1993 TURFGRASS RESEARCH

KANSAS TURFGRASS FOUNDATION

REPORT OF PROGRESS 685

Agricultural Experiment Station • Kansas State University, Manhattan • Marc A. Johnson, Director

Foreword

1993 Turfgrass Research Report contains a wealth of information. Work has been done to identify top-performing turf cultivars, and to select effective herbicides for weed control and fungicides for disease control. Other research addresses common turf cultural practices, such as establishment and irrigation requirements.

We were fortunate in January, 1993 to have Dr. Ken Marcum join our turfgrass research team. Ken has extensive experience in turf research, his last stop being at Texas A & M, Dallas, as a postdoctoral researcher.

In spring, 1993, the office/classroom/shop building was completed at Rocky Ford. This facility was badly needed. The entire Kansas turf industry should be thanked for making this facility a reality. Most of the funds used to construct the building came from the industry. Dr. Tom Warner was able to obtain an additional 2 acres on loan from the Dept. of Entomology for turf research south of Barnes Road. This will be needed as we continue to expand our research efforts. The possibility of obtaining additional land east of Rocky Ford is under investigation.

A goal in 1993-1994 is to obtain an in-ground, automated, irrigation system at the Rocky Ford site. When that is installed, Rocky Ford will be one of the better equipped turfgrass research facilities in the U.S.

As those in the Kansas turf industry continue to work cooperatively with faculty and staff at Kansas State University, there is no limit to what we can accomplish. Thank you!

The K-State Turfgrass Group

Personnel Associated with the K-State Turfgrass Program

Mike Daratt	Farmer II, Horticulture Research Center, Wichita
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Steven Wiest	Associate Professor of Horticulture, Plant Stress Research

THANKS!!!

Several organizations and corporations provided a significant level of support to the KSU turfgrass research program in 1992. Aid was in the form of substantial grants-in-aid or equipment contribution.

Kansas Turfgrass Foundation

Heart of America Golf Course Superintendent Association

Kansas Golf Course Superintednet Association

Kansas Ag Experiment Station

City of Wichita

Manhattan Country Club

Champion Turf (Toro Company)

Excel Corporation

Robison's Lawn & Golf (Cushman Manufacturing)

Numerous other companies provided grants for pesticide evaluation or donated seed, fertilizer, or chemicals. Several golf course superintendents in state were gracious enough to allow research to be done on their site. Without the support of each of these individuals and organizations, turf research at KSU would be severely inhibited. Thanks to all for your support!

Note: Trade names used in Kansas State University publications are not meant as an endorsement of the product or as a criticism of a similar product not mentioned.

Contribution No. 93-454-S from the Kansas Agricultural Experiment Station.

Table of Contents

Turfgrass Cultivar Evaluations

Turfgrass Cultural Practices

Turfgrass Disease Control

Turfgrass Weed Control

TITLE: Creeping Bentgrass Cultivar Evaluation

OBJECTIVE: To evaluate the performance of 23 bentgrass cultivars under putting green conditions.

PERSONNEL: Jack Fry, Kevin Kamphaus, and John Pair

INTRODUCTION:

'Penncross' creeping bentgrass has long been considered the elite cultivar for use on golf greens in cool regions throughout the U.S. In the last few years, however, several new bentgrass cultivars have been released, and evaluation of experimental selections continues. A study is underway to identify creeping bentgrass cultivars that perform well on golf course fairways and putting greens in Kansas.

MATERIALS AND METHODS:

Manhattan

In fall 1989, cultivars were seeded at 1 lb./1,000 sq. ft. on the USGA putting green at the Rocky Ford Turf Research Center. Turf was mowed 6 days weekly at 5/32". A total of 5 lbs. N/1,000 ft^2 was applied in 1991. Irrigation was applied as needed to prevent drought stress. Turf quality was rated visually, where 0 = dead turf; 7 = acceptable quality for a putting green; and 9 = optimum color, density, and uniformity. Dollar spot infection was rated on a 0 to 9 scale (9 = no infection).

Wichita

Bentgrass was seeded on September 27, 1989. Plots measured 8 by 8 feet and were arranged in a randomized complete block design. Turf was mowed 3 days per week at 0.5", and clippings were removed. A total of 4 lbs. N/1,000 ft^2 was applied in 1991. Irrigation was applied as needed to prevent drought stress. Turf quality was rated visually on a 0 to 9 scale, where 9 = optimum quality.

RESULTS:

Manhattan

No differences in turf quality among cultivars were observed between March and May. Cultivars exhibiting less than acceptable quality in April were Lopez, Pro/cup, Tracenta, Emerald, and National. Top performing cultivars were Providence, Putter, Regent, 88.CBE, Penncross, 88.CBL, and Pennlinks.

Cultivars that exhibited a significant dollar spot infection were SR-1020 and BISKA.

Wichita

The best performing cultivars after 3 years were Providence, 88.CBL, Normarc 101, Penneagle, SR1020, Putter, Forbes 89-12, WVPD, 89-D-15, Penncross, TAMU 88-1 and Cobra (Table 2). Because of poor performance of colonial bent cultivars and other miscellaneous species in the trial many plots were invaded by the adjoining creeping bentgrass cultivars. Therefore, this trial was terminated to provide space for a new national trial beginning in September, 1993.

Table 1. Quality and dollar spot in 23 creeping bentgrass cultivars under putting green conditions at Manhattan, KS in 1992.

Cultivar	Turfgrass Quality*						Dollar Spot
	March	April	May	June	July	Mean	
Providence	6.0	8.0	8.0	9.0	9.0	8.0	9.0
Putter	6.0	8.0	8.0	9.0	8.7	7.9	9.0
Normarc 101 (Regent)	6.0	7.7	8.0	8.3	8.0	7.6	9.0
88.CBE	6.0	7.3	8.0	8.7	7.7	7.5	9.0
Penncross	5.7	7.7	8.0	8.0	8.0	7.5	9.0
88.CBL	5.7	7.3	7.7	8.3	8.0	7.4	9.0
Pennlinks	6.0	7.3	7.7	8.0	8.0	7.4	9.0
Bardot	6.0	7.7	7.7	7.7	7.3	7.3	9.0
Cobra	6.0	7.3	7.3	8.0	7.7	7.3	9.0
WVPB 89-D-15 (Lopez)	6.0	6.7	7.7	8.0	8.0	7.3	9.0
SR 1020	6.0	7.3	7.3	8.0	7.3	7.2	7.7
Allure	6.0	7.3	7.3	8.0	7.0	7.1	9.0
BR 1518	5.3	70	7.3	8.3	7.3	7.1	9.0
Carmen	5.7	7.3	7.0	7.7	7.7	7.1	9.0
Forbes 89-12 (Pro/cup)	5.7	6.7	7.3	8.3	7.3	7.1	9.0
MSCB-8	5.7	7.7	7.3	7.7	7.0	7.1	9.0
Egmont	5.7	7.3	7.0	7.7	7.3	7.0	9.0
MSCB-6	5.3	7.3	7.3	7.7	7.0	6.9	9.0
AMU 88-1	5.3	7.3	7.0	7.3	7.3	6.9	9.0
Tracenta	5.3	6.7	7.7	8.0	7.0	6.9	9.0
Emerald	5.3	6.7	7.3	7.3	7.3	6.8	8.7
Biska	5.3	7.0	7.0	8.3	6.3	6.8	5.7
National	5.3	6.7	7.0	7.7	7.0	6.7	9.0
MSD	NS	NS	NS	1.0	0.8	0.6	1.1

*To determine statistical differences among entries, subtract one entry's mean from another's. Cultivars are statistically different when this value is larger than the corresponding MSD value.

Table 2. Bentgrass cultivar performance at Wichita, KS 1990-92 [1/].

Cultivar	Turf Quality			
	1990	1991	1992	Average
Providence	7.8	8.2	8.5	8.2
88.CBL	7.8	7.6	8.5	8.0
Normarc 101	7.9	7.5	7.7	7.7
Penneagle	7.8	7.5	7.2	7.5
SR 1020	7.8	7.4	7.3	7.5
Putter	7.8	7.8	6.7	7.4
Forbes 89-12	7.9	7.8	6.5	7.4
WVPB 89-D-15	7.7	7.6	7.0	7.4
Penncross	7.9	6.9	7.2	7.3
TAMU 88-1	7.6	7.1	7.2	7.3
Cobra	7.6	6.7	7.2	7.2
National	7.3	6.5	6.5	6.8
Emerald	7.4	6.2	6.2	6.6
Carmen	6.7	7.0	6.2	6.6
Tracenta	5.5	4.5	6.2*	5.4
Bardot	5.8	4.7	5.3*	5.3
Egmont	6.2	4.3	4.7*	5.1
BR 1518	5.1	4.8	5.2*	5.0
Allure	5.1	4.1	4.3*	4.5

[1/] Seeded 9-27-89. Plot size was 8' x 8'. Seeding rate was 13 gms/plot (equivalent to 4.4 lbs./1,000 sq. ft.) Maintained at 4 lbs. N/1,000 sq. ft. Mowed at ½ inch with clippings removed.

* Invaded by adjoining cultivars.

TITLE: National Tall Fescue Cultivar Trial

OBJECTIVE: To evaluate commercial and experimental tall fescue genotypes under Kansas conditions and provide that data to the National Turfgrass Evaluation Program.

PERSONNEL: John Pair and Ned Tisserat

INTRODUCTION:

Tall fescue is the best adapted, cool-season turfgrass for use in the transition zone because of its greater drought and heat tolerance. Although tall fescue has few serious insect and disease problems, it possesses a coarse leaf texture and does not recover from injury, because it lacks stolons and has only very short rhizomes. Efforts to improve tall fescue cultivars include selection for finer leaf blades, good mowing quality, a rich green color, and better sward density, while maintaining good stress tolerance characteristics.

MATERIALS AND METHODS:

A trial of 65 cultivars and experimental numbers was established on September 10, 1987 in Wichita. Plots were maintained at 4 lbs. N/1000 sq. ft. per year, mowed at 2 1/2 in. with clippings removed, and irrigated to alleviate stress. Team (Balan/Treflan) was applied in April and June to prevent crabgrass growth. This trial was terminated after 4 years and a new national trial was initiated in fall, 1992.

RESULTS:

Cultivars rated highest after five years were Shenandoah, Hubbard 87, Crossfire, Tribute, Safari, Monarch, Cimmaron, and Amigo. Other top contenders (rated 7.0 or above) were Maverick II, Guardian, Vegas, Winchester, Legend, Shortstop and experimental numbers PE-7 and PST-DBC (Table 1).

Because the trial was nearing completion and we were concerned about Rhizoctonia Brown Patch, all plots were inoculated in August, 1990 and 1991. There was no clear indication of resistance among cultivars and some infection occurred in all cultivars. Nevertheless, infection for two years is reported. The disease was especially rampant in 1991 affecting over 50 percent of the area in some plots. Infection was not so severe during the cooler summer of 1992.

A new trial of 95 cultivars and experimental numbers planted September 24, 1992 has yielded only preliminary data on seedling vigor, genetic color and early establishment performance. Initial seedling vigor was rated to determine the dwarfness or tallness of individual selections, which is obscured by mowing.

It is quite apparent there are a number of new dwarf types in this trial. Based on very preliminary data, good initial performance was noted on cultivars Rebel, Jr., Bonsai Plus, Micro DD, Silverado, Cochise, Pixie, Duke, Lancer, and Guardian. Experimental numbers also rated high were MB-21-92, MB-23-92, GEN-91, PST-59S, ZPS-ML, ITR-90-2, ZPS-E2, Pick 90-10 and PST-5LX.

Table 1. Tall fescue cultivar performance 1988-92, Wichita, KS [1].

Cultivar Name	Turf Quality (0-9 w/9 = best) 1988	1989	1990	1991	1992	Avg.	Brown Patch (% plot area) 1990	1991
Shenandoah	7.6	7.4	7.5	6.9	7.0	7.3	45	13
Hubbard 87	7.8	7.3	7.5	7.2	6.8	7.3	15	12
Crossfire	7.7	7.7	7.4	6.4	6.7	7.2	18	13
Tribute	7.6	7.2	6.8	7.1	7.2	7.2	34	10
Safari	7.5	7.4	6.9	6.3	7.8	7.2	35	15
PE-7	7.6	7.5	7.7	6.8	6.2	7.2	35	10
Monarch	7.7	7.5	6.9	6.9	7.0	7.2	48	10
Cimmaron	7.2	7.3	6.9	7.1	7.2	7.1	35	9
PST-50L	7.5	NA	7.0	6.8	7.2	7.1	32	10
Amigo	7.5	7.2	7.4	7.1	6.3	7.1	22	17
Maverick II	7.5	7.3	7.0	6.1	7.0	7.0	30	22
Guardian	7.4	7.4	6.5	6.5	7.2	7.0	50	20
Vegas	7.7	7.0	7.0	7.0	6.2	7.0	32	18
PST-DBC	7.1	6.9	6.9	6.8	7.3	7.0	20	13
Winchester	7.2	7.3	6.9	6.1	7.2	7.0	28	7
Legend	7.2	7.2	6.7	6.9	6.8	7.0	53	12
Shortstop	7.7	7.1	7.3	6.3	6.7	7.0	50	13
Bel 86-2	7.3	7.1	7.0	6.2	7.0	6.9	37	22
Phoenix	7.4	NA	7.1	6.9	6.0	6.9	18	5
PST-5AP	7.2	7.4	7.0	6.4	6.3	6.9	22	18
Mesa	6.8	7.2	7.3	6.4	6.7	6.9	22	18
Aztec	7.6	7.5	7.3	5.5	6.7	6.9	27	32
Apache	7.3	7.0	6.8	6.3	6.5	6.8	27	17
ElDorado	7.4	7.2	6.7	6.0	6.8	6.8	23	30
Carefree	7.3	6.7	6.6	6.1	7.2	6.8	28	11
KWS-DUR	7.2	6.9	6.4	6.3	7.3	6.8	32	20
Trailblazer	7.4	7.2	6.8	6.6	6.3	6.8	22	20
Thoroughbred	7.3	6.9	6.6	6.6	6.8	6.8	33	12
PST-5AG	7.2	6.8	6.5	6.3	6.7	6.7	23	18
Wrangler	7.3	7.1	6.1	6.2	6.8	6.7	42	18
Bel 86-1	7.3	7.1	6.8	6.1	6.3	6.7	37	17
PST-5EN	7.3	7.0	6.6	5.7	6.8	6.7	25	17
Twilight	7.7	6.9	6.5	6.0	6.5	6.7	30	28
Emperor	7.7	7.4	6.5	5.5	6.2	6.7	40	28
Sundance	7.2	7.1	6.7	6.5	6.0	6.7	38	20
Chieftan	7.0	7.3	6.7	5.9	6.7	6.7	42	20
Cochise	7.5	7.5	6.5	5.4	6.5	6.7	24	35
Avanti	7.6	7.4	6.7	6.0	5.7	6.7	50	24
Bonanza	7.4	7.1	6.7	6.2	5.5	6.6	35	25
Titan	7.0	7.0	6.6	6.1	6.2	6.6	13	15
Murietta	7.4	7.1	6.6	6.2	5.5	6.6	47	20
Olympic	7.1	6.7	6.9	6.8	5.7	6.6	32	18
BAR Fa 7851	7.1	6.8	7.1	6.4	5.5	6.6	35	13
Finelawn 5GL	7.3	6.9	6.0	5.9	7.0	6.6	63	15
Silverado	7.1	7.2	7.2	6.4	5.3	6.6	42	27
Jaguar II	7.3	6.8	6.6	6.1	6.2	6.6	25	18
JB-2	7.0	6.8	6.1	5.3	7.5	6.5	22	19
Austin	7.5	7.1	7.2	5.6	5.3	6.5	16	27
Rebel II	6.8	NA	7.1	6.4	5.7	6.5	17	12
Taurus	6.9	6.8	6.9	6.2	5.7	6.5	35	25
PST-5DM	7.5	6.9	6.8	4.6	6.8	6.5	27	47
Trident	6.9	6.9	6.7	5.8	5.8	6.4	28	25
Rebel	6.7	6.6	6.3	6.3	6.3	6.4	23	13
Adventure	6.9	6.5	5.8	6.1	6.3	6.3	32	18
Arid	6.9	6.3	6.3	6.2	5.7	6.3	37	22
Willamette	7.1	6.2	6.1	6.5	5.0	6.2	38	7
Falcon	6.7	6.4	5.6	5.4	5.7	6.0	33	23
Finelawn I	6.8	6.7	5.8	5.5	5.3	6.0	33	13

Cultivar Name	Turf Quality (0-9 w/9 = best) 1988	1989	1990	1991	1992	Avg.	Brown Patch (% plot area) 1990	1991
Jaguar	7.0	6.7	6.1	5.3	4.7	6.0	30	25
Syn Ga	6.9	6.6	5.8	5.9	4.7	6.0	45	18
Richmond	6.7	6.4	6.0	5.6	4.7	5.9	27	13
Pacer	6.7	6.3	5.5	5.8	5.3	5.9	42	25
Fatima	6.4	6.2	6.1	5.5	5.0	5.8	18	17
Tip	6.2	5.3	5.5	5.7	5.3	5.6	33	13
Ky-31	6.1	5.2	5.0	4.7	4.3	5.1	25	15

[1] Established Sept. 10, 1987. Seedling rate was 6 lbs./1,000 sq. ft. Maintained at 4 lbs. nitrogen/1,000 sq. ft./year. Mowing height was 2½ inches with clippings returned.

Table 2. Preliminary performance of tall fescue cultivars, 1993 [1/].

Cultivar or Exp. No.	Vigor 4-5-93	Genetic Color	Quality 4-5-93	Quality 5-1-93
MB-21-92	7.2	8.2	7.8	DG
MB-23-92	6.3	7.7	7.8	DG
Micro DD	5.8	7.7	7.8	DG
GEN-91	6.7	7.3	7.8	DG
Silverado	6.5	7.7	7.8	
PST-59D	6.0	7.0	7.8	T,DG
Cochise	7.3	8.0	7.8	DG
Bonsai Plus	6.5	7.5	7.7	
Pixie	6.8	7.5	7.7	DG
Lancer	6.2	7.2	7.7	DG
ZPS-ML	5.3	7.2	7.7	DG,F
ITR-90-2	5.7	7.0	7.7	
ZPS-E2	6.2	7.0	7.7	DG
Pick 90-10	5.3	6.8	7.7	DG,T
PST-5LX	5.3	7.2	7.7	DG,W
Rebel, Jr.	6.5	8.0	7.7	
ISI-AFA	6.5	8.0	7.5	
PST-5VC	6.8	7.8	7.5	
Duke	7.5	7.5	7.5	M
Guardian	7.2	7.8	7.5	
KWS-DSL	6.7	7.7	7.5	
SFL	6.8	7.0	7.5	T,W
WMB-25-92	6.0	7.7	7.5	
403	7.3	7.5	7.3	
Pick CII	6.8	7.5	7.3	DG
Pick 90-6	4.5	7.2	7.3	DG,W
J-1047	6.8	7.2	7.3	
WXI-208-2	7.2	7.2	7.3	
Rebel-3D	6.8	7.3	7.3	C
SR 8200	6.7	7.0	7.3	T
Lexus	5.5	7.2	7.3	DG,T,W
Finelawn Petite	6.3	7.5	7.3	DG
Vegas	6.5	7.0	7.2	DG
Leprechaun	6.7	7.2	7.2	
MB-22-92	6.2	7.2	7.2	DG
PST-5STB	7.3	6.8	7.2	
ZPS-VL	5.3	7.2	7.2	
BAR Fa 0855	7.8	7.2	7.2	
Pick 90-12	5.8	6.8	7.2	DG
Bonanza II	7.0	7.5	7.2	M
Bonanza	7.5	7.5	7.0	

Cultivar or Exp. No.	Vigor 4-5-93	Genetic Color	Quality 4-5-93	Quality 5-1-93	
ISI-CRC	7.8	7.7	7.0		
ATF-006	6.5	7.2	7.0	T,W	
Virtue	7.3	7.5	7.0		
ISI-ATK	7.3	7.5	7.0		
FA-19	6.8	7.3	7.0	W	
Tomahawk	6.7	7.2	7.0	T	
PST-5PM	6.5	6.5	7.0	T,W	
PST-RDG	5.5	7.2	7.0	T,W	
ATF-007	6.2	6.8	7.0		
Twilight	7.7	7.7	7.0		
SR 8010	7.5	7.3	7.0	LG	
STU-1	7.0	7.7	7.0		
Eldorado	7.2	7.7	6.8		
ISI-AFE	7.2	7.7	6.8	T	
SR 8400	7.3	7.5	6.8		
Kittyhawk	7.2	7.2	6.8		
Monarch	6.7	7.5	6.8	LG	
Aztec	7.2	7.3	6.8		
OFI-TF-601	6.3	7.2	6.8	T,LG	
ZPS-J3	6.5	7.0	6.8		
PST-5DX w/endo.		6.8	7.0	6.8	T
BAR Fa 2AB	7.0	6.8	6.8		
Bonsai	3.5	6.2	6.8		
SR 8210	6.5	6.8	6.8		
Montank	6.5	6.7	6.8		
BAR Fa 214	5.7	7.2	6.8	W	
J-1048	7.2	7.5	6.8	T	
M-2	7.5	7.8	6.7		
Austin	7.7	7.2	6.7	LG	
Safari	8.0	7.3	6.7	LG	
PRO-9178	6.8	6.7	6.7		
PSTF-401	7.5	6.8	6.7	LG	
CAS-MA21	7.0	7.2	6.7		
FA-22	7.3	7.2	6.7	LG	
Finelawn 88	7.0	6.8	6.5	T	
Phoenix	8.3	7.2	6.5	LG,C	
Excaliber	5.7	6.3	6.5	T	
Trailblazer II	8.2	7.5	6.5		
Cafa101	7.8	7.3	6.3	C	
CAS-LA20	6.3	6.5	6.3	T,W	
PSTF-LF	7.0	7.0	6.3	LG	

Cultivar	Vigor	Genetic	Quality	
or Exp. No.	4-5-93	Color	4-5-93	5-1-93
Shenandoah	7.3	7.3	6.3	LG
MB-24-92	5.3	6.0	6.2	T,DG
Arid	8.0	6.7	6.2	LG
Evergreen	7.7	7.2	6.2	C,LG
SR 8300	7.8	6.5	6.0	T
Avanti	7.8	7.0	6.0	LG
Olympic II	8.0	7.5	5.7	LG
Astro 2000	8.2	7.3	5.7	LG,C
PSTF-200	7.8	7.3	5.7	LG
Falcon	8.3	7.0	5.3	
Anthem	9.0	6.0	5.0	LG,C
KY-31 no endo	8.7	6.0	4.3	LG,C
Ky-31 w/endo.	8.8	6.0	4.0	C,LG

[1/] Established Sept. 24, 1992 at 4.6 lbs. seed per 1,000 sq. ft. Ratings based on scale of 0-9 w/9 = best vigor, darkest green and highest quality.

LG = Light green, M = Medium green, DG = Dark green, T = Thin, W = Weedy, C = Coarse

TITLE: Perennial Ryegrass Cultivar Evaluation - Manhattan

OBJECTIVE: To evaluate the performance of 61 perennial ryegrass cultivars under high maintenance conditions.

PERSONNEL: Ward Upham and Kevin Kamphaus

INTRODUCTION:

Perennial ryegrass as a species is not well adapted to the transition zone. Therefore, evaluation is needed to determine the cultivars best able to withstand midwestern stresses.

MATERIALS AND METHODS:

Sixty-one perennial ryegrass cultivars were seeded at the Rocky Ford Turf Research Center in Manhattan during the fall of 1990. The turf was mowed at a height of 1 inch to simulate fairway conditions. Fertilizer was applied at the rate of 4 lbs. nitrogen/1,000 ft^2 per year.

Irrigation was applied as needed to prevent drought stress. Turf quality was rated visually, where 0 = dead turf; 6 = acceptable quality; and 9 = optimum color, density, and uniformity.

RESULTS:

Cultivars that exhibited an average quality rating of greater than 7.0 were Commander, Gettysburg, Charger, Stallion, Equal, Nomad, VIP, and Endo-Fighter.

Cultivars that showed an average rating of less than 6.0 and, therefore, were deemed unacceptable were Troubadour, Danilo, Surprise, Meteor, Entrar, Advent, Pennfine, Caravelle, Toronto, and Linn.

Table 1. Quality of 61 perennial ryegrass cultivars between March and September, 1992 at Manhattan, KS.

Cultivar	Genetic Color	Quality (0-9 w9 = best)							
		Mar.	Apr.	May	June	July	Aug.	Sept.	Avg.
Riviera	7.7	5.3	6.3	6.0	7.3	6.7	7.0	6.3	6.0
Calypso	6.7	5.0	6.0	6.0	6.7	6.7	7.3	7.0	6.0
Seville	7.3	5.7	6.3	6.7	7.0	7.0	7.3	7.0	6.3
Caliente	7.3	6.0	6.7	6.3	6.7	7.3	7.0	6.7	6.3
Barrage	7.0	5.7	6.3	6.0	7.3	6.7	7.0	6.0	6.3
Barrage ++	6.7	5.3	7.0	6.7	6.3	6.7	6.7	6.7	6.0
Legacy	7.0	5.7	6.3	6.7	7.0	7.7	8.0	7.0	6.7
Assure	7.0	5.0	6.0	6.0	6.3	8.0	7.7	7.3	6.7
Commander	7.7	5.7	6.7	7.3	7.0	7.3	8.3	8.0	7.3

Cultivar	Genetic Color	Quality (0-9 w9 = best)							
		Mar.	Apr.	May	June	July	Aug.	Sept.	Avg.
Dandy	7.3	5.0	5.7	6.7	7.0	7.7	7.0	7.3	7.0
Danilo	6.7	4.7	5.3	6.0	6.7	6.7	6.0	5.7	5.0
Danaro	7.3	5.0	6.0	6.7	7.7	7.0	7.0	7.3	6.7
Allegro	7.7	6.0	6.7	6.3	7.7	6.7	6.7	6.3	6.3
Taya	6.7	5.3	6.3	6.0	6.7	7.0	6.7	6.3	6.0
Loretta	6.7	4.7	6.0	6.7	6.7	6.3	6.3	6.0	6.0
Ovation	6.7	6.3	6.3	6.3	6.7	7.0	7.0	6.7	6.7
Pleasure	7.7	6.7	7.0	7.3	7.0	7.7	7.0	7.0	6.0
Accolade	7.7	6.3	6.3	6.3	7.0	7.7	7.7	7.0	7.0
Sherwood	6.7	6.0	6.7	6.7	7.0	7.0	7.0	7.3	7.0
Gettysburg	7.0	5.0	7.0	6.3	6.3	7.3	7.3	7.7	7.3
Pebble Beach	7.0	5.7	6.7	6.7	6.7	7.3	8.0	7.0	7.0
Fiesta II	7.7	5.7	6.7	7.0	7.3	7.3	7.7	7.7	6.7
Surprise	6.3	5.0	6.0	6.3	6.3	6.0	6.0	6.0	5.7
Cartel	6.7	5.3	5.7	6.3	6.3	7.0	6.7	6.7	6.3
Meteor	6.3	4.0	5.3	6.0	6.0	5.7	5.0	5.3	5.3
Premier	6.7	6.3	6.7	6.3	6.0	6.7	6.7	6.3	6.3
Pinnacle	7.3	5.7	6.7	7.0	7.0	8.0	8.0	7.0	6.7
Duet	6.7	5.3	5.7	6.3	6.7	7.0	7.3	6.0	6.0
Pennant	7.3	6.3	7.0	6.7	7.3	8.0	7.3	6.7	7.0
Competitor	7.7	5.7	6.0	6.7	7.0	7.0	7.7	7.0	7.0
Cutless	7.3	5.3	6.7	6.7	6.3	6.7	7.7	7.3	7.0
Derby Supreme	7.7	6.3	6.7	6.3	7.0	8.0	7.7	7.7	7.0
Regal	7.3	7.0	7.0	6.3	6.7	7.3	7.0	7.0	6.3
Gator	7.3	6.7	6.7	6.7	6.7	8.0	7.7	7.3	6.3
Lindsey	7.0	5.7	6.7	6.3	7.0	7.0	7.3	7.0	6.3
Troubadour	5.7	5.7	6.0	6.0	5.3	5.3	5.7	5.3	4.7
Entrar	7.0	4.3	5.7	6.0	6.7	7.0	7.3	7.3	5.7

Cultivar	Genetic Color	Quality (0-9 w9 = best)							
		Mar.	Apr.	May	June	July	Aug.	Sept.	Avg.
Charger	7.7	5.7	6.0	6.7	7.3	8.3	8.0	8.0	7.3
Citation II	7.7	6.7	6.7	6.3	7.0	7.7	7.3	7.3	6.0
Manhattan II	7.0	6.0	7.0	6.0	7.0	6.7	7.7	7.0	7.0
Envy	7.7	5.7	6.7	6.7	7.0	7.7	7.7	7.0	6.7
Saturn	7.7	6.7	7.0	6.3	7.0	8.0	7.7	7.3	6.7
Stallion	7.3	6.0	6.3	7.0	6.7	7.7	7.0	6.3	7.3
Rodeo II	7.0	6.0	6.7	7.0	6.3	7.3	7.3	6.7	6.7
Patriot II	7.3	5.3	6.7	6.7	6.7	7.7	8.0	7.0	7.0
Target	7.0	3.7	6.3	6.0	6.0	6.7	6.7	6.3	6.3
Goalie	6.3	5.3	6.7	6.0	5.3	6.3	6.3	6.7	6.3
Advent	6.7	5.0	6.3	6.0	5.3	6.3	6.7	6.0	5.7
Pennfine	7.0	5.3	6.3	6.0	6.7	6.3	6.3	6.3	5.3
Repell	7.0	6.0	6.0	6.3	7.0	7.7	7.3	7.0	6.7
Toronto	7.3	5.7	6.0	6.3	7.0	6.7	6.0	6.7	5.7
Equal	8.0	6.0	7.0	6.3	7.3	8.3	8.0	7.7	7.7
Nomad	6.7	6.7	7.0	7.0	7.0	7.7	6.7	7.0	7.3
Linn	7.0	4.3	5.3	5.0	4.3	4.7	5.0	4.7	4.7
VIP	7.0	6.0	6.7	7.3	7.0	7.7	8.0	7.3	7.7
Jazz	7.7	6.7	6.7	6.7	7.7	7.7	7.0	6.3	6.7
Palmer	7.0	5.7	6.7	6.3	6.7	7.7	7.7	7.3	6.7
Endo-Fighter	7.3	5.7	6.3	6.3	7.0	8.3	7.7	8.0	7.3
Aquarius	7.0	5.7	6.3	6.7	6.3	7.0	6.3	6.3	6.7
Par 3	8.0	5.0	6.3	7.0	7.3	8.3	7.7	6.7	6.3
Caravelle	7.3	4.0	5.3	5.7	5.7	4.7	5.0	5.0	5.1
MSD*	1.9	2.4	1.7	2.8	1.7	1.8	2.0	2.5	1.2

* To determine statistical differences among entries, subtract one entry's mean from another's. Cultivars are statistically different when this value is larger than the corresponding MSD value.

TITLE: NTEP Perennial Ryegrass Cultivar Trial - Wichita

OBJECTIVE: To evaluate perennial ryegrass genotypes for adapatability and performance under Kansas conditions.

PERSONNEL: John Pair and Ned Tisserat

INTRODUCTION:

Perennial ryegrasses are used widely in most areas of the United States because they germinate very quickly, cover rapidly, and possess good wear tolerance and a rich green color. Recent efforts to improve perennial ryegrasses include selecting for better mowing quality, disease resistance, and stress tolerance.

MATERIALS AND METHODS:

A new trial of 122 cultivars was established in the fall of 1990. Maintenance included 4 lbs. N/1000 sq. ft. per year and a mowing height of 2 1/2 in. with clippings removed.

RESULTS:

Performance of the ryegrass cultivars is shown in Table 1. Observations made on pink snow mold (Fusarium nivale) infection in late winter showed specific varietal response in 1991. Particularly susceptible cultivars included HE 311, Patriot II, PST-23C, Mom Lp 3182, Bar Lp 086FL, Target, Mom Lp 3111, Gettysburg, ZPS-2EZ, Pennfine, Allegro, PST-20G, and CLP 144, but the disease did not recur in 1992.

Highest performing cultivars to date include Advent, Essence, Sherwood, Legacy, Seville, Pinnacle, Assure, Accolade, Saturn, Sherwood and Envy. Experimental numbers performing best were LDRD, PST-290, Pick 89-4, WVPB-89-PR-A-3, GEN-90, Pick 1800, PST-283, ZPS-28D, Pick DKM, Pick 9100, PST-GH089, and APM. (Table 1). Poorest performers, based on very preliminary data, were Pennfine, Troubadour, Mom Lp3111, Surprise, Cartel, CLP 144, and Linn.

Table 1. Performance of ryegrass cultivars at Wichita, 1991-92 [1/]

Cultivar or Exp. No.	Visual Quality Rating (0-9 w/9 = best) 4-15-91	6-5-92	8-19-92	Avg.
PST-290	8.2	8.0	7.8	8.0
LDRD	8.3	7.8	7.7	7.9
PST-GH089	7.5	8.3	7.8	7.9
Pick 89-4	8.2	7.7	7.7	7.9
Pinnacle	8.2	7.7	7.5	7.8
APM	8.5	7.7	7.3	7.8
Pick 1800	8.3	7.3	7.7	7.8
PST-283	8.0	7.3	8.0	7.8
ZPS-28D	8.3	7.5	7.7	7.8
PR 8820 (Essence)	8.7	7.8	6.8	7.8
Advent	7.7	7.3	8.3	7.8
Sherwood	7.8	7.7	7.8	7.8
Seville	8.0	7.8	7.7	7.8
WVPB-89-PR-A-3	8.2	7.3	7.8	7.8
Pick 9100	8.5	8.0	6.5	7.7
Envy	7.7	7.3	8.0	7.7
LDRF	8.2	7.3	7.5	7.7
P89	8.0	8.0	7.0	7.7
Saturn	8.2	7.5	7.5	7.7
Pick DKM	7.7	8.2	7.3	7.7
Pick 89LLG	8.0	7.3	7.8	7.7
Legacy	8.0	7.7	7.3	7.7
GEN-90	7.7	8.2	7.3	7.7
Assure	8.2	7.5	7.2	7.6
2P2-90	8.2	7.5	7.2	7.6
PST-28M	8.2	7.2	7.3	7.6
SR 4200	8.2	7.8	6.8	7.6
Express	8.0	7.0	7.8	7.6
Equal	8.0	7.2	7.7	7.6
PST-2FQR	8.2	7.3	7.3	7.6
Mom Lp 3147	7.0	7.8	7.7	7.5
Accolade	8.2	6.8	7.5	7.5
PR 9121	8.2	6.8	7.5	7.5
Poly-SH	8.0	7.5	7.0	7.5
PST-2FF	8.3	7.5	6.7	7.5
Pick EEC	7.3	7.7	7.3	7.4
Koos 90-2	7.8	6.8	7.5	7.4
89-666	7.5	7.3	7.5	7.4
4DD-Delaware Dwf.	7.3	7.5	7.0	7.3
Nomad	7.5	7.7	6.7	7.3
Koos 90-1	8.3	6.8	6.8	7.3

Cultivar or Exp. No.	Visual Quality Rating (0-9 w/9 = best) 4-15-91	6-5-92	8-19-92	Avg.
Fiesta II	7.8	6.8	7.2	7.3
Syn-P	8.0	6.7	7.2	7.3
Pleasure	7.7	6.7	7.5	7.3
PST-2DPR	8.5	6.7	6.7	7.3
PST-2ROR	7.5	8.0	6.5	7.3
Manhattan II (E)	8.0	7.0	6.5	7.2
Cutless	7.5	6.7	7.3	7.2
Gator	8.0	6.8	6.7	7.2
Gettysburg	5.7	8.0	8.0	7.2
OFI-F7	7.5	6.8	7.3	7.2
N-33	7.8	6.8	7.0	7.2
Pennant	7.7	6.8	7.2	7.2
WM-II	7.8	7.3	6.5	7.2
HE 311	7.2	7.3	7.2	7.2
Citation II	7.7	7.2	6.7	7.2
WVPB-88-PR-C-23	7.7	6.3	7.5	7.2
Rodeo II	8.0	6.8	6.5	7.1
PR 9108	7.7	6.5	7.0	7.1
Lindsay	7.8	7.0	6.5	7.1
Repell	7.7	6.8	6.8	7.1
Commander	8.0	6.7	6.7	7.1
WVPB-89-87A	7.7	7.2	6.5	7.1
WVPB-88-PR-D-12	7.7	6.7	7.0	7.1
Derby Supreme	8.0	6.7	6.7	7.1
Unknown	7.8	6.8	6.8	7.1
2H7	7.7	7.2	6.3	7.1
Charger	7.5	6.8	7.0	7.1
PR 9118	7.8	6.7	6.5	7.0
Barrage	7.7	6.2	7.0	7.0
Dandy	7.2	6.8	7.0	7.0
MVF 89-90	7.7	6.5	6.7	7.0
Premier	7.5	6.2	7.2	7.0
MVF 89-88	8.2	6.5	6.3	7.0
WVPB-88-PR-D-10	7.8	6.5	6.5	6.9
Competitor	7.3	6.7	6.8	6.9
PST-23C	6.8	7.2	6.7	6.9
Kansas Premium Blend 7.1	7.2	6.5	6.9	
Riviera	7.3	7.0	6.5	6.9
PR 9109	7.8	6.2	6.8	6.9
PR 9119	7.8	6.2	6.7	6.9
Caliente	7.2	6.0	7.3	6.8

Cultivar or Exp. No.	Visual quality rating (0-9 w/9 = best)			
	4-15-91	6-5-92	8-19-92	Avg.
Calypso	7.5	6.0	6.8	6.8
ZPS-2EZ	5.7	7.0	7.7	6.8
Regal	7.8	6.0	6.7	6.8
Pebble Beach	7.3	7.0	6.0	6.8
CLP 39	7.3	6.5	6.5	6.8
Taya	7.7	6.3	6.5	6.8
Patriot II	7.0	7.2	6.3	6.8
WVPB 89-92	7.7	6.7	5.7	6.7
BAR Lp 086FL	6.2	7.3	6.5	6.7
NK 89001	6.7	6.3	7.0	6.7
Loretta	7.2	5.7	7.2	6.7
Mom Lp 3184	7.0	6.2	6.8	6.7
OFI-D4	7.0	6.2	6.8	6.7
Goalie	7.7	5.7	6.3	6.6
Mom Lp 3185	7.0	6.5	6.2	6.6
ZW 42-176	7.5	7.0	5.3	6.6
PS-105	7.3	6.2	6.3	6.6
Stallion	6.8	6.5	6.5	6.6
Barrage ++	7.8	5.3	6.5	6.5
Duet	6.8	6.7	6.0	6.5
Target	6.0	6.5	7.0	6.5
EEG 358	6.8	5.5	7.0	6.4
C-21	7.0	5.5	6.7	6.4
Bar Lp 852	7.5	6.0	5.3	6.3
Toronto	7.2	5.3	6.3	6.3
Entrar	6.8	6.0	6.0	6.3
856	7.5	5.7	5.8	6.3
Danilo	5.7	6.2	6.8	6.2
PST-20G	4.7	7.7	6.2	6.2
Mom Lp 3179	6.0	6.2	6.0	6.1
Mom Lp 3182	6.3	5.8	6.0	6.0
Meteor	5.7	6.3	5.7	5.9
Ovation	6.7	5.3	5.7	5.9
Allegro	5.5	6.5	5.8	5.9
Danaro	6.5	6.0	5.3	5.9
Pennfine	5.7	5.3	6.5	5.8
Troubadour	6.5	5.3	5.3	5.7
Mom Lp 3111	5.7	5.7	5.7	5.7
Surprise	6.8	4.7	5.0	5.5
Cartel	6.3	5.3	4.7	5.4
CLP 144	4.3	5.7	6.0	5.3
Linn	5.0	4.0	3.7	4.2

[1/] Established September, 1990. Rating scale based on 0-9 , w/0= dead and 9 = best quality

TITLE: Kentucky Bluegrass Cultivar Evaluation

OBJECTIVE: To evaluate the performance of 76 Kentucky bluegrass cultivars under high maintenance conditions.

PERSONNEL: Ward Upham and Kevin Kamphaus

INTRODUCTION:

Kentucky bluegrass as a species is not well adapted to the transition zone. Therefore, cultivar evaluation is needed to determine those best able to withstand midwestern stresses.

MATERIALS AND METHODS:

Seventy-six Kentucky bluegrass cultivars were seeded at the Rocky Ford Turf Research Center in Manhattan during the fall of 1990. The seeding rate was 2 lbs./1,000 ft^2, and the turf was mowed at a height of 1 inch to simulate fairway conditions. Fertilizer was applied at the rate of 4 lbs. nitrogen/1,000 ft^2 per year.

Irrigation was applied as needed to prevent drought stress. Turf quality was rated visually, where 0 = dead turf; 6 = acceptable quality; and 9 = optimum color, density, and uniformity.

RESULTS:

Cultivars that exhibited an average quality rating of 7.0 or above were Midnight, Limousine, Destiny, Princeton 104, Julia, Estate, Freedom, Bristol, Blacksburg, Fortuna, Noblesse, and Baron.

Cultivars that showed an average rating of less than 6.0 and, therefore, were deemed unacceptable were Donna, Park, Argyle, South Dakota Certified, Ronde, Greenley, Kenblue, and Ginger.

Table 1. Quality of 76 Kentucky bluegrass cultivars between March and September, 1992 at Manhattan, KS.

Cultivar	Genetic Color	Quality (0-9 w9 = best)							
		Mar.	Apr.	May	June	July	Aug.	Sept.	Avg.
A-34	6.3	6.7	6.0	6.3	6.7	6.7	6.3	7.3	6.6
Able I	8.0	5.3	6.0	7.0	7.3	7.0	7.0	8.0	6.9
Estate	6.7	6.3	7.0	7.0	7.0	7.0	7.3	8.0	7.1
Marquis	8.0	5.3	6.3	6.3	7.0	7.7	8.0	8.0	6.9
Classic	6.0	6.3	5.7	6.3	5.7	6.7	6.0	7.3	6.4
Monopoly	6.3	5.7	6.0	7.0	6.7	6.3	5.7	7.0	6.3
Broadway	7.0	5.7	6.3	7.0	7.0	7.0	8.3	6.7	6.8
Merit	8.0	5.7	6.0	6.7	6.3	7.0	7.7	7.3	6.7
Barblue	6.3	5.7	6.0	6.3	5.0	5.7	8.3	7.3	6.5
Baron	8.0	5.7	6.3	6.0	7.7	8.0	7.7	7.3	7.0
Indigo	7.7	5.7	6.0	7.0	7.3	7.0	7.7	7.7	6.9
Touchdown	6.7	6.3	6.3	6.3	6.3	7.3	7.3	7.7	6.7
Banff	6.3	5.7	6.7	6.0	5.3	6.7	6.7	7.0	6.4
Alpine	7.0	5.0	6.0	7.3	6.7	6.3	6.0	7.0	6.3
Conni	6.7	6.3	6.7	6.7	6.7	6.7	6.7	7.0	6.6
Platini	7.0	5.3	6.3	6.7	6.3	6.7	6.3	7.0	6.4
Donna	7.7	5.3	6.3	6.3	7.3	6.7	6.3	5.3	6.1
Miranda	8.0	5.0	6.3	6.0	7.0	7.3	7.0	7.0	6.4
Melba	6.7	5.7	6.3	6.7	7.0	7.0	7.3	8.0	6.8
Trampas	5.7	5.7	6.3	6.7	6.7	6.0	7.3	7.7	6.7
Abbey	7.3	5.3	6.3	6.0	6.3	7.0	8.0	6.7	6.6
Coventry	6.0	5.7	7.0	7.0	7.0	6.0	7.3	7.3	6.8
Cardiff	7.0	6.0	7.0	6.7	6.7	7.7	8.7	6.7	6.9

Cultivar	Genetic Color	Quality (0-9 w9 = best)							
		Mar.	Apr.	May	June	July	Aug.	Sept.	Avg.
Ampellia	7.7	6.0	5.7	6.0	7.0	7.0	7.7	7.3	6.6
Fortuna	8.0	5.7	6.3	6.7	7.7	7.3	7.7	7.7	7.0
Noblesse	8.3	5.7	6.7	7.7	7.3	6.7	7.7	8.3	7.0
Miracle	7.3	5.3	6.0	6.3	7.0	7.7	7.7	7.7	6.8
Silvia	5.7	6.0	6.0	6.3	6.7	6.7	6.7	7.0	6.5
Cynthia	7.7	6.3	5.0	6.0	7.3	7.7	8.7	8.0	7.0
Washington	7.0	5.7	5.7	6.0	6.0	6.7	7.0	7.7	6.5
Ram-1	6.3	6.0	6.3	6.0	6.3	7.0	7.3	7.7	6.6
Eagleton	5.7	5.7	6.0	6.3	6.7	6.3	6.0	7.3	6.4
Georgetown	7.0	6.0	6.3	7.0	6.3	6.3	7.0	7.7	6.8
Princeton 104	7.7	6.0	6.0	6.3	7.7	7.7	8.0	8.0	7.2
Livingston	7.0	6.3	6.0	6.7	6.3	6.7	7.3	7.0	6.7
Challenger	7.7	6.0	6.3	7.0	7.0	6.7	7.3	7.7	6.9
Midnight	8.7	5.3	6.7	7.7	8.0	8.0	7.7	7.7	7.4
Blacksburg	7.7	5.7	6.3	7.7	7.0	7.3	7.3	8.0	7.0
Nassau	7.7	5.7	6.3	6.3	5.7	6.7	7.0	7.0	6.4
Summit	8.0	4.0	5.7	6.7	7.3	7.0	8.0	8.3	6.8
Julia	8.3	5.7	6.0	6.7	7.3	8.3	8.0	8.0	7.1
Glade	8.0	5.3	5.7	5.7	6.7	7.7	7.3	8.0	6.6
Freedom	7.3	7.0	7.0	6.0	7.0	7.3	6.7	8.0	7.1
Destiny	7.7	6.3	7.0	7.7	7.0	7.3	7.7	7.3	7.2
Eclipse	8.0	6.3	6.0	6.3	7.7	7.7	6.7	7.3	6.8
Limousine	6.7	5.3	7.0	8.7	7.7	6.7	8.3	8.7	7.3
Merion	7.0	4.7	6.0	6.7	6.0	7.3	7.0	6.7	6.2
NuStar	7.3	6.0	6.0	6.7	7.0	7.0	7.0	7.0	6.6
Liberty	7.3	5.7	6.0	6.3	6.3	6.7	7.3	7.0	6.5
Aspen	7.0	6.0	5.3	7.0	6.7	7.3	7.7	7.7	6.9

Cultivar	Genetic Color	Quality (0-9 w9 = best)							
		Mar.	Apr.	May	June	July	Aug.	Sept.	Avg.
Kelly	8.0	5.0	5.7	6.3	6.3	7.3	7.7	7.7	6.6
Trenton	6.0	6.3	6.7	6.7	5.0	6.7	6.7	6.7	6.5
Dawn	6.7	5.7	6.3	6.7	6.3	6.3	7.7	7.3	6.7
Haga	6.3	6.3	6.7	6.3	6.0	7.0	6.7	7.3	6.8
Opal	8.3	5.3	6.3	6.3	6.7	7.3	8.3	7.7	6.8
Minstrel	7.7	5.3	6.3	7.0	6.3	7.0	7.7	7.3	6.8
Gnome	8.3	5.3	6.0	6.7	7.7	7.3	8.0	7.3	6.9
Chelsea	7.0	4.7	5.3	6.0	6.7	7.3	6.3	6.3	6.1
Cobalt	7.0	5.7	6.3	6.7	6.7	7.3	7.3	7.0	6.8
Ginger	6.7	5.7	4.7	5.0	5.0	6.7	4.0	4.3	4.7
Greenley	6.3	5.7	5.3	5.0	6.7	6.7	5.7	3.3	5.3
Ronde	6.7	5.3	6.0	5.7	5.7	6.0	4.3	5.0	5.4
Kenblue	6.3	5.3	5.3	4.7	5.0	5.0	4.7	5.7	5.2
So. Dak. Cert.	6.3	5.3	5.3	4.7	5.3	5.7	6.0	5.0	5.4
America	7.3	5.3	6.0	6.7	7.0	7.7	7.0	7.7	6.8
True Blue	6.7	6.0	6.0	6.3	6.3	7.0	7.0	7.3	6.6
Huntsville	6.7	5.7	5.3	5.7	6.0	6.3	6.7	6.7	6.2
Park	6.0	5.3	5.0	6.0	5.3	6.7	5.7	5.3	5.7
Argyle	7.0	5.3	5.7	6.3	6.0	6.7	5.3	4.3	5.6
Victa	7.7	5.0	5.7	6.3	7.3	6.7	7.7	7.7	6.6
Bristol	8.0	6.0	7.0	7.0	6.0	7.3	7.7	7.7	7.1
Merit + Ram I + Adelphi	7.7	6.0	6.3	6.7	6.3	6.7	7.3	7.3	6.7
Ram I + Eclipse + Adelphi	7.7	6.0	6.0	5.7	7.0	7.7	7.3	8.0	6.8

Cultivar	Genetic Color	Quality (0-9 w9 = best)							
		Mar.	Apr.	May	June	July	Aug.	Sept.	Avg.
Glade + Baron + Nassau	6.7	6.0	6.0	6.0	6.0	7.0	8.0	7.0	6.6
Merit + Baron + Nassau	7.3	5.7	6.3	6.0	7.0	7.3	7.3	7.3	6.8
Chautea	7.3	6.3	7.3	7.0	6.7	6.3	6.7	6.3	6.7
MSD*	0.9	1.2	1.2	0.8	1.4	1.3	1.2	1.2	0.4

* To determine statistical differences among entries, subtract one entry's mean from another's. Cultivars are statistically different when this value is larger than the corresponding MSD value.

TITLE: Low Maintenance Kentucky Bluegrass Cultivar Trial

OBJECTIVE: To determine performance of bluegrass cultivars under a management regime of low nitrogen and drought stress.

PERSONNEL: John C. Pair

INTRODUCTION:

This trial was initiated because of the need to plant more water-efficient species. Kentucky bluegrass (Poa pratensis) was chosen because it goes dormant during drought and recovers when water is applied. Cultivars were supplied as part of the USDA National Turfgrass Evaluation Program (NTEP).

MATERIALS AND METHODS:

Sixty-six cultivars were established in September, 1990 on an Elandco silty clay loam soil with the specific intent of measuring performance under considerable drought stress. The trial received occasional watering during summer. Nitrogen level was only 2 lbs. N/1000 sq. ft. per season. Mowing height was 3 inches with clippings returned.

Ratings during August and October were done with plots under considerable stress. By August, most plants had gone dormant and considerable weed invasion had occurred. Ratings in October reflect recovery from summer stress.

RESULTS:

After only one season, preliminary data indicated best performance by Baron, Midnight, J-335, PST-C-303, and Cobalt (see 1991 report). Satisfactory turf quality was indicated for BAR VB 895, Fortuna, MN 2405, Ba 74-017, GEN-RSP, ISI-21, Sophia, PST-C-391, PST-YQ, Suffolk, Haga, Chelsea, KWS Pp 13-2 and BAR VB 7037. Poorest quality was noted for Miracle, EVB 13.703, Amazon, and Merion in the first year.

Under low nitrogen and only occasional watering, best performing cultivars after 2 years were Monopoly, Alene, Bartitia, Kenblue, Sophia, Chelsea, and Cynthia. Experimental numbers also worth noting were BAR VB 1169, MN 2405, J-335, H76-1034 and EVB 13.863. These results indicate that certain bluegrass selections also can be considered as drought tolerant if allowed to go dormant during summer, at least under a more moderate nitrogen regime.

Table 1. Low maintenance bluegrass performance, Wichita, KS 1992 [1/].

Cultivar or Exp. No.	Visual Quality (0-9 w/9 = best		
	8-4-92	10-14-92	Average
Monopoly	7.2	7.3	7.3
Alene	6.3	7.0	6.7
ZPS-84-749	6.3	6.5	6.4
J-335	6.8	5.8	6.3
BAR VB 1169	7.0	5.5	6.3
Bartitia	7.5	5.0	6.3
Kenblue	5.3	7.3	6.3
MN 2405	5.0	7.3	6.2
H76-1034	6.2	6.0	6.1
EVB 13.863	6.7	5.2	6.0
Sophia	6.8	5.0	5.9
Barzan	6.5	5.3	5.9
Chelsea	7.0	4.8	5.9
Cynthia	6.8	4.8	5.8
Crest	6.2	5.2	5.7
Barmax	6.5	4.7	5.6
S.Dakota Cert.	5.3	5.7	5.5
PST-A7-111	5.0	6.0	5.5
NuStar	6.7	4.3	5.5
Washington	7.0	4.0	5.5
NE 80-47	6.5	4.2	5.4
Amazon	6.0	4.7	5.4
GEN-RSP	6.0	4.8	5.4
Bronco	6.8	4.0	5.4
BAR VB 7037	6.7	4.0	5.4
NJIC	6.5	4.2	5.4
Cobalt	5.7	4.7	5.2
Gnome	6.2	4.2	5.2
Ram-1	6.0	4.0	5.0
Ba 78-376	5.0	5.0	5.0
Haga	5.3	4.7	5.0
PST-YQ	6.0	4.0	5.0
Freedom	5.2	4.5	4.9
Fortuna	6.0	3.7	4.9
Livingston	5.8	4.0	4.9
PST-C-303	5.0	4.5	4.8
PST-C-76	6.5	3.0	4.8
Merit	6.2	3.3	4.8
Liberty	5.7	3.8	4.8
KWS Pp 13-2	5.5	4.0	4.8
Miracle	5.7	3.7	4.7

Cultivar or Exp. No.	Visual Quality (0-9 w/9 = best 8-4-92	10-14-92	Average
Voyager	6.0	3.3	4.7
Park	5.3	4.0	4.7
SR 2000	6.0	3.3	4.7
J-386	6.3	3.0	4.7
ISI-21	5.3	3.8	4.6
Suffolk	4.7	4.5	4.6
Barsweet	5.5	3.7	4.6
BAR VB 1184	5.8	3.3	4.6
BAR VB 895	5.0	3.7	4.4
J-229	5.5	3.3	4.4
Midnight	6.2	2.3	4.3
Unknown	5.7	2.8	4.3
Ba 74-017	5.8	2.7	4.3
Merion	5.3	3.0	4.2
Destiny	5.0	3.0	4.0
Opal	5.5	2.3	3.9
Baron	5.3	2.0	3.7
PST-C-391	4.7	2.3	3.5
EVB 13.703	4.7	2.0	3.4
798	4.7	2.0	3.4
Kyosti	4.3	2.0	3.2
Haga	5.3	4.7	5.0

[1/] Established Sept. 18, 1990 and maintained under low nitrogen (2 lbs. N/1000 sq. ft. per year) and irrigated only when under severe stress. Mowing was at 2½ inches with clippings returned.

TITLE: National Buffalograss Cultivar Trial

OBJECTIVE: To evaluate the performance of 22 buffalograss cultivars and experimental selections under Kansas conditions.

PERSONNEL: John C. Pair, Jack Fry, and Larry Leuthold

INTRODUCTION:

Buffalograss is the only native species used for turfgrass in Kansas. Its heat and drought tolerance and the introduction of many new selections have aroused considerable interest in growing buffalograss in low maintenance turf situations. In addition, both seeded and vegetative types are now available but not yet fully evaluated.

Manhattan

Cultivars were plugged in June, 1991. Fertilizer was applied in June to provide 1 lb. N/1,000 ft^2. Turf was mowed once weekly at 2.5 inch. Irrigation was applied to prevent stress. Turfgrass quality was rated on a 0 to 9 scale where 0 = dead; 6 = acceptable quality for a home lawn, and 9 = optimum quality. Color and green-up were rated on a 0 to 9 scale where 0 = brown and 9 = optimum green.

Wichita

As part of the National Turf Evaluation Program sponsored by USDA, 22 selections were established on July 1. All entries, even seeded types previously sown in the greenhouse, were plugged on 1 foot centers. Fertilizer was lightly incorporated at the rate of 1 lb. of N/1000 sq. ft. as 13-13-13 prior to planting. A pre-emergent herbicide, XL granules containing Surflan and Balan, was applied at 100 lbs/acre (2.12 lbs/1000 sq. ft) on July 2. Plots were watered to prevent transplant loss and encourage rapid coverage in the first season. Plots were maintained under a low fertility regime of 1 lb. N/1000 sq. ft. per season and moderate drought stress in subsequent years. Mowing height was 2 inches with clippings returned.

RESULTS:

Manhattan

Cultivars exhibiting most rapid spring green-up were NE 84-315, Texoka, NTDG-1, NE-84-436, NTDG-2, NE 84-378, NTDG-3, Sharp's Improved, NE 84-45-3, and Plains.

Highest turf quality was observed in July. Better quality cultivars were NE 84-315, NTDG-1, NTDG-5, Top Gun, NE 84-436, NTDG-2, A2143, NE 84-378, Texoka, and NE 84-609.

Genetic color was rated in late spring. Those cultivars with better color ratings were NTDG-2, NTDG-1, NTDG-5, NE 84-315, NE84-378, and NTDG-3.

Wichita

Although some accessions grew more aggressively than others, all plots covered the space between plugs by the end of the first season. Data were taken on genetic color, density, and visual turf qualtiy. Preliminary data indicate dark greeen color on NE 84-609, NE 85-378, NTDG-2, NTDG-4, and Bison. Selections rated superior in density included Top Gun (BAM 101), Bison, Highlight 4, NTDG-2, Sharp's Improved, Rutger's, Highlight 25 and NE 84-45-3. Cultivars that appeared to have above average turf quality were Bison, Top Gun, Sharp's Improved, Plains, and NE 84-609.

After only two seasons, the top performers in visual quality at Wichita were NE84-609, NE85-378, NTDG-1, and NTDG-4. Based on density at two mowing heights, excellent results occurred on NE84-315, AZ143, NE84-609, NTDG-4, and NTDG-5. NE84-315, NE84-45-3, and AZ143 performed particularly well at the lower mowing height. Best genetic color appears to be for NE84-609, which holds color well into October (Table 1).

Some herbicide injury occurred when Trimec was applied on August 7. Even though it was below 85°F on that day, temperatures the following day rose to near 90°F. The response appeared to be varietal, with NE84-45-3, AZ143, Highlight 25, Prairie and Plains being most affected, but all recovered injury in a few days. NE85-378 was largely unaffected.

Table 1. Spring green-up, quality, and genetic color of 22 buffalograss cultivars at Manhattan, KS in 1992.

Cultivar	Spring Green-up	Turfgrass Quality*					Genetic Color
		May	June	July	October	Mean	
NTDG-1	4.3	6.7	6.3	7.3	3.3	5.9	7.3
NTDG-5	4.0	6.7	6.7	7.0	3.3	5.9	7.3
Highlight 4	1.3	5.7	6.7	6.3	4.3	5.8	6.3
NE 84-315	5.0	6.7	7.3	7.7	1.3	5.8	7.0
Buffalawn	2.0	6.0	6.7	6.0	4.0	5.7	5.7
BAM 10 (Top Gun)	3.3	5.7	6.7	7.0	3.0	5.6	6.0
Highlight 25	2.3	5.7	7.0	6.3	3.3	5.6	5.7
NE 84-436	4.3	6.7	7.0	7.0	1.7	5.6	6.7
NTDG-2	4.3	6.3	6.3	7.0	2.7	5.6	7.7
AZ 143	4.0	6.0	7.3	7.3	1.3	5.5	6.0
NE 84-378	4.3	7.0	6.7	7.0	1.3	5.5	7.7
Rutgers	1.7	5.0	6.7	6.3	4.0	5.5	5.7
NTDG-3	4.3	5.3	6.7	6.3	3.0	5.3	7.0
Prairie	3.7	5.0	5.0	6.3	4.7	5.3	4.7
Texoka	4.7	5.3	5.7	6.7	3.3	5.3	6.3
Highlight 15	2.3	5.3	5.7	5.7	4.0	5.2	6.0
NTDG-4	3.7	5.7	6.0	6.0	3.0	5.2	6.7
Sharps Improved	4.3	6.0	4.7	6.0	3.7	5.1	6.3
NE 84-609	3.3	3.3	4.7	7.3	4.3	4.9	4.0
Bison	3.7	5.0	5.0	5.3	3.7	4.8	6.7
NE 84-45-3	4.3	5.0	6.3	6.7	1.0	4.8	5.3
BAM 202 (Plains)	4.3	5.0	4.7	5.3	3.7	4.7	6.7
MSD	0.7	1.3	1.3	1.2	1.0	0.9	1.6

*To determine statistical differences among entries, subtract one entry's mean from another's. Cultivars are statistically different when this value is larger than the corresponding MSD value.

Table 1. Buffalograss cultivar performance at Wichita, KS, 1992.

Cultivar	Quality Rating[1/] 4-27	Quality Rating[1/] 6-1	Quality Rating[1/] 7-10	Genetic Color[2/]	Color 10-6[3/]	Unmowed Height W/inf.	Unmowed Height W/o inf.	Density 1½"	Density 3"[4/]	Herbicide Injury 8-12[5/]
NE 84-609	7.2	8.2	8.3	8.7	7.7	NA	6.0	7.8	8.2	6.3
NE 84-315	8.0	8.0	7.5 LS	7.8	2.8	5.0	5.2	8.3	8.5	5.7
NE 85-378	8.7	8.3	8.2	8.0	3.4	NA	6.0	7.3	8.0	8.0
NE 84-45-3	7.0	6.5 SH	5.3	6.3	2.7	6.3	5.7	8.0	7.8	3.0
NE 84-436	7.2	7.8	6.7	6.8	2.7	6.7	6.0	7.7	7.8	6.2
Buffalawn	6.7	8.3	7.7	6.5	6.5	NA	6.0	6.2	6.7	6.7
AZ143	7.8	7.7	7.2	6.5	2.7	5.7	5.2	8.0	8.3	4.7
Highlight 4	6.5	8.0	7.0	6.5	6.3	7.0	5.5	5.8	6.3	5.0
Highlight 15	5.8	7.7 LG	6.7	5.7	6.6	7.3	6.5	5.0	6.0	6.7
Highlight 25	5.7	7.3 LG	6.7 LS	5.3	6.2	NA	6.5	5.3	5.7	4.7
Prairie	5.8	6.7 LG	6.5	5.7	6.6	NA	5.8	6.5	7.2	4.7
Rutger's	6.2	7.7 SH	7.2	6.3	6.9	6.5	6.0	6.0	7.0	6.3
Sharp's Imp.	6.8	7.2	7.2	7.3	5.3	7.8	7.2	5.3	6.5	6.0
NTDG-1	7.8	7.7	7.8	7.7	5.0	7.3	6.3	7.2	7.8	6.2
NTDG-2	7.7	7.3	7.0	7.5	4.4	6.5	6.3	7.7	8.0	7.2
NTDG-3	7.7	7.5	7.0	7.3	4.7	6.8	6.5	7.3	7.8	6.0
NTDG-4	7.5	7.5	7.8	7.7	4.4	7.0	6.2	7.8	8.5	6.8
NTDG-5	7.8	7.8	7.3 LS	7.2	2.8	6.8	6.0	7.5	8.2	6.8
Bison	5.7	6.3 W	6.2	7.2	4.2	7.8	7.0	5.7	6.8	6.0
Topgun	6.8	7.5	7.3 LS	7.3	4.0	7.7	6.5	6.8	7.2	5.0
Plains	5.7	6.3 W	5.7 W	7.2	4.7	7.2	6.7	5.0	6.5	4.8
Texoka	7.2	7.2 W	5.7	6.3	4.0	7.0	6.2	6.3	7.2	5.3

1/ Quality rated on a scale of 0-9 w/9 = best. LS = Leaf Spot; LG = Light Green;W = Weedy; SH = Seed Heads; Not Applicable.

2/ Genetic color and visual quality rated on July 10 on unmowed grass near 3" tall.

3/ Color rated before frost but some had gone off color, others still bright green. Rated on scale of 0-9 w/0 = brown, 9 = most green.

4/ Density rated on a scale of 0-9 w/9 = most dense.

5/ Trimec applied on August 7 at a rate of 1.3 oz./gal./1,000 sq. ft. Herbicide injury noted following application. Rated on a scale of 0-9 w/0 = brown (dead); 9 = unaffected.

TITLE: NTEP Bermudagrass Cultivar Trial

OBJECTIVE: To evaluate both seeded and vegetative cultivars and experimental numbers for performance under Kansas conditions.

PERSONNEL: John C. Pair and Ned Tisserat

INTRODUCTION:

Greater hardiness and finer quality of new bermudagrass introductions have once again aroused the interest of turfgrass managers in this wear-resistant and low water-demand turf species. The development of hardy seeded types provides greater winter survival than available with Arizona common. New vegetative cultivars with Spring Dead Spot resistance and greater sod strength offer more choices for both sod growers and consumers.

MATERIALS AND METHODS:

A national turf evaluation program (NTEP) cultivar trial, coordinated by USDA and consisting of 26 selections, was established on June 23, 1992. Entries consisted of 16 seeded types and 10 vegetative selections. Four miscellaneous KSU clones were also included. Plots were maintained at 4 lbs. of actual nitrogen per 1,000 sq. ft. and mowed at 1 inch with clippings removed. Qualities rated included color, texture, and visual quality during August and September and spring green-up in April. In subsequent years, resistance to Spring Dead Spot will be evaluated.

RESULTS:

In preliminary observations during the first season, highest quality ratings were given to vegetative types Midlawn, Midway, and Tifway, although the latter is not expected to be hardy in Kansas. The highest rated seeded type was OKS 91-11, which also exhibited early green-up, as did J-27 and Guymon. Darkest green color occurred on OKS 91-11, Tifway, STF-1 and Midway, followed closely by Midlawn. Finest texture was rated on FHB-135 (a very refined Florida introduction of doubtful hardiness), Tifgreen, and TDS-BM1, which had a spring green-up equal to that of Midlawn. Midiron and Midfield continued to exhibit excellent hardiness and early green-up (Table 1). Hardiness of bermudagrass was really not tested under the conditions of the past winter with abundant moisture and much insulating snow cover. Meanwhile, plots are becoming well established to provide much needed quality comparisons, plus future tests of hardiness under more typical Kansas winters.

Table 1. Performance of NTEP Bermuda Cultivars, Wichita KS [1/]

Cultivar	Visual Quality Rating[2] 8-31-92	Visual Quality Rating[2] 9-30-92	Color Rating[3] 10-2-92	Texture Rating[4] 9-30-92	Green-up Rating[5] 4-29-93
Seeded Entries					
J-27	6.0	7.0 C	7.8	3.7	6.5
J-912	7.2	7.8	7.2	5.3	3.0
Sonesta	5.7	7.3	6.7	5.0	1.7
Cheyenne	5.8	7.3	5.2	5.0	2.0
FMC 1-90	6.2	7.0	5.3	4.8	1.3
FMC 2-90	7.2	7.8	7.0	4.5	2.3
FMC 3-91	7.0	7.2	5.7	5.0	1.0
FMC 5-91	7.3	7.7	6.7	4.8	2.2
FMC 6-91	7.2	7.8	6.7	5.7	1.7
Sundevil	6.0	7.3	5.5	4.8	2.0
Arizona Common	6.5	7.2 LG	5.0	5.0	1.3
90173	6.8	7.3	6.2	4.7	4.2
OKS 91-1	6.7	7.2	5.5	4.8	2.5
OKS 91-11	6.8 W	8.2 DG	8.2	4.8	8.0
Sahara	6.2	7.3	6.2	5.3	1.0
Guymon	4.7	6.0 C	7.3	3.0	7.2
Vegetative Entries					
FHB-135(pat.pend)	6.0 F	7.2 F	7.2	9.0	3.7
Arizona Common	5.0 C	6.0 LG	5.3	3.7	2.7
Midiron	6.3	6.8 SH	6.5	6.0	7.0
Tifgreen	7.4 SH	7.2 SH	6.7	8.3	6.3
Tifway	6.8	8.3 DG	8.5	7.2	2.3
Texturf 10	7.2	7.2	7.5	5.0	5.0
STF-1	7.8 DG	7.5	8.0	4.3	5.7
Midlawn(PP#8162)	8.2	8.2 DG	7.8	7.2	5.8
Midfield(PP#8168)	7.0	7.5	6.7	5.0	6.5
TDS-BM1	7.5 SH	7.2 SH	6.0	8.3	5.8
Misc. KSU entries					
A-7	7.7 DG	7.7	6.7	4.7	8.8
A-12	7.3	7.5	6.3	5.3	8.3
E-7	6.3	6.5	6.8	6.2	7.8
Midway	7.0	8.0 DG	8.5	6.0	9.0

[1/] Plots established on June 23, 1992. Fertilizer incorporated 13-13-13 @ 1 lb. N-P-K per 1000 sq. ft. XL granules applied to vegetative types at planting time. 18-5-9 applied 8-31-92 @ 1 lb. N/M.

[2/] Quality rated on a scale of 0-9 w/9 = best quality. SH = Seedheads; C = Coarse texture; F = Fine; LG = Lt. Green; DG = Dark Green; LS = Leaf Spot.

[3/] Color rating Oct. 2, 1992 on a scale of 0-9 w/9 = darkest green.

[4/] Texture rated on scale of 0-9 w/9 = finest texture.

[5/] Green-up rated 0-9 w/9 = most green, 0 = dormant or dead.

TITLE: Zoysiagrass Cultivar Performance at Wichita, 1991-92

OBJECTIVE: To evaluate 24 cultivars and experimental numbers under Kansas conditions.

PERSONNEL: John C. Pair and Ned Tisserat

INTRODUCTION:

Zoysiagrass is one of the hardiest warm-season turfgrass species grown in the transition zone. In addition to common Korean zoysiagrass (Zoysia japonica), few cultivars have been introduced that offer advantages of more rapid establishment and higher turf qualities. As water restrictions increase, this drought-resistant species may again become a popular choice, especially if more attractive cultivars are available.

MATERIALS AND METHODS:

Twenty-four selections, including the standard Meyer (Z-52) were provided by USDA-NTEP for evaluation. All were established from vegetative plugs on June 11, 1991 on 12 inch centers. Fertilizer was incorporated prior to planting at the rate of 1 lb. N-P-K/1000 sq. ft. as 13-13-13. An additional application of fertilizer containing Atrazine was made in September. Mowing was at 1 inch with clippings returned.

RESULTS:

Preliminary data indicate much more rapid establishment for Korean Common, and Atrazine injury occurred on J2-1, Belair, and TGS-B10. Winter injury was apparent on Belair, Emerald, DALZ 8501, DALZ 8502, DALZ 8508, DALZ 8701. and JZ-1, perhaps partially because of the phytotoxicity of Atrazine for certain cultivars. Early spring green-up was particularly good on TC 5018, GT 2057, and Meyer (Table 1).

The most vigorous and quickest to cover was DALZ 8512 which fully covered the plots in 11 months when planted on 12-inch centers. Other vigorous selections were El Toro, DALZ 8514, GT 2057, CD 2013, TC 5018, and TC 2033 (Table 2). Selections with highest quality ratings were TC 2033, CD 2013, TC 5018, GT 2004, Meyer, El Toro, DALZ 8512, DALZ 8514, and DALZ 8508.

Table 1. Performance of zoysiagrass cultivars in Wichita, KS, 1991-92[1].

Cultivar or Accession no.	Genetic Color	Leaf Texture	Density	Vigor	Herbicide [2] Injury
TC 2033	8.0	6.7	5.3	5.7	9.0
GT 2057	6.3	5.3	6.7	7.3	9.0
CD 2013	6.7	7.0	5.7	4.7	9.0
TC 5018	7.7	5.0	5.3	5.3	9.0
GT 2004	6.3	7.3	4.7	4.3	9.0
CD 259-13	7.0	5.0	7.0	7.3	9.0
*Korean Common	6.0	1.0	6.0	5.7	6.0
*JA-1(lot #A89-1)	6.7	3.7	5.3	6.3	4.7
Meyer	8.3	6.3	4.7	5.3	9.0
Emerald	7.7	9.0	2.7	3.0	9.0
Belair	9.0	5.0	5.0	5.0	6.3
Sunburst	7.7	5.0	5.0	4.7	9.0
El Toro	6.3	4.3	8.3	8.7	9.0
DALZ 8514	7.3	4.7	8.3	8.0	9.0
DALZ 8512	6.7	3.0	9.0	9.0	9.0
DALZ 8516	9.0	7.7	3.0	8.0	9.0
DALZ 8507	6.7	8.0	6.7	6.7	9.0
DALZ 8508	7.3	8.7	4.7	4.7	9.0
DALZ 9006	7.7	8.7	4.7	5.3	9.0
DALZ 8502	7.7	9.0	2.7	2.3	9.0
DALZ 8701	6.7	8.7	3.3	3.3	9.0
*TGS-B10	7.3	3.3	6.0	6.0	5.3
*TGS-W10	8.0	3.7	5.0	6.0	8.0
DALZ 8501	6.0	8.7	4.3	4.3	9.0

[1] Established on June 11, 1991 in 8' x 10' plots of 3 replications, from plugs planted on 12" center. Fertilizer incorporated at 1 lb. N-P-K per 1,000 sq. ft. prior to planting. Betasan 12.59 applied 7-3-91 at 1.87 lbs./1,000 sq. ft. *Denotes seeded selection; other are vegetative. Ratings on scale of 0 to 9, with 9 = best color, density, and vigor and finest texture.

[2] Atrazine @ 2 lbs. A1/A plus 26-3-3 fertilizer applied at 1.5 lbs. N/1,000 sq. ft. on 9-6-91.

Table 2. Zoysiagrass cultivar performance Wichita, KS 1992 [1/].

Cultivar or Accession no.	Spring Green-up 4-7-92	% Cover 5-12-92	Quality rating (0-9 w/9=best) 8-31-92
TC 2033	7.0	83	8.2
GT 2057	7.7	87	7.2
CD 2013	7.0	85	8.3
TC 5018	8.5	85	8.2
GT 2004	7.0	78	8.0
CD 259-13	6.7	83	7.3
*Korean Common	5.5	50	6.3
*JA-1(lot #A89-1)	4.0	53	6.0
Meyer	7.5	77	8.0
Emerald	3.7	47	7.7
Belair	4.2	53	7.7
Sunburst	6.5	75	7.7
El Toro	5.7	93	8.3
DALZ 8514	6.0	93	8.0
DALZ 8512	6.0	99	8.2
DALZ 8516	4.8	37	7.7
DALZ 8507	5.2	80	7.5
DALZ 8508	5.0	68	8.0
DALZ 9006	5.0	65	7.8
DALZ 8502	3.0	43	7.0
DALZ 8701	2.5	35	6.8
*TGS-B10	5.5	62	7.0
*TGS-W10	6.7	73	7.2
DALZ 8501	2.2	47	7.0

[1/] Established on June 11, 1991 in 8' x 10' plots of 3 replications from plugs planted on 12" center. Fertilizer incorporated at 1 lb. N-P-K per 1,000 sq. ft. prior to planting. Betasan 12.59 applied 7-3-91 at 1.87 lbs./1,000 sq. ft.

* Denotes seeded selection; other are vegetative. Ratings on scale of 0 to 9, with 9 = best color, density, and vigor and finest texture.

TITLE: Rooting, Drought Resistance, and Water Use of Three Tall Fescue Cultivars

OBJECTIVE: To compare rooting, drought resistance, and evapotranspiration (ET) rates of three tall fescue cultivars with distinctly different growth rates.

PERSONNEL: Jack D. Fry and Ward Upham

SPONSORS: City of Wichita, Kansas Golf Course Superintendent's Association, Heart of America Golf Course Superintendent's Association

INTRODUCTION:

The recent advent of slow-growing (dwarf) tall fescue cultivars has lead to questions concerning their drought resistance relative to turf-type (nondwarf) and pasture-type cultivars. Kentucky-31, a pasture type tall fescue, is used extensively in Kansas, partly because it is believed to have better drought resistance than newer cultivars. Research is needed to document the relative drought resistance and ET rates of tall fescue cultivars.

MATERIALS AND METHODS:

Greenhouse Study. Kentucky-31 (pasture-type), Mustang (turf-type, nondwarf), and M1C18 (dwarf) tall fescue were seeded on a 90% sand, 10% peat medium on November 19, 1991. Soil was retained by PVC columns measuring 4 in. diam. by 48 in. deep. Twenty-four columns were used (3 cultivars, 4 replications, 2 sampling purposes). Turf was clipped weekly at 2.4 in. Plant height was measured prior to clipping. Peter's 20-10-20 fertilizer was applied at 1 lb. N/1,000 sq. ft. weekly in 36 fl. oz. of water. Each column also received 34 fl. oz. of water twice weekly.

One hundred seventy-six days after planting, half of the columns were cut in sections to determine root weights between 0-12, 12-24, 24-36, and 36-48 in. Sand was washed from roots, then roots were dried at 100 F for 48 hours and weighed.

Water was witheld from turf in the remaining 12 tubes for 57 days. During this period, leaves from tubes were sampled periodically to determine relative water content (RWC): RWC = (fresh leaf wt. - dry wt./turgid wt. - dry wt.) x 100. Turf in tubes was also rated visually throughout the stress period for leaf firing (wilt) on a 0 to 9 scale where 0 = no wilt and 9 = severe wilt. Turf was watered and fertilized as previously described beginning 58 days after stress was initiated to observe recovery.

Field Studies.

Rooting and Drought Resistance. Field plots measuring 20 ft. by 20 ft. were seeded at 5 lbs. seed/1,000 sq. ft. with the previously mentioned tall fescue cultivars on Sept. 19, 1991. Four replications were used. In Spring, 1993, a 7 in. x 30 in. area was excavated to a depth of 30 in. in the center of each plot, and a wooden box installed. Holes were drilled through the box at soil depths of 6 in. and 24 in. Two 6 in.-long steel probes were inserted horizontally through each hole to allow periodic measurement of soil moisture content using time domain reflectometry (TDR). Data were also collected on drought stress, visual rating, and canopy temperature, determined using an infrared thermometer. Rooting was determined by using a 2 in.-diam. probe to obtain three core samples per plot to a depth of 24 in. Soil was washed from roots, and root length density was determined for 0-8, 8-16, and 16-24 in. depths.

Evapotranspiration. The same tall fescue cultivars were seeded at 5 lbs./1,000 sq. ft. in the greenhouse in spring 1992 in 10 in.-diam by 10 in.-deep lysimeters containing fritted clay. Osmocote (18-6-12) was applied at 2.9 oz./lysimeter to the surface of the fritted clay after germination. Lysimeters were set in sleeves in an area of K-31 tall fescue in the field so that turf in the lysimeter was at the same level as surrounding turf. After wetting to field capacity, ET was determined 4 days weekly by weighing lysimeters. Turf was clipped once weekly at 3 in.

RESULTS:

Greenhouse Study. Measurements in the greenhouse confirmed the distinct growth rates of cultivars evaluated. Average rate of shoot elongation was 0.063 in./day for K-31, .047 in/day for Mustang, and 0.016 in./day for M1C18.

Sixty-six to 72% of total root mass of all cultivars was present between 0- 12 in. At 0 - 12 in., Mustang's root mass was significantly greater than that of M1C18, but not K-31. At 12-24 in, K-31 and Mustang exhibited a greater root mass than M1C18. At 24-36 in., root mass of K-31 was greater than that of other cultivars. Total root mass between 0 and 48 in. was similar for K-31 and Mustang and greater than that of M1C18 (Table 1).

Leaf relative water content declined faster in K-31 and Mustang than in M1C18 (Table 2). These cultivars also exhibited visual wilt symptoms sooner than M1C18. Earlier wilt in the faster-growing cultivars probably occurred because they had higher ET rate and more extensive root systems that extracted water from throughout the soil column (Table 3).

After severe wilt occurred in all cultivars, complete recovery was observed 23 days after a routine watering schedule resumed.

Field Studies No differences in rooting were observed among cultivars in the field (Table 4). However, at 0-8 in., the root length density (RLD) of K-31 was 31% greater than that of M1C18 and 12% greater than that of Mustang. Total RLD of K-31 between 0-24 in. was 25% greater than that of M1C18 and 13% greater than that of Mustang.

Because the 1992 summer was extremely wet, no differences in soil moisture extraction, canopy temperature, or turf quality of tall fescue from drought stress were observed. Evapotranspiration was measured on 31 days between June 19 and Sept. 4. Significant differences in ET occurred among cultivars on six dates. K-31 ET was higher than that of Mustang and M1C18 on five of these dates. On July 31, Mustang ET exceeded that of M1C18.

SUMMARY:

Growth rates of the three cultivars evaluated ranked as K-31 > Mustang > M1C18. Preliminary data suggest that K-31 and Mustang tall fescues may produce more roots, and root more deeply than M1C18, a slow-growing cultivar. More work is needed to determine differences in drought resistance between Mustang and K-31. Evapotranspiration of K-31 was significantly higher than that of other cultivars on selected dates. Work will continue in 1993 to compare rooting and drought resistance of these three tall fescue cultivars.

Table 1. Root weights* of three tall fescue cultivars between 0-12, 12-24, 24-36, and 36-48 inch depths in a greenhouse study.

	Depth (in.)				
Cultivar	0-12	12-24	24-36	36-48	0-48
			(g)		
Kentucky 31	1.68 ab**	0.55 a	0.24 a	0.06	2.53 a
Mustang	1.92 a	0.56 a	0.18 b	0.01	2.67 a
M1C18	1.22 b	0.41 b	0.15 b	0.02	1.80 b
				NS	

* Roots were harvested 176 days after seeding turf on a 90% sand, 10% peat medium.

** Means followed by the same letter in a column are not significantly different (P = 0.05).

Table 2. Leaf relative water content (RWC)* of three tall fescue cultivars in the greenhouse.

	Days since Beginning of Stress Period			
Cultivar	20	46	53	55
	(%)			
K-31	96.4 a**	61.9 b	54.0 b	43.8 b
Mustang	93.4 b	60.0 b	78.3 ab	55.6 ab
M1C18	92.3 ab	92.9 a	91.7 a	71.5 a

* RWC was calculated as: RWC = (fresh leaf wt. - dry wt./turgid wt. - dry wt.) x 100.

** Means followed by the same letter in a column are not significantly different (P = 0.05).

Table 3. Leaf firing* of three tall fescue cultivars during a stress period in a greenhouse study.

Cultivar	Days since Beginning of Stress Period						
	36	38	40	43	45	47	54
K-31	5.3 a**	5.5 a	6.0 a	6.5 a	6.5 a	7.5 a	8.0 a
Mustang	5.0 a	5.5 a	5.5 a	4.5 ab	5.0 ab	6.0 ab	7.5 ab
M1C18	1.0 b	2.0 b	2.0 b	2.5 b	3.8 b	3.8 b	6.5 b

* Leaf firing was rated on a 0 to 9 scale where 0 = no wilt, and 9 = severe wilt.

** Means followed by the same letter in a column are not significantly different (P = 0.05).

Table 4. Root length density* of three tall fescue cultivars between 0-8, 8-16, and 16-24 inch soil depths in the field at Manhattan, KS in 1992.

Cultivar	Depth (in.)			
	0-8	8-16	16-24	0-24
		in./0.06 in^3		
Kentucky 31	27.8	9.8	5.0	42.6
Mustang	24.4	7.7	5.0	37.1
M1C18	19.3	8.3	4.4	32.0
	NS**	NS	NS	NS

* Three 2.0-in. diameter cores were sampled from each plot on July 19, 1992.

** Cultivars not statistically different.

Table 5. Evapotranspiration (ET) rates of three tall fescue cultivars on selected dates at Manhattan, KS in 1993.

	ET (in./day)						
Cultivar	19 June	17 July	24 July	30 July	31 July	6 Aug.	Mean
K-31	0.22 a	0.24 a	0.36 a	0.32 a	0.37 a	0.26 a	0.27
Mustang	0.20 b	0.19 b	0.29 b	0.28 b	0.31 b	0.23 ab	0.25
M1C18	0.19 b	0.17 b	0.28 b	0.27 b	0.28 c	0.20 b	0.24 NS

* Means followed by the same letter in a column are not significantly different (P = 0.05).

TITLE: Clipping Yields and Turf Performance of Dwarf Fescue Cultivars

OBJECTIVE: To compare relative cultivar performance of dwarf tall fescues and response to clipping removal vs. mowing with mulching mower.

PERSONNEL: John C. Pair

INTRODUCTION:

Concern for continual deposit of bagged clippings in landfills has prompted the practice of returning clippings rather than collecting them. Dwarf tall fescues may produce fewer clippings, but their performance has not been fully evaluated. Also, the effect of not catching clippings on such diseases as Rhizoctonia Brown Patch has not been determined.

MATERIALS AND METHODS:

Plots were initially established in fall, 1990 using Bonsai, Rebel Jr., Shortstop, and the semi-dwarf Trailblazer. Added later in fall, 1991 were Twilight and a blend of Bonsai, Shortstop, and Twilight.

Management regimes included fertilizing with 3 and 4 lbs. of nitrogen per 1,000 sq. ft. and mowing @ 2½ inches with a mulching mower vs. clipping removal. Fresh and dry weights of clippings were determined to measure yield by cultivar and effects on turf performance including disease incidence.

RESULTS:

Generally, no difference occurred among cultivars, except that Trailblazer was noticeably taller and usually yielded the most fresh weight of clippings. Dry weights were not appreciably different in July and August. Clippings returned provided noticeably better green-up in the spring because of the recycled nitrogen they contained.

Highest ratings on July 30, 1991 were at 3 and 4 lbs. N per 1,000 sq. ft. (data not shown). Shortstop plots rated highest when clippings were returned because of the residual nitrogen. However, by August 26, considerable Rhizoctonia Brown Patch had invaded plots at the 4 lb. N rate, especially in Rebel, Jr. and Shortstop. During the cooler summer of 1992, the disease was less evident. Perhaps a more moderate nitrogen rate, especially where clippings are returned, would reduce the threat of this disease and improve performance of this new dwarf generation of tall fescues.

TITLE: Estimating Turfgrass Evapotranspiration (ET)

OBJECTIVE: To compare actual turfgrass ET to ET estimated from atmometers and empirical models.

PERSONNEL: Jack D. Fry, Ward Upham, and Steven C. Wiest

SPONSORS: City of Wichita, Kansas Golf Course Superintendent's Association., Heart of America Golf Course Superintendent's Association

INTRODUCTION:

Good irrigation is a science and an art, but too often the science is ignored. Environmental and cultural factors influence turfgrass ET; therefore, water requirements vary significantly over time. Nevertheless, many landscape managers irrigate by intuition or according to a set schedule. Information on tools that can be used by the turf manager on-site to estimate ET is needed. A crop coefficient, or multiplier, is used to convert atmometer evaporation to turf ET: Evaporation x crop coefficient = Turf ET.

MATERIALS AND METHODS:

Actual turf ET was determined using small weighing lysimeters (10 in. diam x 10 in. deep) and compared to ET estimates generated by atmometers and empirical models. Grasses in lysimeters evaluated for ET at golf course fairway height (0.5") were Meyer zoysia and Fiesta II perennial ryegrass. Mustang tall fescue ET was determined at a height of 3". Lysimeters were wetted to field capacity, set in a sleeve in an area of turf maintained as that in the lysimeter, and weighed on 4 days each week to determine water loss. At each weighing, lysimeters were returned to the reference weight.

Atmometers included the Class A evaporation pan and the Bellani plate. Depth of water loss from the pan was measured on the same days when ET was determined. Evaporation from Bellani plates was determined by weighing the water reservoir that supplied each plate with water. Weight of water evaporated from the plate was multiplied by 0.30 to convert to depth of water lost (mm).

RESULTS:

Crop coefficients for the evaporation pan ranged from 0.92 to 1.31 for tall fescue mowed at 3" and 0.68 to 0.81 for perennial ryegrass mowed at 0.5" (Table 1). These results suggest that the standard coefficient of 0.8 recommended for cool-season grasses is not always accurate. In fact, coefficients obtained from the evaporation pan were quite variable, as indicated by the rather large standard deviation observed in most months.

Coeffients for the Bellani plate were less variable than those obtained for the evaporation pan (Table 1). Tall fescue coefficents ranged from 0.67 to 0.83, and perennial ryegrass from 0.52 to 0.54. The narrow range of coefficients observed, particularly for perennial ryegrass and zoysia, indicates that the Bellani plate is a relatively accurate tool for use in estimating turf ET.

A modified Penman-Monteith equation was used to estimate ET from weather data. Monthly ET means were fairly consistent, although there were individual days when actual turf ET and estimated ET varied considerably (Table 2).

Table 1. Bellani plate and evaporation pan crop coefficients for zoysiagrass, perennial ryegrass and tall fescue at Manhattan, KS in 1992.

		Crop coefficient					
		Evaporation pan			Bellani plate		
	No. of days	0.5" ht.		3" ht.	0.5" ht.		3" ht.
Month	evaluated	Zoysiagrass	Perennial rye	Tall fescue	Zoysiagrass	Perennial rye	Tall fescue
June	7	0.57 ± 0.15	0.68 ± 0.17**	0.94 ± 0.19	0.43 ± 0.13	0.53 ± 0.16	0.71 ± 0.14
July	10	0.71 ± 0.21	0.81 ± 0.31	1.31 ± 0.41	0.46 ± 0.10	0.52 ± 0.10	0.83 ± 0.14
August	12	0.65 ± 0.14	0.73 ± 0.12	0.92 ± 0.18	0.47 ± 0.10	0.54 ± 0.07	0.67 ± 0.14
September	2	0.64 ± 0.01	0.78 ± 0.05	0.98 ± 0.08	0.45 ± 0.01	0.54 ± 0.03	0.69 ± 0.05

$$\text{* Crop coefficient} = \frac{\text{Actual turf ET (from lysimeter)}}{\text{Evaporation (from pan or Bellani plate)}}$$

**Coefficient ± standard deviation

Table 2. Comparison of actual turf ET to ET estimated from an empirical model at Manhattan, KS in 1992.

		3" ht.		0.5" ht.			
		Kentucky-31 tall fescue		'Fiesta II' perennial ryegrass		'Meyer' Zoysia	
	No. of days	Actual *	Predicted**	Actual	Predicted	Actual	Predicted
Month	evaluated	ET (in./day)	ET (in./day)	ET (in./day)	ET (in. day)	ET (in./day)	ET (in./day)
June	5	0.29	0.28	0.21	0.18	0.17	0.16
July	10	0.31	0.29	0.19	0.20	0.17	0.18
August	12	0.23	0.24	0.18	0.18	0.16	0.15
September	2	0.26	0.19	0.20	0.13	0.17	0.11

* Actual ET was determined using small weighing lysimeters.

** A modified Penman-Monteith equation was used to predict ET.

TITLE: Planting Month and Seed Soaking Effects on Buffalograss Establishment

OBJECTIVE: To evaluate the influence of planting month and seed soaking treatment on buffalograss establishment.

PERSONNEL: Jack Fry, Ward Upham, and Larry Leuthold

SPONSOR: Sharp Brothers Seed Co.

INTRODUCTION:

Buffalograss is typically seeded between April and August in Kansas, but the optimum seeding month has not been determined. Establishment can be slowed due to poor seed germination, and there is interest in evaluating techniques that may enhance germination. Others have reported that soaking buffalograss burs in water prior to seeding can reduce the influence of a growth-inhibiting oil present in the buffalograss seed.

MATERIALS AND METHODS:

Studies evaluated the influence of four or five planting dates and two seed soaking treatments on establishment. In 1991, burs were seeded at 3 lb/1,000 ft^2 on May 10, June 7, July 10, and August 8. In 1992, seeding rate was 1 lb/1,000 ft^2 on April 13, May 15, June 12, July 16, and August 14.

Bur treatments were "soaked" and "nonsoaked". Soaking treatments were applied as follows: i) on the first day, burs were placed in a cotton bag, submerged in water for 6 h, and drained; ii) the cotton bag was covered with plastic after soaking to ensure moisture retention; iii) on the second and third days bags containing burs were submerged until bubbling ceased, removed, and drained; and iv) on the fourth day, burs were removed from the cotton bag and allowed to air dry by spreading on white paper.

Planting date and seed soaking treatments were arranged factorially in a randomized complete block design with three replications. Plots measured 1 by 2 m. Buffalograss coverage was rated visually using a 0 to 100% scale each week beginning 3 weeks after planting (WAP) and ending 7 WAP in 1991. In 1992, coverage was rated between 4 and 13 WAP. No data were collected for the August planting date after 7 WAP in 1992, because cold temperatures prevented buffalograss spread.

RESULTS:

In 1991, buffalograss seeded in May, June, or July exhibited complete coverage by 7 WAP (Fig. 1). In 1992, seeding in June or July resulted in > 95% coverage by 9 WAP. In the same year, seeding in April or May required 12 to 13 weeks for complete stand establishment. Buffalograss seeded in August exhibited <25% coverage by the end of the first growing season.

Subjecting buffalograss burs to a water soaking treatment prior to planting resulted in >30% more seedlings by 2 WAP compared to nonsoaked burs and increased coverage by up to 18% on selected rating dates at 3 to 13 WAP (data not shown). However, complete buffalograss coverage occurred only about 1 week sooner where soaked vs. nonsoaked burs were planted.

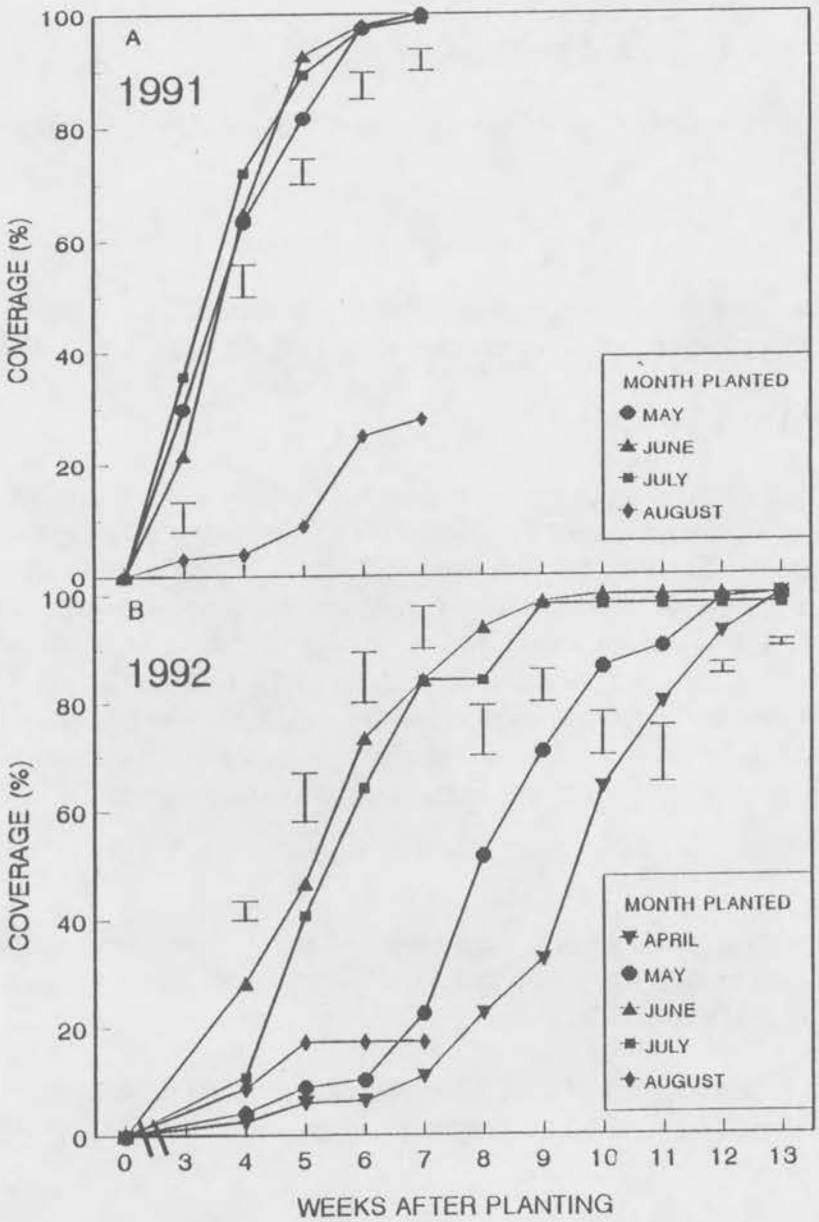


Figure 1. Effect of seeding month on buffalograss coverage in 1991 (A) and 1992 (B) at Manhattan, KS.

TITLE: Comparison of Aerifiers for Use on Golf Course Fairways

OBJECTIVE: To evaluate turf performance after treatment with various aerifiers.

PERSONNEL: Jack D. Fry and Kevin Kamphaus

SPONSORS: Kansas Golf Course Superintendent's Association , Manhattan Country Club

INTRODUCTION:

Information is needed on turf response following aerification. Many aerifiers are available, but a comparison of units for efficacy in alleviating compaction is needed.

MATERIALS AND METHODS:

Research was done on a fairway at Manhattan Country Club in Manhattan, Kansas. Turf was a blend of perennial ryegrass cultivars. Soil was a silty clay loam. Aerifiers evaluated and their specifications are presented in Table 1. Aerification was done in April, 1992 on plots measuring 8 ft. x 96 ft. Two parallel passes were made over the length of each plot. Turf was observed for visual quality throughout the summer of 1992. Clippings were collected on May 7 using a 22 in.-wide walk-behind greensmower. A 5 ft.-long pass was made in each plot, and clippings were dried and weighed. On July 8, 3 4-in.-diam. x 4-in.-deep plugs were removed from random locations in each plot. Soil was washed from plugs using a root washer, and roots were dried at 100 F and weighed.

RESULTS:

No differences in visual quality were observed at any time during the summer. After clipping and root weight data were analyzed, no differences for either attribute were observed between the control and any aerifier.

Significant differences might have been observed on a more severely compacted soil. Furthermore, the summer of 1992 was quite wet, which might have had an effect on turf response to aerification.

Table 1. Specifications for aerifiers evaluated at Manhattan Country Club in 1992.

Aerifier	Tine Length	Tine Diameter	Centers	Hole Depth	No. Holes/ft^2
Terracare 320 (6 batteries for weight)	3"	0.5"	3.25"	~1"	11
Aerway	6.5" (spikes)	~0.25" width	13" apart	2.5-3"	2-3
Ryan GA-60	4"	0.75"	2.5"	~2"	13
Ryan Walk-behind	3.5"	0.5"	2"	2"	26

Table 2. Clipping weights and root weights of perennial ryegrass after aerification at Manhattan Country Club on April 7, 1992.

Aerifier	Clipping wt. (g) (5/7)	Root wt. (7/8)
Terracare 320	44.4	1.8
Aerway	43.6	2.9
Ryan GA-60	43.0	2.3
Ryan walk-behind	44.9	1.8
Untreated	44.3	1.7
	NS*	NS

* NS - treatments were not statistically different (P = 0.05).

TITLE: Tall Fescue Response to Three Fertilizer Programs

OBJECTIVES: To compare single applications of ONCE 24-6-10 with various fertilizer programs, all at 4 lbs. of nitrogen per 1000 sq. ft. per season.

PERSONNEL: John C. Pair

SPONSOR: Grace-Sierra Company

INTRODUCTION:

Most fertilizer programs for home lawns consist of approximately 4 lbs. of actual nitrogen per 1000 sq. ft. per season. Applications are typically distributed over the months from April through November, with the summer applications often consisting of a slowly available nitrogen source. A series of treatments was designed to compare various fertilizer programs, all at the same nitrogen level (4 lbs. N per year), two of which were applied at the full rate all at once using a slowly available nitrogen carrier (ONCE 24-6-10).

MATERIALS AND METHODS:

Six fertility programs were applied to a 3-year-old stand of a tall fescue premium blend (containing Arid, Apache, Rebel II, and Bonanza) beginning in the fall, 1990. Treatments were as follows:

1. (24-6-10 ONCE product) applied at 4 lbs. N/1000 sq. ft. in September.
2. 24-6-12 (a commercial blend) applied at 1 lb. N/1000 sq. ft. in Sept., Nov., April, and June.
3. Same as No. 2, except June application was sulfur-coated urea (36-0-0).
4. 46-0-0 (urea) at 1 lb. N/1000 sq. ft. plus 6% P_2O_5 and 11% K_2O applied in Sept., urea in Nov. and April, and sulfur-coated urea (36-0-0) in June.
5. 46-0-0 (urea) at 1 lb. N/1000 sq. ft. in Sept. and Nov. with 24-6-10 (ONCE) applied at 2 lbs. N/1000 sq. ft. in April (with subsequent spring applications of ONCE at 4 lbs. N).
6. No fertilizer in the fall but 4 lbs. N/1000 sq. ft. in March as ONCE 24-6-10 (with subsequent spring applications at the 4 lbs. N rate).

All fertilizer treatments were applied as dry, granular, or pelletized products and immediately watered in. Tall fescue was irrigated to avoid stress and mowed at 2.5 inches with clippings allowed to drop except when collected for weighing.

Initial observations were made on color, vigor, and overall turf quality, plus spring green-up in late March, 1991. At that time, a spring treatment of ONCE was also applied at a full rate of 4 lbs. N/1000 sq. ft. Quality ratings continued throughout 1991, at which time a second year of treatments was applied and into spring, 1992 when a second spring application was again compared to fall treatments.

Clipping yields were collected from June through October of 1991 and from June through August of 1992, at which time the experiment was terminated. Initial fresh weights were taken at time of collection and again later, after clippings were dried.

RESULTS:

After only one season of observations, most treatments were providing satisfactory results based on visual quality and clipping yields. Peaks in vigor and color coincided with individual treatment applications as expected. A fall application of 4 lbs. of nitrogen per 1000 sq. ft. applied all at once, provided excellent growth, quality and spring green-up through the first spring season (Table 1).

Table 1. Response of tall fescue to various fertilizer programs [1/].

Fertilizer Program	Turf Quality (0-9 w/9 = best)			
	10-1-90	10-18-90	11-12-90	3-28-91
1. ONCE (24-6-10) @ 4 lbs. N. in Sept.	8.8	8.8	8.3	7.4
2. 24-6-12 @ 1 lb. N. Sept., Nov., April & June	7.8	5.5	5.6	6.1
3. Same as #2 above but SCU in June	7.1	5.5	6.1	5.8
4. Urea (46-0-0) @ 1 lb. N. Sept., Nov., & April, SCU in June	8.5	6.5	6.0	7.3
5. Urea @ 1 lb. N. Sept. & Nov. ONCE (24-6-10) @ 2 lbs. N. April	8.5	6.6	6.4	7.3
6. No fertilizer in fall, 1990 ONCE (24-6-10) @ 4 lbs. N. in March, 1991-92	4.5	4.0	5.0	2.9

[1/] Applied to a 3-year-old stand of tall fescue premium blend (mean of four replications).

Summer quality was satisfactory from a single application of ONCE in the fall but did not maintain the quality ratings, particularly in late summer, that were achieved by spring applications of 4 lbs. ONCE (treatments 5 & 6). Results of ONCE applied in the fall were similar to treatment 3, which received 24-6-12 plus SCU in June (Table 2).

Table 2. Response of tall fescue to various fertilizer programs

Trt.	Turf Quality (0-9 w/9 = best)						1991	1992		
No.[1]	4-22	6-3	6-28	7-31	8-29	9-12	10-9	3-5	4-27	8-4
1.	8.0	6.4	6.3	6.5	6.6	6.8	8.1	7.1	7.3	5.9
2.	6.9	6.8	6.0	6.5	6.3	6.5	6.6	5.9	6.6	6.5
3.	6.8	7.4	6.5	7.0	7.1	7.1	7.0	4.0	6.8	7.5
4.	7.5	7.1	6.8	6.5	6.4	6.6	6.9	5.8	6.4	7.0
5.	*7.5	7.5	7.6	7.5	7.4	7.4	5.8	*1.5	8.6	7.0
6.	*8.6	8.3	8.1	8.1	7.6	7.5	5.6	*2.3	8.6	6.6

1/ Treatments 1 thru 6 were same as in Table 1. *Treatments 5 and 6 (ONCE in spring) were applied before ratings taken on 4-22-91 but after data shown for 3-5-92.

Although data were collected, including clipping weights, on all six treatments for 2 years, several standard comparisons (treatments 2, 3, and 4) were very similar in response. Therefore, only treatment 3 (a premixed 24-6-12 commercial blend) plus sulfur-coated urea (36-0-0) applied in June representing a typical 4 applications-per-year program is used in most graphs for comparison to one application per year of ONCE 24-6-10.

Spring green-up quality of ONCE-treated plots exceeded that of conventional treatments in April because of extra nitrogen from the 4 lb. rate. However, additional nitrogen applied in June, such as sulfur-coated urea in treatment No. 3, increased color and vigor greater than ONCE (treatment No. 1) applied in the previous fall (Fig. 1).

Clipping weights confirmed that fall-applied nitrogen (ONCE) at the 4 lb. rate (Trt. No. 1) produced fewer or similar amounts of clippings compared to conventional programs applying 1 lb. N each month of September, November, April, and June (Fig. 2). However, ONCE applied in the spring (treatment No. 6), as expected, produced more clippings than the same product applied in the fall. Fewer total clippings were harvested from the fall applied ONCE (treatment No. 1 with 722.1 gms. fresh and 367.8 gms. dry weight, respectively) than other treatments, offering same advantage when mowing (Table 3).

Table 3. Fresh and dry weight of clippings removed from six fertilizer comparisons.

Trt.	Fresh Weight (gms.)						
No.	6-12	8-1	8-30	6-18	7-9	8-5	Total
1.	127.3	103.0	204.5	183.0	64.8	39.5	722.1
2.	129.0	89.3	175.5	205.0	84.8	63.5	747.1
3.	126.0	104.3	182.5	251.3	113.5	70.3	847.8
4.	153.8	97.3	186.3	254.8	94.3	61.8	848.0
5.	193.3	162.3	258.3	360.3	101.3	89.7	1164.9
6.	162.3	169.8	190.3	379.8	113.3	92.0	1107.3
Trt.	Dry Weight						
No.	6-28	8-27	9-23	7-8	7-17	8-20	Total
1.	68.8	58.8	84.5	90.8	49.8	15.3	367.8
2.	69.5	56.3	76.8	92.3	55.5	22.5	372.8
3.	67.3	60.5	80.0	100.8	63.3	23.3	395.1
4.	74.3	60.0	79.3	105.0	58.5	21.0	398.0
5.	84.0	77.3	96.5	118.3	59.5	28.0	463.5
6.	74.3	77.0	82.0	121.3	62.0	29.5	446.0

Although spring-applied ONCE maintained higher visual quality during late summer, high rates of spring-applied nitrogen have certain disadvantages, including possible increase of certain fungus diseases.

1991
ONCE Comparisons

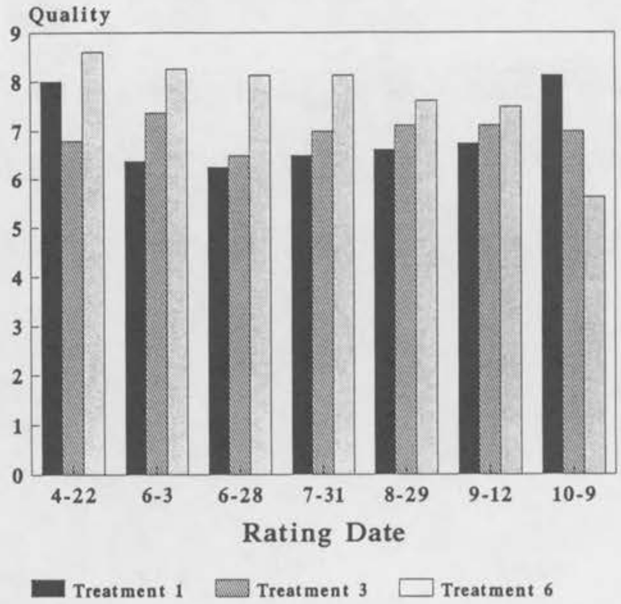


Fig. 1. A comparison of ONCE 24-6-10 applied fall and spring with conventional lawn care program applied 4 x per year.

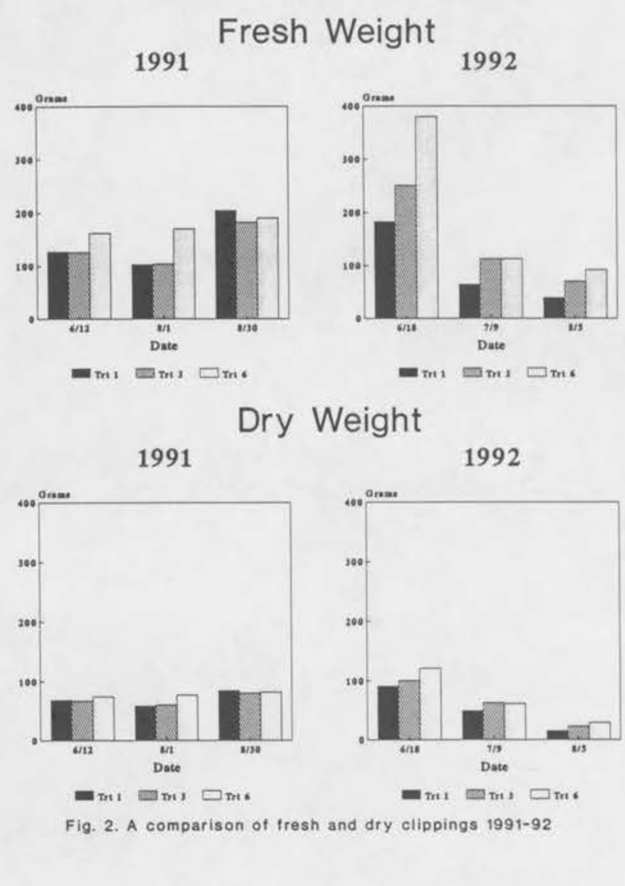


Fig. 2. A comparison of fresh and dry clippings 1991-92

TITLE: Effects of Mowing Height and Nitrogen on Large Patch Disease of Zoysiagrass

OBJECTIVE: To determine if mowing height, nitrogen rate, or nitrogen carrier has any effects on development of large patch disease of zoysiagrass.

PERSONNEL: David Green II, Jack Fry, John Pair, and Ned Tisserat

MATERIALS AND METHODS:

The effects of nitrogen and mowing height on large patch development was studied at the Rocky Ford Research Center in Manhattan, KS and the Wichita Research Center. The experimental design was a split plot, with mowing height as the main plot and nitrogen treatments as subplots. We used three mowing heights of 0.5", 1", and 2" and 10 nitrogen treatments. The nitrogen treatments were composed of five nitrogen carriers of urea, Nitroform, Milorganite, Sustane, and Bova Mura, each at two rates of 1.5 and 3 lbs. N a.i./1000 sq ft/yr. Plots were monitored weekly for the rate of patch development, disease severity within the patch, and overall turf quality.

RESULTS:

Because of the complexity in displaying all of the data, only a summary of the experiment will be included. In general, disease severity increased as mowing height decreased. The disease was most severe at the 0.5" mowing height. The different rates of nitrogen application (1.5 and 3 lb) did not affect disease severity, although turfgrass recovery was enhanced by the higher nitrogen levels in Manhattan, but not Wichita. The type of nitrogen carrier, including organic compost sources, did not influence large patch development or patch recovery. There was a slight trend towards faster turfgrass recovery following applications of the faster release N carriers (urea and Sustane).

TITLE: Influence of Preemergence Herbicide Applications on the Severity of Large Patch Disease of Zoysiagrass

OBJECTIVE: To determine whether application of preemergence herbicides predisposes zoysiagrass to increased injury from large patch disease.

PERSONNEL: David Green II, Jack Fry, John Pair, and Ned Tisserat

MATERIALS AND METHODS:

Preemergence herbicides were applied in April and June as liquids using a CO_2 backpack sprayer and a two-nozzle hand-held boom with T-jet flat fan nozzles. Herbicide treatments and an untreated control were arranged in a randomized complete block design with three blocks. Treatments were initially applied in 1988 and were continued yearly through 1992. Turf was mowed at 0.75 in. throughout the experiment. Plots were rated yearly for the percent plot area diseased.

RESULTS:

None of the preemergence herbicides tested influenced disease severity or turfgrass recovery following disease development (Table 1). The association of large patch development with spring preemergence herbicide applications may simply coincide with favorable environmental conditions necessary for patch development. Furthermore, some turfgrass managers mix nitrogen fertilizers with herbicides in spring. The apparent increase in large patch severity may be a result of increased nitrogen levels rather than deleterious effects of the herbicide.

Table 1. Effects of preemergence herbicides on symptoms of large patch disease on zoysiagrass, 1992.

		AUDPC[z]		
Preemergence Herbicide	Application Level (lb/A^{-1})	Patch Diameter[y]	Turf Damage[x]	Shoot Density Reduction[w]
DCPA	10.5	660 a[v]	84 a	1752 a
	5.3	687 a	145 a	2251 a
Oxadiazon	3.0	670 a	116 a	2338 a
	1.5	704 a	120 a	2551 a
Benefin	2.0	685 a	107 a	2285 a
	1.0	612 a	82 a	1523 a
Bensulide	10.0	657 a	112 a	2142 a
	5.0	603 a	86 a	1717 a
Pendimethalin	1.4	623 a	95 a	1420 a
	0.7	705 a	102 a	1857 a
Simazine	2.0	681 a	122 a	2310 a
	1.0	647 a	82 a	1829 a
Siduron	18.0	642 a	87 a	1524 a
	9.0	649 a	102 a	1738 a
Control		565 a	87 a	1285 a

[z] Area under the disease progression curve. AUDPC values for spring and fall were combined for analysis.

[y] Total area under mean patch diameter curve.

[x] Total area under mean turf damage rating curve (0 = no plot damage, and 9 = > 88% plot damage).

[w] Total area under mean shoot density reduction (SDR) curve (SDR(%) = Avg. no. of shoots in 2.54 cm^2 at center of healthy turf - no. of shoots in 2.54 cm^2 at center of disease patches/no. of shoots in 2.54 cm^2 of healthy turf X 100).

[v] Means in the same column followed by the same letter are not significantly different ($p \leq 0.05$) according to Scheffe's S method.

TITLE: Curative Fall Fungicide Applications for Control of Large Patch Disease of Zoysiagrass

OBJECTIVE: To determine whether application of certain fungicides in the fall will suppress development of large patch disease of zoysia, caused by Rhizoctonia solani AG2-2.

PERSONNEL: Ned Tisserat, Jack Fry, and Ann Nus

MATERIALS AND METHODS:

Fungicides were evaluated on a zoysiagrass plot at the turf research farm, Manhattan, KS. Applications were made on 17 Sep 92 just as symptoms of large patch were developing. Fungicides were applied with a CO_2-powered backpack sprayer with 8004 Tee Jet nozzles at 20 psi in water equivalent to 4.5 gal/1000 ft^2. Plots were irrigated with approximately 1/4 in. of water immediately after fungicide applications. Plots were 5 X 6 ft and arranged in a randomized complete block design with four replicates. Plots were rated on 7 Oct 92 for the percent area of each plot damaged by large patch.

RESULTS:

Disease severity was moderate. Applications of all fungicides, except Lynx and the low rates of Vorlan plus and Banner, resulted in significant disease control. Several fungicides, including the high rate of Vorlan plus, the high rate of Broadway, Prostar, Chipco 26019, and Bayleton did a good job of reducing disease severity. Previous studies suggest that fall fungicide applications may also suppress disease development in the spring. Therefore, plots will be rated in April and May 1993 for symptoms of large patch.

Treatment	Rate/1000 ft^2	Diseased Area %*
No fungicide	---	35.0 a
Banner 1.1 EC	2 fl oz	25.0 ab
Vorlan Plus	2 oz	25.0 ab
Lynx 25 DF	1 oz	20.0 abc
RH 0611	6 oz	15.0 bcd
EXP 10064B 1.67 SC	1.5 fl oz	13.8 bcd
Broadway 4.42 AS	3 fl oz	12.5 bcd
Eagle 40 WP	0.6 oz	12.5 bcd
CGA 173506 75 WG	0.4 oz	10.0 bcd
Banner 1.1 EC	4 oz	10.0 bcd
Chipco 26019 50 DG	4 oz	8.8 cd
Vorlan Plus	4 oz	8.0 cd
Bayleton 25 DF	2 oz	7.5 cd
Chipco 26019 50 DG	2 oz	6.3 cd
Prostar 50 WP	2 oz	3.8 d
Prostar 50 WP	2 oz	1.3 d
Broadway 4.42 AS	6 oz	1.3 d

* Means not followed by the same letter are significantly different ($\underline{P} \leq 0.05$) by Fischer's protected LSD test.

TITLE: Resistance of Kentucky Bluegrass Cultivars to Summer Patch

OBJECTIVE: To evaluate Kentucky bluegrass cultivars for resistance to summer patch.

PERSONNEL: Jack Fry, Ward Upham, and Ned Tisserat

INTRODUCTION:

Summer patch, caused by the fungus Magnaporthe poae, is a perennial, destructive disease of Kentucky bluegrass. The disease is difficult to control with chemicals, but recent evidence suggests that certain cultivars may have resistance or tolerance to this disease.

MATERIALS AND METHODS:

Seventy-three Kentucky bluegrass cultivars in a field study were evaluated for summer patch resistance. Plots were established in fall 90 on a silt loam soil. Cultivars were arranged in a randomized complete block design with three replications. Turf was maintained at a 0.75 in. height and fertilized with 1 lb. N/1,000 ft^2 in Sep and Oct 91 and May 92. Irrigation was used to prevent stress. Plots were rated visually for summer patch infection on 20 Aug 92 as described below. Magnaporthe poae was isolated from infected roots and confirmed by ascocarp formation after pairing with opposite mating types.

RESULTS:

Significant differences in disease resistance were found among Kentucky bluegrass cultivars (Table 1). Several cultivars showed no damage from summer patch (9 rating), whereas many others (ratings 7-8) exhibited only minor damage. Cultivars with a rating of <8 had an unacceptable level of summer patch.

Table 1. Ratings of Kentucky bluegrass cultivars for resistance to summer patch, 1992.

Cultivar	Summer patch*
Abbey	9.0
America	9.0
Aspen	9.0
Banff	9.0
Barblue	9.0
Blacksburg	9.0
Bristol	9.0
Challenger	9.0
Chateau	9.0
Classic	9.0
Cobalt	9.0
Cynthia	9.0
Dawn	9.0
Destiny	9.0
Eagleton	9.0
Eclipse	9.0
Estate	9.0
Freedom	9.0
Georgetown	9.0
Glade	9.0
Gnome	9.0
Haga	9.0
Huntsville	9.0
Indigo	9.0
Julia	9.0
Kelly	9.0
Kenblue	9.0
Limousine	9.0
Livingston	9.0
Marquis	9.0
Melba	9.0
Midnight	9.0
Minstrel	9.0
Monopoly	9.0
Nustar	9.0
Platini	9.0
Princeton 104	9.0
Summit	9.0
Trenton	9.0
True Blue	9.0
Washington	9.0
A-34	8.7
Alpine	8.7
Ampellia	8.7
Conni	8.7
Coventry	8.7
Liberty	8.7
Merit	8.7
Miracle	8.7
Nassau	8.7
Opal	8.7
Silvia	8.7
Trampas	8.7
Victa	8.7
Merion	8.0
Noblesse	8.0
Ram-1	8.0
Chelsea	7.7
Fortuna	7.7
Cardiff	7.0
Miranda	6.3
Park	6.0
South Dakota Certified	6.0
Donna	5.3
Argyle	5.0
Ronde	4.7
Greenley	4.0
Ginger	2.7
MSD**	1.4

* Infection rated visually on a 0 to 9 scale where 0 = dead turf and 9 = no turf damage.

** Minimum significant difference according to the Waller-Duncan K-ratio t test (K = 100, P = 0.05). MSD value determined by analysis of cultivars with mean ratings of 8.7 or less.

TITLE: Preventive Fall Fungicide Applications for Control of Yellow Patch on Creeping Bentgrass.

OBJECTIVE: To determine the types of fungicides effective in controlling yellow patch of creeping bentgrass, caused by Rhizoctonia cerealis.

PERSONNEL: Ned Tisserat

MATERIALS AND METHODS:

Fungicides were evaluated on a bentgrass putting green at the Alvamar Country Club, Lawrence, KS. Fungicides were applied on 5 Nov 92 with a CO_2-powered backpack sprayer equipped with 8004 flat fan nozzles at 20 psi in water equivalent to 4.5 gal/1000 ft^2. Plots were 5 X 6 ft and arranged in a randomized complete block design with four replicates. Plots were irrigated with 1/4 inch water immediately after fungicide application. Plots were rated on 16 March for the number of patches, the percent plot area damaged by the patches, and severity of the disease within patches.

RESULTS:

Mild symptoms of yellow patch were present on the turf at the time of fungicide application in November. The winter of 1992-1993 was unusually wet and cold, and snow covered the experimental plots for long periods in January and February. By March, yellow patch symptoms were severe. Damage more closely resembled injury from pink or gray snow mold; however, fungi associated with snow molds were not isolated from diseased plants. Large, brown sclerotia were abundant in patches, and Rhizoctonia cerealis was consistently isolated from sclerotia and diseased tissue. Disease severity was variable in the experimental plots, resulting in a significant (P = 0.05) block effect. Several fungicides appeared to suppress patch development; however many of the treatments were not significantly different than the control because of extreme variability within plots (Table 1). Application of Lynx and Polyoxin significantly (P = 0.05) reduced disease severity.

Table 1. Fungicide control of yellow patch of creeping bentgrass, 1992.

Treatment	Rate /1000 ft^2	Number of Patches/Plot[t]	Plot Area Damaged (%)[u]	Patch Severity[v]
Lynx 25 DF	1 oz	0.3a	0.5a	0.3a
Polyoxin 11.2 DF	0.7 oz	0.5a	1.0ab	0.5ab
Polyoxin 2.2 WP	3.6 oz	0.8ab	2.5abc	0.5ab
EXP 10064B 1.6 SC	1.5 fl oz	1.5ab	4.0abcde	1.3abc
Broadway 4.42 AS[x]	6 fl oz	2.0abc	6.3abcd	1.3abc
Bayleton 25 DF	4 oz	2.0abc	10.3abcdef	1.5abcd
RH 0611 WP[y]	6 oz	3.0abcd	8.8abcdef	2.0 bcde
Banner 1.1 E	4 oz	3.5abcd	21.3 cdef	1.5abcd
Bayleton 25 DF	2 oz	3.8abcde	16.3 cdef	2.0 bcde
Banner 1.1 E	2 oz	4.5 bcdef	11.2 bcdef	1.8abcde
Eagle WP	0.6 oz	4.5 bcdef	25.0 f	2.8 cde
CGA 173506 75WG	0.4 oz	4.5 bcdef	13.8 cdef	3.0 de
Prostar 70 WG	2.8 oz	5.5 cdef	16.3 def	2.5 cde
Fungo 50 WP	4 oz	5.5 cdef	18.8 cdef	2.3 cde
No fungicide		5.5 cdef	22.5 f	2.3 cde
Vorlan plus WP	2 oz	5.8 cdef	23.0 def	3.3 e
Fungo + Vorlan	2 + 2 oz	5.8 cdef	28.8 f	2.8 cde
Chipco 26019 DG	6 oz	6.3 def	20.0 def	2.8 cde
Vorlan Plus WP	4 oz	8.0 f	23.0 ef	2.8 cde

[t] Size of individual patches in plot ranged from less than .5 ft - 2 ft in diameter. Values not followed by the same letter are significantly different ($\underline{P}$ = 0.05) by Fisher's protected LSD test.

[u] Data on percent plot area diseased were arcsine-square root transformed before analysis, then back-transformed for presentation in the table.

[v] Severity of disease within patches was rated on a 0-5 scale where 0= no patches; 1= patches with slight discoloration but no turf death; and 5 = complete kill of all turfgrass within patch.

[x] Combination of chlorothalonil plus fenarimol

[y] Combination of myclobutanil (Nova) plus mancozeb

TITLE: Effects of Various Postemergence Herbicides on Seedling Buffalograss under Field and Greenhouse Conditions

OBJECTIVE: To evaluate the phytotoxicity of various postemergence herbicides on newly seeded buffalograss under field and greenhouse conditions.

PERSONNEL: Ward Upham, Jack D. Fry, and Bryan Lappin

MATERIALS AND METHODS:

Greenhouse Study

The experiment was conducted at the Kansas State University Greenhouse Range at Manhattan, KS. Sharps Improved buffalograss was seeded in standard greenhouse flats on 24 September, 1992. Planting rate was 1.25 lbs/1000 $ft.^2$,and the media consisted of two parts peat, one part perlite, and one part soil. Milorganite was incorporated prior to seeding at the rate of 1 lb. N/1000 ft^2. Germination occurred 6 days after seeding.

On 20 October, 1992, flats were temporarily removed from the greenhouse for treatment. Eleven postemergence herbicides with four replications were employed. Treatments were applied with a backpack CO_2 sprayer equipped with 8004 flat fan nozzles calibrated to deliver 60 GPA (1.4 gal/1000 ft^2) at 35 psi. Flats were returned to the greenhouse and placed on a bench in a completely randomized fashion. An overhead mist system was used for irrigation.

Data were collected on plant height, tiller number, and phytotoxicity. Three plants were randomly labeled in each flat and rated throughout the study. The rating for each flat consisted of the average rating of the three individual plants. Plant height was determined by measuring the distance between the tip of the longest living leaf and the soil surface. Phytotoxicity was rated visually on a 0-9 scale, where 0 = no damage and 9 = death. Ratings that were greater than or equal to 4.5 indicated unacceptable phytotoxicity. Tiller proliferation was acceptable at a rating of 2.5 or greater.

Data were subjected to analysis of variance, and means were separated using the Waller/Duncan Bayesian $\underline{k}$ ratio $\underline{t}$ test ($\underline{k}$=100, P=0.05).

Field Study

The field study was done at the Kansas State University Turf Research Center in Manhattan, KS. Sharps Improved buffalograss was seeded at the rate of 1 lb seed/1000 ft^2 on 2 July, 1992. All treatments were applied on 7/28/92. Eleven postemergence herbicides with three replications were used. Treatments were applied with a backpack CO_2 sprayer equipped with 8004 flat fan nozzles calibrated to deliver 60 GPA (1.4 gal/1000 ft^2) at 35 psi.

Data were collected on phytotoxicity and percent of plot covered with turf. Phytotoxicity was rated visually with 9 = no damage and 0 = completely brown.. Phytotoxicity ratings were taken at 2 and 4 weeks after treatment (WAT). At 4 and 6

WAT, ratings of percent of plot covered were taken by visual estimation.

Data were subjected to analysis of variance, and means were separated using the Waller/Duncan Bayesian k ratio t test (k=100, P=0.05).

RESULTS:

Greenhouse Study

At 14 days after treatment (DAT), all treatments except dithiopyr, quinclorac, and MSMA demonstrated unacceptable phytotoxicity (Table 1). These same three treatments were the only ones that maintained their acceptable rating throughout the experiment. Flats treated with 2,4-D + triclopyr + chlopyralid showed a rapid decline in quality at 7 and 14 DAT, then leveled off below the acceptable range. The same treatments that exhibited the least phytotoxicity also were the only three that resulted in acceptable tiller proliferation and plant height (Tables 2&3). Immediately following application, a rapid decline in tiller number and plant height was induced in all treatments except those previously mentioned. At 14 DAT, flats treated with dithippyr, quinclorac and MSMA were the only ones that continued to grow. The remainder simply went into a state of rapid decline and never recovered. Although no observable recovery was demonstrated for any of the treatments except those mentioned previously, flats treated with 2,4-D + triclopyr + chlopyralid and 2,4-D Amine did level off into a slower rate of decline starting at 21 DAT.

Field Study

Phytotoxicity Ratings: Ratings taken at two WAT revealed that Trimec Classic, Turflon II Amine, Banvel, and Acclaim showed significant damage as compared to the control, with Banvel and Acclaim being the most damaging (Table 4). By 4 WAT, all treatments had recovered except Banvel and Acclaim. These are found in Table 5.

Percent of Plot Covered Ratings: At 4 WAT, Turflon Ester and Drive plots showed significantly higher coverage than the control plots, and Banvel, and Acclaim showed coverage that was significantly lower. The treatment utilizing Drive had 88.3% coverage, the Control had 65% coverage and Acclaim had 4.3 % coverage. By 6 WAT, only Banvel and Acclaim treatments had less than 90% coverage (85% and 5% respectively); they also were the only two treatments to differ significantly from the control.

Table 1: Phytotoxicity rating of selected postemergence herbicides for Sharp's Improved buffalograss grown in a greenhouse environment.

Herbicide	Rate (lbs a.i./A)	Phytotoxicity*				
		Days after Treatment				
		7	14	21	28	35
Control	----------	0.1 f*	0.0 f	0.3 f	0.0 e	0.5 e
Dithiopyr (Dimension)	0.5	0.9 ef	0.7 ef	3.1 d	1.8 d	2.3 d
Fenoxaprop (Acclaim)	0.18	4.6 ab	7.7 ab	9.0 a	9.0 a	9.0 a
Quinclorac (Drive)	0.75	1.2 ef	1.5 e	1.1 ef	1.5 d	1.5 d
MSMA (Daconate 6)	2.0	1.6 de	0.6 ef	2.1 de	1.8 d	1.6 d
Triclopyr (Turflon Ester)	0.41	4.0 bc	7.2 abc	8.6 a	8.9 a	9.0 a
Clopyralid (Confront)	0.61	2.1 de	6.6 bcd	7.5 abc	8.6 a	8.8 ab
2,4-D + Triclopyr (Turflon II Amine)	1.18	3.7 bc	7.4 abc	8.6 a	8.6 a	9.0 a
2,4-D + Triclopyr + Clopyralid (XRM - 5202)	1.0	3.0 cd	6.3 cd	7.0 bc	6.5 c	7.0 c
2,4-D + MCPP + Dicamba (Trimec Classic)	1.1	4.0 bc	8.4 a	9.0 a	9.0 a	9.0 a
Dicamba (Banvel)	0.61	5.8 a	7.5 abc	8.4 ab	8.4 ab	8.8 ab
2,4-D Amine	0.6	1.7 de	5.8 d	6.5 c	7.3 bc	8.0 b

*Rated visually on a scale of 0-9, where 0 = no damage and 9 = dead and 4.5 = minimum acceptability.

**Letters below rating show the Waller Grouping (all numbers within the same column having a common letter are not significantly different).

Table 2: Tiller number of Sharp's Improved buffalograss treated with selected postemergence herbicides and grown in a greenhouse environment.

Herbicide	Rate (lbs a.i./A)	Tiller Number* Days after Treatment 7	14	21	28	35
Control	----------	2.5 a**	3.5 a	4.0 a	3.8 a	4.4 a
Dithiopyr (Dimension)	0.5	2.6 a	2.8 bc	3.1 b	2.8 b	2.9 b
Fenoxaprop (Acclaim)	0.18	1.9 b	0.7 efg	0.2 e	0.0 e	0.0 d
Quinclorac (Drive)	0.75	2.2 ab	2.4 c	2.6 b	2.8 b	3.1 b
MSMA (Daconate 6)	2.0	2.3 ab	3.2 ab	2.8 b	3.4 ab	3.3 b
Triclopyr (Turflon Ester)	0.41	2.2 ab	0.7 fg	0.3 e	0.2 e	0.0 d
Clopyralid (Confront)	0.61	2.2 ab	0.9 def	0.7 cde	0.4 de	0.3 d
2,4-D + Triclopyr (Turflon II Amine)	1.18	2.3 ab	1.0 def	0.4 de	0.3 de	0.2 d
2,4-D + Triclopyr + Clopyralid (XRM - 5202)	1.0	2.0 ab	1.3 de	1.2 c	1.3 c	0.9 c
2,4-D + MCPP + Dicamba (Trimec Classic)	1.1	2.2 ab	0.2 g	0.2 e	0.0 e	0.0 d
Dicamba (Banvel)	0.61	2.0 ab	0.9 def	0.5 cde	0.4 de	0.3 d
2,4-D Amine	0.6	2.1 ab	1.4 d	1.1 cd	1.0 cd	1.0 c

*Rated on number of tillers per plant. A rating of 2.5 or more was deemed acceptable.

**Letters below rating show the Waller Grouping (all numbers within the same column having a common letter are not significantly different).

Table 3: Plant height of Sharp's Improved buffalograss treated with selected postemergence herbicides in a greenhouse environment.

		Plant Height (in.)				
Herbicide	Rate (lbs a.i./A)	Days after Treatment				
		7	14	21	28	35
Control	----------	4.7 a*	5.8 a	6.5 a	7.4 a	7.9 a
Dithiopyr (Dimension)	0.5	3.9 abcd	4.1 bc	4.3 b	4.2 b	4.4 b
Fenoxaprop (Acclaim)	0.18	3.3 d	1.9 de	0.2 e	0.0 e	0.0 d
Quinclorac (Drive)	0.75	4.5 ab	5.2 ab	4.8 b	5.4 b	5.5 b
MSMA (Daconate 6)	2.0	3.6 cd	4.0 bc	4.3 b	5.0 b	5.4 b
Triclopyr (Turflon Ester)	0.41	4.0 abcd	2.9 cde	1.1 e	0.7 e	0.0 d
Clopyralid (Confront)	0.61	3.9 bcd	3.0 cde	2.4 d	1.0 de	1.0 cd
2,4-D + Triclopyr (Turflon II Amine)	1.18	3.6 cd	2.8 cde	1.1 e	0.9 e	0.5 d
2,4-D + Triclopyr + Clopyralid (XRM - 5202)	1.0	4.1 abcd	4.0 bc	3.7 bc	2.8 c	2.2 c
2,4-D + MCPP + Dicamba (Trimec Classic)	1.1	3.8 bcd	1.5 e	0.6 e	0.0 e	0.0 d
Dicamba (Banvel)	0.61	4.2 abc	3.6 bcd	2.3 d	1.0 de	0.6 d
2,4-D Amine	0.6	3.9 abcd	3.6 bcd	3.0 cd	2.2 cd	2.0 c

*Letters below rating show the Waller Grouping (all numbers within the same column having a common letter are not significantly different).

Table 4: Phytotoxicity ratings of selected postemergence herbicides for Sharp's Improved buffalograss grown in the field.

		Phytotoxicity*	
Herbicide	Rate (lbs a.i./A)	Weeks after Treatment	
		2	4
Control	----------	9.0 a**	9.0 a
Dithiopyr (Dimension)	0.5	9.0 a	9.0 a
Fenoxaprop (Acclaim)	0.18	2.0 e	1.0 c
Quinclorac (Drive)	0.75	9.0 a	9.0 a
MSMA (Daconate 6)	2.0	9.0 a	9.0 a
Triclopyr (Turflon Ester)	0.41	8.3 a	9.0 a
Clopyralid (Confront)	0.61	9.0 a	9.0 a
2,4-D + Triclopyr (Turflon II Amine)	1.18	6.0 c	8.3 a
2,4-D + Triclopyr + Clopyralid (XRM - 5202)	1.0	7.7 ab	9.0 a
2,4-D + MCPP + Dicamba (Trimec Classic)	1.1	6.3 bc	8.3 a
Dicamba (Banvel)	0.61	4.3 d	6.0 b
2,4-D Amine	0.6	9.0 a	9.0 a

*Rated on 0 to 9 scale with 0 = totally brown and 9 = no visible damage..

**Letters beside rating show the Waller Grouping (all numbers within the same column having a common letter are not significantly different).

Table 5: Ratings of percent of plot covered by Sharp's Improved buffalograss treated with selected postemergence herbicides.

		Percent of Plot Covered*	
Herbicide	Rate (lbs a.i./A)	Weeks after Treatment	
		4	6
Control	----------	65.0 b**	96.0 ab
Dithiopyr (Dimension)	0.5	73.3 ab	95.0 ab
Fenoxaprop (Acclaim)	0.18	4.3 d	5.0 d
Quinclorac (Drive)	0.75	88.3 a	100.0 a
MSMA (Daconate 6)	2.0	78.3 ab	94.3 b
Triclopyr (Turflon Ester)	0.41	88.3 a	100.0 a
Clopyralid (Confront)	0.61	78.3 ab	97.0 ab
2,4-D + Triclopyr (Turflon II Amine)	1.18	71.7 ab	97.7 ab
2,4-D + Triclopyr + Clopyralid (XRM - 5202)	1.0	76.7 ab	100.0 a
2,4-D + MCPP + Dicamba (Trimec Classic)	1.1	76.7 ab	96.7 ab
Dicamba (Banvel)	0.61	40.0 c	85.0 c
2,4-D Amine	0.6	83.3 ab	96.7 ab

*Rated visually on percent of plot covered with buffalograss.

**Letters beside rating show the Waller Grouping (all numbers within the same column having a common letter are not significantly different).

TITLE: Efficacy of MON 12051 and Basagran on Yellow Nutsedge

OBJECTIVE: To study the efficacy of MON 12051 and Basagran against yellow nutsedge in perennial ryegrass.

PERSONNEL: Ward Upham, Jack Fry, and Kevin Kamphaus

INTRODUCTION:

MON 12051 (Manage) is a new postemergence herbicide for control of yellow nutsedge in turf. It is expected to be available in 1994 or 1995. The efficacy of MON 12051 relative to Basagran is not known.

MATERIALS AND METHODS:

Two perennial ryegrass fairways located at the Shawnee Country Club in Topeka, KS were used for this study. One fairway (#10) was used to look at efficacy at weeks 2 through 4. The second fairway (#15) was rated on weeks 5 and 8. A backpack CO_2 sprayer equipped with 8004 flat fan nozzles calibrated to deliver 60 GPA (1.4 gal/1000 ft^2) at 35 psi was used to apply all treatments.

Plot size was 3.3 x 6.6 feet and the experimental design was a completely randomized design with three replications. Data were collected on phytotoxicity in the weeks mentioned above. Data were subjected to analysis of variance, and means were separated using the Waller-Duncan Bayesian k ratio t test (k = 100, P = 0.05).

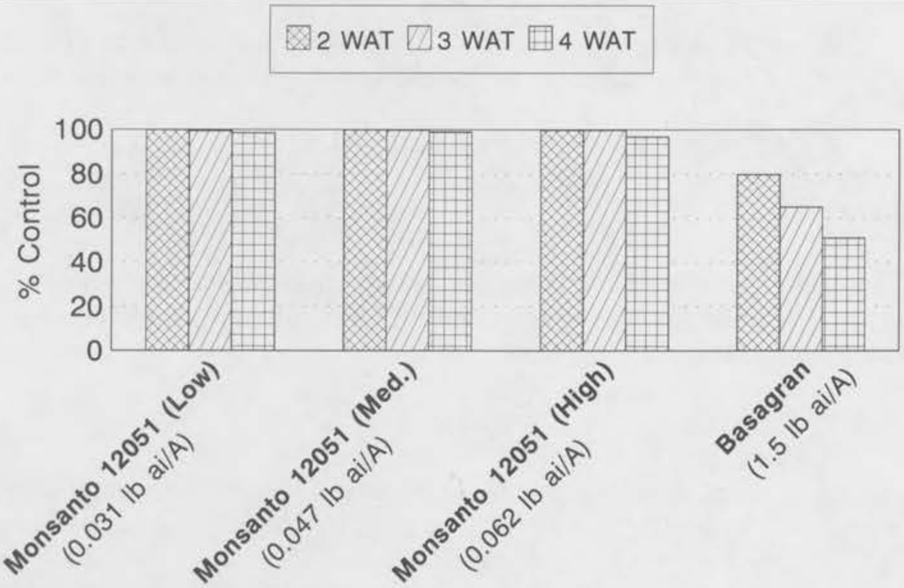
RESULTS:

Fairway #10: MON 12051 at all rates gave over 95% control for weeks 2 through 4. Basagran gave 80% control on week 2, but by week 4, control had fallen to 51% (Fig. 1).

Fairway #15: There were no significant differences among the three rates of MON 12051 at either 5 or 8 weeks after treatment. Nutsedge control ranged from 68 to 97%. However, Basagran was significantly less effective and gave 30 and 14% control for the 5- and 8- week rating periods, respectively (Fig. 2).

Nutsedge Control Study*

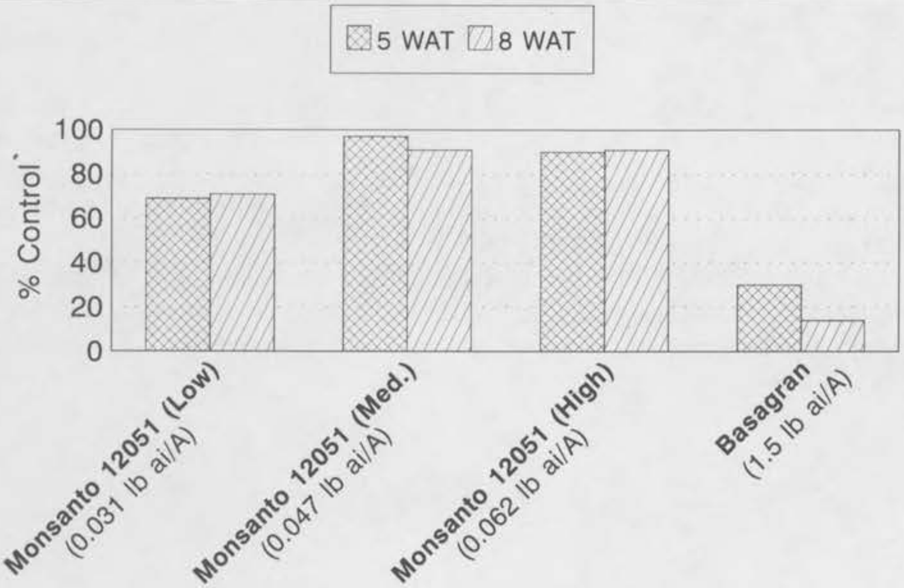
Percent Control 1



* Chemicals applied 7/23/92

Nutsedge Control Study*

Percent Control 2



* Chemicals applied 5/27/92

TITLE: Phytotoxicity of MON 12051 and Basagran at 2X, 4X, and 6X Application Rates

OBJECTIVE: To study the phytotoxicity of MON 12051 and compare it to Basagran at 2X, 4X, and 6X rates on creeping bentgrass, Kentucky bluegrass, and perennial ryegrass.

PERSONNEL: Ward Upham, Jack Fry, and Kevin Kamphaus

INTRODUCTION:

Basagran is commonly used for yellow nutsedge control in Kansas turf. A new herbicide, MON 12051 (Manage) is to be available in 1994 or 1995. Information is needed on turf tolerance to to MON 12051 relative to Basagran.

MATERIALS AND METHODS:

The three grass species used for this study were Mystic Kentucky bluegrass (0.75 in. mowing height), Gator perennial ryegrass (0.75 in. mowing height), and Penncross creeping bentgrass (0.18 in. mowing height). The experimental area was located at the KSU Rocky Ford Turfgrass Research Center near Manhattan, KS. A backpack CO_2 sprayer equipped with 8004 flat fan nozzles calibrated to deliver 60 GPA (1.4 gal/1000 ft^2) at 35 psi was used to apply all treatments on 7/23/92. The 2X, 4X, and 6X application rates for each herbicide are indicated on figures.

Plot size was 3.3 x 6.6 feet and the experimental design was a randomized complete block with three replications. Data were collected on phytotoxicity at 1 day after treatment and at weekly intervals thereafter until there were no rating differences among plots. Data were subjected to analysis of variance, and means were separated using the Waller-Duncan Bayesian k ratio t test (k = 100, P = 0.05).

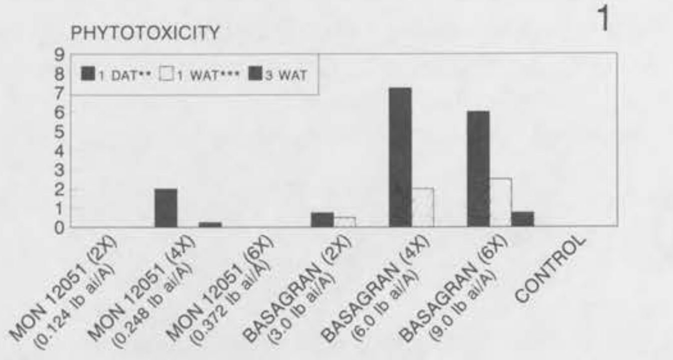
RESULTS:

Creeping Bentgrass: MON 12051 caused only slight phytotoxicity, even at the 6X rate. Basagran caused extensive injury at the 4X and 6X rates, but Basagran-treated turf had recovered by 4 WAT (Fig. 1).

Kentucky Bluegrass: All phytotoxicity was minor but was most noticeable with Basagran at the 4X and 6X rates. All plots had recovered by 3 WAT (Fig. 2).

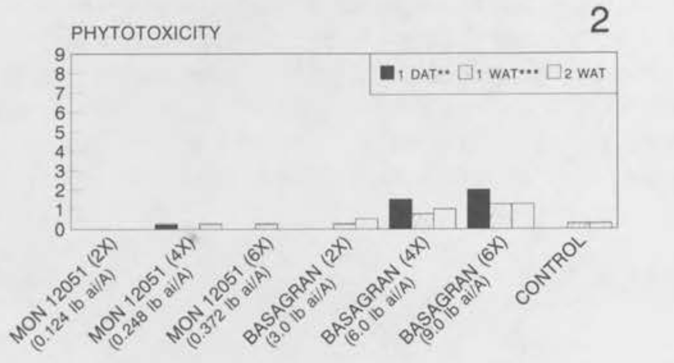
Perennial Ryegrass: MON 12051 caused a slight but acceptable level of leaf bleaching at 2X, but more severe bleaching at 4X and 6X. Turf in all MON 12051 treatments had recovered by 4WAT. Basagran caused an unacceptable level of phytotoxicity at all rates. Turf recovery was not complete until 8 WAT (Fig. 3).

PHYTOTOXICITY ON CREEPING BENTGRASS*
1992



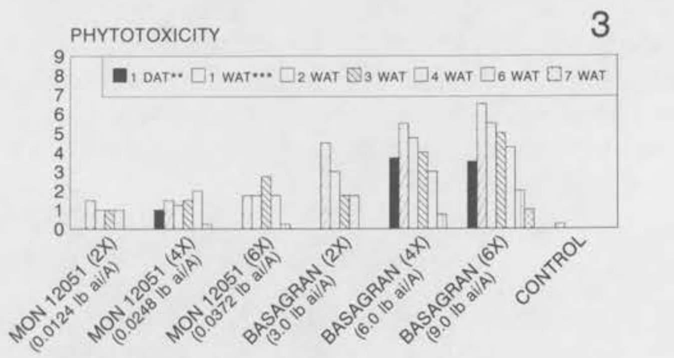
* 0 = NO DAMAGE, 9 = COMPLETELY BROWN
** DAT = DAY AFTER TREATMENT
*** WAT = WEEK AFTER TREATMENT

PHYTOTOXICITY ON KENTUCKY BLUEGRASS*
1992



* 0 = NO DAMAGE, 9 = COMPLETELY BROWN
** DAT = DAY AFTER TREATMENT
*** WAT = WEEK AFTER TREATMENT

PHYTOTOXICITY ON PERENNIAL RYEGRASS*
1992



* 0 = NO DAMAGE, 9 = COMPLETELY BROWN
** DAT = DAY AFTER TREATMENT
*** WAT = WEEK AFTER TREATMENT

TITLE: Control of Crabgrass and Dandelion in Kentucky Bluegrass Turf with Selected Post-emergence Herbicides

OBJECTIVE: To evaluate the effectiveness of spring applications of various postemergence herbicides in controlling annual grassy weeds and dandelion in cool-season turf.

PERSONNEL: Ward Upham, Jack D. Fry, and Kevin Kamphaus

MATERIALS AND METHODS:

A Kentucky bluegrass turf was used for this study. The plots were located at the KSU Rocky Ford Turfgrass Research Center near Manhattan, KS. Large crabgrass (Digitaria sanguinalis) was overseeded to augment existing populations. The test area was repeatedly scalped and overwatered to encourage annual grass infestations. Herbicides and application rates are shown in Table 1.

Treatments were applied with a backpack CO_2 sprayer equipped with 8004 flat fan nozzles calibrated to deliver 60 GPA (1.4 gal/1000 ft^2) at 35 psi. All test treatments were applied on 6/25/92 (see Table 1). Crabgrass was primarily at the 2-3 leaf stage and dandelions were primarily seedlings at the time of application. Temperature was 75 degrees, the sky was hazy, and winds were less than 5 mph.

Plot size was 3.3 x 6.6 feet, and the experimental design was a randomized complete block with three replications. Plots were checked for differences in phytotoxicity at 7 and 14 DAT (days after treatment). Ratings were taken on percent of plot covered with crabgrass and number of dandelions per plot at 14, 30, 60, and 90 DAT. Data were subjected to analysis of variance, and means were separated using the Waller/Duncan Bayesian k ratio t test (k=100, P=0.05). Weed control was then calculated by normalizing treatment means to the check mean with the check representing 0% control. The attached tables use "percent control" data.

RESULTS:

Phytotoxicity

Phytotoxicity was noted for the Acclaim and the Dimension + Acclaim treatments for both the 1 and 2 week rating periods (Table 1). No other treatments differed from the check.

Crabgrass Control

All treatments were significantly lower in crabgrass infestation than the check for all rating dates (Tables 2,3,4,5).

All chemical treatments provided acceptable control (>90% as compared to the check) for the 14 and 30 DAT rating periods. By 60 DAT, four treatments provided acceptable control: the low and high rates of Drive, Dimension + Acclaim, and Dimension + MSMA.

Low night temperatures reduced crabgrass populations by 90 DAT. All chemical treatments, except Acclaim, provided acceptable control.

Dandelion Control

Details of dandelion control are shown in Tables 2,3,4, and 5. At 14 DAT, no treatments provided greater than 90% control. At 30 and 60 DAT, both Drive treatments gave acceptable control. At 90 DAT, both Drive treatments and the Dimension + MSMA treatment gave acceptable control.

Table 1. Phytotoxicity with selected postemergence herbicides at Manhattan, KS - 1992

Treatment*	Rate lb ai/A	7 DAT		14 DAT	
		Phyto**	Waller Grouping ***	Phyto	Waller Grouping
Check	----	9.0	A	9.0	A
Dimension 1-EC	0.50	9.0	A	9.0	A
Dimension 1-EC Acclaim 1-EC	0.38 0.12	7.8	B	8.0	B
Dimension 1-EC Daconate 6-L	0.38 1.00	8.8	A	9.0	A
Acclaim 1-EC	0.18	7.3	C	8.0	B
Drive 0.75-WDG	0.75	9.0	A	9.0	A
Drive 0.75-WDG	1.00	8.8	A	8.8	A

* Herbicides were initially applied on 25 June 1992.
** 9=no damage, 0=turf completely brown.
*** Means followed by the same letter in a column are not significantly different (P=0.05)

Table 2. Crabgrass and dandelion control 14 DAT with selected postemergence herbicides at Manhattan, KS - 1992

Treatment*	Rate lb ai/A	Crabgrass		Dandelion	
		% Control**	Waller Grouping ***	% Control	Waller Grouping
Check	----	----	A	----	A
Dimension 1-EC	0.50	97.6	B	68.1	C
Dimension 1-EC Acclaim 1-EC	0.38 0.12	100	B	32.1	B
Dimension 1-EC Daconate 6-L	0.38 1.00	100	B	68.1	C
Acclaim 1-EC	0.18	100	B	0	A
Drive 0.75-WDG	0.75	100	B	71.9	C
Drive 0.75-WDG	1.00	100	B	76.0	C

* Herbicides were initially applied on 25 June 1992.
** Weed control calculated as a percentage of check plot mean.
*** Means followed by the same letter in a column are not significantly different (P=0.05)

Table 3. Crabgrass and dandelion control 30 DAT with selected postemergence herbicides at Manhattan, KS - 1992

Treatment*	Rate lb ai/A	Crabgrass		Dandelion	
		% Control**	Waller Grouping ***	% Control	Waller Grouping
Check	----	----	A	----	B
Dimension 1-EC	0.50	93.0	B	34.2	CD
Dimension 1-EC Acclaim 1-EC	0.38 0.12	100	B	30.6	BC
Dimension 1-EC Daconate 6-L	0.38 1.00	100	B	86.9	DE
Acclaim 1-EC	0.18	100	B	0	A
Drive 0.75-WDG	0.75	99.5	B	100	E
Drive 0.75-WDG	1.00	100	B	97.2	E

* Herbicides were initially applied on 25 June 1992.
** Weed control calculated as a percentage of check plot mean.
*** Means followed by the same letter in a column are not significantly different (P=0.05)

Table 4. Crabgrass and dandelion control 60 DAT with selected postemergence herbicides at Manhattan, KS - 1992

Treatment*	Rate lb ai/A	Crabgrass		Dandelion	
		% Control**	Waller Grouping ***	% Control	Waller Grouping
Check	----	----	A	----	AB
Dimension 1-EC	0.50	72.0	B	50.4	C
Dimension 1-EC Acclaim 1-EC	0.38 0.12	99.6	C	23.1	BC
Dimension 1-EC Daconate 6-L	0.38 1.00	100	C	87.3	D
Acclaim 1-EC	0.18	88.4	BC	0	A
Drive 0.75-WDG	0.75	95.6	BC	98.7	D
Drive 0.75-WDG	1.00	99.1	C	96.9	D

* Herbicides were initially applied on 25 June 1992.
** Weed control calculated as a percentage of check plot mean.
*** Means followed by the same letter in a column are not significantly different (P=0.05)

Table 5. Crabgrass and dandelion control 90 DAT with selected postemergence herbicides at Manhattan, KS - 1992

Treatment*	Rate lb ai/A	Crabgrass		Dandelion	
		% Control**	Waller Grouping ***	% Control	Waller Grouping
Check	----	----	A	----	A
Dimension 1-EC	0.50	95.1	BC	56.1	BC
Dimension 1-EC Acclaim 1-EC	0.38 0.12	100	C	49.2	B
Dimension 1-EC Daconate 6-L	0.38 1.00	100	C	90.0	CD
Acclaim 1-EC	0.18	78.7	B	0	A
Drive 0.75-WDG	0.75	96.4	BC	98.7	D
Drive 0.75-WDG	1.00	98.2	BC	93.9	CD

* Herbicides were initially applied on 25 June 1992.
** Weed control calculated as a percentage of check plot mean.
*** Means followed by the same letter in a column are not significantly different (P=0.05)

TITLE: Control of Broadleaf Weeds in Cool-Season Turf with Postemergence Herbicides

OBJECTIVE: To determine the effectiveness of various postemergence broadleaf herbicides in a Kentucky bluegrass turf.

PERSONNEL: Ward Upham, Jack Fry, and Kevin Kamphaus

MATERIALS AND METHODS:

A Kentucky bluegrass turf at the KSU Rocky Ford Turfgrass Research Center near Manhattan, KS was used for this study. The experimental area had been overseeded for 2 years with various broadleaf weeds. This resulted in a high level of infestation with dandelions predominating. Table 1 shows herbicides and application rates.

Treatments were applied with a backpack CO_2 sprayer equipped with 8004 flat fan nozzles and calibrated to deliver 60 GPA (1.4 gal/1000 ft^2) at 35 psi. All treatments were applied on 5/19/92. A second application was deemed unnecessary.

Plot size was 3.3 X 6.6 feet, and the experimental design was a randomized complete block with three replications. Data were collected on turf phytotoxicity and number of dandelions (Taraxacum officinale) per plot. Data for dandelion infestations were taken at 2, 4, and 8 weeks after treatment (WAT). Percent control on each date was calculated as:

$$1-\left[\frac{\text{Rating Date Weed Count}}{\text{Initial Weed Count}}\right]*100$$

Data were subjected to analysis of variance, and means were separated using the Waller-Duncan Bayesian k ratio t test (k = 100, P = 0.05).

RESULTS:

Phytotoxicity: No phytotoxicity was noted for any treatment on any date.

Dandelion Control: There were no significant differences among treatments at 2 WAT (Table 1) .

All chemical treatments were significantly better than the control at 4 and 8 WAT; however, there were no significant differences among chemical treatments.

Table 1. Percent dandelion control with selected postemergence herbicides at Manhattan, KS - 1992.

Treatment	Rate (pints/a)	Dandelion Control (%)		
		2 WAT*	4 WAT	8 WAT
Control	----	0	0	0
Turflon Ester + Trimec Classic	1 3.25	37.0	100.0	89.0
Confront	2	51.0	93.3	100.0
Turflon II Amine	3	36.7	93.7	93.3
XRM-5202	3	28.3	89.7	95.0
Trimec Classic	3.25	30.7	96.0	96.0
MSD***	------	NS**	11.8	16.6

* WAT = Weeks After Treatment.

** NS = Nonsignificant

*** To determine statistical differences among treatments, subtract one entry's mean from anothers'. Cultivars are statistically different when this value is larger than the corresponding MSD value.

TITLE: Control of Broadleaf Weeds and Annual Grasses in Cool-Season Turfgrass with Gallery Herbicide

OBJECTIVE: To determine the efficacy of Gallery and Gallery/Team/Fertilizer on broadleaf weeds and annual grasses in cool-season turf.

PERSONNEL: Ward Upham, Jack Fry, and Kevin Kamphaus

MATERIALS AND METHODS:

A Kentucky bluegrass turf located at the KSU Rocky Ford Turfgrass Research Center near Manhattan, KS was utilized for this study. The experimental area had been overseeded for 2 years with large crabgrass (Digitaria sanguinalis) to supplement native weed populations. The test area was repeatedly scalped and overwatered to encourage annual grass infestations. Dandelion and spurge were the most prevalent broadleaf weeds in 1991. In 1992, dandelion was the only broadleaf present in sufficient quantities to rate. Herbicides and application rates are shown in Table 1.

Treatments were applied with a backpack CO_2 sprayer equipped with 8004 flat fan nozzles calibrated to deliver 60 GPA (1.4 gal/1000 ft^2) at 35 psi. Granular treatments were applied by hand. The spring 91, fall 91, and spring 92 treatments were applied on 4/9/91, 8/28/91, and 3/27/92 respectively. Weather conditions on 4/9/91 were 55 degrees, cloudy, with winds 5-15 mph. On 8/28/91, the conditions were 75 degrees, sunny, and calm. The weather on 3/27/92 was 50 degrees, sunny, with winds 10-15 mph.

Plot size was 3.3 x 6.6 feet, and the experimental design was a randomized complete block with three replications. Data were collected on phytotoxicity and crabgrass, dandelion, and spurge infestations at monthly intervals. Data were subjected to analysis of variance, and means were separated using the Waller-Duncan Bayesian $\underline{k}$ ratio $\underline{t}$ test ($\underline{k}$ = 100, P = 0.05).

RESULTS:

1991 Results

Phytotoxicity: No phytotoxicity was noted for any treatment for any date.

Annual Grass Control: No annual grassy weeds were noted until the July rating period (Table 1). During July, the spring 91 Gallery treatment was significantly better than all treatments except the Trimec Classic and spring 92 Gallery treatments. August and September ratings showed no significant differences. No treatment on any date gave acceptable control (>90% as compared to the check).

Dandelion Control: No dandelions were found for the May and June rating dates. During July and August, the number of dandelions in the spring 91 Gallery plots was at the low end of the range, but differences were not significant. Significant differences did appear on the September rating date with the spring 91 Gallery treatment showing the least number of weeds (Table 2). The October rating period occurred after the Gallery treatment and, therefore, the Trimec treatment. The check contained significantly more dandelions than any other treatment, but no differences occurred among treatments. No treatment on any date gave greater than 90% control.

Spurge Control: Spurge control mirrored that of dandelion through August, with no spurge showing up until July and differences being nonsignificant (Table 3). Though there were significant differences for dandelion at the September rating date, there were none for spurge control. Frost occurred before the October rating period. Some treatments gave over 90% control: for the August rating period, the spring 91 and fall 91 applications of Gallery at 1.0 and 0.75 lbs ai/A respectively; for the September rating period, spring 91 application of Gallery at 1.0 lbs ai/A.

1992 Results

Phytotoxicity: No phytotoxicity was noted for any treatment for any date.

Annual Grass Control: No annual grasses were noted until the July rating period (Table 4). Only two treatments provided greater than 90% control: Gallery @ 0.75 lb ai/A and the Gallery/Team/Fertilizer, both of which were applied in both fall 91 and spring 92. By September, only the Gallery/Team/Fertilizer treatment applied in both fall 91 and spring 92 gave acceptable control. There were no significant differences among treatments for the September and October rating dates (data not shown).

Dandelion Control: Trimec Classic was applied at the rate of 3.5 pints/A on 3/26/92 to all treatments except the check to eliminate existing broadleaf weeds. The spring 92 chemical treatments were applied on 3/27/92. One-third inch of rain fell between 3/27 and 3/29. All chemical treatments gave greater than 90% control for April and May (Table 5). By June, two treatments gave unacceptable control: Trimec Classic @ 3.5 pints/A (applied spring & fall 91 and spring 92) and the Gallery treatment @ 1 lb ai/A (applied spring 91). The July, August, September, and October rating periods (Table 6) showed two treatments providing acceptable control: Gallery @ 0.75 lb ai/A (fall 91, spring 92) and Gallery @ 1 lb ai/A (spring 92).

Spurge Control: Spurge populations during 1992 were insufficient to warrant rating.

Miscellaneous Information

The following tables present percent control as normalized to the check. The raw data in the "SAS" packet is not "percent control" data: the raw crabgrass data is "percent of plot covered with crabgrass" and the dandelion data is "number of dandelions per plot".

Table 1. Percent annual grass control with Gallery preemergent herbicide at Manhattan, KS - 1991.

Treatment	Rate (lbs ai/A)	Application Times	Annual Grass Control (%)*		
			July	August	September
Gallery 75 DF	1.00	Spring 91	57.1 C**	0	0
Gallery 75 DF	1.00	Fall 91	0 A	0	0
Gallery 75 DF	.75	Fall 91	0 AB	0	0
Gallery 75 DF	1.00	-------------	21.4 BC	0	0
Gallery/Team/Fert. 2G	2.72	Fall 91	0 AB	0	0
Trimec Classic	1.45	Spring & Fall 91	21.4 BC	0	0
Check	----------	-------------	AB	---------	---------
P-value	----------	-------------	0.01	NS***	NS

* Percent control was determined by comparing each treatment to the check for that rating date.

** Means followed by the same letter in a column are not significantly different (P=0.05).

*** NS = Non-significant

Table 2. Percent dandelion control with Gallery preemergent herbicide at Manhattan, KS - 1991.

Treatment	Rate (lbs ai/A)	Application Times	Dandelion Control (%)*		
			July	August	September
Gallery 75 DF	1.00	Spring 91	0	0	80.0 D**
Gallery 75 DF	1.00	Fall 91	0	0	15.0 CD
Gallery 75 DF	.75	Fall 91	43.5	0	0 BC
Gallery 75 DF	1.00	-------------	65.0	0	0 AB
Gallery/Team/Fert. 2G	2.72	Fall 91	35.0	0	0 BC
Trimec Classic	1.45	Spring & Fall 91	0	0	0 A
Check	----------	-------------	0	---------	CD
P-value	----------	-------------	NS***	NS	0.006

* Percent control was determined by comparing each treatment to the check for that rating date.

** Means followed by the same letter in a column are not significantly different (P=0.05).

*** NS = Non-significant

Table 3. Percent spurge control with Gallery preemergent herbicide at Manhattan, KS - 1991.

Treatment	Rate (lbs ai/A)	Application Times	Spurge Control (%)*		
			July	August	September
Gallery 75 DF	1.00	Spring 91	83.5	91.0	91.0
Gallery 75 DF	1.00	Fall 91	0	72.7	0
Gallery 75 DF	.75	Fall 91	83.5	91.0	64.9
Gallery 75 DF	1.00	-------------	50.0	27.2	0
Gallery/Team/Fert. 2G	2.72	Fall 91	0	64.9	64.9
Trimec Classic	1.45	Spring & Fall 91	0	18.9	0
Check	----------	-------------	--------	---------	---------
P-value	----------	-------------	NS**	NS	NS

* Percent control was determined by comparing each treatment to the check for that rating date.
** NS = Non-Significant.

Table 4. Percent annual grass control with Gallery preemergent herbicide at Manhattan, KS - 1992.

Treatment	Rate (lbs ai/A)	Application Times	Annual Grass Control (%)*	
			July	Aug **
Gallery 75 DF	1.00	Spring 91	0 AB**	0 A
Gallery 75 DF	1.00	Fall 91	12.0 ABC	0 AB
Gallery 75 DF	.75	Fall 91, Spr. 92	90.2 BC	63.0 C
Gallery 75 DF	1.00	Spring 92	72.2 BC	69.3 C
Gallery/Team/Fert. 2G	2.72	Fall 91, Spr. 92	97.7 C	90.1 C
Trimec Classic	1.45	Sp.91, F91, Sp.92	0 A	0 A
Check	----------	-------------	ABC	B

* Percent control was determined by comparing each treatment to the check for that rating date.

** Means followed by the same letter in a column are not significantly different (P=0.05).

Table 5. Percent dandelion control with Gallery preemergent herbicide for April, May, June and July at Manhattan, KS - 1992.

Treatment	Rate (lbs ai/A)	Application Times	Dandelion Control (%)*			
			April	May	June	July
Gallery 75 DF	1.00	Spring 91	100 A**	100 A	48 B	0 A
Gallery 75 DF	1.00	Fall 91	100 A	100 A	94 C	78 C
Gallery 75 DF	.75	Fall 91, Spr. 92	100 A	100 A	100 C	100 C
Gallery 75 DF	1.00	Spring 92	100 A	100 A	100 C	100 C
Gallery/Team/Fert. 2G	2.72	Fall 91, Spr. 92	100 A	100 A	97 C	70 C
Trimec Classic	1.45	Sp.91, F91, Sp.92	95 A	100 A	79 BC	55 BC
Check	----------	-------------	0 B	0 B	0 A	0 AB

* Percent control was determined by comparing each treatment to the check for that rating date.

**** Means followed by the same letter in a column are not significantly different (P=0.05).

Table 6. Percent dandelion control with Gallery preemergent herbicide for August, September, and October at Manhattan, KS - 1992.

Treatment	Rate (lbs ai/A)	Application Dates	Dandelion Control (%)*		
			August	Sept	October
Gallery 75 DF	1.00	Spring 91	0 A**	0 A	0 A
Gallery 75 DF	1.00	Fall 91	0 AB	58 BC	53 BC
Gallery 75 DF	.75	Fall 91, Spr. 92	63 C	99 C	97 C
Gallery 75 DF	1.00	Spring 92	69 C	95 C	94 C
Gallery/Team/Fert. 2G	2.72	Fall 91, Spr. 92	90 C	67 BC	67 BC
Trimec Classic	1.45	Sp.91, F91, Sp.92	0 A	45 ABC	35 ABC
Check	----------	-------------	0 B	0 AB	0 AB

* Percent control was determined by comparing each treatment to the Check for that rating date.

** Means followed by the same letter in a column are not significantly different (P=0.05).

TITLE: Control of Crabgrass and Dandelion in Kentucky Bluegrass Turf with Selected Pre-emergence Herbicides

OBJECTIVE: To evaluate the efficacy of spring applications of various pre-emergence herbicides in controlling annual grassy weeds and dandelion in cool-season turf.

PERSONNEL: Ward Upham, Jack D. Fry, and Kevin Kamphaus

INTRODUCTION:

As new preemergence herbicides are developed, it is important to identify optimum application rates for weed control in Kansas.

MATERIALS AND METHODS:

A Kentucky bluegrass turf was used for this study. The plots were located at the KSU Rocky Ford Turfgrass Research Center near Manhattan, KS. Native populations of large crabgrass (Digitaria sanguinalis) were felt to be sufficient, and no overseeding of crabgrass was done. The test area was repeatedly scalped and overwatered to encourage annual grass infestations. Herbicides and application rates are shown in Table 1.

Treatments were applied with a backpack CO_2 sprayer equipped with 8004 flat fan nozzles calibrated to deliver 60 GPA (1.4 gal/1000 ft^2) at 35 psi. Granular treatments were applied by hand. Trimec Classic was applied at the rate of 3.5 pints per acre on 4/6/92 to eliminate broadleaf weeds. All test treatments were applied on 4/14/92. A second application was made on 6/1/92 for those products so designated in the protocol (see Table 1).

Plot size was 3.3 x 6.6 feet, and the experimental design was a randomized complete block with three replications. Plots were checked for differences in turfgrass quality and phytotoxicity at 30 and 90 DAT (days after treatment). Data was taken on crabgrass infestation and number of dandelions per plot at 90 and 120 DAT. No ratings were taken at the 60 DAT date because of a lack of weed pressure. Weed control was calculated by normalizing treatments to the check, with the check representing 0% control. Data were subjected to analysis of variance, and means were separated using the Waller/Duncan Bayesian $\underline{k}$ ratio $\underline{t}$ test ($\underline{k}$=100, P=0.05).

RESULTS:

No phytotoxicity and no differences in turfgrass quality were noted for any treatment on either rating date. Exceptionally cool spring weather resulted in slow crabgrass germination and growth, and no visible weed populations appeared until the 90 DAT rating date.

Crabgrass Control

All herbicides effectively reduced crabgrass at 90 DAT. The only herbicide that showed significantly lower efficacy was Pendimethalin 1.07 G/Fertilizer (14-0-14). However, the following treatments exhibited less than acceptable control (<90% control as normalized to the check).

1. Pendimethalin 1.07-G/Fertilizer (1.75 lbs ai/A)
2. FN 9064 1.09-G (2.75 lbs ai/A)
3. Team 2-G (2 lbs ai/A)
4. Gallery 75-DF (0.75 lbs ai/A)
5. Team 1.15-G/Fertilizer (1.5 lbs ai/A)
6. Team 2-G (3 lbs ai/A)

By 120 DAT, only the following treatments provided grêater than 90% crabgrass control.

1. Barricade 65-WG (all 5 treatments)
2. Barricade 65-WG (0.5 lbs ai/A) + Gallery 75-DF (0.75 lb ai/A)
3. Dimension .1-G (all 3 treatments)
4. FN 9064 1.09-G (4 lbs ai/A)
5. Ronstar 2-G (4 lbs ai/A)

By the 180 DAT rating period, crabgrass was dying because of low night temperatures. Less than 90% crabgrass control was observed in plots treated with:

1. Betasan 12.5-G (7.5 lbs ai/A)
2. Dimension 1-EC (0.5 lbs ai/A)
3. Gallery 75-DF (0.75 lbs ai/A)
4. Team/Gallery/Fert (163 lbs product/A)

Tables 1, 3, and 5 contain applicable data.

Dandelion Control

No treatments for the 90 DAT rating period provided greater than 90% control except Barricade + Gallery. The Gallery and the Barricade + Gallery treatments exhibited acceptable control for both the 120 and 180 DAT rating periods.

Tables 2, 4, and 6 contain all data.

Table 1. Crabgrass control with selected preemergence herbicides at Manhattan, KS - 1992

Treatment*	Rate (lb ai/a)	Reapp. Interval	90 DAT	
			% Control**	Waller Grouping***
Check	----------	---------	-----	A
Balan 2.5-G	1.5	7 Weeks	98.1	C
Barricade 65-WDG	0.49	---------	92.6	BC
Barricade 65-WDG	0.65	---------	100.0	C
Barricade 65-WDG	0.75	---------	99.2	C
Barricade 65-WDG	0.65, 0.16	7 Weeks	100.0	C
Barricade 65-WDG	0.75, 0.49	7 Weeks	99.2	C
Barricade 65-WDG + Gallery 75-DF	0.49 0.75	---------	99.2	C
Betasan 12.5-G	7.5	---------	91.8	BC
Dimension 1-EC	0.5	---------	96.5	BC
Dimension 0.1-G	0.187	---------	98.1	C
Dimension 0.1-G	0.25	---------	99.2	C
Dimension 0.1-G	0.38	---------	100.0	C
FN-9064 1.09-G	2.7	---------	70.8	BC
FN-9064 1.09-G	4.1	---------	96.5	BC
Gallery 75-DF	0.75	---------	83.7	BC
Pendimethalin 1-G + Fert. 14-0-14	1.75, 1.75	7 Weeks	67.3	B
Ronstar 2-G	4.0	---------	92.6	BC
Team 2-G	2.0	---------	80.1	BC
Team 2-G	3.0	---------	88.3	BC
Team 2-G	1.5, 1.5	7 Weeks	94.6	BC
Team 1.15-G + Gallery 75-DF + Fert. 18-5-9	163 lbs product/A	7 Weeks	88.3	BC

*Herbicides were initially applied on 14 April 1992.

**Crabgrass control calculated as a percentage of check plot mean.

***Means followed by the same letter in a column are not significantly different.

Table 2. Dandelion control with selected preemergence herbicides at Manhattan, KS - 1992

Treatment*	Rate (lb ai/a)	Reapp. Interval	90 DAT	
			% Control**	Waller Grouping***
Check	----------	---------	-----	ABC
Balan 2.5-G	1.5	7 Weeks	0	ABC
Barricade 65-WDG	0.49	---------	12.3	ABC
Barricade 65-WDG	0.65	---------	0	ABC
Barricade 65-WDG	0.75	---------	0	ABC
Barricade 65-WDG	0.65, 0.16	7 Weeks	0	ABC
Barricade 65-WDG	0.75, 0.49	7 Weeks	0	ABC
Barricade 65-WDG + Gallery 75-DF	0.49 0.75	---------	94.7	C
Betasan 12.5-G	7.5	---------	0	ABC
Dimension 1-EC	0.5	---------	82.5	C
Dimension 0.1-G	0.187	---------	59.6	BC
Dimension 0.1-G	0.25	---------	47.4	ABC
Dimension 0.1-G	0.38	---------	82.5	C
FN-9064 1.09-G	2.7	---------	70.2	BC
FN-9064 1.09-G	4.1	---------	59.6	BC
Gallery 75-DF	0.75	---------	77.2	BC
Pendimethalin 1-G + Fert. 14-0-14	1.75, 1.75	7 Weeks	0	ABC
Ronstar 2-G	4.0	---------	87.7	C
Team 2-G	2.0	---------	0	A
Team 2-G	3.0	---------	0	AB
Team 2-G	1.5, 1.5	7 Weeks	0	ABC
Team 1.15-G + Gallery 75-DF + Fert. 18-5-9	163 lbs product/A	7 Weeks	0	ABC

*Herbicides were initially applied on 14 April 1992.
**Crabgrass control calculated as a percentage of check plot mean.
***Means followed by the same letter in a column are not significantly different.

Table 3. Crabgrass control with selected preemergence herbicides at Manhattan, KS - 1992

Treatment*	Rate (lb ai/a)	Reapp. Interval	120 DAT	
			% Control**	Waller Grouping
Check	----------	---------	-----	A
Balan 2.5-G	1.5	7 Weeks	87.0	DEF
Barricade 65-WDG	0.49	---------	90.9	DEF
Barricade 65-WDG	0.65	---------	99.6	F
Barricade 65-WDG	0.75	---------	93.5	DEF
Barricade 65-WDG	0.65, 0.16	7 Weeks	100	F
Barricade 65-WDG	0.75, 0.49	7 Weeks	100	F
Barricade 65-WDG + Gallery 75-DF	0.49 0.75	---------	97.8	EF
Betasan 12.5-G	7.5	---------	65.2	BC
Dimension 1-EC	0.5	---------	78.2	CDE
Dimension 0.1-G	0.187	---------	97.8	EF
Dimension 0.1-G	0.25	---------	97.4	EF
Dimension 0.1-G	0.38	---------	99.6	F
FN-9064 1.09-G	2.7	---------	78.2	CDE
FN-9064 1.09-G	4.1	---------	93.1	DEF
Gallery 75-DF	0.75	---------	45.6	B
Pendimethalin 1-G + Fert. 14-0-14	1.75, 1.75	7 Weeks	73.9	CD
Ronstar 2-G	4.0	---------	96.1	EF
Team 2-G	2.0	---------	80.5	CDEF
Team 2-G	3.0	---------	81.7	CDEF
Team 2-G	1.5, 1.5	7 Weeks	93.1	DEF
Team 1.15-G + Gallery 75-DF + Fert. 18-5-9	163 lbs product/A	7 Weeks	81.4	CDEF

*Herbicides were initially applied on 14 April 1992.
**Crabgrass control calculated as a percentage of check plot mean.
***Means followed by the same letter in a column are not significantly different.

Table 4. Dandelion control with selected preemergence herbicides at Manhattan, KS - 1992

Treatment*	Rate (lb ai/a)	Reapp. Interval	120 DAT	
			% Control**	Waller Grouping***
Check	----------	---------	-----	CDEFGH
Balan 2.5-G	1.5	7 Weeks	0	ABCDEF
Barricade 65-WDG	0.49	---------	0	ABC
Barricade 65-WDG	0.65	---------	0	ABCD
Barricade 65-WDG	0.75	---------	0	A
Barricade 65-WDG	0.65, 0.16	7 Weeks	0	ABCDE
Barricade 65-WDG	0.75, 0.49	7 Weeks	0	BCDEFG
Barricade 65-WDG + Gallery 75-DF	0.49 0.75	---------	96.3	H
Betasan 12.5-G	7.5	---------	0	ABCDE
Dimension 1-EC	0.5	---------	28.8	DEFGH
Dimension 0.1-G	0.187	---------	0	CDEFGH
Dimension 0.1-G	0.25	---------	33.8	EFGH
Dimension 0.1-G	0.38	---------	58.8	FGH
FN-9064 1.09-G	2.7	---------	83.8	GH
FN-9064 1.09-G	4.1	---------	83.8	GH
Gallery 75-DF	0.75	---------	96.3	H
Pendimethalin 1-G + Fert. 14-0-14	1.75, 1.75	7 Weeks	0	CDEFGH
Ronstar 2-G	4.0	---------	62.5	FGH
Team 2-G	2.0	---------	0	ABC
Team 2-G	3.0	---------	0	AB
Team 2-G	1.5, 1.5	7 Weeks	0	ABCDEFG
Team 1.15-G + Gallery 75-DF + Fert. 18-5-9	163 lbs product/A	7 Weeks	0	CDEFGH

*Herbicides were initially applied on 14 April 1992.

**Dandelion control calculated as a percentage of check plot mean.

***Means followed by the same letter in a column are not significantly different.

Table 5. Crabgrass control with selected preemergence herbicides at Manhattan, KS - 1992

Treatment*	Rate (lb ai/a)	Reapp. Interval	180 DAT % Control**	180 DAT Waller Grouping
Check	----------	---------	-----	A
Balan 2.5-G	1.5	7 Weeks	91.1	D
Barricade 65-WDG	0.49	---------	98.7	D
Barricade 65-WDG	0.65	---------	99.1	D
Barricade 65-WDG	0.75	---------	100	D
Barricade 65-WDG	0.65, 0.16	7 Weeks	99.6	D
Barricade 65-WDG	0.75, 0.49	7 Weeks	100	D
Barricade 65-WDG + Gallery 75-DF	0.49 0.75	---------	98.7	D
Betasan 12.5-G	7.5	---------	82.5	CD
Dimension 1-EC	0.5	---------	58.2	B
Dimension 0.1-G	0.187	---------	97.1	D
Dimension 0.1-G	0.25	---------	96.6	D
Dimension 0.1-G	0.38	---------	99.6	D
FN-9064 1.09-G	2.7	---------	93.2	D
FN-9064 1.09-G	4.1	---------	94.5	D
Gallery 75-DF	0.75	---------	63.9	B
Pendimethalin 1-G + Fert. 14-0-14	1.75, 1.75	7 Weeks	94.5	D
Ronstar 2-G	4.0	---------	100	D
Team 2-G	2.0	---------	91.4	D
Team 2-G	3.0	---------	94.5	D
Team 2-G	1.5, 1.5	7 Weeks	93.6	D
Team 1.15-G + Gallery 75-DF + Fert. 18-5-9	163 lbs product/A	7 Weeks	85.6	D

*Herbicides were initially applied on 14 April 1992.

**Crabgrass control calculated as a percentage of check plot mean.

***Means followed by the same letter in a column are not significantly different.

Table 6. Dandelion control with selected preemergence herbicides at Manhattan, KS - 1992

Treatment*	Rate (lb ai/a)	Reapp. Interval	180 DAT	
			% Control**	Waller Grouping***
Check	----------	---------	-----	ABCD
Balan 2.5-G	1.5	7 Weeks	0	ABCD
Barricade 65-WDG	0.49	---------	0	AB
Barricade 65-WDG	0.65	---------	0	ABCD
Barricade 65-WDG	0.75	---------	0	A
Barricade 65-WDG	0.65, 0.16	7 Weeks	0	ABCD
Barricade 65-WDG	0.75, 0.49	7 Weeks	18.0	ABCD
Barricade 65-WDG + Gallery 75-DF	0.49 0.75	---------	91.3	D
Betasan 12.5-G	7.5	---------	0	ABC
Dimension 1-EC	0.5	---------	40.0	BCD
Dimension 0.1-G	0.187	---------	18.0	ABCD
Dimension 0.1-G	0.25	---------	60.0	BCD
Dimension 0.1-G	0.38	---------	55.3	BCD
FN-9064 1.09-G	2.7	---------	75.3	CD
FN-9064 1.09-G	4.1	---------	84.7	D
Gallery 75-DF	0.75	---------	93.3	D
Pendimethalin 1-G + Fert. 14-0-14	1.75, 1.75	7 Weeks	4.7	ABCD
Ronstar 2-G	4.0	---------	68.7	CD
Team 2-G	2.0	---------	0	A
Team 2-G	3.0	---------	0	A
Team 2-G	1.5, 1.5	7 Weeks	11.3	ABCD
Team 1.15-G + Gallery 75-DF + Fert. 18-5-9	163 lbs product/A	7 Weeks	42.0	BCD

*Herbicides were initially applied on 14 April 1992.
**Dandelion control calculated as a percentage of check plot mean.
***Means followed by the same letter in a column are not significantly different.

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