TENTH
ANNUAL PROGRESS REPORT
concerning
BREEDING AND DEVELOPMENT
OF BENTGRASS
Submitted By:

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BREEDING AND DEVELOPMENT OF BENTGRASS

1994 RESEARCH REPORT
BREEDING AND DEVELOPMENT OF BENTGRASS

EXECUTIVE SUMMARY

Principle Investigator: Dr. M. C. Engelke
Technical Support: Ms. J. M. Arnold
Student Intern: Ms. N. M. Tiers

Research Period: 1 November 1993 through 1 November 1994.

CRENSHAW and CATO 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 was been licensed to Pickseed West, Tangent, Oregon and was commercially available in quantity in the fall 1994. CRENSHAW was been licensed to Lofts Seed, Inc. Bound Brook, N.J. and was commercially available with limited supplies in 1993. CRENSHAW's performance has steadily increased its demand in 1994 and regardless of increased production, seed was in heavy demand far exceeding available supply. Syn1-88 is a reselection from Seaside and has been optioned to Pick Seed West for increase and will be commercially available in 1995. Syn1-88 is recognized for its low maintenance requirements and excellent salt tolerance. Syn1-88 is being evaluated extensively in California and West Texas for salinity tolerance under field conditions.

Burlingham & sons have negotiated an option agreement with Texas A&M for testing and evaluation rights on Syn92-1 and Syn92-5 creeping bentgrasses. Other grasses within the 1992 series are under negotiations at press time. Four 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.

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.

1994 RESEARCH REPORT
BREEDING AND DEVELOPMENT OF BENTGRASS

Dr. M. C. Engelke, Ms. J. M. Arnold and Ms. N. M. Tiers

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

Ms. Jamie M. Arnold holds the position of Research Assistant since June 1993 . She has a BS degree in Horticulture from Texas A&M University. Ms. Natalie Tiers has worked on the project from the past 6 months as a foreign exchange student from Institut Superieur d;Agriculture - Membre de l'Universite Catholique de Lille, Lille Cedex, France. She has worked closely with Ms. Arnold in research of bentgrass breeding.

III. STATUS OF BENTGRASS RELEASES

THE 1988 SERIES OF CREEPING BENTGRASSES

CATO (Syn4-88) and **CRENSHAW** (Syn3-88) were officially released in April 1993. CATO was licensed to Pick Seed West, Tangent, OR with the first commercial seed being available in the fall 1994. CRENSHAW (Syn3-88) is a high yield creeping bentgrass cultivar producing nearly 800 pounds of seed per acre in its first year of production. Second and subsequent years production approach 1000 pounds per acre. Twelve acres were established in 1989 with an additional 250 acres planted in 1993. The high demand for "Crenshaw" resulted in short supplies again in 1994, regardless of its high seed yield and added acreage. Approximately 35,000 pounds of seed were available of CATO this fall 1994 and all stocks have been sold.

A 5-acre field of **Syn1-88** was established in 1992 and provided approximately 2500 pounds of seed in 1993 and again in 1994. 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. To date plantings have been made at; Denver Country Club,

Colorado were Syn1-88 is being evaluated for performance under fairway conditions, as well as at Midland and Odessa Country Clubs, Texas testing for salinity tolerance under greens conditions. 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 In September 1994, Pickseed West requested and received an option agreement to initiate production of Syn1-88. The release of Syn1-88 is in the final stages of review and evaluation. Seed should be available in the fall of 1995.

THE 1992 SERIES OF CREEPING BENTGRASSES

The 1992 series of creeping bentgrasses are presently in the 1993 National Turfgrass Evaluation Program and are identified as Syn92-1, Syn92-2, Syn92-4 and Syn92-5. Approximately 5 pounds of seed were harvested from each breeder field in 1993 for entry in to the NTEP. Production in 1994 ranged from 35 - 50 pounds for each of the varieties permitting further testing and evaluation. In our attempts to be more efficient in our breeding program, we were able to enter in to cooperative agreements with members of industry to aid in further development of these grasses. Through the options contracts, the licensee To date a single contract has been effected involving two or the 92 series grasses.

Specifically, E. F. Burlingham & Sons, Forest Grove, Oregon has received and Option agreement on Syn92-1 and Syn92-5 effective September 1994 for advanced testing and evaluation of these varieties. Limited acreage of each 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. This includes covering testing and evaluation cost for each of the varieties provided. See appendix for Burlingham & Sons mailer dated Oct 21, 1994.

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 1993 to enter Syn92-1 into the National Turf Evaluation Trials. Approximately 40 pounds of seed were harvested in 1994. Burlingham has initiated a 5+ acre seed increase planting from which sufficient seed will be available in 1995 for advanced testing. I would generally classify Syn92-1 to be in the late maturity group. It should be a reasonably good seed yielder. Heavy selection for plant type and flowering occurred in 1993 , with minimal selection pressure primarily for floral niching in 1994 results in a variety possessing multiple physiological and pathological advantages over existing cultivars.

The second variety chosen by Burlingham and Sons is:

Syn92-5 which is a seven clone synthetic (Table IV-2e) and is earlier and potentially one of the highest yielding of the experimental varieties under development. The variety is 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 was harvested 1993 to enter Syn92-5 into the National Turf Evaluation Trials. Approximately 50 pounds of seed were harvested in 1994. Burlingham has initiated a 5+ acre seed increase planting from which sufficient seed will be available in 1995 for advanced testing. Sufficient seed should be available of this variety to provide for extensive testing and evaluation in 1995 and beyond..

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 and in 1994 approximately 40 pounds were produced.. Syn92-2 is moderately coarse textured with an intermediate leaf type. This particular grass is under negotiations for option to obtain for advanced testing and evaluation by a partnership between two major turf distributors. Notification of contract will be announced when signatures and terms are finalized.

Syn92-4 is the only variety that is still available from the 92 Series.yet unspoken for. 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, however sufficient seed was produced during 1994 for advanced testing.

IV. OREGON BREEDER FIELDS

1993 BREEDER PERFORMANCE NURSERIES were established in Oregon in December 1992 which included five individual polycross populations as previously defined. The breeder nurseries of Syn92-1, Syn92-2, Syn92-4 and Syn92-5 will be continued for another year. The breeder nursery identified as Syn92-3 located in St. Paul, OR was discontinued. Seed was harvested from individual plants and the entire nursery was destroyed.

V. PARENT-PROGENY POLYCROSS POPULATION

The parent-progeny polycross population under evaluation in a modified soil based putting green was established in 1993 from crosses made during 1990. Each parental line or TAES accession was used in one or more polycross isolation nurseries identified as A thru N (Table 1). Seed was harvested by maternal clone for each polycross. Replicated Parent-Progeny nursery was established for most maternal clones 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 compared to Penncross is presented in Table 2. 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 E with a TPI = 4 is a 10 clone synthetic (see Table 1) and has the highest overall mean of 6.7. Populations K, C and I also within the highest overall mean group are 5, 10 and 7 clone synthetics and rank second in TPI = 3. Note that populations L and J have higher overall means but lower TPI's.

Parental means based on progeny performance demonstrated considerable genetic variability (Table 3). Maternal clone 2915 had the highest overall progeny mean, but ranked second for TPI with a 3 out 4 possible. Clones 2833 and 2831 both had the highest TPI = 4 and ranked among the highest in both parental and progeny means. 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 1994. Clone 3307 had the highest parental mean (7.1) with a progeny mean in the upper group, however, it TPI =2 rating would suggest that this clone is highly susceptible to environmental fluctuations and may not be the best parent available. Note clones TAES# 2833, 2831, 3271, 2784, 2915 consistently average higher that many other progeny populations although parental performance of these lines was not necessarily superior to any others.

This nursery is presently being maintained at 5/32 inches with daily mowing and will be under continued evaluation for at least one more year. The height of cut will be lowered to 1/8 inches 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.

VI. 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 Syn92-5 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 (Table 4) and for genetic color (Table 5). It is interesting to note the origin of many of the vegetative plants. Eighteen of the 73 vegetative clones are progeny of parental clone 2922, 11 from parental clone 3307, 10 from parental clone 3153, and nine from parental clone 3794. These four parents account for over 65% of all of the vegetative selections. Root heat tolerance, salinity, and root growth characters, are planned for the near future assessment along with field turf quality parameters. Future studies will include disease and insect response and vegetative growth rates and establishment characters.

VII. SCREENING GERMPLASM FOR INSECT RESISTANCE

Dr. James A Reinert assumed full time research responsibilities in July 1994 and in addition to previous work (see Appendix B), has initiated more intensive host-plant resistance studies involving numerous turfgrass species involving the creeping bentgrasses. A portion of the support provided by USGA is being directed to support activities in the area of host-plant resistance studies with both of this species.

Future work will also be directed toward screening the hybrids of numerous germplasm lines in search for additional sources of resistance to insects such as: fall army worm, black cut worm, tropical sod web worm etc.

It is our philosophy that the development of drought tolerant, water use efficient plant materials and the development and acceptance of appropriate management practices will result in a substantial change in the microenvironment in which the plant community lives. This will include the environment for all supporting and allied organism as well. Theoretically we should see a substantial reduction in the incidence of the common diseases presently impacting our turf since most of these require high humidity (frequent irrigation) and high fertility (frequent heavy fertilization). Once reductions are realized in both frequency and intensity of irrigation and fertilization a less favorable disease environment should result. However, we very well may see the environment also being changed in favor of increased insect activity which generally favor a lower moisture environment, but also proliferates where a plant is growing slower enabling the insect population to "get ahead" of the plant resulting in greater damage being evident. To that end, collaboration with Dr. Reinert can and will play and important role.

Table 1. A listing of the 1990 Polycross populations developed in Tangent Oregon June 1990. Each population will be referenced as a Synthetic (SYNx -90), where x = A thru N. The information presented is of the number of progeny successfully produced, germinated and established in the greenhouse in 1990. *Reproduction of Table 4, page 8 of 6th Annual Report*

	Polycross population or SYNx-90													
TAES Accession#	A	B	C	D	E	F	G	H	I	J	K	L	M	N
2784				108								108		
2794		3						72						
2798		72												
2799		29					72							
2831					108			72				39		
2833			108		108	72								
2845					108	72				108	72			
2852			108	108								108		
2856		108	108		108									
2859				108				72				72		144
2860							72	72						
2915			108		72	72						108		
2916			108		108	72								60
2922		108	108			72								72
3106	108					72		72	56		0		72	
3120					108	72							72	
3141			108	0			72							
3153			108		108	72				0				
3165		108					72							
3171		108												
3225		108	108				72			0	51			
3250	108							72			72			
3271	108								72				72	
3276	108								72				72	72
3283	108				108			72	72				72	
3285	108							72	72				72	
3293	85	108				72			72				72	
3307			108		108	72				O	O		54	
9999	108								72					
Total # Parental Clones	8	9	10	4	10	10	5	8	7	4	5	5	8	4
Total # progeny 841	752	1080	324	1044	720	360	576	488	108	197	435	558	348	7831

Table 2. General turf quality (1 to 9, where 9 = best) averaged over polycross populations grown on modified sand greens at TAES-Dallas. Field vegetatively in April 1994.

Polycross Population	# Maternal Clones	1994 5Jan[1]	24Jan[1]	15Feb[1]	23Jun[1]	Mean	TPI
E	10	6.0a[2]	7.4a	6.9a	6.7a	6.7a	4
L	5	5.4	6.9	7.2a	7.0a	6.6a	2
J	4	6.4a	6.9	6.1	6.5a	6.5a	2
K	5	5.8a	7.5a	5.9	6.7a	6.5a	3
PENN	28	6.0a	6.9	6.1	6.9a	6.5a	2
C	10	5.9a	6.6	6.7a	6.5a	6.4a	3
D	4	6.2a	6.7	6.3	6.4a	6.4a	2
I	7	6.3a	7.5a	5.2	6.4a	6.3a	3
N	4	5.9a	6.6	6.3	6.6a	6.3a	2
A	8	6.2a	6.2	6.0	6.5a	6.2	1
B	9	5.8a	6.3	5.8	6.4a	6.1	1
Parental Grp	28	6.0a	6.9	6.2	6.6a	6.4a	3

[1]Observations included in calculation of Turfgrass Performance Index (TPI) which is the frequency of occurrence an entry was in the highest statistical grouping (a). Does not include the overall mean.
[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 3. General turf quality (1 to 9, where 9 = best) for parent-progeny polycross populations grown on modified sand green at TAES-Dallas.

Maternal Clone	Polyx Pop	Parental Mean	1994 5Jan[1]	24Jan[1]	15Feb[1]	23Jun[1]	Progeny Mean	TPI[2]
2915	CEL[5]	6.9a[3]	5.9[4]	7.0a[4]	7.5a[4]	7.2a[4]	6.9a	3
2833	CE	7.0a	6.2a	7.2a	7.1a	6.6a	6.8a	4
2831	EL	6.7a	6.0a	6.9a	7.1a	7.1a	6.8a	4
3307	CE	7.1a	6.6a	7.7a	6.5	6.3	6.7a	2
2784	DL	6.9a	5.8	7.0a	7.3a	6.7a	6.7a	3
3271	AI	6.9a	6.9a	6.8a	6.1	6.8a	6.7a	3
2852	CDL	6.8A	5.8	6.8a	7.2a	6.7a	6.6a	3
3120	E	7.0A	6.0a	7.4a	6.4	6.6a	6.6a	3
3153	CE	7.4A	6.0a	7.2a	6.6	6.6a	6.6a	3
2845	EJK	6.6A	6.0a	7.3a	6.2	6.8a	6.6a	3
2856	BCE	6.4A	5.5	7.1a	6.9a	6.7a	6.6a	3
3225	BCK	6.7	6.3a	6.8a	5.8	6.8a	6.4	3
3106	AI	6.6	6.0a	7.1a	5.6	6.8a	6.4	3
9999	AI	6.5	6.5a	6.7	5.9	6.5a	6.4	2
3276	AIN	6.1	6.1a	6.7	6.4	6.3a	6.4	2
2859	DLN	6.3	5.6	7.0a	6.4	6.4a	6.3	2
3285	AI	6.5	6.1a	6.8a	5.4	6.9a	6.3	3
2916	CN	5.8	5.2	6.3	7.0a	6.6a	6.3	2
3283	AEI	6.1	6.2a	7.1a	5.6	6.2	6.2	2
3250	AK	6.4	5.9	6.9a	5.5	6.6a	6.2	2
3165	B	6.2	6.5a	5.7	5.8	6.5a	6.1	2
3141	CD	6.2	5.8	5.9	6.1	6.4a	6.1	1
2799	B	6.6	4.8	6.4	6.6	6.5a	6.1	1
3171	B	6.1	6.1a	5.6	6.1	6.1	6.0	1
3293	BI	6.1	5.7	6.9a	5.0	6.4a	6.0	2
2798	B	5.9	5.8	6.7	5.2	6.3	6.0	0
2794	B	5.9	5.0	5.9	6.3	6.7a	6.0	1
2922	BCN	5.4	5.8	6.1	5.2	6.7a	5.9	1

[1]Observations 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]TPI calculated on basis of progeny only.
[3]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 1 .

Table 4. Relative rate of spread of vegetative bentgrasses selected from polycross populations Syn92-1, Syn92-2, Syn92-4 and Syn92-5. Plant materials vegetatively increased and entered in production and performance trials at TAES-Dallas 1993.

TAES #	Parental Clone	Polycross	Rate of Spread, 1 - 9, 9 = fastest JUN29	JUL19	SEP09	Average	TPI
4039	3794	SYN92-1	2.3	2.0	3.3	2.6	
4040	3307	SYN92-1	3.3a	5.3a	6.0a	4.9a	3
4041	3387	SYN92-1	3.0a	4.0	4.0	3.7	1
4042	3794	SYN92-1	2.7	4.3a	5.0	4.0	1
4043	2831	SYN92-1	4.0a	5.0a	5.3a	4.8a	3
4044	3250	SYN92-1	4.0a	4.3a	4.3	4.2	2
4045	3794	SYN92-1	3.0a	4.3a	3.7	3.7	2
4046	3794	SYN92-1	2.3	4.0	4.3	3.6	0
4047	3153	SYN92-1	3.3a	4.0	3.7	3.7	1
4048	3153	SYN92-1	3.3a	5.0a	6.0a	4.8a	3
4049	3307	SYN92-1	2.7	5.0a	4.7	4.1	1
4050	3794	SYN92-1	3.0a	4.0	4.3	3.8	1
4051	3153	SYN92-1	3.0a	4.7a	4.3	4.0	2
4052	3153	SYN92-1	2.7	4.3a	4.3	3.8	1
4053	3799	SYN92-1	2.7	4.3a	4.0	3.7	2
4054	3153	SYN92-1	2.7	4.3a	5.0	4.0	2
4055	3153	SYN92-1	2.7	4.0	4.0	3.6	0
4056	3153	SYN92-1	3.3a	5.0a	6.0	4.8a	2
4057	3794	SYN92-1	3.0a	4.0	4.3	3.8	1
4058	3153	SYN92-1	3.3a	4.7a	5.0	4.3	2
4059	3794	SYN92-1	2.7	4.0	4.7	3.8	0
4060	3794	SYN92-1	2.7	4.3a	4.7	3.9	1
4061	3794	SYN92-1	3.0a	5.0a	4.7	4.2	2
4062	2922	SYN92-2	2.7	5.3a	5.3a	4.4	2
4063	3276	SYN92-2	3.7a	5.7a	6.3a	5.2a	3
4064	2922	SYN92-2	3.0a	5.7a	6.3a	5.0a	3
4065	2922	SYN92-2	3.7a	5.7a	6.0a	5.1a	3
4066	2922	SYN92-2	2.7	5.0a	5.7a	4.4	2
4067	2922	SYN92-2	4.0a	5.3a	7.0a	5.4a	3
4068	2922	SYN92-2	2.7	4.7a	6.0a	4.4	2
4069	2922	SYN92-2	3.3a	5.0a	5.7a	4.7a	3
4070	3276	SYN92-2	2.3	4.3a	5.3a	4.0	2
4071	2922	SYN92-4	2.3	4.0	5.0	3.8	0
4072	3153	SYN92-4	2.3	4.3a	5.3a	4.0	3
4073	2852	SYN92-4	2.3	4.3a	3.7	3.4	3
4074	2852	SYN92-4	2.7	5.0a	4.3	4.0	3
4075	2852	SYN92-4	2.7	3.3	3.7	3.2	0
4076	3153	SYN92-4	3.7a	5.7a	5.7a	5.0a	3
4077	2915	SYN92-4	2.7	4.7a	5.3a	4.2	2

[1]Means included in calculation of Turfgrass Performance Index(TPI) which is the frequency an entry occurs in the highest statistical grouping(a).
[2]Average and TPI calculated on basis of progeny, and not on parental clone.
[3]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 4. (cont). Relative rate of spread of vegetative bentgrasses selected from polycross populations Syn92-1, Syn92-2, Syn92-4 and Syn92-5. Plant materials vegetatively increased and entered in production and performance trials at TAES-Dallas 1993. Spread rate measured on 1 to 9, where 9 = fastest.

TAES #	Parental Clone	Polycross	Rate of Spread				TPI
			JUN29	JUL19	SEP09	Average	
4078	3225	SYN92-4	3.0a	4.0	5.0	4.0	1
4079	2852	SYN92-4	3.3a	4.7a	5.3a	4.4	3
4080	2852	SYN92-4	4.3a	6.0a	6.3a	5.6a	3
4081	2916	SYN92-4	3.0a	4.7a	4.7	4.1	2
4082	2922	SYN92-4	2.7	4.0	4.3	3.7	0
4083	2852	SYN92-4	2.3	3.0	3.0	2.8	0
4084	2952	SYN92-4	2.7	4.0	3.0	3.2	0
4085	3307	SYN92-4	3.7a	5.7a	6.0a	5.1a	3
4086	3307	SYN92-4	2.7	5.0a	5.3a	4.3	2
4087	2922	SYN92-4	2.7	4.3a	4.0	3.7	1
4088	2916	SYN92-5	3.0a	5.0a	6.3a	4.8a	3
4089	3106	SYN92-5	2.7	4.0	4.3	3.7	0
4090	3106	SYN92-5	2.7	3.7	4.0	3.4	0
4091	3106	SYN92-5	2.7	3.7	4.0	3.4	0
4092	3293	SYN92-5	2.7	4.7a	4.0	3.8	1
4093	2922	SYN92-5	3.7a	5.3a	5.0	4.7a	2
4094	2845	SYN92-5	4.0a	5.3a	5.7a	5.0a	3
4095	3307	SYN92-5	2.3	3.7	4.0	3.3	0
4096	3307	SYN92-5	2.7	4.7a	6.0a	4.4	2
4097	3307	SYN92-5	4.0a	6.3a	7.0a	5.8a	3
4098	3307	SYN92-5	3.0a	5.0a	6.0a	4.7a	3
4099	3307	SYN92-5	2.7	4.3a	5.3a	4.1	2
4100	3307	SYN92-5	3.3a	4.0	4.3	3.9	1
4101	2833	SYN92-5	3.0a	5.0a	5.7a	4.6a	3
4102	2916	SYN92-5	3.0a	4.3a	4.3	3.9	2
4103	2833	SYN92-5	3.7a	5.3a	5.7a	4.9a	3
4104	2922	SYN92-5	3.3a	5.0a	5.0	4.4	2
4105	2922	SYN92-5	3.7a	5.0a	5.0	4.6a	2
4106	2922	SYN92-5	3.3a	5.0a	4.7	4.3	2
4107	2922	SYN92-5	2.3	4.3a	5.0	3.9	1
4108	2922	SYN92-5	2.7	4.7a	4.3	3.9	1
4109	2922	SYN92-5	4.0a	6.0a	7.7a	5.9a	3
4110	2922	SYN92-5	3.7a	5.7a	6.3a	5.2a	3
4111	3307	SYN92-5	3.7a	5.3a	5.7a	4.9a	3
Cato		Syn4-88	2.0	3.3	3.0	2.8	0
Crenshaw		Syn3-88	3.0a	3.3	4.0	3.4	1
Penncross			3.3a	5.3a	6.0a	4.9a	4
Seaside			3.3a	3.3	6.3a	4.3	2
Syn1-88			4.0a	4.3a	4.7a	4.3	3

[1]Means included in calculation of Turfgrass Performance Index(TPI) which is the frequency an entry occurs in the highest statistical grouping(a).
[2]Average and TPI calculated on basis of progeny, and not on parental clone.
[3]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 5. Relative rate of spread of vegetative bentgrasses by maternal clone of progeny selected from polycross populations Syn92-1, Syn92-2, Syn92-4 and Syn92-5. Spread rate measured on 1 to 9, where 9 = fastest.

Parental	JUN29	JUL19	SEP09	MEAN	TPI
2845	4.0a	5.3a	5.7a	5.0a	3
Penncross	3.0a	5.3a	6.0a	4.9a	3
2831	4.0a	5.0a	5.3a	4.8a	3
2833	3.3a	5.2a	5.7a	4.7a	3
3276	3.0a	5.0a	5.8a	4.6a	3
2922	3.1a	5.0a	5.5a	4.5a	3
3307	3.1a	4.9a	5.5a	4.5a	3
Seaside	3.3a	3.3	6.3a	4.3a	2
Syn1-88	4.0a	4.3a	4.7a	4.3a	3
2916	3.0a	4.7a	5.1a	4.3a	3
3250	4.0a	4.3a	4.3a	4.2a	3
2915	2.7a	4.7a	5.3a	4.2a	3
3153	3.0a	4.6a	4.9a	4.2a	3
3225	3.0a	4.0a	5.0a	4.0a	3
2852	2.9a	4.4a	4.4a	3.9a	3
3293	2.7a	4.7a	4.0	3.8	1
3794	2.7a	4.0a	4.3a	3.7	2
3387	3.0a	4.0a	4.0	3.7	1
3799	2.7a	4.3a	4.0	3.7	1
3106	2.7a	3.8a	4.1	3.5	1
Crenshaw	3.0a	3.3	4.0	3.4	0
2952	2.7a	4.0a	3.0	3.2	1
Cato	2.0	3.3	3.0	2.8	0

[1]Means included in calculation of Turfgrass Performance Index(TPI) which is the frequency an entry occurs in the highest statistical grouping(a).
[2]Average and TPI calculated on basis of progeny, and not on parental clone.
[3]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 6. Munsell Color chart color ratings by rep of stolons of vegetative bentgrasses selected from polycross populations Syn92-1, Syn92-2, Syn92-4 and Syn92-5. Plant materials vegetatively increased and entered in production and performance trials at TAES-Dallas 1993.

TAES #	REP1	REP2	REP3
4039	-	-	-
4040	-	-	5R4/2
4041	-	-	5R4/6
4042	-	-	-
4043	-	5R3/6	5R4/6
4044	2.5R4/4	-	5R4/4
4045	-	-	5R4/4
4046	-	5R4/6	5R4/4
4047	2.5R4/6	5R3/4	5R4/6
4048	2.5R4/6	5R3/2	5R4/4
4049	2.5R4/6	5R4/4	5R4/4
4050	2.5R4/6	-	-
4051	2.5R4/6	5R3/6	5R4/4
4052	2.5R4/6	-	-
4053	-	-	5R4/2
4054	-	-	-
4055	5R3/6	5R4/4	5R4/4
4056	5R3/4	5R3/4	5R4/4
4057	-	-	5R4/4
4058	5R3/6	-	5R5/4
4059	-	-	5R4/6
4060	-	5R4/6	-
4061	-	5R4/2	5R4/4
4062	5R3/4	5R3/4	5R4/4
4063	5R3/6	5R4/4	5R4/4
4064	5R3/4	7.5GY5/4	7.5GY5/4
4065	5R3/4	5R5/4	5R4/4
4066	5R3/6	-	5R4/4
4067	2.5R4/4	5R4/2	5R4/4
4068	5R3/2	5R4/6	5R3/4
4069	5R3/4	5R3/4	5R4/4
4070	5R3/2	5R4/8	5R4/4
4071	-	-	7.5GY5/2
4072	5R3/4	5R3/4	7.5GY5/6
4073	-	5R4/4	7.5GY5/4
4074	5GY5/4	5R3/6	5R4/4
4075	-	-	-
4076	2.5R4/4	5R3/4	5R4/4
4077	2.5R4/4	-	5R3/6
4078	-	-	5R4/6
4079	5R3/4	5R4/8	7.5GY5/4
4080	5R3/4	7.5GY5/4	5R4/6
4081	5R3/4	5R4/4	-
4082	5R4/2	7.5GY5/4	5R4/4

Table 6 (cont). Munsell Color chart color ratings by rep of stolons of vegetative bentgrasses selected from polycross populations Syn92-1, Syn92-2, Syn92-4 and Syn92-5. Plant materials vegetatively increased and entered in production and performance trials at TAES-Dallas 1993.

TAES #	REP1	REP2	REP3
4083	-	5R4/4	5R3/6
4084	5R3/8	5R3/4	7.5GY5/4
4085	5R3/4	5R4/8	5R4/6
4086	5R3/6	-	5R4/4
4087	-	5R4/6	5R4/6
4088	5R5/6	-	5R5/6
4089	-	-	5R4/6
4090	7.5GY6/6	5R4/6	5R4/4
4091	7.5GY5/8	5R4/4	-
4092	-	-	-
4093	-	5R4/4	7.5GY6/4
4094	5R3/2	5R3/8	5R5/4
4095	5R3/4	7.5GY6/4	5R4/6
4096	5R3/4	5R4/8	5R4/2
4097	5R3/8	7.5GY4/4	7.5GY5/4
4098	5R3/6	7.5GY5/4	7.5GY5/2
4099	7.5GY4/4	-	5R4/6
4100	-	-	5R4/2
4101	5R3/4	5R3/6	5R4/4
4102	5R3/4	5R4/6	5R4/6
4103	5R3/6	5R4/4	5R4/4
4104	-	5R4/6	7.5GY5/4
4105	5R3/4	7.5GY5/4	5R4/4
4106	-	5R4/4	5R4/6
4107	-	5R4/4	5R4/6
4108	-	5R4/4	5R4/6
4109	7.5GY5/2	5R4/4	5R4/6
4110	5R4/2	-	5R4/4
4111	5R5/4	5R4/6	7.5GY5/4
Seasi.	5R6/2	7.5GY4/2	-
Syn1.	5R5/4	-	-
Cren.	-	7.5GY5/4	SR4/2
Cato	-	7.5GY6/6	-
Penn.	5R3/2	7.5GY5/2	5R4/2