1993
ANNUAL RESEARCH REPORT
concerning
BREEDING AND DEVELOPMENT
OF BENTGRASS

Submitted By:

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1993 RESEARCH REPORT
BREEDING AND DEVELOPMENT OF BENTGRASS

EXECUTIVE SUMMARY

Principle Investigator: Dr. M. C. Engelke
Technical Support: Ms. J. M. Arnold

Research Period: 1 November 1992 through 1 November 1993.

CRENSHAW (Syn3-88) and CATO (Syn4-88) were released in April 1993. Considerable success has been realized in the performance and utility of both grasses especially throughout the southern United States. CATO has been licensed to Pickseed West, Tangent, Oregon and was placed into production in September 1993. Commercial seed stocks will be available in 1994. CRENSHAW has been licensed to Lofts Seed, Inc. Bound Brook, N.J. and was placed in production in September 1993. A limited quantity of seed was available for commercial distribution in 1993. Syn1-88 seed was harvested for a 5 acre production in August 1993. Production approximated 550 pounds per acre and will be used in experimental plantings in cooperation with University personnel and golf course superintendents. Syn1-88 is being evaluated extensively in California and West Texas for salinity tolerance under field conditions.

Five additional elite bentgrasses breeding lines were increased in 1993, with three being entered into the 1993 NTEP bentgrass trials. These new varieties were developed specifically for improvements in heat tolerance- tissue and root, and/or deep root growth characters, disease resistance and turf quality persistence and competitive ability. Syn92-1, Syn92-2 and Syn92-5 were included in the NTEP trials along with Syn1-88. Both CATO and CRENSHAW were sponsored by their respective licensees.

Vegetative selections were identified in the production fields in Oregon from among the progeny of the advanced lines and will be included in test to evaluate total plant performance at TAES-Dallas including vegetative growth characters, turf quality, disease resistance, insect resistance, traffic and salinity tolerance, heat tolerance and root growth characters.

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Dr. M. C. Engelke and Ms. J. M. Arnold

I. 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 Apr. 1985. Semiannual progress reports are submitted 1 May, and annual reports are submitted 1 Nov. each year. This report, with the May 1991 INTERIM REPORT, constitutes the 1991 Annual Progress Report for the Bentgrass Breeding Program.

II. PROFESSIONAL AND TECHNICAL SUPPORT

The Bentgrass Breeding Program has recently added the talents of Ms. Jamie M. Arnold as Research Assistant replacing Mr. Roland M. Murphy who gained employment with Seed Research of Oregon as their Dallas based Warehouse Manager. Ms. Arnold holds a BS degree from Texas A&M University from the Department of Horticulture. Dr. Virginia Lehman Lofts Seeds, Inc. continues to work with the program in assisting in seed production evaluation research in Oregon, in addition to the continued cooperation with Dr. Jerry Pepin, Pickseed West - Tangent Oregon.

III. STATUS OF BENTGRASS RELEASES

CATO (Syn4-88) and CRENSHAW (Syn3-88) were officially released in April 1993. CATO was licensed to Pick Seed West, Tangent, OR with initial commercial seed availability anticipated for the fall 1994. Approximately 90 acres of seed production were established in September 1993 with anticipated yields of 400 - 600 pounds per acre in the first year(36 - 54,000 pounds - 1994) and 500 - 750 pounds per acre in subsequent years. CRENSHAW (Syn3-88) is a high yield Creeping Bentgrass line yielding 600 acres the first year of production and the subsequent 2 years averages approximately 950 pounds per acre. Twelve acres were established in 1989 with an additional 250 acres planted in 1993. Ample quantities of seed will be available for both cultivars in 1994. The abbreviated release documents are included as Appendix A (CATO) and Appendix B (Crenshaw). Bentgrass Research, Inc. (BRI) will be hosting a fund raising tournament November 16, 1993 and in conjunction with Pickseed West, and Lofts Seed, Inc. will host an invitation only breakfast at the upcoming GCSAA conference to promote both

CATO and CRENSHAW as well as to raise the awareness of additional research needs in learning how to best incorporate the new cultivars into existing greens.

CATO and CRENSHAW were each established to nine old bermudagrass greens at Sherrill Park - Richardson, Tx, and during 1993 received approximately 55,000 rounds of golf between April and September. The greens were renovated by deep time aerification, fumigation and reseeding with the bentgrass in September 1992. The course opened for play in January 1993 and will be on display during the Turf Tour for the GCSAA Conference February 3, 1994.

A 5-acre field of Syn1-88 was established in 1992 and provided approximately 2500 pounds of seed in 1993. These seed stocks will be used for Foundation Seed Stocks as well as for extensive testing and evaluation at Universities and in cooperation with interested golf course superintendents. Syn1-88 is a direct reselection of SEASIDE Creeping Bentgrass with concentration on improvement in stability and uniformity, color and turf quality. Salinity test conducted during 1992/93 suggest the salinity tolerance of Syn1-88 remains comparable to Seaside

IV. OREGON BREEDER FIELDS

1993 BREEDER PERFORMANCE NURSERIES were established in Oregon in December 1992 which includes five individual polycross populations (Table IV-1) ranging from four to seven clones per polycross. The polycrosses and parental lines are identified as follows: Syn92-1 which may also be designated Syn1-92 is a six clone synthetic (Table IV-2a), Syn92-2 also acceptable for designation as Syn2-92 is a four clone synthetic (Table IV-2b), Syn92-3 or Syn3-92 also a four clone synthetic (Table IV-2c), Syn92-4 or Syn4-92 is a seven clone synthetic (Table IV-2d) and finally Syn92-5 or Syn5-92 is also a seven clone synthetic (Table IV-2e). The field located near Brooks, OR were planted Dec 15 - 22, 1992. Each field is approximately 0.1 ha in area. Four fields are located near Brooks, OR, the fifth field is located near St. Paul, OR.

Fields were established by transplant using up to 30 progeny plants per parent row per replication, with up to eight replications for each polycross population. Generally, the total plant count in each of the populations will approach 1200 individual plants.

In June 1993 the populations were assessed for numerous agronomic characters. These characters include: leaf type which ranges from straight (1) to highly curly (9), leaf texture ranging from coarse (1) to very fine (9), leaf color based on coloration of the full unmown leaf ranging from yellow(1) to dark green (9), and floral maturity represented by the presence of seed heads where 1 represents no florescence present on June 18 and 9 indicates maximum florescence present.

Note the differences between each of the populations (Table IV-1) for each of these traits. Syn92-4 is characterized as having a highly curly type leaf, Syn92-3 is the finest textured of the group, Syn92-1 is the darkest green color and also the earliest in maturity.

Seed has been harvested from 15 progeny of each of the parents in each of the populations and will be used for additional studies. In addition following the normal rouging process several of the progeny of selected parental lines were eliminated from specific populations to restrict pollen/seed contribution to the next generation. Generally rouging occurred due to incompatibility of individual plants based on plant type or floral habit.

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 clone include: TAES 2831, 3153, 3250, 3307, 3794 and 3799. Sufficient seed was harvested from Syn92-1 to enter it into the national turf trials. I would generally classify Syn92-1 to be in the late maturity group. It should be a reasonably good seed yielder. Several plants were removed from the population as incompatible types. Additionally, approximately 17 plants were selected as unique, superior phenotypes for advanced testing and evaluation for vegetative and biological traits. These individual plants will be established vegetatively at TAES-Dallas in the fall 1993.

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. Syn92-2 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. Syn92-2 is moderately coarse textured with an intermediate leaf type. Ten individual plants were further selected for additional evaluations for vegetative and biological turf characters. These individual plants will be established vegetatively at TAES-Dallas in the fall 1993.

Syn92-3 is also a four clone synthetic for which selection was based primarily on very fine leaf texture with some curly stolon/leaf growth evident. Individual clones comprising this clone include: TAES 3293, 3783, 3796, and 3800. Syn92-3 is a late maturing population and due to the lateness of the variety sufficient seed was not available for entry into the national turf trial. This experimental variety is grown at the Grassman Farm near St. Paul, OR. Severe rouging was imposed to enhance uniformity. Most of the parental clones in this plant were rogued from CATO or CRENSHAW breeder fields. None of these parents were included in the final constitution of either CATO or CRENSHAW. This cultivar may be more important as a germplasm resource than as an experimental variety. Sufficient seed will be collected next year to permit more extensive testing and evaluation of its performance potential.

Syn92-4 is a seven clone synthetic which is one of the latest maturity groups under increase. Individual clones comprising this clone include: TAES 2852, 2915, 2916, 2922, 3153, 3225 and

3307. No seed was harvested from this nursery in 1993. Syn92-4 is composed of a high frequency of curly leaf types (Figure 1). It is noted in the various nurseries that such types generally are late maturing. Sufficient seed should be available of this variety to provide for extensive testing and evaluation in 1994 and beyond..

Syn92-5 is a seven clone synthetic (Table IV-2e) which is the earliest and potentially one of the highest yielding of the experimental varieties under development. The variety coarser texture with intermediate to good genetic color. Individual clones comprising this clone include: TAES 2833, 2845, 2916, 2922, 3106, 3293 and 3307. Sufficient seed should be available of this variety to provide for extensive testing and evaluation in 1994 and beyond..

It should be noted that several of these clones are being used in various combinations such as TAES2916 in Syn92-2, Syn92-4 and Syn92-5, or TAES 3307 in Syn92-1, Syn92-4 and Syn92-5. These clones has been selected either as an excellent source of disease resistance (2916) or fine leaf texture (3307) and is generally phenotypically compatible with the clones in these groups. As such, the progeny when harvested from the maternal clone will have been pollinated by different potential pollen sources. By examining the diversity and or stability of the progeny, based on phenotypic performance of the progeny, the maternal character of the plant can be determined, i.e., does this maternal plant produce strong progeny overall, and are there specific parental combinations better than others. Several of these parental clones have been included, with progeny in the polycross nursery and in the hot water heat bench studies included in this report. The frequency distributions of each of the populations of these agronomic parameters are also present in graphic form to better depict their unique descriptions. Included in each of the graphs is the mean and range of observations for each trait by population (Figures 1 - 4).

Table IV-1. Agronomic comparisons between the 1992 breeder blocks in Brooks Oregon - June 1993.

Population	#Parents	Leaf type	Leaf texture	Leaf color	Floral maturity
Syn92-1	6	2.8	3.8	6.6	4.5
Syn92-2	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
Syn92-5	7	3.6	3.1	.	3.1
Average		3.7	3.4	6.2	3.5

Table IV-2a. Agronomic traits measured on progeny populations of Syn92-1 a six clone synthetic - June 1993, Brooks, OR.

Parents	#OBS	Leaf type	Leaf texture	Leaf color	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

Table IV-2b. Agronomic traits measured on progeny populations of Syn92-2, a four clone synthetic June 1993, Brooks OR.

Parents	#OBS	Leaf type	Leaf texture	Leaf color	Floral maturity
2859	90	3.9	2.8	5.6	3.6
2916	90	3.7	2.9	6.2	4.2
2922	90	3.5	3.0	6.6	3.7
3276	90	2.7	2.9	6.1	4.9
Average		3.4	2.9	6.2	4.1

Table IV-2c. Agronomic traits measured on progeny populations of Syn92-3, a four clone synthetic June 1993, Brooks OR.

Parents	#OBS	Leaf type	Leaf texture	Leaf color	Floral maturity
3293	90	4.0	5.4	6.0	2.6
3783	90	3.2	4.0	6.1	2.5
3796	90	5.2	5.1	6.0	3.0
3800	90	4.5	5.4	6.4	2.5
Average		4.2	4.9	6.1	2.6

Table IV-2d. Agronomic traits measured on progeny populations of Syn92-4, a seven clone synthetic June 1993, Brooks OR.

Parents	#OBS	Leaf type	Leaf texture	Leaf color	Floral maturity
2852	90	3.2	2.6	5.8	4.2
2915	90	4.0	3.0	6.1	3.1
2916	90	3.9	2.4	5.8	3.9
2922	90	4.9	2.8	6.0	4.3
3153	90	4.6	3.6	6.2	3.8
3225	90	5.7	2.9	6.0	3.4
3307	90	4.8	4.1	6.1	2.9
Average		4.4	3.1	6.0	3.6

Table IV-2e. Agronomic traits measured on progeny populations of Syn92-5, 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

Fig 1. Seed Production - Field Performance for 1992

Bentgrass Breeder Lines Population Frequency Distribution
Leaf Texture

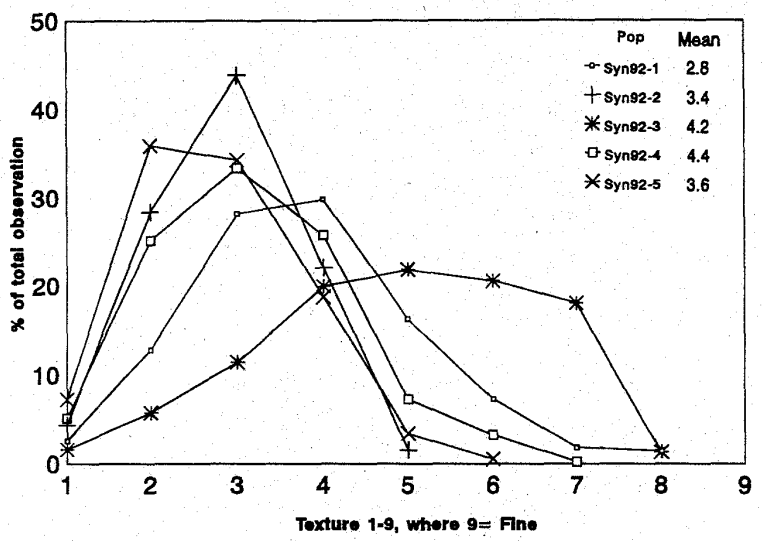


Fig 2. Seed Production - Field Performance for 1992

Bentgrass Breeder Lines Population Frequency Distribution
Leaf Type

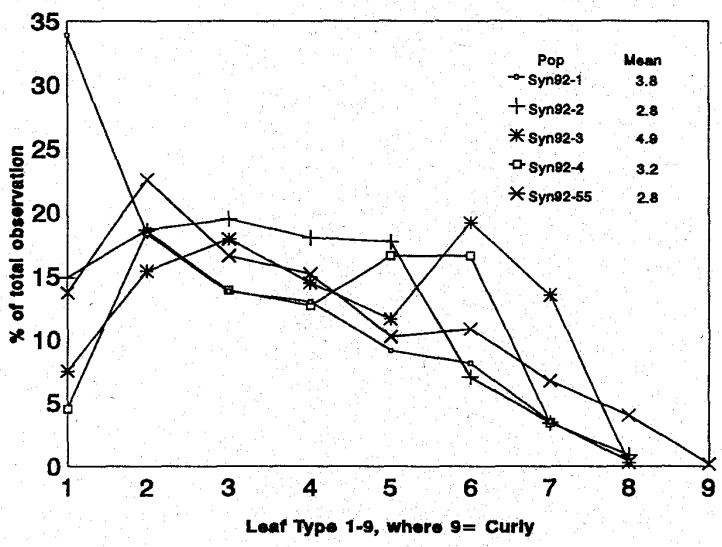


Fig 3. Production - Field Performance for 1992

Bentgrass Breeder Lines Population Frequency Distribution
Color

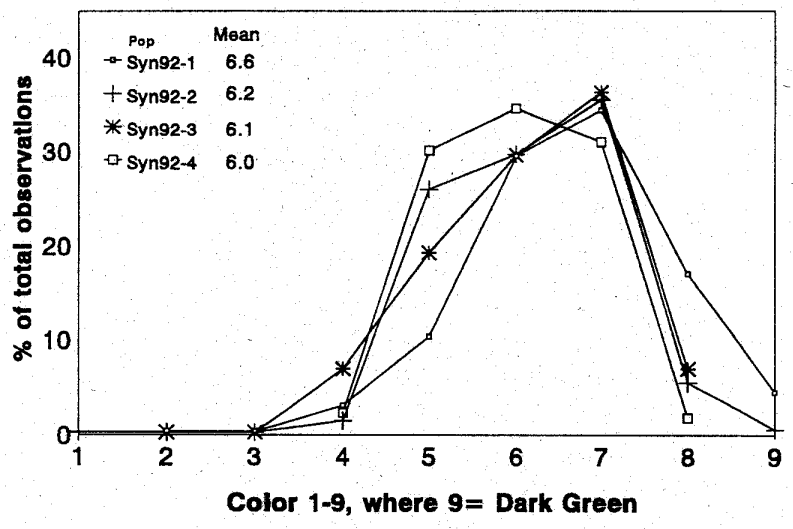
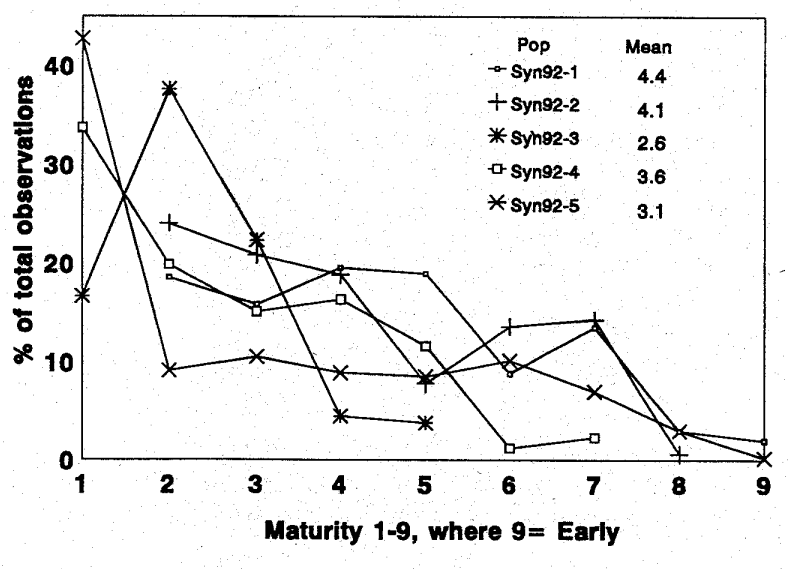


Fig 4. Seed Production - Field Performance for 1992

Bentgrass Breeder Lines Population Frequency Distribution
Maturity



V. BENTGRASS SELECTION AND PERFORMANCE UNDER HIGH SOIL TEMPERATURES.

A hot water supplied heat bench was constructed in 1982 as a research tool to evaluate plant persistence and varietal performance under controlled high soil temperatures.

The bench measures 1.5 m wide, 2.7 m long and 0.6 m deep. The soil media is 100% silica sand for a depth of 0.5 m. Soil temperature is controlled by circulating water form a thermostatically controlled water heater through a grid of copper pipes spaced 15.2 cm apart running by length and with of the bench at a constant depth of 10 cm. Continuous monitoring of soil temperatures with multiple thermotransducers indicate soil temperatures may very by +\- 2 C° across the bench.

Each 15.2 cm^2 grid was fitted with nine 3.8 cm dia by 6 cm deep open ended plastic inserts, arranged in a 3 x 3 pattern. The bench has 84 such grids allowing for a total of 756 individual plants to be evaluated simultaneously. The outer 5 cm edge of the bench is sodded to a standard grass variety to provide some degree of environmental buffering.

The center cell of each grid was vegetatively planted to Penncross creeping bentgrass to serve as a check. The remaining eight positions were randomly assigned to two unique populations consisting of one parent (maternal) and three progeny. Space permitting and plant material available six replications of each parent-progeny populations were included. The parents were vegetatively propagated for this study, whereas the progeny each represent unique individuals of the maternal population.

Table V-1. Creeping Bentgrass polycross population survival from parent-progeny populations exposed to high soil temperatures (44°C) for 6 weeks. Scale from 0 - 9 where 0 = no survival. Trials conducted in greenhouse Heat bench at TAES-Dallas.

Polycross Population	# Maternal Clones	1993 20Jul[1]	4Aug[1]	14Aug[1]	25Aug[1]	2Sept[1]	Mean[1]	TPI
N	4	6.9a[2]	6.9a	5.8a	4.1	1.1a	5.0a	5
J	4	6.8a	6.7a	4.7	6.3a	0.0	4.9a	4
L	5	6.7a	6.7a	5.6a	4.5	0.4	4.8a	4
B	9	6.7a	6.6a	5.3a	4.8	0.4	4.7	3
C	10	6.9a	6.6a	5.0	4.6	0.4	4.7	2
I	7	6.8a	6.8a	4.8	4.6	0.5	4.7	2
E	10	6.6a	6.7a	5.1a	4.7	0.2	4.7	3
K	5	6.7a	6.4	5.3a	4.8	0.1	4.6	2
A	8	6.6a	6.7a	4.4	4.8	0.3	4.6	2
D	4	6.5	6.7a	3.6	4.8	0.3	4.4	1
PENN		6.6a	6.7a	4.7	4.9	0.3	4.6	2
Parental Grp	28	6.5	6.7a	4.7	4.8	0.2	4.6	1

[1] Means included in calculation of Turfgrass Performance Index (TPI) which is the frequency of occurrence an entry was in the highest statistical grouping (a).

[2]Means within a column followed by an "a" indicate performance was in the highest statistical group using the Waller-Duncan k-ratio t test (k=100).

Table V-2. Creeping Bentgrass progeny survival for parent-progeny polycross populations exposed to high soil temperatures (44 °C) for 6 weeks. Scale from 0-9, where 0 = no survival. Trials conducted in greenhouse Heat bench at TAES-Dallas.

Maternal Clone	Polyx Pop	Parental Average	1993 20Jul[1]	4Aug[1]	14Aug[1]	25Aug[1]	2Sept[1]	Mean[2]	TPI[2]
2922	B[5]	4.9A[3]	6.9a[4]	6.7a	5.6a	4.4	1.0a	4.9a	5
2798	B	4.9A	7.0a	7.0a	5.2a	4.8	0.6a	4.9a	5
2915	CEL	4.8A	6.8a	6.6	6.0a	4.3	0.7a	4.9a	4
3276	AIN	4.6A	6.8a	6.9a	5.1a	4.6	0.8a	4.9a	5
2916	CN	4.8A	6.7a	6.7a	5.8a	4.4	0.7a	4.8a	5
2833	CE	4.9A	7.0a	7.0a	5.2a	4.8	0.1	4.8a	4
3165	B	4.8A	6.7a	7.0a	5.6a	4.8	0.1	4.8a	4
3307	CE	4.6A	6.8a	7.1a	5.3a	4.7	0.1	4.8	4
3250	AK	4.8A	6.8a	6.5	5.7a	4.6	0.3	4.8a	3
2845	EJK	4.7A	6.9a	6.6	5.2a	5.2a	0.0	4.8a	4
3153	CE	4.6A	7.0a	6.8a	5.0a	4.8	0.1	4.7a	4
3271	I	4.7A	6.9a	6.9a	4.8	4.9a	0.1	4.7a	4
2852	DL	4.7A	6.7a	6.8a	4.7	4.8	0.5a	4.7a	4
9999	A	4.7A	6.8a	7.0a	4.7	4.8a	0.0	4.7a	4
2859	DLN	4.6A	6.6a	6.8a	4.8	4.7	0.2	4.6a	3
3225	BCK	4.6A	6.6a	6.6	4.9	4.8a	0.2	4.6	2
3120	E	4.6A	6.9a	6.7	4.5	5.0a	0.0	4.6	2
3283	AEI	4.5A	6.8a	6.7a	4.5	4.8a	0.1	4.6	3
3285	AI	4.4A	6.4	6.8a	4.8	4.7	0.1	4.6	1
3106	AI	4.5A	6.6a	6.6	4.5	4.7	0.3	4.5	
2831	EL	4.5A	6.3	6.6	4.8	4.5	0.3	4.5	
2856	BCE	4.3A	6.4	6.3	5.0	4.6	0.2	4.5	1
3171	B	4.7A	6.4	6.3	4.8	4.8	0.0	4.5	
2784	DL	4.4A	6.4	6.7a	4.0	4.7	0.3	4.4	1
3293	ABI	4.1	6.5a	6.6	3.8	4.6	0.4	4.4	1
3141	CD	4.0	6.3	6.4	3.6	4.8	0.1	4.2	
2799	B	3.9	5.6	5.9	4.1	4.8	0.2	4.1	
PENN		6.6a	6.7a	4.7	4.9a	0.3	4.6a	4.0	3

[1] Means included in calculation of Turfgrass Performance Index (TPI) which is the frequency of occurrence an entry was in the highest statistical grouping (a). Rounding error may result in similar values in different statistical groups.

[2]Means calculated on basis of progeny only. Parental performance is not included in this mean or for calculation of TPI.

[4]Means within this column are for comparison of parental lines only and those followed by an "A" indicate performance was in the highest statistical group using the Waller-Duncan k-ratio t test (k=100).

[4]Means within a column followed by an "a" indicate performance was in the highest statistical group using the Waller-Duncan k-ratio t test (k=100).

[5]Polyx pop refers to the polycross populations generated in 1990 as listed in Table 4 - 1990 Annual Bentgrass Research Report p8.

VI. PARENT-PROGENY POLYCROSS POPULATION

The parent-progeny polycross population under evaluation in the modified soil based putting green (est1987) was established from crosses made during 1990. (See 1990 Annual Bentgrass Research Report - Table 4). Each parental line or TAES accession was used in one or more polycross isolation nurseries (A-N). Seed was harvested by maternal clone for each polycross. Progeny plantings of each maternal cross were established as individual plants in greenhouse cell-packs. These plants were transferred to replicated field trials in April 1993. Six progeny and its vegetatively propagated maternal plant were planted in parent progeny rows with each plot measuring 18" x 18" and each row measuring 18" x 126" with three replications in a Randomized Complete Block design.

A total of 10 polycross populations involving 28 maternal lines are under evaluation for turf quality and general field performance. The objective of this study is to evaluate the parental performance based on progeny performance. Simultaneously we will have the opportunity to select superior progeny for additional testing and evaluation. Quality notes were reported on the individual plants throughout the summer of 1993.

Turf quality, rated on a 1 - 9 scale, where 9 = best, for 10 polycross populations is presented in Table VI-1. Turf Performance Index (TPI) for quality is calculated as the frequency an entry occurs in the top statistical grouping during the conduct of a study. Population L is a five clone synthetic which includes clones TAES#2784, 2831, 282, 2859 and 2915. It's TPI = 5 and is the highest rated population in the study thus far. A close second in Population I which is a seven clone synthetic which includes TAES#3106, 3250, 3271, 3276, 3285, 3293 and 9999. There is no duplication of clones between the two populations (Table VI-2) which suggest that considerable diversity may exist in genetic background at a relatively high performance level.

The individual parents used in the various combinations (Table VI-2) also provided a range in progeny performance. The polycross populations for which each clone was included is listed along with the phenotypic performance of the clone itself, as well as the average performance of the progeny during the summer of 1993. Note clones TAES#3271, 3293, 3283, 3276, 2852 and 2831 consistently average higher that other progeny populations (TPI=5) although parental performance of these lines was not necessarily superior to any others.

This nursery is presently being maintained at 4.7 mm with daily mowing. The height of cut will be lowered to 3.1 mm and simulated traffic will be imposed to further stress the plants. Periodic visual notes will be recorded for turf quality, texture, density, plant growth habit and any disease response noted under field conditions.

Table VI-1. General turf quality (1 to 9, where 9 = best) averaged over polycross populations grown on modified sand greens at TAES-Dallas. Field vegetatively established in April 1993.

Polycross Population	# Maternal Clones	5-May[1]	5-Jun[1]	9-Aug[1]	23-Sep[1]	Mean[1]	TPI
L	5	7.3a[2]	7.3a	7.3a	7.3a	7.3a	5
I	7	7.1a	7.1a	7.1a	7.1a	7.1	4
B	9	7.0a	7.0a	7.0	7.0	7.0	2
A	8	6.9	6.9	7.0	7.0	7.0	-
N	4	7.0a	6.9	7.0	6.9	7.0	1
E	10	6.9	6.9	7.0	7.0	7.0	-
D	4	6.9	6.9	6.9	7.0	7.0	-
J	4	6.8	6.8	6.8	6.8	6.8	-
C	10	6.7	6.7	6.7	6.7	6.7	-
K	5	6.6	6.6	6.6	6.6	6.6	-
Parents	28	6.1	6.2	6.6	6.7	6.4	-

[1] Means included in calculation of Turfgrass Performance Index (TPI) which is the frequency of occurrence an entry was in the highest statistical grouping (a).

[2]Means within a column followed by an "a" indicate performance was in the highest statistical group using the Waller-Duncan k-ratio t test (k=100).

Table VI-2. General turf quality (1 to 9, where 9 = best) for parent-progeny polycross populations grown on modified sand greens at TAES-Dallas. Field vegetatively established in April 1993.

Maternal Clone	Polyx Pop	Parental Average	5May[1]	5June[1]	9Aug[1]	23Sep[1]	Mean[2]	TPI[2]
3271	AIM[5]	7.3A[3]	7.2a[4]	7.2a	7.2a	7.2a	7.2a	5
3293	ABFIM	6.8	7.0a	7.0a	7.2a	7.2a	7.1a	5
3283	AEHIM	7.3A	7.0a	7.0a	7.1a	7.1a	7.1a	5
3276	AIMN	6.7A	7.1a	7.0a	7.1a	7.0a	7.0a	5
2852	CDL	6.9A	7.0a	7.1a	7.0a	7.1a	7.0a	5
2831	EHL	7.2A	7.1a	7.0a	7.1a	7.0a	7.0a	5
2784	DL	6.8A	7.0a	7.0a	7.0a	7.0a	7.0a	5
2915	CEFL	6.4	7.0a	7.0a	7.0a	7.0a	6.9	4
3171	B	7.0A	7.1a	6.8a	7.1a	6.8a	6.9	4
3225	BCGJK	7.0A	6.9a	6.9a	6.9a	6.9a	6.9	4
3165	BG	6.7A	6.9a	7.0a	6.9a	7.0a	6.9	4
3141	CDG	6.5	6.9a	6.9a	6.9a	6.9a	6.9	4
2856	BCE	7.3A	6.9a	6.9a	6.9a	6.9a	6.9	4
2859	DHLN	6.4	6.9a	6.8a	6.9a	6.8a	6.9	4
3285	AHIM	7.3A	6.8a	6.8	6.8a	6.9a	6.8	3
2798	B	6.0	6.9a	6.8a	6.9a	6.8a	6.8	4
3307	CEFJKM	6.5	6.8a	6.8a	6.8a	6.8a	6.8	4
3153	CEFJ	6.1	6.8a	6.8a	6.8a	6.8a	6.8	4
2833	CEF	7.1A	6.8a	6.8a	6.8a	6.7a	6.8	4
2799	BG	6.7A	6.8a	6.8a	6.8a	6.8a	6.8	4
3250	AHK	6.8A	6.8a	6.8a	6.8a	6.8a	6.8	4
2922	BCFN	6.2	6.8a	6.8a	6.8a	6.8a	6.8	4
2845	EFJK	6.5	6.8a	6.8a	6.8a	6.8a	6.8	4
2794	BH	5.8	6.7	6.7	6.7a	6.7a	6.7	2
3106	AFHIKM	3.6	6.3	6.2	7.1a	7.2a	6.7	2
2916	CEFN	5.7	6.5	6.5	6.5	6.5	6.5	-
9999	AI	3.1	6.0	6.1	6.8a	7.0a	6.5	2
3120	EFM	3.0	6.0	5.8	6.6a	6.8a	6.3	2

[1] Means included in calculation of Turfgrass Performance Index (TPI) which is the frequency of occurrence an entry was in the highest statistical grouping (a). Rounding error may result in similar values in different statistical groups.

[2]Means calculated on basis of progeny only. Parental performance is not included in this mean or for calculation of TPI.

[4]Means within this column are for comparison of parental lines only and those followed by an "A" indicate performance was in the highest statistical group using the Waller-Duncan k-ratio t test (k=100).

[4]Means within a column followed by an "a" indicate performance was in the highest statistical group using the Waller-Duncan k-ratio t test (k=100).

[5]Polyx pop refers to the polycross populations generated in 1990 as listed in Table 4 - 1990 Annual Bentgrass Research Report p8.

VII. VEGETATIVE CREEPING BENTGRASS SELECTIONS

Assessment of genotype performance continues in the greenhouse, field and laboratory, with screening of germplasm. Approximately 73 superior plants were selected from the breeder fields of Syn92-1 through Syn92-1 in Brooks and St. Paul, Oregon and are being evaluated for vegetative growth characters, heat and salinity tolerance, root growth characters and turf quality beginning in 1993 (VII-1). Invaluable cooperation continues from Pickseed West, with Dr. Jerry Pepin and Mr. Doug King, as well as Dr. Virginia Lehman with the Lofts Seeds, Inc.

Table VII-1. Vegetative bentgrass selected form breeder fields of Syn92-1 through Syn92-5 from Brooks, Or. Plant materials vegetatively increased and entered in production and performance trials at TAES-Dallas 1993.

TAES NUMBER	PARENT NUMBER	BREEDER LINE	FIELD SITE	TAES NUMBER	PARENT NUMBER	BREEDER LINE	FIELD SITE
4039	3794	SYN92-1	(2-19)	4075	2852	SYN92-4	(11-10)
4040	3307	"	(6-25)	4076	3153	"	(13-5)
4041	3387	"	(9-7)	4077	2915	"	(14-32)
4042	3794	"	(10-16)	4078	3225	"	(15-29)
4043	2831	"	(11-24)	4079	2852	"	(16-5)
4044	3250	"	(13-15)	4080	2852	"	(16-26)
4045	3794	"	(15-20)	4081	2916	"	(19-9)
4046	3794	"	(15-28)	4082	2922	"	(20-31)
4047	3153	"	(17-16)	4083	2852	"	(22-17)
4048	3153	"	(17-20)	4084	2952	"	(22-19)
4049	3307	"	(19-13)	4085	3307	"	(23-24)
4050	3794	"	(12-1)	4086	3307	"	(23-25)
4051	3153	"	(24-22)	4087	2922	"	(30-31)
4052	3153	"	(24-26)	4088	2916	SYN92-5	(1-26)
4053	3799	"	(26-2)	4089	3106	"	(2-9)
4054	3153	"	(27-9)	4090	3106	"	(2-13)
4055	3153	"	(27-15)	4091	3106	"	(2-34)
4056	3153	"	(27-20)	4092	3293	"	(3-4)
4057	3794	"	(29-17)	4093	2922	"	(4-11)
4058	3153	"	(32-6)	4094	2845	"	(5-24)
4059	3794	"	(34-2)	4095	3307	"	(7-7)
4060	3794	"	(34-13)	4096	3307	"	(7-9)
4061	3794	"	(34-16)	4097	3307	"	(7-13)
4062	2922	SYN92-2	(2-17)	4098	3307	"	(7-23)
4063	3276	"	(8-28)	4099	3307	"	(7-27)
4064	2922	"	(13-14)	4100	3307	"	(7-32)
4065	2922	"	(19-14)	4101	2833	"	(10-13)
4066	2922	"	(20-16)	4102	2916	"	(14-17)
4067	2922	"	(23-3)	4103	2833	"	(15-19)
4068	2922	"	(23-30)	4104	2922	"	(16-22)
4069	2922	"	(26-28)	4105	2922	"	(16-25)
4070	3276	"	(28-17)	4106	2922	"	(16-30)
4071	2922	SYN92-4	(1-25)	4107	2922	"	(16-33)
4072	3153	"	(2-2)	4108	2922	"	(25-4)
4073	2852	"	(5-24)	4109	2922	"	(25-21)
4074	2852	"	(5-30)	4110	2922	"	(25-35)
				4111	3307	"	(28-27)

VIII. NOTABLE PUBLICATIONS

Lehman, V. G., and M. C. Engelke. 1993. Heritability of creeping bentgrass shoot water content under soil dehydration and elevated temperatures. TA#30155. Accepted for publication Crop Sci 33: Sept-Oct.

Lehman, V. G., M. C. Engelke, and R. H. White. 1993. Leaf water potential and relative water content variation in Creeping Bentgrass clones. TAES TA#31068 Submitted for publication Crop Sci .

M. C. Engelke, V. G. Lehman, W. R. Kneebone, P. F. Colbaugh, J. A. Reinert and W. E. Knoop, 1994, Registration of CRENSHAW Creeping Bentgrass. Submitted to Crop Science Sept 1993.

M. C. Engelke, V. G. Lehman, C. Mays, P. F. Colbaugh, J. A. Reinert, and W. E. Knoop, 1994. Registration of CATO Creeping Bentgrass. Submitted to Crop Science Sept 1993.