.7
4063	6.5	7.0a	7.0a	7.3a	4.7	6.7a	6.2	6.5	4102	6.5	7.0	6.7	6.3	6.0	6.2	6.2	6.4
4064	6.8	6.3	5.7	7.0a	6.3a	6.8a	6.7a	6.5	4103	7.2	7.2	6.3	7.2	6.3	6.8	6.5	6.8
4065	7.3	6.0	5.7	6.8a	6.0a	5.8	6.2	6.3	4104	7.0	7.2	7.0	7.5	7.0	7.0	6.7	7.0a
4066	6.2	6.0	5.7	6.7	6.3a	7.3a	6.8a	6.4	4105	5.8	7.3	6.7	7.5	6.7	7.0	6.2	6.7
4067	6.0	6.7	6.3a	7.0a	6.3a	6.7a	6.8a	6.5	4106	7.0	7.2	6.7	7.2	6.3	6.2	6.0	6.6
4068	6.8	7.3a	6.7a	6.8a	6.7a	6.8a	7.5a	7.0a	4107	6.0	6.8	6.3	6.7	6.3	6.7	6.3	6.5
4069	7.0	7.8a	6.3a	7.2a	5.7	4.7	6.3	6.4	4108	5.8	6.0	6.3	7.0	6.0	7.2	7.0	6.5
4070	6.3	7.5a	6.7a	7.2a	6.7a	6.8a	6.3	6.8	4109	7.3	6.5	6.0	6.5	6.0	7.3	6.8	6.6
4071	6.5	6.0	6.7a	6.8a	5.3	6.2	6.0	6.2	4110	6.7	7.3	6.7	7.2	5.7	6.8	6.3	6.7
4072	6.5	7.7u	6.3u	7.2u	6.7u	6.5u	6.3	6.7	4111	7.5	8.0	6.3	7.3	6.7	7.2	6.7	7.1a
4073	6.8	7.7a	6.3a	7.2a	7.7a	8.0a	7.2a	7.3a	Cato	6.8	7.3	6.3	7.0	5.0	6.3	6.0	6.4
4074	6.8	7.7a	6.7a	7.2a	5.3	6.7a	6.3	6.7	Crenshaw	7.5	6.7	6.7	7.2	5.7	6.5	6.5	6.7
4075	6.0	7.2a	7.0a	7.8a	6.0a	4.7	5.2	6.3	Penncross	7.2	6.7	7.0	6.3	6.7	7.2	7.2	6.9
4076	6.2	7.7u	6.3u	7.2u	6.7u	7.2u	6.8	6.9	Senside	6.8	7.0	6.7	6.3	4.7	6.7	6.8	6.4
4077	7.0	7.3a	6.7a	6.7	6.7a	7.5a	7.2a	7.0a	Mariner	7.2	7.2	6.0	6.5	6.3	7.0	6.3	6.6
MSD ²	ns	1.2	1.5	1.1	1.7	1.7	1.0	0.5	MSD ²	ns	1.2	1.5	1.1	1.7	1.7	1.0	0.5

¹ Turf quality ratings were based on 1-9 scale, where 9 is the best and 5 is the minimum acceptable turf quality.

² MSD is the least significant difference between means based on Fisher's mean separation ($p \leq 0.05$).

'a' indicates in the highest statistical group. 'ns' indicates means were not significant based on ANOVA F-test.

Table 4. Turf quality ratings¹ during 1997 for the 1993 NTEP sand-modified bentgrass trial at TAES-Dallas.

Entry	28Jan	26Feb	11Mar	29Apr	23May	12Jun	20Jun	27Jun	11Jul	25Jul	19Aug	24Sep	22Oct	7Nov	Mean	TPI ³
18th Green	6.7	7.2a	6.7	6.7	6.3a	7.2	6.7	6.8	6.7	6.7	6.5	6.7	6.3	5.8	6.6	12
Regent	6.7	7.2a	6.3	7.2	6.3a	7.5	7.0	7.2	7.0	7.0	6.5	6.3	6.7	6.5	6.8	12
BarAs493	6.3	6.3	6.5	6.3	6.0a	7.0	6.3	7.0	6.2	6.7	6.7	6.3	6.5	6.5	6.5	11
VarWs42102	6.0	7.0a	6.5	6.8	6.5a	7.0	6.7	6.8	6.3	6.7	6.5	6.0	6.2	6.2	6.5	12
Trueline	6.7	6.8a	6.7	6.7	6.3a	7.0	6.2	6.3	6.3	6.5	6.2	6.2	6.0	5.7	6.4	12
Seaside	6.7	6.2	6.3	6.5	7.0a	7.2	6.5	7.0	6.8	6.8	6.3	6.0	6.5	6.2	6.6	11
Cato	6.3	6.2	6.5	7.0	6.0a	6.8	6.5	7.2	6.7	6.8	6.3	6.0	6.0	6.0	6.5	11
Pro/Cup	6.7	6.7	6.8	6.7	6.3a	7.0	6.8	6.8	6.7	7.3	6.8	5.8	6.5	6.8	6.7	11
Crenshaw	6.7	5.3	6.3	6.8	5.8a	7.3	6.8	7.0	6.5	7.2	6.8	5.7	6.5	6.2	6.5	11
Southshore	6.3	7.0a	7.0	7.5	6.5a	7.7	6.8	6.7	6.8	7.3	6.2	5.8	6.7	6.3	6.8	12
Providence	7.0	6.2	6.3	6.7	6.7a	7.0	6.5	6.7	6.7	7.0	7.2	5.8	6.2	6.0	6.6	11
SR1020	6.3	6.7	6.5	7.2	6.3a	7.3	6.8	7.3	7.0	7.3	5.5	5.7	6.5	6.3	6.6	11
Century	6.0	6.8a	6.7	7.2	6.7a	7.0	6.8	6.8	6.7	7.0	6.7	6.0	6.0	6.0	6.6	12
Backspin	6.3	6.3	6.2	6.2	6.3a	6.8	6.7	7.0	6.7	6.7	6.8	5.2	6.0	5.7	6.3	11
Imperial	6.7	6.0	6.7	7.0	6.7a	7.0	6.7	6.8	6.7	7.2	6.3	5.7	6.5	6.0	6.6	11
Penncross	6.3	5.8	6.3	6.8	6.2a	6.7	6.7	6.8	6.3	6.8	6.8	5.5	6.2	6.0	6.4	11
Penn A-1	6.7	6.3	6.7	7.2	7.0a	7.2	6.8	7.3	7.0	7.2	6.3	5.8	6.8	6.7	6.8	11
Penn A-4	6.7	6.7	4.3	6.3	6.8a	7.5	7.0	7.3	6.5	7.2	6.8	5.7	6.8	6.7	6.6	11
Penn G-2	6.0	6.0	6.3	6.2	5.8a	7.2	6.7	6.8	6.7	6.8	7.0	6.2	6.8	6.3	6.5	11
Penn G-6	6.3	6.5	6.5	7.0	6.3a	7.5	7.0	6.8	7.0	7.5	7.2	6.0	6.5	6.7	6.8	11
Pennlinks	6.0	6.0	6.7	6.0	6.0a	7.0	6.5	7.0	6.7	6.8	6.8	6.5	6.3	6.2	6.5	11
DG-P	6.7	6.5	6.2	6.7	6.5a	7.7	7.0	7.0	6.5	7.3	6.8	5.7	6.3	6.0	6.6	11
MSUEB	6.3	6.3	6.7	6.8	6.2a	7.2	6.5	7.0	6.0	6.3	7.0	5.5	6.2	5.8	6.4	11
L-93	7.0	6.5	7.0	7.5	4.2	7.7	7.0	6.8	7.0	7.3	6.0	5.8	6.3	6.3	6.6	10
Lopez	7.3	6.5	6.2	7.2	6.0a	7.2	6.7	6.8	6.5	6.7	6.8	5.8	6.3	6.3	6.6	11
Tendez	6.7	6.2	6.5	7.0	6.2a	7.2	6.8	6.8	6.7	6.7	7.0	6.2	5.8	6.2	6.6	11
ISIAp89150	6.7	7.2a	6.7	6.7	6.7a	7.0	6.8	7.0	7.0	7.2	6.7	5.8	6.3	6.0	6.7	12
Mariner	6.7	7.2a	6.8	6.8	6.3a	6.8	6.5	6.7	6.7	6.8	6.8	6.0	6.5	6.2	6.6	12
C&C	6.0	7.5a	6.5	7.0	6.3a	7.0	6.8	7.0	6.8	7.3	6.8	6.2	6.5	6.5	6.7	12
Dominant	6.0	5.8	6.8	7.0	5.8a	7.0	6.5	6.7	6.5	6.5	6.8	6.2	6.3	6.0	6.4	11
MSD ²	ns	.68	ns	ns	2.06	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	12

¹ Turf quality ratings were based on 1-9 scale, where 9 is the best and 5 is the minimum acceptable turf quality.

² MSD is the least significant difference between means based on Fisher's mean separation ($p \leq 0.05$).

'a' indicates in the highest statistical group. 'ns' indicates means were not significant based on ANOVA *F*-test.

³ TPI is the turf performance index which is the number of times an entry was rated in the top statistical group (does not include mean).

013

Table 5. 1997 Turf quality ratings¹ under mowing height (7/64") for the 1993 NTEP sand-modified bentgrass trial at TAES-Dallas.

Entry	29Apr	23May	12Jun	20Jun	27Jun	11Jul	25Jul	19Aug	24Sep	22Oct	7Nov	Mean	TPI ³
18th Green	6.7	6.3a	7.2	6.7	6.8	6.7	6.7	6.5	6.7	6.3	5.8	6.6a	11
Regent	7.2	6.3a	7.5	7.0	7.2	7.0	7.0	6.5	6.3	6.7	6.5	6.8a	11
BarAs493	6.3	6.0a	7.0	6.3	7.0	6.2	6.7	6.7	6.3	6.5	6.5	6.5a	11
VarWs42102	6.8	6.5a	7.0	6.7	6.8	6.3	6.7	6.5	6.0	6.2	6.2	6.5a	11
Trueline	6.7	6.3a	7.0	6.2	6.3	6.3	6.5	6.2	6.2	6.0	5.7	6.3	11
Seaside	6.5	7.0a	7.2	6.5	7.0	6.8	6.8	6.3	6.0	6.5	6.2	6.6a	11
Cato	7.0	6.0a	6.8	6.5	7.2	6.7	6.8	6.3	6.0	6.0	6.0	6.5a	11
Pro/Cup	6.7	6.3a	7.0	6.8	6.8	6.7	7.3	6.8	5.8	6.5	6.8	6.7a	11
Crenshaw	6.8	5.8a	7.3	6.8	7.0	6.5	7.2	6.8	5.7	6.5	6.2	6.6a	11
Southshore	7.5	6.5a	7.7	6.8	6.7	6.8	7.3	6.2	5.8	6.7	6.3	6.8a	11
Providence	6.7	6.7a	7.0	6.5	6.7	6.7	7.0	7.2	5.8	6.2	6.0	6.6a	11
SR1020	7.2	6.3a	7.3	6.8	7.3	7.0	7.3	5.5	5.7	6.5	6.3	6.7a	11
Century	7.2	6.7a	7.0	6.8	6.8	6.7	7.0	6.7	6.0	6.0	6.0	6.6a	11
Backspin	6.2	6.3a	6.8	6.7	7.0	6.7	6.7	6.8	5.2	6.0	5.7	6.4a	11
Imperial	7.0	6.7a	7.0	6.7	6.8	6.7	7.2	6.3	5.7	6.5	6.0	6.6a	11
Pennncross	6.8	6.2a	6.7	6.7	6.8	6.3	6.8	6.8	5.5	6.2	6.0	6.4a	11
Penn A-1	7.2	7.0a	7.2	6.8	7.3	7.0	7.2	6.3	5.8	6.8	6.7	6.8a	11
Penn A-4	6.3	6.8a	7.5	7.0	7.3	6.5	7.2	6.8	5.7	6.8	6.7	6.8a	11
Penn G-2	6.2	5.8a	7.2	6.7	6.8	6.7	6.8	7.0	6.2	6.8	6.3	6.6a	11
Penn G-6	7.0	6.3a	7.5	7.0	6.8	7.0	7.5	7.2	6.0	6.5	6.7	6.9a	11
Pennlinks	6.0	6.0a	7.0	6.5	7.0	6.7	6.8	6.8	6.5	6.3	6.2	6.5a	11
DG-P	6.7	6.5a	7.7	7.0	7.0	6.5	7.3	6.8	5.7	6.3	6.0	6.7a	11
MSUEB	6.8	6.2a	7.2	6.5	7.0	6.0	6.3	7.0	5.5	6.2	5.8	6.4a	11
L-93	7.5	4.2	7.7	7.0	6.8	7.0	7.3	6.0	5.8	6.3	6.3	6.5a	10
Lopez	7.2	6.0a	7.2	6.7	6.8	6.5	6.7	6.8	5.8	6.3	6.3	6.6a	11
Tendez	7.0	6.2a	7.2	6.8	6.8	6.7	6.7	7.0	6.2	5.8	6.2	6.6a	11
ISIAp89150	6.7	6.7a	7.0	6.8	7.0	7.0	7.2	6.7	5.8	6.3	6.0	6.7a	11
Mariner	6.8	6.3a	6.8	6.5	6.7	6.7	6.8	6.8	6.0	6.5	6.2	6.6a	11
C&C	7.0	6.3a	7.0	6.8	7.0	6.8	7.3	6.8	6.2	6.5	6.5	6.8a	11
Dominant	7.0	5.8a	7.0	6.5	6.7	6.5	6.5	6.8	6.2	6.3	6.0	6.5a	11
MSD ²	ns	2.06	ns	ns	ns	ns	ns	ns	ns	ns	ns	0.54	11

¹ Turf quality ratings were based on 1-9 scale, where 9 is the best and 5 is the minimum acceptable turf quality.

² MSD is the least significant difference between means based on Fisher's mean separation ($p \leq 0.05$).

'a' indicates in the highest statistical group. 'ns' indicates means were not significant based on ANOVA *F*-test.

³ TPI is the turf performance index which is the number of times an entry was rated in the top statistical group (does not include mean).

Table 6. 1997 Turf quality ratings¹ under mowing height (5/32") for the 1993 NTEP sand-modified bentgrass trial at TAES-Dallas.

Entry	29Apr	23May	12Jun	20Jun	27Jun	11Jul	25Jul	19Aug	24Sep	22Oct	7Nov	Mean	TPI ³
18th Green	7.0	7.0	7.5	7.5	8.0	7.5	7.2	6.7	6.8	7.5	7.2	7.3	11
Regent	7.5	7.3	8.0	7.7	8.0	8.0	7.0	6.2	7.2	8.0	7.5	7.5	11
BarAs493	7.2	7.0	7.5	7.2	8.0	7.5	6.8	6.8	6.7	7.7	7.2	7.2	11
VarWs42102	7.5	7.5	7.8	7.8	8.0	7.8	6.8	6.7	6.8	7.0	7.0	7.3	11
Trueline	7.7	7.0	7.7	7.5	7.8	7.2	7.0	6.7	6.8	7.3	7.2	7.3	11
Seaside	7.3	7.3	7.8	7.5	8.0	7.8	6.8	6.7	6.7	7.5	7.3	7.3	11
Cato	7.3	7.0	7.5	7.2	8.0	8.0	6.8	6.7	6.7	7.3	7.3	7.3	11
Pro/Cup	7.5	7.2	7.8	8.0	8.0	7.7	7.2	7.3	6.7	7.3	7.3	7.5	11
Crenshaw	7.5	7.2	7.8	7.7	8.0	7.5	7.3	6.8	6.7	7.7	7.5	7.4	11
Southshore	8.0	7.0	7.5	7.8	7.8	8.0	7.2	6.8	7.0	7.3	7.8	7.5	11
Providence	7.3	7.7	7.7	7.7	7.7	7.5	7.0	6.8	6.8	7.3	7.2	7.3	11
SR1020	7.8	7.5	7.8	7.8	7.8	8.0	7.5	6.0	6.8	7.3	7.3	7.4	11
Century	7.5	7.3	7.8	7.7	7.8	7.5	7.3	6.5	6.3	7.3	7.2	7.3	11
Backspin	7.7	7.3	7.8	7.8	8.0	7.7	7.0	6.5	6.3	7.3	7.2	7.3	11
Imperial	7.7	7.3	7.8	7.5	8.0	7.5	6.8	6.5	6.3	7.7	7.3	7.3	11
Penncross	7.8	7.3	7.3	7.7	7.8	7.3	7.2	7.2	6.2	7.3	7.5	7.3	11
Penn A-1	8.0	7.3	8.0	8.0	8.0	7.8	7.0	5.5	6.7	7.3	7.3	7.4	11
Penn A-4	6.7	7.2	7.5	7.8	8.0	8.0	7.0	7.0	6.3	7.7	7.7	7.3	11
Penn G-2	7.5	7.0	7.7	7.5	7.8	7.5	6.7	7.0	6.7	7.7	7.5	7.3	11
Penn G-6	7.8	7.3	7.8	7.7	8.0	5.3	7.2	6.5	6.8	7.2	7.5	7.2	11
Pennlinks	7.2	7.2	7.7	7.5	7.8	7.5	6.7	7.0	6.7	7.0	7.2	7.2	11
DG-P	7.5	7.5	7.8	7.8	8.0	7.8	6.8	6.8	6.7	7.5	7.2	7.4	11
MSUEB	7.5	7.2	7.3	7.7	7.7	7.2	6.5	7.0	6.3	7.2	7.2	7.2	11
L-93	8.0	7.3	8.0	7.8	8.0	7.7	7.0	5.5	6.5	7.0	7.3	7.3	11
Lopez	7.5	6.8	8.0	7.7	7.8	7.5	6.7	7.2	6.7	7.2	7.5	7.3	11
Tendez	7.8	7.2	8.0	7.7	7.8	7.8	7.2	6.3	6.8	7.3	7.3	7.4	11
ISIAp89150	7.7	7.8	7.7	7.8	8.0	7.7	6.8	6.3	6.5	7.0	7.0	7.3	11
Mariner	7.7	7.2	7.8	7.7	7.7	7.5	6.8	7.3	6.5	7.3	7.3	7.3	11
C&C	7.7	7.2	7.8	7.8	7.8	8.0	7.3	6.7	6.7	7.3	7.2	7.4	11
Dominant	7.5	6.8	7.3	7.7	7.7	7.5	7.2	7.2	6.7	7.3	7.3	7.3	11
MSD ²	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	11

¹ Turf quality ratings were based on 1-9 scale, where 9 is the best and 5 is the minimum acceptable turf quality.

² MSD is the least significant difference between means based on Fisher's mean separation ($p \leq 0.05$).

'a' indicates in the highest statistical group. 'ns' indicates means were not significant based on ANOVA *F*-test.

³ TPI is the turf performance index which is the number of times an entry was rated in the top statistical group (does not include mean).

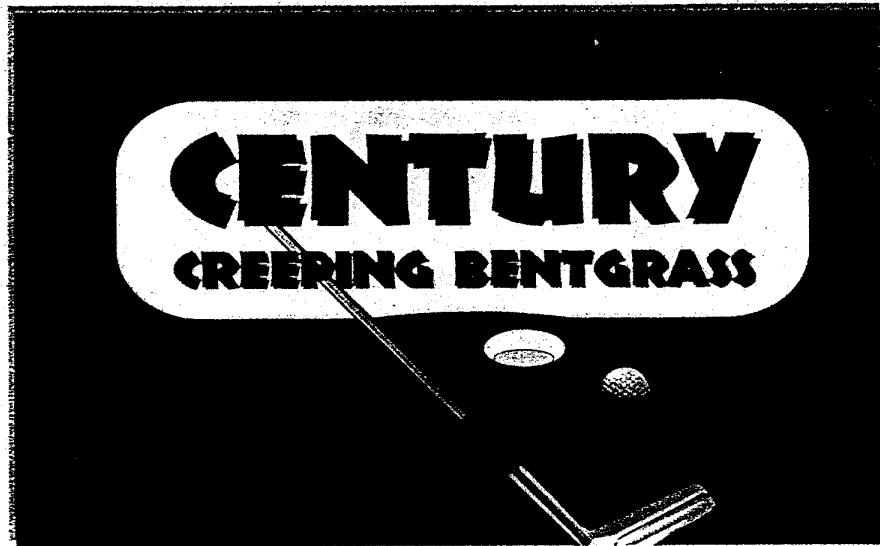
Table 7. Turf quality¹ ratings during 1997 on a sand-modified bentgrass trial at TAES-Dallas with Betasan and Tupersan treatment effects.

Treatment	15Apr	8May	15May	22May	29May	5Jun	12Jun	19Jun	27Jun	8Jul	1Aug	21Aug	5Sep	19Sep	26Sep	TPI ²
Control	6.98a	6.26a	6.6	6.52a	6.67a	6.77a	6.89a	6.77a	6.83	6.81a	6.69a	5.73	6.27	6.33	6.7	12
Betasan 1	5.9	5.7	6.61	6.4	6.58	6.39	6.86a	6.85a	6.77	6.64	6.60a	5.8	6.1	6.24	6.64	6
Betasan 2	5.73	5.63	6.66	6.4	6.68a	6.53	6.85a	6.64	6.84a	6.75a	6.59	5.93	6.24	6.42	6.82	7
Tupersan 1	5.79	5.69	6.72	6.62a	6.58	6.42	6.74	6.68	6.83	6.71a	6.65a	5.84	6.13	6.38	6.71	6
Tupersan 2	5.77	5.69	6.65	6.55a	6.75a	6.54	6.78	6.71	6.92a	6.79a	6.73a	5.83	6.28	6.49	6.69	8
LSD ³	0.23	0.17	ns	0.18	0.16	0.18	0.10	0.14	0.09	0.13	0.14	ns	ns	0.19	0.13	15

¹Turf quality ratings were based on 1-9 scale, where 9 is the best and 5 is the minimum acceptable turf quality.²TPI is the turf performance index which is the number of times an entry was rated in the top statistical group (does not include overall mean).³LSD is the least significant difference between means based on Fisher's mean separation ($p \leq 0.05$).'a' indicates in the highest statistical group. 'ns' indicates means were not significant based on ANOVA *F*-test.**Table 8. Turf quality¹ ratings during 1997 on a sand-modified bentgrass trial at TAES-Dallas with Betasan and Tupersan treatments.**

Entry	15Apr	8May	15May	22May	29May	5Jun	12Jun	19Jun	27Jun	8Jul	1Aug	21Aug	5Sep	19Sep	26Sep
BR1518	6.27a	5.97a	6.63a	6.33	6.7a	6.33	6.67	6.6	6.83	6.83a	6.53	5.57	6.13	6.50a	6.80a
Carmen	6.33a	5.53	6.67a	6.4a	6.5a	6.53a	6.7	6.67	6.77	6.63	6.57a	5.57	5.97	6.30a	6.73a
MSCB-6	6.07a	5.77a	6.7a	6.47a	6.57a	6.8a	6.77a	6.87a	6.87	6.6	6.57a	4.87	6.2a	6.33a	6.80a
SR1020	6.47a	5.87a	6.67a	6.47a	6.67a	6.67a	6.8a	6.77a	6.77	6.7a	6.57a	5.1	5.73	5.83	6.53
Providence	6.33a	5.8a	6.53	6.47a	6.6a	6.6a	6.83a	6.7a	6.8	6.63	6.7a	5.4	6	6.03	6.5
Penncross	6.2a	5.57	6.63a	6.67a	6.73a	6.47	6.87a	6.9a	6.87	6.73a	6.7a	5.83a	6.47a	6.40a	6.83a
Pennlinks	6.2a	6.07a	6.93a	6.6a	6.63a	6.8a	6.93a	6.9a	6.8	6.67a	6.67a	6.23a	6.57a	6.1	6.70a
UM8401	5.93	5.73a	6.5	6.27	6.7a	6.53a	6.8a	6.63	6.9	6.77a	6.67a	5.83a	6.33a	6.53a	6.93a
Normarc	5.87	5.7	6.47	6.67a	6.8a	6.8a	6.87a	6.77a	6.93	6.9a	6.63a	6.00a	6.2a	6.63a	6.67
Forbes8912	6.4a	6.0a	6.7a	6.73a	6.77a	6.63a	6.83a	6.57	6.87	6.8a	6.7a	5.9a	6.23a	6.40a	6.53
Cato	5.8	5.83a	6.53	6.67a	6.6a	6.47	6.77a	6.73a	6.87	6.77a	6.83a	6.1a	6.1	6.43a	6.87a
MSCB-8	5.8	5.67	6.67a	6.4a	6.57a	6.47	6.9a	6.7a	6.77	6.73a	6.57a	6.17a	6.3a	6.53a	6.77a
Putter	5.93	5.67	6.63a	6.4a	6.73a	6.47	6.83a	6.8a	6.83	6.7a	6.73a	5.83a	6.03	6.30a	6.57
Crenshaw	5.8	5.97a	6.63a	6.33	6.63a	6.5	6.93a	6.97a	6.8	6.8a	6.83a	5.6	5.93	6.2	6.53
Mariner	5.8	5.53	6.63a	6.67a	6.8a	6.87a	6.83a	6.8a	6.87	6.7a	6.67a	6.07a	6.3a	6.47a	6.77a
Cobra	5.73	5.47	6.67a	6.67a	6.53a	6.33	6.87a	6.8a	6.83	6.87a	6.57a	5.53	6	6.30a	6.87a
88.CBL	5.87	5.93a	6.93a	6.67a	6.7a	6.33	6.87a	6.8a	6.8	6.67a	6.73a	6.2a	6.33a	6.53a	6.77a
88.CBE	6.07a	5.93a	6.53	6.47a	6.73a	6.4	6.8a	6.6	6.9	6.9a	6.63a	6.3a	6.27a	6.67a	6.73a
National	5.8	5.97a	6.6	6.4a	6.67a	6.4	6.87a	6.67	6.8	6.6	6.63a	5.93a	6.47a	6.40a	6.63
WVP89D	6	5.9a	6.63a	6.2	6.4	6.4	6.77a	6.4	6.83	6.77a	6.57a	6.4a	6.53a	6.37a	6.70a
LSD ²	0.45	0.35	0.32	0.35	0.31	0.3646	0.1948	0.2724	ns	0.2585	0.2709	0.6757	0.404	0.3752	0.2591

¹Turf quality ratings were based on 1-9 scale, where 9 is the best and 5 is the minimum acceptable turf quality.²LSD is the least significant difference between means based on Fisher's mean separation ($p \leq 0.05$).'a' indicates in the highest statistical group. 'ns' indicates means were not significant based on ANOVA *F*-test.



**A high quality heat tolerant creeping
bentgrass**

**DEVELOPED BY
TEXAS A&M UNIVERSITY
IN COOPERATION WITH
THE UNITED STATES GOLF
ASSOCIATION
AND
BENTGRASS RESEARCH, INC
1997**

PLANT MATERIALS RELEASE PROPOSAL

Petition to Release

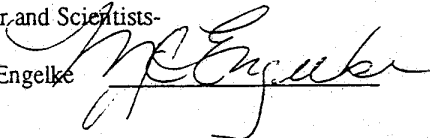
Date 1 May 1997

- 1 CROP Creeping Bentgrass Type of Release: Varietal
- 2 Proposed name or identification: CENTURY
- 3 Designation or name in development stages: Syn92-1 or Syn92-1-93
- 4 Primary features or advantages: 'Century' (tested as Syn92-1) creeping bentgrass is a six clone synthetic, selected for its genetic uniformity, fine leaf texture and dark leaf color. Individual clones were screened for heat tolerance, disease response, root growth characters under artificial high soil temperatures, turf texture, quality performance and persistence under routine golf management practices. Data supports superior summer performance compared to 'Penncross' creeping bentgrasses. Century is noted for its superior leaf texture and genetic color in combination with broad-based adaptability to a variety of environmental conditions.
- 5 Plant Variety Protection - suggested action: Certification required, process for Plant Variety Protection. PVPA data to be submitted in 1997.
- 6 Seed -- amount available and date: Approximately 50 pounds of Breeder Class seed and 500 pounds of foundation Class seed were available as of 20 July 1995. A 30-acre experimental seed stock-production field was established in the fall of 1995. First harvest 1996, est. Total yield 20,000 pounds.
- 7 Provisions to maintain breeder seed: Breeder seed has been placed in long-term cold storage in Tangent Oregon. A Foundation class seed increase field was established in 1995 to generate sufficient seed stock increase for future perpetuation. Maternal clones are maintained vegetatively at TAES-Dallas. If necessary to produce more breeder class seed, vegetative plantings from the original clones may be re-established in Oregon to produce seed. Experimental certification status was established in 1996.
- 8 Proposed seed distribution: Recommend this variety be licensed to E.F. Burlingham & Sons Forest Grove, Oregon under their option agreement for marketing, production, and distribution. First harvest was made in August 1996.
- 9 Suggested Fees (for Breeder or Genetic Stock): \$5,000 + for a License w/6% royalty
- 10 Supportive documents attached: Release proposal XXXX
- 11 Release Proposal - prepared with or reviewed by: Drs. M. C. Engelke, P. F. Colbaugh, V. G. Lehman, and J. A. Reinert
- 12 Suggested Reviewers: In Texas and U.S. (Names and Locations):

Submitted by:

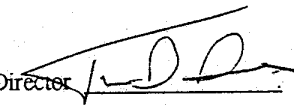
Breeder and Scientists-

M. C. Engelke



Unit Head

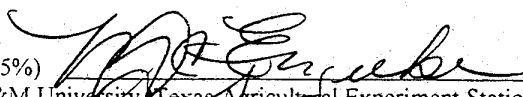
Tim Davis, Ph. D. Resident Director

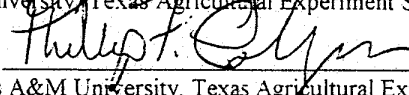


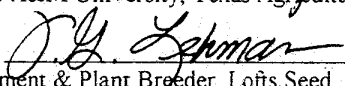
CREATIVE DEVELOPMENT:

Century has been under development for several years and numerous individuals have had the opportunity to provide *value added* to the knowledge base and understanding of this grass. As such, we have identified the primary individuals whom we believe have significantly contributed to the development of this grass. Each individual listed made a significant contribution to the development of this variety.

Authorship and % Contribution by each

M. C. Engelke (45%) 
Professor, Texas A&M University, Texas Agricultural Experiment Station-Dallas

P. F. Colbaugh (15%) 
Associate Professor, Texas A&M University, Texas Agricultural Experiment Station-Dallas

V. G. Lehman (35%) 
Director, Product Development & Plant Breeder, Loftis Seed, Inc., Albany, OR

DEVELOPMENTAL FUND: 5%

It is also the desire of the authors, as agreed to by their signature above that a portion of the royalty income assigned to the Inventors (authors) be designated for a specific developmental fund.

CENTURY CREEPING BENTGRASS

Century creeping bentgrass has high quality, fine leaf texture, and good genetic color. It is a six clone synthetic variety developed and tested as Syn92-1 by the Texas Agricultural Experiment Station, Texas A&M University System, Dallas, TX under grants from the United States Golf Association and Bentgrass Research, Inc. Century is intended for use as high quality-putting surfaces in areas where bentgrasses are presently used. Briefly, its merits and limitations are as follows:

MERITS

Fine leaf texture

Broadened genetic base incorporating germplasm from Europe

High quality and persistence in NTEP trials in 26 locations in the US

Documented summer and winter performance

Excellent genetic color

Resistance to Fusarium Patch

LIMITATIONS

Moderate susceptibility to Sclerotinia Dollar Spot

RELEASE PROPOSAL
CENTURY CREEPING BENTGRASS¹

M. C. Engelke, P. F. Colbaugh, and V. G. Lehman²

'Century' creeping bentgrass (*Agrostis stoloniferous* subsp. *palustris* Huds.) was developed by the Texas Agricultural Experiment Station and tested as Syn92-1. Century is an improved cool-season turfgrass suitable as a quality turf throughout the typical areas of adaptation of creeping bentgrass, and provides improved performance capabilities in the Southern Transition Zone. Century is noted for its superior leaf texture and genetic color in combination with broad-based adaptability to varying environmental conditions.

Breeding History

Century tested as Syn92-1 is a six-clone synthetic for which the parents were selected for uniformity in plant type and leaf color. Individual clones comprising this cultivar include TAES 2831, 3153, 3250, 3307, 3794, and 3799. Each of the parental clones trace back to a collection of approximately 1500 clones of creeping bentgrasses which have been under evaluation at Texas A&M University Research and Extension Center beginning in 1982. Specifically each of the clones traces to locations and dates of entry into the germplasm collection as noted in Table 1. Parental clones of Century originated from several sources to include field collections from Italy and France, Texas Golf courses. Second generation selections from breeder fields of CATO creeping bentgrass were also used as parental clones. Individual clones were screened for heat tolerance, disease response, root growth characters under ambient and artificial high soil temperatures, turf texture, quality performance, and persistence under routine golf management practices.

Parental clones were placed in a replicated isolation nursery in Linn County Oregon in 1991 and allowed to freely interpollinate. Seed from each of the maternal lines harvested in 1992 was germinated and an equal number from each parental line was transplanted to a 1000 plant nursery arranged in replicated progeny rows in Brooks, Oregon in the fall 1992. Prior to anthesis extensive information was collected on leaf characteristics and floral formation (Table 2). The nursery was rouged for off-type and undesirable plant types in the spring of 1993 prior to anthesis. The remaining plants were allowed to interpollinate to produce breeder seed. Sufficient seed was harvested in 1993 for entry into the Creeping Bentgrass National Turf Evaluation Trials. Minor rouging to eliminate non-flowering off-type plants was conducted during the spring/summer of 1994. Approximately 40 pounds of breeder seed were harvested in 1994 and used to establish foundation seed stock production.

1 Century was developed by the Texas Agricultural Experiment Station with partial funding from the United States Golf Association, Far Hills, NJ, and Bentgrass Research, Inc., Dallas, TX.

2 Professor - Turfgrass Breeding & Genetics and Associate Professor, Turfgrass Pathology, Texas A&M University Research and Extension Center, Dallas, TX and Director of Research, Lofts Seed Inc., Lebanon, OR

Agronomic description

The agronomic traits of Century (Table 2) are based on a population of 90 progeny evaluated for each of the indicated characters across 6 replications of the space plant field nursery.

Most of the parental lines were subjected to close mowing and general turf performance evaluation studies over a three year period (1989-1992), prior to selection for seed increase (Table 3). When compared to Pennncross, the parents and progeny of four of the lines were evaluated specifically for turf quality and heat tolerance, and in all cases they were similar or superior to Pennncross.

When compared to other experimental cultivars in the program, distinct differences are observed for each of the cultivars (Table 4). Century will be characterized as having a preponderance of straight leaf-types, with medium-fine texture and good genetic color. Of the cultivars compared in this trial, Century is the earliest flowering.

Agronomic Attributes and Turf Performance Record

Century was included in the 1992 National Turfgrass Evaluation Program Creeping Bentgrass trials along with 27 other entries. The trials were established at 26 locations throughout the region including TAES-Dallas where bentgrasses are adapted and routinely used for golf course putting greens and fairways.

Leaf texture ratings (Table 5, #5a and #5b) recorded at TAES-Dallas in 1996 and the 1994 and 1995 NTEP trials identified Century as being among those having the finest leaf texture (8.7, 7.7 and 7.7, respectively). Century also rated high for desirable genetic leaf color (Table 6).

Turfgrass quality is the ultimate measure of performance of a variety. When compared to 27 other varieties at several locations (26) across 20 States over a 2-year period (1994-1995), the adaptability and comparative performance of a variety is obtained (Tables 7a, #7b). Information is summarized in the form of a mean over all locations, the Performance Index (PI) over location and a relative rank in performance based on the PI. The ranks presented in both Tables 7a and 7b are based on a comparison with other varieties that are classified as moderate to low maintenance bentgrasses. The entries from Pennsylvania State University have been released only under the disclaimer that a significantly higher level of maintenance will be required for long term performance. One of the primary objectives of the turfgrass breeding program at Texas A&M University has been to significantly reduce maintenance, comparisons are restricted to such functionally lower maintenance-type varieties. The variety Century fits well within these development objectives.

The overall turfgrass quality rankings for Century was among the top five varieties comparing 24 varieties in the 1994 and 1995 NTEP trials. Century ranked 5.5 of 24 varieties in 1994 (Table 7a) and ranked 4th in 1995 (Table 7b). A comparison of the turf performance for physiological traits (Table 8) reveals that Century was the leader (ranked 1st) in performance for physiological characteristics at

the 26 NTEP locations. Specifically, the varieties were evaluated for establishment, vigor, scalping tendency, thatching, seasonal density, wear, and recovery from aerification.

Century does have moderate tolerance to Rhizoctonia brown patch and Pythium blight diseases. Century as expressed excellent resistance to Fusarium patch in two studies in Washington (Table 9) during 1996. The accumulative performance index for disease response was less than impressive especially for Dollar Spot (*Sclerotinia homeocarpa*) but improved over Crenshaw, SR1020 and 18th Green (Table 10).

When compared to all varieties in the national trial (1993 NTEP) over 2-years, Century was among the top 10 varieties in overall performance evaluations. When compared to those grasses requiring moderate to minimal maintenance for putting greens, Century ranked 6th across 26 locations in 20 states over a 2 year time period (Table 11).

Maintenance and Production of Breeder seed and seed stock classes

Breeder seed was produced by Texas A&M University from plants remaining from an original 1000 plant spaced nursery in Brooks, Oregon. Breeder seed is stored under controlled refrigeration conditions, with adequate quantities stored to maintain and regenerate the variety.

Century is limited to one generation each of foundation, registered, and certified.

Specifically, E. F. Burlingham & Sons, Forest Grove, Oregon received an option agreement on Century effective September 1994 for advanced testing and evaluation of these varieties. Limited acreage was planted in the fall of 1994 permitting evaluation of seed production potential as well as providing enough seed to expand the field testing throughout a broader region of the country.

Anticipated date of first sale: Spring 1997

Will application for PVP occur? Yes, submission will occur following approval of release.

Table 1. Parental resources comprising Century Creeping Bentgrass including origin and date of entry into the Texas A&M University germplasm nursery.

Parental Accession	Date of Entry	Origin
2831	7/16/84	Brookhollow C.C.
3153	4/10/86	Rome Acquisanta G.C. Italy.
3250	4/10/86	Nimes Campagne G.C. France.
3307	4/10/86	Mediterranean area
3794	10/8/90	Cato Creeping Bentgrass
3799	10/8/90	Cato Creeping Bentgrass

Table 2. Agronomic traits measured on progeny populations of Century a six clone synthetic - June 1993, Brooks, OR.

Parents	#OBS	Leaf type ¹	Leaf texture ²	Leaf color ³	Floral maturity
2831	90	2.4	3.7	5.9	4.0
3153	90	5.2	4.0	6.5	2.3
3250	90	2.5	2.8	6.5	4.6
3307	90	4.0	4.0	6.0	3.6
3794	90	1.6	4.0	7.7	4.7
3799	90	1.5	4.3	7.1	5.1
Average		2.8	3.8	6.6	4.5

1 Type 1-9, where 1 = straight and 9 = curly

2 Texture 1-9, where 1 = coarse and 9 = very fine

3 Color 1-9, where 1 = yellow and 9 = dark green

4 Floral maturity 1-9, where 1 = no florescence present on June 19 and 9 = heavy seed head production.

Table 3. Turf quality ratings of parental lines and progeny performance trials for Century Creeping Bentgrass tested at Texas A&M University - Dallas

Parental Accession	Turf Quality		Heat Tolerance ¹		3 yr. Perform ² Index
	Parent	Progeny	Parent	Progeny	
2831	7.2a	7.0a	4.5a	4.5	68.2
3153	6.1	6.8	4.6a	4.7a	72.7
3250	6.8	6.8	4.8a	4.8a	54.5
3307	6.5	6.8	4.6a	4.8a	68.2
3794	
3799	
Penncross	6.6a		4.0		

¹Heat Bench studies provided relative heat tolerance rank 1 - 5, 5 = best.

²Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study.

Table 4. Agronomic comparisons among the 1992 breeder blocks in Brooks Oregon, June 1993.

Population #	Parents	Leaf type ¹	Leaf texture ²	Leaf color ³	Floral maturity ⁴
Century	6	2.8	3.8	6.6	4.5
Backspin	4	3.4	2.9	6.2	4.1
Syn92-3	4	4.2	4.9	6.1	2.6
Syn92-4	7	4.4	3.1	6.0	3.6
Imperial	7	3.6	3.1	.	3.1
Average		3.7	3.4	6.2	3.5

¹Leaf type rated 1-5, where 1 = straight leaf and 5 = curly leaf

²Leaf texture rated 1-5, where 5 = very fine texture.

³Leaf Color rated 1-9, where 9 = dark green.

⁴Floral maturity rated 1-5 where 5 = maximum seed head production.

Table 5. Leaf texture rating¹ during 1996 for the 1993 NTEP sand-modified bentgrass trial at TAES-Dallas.

Entry	15May	Entry	15May
18th Green	7.3	L-93	8.8a
A-1	8.5a	Lopez	7.5
A-4	8.7a	Mariner	8.2a
Backspin	8.3a	MSUEB	7.5
BAR As 493	7.7a	Penncross	8.3a
C&C	8.7a	Pennlinks	8.3a
Cato	8.5a	Pro/Cup	7.5
Century	8.7a	Providence	8.2a
Crenshaw	8.7a	Regent	8.2a
DG-P	8.3a	Seaside	8.5a
Dominant	8.0a	Southshore	8.8a
G-2	8.7a	SR1020	8.0a
G-6	8.7a	Tendez	8.3a
Imperial	7.2	Trueline	7.8a
ISI-Ap-89150	7.2	BAR Ws 42102	8.7a
MSD ²	1.3	MSD ²	1.3

¹ Texture rating was based on 1-9 scale, where 9 is the finest leaf texture.

² MSD is the minimum significant difference between means based on the Waller-Duncan k-ratio *t*-test (*k*-ratio=100). 'a' indicates entry was in the highest statistical group. 'ns' indicates means were not significantly different based on ANOVA *F*-test.

Table 5a. 1995 NTEP Leaf Texture ratings of bentgrass cultivars grown on a green – 1994¹.
Data by State. Leaf texture 1-9, 9 = very fine.

Variety	AZ	IL1	KY1	MN	MO	OK	PA	RI	SC	VA	WA1	Mean	PI ²
A-1	7.7	8.7	8.7	7.3	8.0	9.0	8.3	6.0	7.0	7.3	8.3	7.8	10
A-4	8.3	9.0	8.7	7.7	8.0	8.7	8.3	6.0	6.0	7.3	8.3	7.8	10
Century	8.3	9.0	7.7	7.7	8.0	7.7	8.0	7.0	5.3	8.0	8.0	7.7	9
G-6	7.3	8.7	8.7	7.3	8.0	9.0	7.7	6.3	5.7	7.3	8.0	7.6	9
Imperial	7.3	8.7	7.7	7.3	8.0	8.0	7.3	6.3	5.0	7.3	8.0	7.4	8
CATO	7.7	9.0	8.7	7.7	6.7	8.3	7.7	6.7	4.7	6.7	7.7	7.4	7
G-2	7.3	8.7	7.3	7.3	7.7	8.7	6.0	6.0	6.7	6.3	8.0	7.4	7
L-93	7.0	8.3	7.3	7.0	8.0	8.7	7.3	6.7	5.7	6.7	8.0	7.3	6
Crenshaw	7.7	8.3	7.3	7.0	8.0	7.3	7.7	6.3	5.7	6.7	8.0	7.3	6
Backspin	7.3	8.7	7.3	6.3	8.0	8.3	8.0	6.3	4.7	7.3	7.7	7.3	6
SR1020	7.0	8.3	7.3	6.7	8.0	8.0	7.0	7.0	5.3	6.7	8.0	7.2	5
Bar WS42102	7.3	8.7	7.3	7.3	7.7	8.7	7.3	6.0	4.3	6.3	8.0	7.2	7
Providence	6.3	8.3	7.7	6.7	8.0	8.3	7.7	6.7	4.0	6.7	8.0	7.1	7
Southshore	6.7	8.7	8.0	7.0	7.7	7.7	7.0	6.7	5.0	6.3	7.7	7.1	5
ISI-AP-89510	5.7	8.0	7.0	7.0	8.0	7.7	7.3	6.7	3.0	6.0	7.7	6.7	5
18 th Green	5.7	8.0	7.0	6.7	7.7	7.3	7.7	5.3	3.7	7.0	7.7	6.7	5
DG-P	6.0	8.0	7.0	7.0	8.0	8.0	6.0	6.0	4.0	6.0	7.7	6.7	4
Pennlinks	5.7	8.0	7.7	7.0	8.0	7.3	5.0	6.3	4.7	5.7	8.0	6.7	5
MSUEB	5.3	8.0	7.0	6.3	8.0	7.7	3.0	5.3	5.0	5.3	7.7	6.5	3
Regent	6.0	8.0	7.0	6.3	8.0	7.3	4.3	7.0	4.3	5.0	7.3	6.4	3
Pro/Cup	5.3	8.0	7.0	6.3	8.0	7.3	4.0	7.0	3.3	5.3	8.0	6.3	3
Lopez	5.3	8.0	7.7	7.1	8.0	7.0	3.3	5.7	4.0	5.7	8.0	6.3	5
Mariner	5.7	8.0	6.0	6.0	7.7	7.7	5.0	5.7	5.0	5.7	7.3	6.3	3
Penncross	5.3	7.7	7.0	6.3	8.0	7.0	3.3	6.0	3.3	5.0	7.7	6.1	3
Trueline	5.0	8.0	6.7	6.7	7.7	7.3	2.7	5.7	3.7	4.7	8.0	6.0	4
Tendez	4.0	8.7	3.7	6.7	7.3	6.7	6.0	6.0	3.0	6.0	7.0	5.9	5
BAR AS 492	4.0	8.7	3.3	6.7	8.0	6.3	3.0	6.3	2.7	5.7	7.0	5.6	5
Seaside	4.0	7.3	4.3	6.7	7.3	6.0	1.3	7.0	2.7	4.0	7.0	5.2	4
LSD value ³	0.8	0.7	1.1	1.0	0.7	0.9	1.1	1.9	1.2	0.9	1.7	0.9	

¹ Published in NTEP 95-1, Table 6

² Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study

³ To determine statistical difference among entries, subtract one entry's mean from another entry's mean. Statistical differences occur when this value is larger than the corresponding LSD value (LSD 0.05). Leaf Texture ratings 1-9, 9= very fine.

Table 5b. 1996 NTEP Leaf Texture ratings of bentgrass cultivars grown on a green – 1995
Data by State. Leaf texture 1-9, 9 = very fine.

Variety	AZ	IA	IL1	IL2	KS	KY1	KY2	MI	MN	MO	MS	NJ	OK	QE	RI	SC	TX	VA	WA1	WA3	WA4	Mean	PI ²
Century	8.0	7.7	9.0	7.7	9.0	8.3	9.0	5.0	6.0	7.7	6.3	7.3	9.0	7.7	7.7	5.7	8.7	6.7	8.3	8.3	8.0	7.7	20
G-2	8.0	8.3	9.0	6.3	7.3	8.3	9.0	6.0	6.7	8.3	6.0	8.7	9.0	7.3	7.0	7.0	8.7	6.7	8.0	8.3	8.0	7.7	19
A-1	7.7	7.0	9.0	7.3	8.3	8.7	8.7	6.0	7.3	8.0	6.0	8.7	9.0	6.3	7.0	7.7	9.0	7.3	8.0	8.3	5.7	7.7	19
A-4	8.7	7.0	9.0	6.0	9.0	9.0	9.0	5.3	7.0	7.0	6.0	8.0	9.0	7.3	7.3	6.3	8.7	7.0	8.7	8.0	7.0	7.6	19
G-6	7.3	7.0	8.7	5.3	8.7	8.7	9.0	5.7	6.7	8.0	6.0	7.7	9.0	7.7	7.3	6.7	9.0	7.0	8.3	7.7	8.0	7.6	19
Bar WS42102	7.7	8.0	9.0	8.0	8.3	8.7	9.0	5.3	7.0	7.7	5.3	7.0	8.3	6.7	7.0	4.0	8.7	6.0	8.3	8.0	7.7	7.4	18
L-93	7.7	7.0	9.0	7.0	8.7	8.3	8.7	5.3	5.7	7.7	6.0	7.7	8.7	7.0	6.0	5.7	9.0	6.7	8.0	8.0	8.0	7.4	17
Backspin	7.0	7.3	9.0	8.3	8.0	7.3	9.0	5.3	6.0	7.7	5.3	6.7	8.3	6.7	7.0	5.3	8.7	5.7	8.0	7.7	7.0	7.2	16
Crenshaw	7.0	8.0	9.0	6.3	8.3	8.7	9.0	5.0	6.0	8.0	6.0	5.0	7.0	5.7	5.7	6.3	9.0	5.3	8.0	7.3	6.7	7.0	15
CATO	7.3	7.7	9.0	8.3	8.7	9.0	9.0	6.0	6.3	8.3	5.7	7.3	8.0	7.3	6.3	5.7	8.3	6.3	6.0	6.7	7.0	7.4	14
Imperial	7.3	7.3	8.7	7.0	8.0	8.3	9.0	5.0	5.7	7.7	6.0	7.3	8.3	7.3	6.7	5.3	7.0	6.0	8.3	7.3	8.0	7.2	14
Southshore	7.0	7.0	8.3	7.7	8.0	7.3	9.0	5.7	5.0	8.0	6.3	6.7	7.7	7.0	7.0	6.0	9.0	5.3	7.7	8.3	7.7	7.2	13
Providence	7.0	7.0	8.7	7.3	7.3	7.7	9.1	5.3	5.3	7.7	6.0	5.7	8.0	6.0	6.0	4.7	8.0	5.3	7.3	7.0	6.7	6.8	11
ISI-AP-89510	6.0	8.3	8.0	6.3	6.7	8.7	8.7	5.7	5.3	7.0	5.7	5.7	7.0	8.0	5.7	3.3	7.0	5.0	7.7	5.3	7.0	6.6	9
SR1020	7.3	8.0	9.0	6.7	8.0	7.7	8.3	5.3	5.3	7.3	5.3	6.0	8.0	6.0	6.0	6.3	7.7	5.3	8.0	7.0	6.7	6.9	8
DG-P	6.0	6.7	8.3	8.3	6.3	8.0	7.7	5.0	4.7	8.3	5.7	5.7	6.7	5.7	5.3	4.0	8.3	5.3	8.0	5.7		6.5	8
18 th Green	5.7	7.0	8.7	4.7	7.3	8.0	8.0	4.3	4.0	7.3	5.7	4.0	7.0	6.7	5.7	3.7	7.3	6.3	7.3	6.3	6.3	6.3	8
Pennlinks	6.3	6.3	8.3	8.7	6.0	8.0	7.0	5.7	5.3	7.3	5.3	5.3	7.0	6.7	6.7	5.3	8.3	4.7	7.3	5.3	6.0	6.5	7
Regent	6.3	6.7	8.7	7.0	7.0	7.0	7.3	6.0	4.7	8.0	5.3	4.7	6.7	5.3	4.7	4.0	8.0	5.0	7.7	5.7	6.3	6.3	7
MSUEB	6.7	6.7	8.3	6.3	6.3	7.7	7.0	5.7	4.7	8.0	5.7	4.7	6.3	5.3	6.0	5.7	7.3	4.0	7.0	6.3	6.7	6.3	5
Trucline	6.0	7.0	8.0	5.7	7.0	6.7	7.0	5.7	5.3	8.3	5.3	3.7	6.7	6.0	5.3	3.7	7.7	4.0	7.0	6.0	5.3	6.1	5
Mariner	6.0	5.7	8.7	4.3	6.3	7.7	7.0	5.0	4.3	8.0	5.0	3.0	7.0	5.0	6.7	5.3	8.0	4.0	7.0	6.3	6.7	6.0	5
Tendez	4.3	4.3	7.7	6.3	5.0	7.0	7.0	3.3		7.7	5.3	2.7	5.0	6.0	4.3	2.3	8.3	4.0	8.3	5.7	5.7	5.5	5
Penncross	5.3	6.7	8.0	6.0	5.7	7.0	7.0	5.7	4.0	8.0	4.7	3.0	6.0	5.0	5.3	4.3	8.7	3.0	6.7	4.3	4.7	5.7	4
BAR AS 492	3.3	5.3	8.3	3.7	7.3	7.0	7.0	4.0	5.0	7.3	4.0	3.3	5.0	5.0	5.3	2.0	7.7	6.0	7.3	7.7	7.0	5.7	4
Lopez	6.3	6.0	8.0	4.0	6.3	7.3	7.7	6.0	5.0	8.0	5.3	4.7	7.0	5.3	5.3	4.0	7.3	4.3	6.7	5.7	5.3	6.0	3
Pro/cup	6.3	6.0	8.3	3.3	7.0	7.7	7.0	5.3	4.3	7.7	5.7	4.7	6.3	5.7	6.0	4.0	7.3	3.7	6.3	6.0	6.0	5.9	3
Seaside	4.0	4.3	7.0	1.3	5.7	5.0	6.0	5.0	4.3	7.0	5.0	1.7	4.7	4.3	4.3	2.3	8.7	2.7	6.0	3.3	3.0	4.6	2
LSD value ³	0.8	1.3	0.6	3.3	0.9	1.1	0.6	1.1	1.3	0.8	1.1	1.1	0.8	1.7	0.8	1.0	1.0	1.6	1.2	1.2	1.4	0.3	

¹ Published in NTEP 96-1, Table 6

² Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study

³ To determine statistical difference among entries, subtract one entry's mean from another entry's mean. Statistical differences occur when this value is larger than the corresponding LSD value (LSD 0.05). Leaf Texture ratings 1-9, 9= very fine.

028

Table 6. Spring color rating¹ during 1996 for the 1993 NTEP sand-modified bentgrass trial at TAES-Dallas.

Entry	14May	Entry	14May
18th Green	7.3	L-93	7.7
A-1	7.3	Lopez	7.3
A-4	7.7	Mariner	7.0
Backspin	7.0	MSUEB	7.3
BAR As 493	7.2	Penncross	7.3
C&C	7.7	Pennlinks	7.7
Cato	7.5	Pro/Cup	6.5
Century	8.0	Providence	7.7
Crenshaw	7.3	Regent	7.0
DG-P	7.5	Seaside	7.8
Dominant	7.5	Southshore	7.7
G-2	7.0	SR1020	7.7
G-6	7.3	Tendez	7.0
Imperial	7.7	Trueline	7.7
ISI-Ap-89150	7.5	Bar Ws 42102	7.2
MSD ²	ns	MSD ²	ns

¹ Color rating was based on 1-9 scale, where 9 is the darkest green plot and 5 is the minimum acceptable turf color.

² MSD is the minimum significant difference between means based on the Waller-Duncan *k*-ratio *t*-test (*k*-ratio=100). 'a' indicates entry was in the highest statistical group. 'ns' indicates means were not significant based on ANOVA *F*-test.

Table 7a. 1995 NTEP mean turfgrass quality ratings of bentgrass cultivars grown on a green at 26 locations in the United States. - 1994¹
Data by State.

Variety	AZ	GA	GA	IA	IL1	IL2	KS	KY	KY	MA	MI	MN	MO	MO	NH	NJ	OK	PA	RI	SC	TX	VA	WA	WA	WI	WI	Mean	PI ²	Rank ³
	1	2					1	2				1	2									1	3	1	2				
L-93	6.6	4.3	1.9	6.6	5.3	6.3	6.9	8.0	7.4	7.5	6.3	7.3	6.9	6.9	5.9	7.3	6.4	7.4	6.2	5.1	6.4	6.1	6.2	5.7	7.2	7.3	6.4	22	1
A-4	7.2	4.0	2.1	6.7	5.5	7.1	6.9	7.7	7.6	6.1	6.0	7.8	7.3	7.3	6.7	6.0	6.6	6.6	6.1	5.2	7.3	6.6	6.7	6.3	7.4	7.8	6.5	20	
A-1	6.1	3.9	2.2	6.1	5.3	5.7	6.0	8.1	7.4	7.3	5.2	4.7	6.6	7.2	5.2	7.2	6.3	7.3	5.8	5.6	6.7	6.1	6.5	6.2	7.6	7.4	6.3	19	
CATO	7.3	4.1	2.0	6.6	5.1	5.3	6.7	8.0	6.8	7.4	5.8	7.2	7.0	7.0	6.7	5.7	6.0	6.8	6.5	5.0	6.0	6.4	6.0	6.0	7.1	7.3	6.2	17	2
G-6	6.2	4.1	2.2	6.3	4.8	5.5	5.3	7.7	6.8	7.5	5.5	7.5	6.3	7.0	6.4	6.6	6.7	6.5	5.8	5.1	6.3	6.2	6.1	6.0	7.3	7.3	6.1	17	
Providence	6.2	4.2	2.4	6.5	5.9	6.5	6.9	7.4	7.5	7.3	5.8	6.9	7.6	7.5	7.1	6.2	5.9	6.8	6.0	4.3	7.1	6.0	6.4	5.8	7.3	7.2	6.3	16	3
Crenshaw	6.4	3.9	2.3	5.8	5.5	6.7	7.2	7.2	7.4	7.0	5.8	6.9	6.9	7.4	6.2	6.5	6.1	6.1	5.9	5.0	7.1	6.2	6.7	4.9	6.9	7.1	6.2	15	4
G-2	6.2	3.9	2.1	5.4	4.9	5.7	5.4	7.8	7.1	6.5	5.8	7.8	6.9	7.2	5.9	6.8	6.1	6.7	6.1	5.1	5.9	6.1	6.5	5.9	7.2	7.2	6.1	15	
Southshore	6.0	4.5	1.9	6.2	4.9	6.5	6.6	7.1	6.5	6.1	5.5	7.5	7.1	7.2	6.4	5.9	5.7	6.7	6.2	5.1	6.8	5.8	6.3	5.5	7.2	6.6	6.1	14	5.5
Century	6.1	3.9	2.2	5.8	5.1	6.5	7.0	7.1	7.3	6.6	5.2	7.4	7.1	7.3	5.3	5.8	5.9	6.1	5.9	4.4	6.2	6.1	6.1	6.2	7.0	6.8	6.0	14	5.5
Imperial	5.7	3.9	1.9	5.8	5.1	7.1	5.6	7.1	6.6	6.4	5.5	6.5	6.8	7.1	5.1	6.2	5.9	6.3	5.4	4.4	6.9	6.5	6.5	6.4	7.1	7.2	6.0	11	7.5
Backspin	5.7	4.4	2.3	5.3	4.5	7.3	6.5	6.7	7.2	6.0	5.3	7.3	6.9	7.1	5.8	6.0	5.5	5.7	5.7	4.4	6.5	6.3	5.9	5.7	6.8	8.6	5.9	11	7.5
Bar WS42102	2.9	3.9	1.7	5.3	4.6	5.5	6.5	7.4	7.2	5.7	5.3	7.4	6.8	7.0	5.9	4.8	5.5	6.8	5.6	3.9	6.0	5.9	6.4	5.5	7.1	7.3	5.8	10	9.5
ISI-AP-89510	5.0	3.9	1.7	5.5	4.8	5.0	5.9	7.3	6.1	6.6	5.2	7.2	7.2	7.2	5.6	5.3	5.3	6.3	5.2	4.0	6.5	5.5	6.5	5.7	7.1	6.5	5.7	10	9.5
SR1020	5.9	4.3	2.4	5.6	4.8	5.7	6.1	7.1	6.8	5.9	5.5	7.1	6.8	7.0	6.4	5.1	5.8	5.8	6.1	4.6	7.2	5.6	6.3	5.5	7.0	6.9	5.9	9	11
MSUEB	4.8	4.1	2.2	5.4	4.7	6.7	6.0	7.2	7.2	5.6	5.2	6.6	7.5	7.2	5.3	5.8	5.3	6.3	5.2	5.0	5.7	5.3	6.1	4.7	6.9	6.7	5.7	8	13.5
Pro/cup	5.0	4.1	1.7	4.8	4.5	5.1	6.6	7.3	7.2	5.7	4.8	6.7	6.6	7.1	6.0	5.8	5.3	5.5	5.6	3.6	6.5	5.5	6.1	5.3	6.8	6.6	5.6	8	13.5
Penncross	4.9	4.3	2.7	5.3	4.7	6.1	5.9	7.0	7.3	5.2	5.2	6.8	7.0	7.1	6.2	4.7	4.9	5.3	4.8	3.5	7.0	5.2	6.2	4.8	6.2	6.1	5.5	8	13.5
Trueline	4.8	3.8	2.2	5.2	4.3	4.0	6.4	7.3	6.9	5.5	4.3	7.0	7.4	7.1	6.3	5.9	5.1	5.4	5.6	3.7	6.1	5.4	6.0	4.8	7.1	6.6	5.5	8	13.5
Pennlinks	5.0	4.3	2.8	5.5	5.0	6.4	6.5	7.7	6.5	5.8	5.2	6.8	7.3	7.4	6.0	5.4	5.3	6.2	5.3	4.7	6.1	5.5	6.3	5.2	6.8	7.0	5.8	7	17.5
Regent	5.4	4.3	1.8	5.7	4.7	6.0	6.5	7.1	6.7	6.2	5.2	7.0	6.8	7.3	6.2	5.8	5.4	5.6	5.4	4.3	7.2	5.4	6.1	5.2	7.4	6.4	5.8	7	17.5
18 th Green	5.4	3.7	1.7	5.2	4.1	4.7	5.5	6.8	7.1	6.3	5.3	7.5	7.1	7.3	7.2	5.2	5.7	5.9	4.9	4.0	6.1	5.9	6.0	4.9	6.5	7.0	5.7	7	17.5
Lopez	4.8	3.9	3.2	5.5	4.3	6.3	5.9	7.7	6.0	6.1	5.2	6.8	7.2	7.1	5.6	5.8	5.1	5.6	5.2	3.4	6.4	5.4	6.1	4.8	6.8	6.7	5.6	7	17.5
DG-P	5.0	3.9	1.8	4.7	4.2	5.7	5.7	7.2	6.0	6.1	5.2	7.0	6.9	7.1	5.8	5.3	5.3	6.2	4.9	3.8	6.5	5.3	5.6	5.2	7.0	6.6	5.6	6	20
Mariner	4.8	4.6	5.0	4.3	4.8	5.1	5.9	7.1	6.7	4.9	4.7	6.8	6.7	7.1	5.0	5.3	5.3	4.5	4.8	3.8	6.5	5.3	6.0	4.5	6.6	6.3	5.4	5	21
Tendez	2.5	3.9	4.4	3.4	3.3	5.3	4.3	5.8	5.1	5.0	4.2	6.5	6.3	6.8	5.9	4.2	3.7	5.1	3.8	3.1	6.1	5.7	5.1	4.4	5.9	5.8	4.8	3	23
BAR AS 492	2.4	4.8	5.2	3.6	3.1	4.1	5.6	4.6	4.6	3.8	6.5	6.3	6.0	7.0	2.7	3.6	3.6	4.5	5.0	2.5	5.2	5.1	4.5	4.2	6.8	6.5	4.6	3	23
Seaside	3.7	4.3	3.3	3.5	3.9	3.9	4.9	6.3	5.8	3.8	4.0	6.4	6.0	7.0	3.6	3.0	4.0	3.3	4.8	2.8	6.3	3.8	5.1	3.1	5.6	5.6	4.5	3	23
LSD value ⁴	0.7	0.7	0.7	0.9	0.6	1.8	1.4	0.5	0.6	0.9	0.8	0.8	0.7	0.6	0.4	0.6	0.4	0.7	0.9	0.8	1.2	0.5	0.6	0.4	0.5	0.5	0.2		

Published in NTEP 95-6, Table 1

¹Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study

²Does not include the high maintenance turfgrass varieties recently released from Penn State University.

³To determine statistical difference among entries, subtract one entry's mean from another entry's mean. Statistical differences occur when this value is larger than the corresponding LSD value (LSD 0.05). Leaf Texture ratings 1-9, 9= very fine.

Table 7b. 1996 NTEP mean turfgrass quality ratings of bentgrass cultivars grown on a green at 26 locations in the United States. - 1995¹
Data by State.

Variety	AZ	GA 1	GA 2	IA	IL1	IL2	KS	KY 1	KY 2	MA	MI	MN	MO 1	MS	NJ	OK	PA	QE	RI	SC	TX	VA 1	WA 1	WA 3	WAI 4	Mean	PI ²	Rank ³
L-93	7.2	4.4	1.2	5.8	5.4	6.8	7.1	8.3	7.7	6.1	6.2	5.7	7.5	6.0	7.4	7.0	7.8	7.5	6.8	5.2	7.2	6.5	7.2	5.9	5.6	6.4	22	1
A-1	6.8	4.1	1.0	5.3	5.1	5.7	6.5	7.3	7.3	5.8	5.6	6.3	7.6	5.0	7.0	7.2	7.6	7.2	6.1	6.8	6.9	6.0	6.8	5.7	5.8	6.1	19	
A-4	7.7	3.9	1.1	4.8	4.9	6.3	5.9	7.8	7.9	4.4	6.2	5.8	7.6	4.4	6.3	7.2	7.1	7.4	5.6	6.1	7.0	5.8	7.4	6.0	6.1	6.0	14	
G-2	6.5	4.1	1.2	6.7	5.3	5.7	5.7	7.4	7.7	5.7	6.1	6.2	6.8	4.9	6.7	7.0	7.3	7.1	6.9	5.8	6.6	5.4	6.9	5.7	5.6	6.0	14	
Providence	6.8	4.7	1.1	6.0	5.1	5.7	6.3	7.7	7.6	5.6	5.9	5.4	7.4	4.9	6.1	6.7	7.1	7.1	5.7	4.6	7.1	5.7	6.6	5.7	5.5	5.9	12	2
Cato	7.2	4.4	1.1	6.0	5.0	5.8	6.0	7.6	7.4	5.1	5.9	5.4	4.6	4.8	6.6	6.7	7.2	7.2	6.0	5.7	7.1	5.7	6.9	5.4	5.8	6.0	11	3
Century	7.0	4.0	1.2	5.5	5.3	5.7	4.3	7.1	7.5	5.2	5.6	5.1	6.3	4.7	4.8	6.3	5.8	7.2	6.3	4.8	6.8	4.6	6.7	5.6	5.9	5.6	10	4
G-6	5.9	4.2	1.0	5.4	4.8	5.6	5.9	7.6	7.3	5.1	5.8	5.9	7.0	4.9	6.3	7.4	7.1	7.3	5.9	5.6	6.8	6.0	6.9	5.6	5.3	5.9	10	
BAR WS 42102	5.4	3.5	4.4	5.8	5.0	4.6	5.5	7.6	7.4	5.4	5.8	5.6	7.0	5.0	5.3	6.0	6.6	7.1	6.3	3.3	6.6	5.0	7.0	4.8	5.0	5.5	9	6
Crenshaw	7.0	4.7	1.0	6.2	5.0	6.0	4.2	7.2	7.7	4.9	5.7	4.5	4.0	4.7	3.8	6.2	5.1	6.9	6.5	5.9	6.8	4.5	6.8	5.0	5.0	5.5	9	6
Imperial	6.3	4.0	1.0	5.9	5.0	7.0	4.7	7.0	7.6	5.0	5.7	4.8	7.0	4.8	5.3	6.0	5.8	7.3	6.0	4.8	7.0	5.2	6.1	5.5	6.0	5.6	9	6
Backspin	5.9	4.1	1.1	5.0	5.0	6.4	4.9	6.7	7.4	5.0	5.7	5.0	6.7	5.5	4.5	6.0	5.8	7.1	5.6	4.9	6.2	5.0	6.7	5.1	5.3	5.5	7	8.5
ISI-AP-89150	6.0	2.8	1.1	5.8	4.7	5.0	5.9	7.9	7.2	4.4	5.5	5.6	7.1	4.2	5.3	5.8	6.2	7.2	6.0	3.9	7.0	4.6	6.3	4.8	5.1	5.5	7	8.5
Southshore	6.4	4.5	1.0	5.2	5.4	5.9	6.0	7.3	7.3	4.7	5.7	5.0	6.8	4.8	5.6	6.7	6.8	7.3	6.2	5.7	7.2	5.2	6.7	5.4	5.3	5.8	7	8.5
SR1020	6.8	4.1	1.1	6.1	5.0	4.5	4.5	7.2	7.4	5.0	5.8	5.2	6.9	4.7	4.7	6.3	5.8	6.6	5.7	5.0	6.8	4.6	6.7	5.2	5.6	5.5	7	8.5
Pennlinks	5.8	4.3	1.1	5.2	5.1	6.2	6.2	7.7	6.8	5.3	5.8	4.9	7.3	4.5	5.6	5.7	6.4	6.9	5.7	5.1	6.7	5.1	5.9	4.7	4.8	5.6	6	12
DG-P	5.6	4.2	1.1	5.3	5.0	6.8	5.6	7.3	7.0	5.3	5.5	4.6	7.4	4.8	5.0	6.0	6.2	6.9	5.1	3.5	6.9	4.9	6.4	5.4		5.5	5	14
Lopez	5.5	4.0	3.8	5.2	5.2	5.2	5.2	7.6	7.0	4.9	5.7	4.7	7.6	4.8	4.7	5.8	5.4	6.2	5.9	2.9	6.9	4.5	6.0	4.6	4.4	5.4	5	14
MSUEB	6.0	4.3	1.1	5.3	4.8	6.6	6.1	7.0	6.9	4.9	5.7	4.7	7.6	4.8	4.7	5.8	5.4	6.2	5.9	2.9	6.9	4.5	6.0	4.6	4.4	5.4	5	14
18 th Green	6.0	3.4	1.0	5.9	4.1	4.7	4.1	6.8	7.7	4.7	5.5	4.1	7.0	4.2	3.6	5.8	4.8	7.0	5.4	3.3	6.8	4.7	6.1	4.4	4.5	5.0	4	17
Mariner	5.6	4.5	1.0	4.9	4.9	5.5	5.1	7.2	7.5	4.9	5.4	4.4	6.5	4.3	3.7	5.3	4.8	6.1	5.4	4.8	6.9	4.2	5.6	4.8	4.7	5.1	4	17
Penncross	5.3	4.1	1.3	5.4	4.8	6.3	6.0	7.1	6.8	4.8	5.6	4.3	7.3	4.8	3.6	5.3	5.1	6.3	4.0	3.8	6.7	4.4	5.7	4.1	4.8	5.1	4	17
Pro/cup	5.7	4.2	1.0	5.4	5.0	4.8	5.7	7.0	7.0	4.8	5.4	4.6	6.9	5.1	4.8	5.8	5.3	6.5	5.7	3.6	6.8	4.6	6.2	4.6	4.5	5.2	3	19.5
Regent	6.1	4.6	1.3	5.3	4.5	5.3	5.8	7.0	7.0	4.8	5.7	4.6	6.7	4.7	5.0	5.6	5.7	6.4	5.2	4.1	7.3	4.6	6.2	4.7	4.6	5.3	3	19.5
BAR AS 492	3.2	5.9	5.4	4.1	3.5	4.5	5.8	3.4	4.7	3.7	4.2	4.2	5.7	3.8	3.0	2.8	3.1	6.0	3.2	3.4	6.5	4.1	5.0	4.1	3.3	4.3	2	22
Tendez	3.7	4.9	4.2	3.7	3.0	5.1	5.1	4.8	4.6	4.1	4.4		5.5	4.3	2.6	2.6	4.0	3.0	2.1	1.5	7.0	3.7	4.8	3.6	3.6	4.1	2	22
Trueline	5.5	4.3	2.8	5.2	5.0	3.8	5.4	7.3	6.9	4.4	5.4	4.9	7.0	4.7	4.4	5.7	5.4	6.8	5.5	3.3	6.7	5.0	5.9	4.6	4.1	5.2	2	22
Seaside	4.2	4.9	2.5	3.8	3.4	2.5	5.1	5.7	4.8	3.6	4.3	3.9	5.0	4.2	2.0	3.6	3.5	5.0	4.0	2.5	7.0	3.3	4.3	3.6	2.8	4.0	1	24
LSD value ⁴	0.6	0.7	0.3	1.0	0.7	1.9	0.6	0.5	0.5	0.5	0.6	0.9	0.5	1.0	0.5	0.5	0.5	0.7	0.8	0.6	0.6	0.6	0.7	0.5	0.6	0.1		

¹Published in NTEP 96-1, Table 1

²Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study

³Does not include the high maintenance turfgrass varieties recently released from Penn State University.

⁴To determine statistical difference among entries, subtract one entry's mean from another entry's mean. Statistical differences occur when this value is larger than the corresponding LSD value (LSD 0.05). Leaf Texture ratings 1-9, 9= very fine.

Table 8. Turfgrass performance index (PI)¹ or physiological characteristics of the NTEP Trials at 26 locations. Data collected 1994 and 1995. Observations include establishment, vigor, scalping, thatching, season density, wear and recover from aerification (Total # observations)

	PI 94 (51)	% of Max94	PI Rank94	PI 95 (51)	% of Max95	PI Rank95	Cumm. PI (102)	% of Max	Cumm. Rank (28)	Rank Moderate ² Maintenance (24)
A-4	37	72.55	1	39	76.47	2	76	74.51	1	
G-2	27	52.94	10	41	80.39	1	68	66.67	2	
A-1	29	56.86	5.5	36	70.59	3	65	63.73	3	
Century	29	56.86	5.5	34	66.67	4	63	61.76	4	1
L-93	27	52.94	10	33	64.71	5.5	60	58.82	5	2
BarWs42102	27	52.94	10	32	62.75	7	59	57.84	6.5	3
G-6	26	50.98	13	33	64.71	5.5	59	57.84	6.5	
Cato	27	52.94	10	29	56.86	8	56	54.90	8.5	4.5
Crenshaw	34	66.67	2	22	43.14	11	56	54.90	8.5	4.5
Providence	33	64.71	3	17	33.33	13.5	50	49.02	10.5	6.5
Southshore	30	58.82	4	20	39.22	12	50	49.02	10.5	6.5
Imperial	21	41.18	22	28	54.90	9	49	48.04	12	8
Backspin	23	45.10	18.5	23	45.10	10	46	45.10	13	9
SR1020	28	54.90	7	17	33.33	13.5	45	44.12	14	10
Pennlinks	27	52.94	10	10	19.61	16	37	36.27	15	11
ISIAp89150	23	45.10	18.5	12	23.53	15	35	34.31	16	12
Mariner	24	47.06	16	9	17.65	19.5	33	32.35	17.5	13.5
Trueline	25	49.02	14.5	8	15.69	23.5	33	32.35	17.5	13.5
Penncross	25	49.02	14.5	7	13.73	26	32	31.37	19	15
18th Green	22	43.14	21	8	15.69	23.5	30	29.41	20.5	16.5
Regent	23	45.10	18.5	7	13.73	26	30	29.41	20.5	16.5
MSUEB	20	39.22	23	9	17.65	19.5	29	28.43	22.5	18.5
Seaside	23	45.10	18.5	6	11.76	28	29	28.43	22.5	18.5
Lopez	18	35.29	25	9	17.65	19.5	27	26.47	24	20
Pro/Cup	19	37.25	24	7	13.73	26	26	25.49	25	21
Tendez	14	27.45	26	8	16.00	22	22	21.78	26	22
DG-P	12	23.53	27	9	17.65	19.5	21	20.59	27	23
BarAs492	9	17.65	28	9	18.00	17	18	17.82	28	24

¹Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study

²Does not include the high maintenance turfgrass varieties recently released from Penn State University.

Table 9. Fusarium patch rating of bentgrass cultivars grown on a sand based green.
Ratings 1 - 9, 9 = no disease

Cultivar	WA1	WA2	Mean
Century	8.3	8.3	8.3
Providence	8.3	8.3	8.3
A-1	8.7	7.3	8.0
Tendez	8.7	7.3	8.0
BAR Ws 42102	8.0	7.7	7.8
A-4	8.0	8.3	7.7
L-93	8.7	6.7	7.7
Regent	8.0	7.3	7.7
Southshore	8.0	7.3	7.7
BAR As 492	8.0	7.0	7.5
Cato	7.7	7.3	7.5
Imperial	7.3	7.7	7.5
Lopez	7.7	7.3	7.5
SR 1020	7.7	7.3	7.5
Backspin	8.0	6.7	7.3
18 th Green	7.3	7.3	7.3
ISI-AP-89150	6.7	7.7	7.2
Pro/Cup	7.7	6.7	7.2
Crenshaw	8.0	6.3	7.2
DG-P	8.0	6.0	7.0
G-6	6.3	7.7	7.0
Penncross	7.7	6.3	7.0
Pennlinks	7.0	7.0	7.0
Trueline	8.0	6.0	7.0
MSUEB	7.7	6.0	6.8
G-2	6.3	7.3	6.8
Seaside	7.0	6.0	6.5
Mariner	6.0	6.7	6.3
LSD (0.05)	1.6	1.1	1.0

Published in NTEP 96-1 Table 28, page 35.

Table 10. Turfgrass performance index (PI) for disease assessment of the National Turf Evaluation Trials at 26 locations on observations made during 1994 and 1995. Observations targeted primarily dollar spot but also included observations on patch and Pythium diseases.

	PI 94 (13)	% of Max94	PI Rank94	PI 95 (27)	% of Max95	PI Rank95	Cumm. PI (40)	% of Max	Cumm. Rank
L-93	12	92.31	1	24	88.89	1	36	90	1
Providence	11	84.62	2	23	85.19	2.5	34	85	2
Cato	10	76.92	4.5	23	85.19	2.5	33	82.5	3
Penncross	9	69.23	9.5	21	77.78	4	30	75	4
Pennlinks	10	76.92	4.5	18	66.67	10	28	70	5.5
Seaside	8	61.54	16	20	74.07	6	28	70	5.5
A-1	9	69.23	9.5	18	66.67	10	27	67.5	9
A-4	8	61.54	16	19	70.37	8	27	67.5	9
Lopez	7	53.85	22	20	74.07	6	27	67.5	9
Regent	10	76.92	4.5	17	62.96	14	27	67.5	9
Trueline	10	76.92	4.5	17	62.96	14	27	67.5	9
BarWs42102	6	46.15	26.5	20	74.07	6	26	65	13.5
MSUEB	9	69.23	9.5	17	62.96	14	26	65	13.5
Pro/Cup	8	61.54	16	18	66.67	10	26	65	13.5
Southshore	9	69.23	9.5	17	62.96	14	26	65	13.5
DG-P	8	61.54	16	17	62.96	14	25	62.5	17
G-6	9	69.23	9.5	16	59.26	19.5	25	62.5	17
ISIAp89150	9	69.23	9.5	16	59.26	19.5	25	62.5	17
BarAs492	8	61.54	16	16	59.26	19.5	24	60	19
18th Green	7	53.85	22	16	59.26	19.5	23	57.5	20.5
SR1020	8	61.54	16	15	55.56	22	23	57.5	20.5
Century	6	46.15	26.5	16	59.26	19.5	22	55	22.5
G-2	8	61.54	16	14	51.85	23.5	22	55	22.5
Tendez	7	53.85	22	14	51.85	23.5	21	52.5	24
Backspin	7	53.85	22	13	48.15	25	20	50	25
Crenshaw	6	46.15	26.5	12	44.44	26.5	18	45	26.5
Imperial	6	46.15	26.5	12	44.44	26.5	18	45	26.5
Mariner	7	53.85	22	10	37.04	28	17	42.5	28

¹Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study

034

Table 11. Turfgrass performance index (PI)¹ for all character observations of the National Turf Evaluation Trials at 26 locations during the two year period including 1994 and 1995. (Total # observations)

	PI 94 (144)	% of Max94	PI Rank94	PI 95 (172)	% of Max95	PI Rank95	Cumm. PI (316)	% of Max	Cumm. Rank (28)	Rank ² Moderate Maintenance (24)
L-93	101	70.14	2	126	73.26	1	227	71.84	1	1
A-4	104	72.22	1	112	65.12	2	216	68.35	2	
Cato	96	66.67	4	105	61.05	4	201	63.61	3	2
A-1	86	59.72	6.5	108	62.79	3	194	61.39	4	
Providence	100	69.44	3	93	54.07	6	193	61.08	5	3
G-2	82	56.94	8.5	102	59.30	5	184	58.23	6	
G-6	82	56.94	8.5	91	52.91	7	173	54.75	7	
Crenshaw	90	62.50	5	74	43.02	12	164	51.90	8	4
Southshore	86	59.72	6.5	75	43.60	11	161	50.95	9	5
Century	76	52.78	10	83	48.26	8	159	50.32	10	6
BarWs42102	61	42.36	18.5	77	44.77	9	138	43.67	11	7
Imperial	61	42.36	18.5	76	44.19	10	137	43.35	12	8
ISIAp89150	66	45.83	14	67	38.95	13	133	42.09	13	9
SR1020	72	50.00	11	60	34.88	16	132	41.77	14	10
Backspin	63	43.75	17	63	36.63	14	126	39.87	15	11
18th Green	65	45.14	15	60	34.88	16	125	39.56	16.5	12.5
Pennlinks	68	47.22	12.5	57	33.14	19.5	125	39.56	16.5	12.5
MSUEB	60	41.67	20.5	60	34.88	16	120	37.97	18	14
Regent	68	47.22	12.5	51	29.65	23	119	37.66	19	15
Penncross	64	44.44	16	52	30.23	22	116	36.71	20	16
Trueline	60	41.67	20.5	53	30.81	21	113	35.76	21	17
Lopez	51	35.42	25.5	58	33.72	18	109	34.49	22	18
DG-P	51	35.42	25.5	57	33.14	19.5	108	34.18	23	19
Pro/Cup	54	37.50	22	49	28.49	24	103	32.59	24	20
Mariner	53	36.81	23	42	24.42	27	95	30.06	25	21
Seaside	52	36.11	24	38	22.09	28.5	90	28.48	26	22
BarAs492	35	24.31	28	47	27.33	26	82	25.95	27.5	23.5
Tendez	44	30.56	27	38	22.09	28.5	82	25.95	27.5	23.5

¹Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study

²Does not include the high maintenance turfgrass varieties recently released from Penn State University.

035

Appendix B



**A high quality heat tolerant creeping
bentgrass**

**DEVELOPED BY
TEXAS A&M UNIVERSITY
IN COOPERATION WITH
THE UNITED STATES GOLF
ASSOCIATION
AND
BENTGRASS RESEARCH, INC
1997**

PLANT MATERIALS RELEASE PROPOSAL Petition to Release


Date 1 May 1997

- 1 **CROP Creeping Bentgrass** Type of Release: Varietal
- 2 Proposed name or identification: Imperial
- 3 Designation or name in development stages: Syn92-5 or Syn92-5-93
- 4 Primary features or advantages: 'Imperial' (tested as Syn92-5) creeping bentgrass is a seven clone synthetic, selected for its uniformity in plant growth type, leaf texture and leaf color. Individual parental clones were selected for superior heat tolerance, disease response, root growth characters under ambient and artificial high soil temperatures, turf texture, quality performance and persistence under normal golf management practices. Data supports superior summer performance compared to 'Penncross' creeping bentgrasses.
- 5 Plant Variety Protection - suggested action: Certification required, process for Plant Variety Protection. PVPA data to be submitted in 1997.
- 6 Seed -- amount available and date: Approximately 50 pounds of Breeder Class seed and 500 pounds of foundation Class seed were available as of 20 July 1995. A 30-acre experimental seed stock-production field was established in the fall of 1995. First harvest 1996, est. Total yield 20,000 pounds.
- 7 Provisions to maintain breeder seed: Breeder seed has been placed in long-term cold storage in Tangent Oregon. A Foundation class seed increase field was established in 1995 to generate sufficient seed stock increase for future perpetuation. Maternal clones are maintained vegetatively at TAES-Dallas. If necessary to produce more breeder class seed, vegetative plantings from the original clones may be re-established in Oregon to produce seed. Experimental certification status was established in 1996.
- 8 Proposed seed distribution: Recommend this variety be licensed to E.F. Burlingham & Sons Forest Grove, Oregon under their option agreement for marketing, production, and distribution. First harvest was made in August 1996.
- 9 Suggested Fees (for Breeder or Genetic Stock): \$5,000 + for a License w/6% royalty
- 10 Supportive documents attached: Release proposal XXXX
- 11 Release Proposal - prepared with or reviewed by: Drs. M. C. Engelke, P. F. Colbaugh, V. G. Lehman
- 12 Suggested Reviewers: In Texas and U.S. (Names and Locations):

Submitted by:

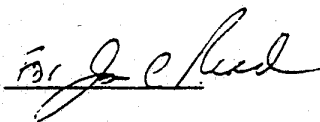
Breeder and Scientists-

M. C. Engelke



Unit Head

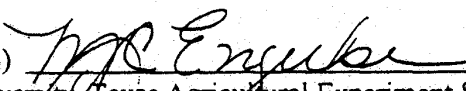
Tim Davis, Ph. D. Resident Director

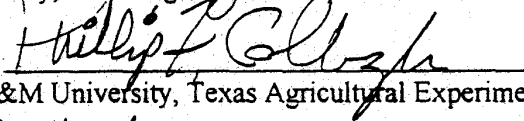


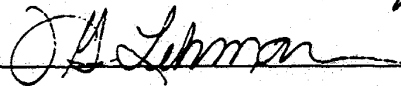
CREATIVE DEVELOPMENT:

Imperial has been under development for several years and numerous individuals have had the opportunity to provide *value added* to the knowledge base and understanding of this grass. As such, we have identified the primary individuals whom we believe have significantly contributed to the development of this grass. Each individual listed made a significant contribution to the development of this variety.

Authorship and % Contribution by each

M. C. Engelke (45%) 
Professor, Texas A&M University, Texas Agricultural Experiment Station-Dallas

P. F. Colbaugh (15%) 
Associate Professor, Texas A&M University, Texas Agricultural Experiment Station-Dallas

V. G. Lehman (35%) 
Director, Product Development & Plant Breeder, Lofts Seed, Inc., Albany, OR

DEVELOPMENTAL FUND: 5%

It is also the desire of the authors, as agreed to by their signature above that a portion of the royalty income assigned to the Inventors (authors) be designated for a specific developmental fund.

IMPERIAL CREEPING BENTGRASS

Imperial creeping bentgrass is with high quality, fine leaf texture, and good genetic color. It is a seven clone synthetic variety developed and tested as Syn92-5 by the Texas Agricultural Experiment Station, Texas A&M University System, Dallas, TX under grants from the United States Golf Association and Bentgrass Research, Inc. Imperial is targeted for use in blends with other improved cultivars of creeping bentgrass and as a major component for golf course fairways. Briefly, its merits and limitations are as follows:

MERITS

Moderate to fine leaf texture

Broadened genetic base incorporating germplasm from Europe

High quality and persistence in NTEP trials in 26 locations in the US

Documented summer and winter performance

Improved heat tolerance

Resistance to Fusarium Patch

Intermediate – dark genetic color

LIMITATIONS

Intermediate field susceptibility to Dollar Spot

RELEASE PROPOSAL IMPERIAL CREEPING BENTGRASS¹

M. C. Engelke, P. F. Colbaugh, and V. G. Lehman²

Imperial' creeping bentgrass (*Agrostis stoloniferous* subsp. *palustris* Huds.) was developed by the Texas Agricultural Experiment Station and tested as Syn92-5. Imperial is an improved cool-season turfgrass suitable as a quality turf throughout the typical areas of adaptation of creeping bentgrass, and provides improved performance in the Southern Transition Zone. Imperial is targeted for use in blends with other improved cultivars of creeping bentgrass and as a major component for golf course fairways.

Breeding History:

IMPERIAL tested as Syn92-5 is a seven-clone synthetic for which the parents were selected for uniformity in plant type and leaf color. Individual clones comprising this cultivar include TAES 2833, 2845, 2916, 2922, 3106, 3293 and 3307. Only clone 3307 is in common with Century. Each of these clones trace back to a collection of approximately 1500 clones of creeping bentgrasses which have been under evaluation at Texas A&M Research and Extension Center beginning in 1982. Specifically each of the clones' trace to locations and dates of entry into the germplasm collection as identified in Table 1. Parental clones of Imperial originated from several sources to include field collections from Italy and France, Wisconsin, Oregon and Texas Golf courses. Individual clones were screened for heat tolerance, disease response, root growth characters under ambient and artificial high soil temperatures, turf texture, quality performance, and persistence under routine golf management practices.

These clones were placed in a replicated isolation nursery in Linn County Oregon in 1991 and allowed to freely interpollinate. Seed from each of the maternal lines harvested in 1992 was germinated and an equal number from each parental line were transplanted to a 1000 plant nursery arranged in replicated progeny rows in Brooks, Oregon in the fall 1992. Prior to anthesis extensive information was collected on selected leaf characteristics and floral formation (Table 2). The nursery was heavily rouged for off type and undesirable plant types in the spring of 1993 prior to anthesis. The remaining plants were allowed to interpollinated to produce breeder seed. Sufficient seed was harvested in 1993 for entry into the Creeping Bentgrass National Turf Evaluation Trials. Minor rouging to eliminate non-flowering off-type plants during the spring/summer of 1994. Approximately 40 pounds of breeder seed were harvested in 1994 and used to establish foundation seed stock production.

¹ Imperial was developed by the Texas Agricultural Experiment Station with partial funding from the United States Golf Association, Far Hills, NJ, and Bentgrass Research, Inc., Dallas, TX.

² Professor - Turfgrass Breeding & Genetics and Associate Professor, Turfgrass Pathology, Texas A&M University Research and Extension Center, Dallas, TX and Director of Research, Loft's Seed Inc., Lebanon, OR

Agronomic description

The agronomic traits of Imperial (Table 2) are based on a population of 90 progeny evaluated for each of the indicated characters across 6 replications of the space plant field nursery.

Most of the parental lines were all subject to close mowing and general turf performance evaluation studies over a 3-year period (1989-1992) prior to selection for seed increase (1992) (Table 3). When compared to Penncross, the parents and progeny of four of the lines were evaluated specifically for turf quality and heat tolerance, and in all cases they were similar or superior to Penncross.

When compared to other experimental cultivars in the program distinct differences are observed for each of the cultivars (Table 4). Imperial will be characterized as having a preponderance of straight leaf-types, with medium-fine texture and good genetic color. Of the cultivars compared in this trial, Imperial is intermediate to late flowering.

Agronomic Attributes and Turf Performance Record

Imperial was included in the 1992 National Turfgrass Evaluation Program Creeping Bentgrass trials along with 27 other entries. The trials were established at 26 locations throughout the region including TAES-Dallas where bentgrasses are adapted and routinely used for golf course putting greens and fairways.

Leaf texture ratings (Table 5, #5a and #5b) recorded at TAES-Dallas in 1996 and the 1994 and 1995 NTEP trials identified Imperial as having an intermediate leaf texture (7.2, 7.4 and 7.2 respectively). By comparison, CATO and Crenshaw rated similar too or slightly lower in leaf texture. Both are highly respected varieties in the market today. Imperial is rated as having an intermediate to dark genetic leaf color (Table 6).

Turfgrass quality is the ultimate measure of performance of a variety. When compared to 27 other varieties at several locations (26) across 20 States over a 2-year period (1994-1995), the adaptability and comparative performance of a variety is obtained (Tables 7a, #7b). Information is summarized in the form of a mean over all locations, the Performance Index (PI) over location and a relative rank in performance based on the PI. The ranks presented in both Tables 7a and 7b are based on a comparison with other varieties that are classified as moderate to low maintenance bentgrasses. The entries from Pennsylvania State University have been released only under the disclaimer that a significantly higher level of maintenance will be required for long term performance. One of the primary objectives of the turfgrass breeding program at Texas A&M University has been to significantly reduce maintenance, comparisons are restricted to such functionally lower maintenance-type varieties. The variety Imperial fits well within these development objectives.

The overall turfgrass quality rankings for Imperial was among the top 10 varieties comparing 24 varieties in the 1994 and 1995 NTEP trials. Imperial ranked 7.5 of 24 varieties in 1994 (Table 7a) and ranked 6th in 1995 (Table 7b). A comparison of the turf performance for physiological traits (Table 8) reveals that Imperial ranked 8st in performance for physiological characteristics at the 26 NTEP locations. Specifically, the varieties were evaluated for establishment, vigor, scalping

tendency, thatching, seasonal density, wear, and recovery from aerification. Five of the top 9 varieties in the highest grouping for physiological stress tolerance were developed by the Texas A&M turfgrass breeding program.

Imperial does have moderate tolerance to Rhizoctonia brown patch and Pythium blight diseases. Imperial as expressed good to excellent resistance to Fusarium patch in two studies in Washington (Table 9) during 1996. The accumulative performance index for disease response was less than impressive especially for Dollar Spot (*Sclerotinia homeocarpa*) in being similar to Crenshaw, SR1020 and 18th Green (Table 10).

When compared to all varieties in the national trial (1993 NTEP) over 2-years, Imperial was among the upper 50% of varieties in overall performance evaluations. When compared to those grasses requiring moderate to minimal maintenance for putting greens, Imperial ranked 8th (upper 25%) across 26 locations in 20 states over a 2 year time period.

Maintenance and Production of Breeder seed and seed stock classes

Breeder seed was produced by Texas A&M University from plants remaining from an original 1000 plant spaced nursery in Brooks, Oregon. Breeder seed is stored under controlled refrigeration conditions, with adequate quantities stored to maintain and regenerate the variety.

Imperial is limited to one generation each of foundation, registered, and certified.

Specifically, E. F. Burlingham & Sons, Forest Grove, Oregon received an option agreement on Imperial effective September 1994 for advanced testing and evaluation of these varieties. Limited acreage was planted in the fall of 1994 permitting evaluation of seed production potential as well as providing enough seed to expand the field testing throughout a broader region of the country.

Anticipated date of first sale:

Spring 1997

Will application for PVP occur?
of release.

Yes, submission will occur following approval

Table 1. Parental resources comprising Imperial creeping bentgrass including origin and date of entry into the Texas A&M University germplasm nursery.

Parents	Date	Collection Location
2833	7/16/84	Brookhollow C.C., Dallas Texas
2845	7/16/84	Brookhollow C.C., Dallas Texas
2916	7/31/84	Walnut C.C., East Lansing MI
2922	8/06/84	Platteville C.C. Platteville, WI
3106	3/01/86	Oregon
3293	4/10/86	Nimes Campagne G.C. France
3307	4/10/86	Mediterranean

Table 2. Agronomic traits measured on progeny populations of Imperial, a seven clone synthetic June 1993, Brooks OR.

Parents	#OBS	Leaf type	Leaf texture	Leaf color	Floral maturity
2833	90	3.1	2.9	-	3.5
2845	90	2.8	2.7	-	2.8
2916	90	4.5	2.5	-	1.4
2922	90	4.3	2.8	-	2.6
3106	90	2.8	2.3	-	4.8
3293	90	2.6	2.7	-	4.6
3307	90	5.4	3.5	-	1.6
Average		3.6	3.1	.	3.1

¹Type 1-9, where 1 = straight and 9 = curly

²Texture 1-9, where 1 = coarse and 9 = very fine

³Color 1-9, where 1 = yellow and 9 = dark green

⁴Floral maturity 1-9, where 1 = no florescence present on June 19 and 9 = heavy seed head production.

Table 3. Turf quality ratings of parental lines and progeny performance trials for Imperial Creeping Bentgrass tested at Texas A&M University - Dallas.

Parental Accession	Turf Quality		Heat Tolerance ¹		3 yr. Perform ²
	Parent	Progeny	Parent	Progeny	Index
2833	7.1a	6.8	4.9a	4.8a	72.7
2845	6.5	6.8	4.7a	4.8a	77.3
2916	5.7	6.5	4.8a	4.8a	68.2
2922	6.2	6.8	4.9a	4.9a	72.7
3106	3.6	6.7	4.5a	4.5	36.4
3293	6.8	7.1	4.1	4.4	54.5
3307	6.5	6.8	4.6a	4.8a	68.2
Avg.	6.1	6.8	4.7	4.7	
Penncross	6.6a		4.0		

¹Heat Bench studies provided relative heat tolerance rank 1-5, 5=best.

²Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study.

Table 4. Agronomic comparison among the 1992 breeder blocks in Brooks Oregon, June 1993.

Population	#Parents	Leaf type ¹	Leaf texture ²	Leaf color ³	Floral maturity ⁴
Century	6	2.8	3.8	6.6	4.5
Backspin	4	3.4	2.9	6.2	4.1
Syn92-3	4	4.2	4.9	6.1	2.6
Syn92-4	7	4.4	3.1	6.0	3.6
Imperial	7	3.6	3.1	.	3.1
Average		3.7	3.4	6.2	3.5

¹Type 1-9, where 1 = straight and 9 = curly

²Texture 1-9, where 1 = coarse and 9 = very fine

³Color 1-9, where 1 = yellow and 9 = dark green

⁴Floral maturity 1-9, where 1 = no florescence present on June 19 and 9 = heavy seed head production.

Table 5. Leaf texture rating¹ during 1996 for the 1993 NTEP sand-modified bentgrass trial at TAES-Dallas.

Entry	15May	Entry	15May
18th Green	7.3	L-93	8.8a
A-1	8.5a	Lopez	7.5
A-4	8.7a	Mariner	8.2a
Backspin	8.3a	MSUEB	7.5
BAR As 493	7.7a	Penncross	8.3a
C&C	8.7a	Pennlinks	8.3a
Cato	8.5a	Pro/Cup	7.5
Century	8.7a	Providence	8.2a
Crenshaw	8.7a	Regent	8.2a
DG-P	8.3a	Seaside	8.5a
Dominant	8.0a	Southshore	8.8a
G-2	8.7a	SR1020	8.0a
G-6	8.7a	Tendez	8.3a
Imperial	7.2	Trueline	7.8a
ISI-Ap-89150	7.2	BAR Ws 42102	8.7a
MSD ²	1.3	MSD ²	1.3

¹ Texture rating was based on 1-9 scale, where 9 is the finest and 1 is the coarsest.

² MSD is the minimum significant difference between means based on the Waller-Duncan k-ratio *t*-test (*k*-ratio=100). 'a' indicates entry was in the highest statistical group. 'ns' indicates means were not significantly different based on ANOVA *F*-test.

Table 5a. Leaf Texture ratings of bentgrass cultivars grown on a green – 1994.¹
Data by State. Leaf texture 1-9, 9 = very fine

Variety	AZ	IL1	KY1	MN	MO	OK	PA	RI	SC	VA	WA1	Mean	PI
A-1	7.7	8.7	8.7	7.3	8.0	9.0	8.3	6.0	7.0	7.3	8.3	7.8	10
A-4	8.3	9.0	8.7	7.7	8.0	8.7	8.3	6.0	6.0	7.3	8.3	7.8	10
Century	8.3	9.0	7.7	7.7	8.0	7.7	8.0	7.0	5.3	8.0	8.0	7.7	9
G-6	7.3	8.7	8.7	7.3	8.0	9.0	7.7	6.3	5.7	7.3	8.0	7.6	9
Imperial	7.3	8.7	7.7	7.3	8.0	8.0	7.3	6.3	5.0	7.3	8.0	7.4	8
CATO	7.7	9.0	8.7	7.7	6.7	8.3	7.7	6.7	4.7	6.7	7.7	7.4	7
G-2	7.3	8.7	7.3	7.3	7.7	8.7	6.0	6.0	6.7	6.3	8.0	7.4	7
L-93	7.0	8.3	7.3	7.0	8.0	8.7	7.3	6.7	5.7	6.7	8.0	7.3	6
Crenshaw	7.7	8.3	7.3	7.0	8.0	7.3	7.7	6.3	5.7	6.7	8.0	7.3	6
Backspin	7.3	8.7	7.3	6.3	8.0	8.3	8.0	6.3	4.7	7.3	7.7	7.3	6
SR1020	7.0	8.3	7.3	6.7	8.0	8.0	7.0	7.0	5.3	6.7	8.0	7.2	5
Bar WS42102	7.3	8.7	7.3	7.3	7.7	8.7	7.3	6.0	4.3	6.3	8.0	7.2	7
Providence	6.3	8.3	7.7	6.7	8.0	8.3	7.7	6.7	4.0	6.7	8.0	7.1	7
Southshore	6.7	8.7	8.0	7.0	7.7	7.7	7.0	6.7	5.0	6.3	7.7	7.1	5
ISI-AP-89510	5.7	8.0	7.0	7.0	8.0	7.7	7.3	6.7	3.0	6.0	7.7	6.7	5
18 th Green	5.7	8.0	7.0	6.7	7.7	7.3	7.7	5.3	3.7	7.0	7.7	6.7	5
DG-P	6.0	8.0	7.0	7.0	8.0	8.0	6.0	6.0	4.0	6.0	7.7	6.7	4
Pennlinks	5.7	8.0	7.7	7.0	8.0	7.3	5.0	6.3	4.7	5.7	8.0	6.7	5
MSUEB	5.3	8.0	7.0	6.3	8.0	7.7	3.0	5.3	5.0	5.3	7.7	6.5	3
Regent	6.0	8.0	7.0	6.3	8.0	7.3	4.3	7.0	4.3	5.0	7.3	6.4	3
Pro/Cup	5.3	8.0	7.0	6.3	8.0	7.3	4.0	7.0	3.3	5.3	8.0	6.3	3
Lopez	5.3	8.0	7.7	7.1	8.0	7.0	3.3	5.7	4.0	5.7	8.0	6.3	5
Mariner	5.7	8.0	6.0	6.0	7.7	7.7	5.0	5.7	5.0	5.7	7.3	6.3	3
Penncross	5.3	7.7	7.0	6.3	8.0	7.0	3.3	6.0	3.3	5.0	7.7	6.1	3
Trueline	5.0	8.0	6.7	6.7	7.7	7.3	2.7	5.7	3.7	4.7	8.0	6.0	4
Tendez	4.0	8.7	3.7	6.7	7.3	6.7	6.0	6.0	3.0	6.0	7.0	5.9	5
BAR AS 492	4.0	8.7	3.3	6.7	8.0	6.3	3.0	6.3	2.7	5.7	7.0	5.6	5
Seaside	4.0	7.3	4.3	6.7	7.3	6.0	1.3	7.0	2.7	4.0	7.0	5.2	4
LSD value	0.8	0.7	1.1	1.0	0.7	0.9	1.1	1.9	1.2	0.9	1.7	0.9	

¹ Published in NTEP 95-1, Table 6

² Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study

³ To determine statistical difference among entries, subtract one entry's mean from another entry's mean. Statistical differences occur when this value is larger than the corresponding LSD value (LSD 0.05). Leaf Texture ratings 1-9, 9= very fine.

Table 5b. 1996 NTEP¹ Leaf Texture ratings of bentgrass cultivars grown on a green – 1995
Data by State. Leaf texture 1-9, 9 = very fine.

Variety	AZ	IA	IL1	IL2	KS	KY1	KY2	MI	MN	MO	MS	NJ	OK	QE	RI	SC	TX	VA	WA1	WA3	WA4	Mean	PI ²	
Century	8.0	7.7	9.0	7.7	9.0	8.3	9.0	5.0	6.0	7.7	6.3	7.3	9.0	7.7	7.7	5.7	8.7	6.7	8.3	8.3	8.0	7.7	20	
G-2	8.0	8.3	9.0	6.3	7.3	8.3	9.0	6.0	6.7	8.3	6.0	8.7	9.0	7.3	7.0	7.0	8.7	6.7	8.0	8.3	8.0	7.7	19	
A-1	7.7	7.0	9.0	7.3	8.3	8.7	8.7	6.0	7.3	8.0	6.0	8.7	9.0	6.3	7.0	7.7	9.0	7.3	8.0	8.3	5.7	7.7	19	
A-4	8.7	9.0	6.0	6.0	9.0	9.0	9.0	5.3	7.0	7.0	6.0	8.0	9.0	7.3	7.3	6.3	8.7	7.0	8.7	8.0	7.0	7.6	19	
G-6	7.3	7.0	8.7	5.3	8.7	8.7	9.0	5.7	6.7	8.0	6.0	7.7	9.0	7.7	7.3	6.7	9.0	7.0	8.3	7.7	8.0	7.6	19	
Bar WS42102	7.7	8.0	9.0	8.0	8.3	8.7	9.0	5.3	7.0	7.7	5.3	7.0	8.3	6.7	7.0	4.0	8.7	6.0	8.3	8.0	7.7	7.4	18	
L-93	7.7	7.0	9.0	7.0	8.7	8.3	8.7	5.3	5.7	7.7	6.0	7.7	8.7	7.0	6.0	5.7	9.0	6.7	8.0	8.0	8.0	8.0	7.4	17
Backspin	7.0	7.3	9.0	8.3	8.0	7.3	9.0	5.3	6.0	7.7	5.3	6.7	8.3	6.7	7.0	5.3	8.7	5.7	8.0	7.7	7.0	7.2	16	
Crenshaw	7.0	8.0	9.0	6.3	8.3	8.7	9.0	5.0	6.0	8.0	6.0	5.0	7.0	5.7	5.7	6.3	9.0	5.3	8.0	7.3	6.7	7.0	15	
CATO	7.3	7.7	9.0	8.3	8.7	9.0	9.0	6.0	6.3	8.3	5.7	7.3	8.0	7.3	6.3	5.7	8.3	6.3	6.0	6.7	7.0	7.4	14	
Imperial	7.3	7.3	8.7	7.0	8.0	8.3	9.0	5.0	5.7	7.7	6.0	7.3	8.3	7.3	6.7	5.3	7.0	6.0	8.3	7.3	8.0	7.2	14	
Southshore	7.0	7.0	8.3	7.7	8.0	7.3	9.0	5.7	5.0	8.0	6.3	6.7	7.7	7.0	7.0	6.0	9.0	5.3	7.7	8.3	7.7	7.2	13	
Providence	7.0	7.0	8.7	7.3	7.3	7.7	9.1	5.3	5.3	7.7	6.0	5.7	8.0	6.0	6.0	4.7	8.0	5.3	7.3	7.0	6.7	6.8	11	
ISI-AP-89510	6.0	8.3	8.0	6.3	6.7	8.7	8.7	5.7	5.3	7.0	5.7	5.7	7.0	8.0	5.7	3.3	7.0	5.0	7.7	5.3	7.0	6.6	9	
SR1020	7.3	8.0	9.0	6.7	8.0	7.7	8.3	5.3	5.3	7.3	5.3	6.0	8.0	6.0	6.0	6.3	7.7	5.3	8.0	7.0	6.7	6.9	8	
DG-P	6.0	6.7	8.3	8.3	6.3	8.0	7.7	5.0	4.7	8.3	5.7	5.7	6.7	5.7	5.3	4.0	8.3	5.3	8.0	5.7		6.5	8	
18 th Green	5.7	7.0	8.7	4.7	7.3	8.0	8.0	4.3	4.0	7.3	5.7	4.0	7.0	6.7	5.7	3.7	7.3	6.3	7.3	6.3	6.3	6.3	8	
Pennlinks	6.3	6.3	8.3	8.7	6.0	8.0	7.0	5.7	5.3	7.3	5.3	5.3	7.0	6.7	6.7	5.3	8.3	4.7	7.3	5.3	6.0	6.5	7	
Regent	6.3	6.7	8.7	7.0	7.0	7.0	7.3	6.0	4.7	8.0	5.3	4.7	6.7	5.3	4.7	4.0	8.0	5.0	7.7	5.7	6.3	6.3	7	
MSUEB	6.7	6.7	8.3	6.3	6.3	7.7	7.0	5.7	4.7	8.0	5.7	4.7	6.3	5.3	6.0	5.7	7.3	4.0	7.0	6.3	6.7	6.3	5	
Trueline	6.0	7.0	8.0	5.7	7.0	6.7	7.0	5.7	5.3	8.3	5.3	3.7	6.7	6.0	5.3	3.7	7.7	4.0	7.0	6.0	5.3	6.1	5	
Mariner	6.0	5.7	8.7	4.3	6.3	7.7	7.0	5.0	4.3	8.0	5.0	3.0	7.0	5.0	6.7	5.3	8.0	4.0	7.0	6.3	6.7	6.0	5	
Tendez	4.3	4.3	7.7	6.3	5.0	7.0	7.0	3.3		7.7	5.3	2.7	5.0	6.0	4.3	2.3	8.3	4.0	8.3	5.7	5.7	5.5	5	
Penncross	5.3	6.7	8.0	6.0	5.7	7.0	7.0	5.7	4.0	8.0	4.7	3.0	6.0	5.0	5.3	4.3	8.7	3.0	6.7	4.3	4.7	5.7	4	
BAR AS 492	3.3	5.3	8.3	3.7	7.3	7.0	7.0	4.0	5.0	7.3	4.0	3.3	5.0	5.0	5.3	2.0	7.7	6.0	7.3	7.7	7.0	5.7	4	
Lopez	6.3	6.0	8.0	4.0	6.3	7.3	7.7	6.0	5.0	8.0	5.3	4.7	7.0	5.3	5.3	4.0	7.3	4.3	6.7	5.7	5.3	6.0	3	
Pro/cup	6.3	6.0	8.3	3.3	7.0	7.7	7.0	5.3	4.3	7.7	5.7	4.7	6.3	5.7	6.0	4.0	7.3	3.7	6.3	6.0	6.0	5.9	3	
Seaside	4.0	4.3	7.0	1.3	5.7	5.0	6.0	5.0	4.3	7.0	5.0	1.7	4.7	4.3	4.3	2.3	8.7	2.7	6.0	3.3	3.0	4.6	2	
LSD value ³	0.8	1.3	0.6	3.3	0.9	1.1	0.6	1.1	1.3	0.8	1.1	1.1	0.8	1.7	0.8	1.0	1.0	1.6	1.2	1.2	1.4	0.3		

047

¹ Published in NTEP 96-1, Table 6

² Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study

³ To determine statistical difference among entries, subtract one entry's mean from another entry's mean. Statistical differences occur when this value is larger than the corresponding LSD value (LSD 0.05). Leaf Texture ratings 1-9, 9 = very fine.

Table 6. Color rating¹ during 1996 for the 1993 NTEP sand-modified bentgrass trial at TAES-Dallas.

Entry	14May	Entry	14May
18th Green	7.3	L-93	7.7
A-1	7.3	Lopez	7.3
A-4	7.7	Mariner	7.0
Backspin	7.0	MSUEB	7.3
BAR As 493	7.2	Penncross	7.3
C&C	7.7	Pennlinks	7.7
Cato	7.5	Pro/Cup	6.5
Century	8.0	Providence	7.7
Crenshaw	7.3	Regent	7.0
DG-P	7.5	Seaside	7.8
Dominant	7.5	Southshore	7.7
G-2	7.0	SR1020	7.7
G-6	7.3	Tendez	7.0
Imperial	7.7	Trueline	7.7
ISI-Ap-89150	7.5	Bar Ws 42102	7.2
MSD ²	ns	MSD ²	ns

¹ Color rating was based on 1-9 scale, where 9 is the darkest green plot and 5 is the minimum acceptable turf color.

² MSD is the minimum significant difference between means based on the Waller-Duncan *k*-ratio *t*-test (*k*-ratio=100). 'a' indicates entry was in the highest statistical group. 'ns' indicates means were not significant based on ANOVA *F*-test.

Table 7a. 1995 NTEP mean turfgrass quality ratings of bentgrass cultivars grown on a green at 26 locations in the United States. - 1994¹
Data by State.

Variety	AZ	GA	GA	IA	IL1	IL2	KS	KY	KY	MA	MI	MN	MO	MO	NH	NJ	OK	PA	RI	SC	TX	VA	WA	WA	WI	WI	Mean	PI ²	Rank ⁴
		1	2					1	2				1	2									1	3	1	2			
L-93	6.6	4.3	1.9	6.6	5.3	6.3	6.9	8.0	7.4	7.5	6.3	7.3	6.9	6.9	5.9	7.3	6.4	7.4	6.2	5.1	6.4	6.1	6.2	5.7	7.2	7.3	6.4	22	1
A-4	7.2	4.0	2.1	6.7	5.5	7.1	6.9	7.7	7.6	6.1	6.0	7.8	7.3	7.3	6.7	6.0	6.6	6.6	6.1	5.2	7.3	6.6	6.7	6.3	7.4	7.8	6.5	20	
A-1	6.1	3.9	2.2	6.1	5.3	5.7	6.0	8.1	7.4	7.3	5.2	4.7	6.6	7.2	5.2	7.2	6.3	7.3	5.8	5.6	6.7	6.1	6.5	6.2	7.6	7.4	6.3	19	
CATO	7.3	4.1	2.0	6.6	5.1	5.3	6.7	8.0	6.8	7.4	5.8	7.2	7.0	7.0	6.7	5.7	6.0	6.8	6.5	5.0	6.0	6.4	6.0	6.0	7.1	7.3	6.2	17	2
G-6	6.2	4.1	2.2	6.3	4.8	5.5	5.3	7.7	6.8	7.5	5.5	7.5	6.3	7.0	6.4	6.6	6.7	6.5	5.8	5.1	6.3	6.2	6.1	6.0	7.3	7.3	6.1	17	
Providence	6.2	4.2	2.4	6.5	5.9	6.5	6.9	7.4	7.5	7.3	5.8	6.9	7.6	7.5	7.1	6.2	5.9	6.8	6.0	4.3	7.1	6.0	6.4	5.8	7.3	7.2	6.3	16	3
Crenshaw	6.4	3.9	2.3	5.8	5.5	6.7	7.2	7.2	7.4	7.0	5.8	6.9	6.9	7.4	6.2	6.5	6.1	6.1	5.9	5.0	7.1	6.2	6.7	4.9	6.9	7.1	6.2	15	4
G-2	6.2	3.9	2.1	5.4	4.9	5.7	5.4	7.8	7.1	6.5	5.8	7.8	6.9	7.2	5.9	6.8	6.1	6.7	6.1	5.1	5.9	6.1	6.5	5.9	7.2	7.2	6.1	15	
Southshore	6.0	4.5	1.9	6.2	4.9	6.5	6.6	7.1	6.5	6.1	5.5	7.5	7.1	7.2	6.4	5.9	5.7	6.7	6.2	5.1	6.8	5.8	6.3	5.5	7.2	6.6	6.1	14	5.5
Century	6.1	3.9	2.2	5.8	5.1	6.5	7.0	7.1	7.3	6.6	5.2	7.4	7.1	7.3	5.3	5.8	5.9	6.1	5.9	4.4	6.2	6.1	6.1	6.2	7.0	6.8	6.0	14	5.5
Imperial	5.7	3.9	1.9	5.8	5.1	7.1	5.6	7.1	6.6	6.4	5.5	6.5	6.8	7.1	5.1	6.2	5.9	6.3	5.4	4.4	6.9	6.5	6.5	6.4	7.1	7.2	6.0	11	7.5
Backspin	5.7	4.4	2.3	5.3	4.5	7.3	6.5	6.7	7.2	6.0	5.3	7.3	6.9	7.1	5.8	6.0	5.5	5.7	5.7	4.4	6.5	6.3	5.9	5.7	6.8	8.6	5.9	11	7.5
Bar WS42102	2.9	3.9	1.7	5.3	4.6	5.5	6.5	7.4	7.2	5.7	5.3	7.4	6.8	7.0	5.9	4.8	5.5	6.8	5.6	3.9	6.0	5.9	6.4	5.5	7.1	7.3	5.8	10	9.5
ISI-AP-89510	5.0	3.9	1.7	5.5	4.8	5.0	5.9	7.3	6.1	6.6	5.2	7.2	7.2	7.2	5.6	5.3	5.3	6.3	5.2	4.0	6.5	5.5	6.5	5.7	7.1	6.5	5.7	10	9.5
SR1020	5.9	4.3	2.4	5.6	4.8	5.7	6.1	7.1	6.8	5.9	5.5	7.1	6.8	7.0	6.4	5.1	5.8	5.8	6.1	4.6	7.2	5.6	6.3	5.5	7.0	6.9	5.9	9	11
MSUEB	4.8	4.1	2.2	5.4	4.7	6.7	6.0	7.2	7.2	5.6	5.2	6.6	7.5	7.2	5.3	5.8	5.3	6.3	5.2	5.0	5.7	5.3	6.1	4.7	6.9	6.7	5.7	8	13.5
Pro/cup	5.0	4.1	1.7	4.8	4.5	5.1	6.6	7.3	7.2	5.7	4.8	6.7	6.6	7.1	6.0	5.8	5.3	5.5	5.6	3.6	6.5	5.5	6.1	5.3	6.8	6.6	5.6	8	13.5
Penncross	4.9	4.3	2.7	5.3	4.7	6.1	5.9	7.0	7.3	5.2	5.2	6.8	7.0	7.1	6.2	4.7	4.9	5.3	4.8	3.5	7.0	5.2	6.2	4.8	6.2	6.1	5.5	8	13.5
Trueline	4.8	3.8	2.2	5.2	4.3	4.0	6.4	7.3	6.9	5.5	4.3	7.0	7.4	7.1	6.3	5.9	5.1	5.4	5.6	3.7	6.1	5.4	6.0	4.8	7.1	6.6	5.5	8	13.5
Pennlinks	5.0	4.3	2.8	5.5	5.0	6.4	6.5	7.7	6.5	5.8	5.2	6.8	7.3	7.4	6.0	5.4	5.3	6.2	5.3	4.7	6.1	5.5	6.3	5.2	6.8	7.0	5.8	7	17.5
Regent	5.4	4.3	1.8	5.7	4.7	6.0	6.5	7.1	6.7	6.2	5.2	7.0	6.8	7.3	6.2	5.8	5.4	5.6	5.4	4.3	7.2	5.4	6.1	5.2	7.4	6.4	5.8	7	17.5
18 th Green	5.4	3.7	1.7	5.2	4.1	4.7	5.5	6.8	7.1	6.3	5.3	7.5	7.1	7.3	7.2	5.2	5.7	5.9	4.9	4.0	6.1	5.9	6.0	4.9	6.5	7.0	5.7	7	17.5
Lopez	4.8	3.9	3.2	5.5	4.3	6.3	5.9	7.7	6.0	6.1	5.2	6.8	7.2	7.1	5.6	5.8	5.1	5.6	5.2	3.4	6.4	5.4	6.1	4.8	6.8	6.7	5.6	7	17.5
DG-P	5.0	3.9	1.8	4.7	4.2	5.7	5.7	7.2	6.0	6.1	5.2	7.0	6.9	7.1	5.8	5.3	5.3	6.2	4.9	3.8	6.5	5.3	5.6	5.2	7.0	6.6	5.6	6	20
Mariner	4.8	4.6	5.0	4.3	4.8	5.1	5.9	7.1	6.7	4.9	4.7	6.8	6.7	7.1	5.0	5.3	5.3	4.5	4.8	3.8	6.5	5.3	6.0	4.5	6.6	6.3	5.4	5	21
Tendez	2.5	3.9	4.4	3.4	3.3	5.3	4.3	5.8	5.1	5.0	4.2	6.5	6.3	6.8	5.9	4.2	3.7	5.1	3.8	3.1	6.1	5.7	5.1	4.4	5.9	5.8	4.8	3	23
BAR AS 492	2.4	4.8	5.2	3.6	3.1	4.1	5.6	4.6	4.6	3.8	6.5	6.3	6.0	7.0	2.7	3.6	3.6	4.5	5.0	2.5	5.2	5.1	4.5	4.2	6.8	6.5	4.6	3	23
Seaside	3.7	4.3	3.3	3.5	3.9	3.9	4.9	6.3	5.8	3.8	4.0	6.4	6.0	7.0	3.6	3.0	4.0	3.3	4.8	2.8	6.3	3.8	5.1	3.1	5.6	5.6	4.5	3	23
LSD ⁴ value	0.7	0.7	0.7	0.9	0.6	1.8	1.4	0.5	0.6	0.9	0.8	0.8	0.7	0.6	0.4	0.6	0.4	0.7	0.9	0.8	1.2	0.5	0.6	0.4	0.5	0.5	0.2		

049

Published in NTEP 95-6, Table 1

performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study

oes not include the high maintenance turfgrass varieties recently released from Penn State University.

o determine statistical difference among entries, subtract one entry's mean from another entry's mean. Statistical differences occur when this value is larger than the corresponding LSD value (LSD 0.05). Leaf Texture ratings 1-9, 9= very fine.

Table 7b. 1996 NTEP mean turfgrass quality ratings of bentgrass cultivars grown on a green at 26 locations in the United States. - 1995¹
Data by State.

Variety	AZ	GA 1	GA 2	IA	IL1	IL2	KS	KY 1	KY 2	MA	MI	MN	MO 1	MS	NJ	OK	PA	QE	RI	SC	TX	VA 1	WA 1	WA 3	WA 4	Mean	PI ²	Rank ³
L-93	7.2	4.4	1.2	5.8	5.4	6.8	7.1	8.3	7.7	6.1	6.2	5.7	7.5	6.0	7.4	7.0	7.8	7.5	6.8	5.2	7.2	6.5	7.2	5.9	5.6	6.4	22	1
A-1	6.8	4.1	1.0	5.3	5.1	5.7	6.5	7.3	7.3	5.8	5.6	6.3	7.6	5.0	7.0	7.2	7.6	7.2	6.1	6.8	6.9	6.0	6.8	5.7	5.8	6.1	19	
A-4	7.7	3.9	1.1	4.8	4.9	6.3	5.9	7.8	7.9	4.4	6.2	5.8	7.6	4.4	6.3	7.2	7.1	7.4	5.6	6.1	7.0	5.8	7.4	6.0	6.1	6.0	14	
G-2	6.5	4.1	1.2	6.7	5.3	5.7	5.7	7.4	7.7	5.7	6.1	6.2	6.8	4.9	6.7	7.0	7.3	7.1	6.9	5.8	6.6	5.4	6.9	5.7	5.6	6.0	14	
Providence	6.8	4.7	1.1	6.0	5.1	5.7	6.3	7.7	7.6	5.6	5.9	5.4	7.4	4.9	6.1	6.7	7.1	7.1	5.7	4.6	7.1	5.7	6.6	5.7	5.5	5.9	12	2
Cato	7.2	4.4	1.1	6.0	5.0	5.8	6.0	7.6	7.4	5.1	5.9	5.4	4.6	4.8	6.6	6.7	7.2	7.2	6.0	5.7	7.1	5.7	6.9	5.4	5.8	6.0	11	3
Century	7.0	4.0	1.2	5.5	5.3	5.7	4.3	7.1	7.5	5.2	5.6	5.1	6.3	4.7	4.8	6.3	5.8	7.2	6.3	4.8	6.8	4.6	6.7	5.6	5.9	5.6	10	4
G-6	5.9	4.2	1.0	5.4	4.8	5.6	5.9	7.6	7.3	5.1	5.8	5.9	7.0	4.9	6.3	7.4	7.1	7.3	5.9	5.6	6.8	6.0	6.9	5.6	5.3	5.9	10	
BAR WS 42102	5.4	3.5	4.4	5.8	5.0	4.6	5.5	7.6	7.4	5.4	5.8	5.6	7.0	5.0	5.3	6.0	6.6	7.1	6.3	3.3	6.6	5.0	7.0	4.8	5.0	5.5	9	6
Crenshaw	7.0	4.7	1.0	6.2	5.0	6.0	4.2	7.2	7.7	4.9	5.7	4.5	4.0	4.7	3.8	6.2	5.1	6.9	6.5	5.9	6.8	4.5	6.8	5.0	5.0	5.5	9	6
Imperial	6.3	4.0	1.0	5.9	5.0	7.0	4.7	7.0	7.6	5.0	5.7	4.8	7.0	4.8	5.3	6.0	5.8	7.3	6.0	4.8	7.0	5.2	6.1	5.5	6.0	5.6	9	6
Backspin	5.9	4.1	1.1	5.0	5.0	6.4	4.9	6.7	7.4	5.0	5.7	5.0	6.7	5.5	4.5	6.0	5.8	7.1	5.6	4.9	6.2	5.0	6.7	5.1	5.3	5.5	7	8.5
ISI-AP-89150	6.0	2.8	1.1	5.8	4.7	5.0	5.9	7.9	7.2	4.4	5.5	5.6	7.1	4.2	5.3	5.8	6.2	7.2	6.0	3.9	7.0	4.6	6.3	4.8	5.1	5.5	7	8.5
Southshore	6.4	4.5	1.0	5.2	5.4	5.9	6.0	7.3	7.3	4.7	5.7	5.0	6.8	4.8	5.6	6.7	6.8	7.3	6.2	5.7	7.2	5.2	6.7	5.4	5.3	5.8	7	8.5
SR1020	6.8	4.1	1.1	6.1	5.0	4.5	4.5	7.2	7.4	5.0	5.8	5.2	6.9	4.7	4.7	6.3	5.8	6.6	5.7	5.0	6.8	4.6	6.7	5.2	5.6	5.5	7	8.5
Pennlinks	5.8	4.3	1.1	5.2	5.1	6.2	6.2	7.7	6.8	5.3	5.8	4.9	7.3	4.5	5.6	5.7	6.4	6.9	5.7	5.1	6.7	5.1	5.9	4.7	4.8	5.6	6	12
DG-P	5.6	4.2	1.1	5.3	5.0	6.8	5.6	7.3	7.0	5.3	5.5	4.6	7.4	4.8	5.0	6.0	6.2	6.9	5.1	3.5	6.9	4.9	6.4	5.4	5.5	5	14	
Lopez	5.5	4.0	3.8	5.2	5.2	5.2	5.2	7.6	7.0	4.9	5.7	4.7	7.6	4.8	4.7	5.8	5.4	6.2	5.9	2.9	6.9	4.5	6.0	4.6	4.4	5.4	5	14
MSUEB	6.0	4.3	1.1	5.3	4.8	6.6	6.1	7.0	6.9	4.9	5.7	4.7	7.6	4.8	4.7	5.8	5.4	6.2	5.9	2.9	6.9	4.5	6.0	4.6	4.4	5.4	5	14
18 th Green	6.0	3.4	1.0	5.9	4.1	4.7	4.1	6.8	7.7	4.7	5.5	4.1	7.0	4.2	3.6	5.8	4.8	7.0	5.4	3.3	6.8	4.7	6.1	4.4	4.5	5.0	4	17
Mariner	5.6	4.5	1.0	4.9	4.9	5.5	5.1	7.2	7.5	4.9	5.4	4.4	6.5	4.3	3.7	5.3	4.8	6.1	5.4	4.8	6.9	4.2	5.6	4.8	4.7	5.1	4	17
Penncross	5.3	4.1	1.3	5.4	4.8	6.3	6.0	7.1	6.8	4.8	5.6	4.3	7.3	4.8	3.6	5.3	5.1	6.3	4.0	3.8	6.7	4.4	5.7	4.1	4.8	5.1	4	17
Pro/cup	5.7	4.2	1.0	5.4	5.0	4.8	5.7	7.0	7.0	4.8	5.4	4.6	6.9	5.1	4.8	5.8	5.3	6.5	5.7	3.6	6.8	4.6	6.2	4.6	4.5	5.2	3	19.5
Regent	6.1	4.6	1.3	5.3	4.5	5.3	5.8	7.0	7.0	4.8	5.7	4.6	6.7	4.7	5.0	5.6	5.7	6.4	5.2	4.1	7.3	4.6	6.2	4.7	4.6	5.3	3	19.5
BAR AS 492	3.2	5.9	5.4	4.1	3.5	4.5	5.8	3.4	4.7	3.7	4.2	4.2	5.7	3.8	3.0	2.8	3.1	6.0	3.2	3.4	6.5	4.1	5.0	4.1	3.3	4.3	2	22
Tendez	3.7	4.9	4.2	3.7	3.0	5.1	5.1	4.8	4.6	4.1	4.4	5.5	4.3	2.6	2.6	4.0	3.0	2.1	1.5	7.0	3.7	4.8	3.6	3.6	4.1	2	22	
Trueline	5.5	4.3	2.8	5.2	5.0	3.8	5.4	7.3	6.9	4.4	5.4	4.9	7.0	4.7	4.4	5.7	5.4	6.8	5.5	3.3	6.7	5.0	5.9	4.6	4.1	5.2	2	22
Seaside	4.2	4.9	2.5	3.8	3.4	2.5	5.1	5.7	4.8	3.6	4.3	3.9	5.0	4.2	2.0	3.6	3.5	5.0	4.0	2.5	7.0	3.3	4.3	3.6	2.8	4.0	1	24
LSD ⁴ value	0.6	0.7	0.3	1.0	0.7	1.9	0.6	0.5	0.5	0.5	0.6	0.9	0.5	1.0	0.5	0.5	0.5	0.7	0.8	0.6	0.6	0.6	0.7	0.5	0.6	0.6	0.1	

Published in NTEP 96-1, Table 1

Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study

oes not include the high maintenance turfgrass varieties recently released from Penn State University.

o determine statistical difference among entries, subtract one entry's mean from another entry's mean. Statistical differences occur when this value is larger than the corresponding LSD value (LSD 0.05). Leaf Texture ratings 1-9, 9= very fine

Table 8. Turfgrass performance index (PI)¹ or physiological characteristics of the NTEP Trials at 26 locations. Data collected 1994 and 1995. Observations include establishment, vigor, scalping, thatching, season density, wear and recover from aerification (Total # observations)

	PI 94 (51)	% of Max94	PI Rank94	PI 95 (51)	% of Max95	PI Rank95	Cumm. PI (102)	% of Max	Cumm. Rank (28)	Rank Moderate ² Maintenance (24)
A-4	37	72.55	1	39	76.47	2	76	74.51	1	
G-2	27	52.94	10	41	80.39	1	68	66.67	2	
A-1	29	56.86	5.5	36	70.59	3	65	63.73	3	
Century	29	56.86	5.5	34	66.67	4	63	61.76	4	1
L-93	27	52.94	10	33	64.71	5.5	60	58.82	5	2
BarWs42102	27	52.94	10	32	62.75	7	59	57.84	6.5	3
G-6	26	50.98	13	33	64.71	5.5	59	57.84	6.5	
Cato	27	52.94	10	29	56.86	8	56	54.90	8.5	4.5
Crenshaw	34	66.67	2	22	43.14	11	56	54.90	8.5	4.5
Providence	33	64.71	3	17	33.33	13.5	50	49.02	10.5	6.5
Southshore	30	58.82	4	20	39.22	12	50	49.02	10.5	6.5
Imperial	21	41.18	22	28	54.90	9	49	48.04	12	8
Backspin	23	45.10	18.5	23	45.10	10	46	45.10	13	9
SR1020	28	54.90	7	17	33.33	13.5	45	44.12	14	10
Pennlinks	27	52.94	10	10	19.61	16	37	36.27	15	11
ISIAp89150	23	45.10	18.5	12	23.53	15	35	34.31	16	12
Mariner	24	47.06	16	9	17.65	19.5	33	32.35	17.5	13.5
Trueline	25	49.02	14.5	8	15.69	23.5	33	32.35	17.5	13.5
Penncross	25	49.02	14.5	7	13.73	26	32	31.37	19	15
18th Green	22	43.14	21	8	15.69	23.5	30	29.41	20.5	16.5
Regent	23	45.10	18.5	7	13.73	26	30	29.41	20.5	16.5
MSUEB	20	39.22	23	9	17.65	19.5	29	28.43	22.5	18.5
Seaside	23	45.10	18.5	6	11.76	28	29	28.43	22.5	18.5
Lopez	18	35.29	25	9	17.65	19.5	27	26.47	24	20
Pro/Cup	19	37.25	24	7	13.73	26	26	25.49	25	21
Tendez	14	27.45	26	8	16.00	22	22	21.78	26	22
DG-P	12	23.53	27	9	17.65	19.5	21	20.59	27	23
BarAs492	9	17.65	28	9	18.00	17	18	17.82	28	24

¹Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study

²Does not include the high maintenance turfgrass varieties recently released from Penn State University.

Table 9. Fusarium patch rating of bentgrass cultivars grown on a sand based green.
 Ratings 1 - 9 = no disease

W A 3. This is on native soil.

Cultivar	WA1	WA2	Mean
Century	8.3	8.3	8.3
Providence	8.3	8.3	8.3
A-1	8.7	7.3	8.0
Tendez	8.7	7.3	8.0
BAR Ws 42102	8.0	7.7	7.8
A-4	8.0	8.3	7.7
L-93	8.7	6.7	7.7
Regent	8.0	7.3	7.7
Southshore	8.0	7.3	7.7
BAR As 492	8.0	7.0	7.5
Cato	7.7	7.3	7.5
Imperial	7.3	7.7	7.5
Lopez	7.7	7.3	7.5
SR 1020	7.7	7.3	7.5
Backspin	8.0	6.7	7.3
18 th Green	7.3	7.3	7.3
ISI-AP-89150	6.7	7.7	7.2
Pro/Cup	7.7	6.7	7.2
Crenshaw	8.0	6.3	7.2
DG-P	8.0	6.0	7.0
G-6	6.3	7.7	7.0
Penncross	7.7	6.3	7.0
Pennlinks	7.0	7.0	7.0
Trueline	8.0	6.0	7.0
MSUEB	7.7	6.0	6.8
G-2	6.3	7.3	6.8
Seaside	7.0	6.0	6.5
Mariner	6.0	6.7	6.3
LSD (0.05)	1.6	1.1	1.0

Reproduced from NTEP 96-1 Table 28 page 35.

10 23

Table 10. Turfgrass performance index (PI) for disease assessment of the National Turf Evaluation Trials at 26 locations on observations made during 1994 and 1995. Observations targeted primarily dollar spot but also included observations on patch and Pythium diseases.

	PI 94 (13)	% of Max94	PI Rank94	PI 95 (27)	% of Max95	PI Rank95	Cumm. PI (40)	% of Max	Cumm. Rank
L-93	12	92.31	1	24	88.89	1	36	90	1
Providence	11	84.62	2	23	85.19	2.5	34	85	2
Cato	10	76.92	4.5	23	85.19	2.5	33	82.5	3
Penncross	9	69.23	9.5	21	77.78	4	30	75	4
Pennlinks	10	76.92	4.5	18	66.67	10	28	70	5.5
Seaside	8	61.54	16	20	74.07	6	28	70	5.5
A-1	9	69.23	9.5	18	66.67	10	27	67.5	9
A-4	8	61.54	16	19	70.37	8	27	67.5	9
Lopez	7	53.85	22	20	74.07	6	27	67.5	9
Regent	10	76.92	4	17	62.96	14	27	67.5	9
Trueline	10	76.92	4.5	17	62.96	14	27	67.5	9
BarWs42102	6	46.15	26.5	20	74.07	6	26	65	13.5
MSUEB	9	69.23	9.5	17	62.96	14	26	65	13.5
Pro/Cup	8	61.54	16	18	66.67	10	26	65	13.5
Southshore	9	69.23	9.5	17	62.96	14	26	65	13.5
DG-P	8	61.54	16	17	62.96	14	25	62.5	17
G-6	9	69.23	9.5	16	59.26	19.5	25	62.5	17
ISIAp89150	9	69.23	9.5	16	59.26	19.5	25	62.5	17
BarAs492	8	61.54	16	16	59.26	19.5	24	60	19
18th Green	7	53.85	22	16	59.26	19.5	23	57.5	20.5
SR1020	8	61.54	16	15	55.56	22	23	57.5	20.5
Century	6	46.15	26.5	16	59.26	19.5	22	55	22.5
G-2	8	61.54	16	14	51.85	23.5	22	55	22.5
Tendez	7	53.85	22	14	51.85	23.5	21	52.5	24
Backspin	7	53.85	22	13	48.15	25	20	50	25
Crenshaw	6	46.15	26.5	12	44.44	26.5	18	45	26.5
Imperial	6	46.15	26.5	12	44.44	26.5	18	45	26.5
Mariner	7	53.85	22	10	37.04	28	17	42.5	28

¹Performance Index = Frequency of which the measured performance was not significantly different from the best performing lines in the study

053

Table 11. Turfgrass performance index for all character observations of the National Turf Evaluation Trials at 26 locations during the 2 year period including 1994 and 1995. (Total # observations)

	TPI 94 (144)	% of Max94	TPI Rank94	TPI 95 (172)	% of Max95	TPI Rank95	Cumm. TPI (316)	% of Max	Cumm. Rank (28)	Moderate Maintenance (24)
L-93	101	70.14	2	126	73.26	1	227	71.84	1	1
A-4	104	72.22	1	112	65.12	2	216	68.35	2	
Cato	96	66.67	4	105	61.05	4	201	63.61	3	2
A-1	86	59.72	6.5	108	62.79	3	194	61.39	4	
Providence	100	69.44	3	93	54.07	6	193	61.08	5	3
G-2	82	56.94	8.5	102	59.30	5	184	58.23	6	
G-6	82	56.94	8.5	91	52.91	7	173	54.75	7	
Crenshaw	90	62.50	5	74	43.02	12	164	51.90	8	4
Southshore	86	59.72	6.5	75	43.60	11	161	50.95	9	5
Century	76	52.78	10	83	48.26	8	159	50.32	10	6
BarWs42102	61	42.36	18.5	77	44.77	9	138	43.67	11	7
Imperial	61	42.36	18.5	76	44.19	10	137	43.35	12	8
ISIAp89150	66	45.83	14	67	38.95	13	133	42.09	13	9
SR1020	72	50.00	11	60	34.88	16	132	41.77	14	10
Backspin	63	43.75	17	63	36.63	14	126	39.87	15	11
18th Green	65	45.14	15	60	34.88	16	125	39.56	16.5	12.5
Pennlinks	68	47.22	12.5	57	33.14	19.5	125	39.56	16.5	12.5
MSUEB	60	41.67	20.5	60	34.88	16	120	37.97	18	14
Regent	68	47.22	12.5	51	29.65	23	119	37.66	19	15
Penncross	64	44.44	16	52	30.23	22	116	36.71	20	16
Trueline	60	41.67	20.5	53	30.81	21	113	35.76	21	17
Lopez	51	35.42	25.5	58	33.72	18	109	34.49	22	18
DG-P	51	35.42	25.5	57	33.14	19.5	108	34.18	23	19
Pro/Cup	54	37.50	22	49	28.49	24	103	32.59	24	20
Mariner	53	36.81	23	42	24.42	27	95	30.06	25	21
Seaside	52	36.11	24	38	22.09	28.5	90	28.48	26	22
BarAs492	35	24.31	28	47	27.33	26	82	25.95	27.5	23.5
Tendez	44	30.56	27	38	22.09	28.5	82	25.95	27.5	23.5