2002
Iowa Turfgrass Research Report

IOWA STATE UNIVERSITY
University Extension
Ames, Iowa

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Department of Horticulture
Department of Plant Pathology
Department of Entomology
Cooperative Extension
IOWA STATE UNIVERSITY

In Cooperation with the
Iowa Turfgrass Institute

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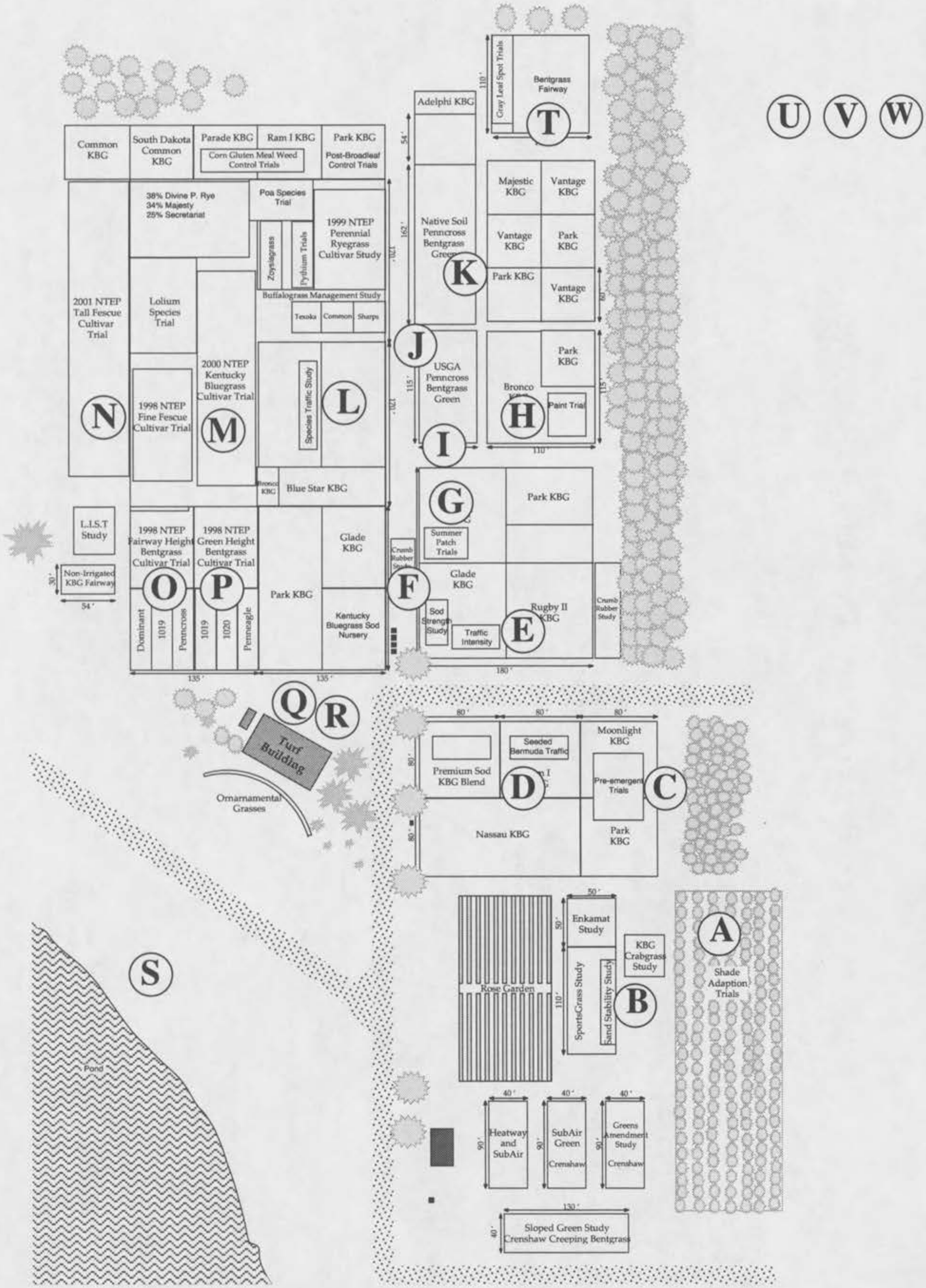

Common KBG
South Dakota Common KBG
Parade KBG
Ram I KBG
Park KBG
Corn Gluten Meal Weed Control Trials
Post-Broadleaf Control Trials
Adelphi KBG
Gray Leaf Spot Trials
Bentgrass Fairway
110'
54'
U
V
W
T
38% Divine P. Rye
34% Majesty
25% Secretariat
Poa Species Trial
Zoysiagrass
Pythium Trials
1999 NTEP Perennial Ryegrass Cultivar Study
120'
162'
Native Soil Penncross Bentgrass Green
K
Majestic KBG
Vantage KBG
Vantage KBG
Park KBG
Park KBG
Vantage KBG
2001 NTEP Tall Fescue Cultivar Trial
Lolium Species Trial
2000 NTEP Kentucky Bluegrass Cultivar Trial
Buffalograss Management Study
Texoka
Common
Sharps
J
USGA Penncross Bentgrass Green
115'
Park KBG
Bronco KBG
Paint Trial
H
110'
1998 NTEP Fine Fescue Cultivar Trial
N
M
Species Traffic Study
L
I
Bronco KBG
Blue Star KBG
G
Park KBG
Summer Patch Trials
L.I.S.T Study
Non-Irrigated KBG Fairway
30'
54'
1998 NTEP Fairway Height Bentgrass Cultivar Trial
1998 NTEP Green Height Bentgrass Cultivar Trial
Glade KBG
Crumb Rubber Study
Glade KBG
O
P
Park KBG
F
Dominant
1019
Penncross
1019
1020
Penneagle
Kentucky Bluegrass Sod Nursery
Sod Strength Study
Traffic Intensity
Rugby II KBG
E
Crumb Rubber Study
135'
135'
180'
Q
R
Turf Building
Ornamental Grasses
80'
80'
80'
Premium Sod KBG Blend
Seeded Bermuda Traffic
Moonlight KBG
Pre-emergent Trials
D
C
Nassau KBG
Park KBG
80'
80'
50'
Enkamat Study
KBG Crabgrass Study
A
Shade Adaption Trials
S
Rose Garden
SportsGrass Study
Sand Stability Study
110'
B
Pond
40'
40'
40'
Heatway and SubAir
SubAir Green
Crenshaw
Greens Amendment Study
Crenshaw
90'
90'
90'
130'
Sloped Green Study
Crenshaw Creeping Bentgrass
40'

Field Day Program- Thursday, July 18, 2002

6:00 am **Equipment Display Setup**
8:00 am **Registration (coffee and donuts)**
8:30 am **Introduction - Registration Tent**
9:00 am **Tours**

Time	Lawn Care / Ground Tour	Golf Course Tour	Sports Turf Tour	Landscape Tour	Pesticide Applicator Training	Respirator Fitting
9:00	**Q**- Drift and Persistence *Dr. Mark Hanna*	**V-** **Equipment & Product Demonstrations** **Renovation & Seeding**	**B**- Sand Field Stability *Dr. Deying Li and Dr. Dave Minner*	**Equipment & Product Demonstrations** **Retaining Wall Construction**	**Q**- Drift and Persistence *Dr. Mark Hanna*	**Respirator Fitting Located in the Exhibit Area –** Applicators will be shown the proper way to put on a respirator and determine the proper fit. Respirators and examples of types of cartridges to use will be available. Bring your respirators to check for proper fitting. *Jim Gunning, ISU Environmental & Health Services and Dr. Mark Shour, ISU Entomology*
9:15			**C**- Pre-emergence Weed Control *Lucas Dant & Dr. Nick Christians*			
9:30	**C**- Pre-emergence Weed Control *Lucas Dant & Dr. Nick Christians*		**D**- Seeded Bermuda Traffic Study *Dr. Dave Minner and Federico Valverde*		**R**- Effects of Pesticides on Water Quality and Non-target Sites *Joyce Hornstein*	
9:45	**A**- Responding to Homeowner Landscape Questions *Richard Jauron*		**E**- Variable Traffic Intensity Study *Dr. Dave Minner and Federico Valverde*			
10:00	**U-** **Equipment & Product Demonstrations** *** Sprayer/Spreader Combo** *** Slit Seeder** *** Dingotype Equipment**	**S**- Pond Management *Dr. Joe Morris*	**G**- Summer Patch Control *Dr. Mark Gleason*	Pruning Techniques *James Romer*	**S**- Pond Management *Dr. Joe Morris*	
10:15			**H**- Turf Painting Trial *Mike Andresen, CSFM and Dr. Dave Minner*	Mulch Selection / Weed Management *James Romer*		
10:30		**P**- Fairway Bentgrass Trials *Dr. Nick Christians*	**L**- Species Traffic Study *Dr. Dave Minner and Federico Valverde*	Planting 101 *James Romer*	**Q**- Drift and Persistence *Dr. Mark Hanna*	
10:45		**O**- Mowing Injury *Mark Howieson*	**M**- Kentucky Bluegrass and Fine Fescue Variety Trial *Dr. Nick Christians*			
11:00	**F**- Non-selective Control and Sod Strength Study *Dr. Deying Li and Dr. Nick Christians*	**J**- Remote Sensing of Moisture and Nutrition *Jason Kruse*	**W-** **Equipment & Product Demonstrations** *** Primo & Embark trials** *** Field lining machines**	Under Used Landscape Plants *James Romer*	**R**- Effects of Pesticides on Water Quality and Non-target Sites *Joyce Hornstein*	
11:15	**G**- Summer Patch Control *Dr. Mark Gleason*	**I**- Fertility of Calcareous Soils *Rodney St.John*		Juniper Trials *James Romer*		

11:30	N- Tall Fescue Variety Trial ***Dr. Shui-Zhang Fei***	K- Bentgrass Fungicide Trials *Dr. Mark Gleason*	*** Logo or graphic painting * Different brands of paint side-by-side**	S- Pond Management *Dr. Joe Morris*	S- Pond Management *Dr. Joe Morris*	
11:45	M- Kentucky Bluegrass and Fine Fescue Variety Trial ***Dr. Nick Christians***	T- Round-up Ready Bentgrass *Dr. Shui-Zhang Fei*				
Noon	**Lunch Served in Exhibit Area**			**Product Demonstrations**		
	Pesticide Applicator Training Turf, Weed, Disease and Insect ID			U,V,W- Visit with the exhibitors and "test drive" the equipment and products and equipment in the Exhibitor Area.		
	Y- Laws & Regulations *Chuck Eckermann*					
1:00	X- Pest Management & Label Changes – Insects *Dr. Donald Lewis*	Turfgrass Identification and Weed, Disease and Insect Control Tour *Dr. Dave Minner and Dr. Nick Christians* **(Meet at registration tent)**				
1:10	Z- Pest Management & Label Changes – Diseases *Ms.Mark Gleason*					
1:35-2:00						

Station	Speaker	Topic
A	Richard Jauron	Responding to home owner and landscape questions
B	Deying Li and Dave Minner	Sand field stability
C	Lucas Dant and Nick Christians	Preemergence weed control
D	Dave Minner and Federico Valverde	Seeded bermuda traffic study
E	Dave Minner and Federico Valverde	Variable traffic intensity study
F	Deying Li and Nick Christians	Non-selective control and sod strength study
G	Mark Gleason	Summer patch control
H	Mike Andresen and Dave Minner	Turf painting trial
I	Rodney St. John	Fertility of calcareous soils
J	Jason Kruse	Remote sensing of moisture and nutrition
K	Mark Gleason	Bentgrass fungicide trials
L	Dave Minner and Federico Valverde	Species traffic study
M	Nick Christians	Kentucky bluegrass and fine fescue NTEP trial
N	Shui-Zhang Fei	Tall fescue NTEP trial
O	Mark Howieson	Mowing injury
P	Nick Christians	Fairway bentgrass trials
T	Shui-Zhang Fei	Round-up ready bentgrass
PESTICIDE CERTIFICATION TOPICS		
Q	Mark Hanna	Pesticide drift and persistence
R	Joyce Hornstein	Pesticides and water quality
S	Joe Morris	Pond management
X	Donald Lewis	Pest management and label changes – insects
Y	Chuck Eckerman	Pesticide laws and regulations
Z	Mark Gleason	Pest management - diseases

Introduction

Nick E. Christians , David D. Minner, and Shui-Zhang Fei

The following research report is the 23nd yearly publication of the results of turfgrass research projects performed at Iowa State University. This is the fifth year that the entire report is available on the Internet. This report and the previous years' reports can be accessed at:

http://turfgrass.hort.iastate.edu/

Several new projects were started in the 2001 season. Many of these are part of Dr. Fei's breeding related work. They include Round-up ready bentgrasses, perennial ryegrass cold hardiness screening trials, and Poa species phylogenetic studies. Dr. Fei also established a new Tall Fescue turfgrass evaluation trial in the fall of 2001.

We would like to acknowledge Will Emley, superintendent of the ISU Horticulture Research Station; Rod St. John, manager of the turf research area; Barbara Bingaman, Postdoctoral researcher; Federico Valverde, research associate; Dr. Young Joo, visiting scientist; Deying Li, Postdoctoral researcher; Mark Howieson, Troy Oster, Natalie Canier, Robert Wieners, Yanwen Xiong, S.K. Lee, and Jason Kruse, graduate students; and all others employed at the field research area in the past year for their efforts in building the turf program.

Special thanks to Zachary P. Kotlarek and Liying Li for helping to prepare this publication.

Edited by Nick Christians, David Minner and Shui-Zhang Fei, Iowa State University, Department of Horticulture, Ames, IA 50011-1100.

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Weather Data for the Iowa State University Research Station April 3 to September 30, 2001

April	Rainfall (in)	Maximum temperature (F°)	Minimum temperature (F°)
1			
2			
3	0.00	50.5	37.9
4	0.00	62.3	32.6
5	0.00	67.7	48.9
6	0.55	62.4	43.7
7	0.01	67.4	43.8
8	0.56	69.9	33.9
9	0.02	58.4	46.2
10	0.33	56.4	45.4
11	0.64	70.2	51.2
12	0.02	55.7	40.7
13	0.05	63.9	31.8
14	0.00	66.9	35.3
15	0.02	58.8	34.9
16	0.00	37.0	28.9
17	0.00	50.5	28.8
18	0.00	61.6	26.8
19	0.00	71.2	43.5
20	0.00	80.0	57.1
21	0.20	69.0	47.9
22	0.68	77.9	44.5
23	0.00	66.6	39.8
24	0.00	67.3	31.7
25	0.00	72.2	39.8
26	0.00	84.3	49.7
27	0.00	80.5	53.3
28	0.00	79.0	54.0
29	0.00	81.8	57.5
30	0.14	69.4	59.1

May	Rainfall (in)	Maximum temperature (F°)	Minimum temperature (F°)
1	0.17	81.9	55.5
2	0.29	70.1	53.8
3	0.62	62.7	50.4
4	0.11	59.9	53.4
5	0.21	63.6	50.1
6	0.24	72.1	55.4
7	0.00	68.6	48.1
8	0.00	75.0	50.3
9	0.04	82.9	53.5
10	0.50	81.0	57.4
11	0.00	69.2	50.8
12	0.00	67.1	43.9
13	0.34	59.4	50.6
14	0.00	86.6	54.8
15	0.00	87.7	70.7
16	0.00	85.3	65.4
17	0.00	82.6	64.7
18	0.00	79.8	55.1
19	0.00	81.0	58.3
20	0.57	71.5	56.7
21	0.29	57.6	48.8
22	0.00	55.7	45.6
23	0.14	51.5	43.4
24	0.13	57.9	41.9
25	0.22	56.4	50.0
26	0.30	60.7	52.0
27	0.00	63.8	51.0
28	0.06	68.9	52.4
29	0.00	74.4	48.7
30	0.00	62.9	52.1
31	0.75	55.7	45.0

June	Rainfall (in)	Maximum temperature (F°)	Minimum temperature (F°)
1	0.04	68.6	42.2
2	0.01	65.1	51.0
3	0.00	62.9	44.5
4	0.00	63.9	50.6
5	0.39	63.6	49.9
6	0.01	73.4	57.2
7	0.00	75.9	60.4
8	0.00	79.2	55.4
9	0.00	83.3	55.5
10	0.09	87.8	63.7
11	0.00	94.4	69.4
12	0.10	82.0	64.3
13	0.02	85.8	72.5
14	0.01	77.6	64.3
15	0.02	76.5	58.6
16	0.00	81.6	61.1
17	0.01	85.7	58.4
18	0.00	89.3	69.6
19	0.02	73.9	58.5
20	0.01	77.3	54.8
21	0.00	76.4	54.2
22	0.00	73.9	52.8
23	0.00	77.4	53.1
24	0.00	86.8	62.2
25	0.00	89.0	69.2
26	0.00	89.7	70.6
27	0.00	85.9	69.0
28	0.00	84.5	63.2
29	0.00	86.3	65.0
30	0.00	91.1	68.9

July	Rainfall (in)	Maximum temperature (F°)	Minimum temperature (F°)
1	0.04	70.5	57.0
2	0.00	74.6	54.4
3	0.01	89.1	67.4
4	0.00	88.3	63.2
5	0.00	81.0	54.8
6	0.00	85.5	60.2
7	0.00	92.2	75.8
8	0.56	83.7	69.7
9	0.00	88.8	66.6
10	0.00	87.4	67.1
11	0.00	80.4	58.9
12	0.00	81.4	63.9
13	0.00	83.4	58.6
14	0.00	84.9	58.8
15	0.00	83.1	63.4
16	0.00	86.3	66.5
17	0.00	90.4	73.7
18	0.01	85.9	71.4
19	0.39	84.9	70.9
20	0.00	83.6	74.1
21	0.00	88.3	75.1
22	0.16	91.0	70.7
23	0.22	88.7	74.5
24	0.41	81.9	69.1
25	0.00	79.9	67.3
26	0.00	76.8	65.7
27	0.00	77.2	63.7
28	0.00	86.6	68.1
29	0.00	88.0	59.8
30	0.00	91.2	71.3
31	0.00	93.9	77.1

August	Rainfall (in)	Maximum temperature (F°)	Minimum temperature (F°)
1	0.00	95.9	78.8
2	0.05	89.4	74.2
3	0.55	85.8	69.7
4	0.00	89.3	69.1
5	0.00	91.5	73.9
6	0.00	93.8	73.2
7	0.00	93.0	71.8
8	0.00	89.7	66.3
9	0.00	89.3	63.2
10	0.00	74.4	54.1
11	0.00	80.9	55.4
12	0.00	87.0	63.7
13	0.00	78.7	55.4
14	0.00	74.6	51.8
15	0.71	67.4	58.9
16	0.00	73.9	58.6
17	0.01	80.5	54.8
18	0.68	73.3	60.5
19	0.01	76.6	56.0
20	0.00	78.6	54.2
21	0.00	85.7	63.4
22	0.02	82.5	69.5
23	0.00	84.2	67.4
24	0.12	72.1	69.2
25	0.31	80.3	64.6
26	0.00	86.3	59.7
27	0.00	84.2	61.4
28	0.00	83.0	55.1
29	0.00	87.4	63.5
30	0.00	84.0	61.3
31	0.00	76.2	54.5

September	Rainfall (in)	Maximum temperature (F°)	Minimum temperature (F°)
1	0.00	77.6	50.1
2	0.00	81.4	59.4
3	0.00	86.4	59.5
4	0.00	82.6	50.5
5	0.00	82.6	58.6
6	1.19	76.3	68.0
7	3.33	75.6	63.1
8	0.35	69.5	55.9
9	0.00	67.4	54.1
10	0.00	75.4	50.0
11	0.00	81.0	56.4
12	0.00	84.7	56.6
13	0.00	66.0	54.2
14	0.04	56.2	52.1
15	0.00	66.3	53.6
16	0.80	63.8	53.6
17	0.09	69.4	57.3
18	0.05	60.6	54.5
19	0.00	70.0	53.3
20	0.02	75.5	51.8
21	0.00	71.9	50.8
22	0.00	76.7	48.3
23	0.00	64.6	47.2
24	0.00	59.2	35.8
25	0.00	63.5	33.8
26	0.00	73.3	34.0
27	0.00	77.8	38.8
28	0.00	73.3	43.1
29	0.00	68.0	43.9
30	0.00	74.4	38.0

Results of Regional Kentucky Bluegrass Cultivar Trials

Rodney A. St. John and Nick E. Christians

The United States Department of Agriculture (USDA) has sponsored several regional Kentucky bluegrass cultivar trials conducted at most of the northern agricultural experiment stations. The trial was established in the fall of 2000. The area received 4 lb N/1000 ft^2/yr, and was irrigated as needed. The objective of this study is to investigate cultivar performance under a cultural regime similar to that used on irrigated home lawns in Iowa.

The values listed under each month in Table 1 are the averages of visual quality ratings made on three replicated plots. Visual quality was based on a scale of 9 to 1: 9 = best quality, 6 = lowest acceptable quality, and 1 = worst quality. Yearly means of monthly data were taken and are listed in the last column (Mean). The first cultivar received the highest average rating for the entire 2001 season. The cultivars are listed in descending order of mean quality. The last row list the LSD (least significant difference), which is a statistical measurement of how widely the means must vary before they are considered to be different from one another.

Data for genetic color (Gcol) and leaf texture (Leafte) also are included. Genetic color was rated using a 9 to 1 scale with 9 = dark and 1 = light green. Leaf texture was assessed with a 9 to 1 scale with 9 = fine and 1 = coarse texture. Grcovsp and grcovfa are measurements of ground cover in spring and fall of 2001 and are measured in % of the ground with grass cover. Pctesta is an estimation of the relative establishment rates of the cultivars and again is measured on a % ground cover basis.

Table 1. 2001 visual quality and other ratings for the High-maintenance Kentucky Bluegrass Trial.

						QUALITY RATINGS						
NAME	GCOL01	LEAFTE	GRCOVSP	GRCOVFA	PCTESTA	MAY	JUN	JUL	AUG	SEP	OCT	MEAN
			%	%	%	9 to 1; 9 = high rating						
MIDNIGHT	8.0	8.3	73.3	93.0	53.3	8.7	8.0	8.7	9.0	8.3	8.3	8.5
A98-739	8.7	8.3	70.0	99.0	53.3	8.0	8.3	8.0	8.7	8.7	8.7	8.4
J-2487	8.7	8.7	70.0	96.0	56.7	8.0	8.3	8.3	8.3	8.7	8.7	8.4
J-2561	8.3	8.3	66.7	99.0	53.3	8.0	7.0	9.0	9.0	8.7	8.7	8.4
A97-1432	9.0	8.0	70.0	96.0	60.0	8.0	8.0	8.3	8.7	8.7	8.3	8.3
ASCOT	8.0	8.0	66.7	96.0	53.3	7.7	8.0	8.7	8.7	8.3	8.7	8.3
BAR PP 0566	8.3	8.0	66.7	96.0	60.0	7.7	7.7	8.7	8.3	8.7	8.7	8.3
J-1368	8.3	8.3	76.7	96.0	66.7	8.0	7.3	8.3	8.7	8.7	8.7	8.3
H92-558	8.3	8.0	70.0	96.0	66.7	7.3	8.3	9.0	8.3	7.7	8.3	8.2
J-2890	8.3	8.3	63.3	96.0	50.0	7.3	7.0	9.0	8.7	8.3	8.7	8.2
RUGBY II	8.0	8.0	60.0	99.0	53.3	7.0	7.3	9.0	8.7	8.3	9.0	8.2
SHOWCASE	8.0	8.0	70.0	93.0	56.7	8.3	8.3	8.3	8.0	8.0	8.0	8.2
SRX 2284	8.0	8.0	63.3	96.0	60.0	6.7	8.0	9.0	8.3	8.3	8.7	8.2
UNKNOWN	8.7	8.3	66.7	92.7	56.7	7.7	7.7	8.7	8.3	8.3	8.3	8.2
A97-1409	8.0	8.0	66.7	93.0	63.3	7.7	8.3	8.7	7.7	8.3	8.0	8.1
ALLURE	8.0	7.7	66.7	96.0	50.0	7.7	8.0	8.0	7.7	8.3	8.7	8.1
ARCADIA	8.0	8.0	63.3	93.0	56.7	7.3	7.7	8.3	8.3	8.3	8.3	8.1
BA 81-058	8.0	8.0	70.0	89.7	66.7	7.3	7.7	8.3	8.3	8.3	8.7	8.1
BA 82-288	8.0	8.0	70.0	99.0	60.0	7.7	8.0	8.3	8.3	8.3	8.0	8.1
BA 83-113	8.0	7.7	56.7	99.0	50.0	7.0	7.7	9.0	8.0	8.3	8.7	8.1
BAR PP 0573	8.0	8.0	70.0	99.0	63.3	7.7	8.0	7.3	8.0	8.7	8.7	8.1

BLACKSTONE	8.3	8.3	70.0	96.0	63.3	7.7	8.0	8.3	7.7	8.3	8.3	8.1
BOOMERANG	8.3	8.3	63.3	93.0	56.7	7.0	7.7	8.7	8.7	8.0	8.3	8.1
J-1838	8.0	8.0	66.7	63.0	56.7	7.3	7.3	8.3	8.7	8.7	8.3	8.1
J-2695	8.7	8.7	66.7	90.0	56.7	7.7	7.7	8.3	8.3	8.0	8.3	8.1
LANGARA	8.0	8.0	70.0	93.0	63.3	8.0	8.0	8.0	7.7	8.3	8.3	8.1
LIBERATOR	8.0	8.0	70.0	93.0	63.3	7.7	8.0	8.3	7.7	8.3	8.3	8.1
PST-1BMY	8.0	8.0	70.0	96.0	66.7	7.7	8.0	7.7	8.0	8.3	8.7	8.1
PST-731	8.3	8.0	66.7	96.0	56.7	7.7	8.0	8.3	8.3	8.3	8.0	8.1
QUANTUM LEAP	8.3	8.0	63.3	93.0	50.0	7.3	7.0	8.7	8.7	8.3	8.3	8.1
RITA	8.3	8.0	76.7	90.0	70.0	6.7	8.3	8.0	8.7	8.3	8.3	8.1
A96-427	7.7	8.0	66.7	96.0	60.0	7.3	8.0	7.3	8.0	8.7	8.7	8.0
IMPACT	8.0	8.3	73.3	96.0	63.3	7.7	7.7	8.0	8.7	7.7	8.3	8.0
NUGLADE	8.0	8.3	73.3	86.3	56.7	8.3	8.0	8.0	8.3	8.0	7.3	8.0
PST-161	8.0	8.0	63.3	96.0	53.3	7.3	7.7	8.0	8.7	8.0	8.3	8.0
SI A96-386	8.0	8.0	66.7	90.0	53.3	7.7	8.0	8.3	7.7	8.0	8.3	8.0
99AN-53	8.0	8.0	70.0	93.0	66.7	7.7	8.3	7.7	7.7	8.0	8.0	7.9
A97-1567	8.0	8.0	76.7	96.0	66.7	8.0	8.0	8.0	8.0	7.7	8.0	7.9
A98-183	8.0	8.0	66.7	86.7	50.0	7.7	7.7	7.7	7.7	8.0	8.7	7.9
A98-881	7.3	8.0	70.0	96.0	56.7	7.7	8.0	7.7	7.7	8.3	8.0	7.9
BEDAZZLED	7.3	8.0	60.0	96.0	56.7	6.7	7.3	8.3	8.3	8.3	8.3	7.9
BLUE RIDGE (A97-1449)	8.0	7.7	73.3	89.7	60.0	8.0	8.0	7.7	8.3	8.0	7.7	7.9
CABERNET	8.0	8.0	73.3	96.0	60.0	8.3	8.0	7.3	7.7	8.3	8.0	7.9
J-1513	8.7	9.0	70.0	93.0	50.0	7.7	7.7	8.3	8.0	8.0	7.7	7.9
J-1655	8.3	8.0	63.3	89.7	56.7	7.3	7.7	7.7	8.3	8.3	8.3	7.9
J-2885	8.0	8.0	66.7	86.3	50.0	7.7	7.7	8.7	8.0	8.0	7.7	7.9
MALLARD (A97-1439)	8.0	8.0	70.0	93.0	63.3	7.3	7.7	8.7	7.7	8.0	8.3	7.9
MONTE CARLO (A96-402)	8.0	8.0	66.7	93.0	60.0	7.3	7.3	8.7	8.0	8.0	8.0	7.9
PICK 113-3	8.7	8.0	70.0	96.0	60.0	7.3	8.0	8.3	7.3	8.3	8.3	7.9
TOTAL ECLIPSE	8.0	8.3	70.0	92.7	56.7	8.0	7.7	7.7	8.0	8.3	8.0	7.9
A93-200	7.3	8.0	70.0	93.0	60.0	8.0	7.7	7.7	7.7	7.7	8.0	7.8
A97-1715	8.0	8.3	70.0	86.7	63.3	8.0	8.7	7.3	7.3	8.0	7.7	7.8
A98-139	8.0	8.0	70.0	93.0	66.7	7.7	8.0	7.7	7.3	8.0	8.3	7.8
A98-365	8.0	8.0	56.7	93.0	46.7	7.0	7.3	9.0	8.3	7.7	7.3	7.8
AWARD	8.3	8.3	63.3	93.0	56.7	7.3	7.3	8.3	8.0	7.7	8.0	7.8
B3-171	8.0	8.0	66.7	92.7	56.7	7.7	7.7	8.7	8.0	7.0	8.0	7.8
B5-144	8.0	8.0	60.0	89.7	50.0	7.0	7.7	8.3	7.7	7.7	8.3	7.8
BA 00-6001	8.3	8.0	56.7	96.0	46.7	6.7	7.7	8.7	8.0	8.0	7.7	7.8
BH 00-6003	8.0	7.3	60.0	96.0	46.7	6.7	7.3	8.7	8.3	8.0	8.0	7.8
BODACIOUS	8.0	8.0	60.0	86.7	50.0	7.0	8.0	8.0	8.0	7.7	8.0	7.8
BOUTIQUE	8.3	8.0	66.7	96.0	63.3	7.0	7.3	8.7	7.3	8.3	8.0	7.8

BROOKLAWN	7.3	8.0	66.7	89.7	53.3	7.7	8.3	8.0	7.3	7.3	8.0	7.8
CHAMPAGNE	7.0	7.7	66.7	93.0	56.7	8.0	8.0	8.3	7.3	7.3	7.7	7.8
EVEREST	8.0	8.3	66.7	96.0	53.3	7.7	7.3	6.7	8.3	8.3	8.7	7.8
FREEDOM II	8.3	8.3	63.3	96.0	53.3	7.3	8.0	7.7	7.7	8.0	8.0	7.8
H94-293	8.0	8.0	70.0	90.0	56.7	8.0	8.0	8.3	7.7	7.3	7.3	7.8
HALLMARK	8.0	8.0	76.7	92.7	70.0	7.7	8.0	8.3	7.7	7.7	7.7	7.8
J-1420	8.3	8.0	56.7	93.0	50.0	6.7	7.3	8.0	8.0	8.3	8.3	7.8
J-1880	8.0	8.0	66.7	96.0	56.7	7.7	7.3	7.0	8.3	8.3	8.3	7.8
ODYSSEY	8.3	8.3	66.7	93.0	56.7	7.7	7.3	8.0	8.0	8.3	7.7	7.8
PICK 453	8.0	8.0	70.0	90.0	63.3	7.3	8.0	7.7	7.7	8.0	8.0	7.8
PST-B5-125	8.0	8.0	70.0	96.0	63.3	7.7	8.0	8.0	7.7	7.7	7.7	7.8
SERENE	7.7	8.0	73.3	93.0	70.0	8.3	8.0	7.3	7.7	7.0	8.3	7.8
A98-296	8.0	8.0	70.0	86.7	66.7	7.3	7.7	8.3	8.0	7.7	7.3	7.7
ABBEY	7.7	8.0	66.7	89.3	63.3	7.3	7.7	8.3	7.7	7.3	7.7	7.7
B3-185	8.0	8.0	63.3	86.7	53.3	7.3	7.3	8.7	7.7	7.7	7.3	7.7
HV 140	8.0	8.0	70.0	93.0	63.3	7.7	7.7	8.0	7.7	7.7	7.7	7.7
J-1515	8.3	8.0	66.7	90.0	53.3	7.3	7.7	6.7	7.7	8.3	8.3	7.7
J-1648	8.0	8.0	73.3	92.7	56.7	7.3	7.3	7.3	8.0	8.3	7.7	7.7
MISTY	7.7	8.0	66.7	93.0	63.3	7.3	7.7	7.7	8.0	7.3	8.3	7.7
PICK 417	8.0	7.7	63.3	93.0	53.3	7.3	8.0	8.3	7.7	7.3	7.7	7.7
PICK-232	8.0	8.0	63.3	90.0	60.0	7.3	7.7	7.7	7.7	8.0	7.7	7.7
PST-108-79	8.0	8.0	63.3	93.0	53.3	7.3	8.0	7.0	8.0	7.7	8.0	7.7
PST-1701	7.3	8.3	70.0	90.0	56.7	7.7	8.0	7.7	8.0	7.3	7.3	7.7
PST-B5-89	8.3	8.0	66.7	89.7	53.3	7.3	7.7	8.3	7.0	8.0	8.0	7.7
RAMBO	7.3	8.0	70.0	99.0	60.0	7.7	7.7	8.0	7.3	8.0	7.7	7.7
SHAMROCK	7.0	8.0	63.3	93.0	56.7	7.3	7.3	7.3	7.7	8.0	8.3	7.7
SONOMA	8.0	8.0	63.3	89.7	53.3	7.0	7.3	8.0	8.0	8.0	8.0	7.7
WILDWOOD	8.0	8.3	73.3	96.0	70.0	7.7	8.0	7.0	7.7	7.7	8.0	7.7
BARZAN	7.0	8.0	60.0	96.0	43.3	7.0	7.3	7.7	8.0	7.3	8.0	7.6
COVENTRY	7.3	8.0	66.7	96.0	60.0	7.3	8.0	7.0	7.7	7.7	8.0	7.6
EVERGLADE	8.0	8.0	66.7	90.0	56.7	7.0	7.3	7.0	8.0	8.0	8.0	7.6
FAIRFAX	7.7	8.0	70.0	93.0	53.3	7.7	7.7	7.7	7.7	7.7	7.3	7.6
HV 238	8.0	7.3	70.0	96.0	53.3	8.0	7.7	7.7	7.3	7.3	7.3	7.6
MARQUIS	8.0	8.0	63.3	90.0	60.0	7.0	7.3	8.3	8.0	7.0	7.7	7.6
MOONLIGHT	8.0	8.0	70.0	90.0	60.0	7.0	7.3	8.0	7.7	8.0	7.7	7.6
PP H 7832	8.3	8.0	60.0	93.0	50.0	7.3	7.7	7.3	7.7	7.7	7.7	7.6
PP H 7907	8.0	8.0	63.3	90.0	53.3	7.3	7.7	8.0	8.0	7.0	7.3	7.6
PRINCETON 105	8.0	8.0	70.0	86.7	60.0	7.7	7.7	6.7	7.7	7.7	8.0	7.6
PRO SEEDS - 453	8.0	8.0	66.7	90.0	53.3	7.3	7.7	7.3	7.7	7.3	8.0	7.6
PST-1804	7.3	8.0	66.7	93.0	63.3	7.3	8.0	7.7	7.0	8.0	7.7	7.6

PST-604	8.0	8.3	66.7	86.7	60.0	7.3	7.7	7.7	7.3	7.7	7.7	7.6
SRX 26351	8.0	8.7	70.0	93.0	56.7	7.7	7.3	7.7	8.3	7.3	7.3	7.6
WELLINGTON	7.3	9.0	73.3	99.0	60.0	8.3	8.0	7.7	7.3	7.0	7.0	7.6
A96-739	8.0	8.3	70.0	90.0	60.0	8.0	8.0	7.7	6.7	7.3	7.3	7.5
A97-1330	8.0	8.3	70.0	93.0	66.7	7.3	7.3	8.0	7.7	7.3	7.3	7.5
A97-857	8.0	8.7	66.7	96.0	56.7	7.7	7.3	6.7	7.7	8.0	7.7	7.5
A98-407	8.0	8.0	53.3	80.0	43.3	6.3	7.7	8.3	7.7	7.3	7.7	7.5
B5-43	8.0	8.0	63.3	93.0	56.7	6.7	7.3	7.3	8.0	7.3	8.3	7.5
BAR PP 0468	7.7	8.0	60.0	90.0	53.3	6.7	7.0	9.0	8.0	7.0	7.3	7.5
BARIRIS	8.0	8.0	73.3	93.0	60.0	7.7	8.0	6.3	7.7	7.3	8.0	7.5
BARON	7.7	8.0	66.7	86.3	60.0	7.0	7.0	8.3	8.0	7.3	7.3	7.5
BARTITIA	8.0	8.0	73.3	90.0	66.7	7.7	7.7	7.3	7.7	7.3	7.3	7.5
BORDEAUX	8.0	8.0	66.7	89.7	53.3	7.3	7.0	8.7	7.7	7.3	7.0	7.5
ENVICTA	7.7	8.0	70.0	86.7	66.7	7.3	8.0	7.7	7.3	7.3	7.3	7.5
JEWEL	7.7	8.0	70.0	86.3	56.7	7.7	8.0	7.0	7.7	7.3	7.3	7.5
PST-1QG-27	8.0	8.0	73.3	89.7	66.7	7.7	7.3	8.0	7.0	7.7	7.3	7.5
PST-H5-35	8.0	8.0	70.0	90.0	60.0	7.3	7.3	7.0	7.7	8.0	7.7	7.5
PST-H6-150	7.7	8.0	63.3	90.0	53.3	7.3	7.7	7.7	7.3	7.3	7.7	7.5
PST-YORK HARBOR 4	8.3	8.0	70.0	90.0	63.3	7.7	8.3	6.3	7.3	7.7	7.7	7.5
SRX 2394	8.0	8.0	66.7	89.7	60.0	7.0	7.3	7.7	7.7	7.7	7.7	7.5
A98-1028	7.3	8.0	66.7	90.0	50.0	7.7	7.7	7.3	6.7	7.7	7.3	7.4
ALPINE	8.0	8.0	60.0	90.0	53.3	6.7	7.7	7.7	7.7	7.7	7.0	7.4
BRILLIANT	7.7	8.0	66.7	83.0	60.0	7.3	8.0	8.0	6.7	7.0	7.3	7.4
CHATEAU	8.0	7.3	66.7	89.7	46.7	7.3	8.0	6.0	7.7	7.7	7.7	7.4
CHELSEA	7.7	8.0	66.7	86.7	56.7	7.7	8.0	7.3	7.7	7.0	6.7	7.4
CHICAGO II	8.3	8.0	60.0	86.7	53.3	7.0	7.7	7.7	7.3	7.3	7.7	7.4
EAGLETON	7.0	8.0	73.3	93.0	66.7	8.0	7.7	7.0	7.0	7.3	7.3	7.4
GOLDRUSH	8.0	8.0	70.0	86.7	63.3	7.3	7.0	7.7	8.0	7.3	7.3	7.4
JEFFERSON	7.3	8.3	70.0	93.0	63.3	7.7	7.7	7.0	7.0	7.3	7.7	7.4
LIMOUSINE	8.0	8.0	80.0	86.7	63.3	8.3	8.0	6.3	7.7	7.0	7.3	7.4
PP H 6370	8.0	8.0	63.3	86.7	53.3	7.3	7.7	7.3	7.7	7.3	7.3	7.4
PST-222	8.0	7.7	56.7	83.3	50.0	6.0	7.0	8.3	8.0	7.7	7.3	7.4
PST-B3-170	8.0	8.0	66.7	90.0	56.7	7.0	7.3	8.0	7.3	7.7	7.3	7.4
PST-B4-246	8.0	8.0	63.3	83.0	53.3	7.0	7.7	7.3	7.3	7.3	7.7	7.4
RAVEN	7.7	7.7	73.3	86.7	70.0	7.7	7.7	7.3	7.3	7.3	7.3	7.4
ROYALE (A97-1336)	7.7	8.0	63.3	90.0	60.0	7.0	7.3	7.7	8.0	7.3	7.3	7.4
SRX 2114	8.0	8.3	70.0	90.0	60.0	7.3	7.7	7.0	7.0	8.0	7.7	7.4
A98-304	8.0	8.3	66.7	83.3	60.0	7.7	7.7	7.3	7.3	7.0	7.0	7.3
B5-45	7.7	8.0	56.7	86.3	46.7	6.7	7.3	7.0	7.7	7.3	7.7	7.3
BAR PP 0471	8.0	8.0	63.3	83.0	53.3	7.3	7.3	7.7	7.0	7.0	7.7	7.3

BARONIE	7.0	7.7	70.0	89.7	73.3	7.0	7.3	7.3	7.0	7.7	7.3	7.3
DLF 76-9036	7.7	8.0	63.3	90.0	60.0	7.3	7.3	7.3	7.7	7.0	7.0	7.3
IB7-308	8.3	8.0	53.3	86.7	40.0	6.7	7.7	7.7	7.0	7.3	7.7	7.3
JULIA	8.0	8.0	66.7	89.7	63.3	7.7	8.3	6.7	7.0	7.0	7.3	7.3
KENBLUE	7.3	9.0	76.7	93.0	70.0	8.3	7.7	7.7	6.7	7.0	6.7	7.3
LILY	7.7	8.0	70.0	96.0	66.7	7.0	7.3	6.7	7.7	7.3	7.7	7.3
LIMERICK	7.7	8.3	70.0	86.7	60.0	8.0	8.0	7.0	7.0	7.0	6.7	7.3
SRX OG245	7.7	8.7	70.0	80.0	56.7	8.0	7.3	8.0	6.7	7.0	7.0	7.3
UNIQUE	7.3	8.0	63.3	90.0	60.0	7.0	6.7	7.7	7.7	7.3	7.7	7.3
A98-1275	8.0	8.0	63.3	90.0	46.7	6.7	7.3	6.7	7.3	7.7	7.3	7.2
APOLLO	7.7	8.7	66.7	83.3	66.7	7.3	7.0	7.3	7.3	7.0	7.0	7.2
BARITONE	8.0	8.0	70.0	53.3	66.7	7.7	8.3	6.3	6.7	7.0	7.3	7.2
DLF 76-9037	7.7	8.0	66.7	86.7	63.3	7.0	7.0	7.7	7.3	7.0	7.3	7.2
H92-203	7.7	8.3	63.3	90.0	50.0	7.3	7.0	7.7	7.3	7.0	7.0	7.2
NA-K991	8.0	8.0	63.3	76.7	46.7	7.3	8.0	7.3	6.7	7.0	7.0	7.2
NORTH STAR	7.7	8.0	63.3	86.3	60.0	6.3	6.7	7.3	7.7	7.7	7.3	7.2
PP H 7929	8.0	8.0	63.3	86.7	53.3	6.7	7.0	7.3	7.3	7.3	7.3	7.2
A96-451	8.0	8.0	63.3	80.0	56.7	7.0	7.3	7.7	7.0	6.3	7.3	7.1
DLF 76-9032	8.0	8.0	63.3	83.3	53.3	6.7	7.0	8.0	7.7	7.0	6.3	7.1
SRX 27921	8.3	8.3	63.3	80.0	53.3	7.0	7.3	7.0	7.0	7.0	7.0	7.1
WASHINGTON	7.0	9.0	80.0	96.0	76.7	8.3	8.0	5.7	6.3	7.0	7.0	7.1
BH 00-6002	7.0	7.7	66.7	83.3	56.7	7.7	7.3	6.3	7.0	6.7	7.0	7.0
B4-128A	7.3	8.0	66.7	80.0	60.0	7.0	7.0	7.3	7.3	6.7	6.3	6.9
A96-742	7.0	8.7	56.7	80.0	46.7	7.0	7.3	7.0	6.0	6.7	7.0	6.8
BLUE KNIGHT	8.3	8.0	63.3	83.3	53.3	6.7	7.7	5.3	7.0	6.7	7.7	6.8
GO-9LM9	6.7	9.0	73.3	80.0	66.7	8.3	7.0	5.3	6.7	7.0	6.7	6.8
PP H 6366	8.0	8.0	66.7	86.3	56.7	6.7	7.3	7.3	6.3	7.0	6.3	6.8
BA 84-140	8.7	7.7	70.0	73.3	56.7	7.0	7.3	7.7	5.3	6.3	6.3	6.7
DLF 76-9034	7.0	7.7	60.0	83.3	50.0	6.7	7.0	7.0	5.7	6.7	7.0	6.7
NA-K992	8.0	8.3	76.7	73.3	56.7	8.0	8.7	5.7	6.3	5.7	5.7	6.7
JULIUS	8.0	8.0	66.7	83.3	56.7	6.7	7.3	6.7	6.3	6.3	6.0	6.6
CVB-20631	8.0	8.0	53.3	73.3	46.7	5.3	7.0	6.3	6.3	7.0	6.3	6.4
LSD (0.05)	0.6	0.6	16.6	19.8	18.9	2.1	1.9	2.2	1.3	1.1	1.2	0.8

Fairway Height Bluegrass Trial

Nick Christians and Deying Li

The fairway height Kentucky bluegrass trial was established in Sept. 1999 to evaluate a number of the new 'low mow' bluegrasses at a 0.5 inch mowing height under non-irrigated conditions. The area receives 3 lbs. N/1000 ft^2/year and is treated with preemergence herbicides in the spring and broadleaf weed controls in the fall. No fungicides were used on the area.

Table 1. Visual quality[1] for cultivars in the 2001 non-irrigated fairway high Kentucky bluegrass cultivar trial.

	Visual quality							
Cultivar	Apr	May	Jun	Jul	Aug	Sep	Oct	Mean
Total Eclipse	3.3	5.0	6.7	3.0	4.0	5.3	6.7	6.8
Sure Shot Mix[2]	4.0	4.7	6.3	3.0	4.0	5.3	6.3	6.5
SodGrower II Mix[3]	4.3	4.3	5.7	3.0	4.0	5.0	5.7	6.0
Rugby II	3.3	4.7	5.7	3.0	3.3	5.0	6.0	5.9
Nuglade	4.0	4.7	6.3	3.3	3.7	5.3	6.7	5.6
Rambo	4.0	4.0	6.0	3.0	4.0	4.7	5.7	5.6
Midnight	4.3	5.0	5.3	3.7	4.7	6.0	7.0	5.4
Park	3.7	3.3	5.0	3.3	5.3	5.0	5.3	5.3
Nublue	3.7	3.7	5.3	3.3	4.7	5.0	4.7	4.8
Kenblue	5.3	3.7	5.0	3.0	5.3	5.3	5.3	4.5
Limosine	4.7	4.3	5.7	3.0	3.0	4.3	4.3	4.2
Bluemoon	4.3	4.3	6.0	3.3	4.0	4.7	5.7	4.2
Award	3.3	4.3	5.3	3.0	4.0	5.3	6.3	4.1
Bluechip	3.3	3.0	6.0	3.3	4.3	5.3	5.3	4.0
Absolute	4.3	5.0	6.3	3.3	4.3	5.3	6.3	3.9
$LSD_{0.05}$	NS	NS	NS	NS	NS	NS	1.0	0.5

[1] Visual quality was assessed using a scale of 9 to 1 with 9 = best, 6 = lowest acceptable, and 1 = worst turf quality.
[2] Includes Nuglade, Bluemoon, Award, Rugby II, and Rambo
[3] Includes Bluechip, Nustar, Rambo, and Rugby II

Perennial Ryegrass Studies

R. A. St. John and N. E. Christians

This was the second year of the trial that began in the fall of 1999 with the establishment of 134 cultivars of perennial ryegrass at the Iowa State University Horticulture Research Station. The study was established on an irrigated area that was maintained at a 2-inch mowing height and fertilized with 3 to 4 lb N/1000 ft^2/yr. The area received herbicide treatments as required.

Cultivars were evaluated for turf quality May through October of 2001. Visual quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptabe, and 1 = worst quality. The values listed under each month in Table 1 are the averages of ratings made on three replicated plots for the three studies. Yearly means of data from each month are listed in the last column. The cultivars are listed in descending order of average quality. The last row list the LSD (least significant difference), which is a statistical measurement of how widely the means must vary before they are considered to be different from one another.

Data for genetic color (Gencol), spring greenup (Gnup), and leaf texture (Ltex) also are included. The cultivars were rated for genetic color in July and the values were made using a 9 to 1 scale with 9 = dark and 1 = light green. Spring greenup data were taken in April and were estimated using a 9 to 1 scale with 9 = green and 1 = dormant turf. Leaf texture was rated on the same scale with 9=finest texture.

Table 1. The 2001 visual quality and other ratings for the 1999 National Perennial Ryegrass Study

				Quality						
CULTIVAR	GENCOL	GNUP	LTEX	MAY	JUN	JUL	AUG	SEP	OCT	MEAN
				9 to 1; 9 = high rating						
ALL STAR2 (CIS-PR-78)	8.0	5.7	8.0	5.0	7.7	8.3	9.0	8.7	8.0	7.8
PINNACLE II (BAR 9 B2)	9.0	6.0	8.3	5.0	8.7	7.7	9.0	8.7	8.0	7.8
APR 1232	7.7	5.0	8.0	5.3	8.7	7.7	8.0	8.0	8.0	7.6
ROBERTS-627	8.0	6.0	8.0	5.3	8.0	8.3	8.3	8.0	7.3	7.6
WILMINGTON	8.7	5.3	8.0	5.0	8.3	7.7	8.3	8.3	7.7	7.6
MONTEREY II (JR-187)	7.7	5.0	8.0	5.0	8.3	7.7	7.7	8.3	8.0	7.5
ALLSPORT	7.0	4.7	8.0	5.3	8.0	7.0	8.0	8.0	8.0	7.4
AMAZING (B1)	8.3	5.7	8.0	5.0	8.3	7.7	7.7	8.3	7.3	7.4
BRIGHTSTAR SLT (PST-2A6B)	7.0	5.3	8.0	5.3	7.3	7.3	7.7	8.3	8.3	7.4
CAS-LP84	8.0	5.0	8.0	4.3	8.0	7.3	8.3	8.3	8.0	7.4
CUTTER II (PICK RC2)	8.3	5.7	8.3	5.7	8.7	7.7	8.0	7.3	7.0	7.4
EXACTA	8.0	6.0	8.0	5.3	8.3	7.3	7.7	8.0	7.7	7.4
GATOR 3 (CIS-PR-85)	8.3	5.7	8.0	5.3	7.3	7.7	8.3	8.0	7.7	7.4
MB 414 (ABT-99-4.903)	8.0	5.3	8.0	4.7	8.3	7.0	8.3	8.7	7.3	7.4
PENNANT II	7.7	4.7	8.0	4.7	8.3	7.0	8.3	8.0	8.0	7.4
PICK MDR	9.0	6.0	8.0	5.0	8.7	7.0	8.3	8.0	7.7	7.4
PROMISE	8.3	5.3	8.0	5.0	8.0	7.7	7.7	8.3	7.7	7.4
PST-2LA	7.7	4.7	8.0	4.3	8.0	8.3	8.0	8.0	8.0	7.4
R8000	7.7	4.7	8.0	4.7	7.3	8.0	7.7	8.3	8.3	7.4
RADIANT	8.7	6.3	8.0	5.0	8.3	7.7	8.3	8.0	7.3	7.4
ABT-99-4.560	8.0	5.3	8.3	4.7	7.7	7.3	8.3	8.3	7.7	7.3
ABT-99-4.834	8.0	5.3	8.0	4.3	7.3	8.0	8.0	8.3	7.7	7.3
BARLENNIUM	7.7	4.7	8.0	4.7	7.7	8.3	8.3	7.7	7.3	7.3
CABO (CIS-PR-80)	8.7	5.7	8.0	4.3	8.3	7.3	8.0	8.3	7.7	7.3
CHARISMATIC (LTP 98-501)	8.3	5.7	8.3	4.7	8.7	7.3	7.3	8.3	7.7	7.3
CIS-PR-75	8.3	5.0	8.0	4.7	7.7	7.7	8.3	8.0	7.3	7.3
KOKOMO (CIS-PR-69)	8.3	5.7	8.7	4.7	8.3	7.3	8.0	7.7	7.7	7.3

LTP-ME	7.7	4.7	8.0	4.3	8.0	7.7	8.0	8.3	7.7	7.3
MANHATTAN (PST-2CRL)	8.0	4.7	8.0	4.7	7.3	7.7	8.3	8.0	8.0	7.3
PARADIGM (APR 1236)	8.3	5.3	8.0	5.0	8.3	7.7	7.3	7.7	8.0	7.3
PARAGON	7.3	5.3	8.0	4.3	8.3	7.3	8.0	8.3	7.7	7.3
PICK PR QH-97	8.0	5.7	8.3	5.7	8.0	6.7	7.7	8.0	7.7	7.3
PIZZAZZ	8.3	5.3	8.0	4.3	7.3	7.0	9.0	8.7	7.7	7.3
PST-2CRR	8.0	6.0	8.0	5.7	8.0	6.3	8.3	8.0	7.7	7.3
SRX 4801	7.3	5.0	8.3	4.3	8.0	7.7	8.3	8.3	7.3	7.3
ABT-99-4.464	7.0	4.7	8.0	4.7	7.7	6.7	7.7	8.3	8.3	7.2
ABT-99-4.815	7.0	5.0	8.0	4.7	7.7	7.7	8.0	7.7	7.7	7.2
ABT-99-4.965	8.7	4.7	8.0	3.7	7.7	7.7	8.3	8.3	7.3	7.2
CATALINA	7.3	5.0	8.0	4.3	7.3	7.3	7.7	8.7	7.7	7.2
CHARGER II	7.7	4.7	8.0	4.7	7.7	7.7	8.0	8.0	7.3	7.2
DIVINE	7.7	5.3	8.0	4.3	8.3	7.0	8.0	7.7	7.7	7.2
DLF-LDD	8.0	5.3	8.0	4.7	7.7	7.7	7.7	8.0	7.3	7.2
MEPY	7.3	5.7	8.0	5.0	7.3	7.3	7.7	8.3	7.7	7.2
MP88	8.0	5.0	8.0	4.0	7.3	7.3	8.0	8.7	8.0	7.2
PACESETTER (6011)	8.0	4.0	8.0	4.3	8.0	7.7	7.3	8.3	7.7	7.2
PANTHER	7.0	4.7	8.0	4.7	7.7	7.3	7.7	8.0	7.7	7.2
PROSPORT (AG-P981)	7.7	4.7	8.7	4.0	7.7	7.7	8.0	8.0	7.7	7.2
PST-2RT	7.7	5.3	8.0	4.7	7.7	7.7	7.7	8.0	7.7	7.2
SRX 4RHT	8.3	5.7	8.0	4.7	8.3	7.0	8.0	8.0	7.3	7.2
UT-1000 (ABT-99-4.709)	7.7	5.0	8.0	4.0	7.3	7.7	8.3	8.0	8.0	7.2
ABT-99-4.115	8.0	5.3	8.0	4.0	7.7	7.0	7.7	8.3	7.7	7.1
ABT-99-4.721	8.0	5.7	8.0	4.3	8.0	7.0	7.7	7.7	7.7	7.1
APPLAUD (PENNINGTON-11301)	8.0	4.3	8.3	3.7	7.3	8.0	8.0	8.0	7.3	7.1
APR 1233	7.3	4.3	8.0	3.7	8.0	8.0	7.7	7.7	7.3	7.1
ASCEND	9.0	5.3	8.0	4.0	8.3	6.7	8.0	7.7	8.0	7.1
CALYPSO II	7.3	5.3	8.0	4.7	8.3	6.7	7.7	7.7	7.7	7.1
CHURCHILL	8.3	5.0	8.0	3.3	8.0	7.7	7.7	8.0	7.7	7.1
CIS-PR-84	8.0	4.0	8.0	3.3	7.3	7.3	8.3	8.3	7.7	7.1
EPD	7.0	4.7	8.0	4.0	7.7	7.7	7.7	8.0	7.3	7.1
JET	8.0	4.7	8.0	3.7	7.7	7.0	8.0	8.3	8.0	7.1
MAJESTY	7.7	4.3	8.3	4.3	7.7	7.3	7.7	7.7	8.0	7.1
MANHATTAN 3	7.3	4.3	8.0	4.0	8.0	7.3	8.0	7.3	7.7	7.1
MB 411 (ABT-99-4.753)	8.0	4.7	8.0	3.7	8.0	6.3	8.0	8.3	8.3	7.1
NEXUS	8.7	4.3	8.3	3.7	7.7	8.0	8.3	8.0	7.0	7.1
PHANTOM	8.3	4.3	8.0	3.7	8.0	7.3	7.7	8.3	7.7	7.1
PICK PRNGS	7.7	4.7	8.0	4.3	8.0	6.7	7.7	8.0	7.7	7.1
PST-2BR	8.3	4.0	8.0	3.3	7.0	8.3	8.0	8.3	7.7	7.1
PST-2SBE	7.7	4.3	8.0	4.0	7.7	7.7	7.7	8.3	7.3	7.1
SALINAS (PST-2SLX)	8.0	5.3	8.0	4.3	7.3	6.7	7.7	8.3	8.0	7.1
A5C (ABT-99-4.960)	8.0	4.3	8.0	4.3	7.3	8.0	7.7	8.0	6.7	7.0
ABT-99-4.339	8.0	4.7	8.0	5.3	8.0	7.0	8.0	5.7	8.0	7.0
ADMIRE (JR-151)	7.7	4.3	8.0	4.3	8.3	8.0	7.0	7.3	7.0	7.0
APR 1237	7.3	4.0	8.0	4.7	8.0	6.3	7.7	8.0	7.3	7.0

BRIGHTSTAR II	7.3	4.7	8.0	4.0	7.3	7.3	7.7	8.0	7.7	7.0
MB 412 (ABT-99-4.461)	8.7	4.7	8.0	3.3	7.3	8.0	7.7	8.3	7.3	7.0
MP103	7.5	5.5	8.0	4.0	7.5	6.5	8.0	8.0	8.0	7.0
SEVILLE II	8.0	4.0	8.0	3.7	7.7	7.0	8.0	8.0	7.7	7.0
SKYHAWK	7.7	4.3	8.0	4.0	7.3	7.7	7.7	7.7	7.7	7.0
STELLAR (CIS-PR-72)	8.0	4.7	8.0	3.3	7.3	7.7	8.0	8.0	7.7	7.0
AFFIRMED	7.7	5.0	8.0	4.3	8.3	6.3	7.3	8.0	7.3	6.9
FIESTA 3	8.0	3.3	8.0	3.7	8.0	6.7	8.0	8.0	7.3	6.9
GALAXY (JR-128)	7.3	4.0	8.0	4.3	7.3	6.7	7.7	7.7	7.7	6.9
LPR 98-143	7.3	4.7	8.0	4.3	8.3	7.0	7.0	7.7	7.3	6.9
MB 410 (ABT-99-4.629)	8.3	4.7	8.0	4.0	7.7	6.3	8.0	8.3	7.3	6.9
MP107	8.0	4.7	8.0	3.0	7.7	7.0	7.7	8.3	8.0	6.9
PICK PR B-97	8.0	5.0	8.0	3.7	7.7	7.3	7.7	7.7	7.3	6.9
PLEASURE XL	7.0	4.0	8.0	3.7	7.3	6.7	8.0	8.3	7.3	6.9
PST-2JH	7.0	4.0	8.3	3.7	7.3	7.7	7.7	8.0	7.3	6.9
PST-2L96	8.0	4.7	8.0	4.0	7.3	8.0	7.3	7.7	7.3	6.9
SRX 4120	7.7	5.0	7.7	5.0	7.7	6.3	7.3	7.7	7.7	6.9
SUPERSTAR (EP57)	7.7	4.7	8.0	3.3	8.0	6.3	7.7	8.3	7.7	6.9
ABT-99-4.600	7.0	3.7	8.0	3.0	7.3	7.0	8.0	7.3	8.0	6.8
ABT-99-4.625	8.0	4.7	8.0	4.0	7.0	8.3	7.3	7.7	6.7	6.8
ABT-99-4.724	7.0	4.3	8.0	4.3	7.3	6.7	8.0	7.7	7.0	6.8
ELFKIN	7.0	4.3	8.3	4.7	7.0	7.3	7.0	7.7	7.3	6.8
MB 413 (ABT-99-4.633)	8.3	5.0	8.0	3.3	7.3	6.7	8.0	8.0	7.3	6.8
MDP	8.0	5.3	8.0	4.0	7.0	7.0	7.3	8.0	7.3	6.8
NJ-6401	8.0	3.7	8.0	3.0	8.0	6.3	8.7	7.3	7.3	6.8
PROWLER (APR 777)	7.0	4.0	8.0	4.3	7.3	7.0	7.3	7.7	7.3	6.8
PST-CATS	8.0	4.0	8.0	2.3	7.3	6.3	8.3	8.3	8.0	6.8
RACER	8.0	4.7	8.0	4.0	7.7	6.3	8.0	7.3	7.3	6.8
SR 4500	7.3	4.7	8.0	4.3	7.3	7.0	7.3	7.3	7.3	6.8
SRX 4820	8.0	4.3	8.3	4.0	7.7	6.7	7.7	8.0	7.0	6.8
WVPB-R-82	6.0	4.3	8.3	4.7	7.0	7.3	7.0	7.7	7.0	6.8
APR 776	7.0	4.3	8.3	3.7	7.3	7.3	7.3	7.3	7.3	6.7
KOOS R-71	6.3	4.0	8.0	4.0	7.0	7.0	7.0	7.3	7.7	6.7
PALMER III	7.3	4.0	8.0	3.3	7.7	7.0	7.3	7.7	7.3	6.7
PASSPORT	7.0	4.0	8.0	4.7	7.3	6.7	7.0	7.3	7.0	6.7
PST-2M4	8.0	3.0	8.0	2.7	7.7	7.3	8.0	7.7	7.0	6.7
APR 1231	7.3	3.7	8.0	3.7	7.7	5.7	7.7	7.3	7.7	6.6
APR 1235	8.0	4.0	7.7	3.3	8.0	7.0	7.0	7.3	6.7	6.6
CATHEDRAL II	8.0	4.3	8.3	4.0	7.7	6.7	7.0	7.3	7.0	6.6
EDGE	6.7	4.0	7.7	3.3	7.7	7.3	6.3	7.0	7.7	6.6
EP53	7.7	4.3	8.0	3.0	7.0	6.7	7.7	8.0	7.0	6.6
EXTREME (JR-317)	7.0	3.7	8.0	3.3	7.3	7.0	7.0	7.7	7.3	6.6
HEADSTART	7.3	4.3	8.0	3.7	7.7	7.0	6.7	7.3	7.0	6.6
LINE DRIVE	8.0	4.3	8.0	3.3	7.3	7.3	7.0	7.3	7.3	6.6
PICK EX2	6.7	4.3	8.0	4.3	7.7	6.3	6.7	7.7	7.0	6.6
PREMIER	6.7	3.0	8.0	3.7	7.0	7.0	7.0	7.7	7.3	6.6

PREMIER II	7.7	3.7	8.0	3.3	7.3	6.7	7.3	7.7	7.3	6.6
SECRETARIAT	7.0	4.0	8.0	4.7	7.3	6.3	6.7	7.0	7.7	6.6
APR 1234	7.3	3.0	7.7	3.0	7.7	6.7	7.3	7.0	7.0	6.4
DP LP-1	6.3	4.7	7.3	3.7	7.0	7.0	6.7	7.0	7.3	6.4
LPR 98-144	7.0	4.0	8.0	4.0	7.0	6.0	7.3	7.3	7.0	6.4
PICK PR 1-94	8.3	4.3	8.3	3.3	7.3	6.3	7.3	7.7	6.7	6.4
BUCCANEER	6.0	3.7	8.0	3.7	7.3	6.3	6.3	7.0	7.3	6.3
BY-100	6.7	4.0	8.0	4.0	7.3	5.7	6.7	7.0	7.0	6.3
WVPB-R-84	6.3	3.3	8.0	3.0	7.3	6.7	6.0	7.3	7.3	6.3
DP 17-9069	6.3	4.0	8.3	3.3	7.0	6.7	6.0	7.0	7.3	6.2
YATSUGREEN	6.3	3.7	7.3	3.0	7.3	7.3	6.0	7.0	6.3	6.2
AFFINITY	7.0	3.3	8.0	3.0	7.3	5.3	6.7	7.0	6.7	6.0
DP 17-9391	6.7	3.0	7.7	2.7	7.0	6.3	5.7	7.3	6.3	5.9
DP 17-9496	6.0	3.0	6.7	2.0	6.3	6.7	5.0	6.3	6.0	5.4
LINN	6.0	2.3	7.0	1.7	5.3	5.7	4.3	6.3	5.7	4.8
LSD (0.05)	1.1	1.9	0.6	3.8	3.1	2.5	1.1	1.5	1.7	1.0

National Tall Fescue Cultivar Evaluation

Shui-zhang Fei and Rodney A. St. John

This tall fescue trial was established in September, 2001 and is part of the National Turfgrass Evaluation Program(NTEP). Similar trials are being conducted at many different locations around the US. The purpose of this trial is to evaluate the regional adaptation of 163 tall fescue cultivars under non-irrigated conditions with 2 lbs N /1000 ft^2 per year and a mowing height of 2.5-3.5".

This is the first year of the trial and the only data that is available at this time is the percentage cover which was taken one month after sowing the seeds.

Entry	Name	Ground Cover %
1	Ky-31 E	40.0
2	Elisa	35.0
3	RB2-01	46.7
4	F-4	50.0
5	LTP-7801	48.3
6	18	55.0
7	R-4	46.7
8	Roberts-L1Z	38.3
9	Pick-OD3-01	46.7
10	Plantation	45.0
11	Signia	38.3
12	Rebel Exeda	41.7
13	Prospect	41.7
14	Rebel Sentry	36.7
15	Finesse II	46.7
16	Millennium	46.7
17	BE-2	35.0
18	Dominion	56.7
19	Focus	45.0
20	2nd Mellennium	46.7
21	JT-99	53.3
22	TF-66	38.3
23	Barlexas	41.7
24	Tracer	36.7
25	Barrera	35.0
26	Barrington	36.7
27	Barlexas II	46.7
28	Scorpion	45.0
29	MCN-RC	45.0
30	ATF 706	38.3
31	ATF 702	38.3
32	ATF 707	40.0
33	ATF 806	33.3
34	ATF 799	35.0
35	ATF 704	41.7
36	ATF 586	36.7

Entry	Name	Ground Cover %
37	Kitty Hawk 2000	43.3
38	ATF 802	35.0
39	Rendition	35.0
40	Titan Ltd.	43.3
41	Biltmore	40.0
42	NA-TDD	38.3
43	Bravo	40.0
44	Lancer E	55.0
45	OD-4	35.0
46	NJ-4	40.0
47	Stetson	41.7
48	T991	30.0
49	Laramie	38.3
50	Mustung 3	38.3
51	Dynasty	31.7
52	Watchdog	36.7
53	CIS-TF-65	38.3
54	CIS-TF-64	33.3
55	CIS-TF-33	38.3
56	CIS-TF-67	41.7
57	CIS-TF-60	45.0
58	CIS-TF-77	36.7
59	Bingo	41.7
60	B-7001	45.0
61	DLSD	35.0
62	SBM	48.3
63	ATF-593	46.7
64	Cayenne	40.0
65	Pick-00-AFA	43.3
66	Pick TF H-97	45.0
67	Roberts SM 4	36.7
68	JTTFF-2000	30.0
69	P-58	36.7
70	BAR Fa 1003	36.7
71	BAR Fa 1005	31.7
72	Jaguar 3	38.3

Entry	Name	Ground Cover %
73	Roberts DOL	33.3
74	Pick ZMG	41.7
75	PST-5NAS	38.3
76	PST-5T1	43.3
77	PST-5KU	53.3
78	PST-57E	51.7
79	PST-5JM	26.7
80	PST-5S12	46.7
81	PST-5A1	41.7
82	PST-5BZ	43.3
83	PST-DDL	38.3
84	PST-5TR1	40.0
85	PST-578	45.0
86	PST-5K1	36.7
87	PST-5FZD	43.3
88	PST-5LO	41.7
89	PST-5ASR	38.3
90	PST-53T	36.7
91	Endeavor	43.3
92	Matador	36.7
93	Olympic Gold	50.0
94	Tar Heel	50.0
95	Wolfpack	46.7
96	Tomahawk RT	43.3
97	Pure Gold	40.0
98	JT-6	35.0
99	JT-13	40.0
100	JT-18	31.7
101	JT-12	36.7
102	JT-15	23.3
103	JT-9	33.3
104	Quest	50.0
105	K01-8015	35.0
106	Coyote	33.3
107	Wyatt	45.0
108	K01-E03	30.0
109	K01-E09	38.3
110	K01-WAF	48.3
111	01-TFOR3	41.7
112	01-ORU1	40.0
113	01-RUTOR2	40.0
114	BE1	38.3
115	DLF-J210	41.7
116	PST-5BAB	35.0
117	PST-5TUO	36.7
118	BAR Fa 1CR7	33.3
119	MA 138	41.7
120	MA 158	41.7
121	UT-155	41.7
122	CAS-157	31.7
123	CAS-MC1	38.3
124	CAS-ED	38.3
125	MA 127	41.7
126	EA 163	35.0
127	Grande II	41.7
128	SR 8250	53.3
129	SR 8600	43.3
130	SRX 805	51.7
131	SRX 8BE4	35.0
132	Picasso	36.7
133	Masterpiece	41.7
134	Rembrandt	33.3
135	Legitimate	48.3
136	ProSeeds 5301	45.0
137	Falcon II	46.7
138	GO-OD2	35.0
139	GO-FL3	56.7
140	GO-RD4	40.0
141	GO-SIU2	43.3
142	Karahari	40.0
143	UT-RB3	41.7
144	Southern Choice II	40.0
145	MRF 22	41.7
146	MRF 23	35.0
147	MRF 24	35.0
148	MRF 25	48.3
149	MRF 26	36.7
150	MRF 27	43.3
151	MRF 28	36.7
152	MRF 29	33.3
153	MRF 210	38.3
154	MRF 211	45.0
155	K01-8007	50.0
156	DP50-9082	45.0
157	DP50-9226	41.7
158	ATF-800	40.0
159	ATF-803	38.3
160	Bonsai	38.3

Regional Fine Fescue Cultivar Trial

Nick E. Christians and Rodney A. St. John

This was the fourth year of data from the 1998 Fineleaf Fescue National Turfgrass Evaluation Program (NTEP) trial. It is being conducted at many locations around the U.S. The purpose of the trial is to study the regional adaptation of 79 fineleaf fescue selections. Cultivars are evaluated for quality each month of the growing season through October. The study is conducted in full sun. Three replications of the 3 x 5 ft (15 ft^2) plots were established for each cultivar in October 1998. The trial has been maintained at a 2-inch mowing height, fertilized with 3.5 lbs N/1000 ft^2 during the growing season, and has been irrigated when needed to prevent drought. Preemergence herbicide was applied once in the spring.

Visual quality was evaluated monthly in 1999 from May through October (Table 1). Quality was assessed using a 9 to 1 with 9 = best , 6 = lowest acceptable, and 1 = worst quality. The values listed under each month in Table 1 are the averages of visual quality ratings made on three replicated plots for the three studies. Yearly means of monthly data were taken and are listed in the last column. The first cultivar received the highest average rating for the entire 1999 season. The cultivars are listed in descending order of average quality. The last row list the LSD (least significant difference), which is a statistical measurement of how widely the means must vary before they are considered to be different from one another.

Data for genetic color (Genco), spring greenup (Grn), and leaf texture (Leaf) also are included for the high-maintenance, irrigated and for the low-maintenance trials. Genetic color was rated using a 9 to 1 scale with 9 = dark and 1 = light green. Spring greenup was estimated using a 9 to 1 scale with 9 = green and 1 = dormant turf. Leaf texture was assessed with a 9 to 1 scale with 9 = fine and 1 = coarse texture.

Table 1. The 2001 visual quality and other turf attribute ratings for cultivars in the 1998 Fineleaf Fescue Cultivar Trial.

				Quality						
NAME	GENCO	GRN	LEAF	MAY	JUN	JUL	AUG	SEP	OCT	MEAN
4001	7.7	5.0	7.7	6.3	5.7	7.7	7.0	6.0	7.3	6.7
PST-4HM	7.3	4.7	7.0	5.0	7.0	7.0	6.3	7.3	7.7	6.7
ABT-HF-3	5.7	5.0	6.3	6.7	6.0	7.0	6.3	7.0	6.7	6.6
SRX 3961	6.7	5.0	8.0	6.0	6.0	7.3	7.0	6.3	7.0	6.6
CHARIOT (ISI FL 12)	6.0	4.3	7.0	5.7	5.7	7.0	6.7	7.0	7.0	6.5
NORDIC (E)	7.0	5.0	7.3	6.3	6.0	7.7	6.7	6.0	6.3	6.5
ABT-HF-2	7.0	5.0	7.3	6.3	6.0	7.0	7.7	5.3	6.0	6.4
ABT-HF-4	5.7	3.3	6.3	5.7	6.0	7.0	7.7	6.0	6.0	6.4
ABT-HF1	6.3	5.7	7.0	6.3	5.7	6.7	7.7	6.0	6.3	6.4
SRX 52961	8.0	3.7	6.3	5.3	7.3	7.3	5.3	6.0	7.0	6.4
PICK FF A-97	6.3	4.0	6.7	5.7	5.7	6.7	6.7	6.7	6.7	6.3
MINOTAUR	6.0	4.7	6.0	5.7	6.0	6.7	7.0	5.7	6.3	6.2
PST-4MB	6.0	3.3	6.0	6.3	6.0	6.7	6.0	6.0	6.3	6.2
SALSA	7.3	4.0	6.7	4.3	6.0	7.0	6.0	7.3	6.3	6.2
CINDY LOU (ISI FRR 7)	7.7	4.7	6.7	6.0	7.0	6.3	5.0	5.3	6.7	6.1
JASPER II	7.7	3.0	7.0	5.3	6.7	6.3	5.7	6.3	6.0	6.1
MB-63	7.0	5.3	6.7	6.0	7.0	6.0	6.0	5.3	6.3	6.1
PST-EFL	8.0	3.3	6.0	4.3	7.0	7.3	6.0	5.3	6.7	6.1
SCALDIS II (AHF 008)	6.0	4.0	7.3	5.3	5.7	6.3	6.7	5.7	6.7	6.1
ABT-CHW-3	7.0	4.7	7.3	5.3	6.7	6.3	6.0	5.7	6.0	6.0
ABT-CR-3	7.7	3.7	6.7	5.7	6.7	6.3	5.3	5.3	6.7	6.0
BIGHORN	6.0	4.0	6.3	6.0	6.3	6.0	6.0	5.7	6.0	6.0
BRIDGEPORT	6.3	5.0	6.7	5.7	6.7	5.3	5.7	6.3	6.3	6.0

LONGFELLOW II	6.7	5.3	7.3	6.0	6.3	6.7	5.7	5.3	6.0	6.0
BOREAL	7.3	5.0	6.0	4.7	7.7	7.0	6.0	5.0	5.3	5.9
EUREKA II (ISI FL 11)	6.0	4.3	7.0	5.7	5.0	6.0	6.0	6.3	6.3	5.9
HARDTOP (BAR HF 8 FUS)	5.3	4.7	6.3	5.3	5.3	6.7	6.0	5.7	6.7	5.9
OXFORD	7.0	3.7	7.0	4.7	5.7	6.7	6.0	5.7	6.7	5.9
PICK FRC A-93	7.3	3.3	7.3	5.3	6.7	5.7	6.3	5.3	6.0	5.9
QUATRO	6.0	3.7	7.7	5.7	5.3	5.7	6.7	6.0	6.0	5.9
RELIANT II	6.7	4.0	7.3	5.7	5.3	6.7	6.3	5.3	6.0	5.9
SHADEMARK	7.0	5.7	6.3	4.7	6.3	6.3	5.7	5.7	6.7	5.9
STONEHENGE (AHF 009)	6.0	4.7	7.0	5.3	5.3	6.7	6.0	6.3	6.0	5.9
TIFFANY	6.3	5.3	7.3	5.7	7.0	5.7	5.3	5.7	6.3	5.9
ABT-CHW-1	7.0	4.7	7.3	5.7	6.0	5.3	5.7	5.7	6.7	5.8
ABT-CHW-2	6.3	4.3	7.7	5.3	6.0	6.3	5.0	6.0	6.0	5.8
ABT-CR-2	8.0	3.3	6.3	4.7	6.3	6.3	5.7	6.0	5.7	5.8
AMBASSADOR	6.7	5.0	7.0	4.7	6.3	5.7	6.0	5.7	6.7	5.8
BRITTANY	7.7	5.0	7.0	4.3	7.3	5.0	5.7	6.0	6.7	5.8
CULOMBRA	6.7	4.0	7.3	5.3	6.7	5.7	5.3	5.7	6.0	5.8
SHADOW II	7.0	4.7	7.7	5.0	6.0	6.3	6.0	6.3	5.0	5.8
BAR CF 8 FUS1	7.3	4.0	6.7	4.3	6.3	5.7	6.0	6.3	5.7	5.7
PST-4FR	7.3	4.7	7.0	5.0	6.0	6.7	6.0	5.0	5.7	5.7
RESCUE 911	6.7	2.3	6.7	5.0	5.3	5.7	6.7	5.7	6.0	5.7
ATTILA E	5.7	5.0	6.7	4.3	4.7	6.3	6.7	5.7	6.0	5.6
INTRIGUE	7.0	3.3	6.7	4.7	6.0	6.0	5.3	5.0	6.3	5.6
MB-82	6.3	3.7	7.3	5.0	5.3	6.0	6.3	5.7	5.0	5.6
SCALDIS	5.7	3.7	6.7	5.0	5.0	6.0	5.7	5.0	7.0	5.6
TREAZURE (E)	6.3	4.0	7.3	5.3	6.0	5.3	6.0	5.0	5.7	5.6
BAR CHF 8 FUS2	6.7	3.7	7.3	4.7	5.7	5.0	6.0	5.3	6.3	5.5
COMMON CREEPING RED	7.0	3.7	6.7	4.3	6.7	6.0	5.0	5.7	5.3	5.5
DISCOVERY	6.0	3.7	7.7	4.3	5.3	6.3	6.0	5.0	6.0	5.5
FLORENTINE	8.0	2.7	7.0	4.0	6.3	6.0	5.3	5.7	5.7	5.5
SR 3200	6.0	3.3	6.0	5.0	6.0	5.3	5.7	5.3	5.7	5.5
BANNER III	7.3	3.7	6.7	5.0	6.0	5.7	5.7	5.0	5.0	5.4
DGSC 94	7.7	4.7	7.3	5.3	5.7	6.3	5.3	5.7	4.3	5.4
JAMESTOWN II	5.7	4.7	7.3	5.0	5.7	5.3	5.3	5.7	5.7	5.4
OSPREY	6.3	3.7	6.7	5.0	6.0	6.3	5.3	5.0	5.0	5.4
SANDPIPER	6.3	4.3	7.0	4.7	5.3	5.3	6.0	5.7	5.3	5.4
ACF 083	7.3	4.7	8.0	3.7	5.3	5.7	5.7	5.0	6.3	5.3
ASC 082	7.3	3.7	7.0	4.7	6.0	4.7	5.3	5.3	5.7	5.3
ASR 049	7.0	3.0	6.7	4.3	5.0	6.0	6.3	5.0	5.3	5.3
DEFIANT	7.0	4.0	7.3	4.3	4.7	6.0	5.7	6.0	5.3	5.3
HERON	5.3	5.0	7.0	4.3	4.7	5.3	5.0	6.3	6.0	5.3
NAVIGATOR (ISI FRR 5)	7.3	3.0	6.3	4.0	5.7	5.7	5.3	6.0	5.3	5.3
WRIGLEY (ACF 092)	6.7	4.3	7.3	4.3	5.3	5.0	5.0	5.3	6.7	5.3
ASC 172	7.7	4.3	6.7	4.7	5.0	5.0	5.7	5.7	5.3	5.2
BAR SCF 8 FUS3	7.0	3.7	7.0	4.3	5.0	5.3	5.3	5.3	6.0	5.2
MAGIC	6.3	3.7	7.3	4.7	5.7	4.7	5.7	5.7	5.0	5.2

PST-47TCR	7.7	3.3	6.7	4.0	6.0	5.3	5.0	5.0	6.0	5.2
SILHOUETTE (PICK FRC 4-92)	7.0	3.7	7.3	4.7	6.0	4.7	5.3	5.7	5.0	5.2
SR 5100	5.3	3.7	7.0	4.3	5.0	5.0	6.0	5.7	5.3	5.2
SR 5210 (SRX 52LAV)	7.3	3.3	7.0	4.0	5.3	5.7	5.3	5.7	4.7	5.1
PATHFINDER	7.7	4.0	6.3	4.0	5.7	4.7	5.0	5.3	5.3	5.0
SEABREEZE	6.3	3.7	6.7	3.7	4.3	4.7	5.7	5.3	6.0	4.9
SHADEMASTER II	7.3	3.0	6.3	3.0	4.7	5.3	5.3	5.7	5.3	4.9
DAWSON E+	6.7	2.0	6.7	3.3	4.3	4.7	5.7	5.3	5.3	4.8
ROSE (ASC 087)	7.0	4.0	6.3	4.0	5.0	4.3	5.0	5.7	4.7	4.8
SR 6000	6.3	3.7	4.7	4.3	6.0	4.0	5.3	5.0	4.3	4.8
LSD (0.05)	1.5	2.8	1.2	1.7	1.6	1.3	2.1	5.6	2.0	0.9

Fairway Height Bentgrass Cultivar Trials

N. E. Christians and R. A. St. John

This is the fourth year of data from the Fairway Height Bentgrass Cultivar trial established in the fall of 1998. The area was maintained at a 0.5 in. mowing height. This is a National Turfgrass Evaluation (NTEP) trial and is being conducted at several research stations in the U.S. It contains 26 of the newest seeded cultivars and a number of experimentals. The cultivars are maintained with 4 lbs of N/1000 ft^2/growing season. Fungicides are used as needed in a preventative program. Herbicides and insecticides also are applied as needed.

Visual quality ratings were taken from May through October 2001 (Table 1). Visual quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst quality. Spring greenup (Green) was evaluated in April 2000 using a 9 to 1 scale with 9 = best and 1 = worst greenup. Genetic color (Color) and spring density (dens) were evaluated in June 2001. Genetic color was based on a 9 to 1 scale with 9 = dark green and 1 = light green. Density (Dens) was also evaluated on a scale of 9 to 1, where 9 = greatest density.

Table 1. The 2001 Visual turf quality and other physical ratings for cultivars in the 1998 Fairway Height Bentgrass Trial.

				QUALITY						
NAME	COLOR	GREEN	DENS	MAY	JUN	JUL	AUG	SEP	OCT	MEAN
BACKSPIN	7.3	6.0	7.7	7.3	7.0	8.3	8.3	6.3	7.0	7.4
BRIGHTON (SRX 1120)	8.0	7.0	7.7	7.3	7.0	8.0	7.7	7.0	7.3	7.4
IMPERIAL	8.0	6.3	8.0	7.7	7.3	8.3	7.3	6.7	7.3	7.4
L-93	7.0	6.7	7.7	8.0	7.0	7.3	8.0	6.7	7.0	7.3
SEASIDE II	6.7	6.3	7.0	7.7	6.0	7.0	6.7	7.3	7.7	7.1
CENTURY	7.0	6.3	7.7	6.0	7.3	7.7	7.3	6.7	7.0	7.0
PST-0VN	7.7	6.7	6.3	6.3	6.3	6.7	7.7	7.0	7.3	6.9
GRAND PRIX	6.7	6.0	7.3	6.3	7.0	7.0	7.0	6.3	7.0	6.8
PENN G-6	7.0	6.3	7.3	7.0	7.0	6.7	7.3	6.3	6.3	6.8
SR 1119	7.3	6.7	6.0	6.7	6.0	7.3	7.0	6.7	6.3	6.7
PROVIDENCE	6.7	6.3	6.0	6.3	6.3	6.7	7.0	6.7	6.3	6.6
SRX 1BPAA	6.7	6.7	7.0	6.3	6.3	7.3	7.3	6.7	5.7	6.6
TRUELINE	7.0	7.0	6.0	6.3	6.0	6.0	7.7	6.0	6.3	6.4
PRINCEVILLE	7.0	6.7	5.7	5.3	6.0	6.3	6.3	6.3	6.0	6.1
PENNCROSS	7.0	6.0	6.3	5.0	6.3	6.0	5.7	5.7	6.3	5.8
PENNEAGLE	6.7	6.3	5.3	4.7	5.0	6.3	6.7	6.0	5.7	5.7
PST-9PM	6.0	5.7	4.7	5.3	5.0	4.7	4.7	5.3	5.3	5.1
RADIANCE (PST-9HG)	6.0	6.3	5.7	4.7	5.3	4.7	5.0	5.0	5.0	4.9
SRX 7MOBB	5.3	6.0	6.7	4.7	5.0	4.7	5.3	4.3	4.7	4.8
ABT-COL-2	6.0	6.0	6.0	5.0	4.7	4.7	4.7	5.0	4.3	4.7
TIGER	6.0	6.0	5.0	5.0	4.0	4.7	5.0	5.0	4.3	4.7
ISI AT-5	5.7	5.0	6.0	4.7	5.3	4.0	4.7	4.3	4.7	4.6
SR 7100	6.0	6.0	5.3	4.7	4.7	4.3	4.7	4.3	4.7	4.6
GOLFSTAR	6.0	5.0	4.0	4.0	4.3	4.3	4.7	4.3	5.3	4.5
SEASIDE	6.0	5.7	4.0	3.3	4.3	5.0	4.7	4.3	4.3	4.3
SRX 7MODD	5.7	6.0	6.3	4.3	4.3	3.7	4.7	4.3	4.3	4.3
LSD (0.05)	1.0	1.1	1.1	1.1	1.1	0.9	1.1	1.0	1.0	0.6

Green Height Bentgrass Cultivar Trials

N. E. Christians and R. A. St. John

This is the fourth year of data from the Green Height Bentgrass Cultivar trial established in the fall of 1998. The area is maintained at a 3/16-inch mowing height. This is a National Turfgrass Evaluation Program (NTEP) trial and is being conducted at several research stations in the U.S. It contains 29 seeded cultivars, including a number of experimentals. Most are creeping bentgrass and two, Pick MVB and Bavaria are velvet bentgrasses.

The cultivars are maintained with a fertilizer program of 1/4 lb N applied at 14-day intervals with a total of 4 lbs of N/1000 ft^2/growing season. Fungicides are used as needed in a preventive program. Herbicides and insecticides are applied as needed.

Visual quality ratings were taken from May through October 1999 (Table 1). Visual quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst quality. Spring greenup (Green) was evaluated in April 2001 using a 9 to 1 scale with 9 = best and 1 = worst greenup. Genetic color (Genc) and leaf texture (Leaf) were evaluated in June 1999. Genetic color was based on a 9 to 1 scale with 9 = dark green and 1 = light green. Spring density values represent the percentage area per plot covered by bentgrass.

Table 1. The 2001 visual turf quality and other physical ratings for cultivars in the 1998 Green Height Bentgrass Trial.

				QUALITY						
NAME	GENC	GREEN	LEAF	MAY	JUN	JUL	AUG	SEP	OCT	MEAN
SYN 96-1	7.3	6.7	8.0	7.7	7.7	8.7	7.7	7.0	7.3	7.7
CRENSHAW	7.3	6.0	6.7	7.0	7.7	7.7	7.7	7.7	7.0	7.4
SYN 96-2	7.3	6.7	7.7	8.0	8.0	7.7	6.3	6.7	8.0	7.4
L-93	6.7	6.3	7.7	7.7	7.0	6.3	7.7	7.3	7.7	7.3
IMPERIAL	7.0	5.3	7.3	6.7	7.7	7.3	7.3	6.7	7.3	7.2
SYN 96-3	7.3	6.3	8.0	7.0	8.0	8.0	7.7	5.7	6.7	7.2
BENGAL (BAR AS 8FUS2)	6.7	5.7	6.7	7.3	6.0	7.7	7.7	6.3	7.3	7.1
PENN A-4	6.7	5.7	7.7	6.7	6.7	7.0	7.3	7.0	7.7	7.1
PENN G-1	7.0	5.7	7.0	6.7	6.7	7.0	7.3	7.0	6.7	6.9
PST-A2E	6.7	5.3	7.0	7.7	6.7	7.3	7.0	6.3	6.7	6.9
CENTURY	7.0	6.0	8.0	7.0	7.0	7.0	6.3	6.0	7.3	6.8
ABT-CRB-1	7.0	6.0	7.0	7.3	7.3	6.3	6.7	6.0	6.3	6.7
PENN A-2	6.7	6.0	7.0	5.7	6.3	7.0	6.7	7.0	7.0	6.6
BAR CB 8US3	6.3	5.3	6.3	6.3	6.3	6.3	7.0	6.3	6.7	6.5
PENN A-1	6.3	5.3	7.3	6.0	5.7	7.0	7.0	6.7	6.0	6.4
SRX 1NJH	6.7	5.3	6.3	6.0	6.0	6.3	6.3	6.7	7.0	6.4
ISI AP-5	6.3	5.7	6.3	6.7	6.7	6.3	6.0	5.7	6.7	6.3
PICK CB 13-94	6.0	5.7	5.7	6.7	5.7	6.0	6.7	6.7	6.3	6.3
BACKSPIN	6.3	4.7	7.0	5.7	6.0	6.7	7.0	6.3	5.7	6.2
PENN G-6	7.0	6.3	6.3	6.0	6.7	5.3	6.0	6.3	6.7	6.2
SR 1119	6.7	5.3	6.0	5.7	5.7	6.3	7.3	5.7	6.3	6.2
SRX 1BPAA	6.7	4.7	5.7	5.7	6.0	6.3	6.7	6.0	5.7	6.1
PROVIDENCE	6.3	5.7	6.0	5.3	6.3	5.7	5.7	6.3	6.7	6.0
BRIGHTON (SRX 1120)	6.7	5.7	6.0	6.0	6.0	5.3	6.0	6.3	6.0	5.9
PENNLINKS	6.0	4.0	5.0	5.0	4.7	5.3	5.0	5.0	5.0	5.0
PENNCROSS	5.7	4.3	5.7	5.0	4.0	5.3	5.0	4.7	5.0	4.8
VESPER (PICK MVB) *	6.7	5.0	7.7	5.0	4.7	4.3	4.0	4.7	5.0	4.6
BAVARIA *	5.7	4.3	5.3	4.0	4.3	4.7	4.3	5.0	4.7	4.5
SR 7200	6.3	4.3	7.3	4.3	4.3	4.0	4.3	4.7	5.3	4.5
LSD (0.05)	1.6	1.2	0.8	0.9	1.1	1.1	1.5	1.2	1.3	0.7

* Velvet bentgrass

Shade Adaptation Study

Nick E. Christians and Deying Li

The shade adaptation study was established in the fall of 1987 to evaluate the performance of 35 species and cultivars of grasses. The species include chewings fescue (C.F.), creeping red fescue (C.R.F.), hard fescue (H.F.), tall fescue (T.F.), Kentucky bluegrass (KBG), and rough bluegrass (Poa trivialis).

The trials are located under the canopy of a mature stand of Siberian elm trees (Ulmus pumila) at the Iowa State University Horticulture Research Station north of Ames, Iowa. Grasses are mowed at a 2-inch height and receive 2 lb N/1000ft^2/year. No weed control has been required on the area, but the grass has been irrigated during extended droughts.

Monthly quality data are collected from April through October (Table 1). Visual quality is based on a scale of 9 to 1: 9 = best quality, 6 = lowest acceptable quality, and 1 = worst quality.

Table 1. 2001 visual quality[1] data for cultivars in the 1987 Shade Trial in descending order for mean quality.

Cultivar [2]	QUALITY							
	Apr	May	Jun	Jul	Aug	Sep	Oct	Mean
Jamestown (C.F.)	6.0	6.7	6.7	6.0	6.0	6.0	7.7	6.2
Victor (C.F.)	4.3	5.0	7.0	6.7	6.7	6.7	7.0	5.9
Waldina (H.F.)	4.7	5.3	5.7	6.3	6.3	6.0	7.0	5.9
Shadow (C.F.)	5.0	5.0	5.7	5.7	5.7	6.0	6.3	5.8
Banner (C.F.)	4.7	5.7	6.3	5.7	5.7	6.0	6.7	5.8
Atlanta (C.F.)	4.7	5.0	6.0	5.3	5.3	6.0	6.3	5.6
Ensylva (C.R.F.)	4.0	4.7	6.0	5.7	5.7	6.0	6.0	5.5
St-2(SR3000) (H.F.)	4.7	4.7	5.3	5.3	6.0	6.0	6.3	5.5
Agram ((C.F.)	4.7	4.0	5.7	5.3	5.7	6.3	6.3	5.3
Mary (C.F.)	4.3	4.3	6.0	5.7	4.3	6.3	7.3	5.3
BAR Fo 81-225 (H.F.)	4.7	4.7	4.7	6.0	6.0	5.7	6.3	5.2
Estica (C.R.F.)	4.0	4.3	5.0	5.0	4.7	4.7	5.7	5.2
Reliant (H.F.)	4.3	4.7	4.3	5.7	5.7	5.7	5.7	5.1
Rebel II (T.F.)	3.7	5.0	5.0	4.3	4.7	6.0	4.7	5.0
Koket (C.F.)	4.7	5.3	5.3	4.3	5.0	5.3	6.3	5.0
Waldorf (C.F.)	3.3	3.7	5.7	5.0	4.7	6.0	6.3	4.9
Pennlawn (C.R.F.)	3.7	4.3	6.0	5.0	4.0	5.7	6.0	4.8
Highlight (C.F.)	4.0	4.3	4.3	4.0	4.0	4.7	5.0	4.8
Biljart (H.F.)	4.0	4.0	5.0	5.7	5.3	5.3	5.3	4.6
Apache (T.F.)	4.0	4.7	4.3	3.0	4.0	4.0	3.7	4.2
Wintergreen (C.F.)	3.7	4.3	5.0	5.0	4.7	5.0	5.0	4.2
Scaldis (H.F.)	4.3	3.7	4.0	4.0	4.0	4.7	5.0	4.2
Rebl (T.F.)	3.0	3.0	3.7	4.0	4.0	5.0	5.0	4.0
Falcon (T.F.)	4.0	4.7	4.0	3.3	3.7	5.3	4.0	4.0
Spartan (H.F.)	3.3	3.7	3.3	4.3	4.0	5.0	4.7	3.9
Arid (T.F.)	3.3	3.3	3.3	3.3	3.7	4.3	4.7	3.8
Bonanza (T.F.)	2.0	2.3	4.0	3.3	3.0	4.0	4.3	3.5
Midnight (KGB)	3.7	4.0	2.3	3.0	2.3	2.7	2.0	3.1
Nassau (KGB)	3.0	3.3	2.3	2.7	2.3	2.0	2.0	2.7
Ram I (KGB)	2.3	2.0	3.0	2.0	2.3	3.0	2.7	2.4
Coventry (KGB)	3.3	2.7	2.3	2.3	2.0	3.0	2.3	2.4
Chateau (KGB)	2.7	2.7	2.0	1.3	2.3	2.3	2.0	2.3
Sabre (Poa trivialis)	1.7	2.0	2.3	2.3	2.3	2.3	2.0	2.2
Glade (KGB)	2.3	2.3	1.7	2.3	2.0	2.0	1.7	2.0
Bristol (KGB)	2.0	2.0	2.3	2.0	2.0	2.0	2.0	2.0
$LSD_{0.05}$	NS	2.3	1.4	1.6	1.5	1.5	1.6	0.8

[1] Visual quality was assessed using a scale of 9 to 1 with 9 = best, 6 = lowest acceptable, and 1 = worst turf quality.
[2] C.F. = chewings fescue, C.R.F. = creeping red fescue, H.F. = hard fescue, KGB = Kentucky blue grass, T.F. = tall fescue.

Ornamental Grasses Project 2000-2002

Mark Helgeson, Heather McDorman, and Nick Christians

Purpose:

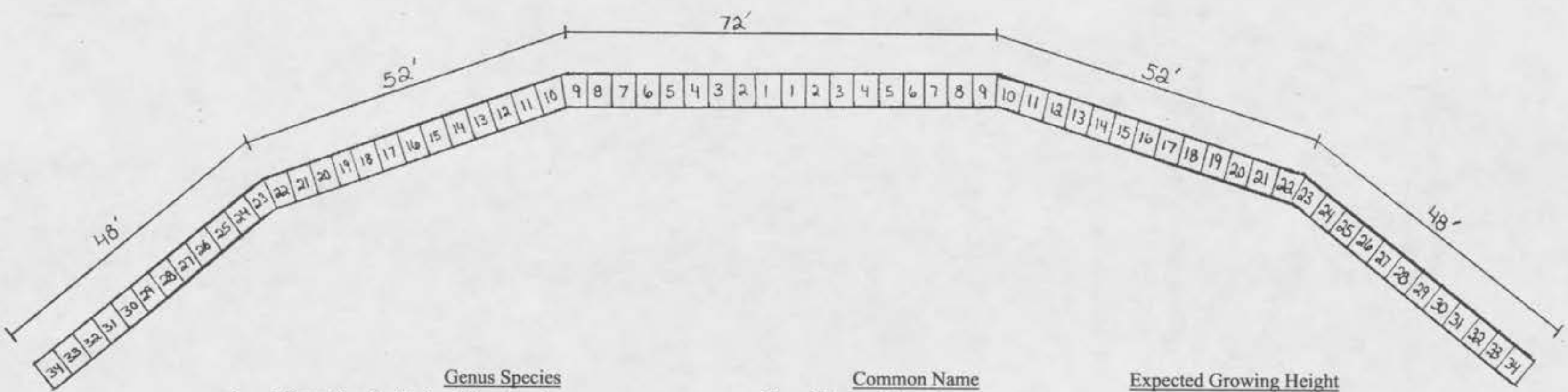
The purpose of the ornamental grass project is to evaluate 34 ornamental grasses for their adaptation to Iowa conditions. The study is located south of the turfgrass research building. Grasses 1 and 2 were established in 1989. Grasses 3-5, 11-15, 17-18, 20-21, and 33 were established in 2000. The remaining grasses were established in June of 2001.

Each plot on this site has a four by five foot spacing. The grasses descend in height from number one in the center, to 34 on each of the ends. The 34 grasses are replicated twice on the two sides of the arc.

Choosing the species:

Ornamental grasses have numerous characteristics, each that could make a difference in which species is chosen for a particular landscape. For the plots at the Horticulture Research Station, the new species have general characteristics of being bunch type, non-aggressive, varying in color, form and shape, in addition to being able to grow in the zones 4 and/or 5.

The grasses will remain in this location for several years. They will be evaluated on their winter survival and overall adaptation to local conditions.



	Genus Species	Common Name	Expected Growing Height
1	Miscanthus floridulus 'Giganteus'	Giant Chinese Silver Grass	12-15'
2	Miscanthus sinensis	Japanese Silver Grass	8'
3	Miscanthus sinensis 'Strictus'	Porcupine Grass	8'
4	Panicum virgatum 'Cloud Nine'	Switch Grass	8'
5	Miscanthus sinensis 'Graziella'	Japanese Silver Grass	5-6'
6	Miscanthus sinensis 'Silberfeder'	Silver Feather	6-8'
7	Molina caerulea ssp. arundinacea 'Transparent'	Tall Moor Grass	5-7'
8	Molina caerulea ssp. arundinacea 'Skyracer'	Tall Moor Grass	7-8'
9	Molina caerulea ssp. arundinacea 'Windspiel'	Tall Moor Grass	6-7'
10	Molina litorialis 'Fontaene'	Tall Moor Grass	6'
11	Calamagrostis x acutiflora 'Karl Foerster'	Feather Reed Grass	4-5'
12	Miscanthus sinensis 'Variegatus'	Japanese Silver Grass	8'
13	Miscanthus sinensis 'Silberspinne'	Japanese Silver Grass	4-5'
14	Panicum virgatum 'Prairie Sky'	Switch Grass	6'
15	Panicum virgatum 'Heavy Metal'	Switch Grass	3-4'
16	Panicum virgatum	Switch Grass	5'
17	Miscanthus sinensis 'Purpurascens'	Japanese Silver Grass	3-4'
18	Sorghastrum nutans	Indian Grass	3-5'
19	Andropogon gerardii	Big bluestem	5'
20	Calamagrostis arundinacea 'Brachyticha'	Korean Feather Reed Grass	3'
21	Panicum virgatum 'Haense Herms'	Red Switch Grass	4'
22	Panicum virgatum 'Shenandoah'	Red Switch Grass	4'
23	Panicum virgatum 'Rotstrahlbusch'	Red Switch Grass	5'
24	Spodiopogon sibiricus	Siberian graybeard	4'
25	Bouteloua curtipendula	Side-oats grama	3'
26	Molina caerulea 'Karl Foester'	Variegated Purple Moor Grass	6-7'
27	Schizachyrium scoparium 'The Blues'	Little bluestem	2-3'
28	Deschampsia cespitosa 'Bronzeschleier'	Tufted Hair Grass	3'
29	Deschampsia cespitosa 'Goldstaub'	Tufted Hair Grass	2-3'
30	Helictotrichon sempervirens 'Saphiresprudel'	Blue-oat Grass	2-3'
31	Festuca mairei	Atlas Mountain Fescue	2-2.5'
32	Molina litoralis 'Bergfreud'	Tall Moor Grass	5-6'
33	Festuca glauca 'Superba'	Blue Fescue	1-2'
34	Festuca glauca 'Elijah Blue'	Blue Fescue	8"

Preemergence Annual Grass Control Study

B. R. Bingaman and N. E. Christians

This trial was conducted to evaluate the level of crabgrass control with several Pendulum formulations and compare Pendulum to other preemergence products. It was located at the Horticulture Research Station north of Ames, IA. The plot was established in 'common' Kentucky bluegrass with a history of crabgrass infestations. The soil was a Nicollet (fine-loamy, mixed, mesic Aquic Hapludoll) with 3.0% organic matter, 112 ppm K, 6 ppm P, and a pH of 7.05. The experimental design was a randomized complete block. Three replications were conducted and individual plot size was 5 x 5 ft. Irrigation was used to supplement rainfall and to maintain the turf in good growing condition.

The commonly-used herbicides Dimension 1EC and Pendimethalin 60WDG were included for comparisons in this trial that included numerous experimental formulations and herbicide plus fertilizer materials (Table 1). Preemergent applications were made on April 27 before crabgrass germination and the sequential application of treatment 22 was made on June 29. Granular materials were applied to dry foliage using 'shaker dispensers' to ensure uniform application. Sprayables were applied using a carbon dioxide backpack sprayer equipped with TeeJet #8006 nozzles at a spray pressure of 30-40 psi. Liquid formulations were mixed with water to a volume equivalent to 3 gal/1000 ft^2. All preemergent materials were 'watered in'.

Turf quality data were taken weekly from May 9 through September 13 (Tables 1 and 2). Quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst quality. Crabgrass infestation data were taken beginning July 25 and ending on September 13 (Table 3). Crabgrass populations were estimated as the percentage area per plot covered by crabgrass. Crabgrass control was determined by converting the population data to percentage reductions as compared to the untreated control (Table 4). In addition, the study was evaluated for phytotoxicity data during the entire duration. Phytotoxicity was assessed using a 9 to 1 scale with 9 = no damage, 5 = uniform damage with some brown turf, and 1 = dead turf (Table 5).

Data were analyzed using the Statistical Analysis System (SAS Institute Inc., 1989-1996) and the Analysis of Variance (ANOVA) procedure. Treatment effects on weed populations and turf quality were tested using Fisher's Least Significant Difference (LSD) test.

On May 9 through May 22, quality was significantly better for turf treated with the experimental formulations with a nitrogen component (treatments 10-18) than for turf treated with other herbicides and the control (Table 1). After June 1, the nitrogen response began to fade and by June 27 there were no quality differences among the treatments.

Crabgrass was first detected in the untreated turf on July 12 but was not large enough to be assessed until July 25. Crabgrass populations in treated turf were significantly lower than the untreated control through August 28 (Table 3). Mean reduction data show that all materials except BAS 656 (treatment 8) provided > 82% crabgrass control and fourteen materials resulted in > 90% control (Table 4). The preemergence application of an experimental from Gowan (treatment 21) was more effective in controlling crabgrass than the same level of the material in split applications (treatment 22).

Discoloration and burning of the leaf blades were observed on turf treated with BAS 656 (treatment 8). After June 1, the phytotoxic symptoms were no longer present and the turf had recovered to a quality level similar to the untreated controls (Table 5).

Table 1. Visual quality[1] of Kentucky bluegrass treated for the 2001 Preemergence Annual Grass study (data through July 11).

	Material	Rate lb a.i./A	May 9	May 22	June 1	June 6	June 15	June 20	June 27	July 3	July 11
1.	Untreated control	NA	7.0	6.7	6.7	6.3	6.0	6.0	5.0	5.0	5.0
2.	P1[2]	1.50	6.7	7.0	6.7	6.3	6.0	6.0	5.0	5.0	5.0
3.	P1[2]	2.00	7.0	6.0	6.0	6.0	6.3	6.3	5.0	5.0	5.0
4.	P2[2]	1.50	7.0	7.3	6.0	6.3	6.0	6.0	5.0	5.0	5.0
5.	P2[2]	2.00	6.0	6.7	6.0	6.7	6.3	6.0	5.0	5.0	5.0
6.	P3[2]	1.50	7.0	7.0	6.3	6.7	6.0	6.0	5.0	5.0	5.0
7.	P3[2]	2.00	7.0	7.0	6.0	6.0	6.0	6.0	5.0	5.0	5.0
8.	BAS 656[2]	21 oz/A[3]	6.3	5.3	5.0	6.0	6.0	6.3	5.0	5.0	5.0
9.	Pendimethalin 60WDG	1.50	6.7	7.0	6.3	6.3	6.0	6.0	5.0	5.0	5.0
10.	XF-0034 (0.17%)[4]	0.18	9.0	8.0	7.7	7.0	6.3	6.0	5.0	5.0	5.0
11.	XF-0034 (0.17%)[4]	0.25	9.0	8.3	8.7	8.3	7.0	6.3	5.0	5.0	5.0
12.	XF-0028 (0.11%)[4]	0.18	9.0	9.0	9.0	8.7	7.0	6.7	5.0	5.0	5.0
13.	XF-0028 (0.11%)[4]	0.25	9.0	9.0	8.7	9.0	8.0	7.7	5.0	5.0	5.0
14.	XF-0029 (0.17%)[4]	0.18	8.7	8.0	7.7	8.3	6.7	7.0	5.0	5.0	5.0
15.	XF-0029 (0.17%)[4]	0.25	9.0	9.0	8.3	8.3	7.7	7.0	5.0	5.0	5.0
16.	XF-01009 ((0.15%)[4]	0.18	8.3	8.0	7.3	7.3	6.7	6.7	5.0	5.0	5.0
17.	XF-01009 ((0.15%)[4]	0.25	9.0	8.7	7.7	7.3	6.0	6.3	5.0	5.0	5.0
18.	XF-00096 (1.29%)[4]	1.50	9.0	7.7	8.0	7.7	7.0	6.7	5.0	5.0	5.0
19.	Dimension 1EC	0.25	6.7	6.7	7.0	6.3	6.3	6.0	5.0	5.0	5.0
20.	Betasan 4E[5]	9.20[6]	7.0	7.0	6.7	6.0	6.0	6.0	5.0	5.0	5.0
21.	Betasan 4E[5]	7.30[6]	7.0	7.7	6.3	6.3	6.0	6.0	5.0	5.0	5.0
22.	Betasan 4E[5]	4.4 & 2.9[6]	7.0	6.7	6.0	6.7	6.0	6.0	5.0	5.0	5.0
	$LSD_{0.05}$		1.0	0.8	0.8	1.0	0.8	0.7	--	--	--

[1]Turf quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst quality.
[2]These materials are being screened for BASF.
[3] oz product/A
[4]These materials are being screened for Dow Agrosciences (Rohm & Haas).
[5]These materials are being screened for Gowan
[6]oz product/1000 ft^2.
Initial applications were made on April 27, 2001 and the sequential application of treatment #22 on June 29, 2001.

Table 2. Visual quality[1] of Kentucky bluegrass treated for the 2001 Preemergence Annual Grass study (data through September 13).

	Material	Rate lb a.i./A	July 17	July 25	Aug 3	Aug 9	Aug 16	Aug 21	Aug 28	Sept 13	Mean
1.	Untreated control	NA	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.6
2.	P1[2]	1.50	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.6
3.	P1[2]	2.00	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.6
4.	P2[2]	1.50	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.6
5.	P2[2]	2.00	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.6
6.	P3[2]	1.50	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.6
7.	P3[2]	2.00	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.6
8.	BAS 656[2]	21 oz/A[2]	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.5
9.	Pendimethalin 60WDG	1.50	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.7
10.	XF-0034 (0.17%)[4]	0.18	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.9
11.	XF-0034 (0.17%)[4]	0.25	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	7.1
12.	XF-0028 (0.11%)[4]	0.18	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	7.3
13.	XF-0028 (0.11%)[4]	0.25	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	7.4
14.	XF-0029 (0.17%)[4]	0.18	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	7.1
15.	XF-0029 (0.17%)[4]	0.25	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	7.2
16.	XF-01009 ((0.15%)[4]	0.18	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	7.0
17.	XF-01009 ((0.15%)[4]	0.25	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	7.0
18.	XF-00096 (1.29%)[4]	1.50	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	7.1
19.	Dimension 1EC	0.25	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.6
20.	Betasan 4E[5]	9.20[5]	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.6
21.	Betasan 4E[5]	7.30[5]	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.7
22.	Betasan 4E[5]	4.4 & 2.9[5]	4.0	5.0	7.0	6.7	8.0	9.0	9.0	9.0	6.6
	$LSD_{0.05}$		--	--	--	--	--	--	--	--	0.2

[1]Turf quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst quality.
[2]These materials are being screened for BASF.
[3] oz product/A
[4]These materials are being screened for Dow Agrosciences (Rohm & Haas).
[5]These materials are being screened for Gowan
[6]oz product/1000 ft^2.
Initial applications were made on April 27, 2001 and the sequential application of treatment #22 on June 29, 2001.

Table 3. Percentage crabgrass cover[1] in Kentucky bluegrass treated for the 2001 Preemergence Annual Grass study.

	Material	Rate lb a.i./A	July 25	Aug 3	Aug 9	Aug 16	Aug 21	Aug 28	Sept 13	Mean
1.	Untreated control	NA	23.3	35.0	41.7	46.7	55.0	65.0	65.0	47.4
2.	P1[2]	1.50	0.3	3.7	3.7	3.7	7.0	7.0	10.0	5.0
3.	P1[2]	2.00	0.3	3.3	2.0	3.7	5.0	5.0	6.7	3.7
4.	P2[2]	1.50	0.3	0.7	2.3	2.0	2.3	2.3	3.7	2.0
5.	P2[2]	2.00	0.7	2.0	2.3	3.7	3.7	2.0	6.7	3.0
6.	P3[2]	1.50	0.7	4.0	3.7	3.7	5.3	7.0	13.3	5.4
7.	P3[2]	2.00	0.7	0.3	0.7	2.0	2.3	2.3	1.0	1.3
8.	BAS 656[2]	21 oz/A[3]	5.3	18.3	18.3	20.0	31.7	36.7	51.7	26.0
9.	Pendimethalin 60WDG	1.50	0.3	0.0	0.3	0.7	1.0	0.7	3.7	1.0
10.	XF-0034 (0.17%)[4]	0.18	0.3	0.7	2.3	1.0	1.0	5.0	3.3	2.0
11.	XF-0034 (0.17%)[4]	0.25	0.7	1.0	2.3	3.7	4.0	4.0	6.7	3.2
12.	XF-0028 (0.11%)[4]	0.18	0.3	2.0	5.3	5.3	5.3	5.3	6.7	4.3
13.	XF-0028 (0.11%)[4]	0.25	0.0	0.3	0.0	0.7	1.0	0.7	2.0	0.7
14.	XF-0029 (0.17%)[4]	0.18	1.7	4.0	3.7	5.7	6.7	6.7	6.7	5.0
15.	XF-0029 (0.17%)[4]	0.25	0.3	2.3	3.3	3.7	3.7	3.7	3.7	3.0
16.	XF-01009 ((0.15%)[4]	0.18	1.7	4.0	4.0	4.0	7.3	7.0	8.7	5.2
17.	XF-01009 ((0.15%)[4]	0.25	0.7	0.3	2.0	2.0	2.0	2.0	8.3	2.5
18.	XF-00096 (1.29%)[4]	1.50	1.7	7.0	3.7	5.0	7.0	8.7	9.0	6.0
19.	Dimension 1EC	0.25	0.0	2.3	0.3	0.7	3.7	3.7	6.7	2.5
20.	Betasan 4E[5]	9.20[6]	0.0	0.3	0.7	2.3	2.3	2.3	5.3	1.9
21.	Betasan 4E[5]	7.30[6]	0.3	0.0	0.7	0.7	0.7	0.3	0.3	0.4
22.	Betasan 4E[5]	4.4 & 2.9[6]	5.0	3.3	5.0	8.3	10.0	10.0	15.0	8.1
	$LSD_{0.05}$		5.8	8.5	8.8	8.5	12.3	13.4	15.7	9.6

[1]Percentage crabgrass cover was determined by estimated the percentage area per plot covered by crabgrass.
[2]These materials are being screened for BASF.
[3] oz product/A
[4]These materials are being screened for Dow Agrosciences (Rohm & Haas).
[5]These materials are being screened for Gowan
[6]oz product/1000 ft^2.
Initial applications were made on April 27, 2001 and the sequential application of treatment #22 on June 29, 2001.

Table 4. Percentage crabgrass reductions[1] in Kentucky bluegrass treated for the 2001 Preemergence Annual Grass study.

	Material	Rate lb a.i./A	July 25	Aug 3	Aug 9	Aug 16	Aug 21	Aug 28	Sept 13	Mean
1.	Untreated control	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.	P1[2]	1.50	98.6	89.5	91.2	92.1	87.3	89.2	84.6	89.4
3.	P1[2]	2.00	98.6	90.5	95.2	92.1	90.9	92.3	89.7	92.2
4.	P2[2]	1.50	98.6	98.1	94.4	95.7	95.8	96.4	94.4	95.9
5.	P2[2]	2.00	97.1	94.3	94.4	92.1	93.3	96.9	89.7	93.7
6.	P3[2]	1.50	97.1	88.6	91.2	92.1	90.3	89.2	79.5	88.6
7.	P3[2]	2.00	97.1	99.0	98.4	95.7	95.8	96.4	98.5	97.2
8.	BAS 656[2]	21 oz/A[3]	77.1	47.6	56.0	57.2	42.4	43.6	20.5	45.1
9.	Pendimethalin 60WDG	1.50	98.6	100.0	99.2	98.6	98.2	99.0	94.4	98.0
10.	XF-0034 (0.17%)[4]	0.18	98.6	98.1	94.4	97.9	98.2	92.3	94.9	95.9
11.	XF-0034 (0.17%)[4]	0.25	97.1	97.1	94.4	92.1	92.7	93.8	89.7	93.3
12.	XF-0028 (0.11%)[4]	0.18	98.6	94.3	87.2	88.6	90.3	91.8	89.7	90.9
13.	XF-0028 (0.11%)[4]	0.25	100.0	99.0	100.0	98.6	98.2	99.0	96.9	98.6
14.	XF-0029 (0.17%)[4]	0.18	92.8	88.6	91.2	87.9	87.9	89.7	89.7	89.5
15.	XF-0029 (0.17%)[4]	0.25	98.6	93.3	92.0	92.1	93.3	94.4	94.4	93.8
16.	XF-01009 ((0.15%)[4]	0.18	92.8	88.6	90.4	91.4	86.7	89.2	86.7	88.9
17.	XF-01009 ((0.15%)[4]	0.25	97.1	99.0	95.2	95.7	96.4	96.9	87.2	94.8
18.	XF-00096 (1.29%)[4]	1.50	92.8	80.0	91.2	89.3	87.3	86.7	86.2	87.3
19.	Dimension 1EC	0.25	100.0	93.3	99.2	98.6	93.3	94.4	89.7	94.8
20.	Betasan 4E[5]	9.20[6]	100.0	99.0	98.4	95.0	95.8	96.4	91.8	96.0
21.	Betasan 4E[5]	7.30[6]	98.6	100.0	98.4	98.6	98.8	99.5	99.5	99.1
22.	Betasan 4E[5]	4.4 & 2.9[6]	78.5	90.5	88.0	82.2	81.8	84.6	76.9	82.9
	$LSD_{0.05}$		24.9	24.4	21.2	18.2	22.3	20.7	24.2	20.2

[1]These data represent reductions in crabgrass cover as compared with the untreated controls.
[2]These materials are being screened for BASF.
[3] oz product/A
[4]These materials are being screened for Dow Agrosciences (Rohm & Haas).
[5]These materials are being screened for Gowan
[6]oz product/1000 ft^2.
Initial applications were made on April 27, 2001 and the sequential application of treatment #22 on June 29, 2001.

Table 5. Phytotoxicity[1] of Kentucky bluegrass treated for the 2001 Preemergence Annual Grass study.

	Material	Rate lb a.i./A	May 21	June 1
1.	Untreated control	NA	9	9
2.	P1[2]	1.50	9	9
3.	P1[2]	2.00	9	9
4.	P2[2]	1.50	9	9
5.	P2[2]	2.00	9	9
6.	P3[2]	1.50	9	9
7.	P3[2]	2.00	9	9
8.	BAS 656[2]	21 oz/A[2]	5	5
9.	Pendimethalin 60WDG	1.50	9	9
10.	XF-0034 (0.17%)[4]	0.18	9	9
11.	XF-0034 (0.17%)[4]	0.25	9	9
12.	XF-0028 (0.11%)[4]	0.18	9	9
13.	XF-0028 (0.11%)[4]	0.25	9	9
14.	XF-0029 (0.17%)[4]	0.18	9	9
15.	XF-0029 (0.17%)[4]	0.25	9	9
16.	XF-01009 ((0.15%)[4]	0.18	9	9
17.	XF-01009 ((0.15%)[4]	0.25	9	9
18.	XF-00096 (1.29%)[4]	1.50	9	9
19.	Dimension 1EC	0.25	9	9
20.	Betasan 4E[5]	9.20[5]	9	9
21.	Betasan 4E[5]	7.30[5]	9	9
22.	Betasan 4E[5]	4.4 & 2.9[5]	9	9
	$LSD_{0.05}$		--	--

[1]Phytotoxicity was assessed using a 9 to 1 scale with 9 = no damage, 5 = uniform damage with some brown turf, and 1 = dead turf.
[2]These materials are being screened for BASF.
[3] oz product/A
[4]These materials are being screened for Dow Agrosciences (Rohm & Haas).
[5]These materials are being screened for Gowan
[6]oz product/1000 ft^2.
Initial applications were made on April 27, 2001 and the sequential application of treatment #22 on June 29, 2001.

Postemergence Broadleaf (Violet) Study

B. R. Bingaman and N. E. Christians

The objective of this study was to evaluate the performance of three experimental 'NB' herbicide formulations against violets, a 'hard-to-control' broadleaf weed species in turfgrass. The trial was conducted in an established area of 'common' Kentucky bluegrass at the Ames Public Cemetery on South Dakota Street in Ames, IA. The experimental design was a split plot with herbicide as the main plot treatment and number of applications as the subplot factor. Individual plot size was 5 x 10 ft with three replications. The 5 x 10 ft main plots were split into 2 - 5 x 5 ft subplots. Herbicide treatments and number of applications were randomly assigned to main and subplots, respectively. The experimental area was laid out so that each 5 x 10 ft plot had approximately 30-35% violet cover pre-treatment.

Three experimental formulations from PBI Gordon - EH1381, EH1382, and EH1383 were screened in single and sequential applications (21 days apart) with Trimec Classic, Millenium Ultra, and an untreated control. Initial applications were made on June 7 to the main 5 x 10 ft plot. Twenty one days later on June 28, the materials were re-applied at the same rate to one 5 x 5 ft subplot for each main plot. The treatments were applied using a carbon dioxide backpack sprayer equipped with TeeJet #8006 nozzles at a spray pressure of 30-40 psi. The formulations were mixed with water to a volume equivalent to 3 gal/1000 ft^2.

Evaluations of violet damage were made from June 11 through July 18 (Table 1). Damage was assessed using a scale from 9 to 1 with 9 = no damage, 8 = slight discoloration, leaf cupping, and/or stem curling, 7 = more uniform symptoms from #8, 6 = all symptoms of #7 plus leaf mottling, 5 = all symptoms of #6 plus browning on leaves, 4 = all symptoms of #5 plus some dead leaves, 3 = more uniform symptoms of #4 with more dead leaves, 2 = all symptoms of #3 plus some dead plants, and 1 = all violets dead within the plot. After July 18, all remaining violets were assumed to have survived treatment and violet populations were assessed for each subplot. The number of violets per plot was counted on July 24, August 3, August 9, August 14, August 24 and August 31 (Table 2). The study was monitored for possible bluegrass phytotoxicity and turf quality for the duration of the study. No phytotoxicity was detected and turf quality was similar for all plots.

Data were analyzed using the Statistical Analysis System (SAS Institute Inc., 1989-1996) and the Analysis of Variance (ANOVA) procedure. Treatment effects on weed populations and visual quality were tested using Fisher's Least Significant Difference (LSD) test. In addition, orthogonal contrasts were conducted using the General Linear Model (GLM) procedure to test for differences between individual treatments (Tables 3).

All herbicides caused significant levels of damage to violets from June 11 through July 11 (Table 1). The three 'EH' formulations provided higher levels of damage than Trimec Classic or Millenium Ultra on June 11, four days after the initial treatments were applied. By June 18, all treated violets expressed similar damage. On July 18, the violets in the untreated turf were beginning to succumb to the high temperatures and dry conditions so the damage levels caused by the treatments were not significant. However, there were differences in damage levels recorded between subplots ($P > F = 0.0377$). Those violets receiving the sequential treatment on June 28 recorded higher levels of damage than those treated only once on June 7.

There were no statistical reductions in the number of violets in the treated turf as compared with the untreated turf (Table 2). There were numerical differences between the violet counts among the main and subplot treatments but they were not statistically significant. By August 3, violets in the untreated areas were dying because of the high temperatures and low rainfall. As a result, treatment effects are hard to interpret from the data (Table 3). Mean counts show that there were numerical reductions as compared with the untreated controls but the differences are not statistically significant.

Table 1. Violet damage[1] in turfgrass treated for the 2001 PBI Gordon Postemergence violet study.

	Material	Rate pts/A	Number of applications	June 11	June 18	June 21	July 3	July 11	July 18	Mean
1.	Untreated control	NA	NA	9.0	9.0	9.0	8.0	9.0	5.3	8.2
1s.	Untreated control	NA	NA	9.0	9.0	9.0	8.0	9.0	4.7	8.1
2.	EH 1382	5.5	1	4.7	5.3	5.7	4.3	6.3	6.3	5.4
2s.	EH 1382	5.5	2	4.7	5.3	5.7	3.7	5.0	6.0	5.1
3.	EH 1381	5.0	1	5.0	5.3	5.3	4.0	4.3	6.0	5.0
3s.	EH 1381	5.0	2	5.0	5.3	5.3	4.7	5.3	3.7	4.9
4.	EH 1383	4.0	1	4.7	5.7	5.7	3.0	5.7	5.7	5.1
4s.	EH 1383	4.0	2	4.7	5.7	5.7	3.3	6.3	3.7	4.9
5.	Trimec Classic	4.0	1	7.0	5.7	6.3	4.7	6.3	6.0	6.0
5s.	Trimec Classic	4.0	2	7.0	5.7	6.3	4.0	5.0	3.7	5.3
6.	Millenium Ultra	2.5	1	6.3	5.0	6.3	3.7	5.0	5.0	5.2
6s.	Millenium Ultra	2.5	2	6.3	5.0	6.3	3.7	4.3	2.7	4.7
	$LSD_{0.05}$			1.2	2.6	1.6	2.2	2.4	NS	0.9

[1]Damage was assessed using a scale from 9 to 1 with 9 = no damage, 8 = slight discoloration, leaf cupping, and/or stem curling, 7 = more uniform symptoms from #8, 6 = all symptoms of #7 plus leaf mottling, 5 = all symptoms of #6 plus browning on leaves, 4 = all symptoms of #5 plus some dead leaves, 3 = more uniform symptoms of #4 with more dead leaves, 2 = all symptoms of #3 plus some dead plants, and 1 = all violets dead within the plot.

The initial applications were made on June 7 to the entire 5 x 10 ft plot. The sequential applications applied 21 days later on June 28 were made to a 5 x 5 ft subplot.

NS = means are not significantly different at the 0.05 level.

Table 2. Violet counts by subplot treatment[1] in turfgrass treated for the 2001 PBI Gordon Postemergence violet study.

	Material	Rate pts/A	Number of applications	July 24	August 3	August 9	August 14	August 24	August 31	Mean
1.	Untreated control	NA	NA	32.7	19.7	13.0	10.0	14.7	8.7	16.4
1s.	Untreated control	NA	NA	36.7	24.7	18.0	15.0	18.3	10.0	20.6
2.	EH 1382	5.5	1	24.0	14.7	12.7	11.3	8.0	7.7	13.1
2s.	EH 1382	5.5	2	17.3	12.3	12.7	13.7	11.0	10.3	12.9
3.	EH 1381	5.0	1	21.0	14.0	12.7	10.3	10.7	10.3	13.2
3s.	EH 1381	5.0	2	23.7	13.0	10.3	8.7	9.0	8.7	12.2
4.	EH 1383	4.0	1	22.0	13.3	11.7	10.7	12.0	8.0	12.9
4s.	EH 1383	4.0	2	13.0	10.0	8.7	4.7	7.3	8.7	8.7
5.	Trimec Classic	4.0	1	20.0	13.3	9.0	5.3	12.0	8.0	11.3
5s.	Trimec Classic	4.0	2	20.3	9.7	8.3	7.0	7.0	8.3	10.1
6.	Millenium Ultra	2.5	1	17.3	10.3	8.7	7.0	9.7	9.3	10.4
6s.	Millenium Ultra	2.5	2	8.7	6.0	5.3	4.7	2.7	3.7	5.2
	$LSD_{0.05}$			NS	NS	NS	NS	NS	NS	NS

[1]These figures represent the number of violets per subplot.

The initial applications made on June 7 were to the entire 5 x 10 ft plot. The sequential applications applied 21 days later on June 28 were made to a 5 x 5 ft subplot.

NS = means are not significantly different at the 0.05 level.

Table 3. Violet counts by main plot treatment[1] in turfgrass treated for the 2001 PBI Gordon Postemergence violet study.

	Material	Rate pts/A	July 24	August 3	August 9	August 14	August 24	August 31	Mean
1.	Untreated control	NA	34.7	22.2	15.5	12.8	16.5	9.3	18.5
2.	EH 1382	5.5	20.7	13.5	12.7	12.5	9.5	9.0	13.0
3.	EH 1381	5.0	22.3	13.5	11.5	9.5	9.8	9.5	12.7
4.	EH 1383	4.0	17.5	11.7	10.2	7.7	9.7	8.3	10.8
5.	Trimec Classic	4.0	20.2	11.5	8.7	6.2	9.5	8.2	10.7
6.	Millenium Ultra	2.5	13.0	8.2	7.0	5.8	6.2	6.5	7.8
	$LSD_{0.05}$	NS	NS	NS	NS	NS	NS	NS	NS

[1]These figures represent the number of violets per main plot.
The initial applications made on June 7 were to the entire 5 x 10 ft plot. The sequential applications applied 21 days later on June 28 were made to a 5 x 5 ft subplot.
NS = means are not significantly different at the 0.05 level.

Dimension Safety on Bentgrass/*Poa annua* Greens

B. R. Bingaman, T. R. Oster, and N. E. Christians

These field trials were designed to measure the quality of creeping bentgrass on sand and soil-based greens following treatment with dithiopyr at three different rates. Two studies were conducted at Veenker Golf Course in Ames, IA on creeping bentgrass practice greens infested with *Poa annua*. One study was established on a sand-based and another on a soil-based green. Individual plot size was 5 x 5 ft and three replications were run. For both studies, Dimension (Dithiopyr) was applied at 0.25, 0.50 and 1.00 lb a.i./A on May 1, 2001. The material was applied using a 'shaker dispenser' to ensure uniform coverage.

The studies were monitored for turf quality and phytotoxicity from May 15 through September 5 (Tables 1 and 2). Turf quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable and 1 = worst quality. No phytotoxicity was observed. Control of *Poa annua* was recorded from May 15 through September 5 (Tables 3 and 4). Populations were determined by estimating the percentage of area per plot covered by *Poa annua*. The small population on the soil-based green died out and/or was overgrown by bentgrass beginning mid July. Some regrowth was observed on September 5.

To quantify possible treatment effects on *Poa annua* seedhead formation, differences in the percentage of *Poa annua* seed head formation per plot were noted for the sand-based green study on May 15, June 15, July 11, and July 24 (Table 5). The *Poa annua* on the soil-based green did not produce seed heads.

The soil-based green was core aerified on August 15 and large cores (approximately 3/4" diameter) were removed. There were obvious differences in recovery from the aerification and these were noted on August 24 and August 28 (Table 6). Recovery was assessed using a 9 to 1 scale with 9 = 100% recovery, 5 = 50% recovery, and 1 = 0% recovery.

Data were analyzed using the Statistical Analysis System (SAS Institute Inc., 1989-1996) and the Analysis of Variance (ANOVA) procedure. Treatment effects on *Poa annua* populations and visual quality were tested using Fisher's Least Significant Difference (LSD) means comparison test. In addition, orthogonal contrasts were conducted using the General Linear Model (GLM) procedure to provide means comparisons among individual treatments (Tables 7-10).

<u>Sand-based Green:</u>

No phytotoxicity was observed on the treated bentgrass. Enhanced turf quality was observed in bentgrass treated with Dimension at 0.25 lb a.i./A on May 15 and May 23 as compared with the other treated and untreated bentgrass (Table 1). On June 6, bentgrass treated with either Dimension at 0.50 or at 1.00 lb a.i./A had better quality than the other treated and untreated turf. After June 6, quality was similar for all treated and untreated bentgrass.

There were numerical reductions in *Poa annua* cover among the treated and untreated plots, but the differences were statistically significant for only June 6 and August 15 (Table 3). On these dates, Dimension at 1.00 lb a.i./A provided the best numerical control but the level of control was not different from that caused by the other Dimension treatments.

There were significant differences in percentage *Poa annua* seedhead formation for June 15, July 11, and July 24 (Table 5). On June 15 and July 11, there were less seedheads in bentgrass treated with Dimension at 0.25 lb a.i./A but there were more in bentgrass treated with Dimension at 0.50 and 1.00 lb a.i./A as compared with the untreated controls. Mean data show that there was significantly more seedhead formation in bentgrass treated with Dimension at 0.50 or 1.00 lb a.i./A than in bentgrass treated at 0.25 lb a.i./A or untreated.

The orthogonal contrasts provide additional information on statistical differences in *Poa annua*cover by giving probabilities of > T values for pairwise comparisons among the treatments (Table 7). On June 1, June 15, August 15, and August 24 the differences between percentage cover in untreated bentgrass were statistically different than in bentgrass treated with Dimension at 1.00 lb a.i./A.

<u>Soil-based Green:</u>

No phytotoxicity was observed on the treated bentgrass. Numerical improvements in turf quality were recorded through September 5 but these differences were statistically significant for only June 1, June 6, and June 15 (Table 2). On these dates, turf quality was best for bentgrass treated with Dimension at 1.00 lb a.i./A as compared with the other treated and untreated areas.

There were reductions in Poa annua cover in treated bentgrass as compared to untreated but the differences were not statistically significant (Table 4). The *Poa annua* population on this green was rather sporadic and appeared to die out by early August. In addition, the population within the experimental area and surrounding it did not form seedheads.

Core aerification performed on August 15 resulted in significant differences in recovery rates (Table 6). On August 24, bentgrass treated with either Dimension at 0.50 or 1.00 lb a.i./A had significantly less recovery from aerification By August 28, the cores were still only 75% regrown in bentgrass treated with Dimension at 1.00 lb a.i./A. The cores in all other treated and untreated areas had completely recovered.

Table 1. Turf quality[1] of creeping bentgrass on a sand-based green treated for the 2001 Dimension Safety study.

	Material	Rate lb a.i./A	May 10	May 15	May 23	June 1	June 6	June 15	June 24	June 29	July 3
1.	Untreated control	NA	8.0	7.7	7.3	6.3	7.3	7.7	8.0	7.7	8.0
2.	Dimension (10-3-10) 0.164% a.i.	0.25	8.0	9.0	8.0	7.3	7.0	7.7	8.0	7.3	8.0
3.	Dimension (10-3-10) 0.164% a.i.	0.50	8.0	7.0	7.3	7.7	8.7	7.7	8.0	8.3	8.0
4.	Dimension (10-3-10) 0.164% a.i.	1.00	8.7	7.3	7.7	8.3	8.7	8.0	8.0	8.0	8.0
			p>F=0.07								
	$LSD_{0.05}$		0.6	0.9	NS	1.3	0.7	NS	NS	NS	--

	Material	Rate lb a.i./A	July 11	July 24	Aug 3	Aug 10	Aug 15	Aug 24	Aug 28	Sept 5	Mean
1.	Untreated control	NA	9.0	9.0	8.0	7.0	8.0	8.0	9.0	8.7	7.9
2.	Dimension (10-3-10) 0.164% a.i.	0.25	9.0	9.0	8.0	7.0	8.0	8.0	9.0	8.0	8.0
3.	Dimension (10-3-10) 0.164% a.i.	0.50	9.0	9.0	8.0	7.0	8.0	8.7	9.0	8.0	8.1
4.	Dimension (10-3-10) 0.164% a.i.	1.00	9.0	9.0	8.0	7.0	8.0	8.3	9.0	8.3	8.2
	$LSD_{0.05}$		--	--	--	--	--	NS	--	NS	0.2

[1]Turf quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst quality.

Materials applied on May 1, 2001

NS = means are not significantly different at the 0.05 level.

-- = means comparisons tests are not valid for these data.

Table 2. Turf quality[1] of creeping bentgrass on a soil-based green treated for the 2001 Dimension Safety study.

	Material	Rate lb a.i./A	May 10	May 15	May 23	June 1	June 6	June 15	June 27	July 3	July 11
1.	Untreated control	NA	8.0	7.0	6.0	6.0	6.3	7.0	7.0	8.0	9.0
2.	Dimension (10-3-10) 0.164% a.i.	0.25	8.0	8.0	8.0	7.3	6.3	7.3	7.3	7.3	9.0
3.	Dimension (10-3-10) 0.164% a.i.	0.50	9.0	8.0	8.0	7.7	6.7	9.0	7.7	7.7	9.0
4.	Dimension (10-3-10) 0.164% a.i.	1.00	9.0	9.0	9.0	8.7	7.7	9.0	8.7	8.3	9.0
	$LSD_{0.05}$		--	--	--	2.5	0.7	1.6	NS	NS	--

	Material	Rate lb a.i./A	July 16	July 24	Aug 3	Aug 10	Aug 17	Aug 24	Aug 28	Sept 5	Mean
1.	Untreated control	NA	8.7	8.3	8.0	8.0	8.0	8.0	8.3	8.7	7.7
2.	Dimension (10-3-10) 0.164% a.i.	0.25	9.0	8.3	8.0	8.0	8.0	8.0	8.0	8.7	7.9
3.	Dimension (10-3-10) 0.164% a.i.	0.50	9.0	8.7	8.0	8.0	8.0	8.0	8.3	8.7	8.2
4.	Dimension (10-3-10) 0.164% a.i.	1.00	8.7	8.7	8.0	8.0	8.0	8.0	8.0	9.0	8.5
	$LSD_{0.05}$		NS	NS	--	--	--	--	NS	NS	0.3

[1]Turf quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst quality.
Materials applied on May 1, 2001
NS = means are not significantly different at the 0.05 level.
-- = means comparisons tests are not valid for these data.

Table 3. Percentage *Poa annua* cover[1] in creeping bentgrass on a sand-based green treated for the 2001 Dimension Safety study.

	Material	Rate lb a.i./A	May 15	May 23	June 1	June 6	June 15	June 24	June 29	July 3
1.	Untreated control	NA	36.7	38.3	45.0	45.0	51.7	41.7	33.3	23.3
2.	Dimension (10-3-10) 0.164% a.i.	0.25	35.0	33.3	33.3	41.7	35.0	31.7	30.0	28.3
3.	Dimension (10-3-10) 0.164% a.i.	0.50	50.0	41.7	30.0	36.7	45.0	40.0	33.3	33.3
4.	Dimension (10-3-10) 0.164% a.i.	1.00	53.3	40.0	23.3	30.0	31.7	31.7	31.7	30.0
						p>F=0.08				
	$LSD_{0.05}$		NS	NS	NS	11.7	NS	NS	NS	NS

	Material	Rate lb a.i./A	July 11	July 24	Aug 3	Aug 10	Aug 15	Aug 24	Aug 28	Sept 5	Mean
1.	Untreated control	NA	20.0	28.3	30.0	35.0	25.0	18.3	15.0	5.7	30.8
2.	Dimension (10-3-10) 0.164% a.i.	0.25	30.0	33.3	28.3	26.7	10.0	10.0	10.0	6.7	26.5
3.	Dimension (10-3-10) 0.164% a.i.	0.50	31.7	30.0	28.3	26.7	16.7	15.0	10.0	7.0	29.7
4.	Dimension (10-3-10) 0.164% a.i.	1.00	33.3	38.3	36.7	20.0	8.3	6.7	6.7	6.7	26.8
							p>F=0.08				
	$LSD_{0.05}$		NS	NS	NS	NS	13.4	NS	NS	NS	NS

[1]These data represent the percentage area per plot covered by *Poa annua*.
Materials applied on May 1, 2001
NS = means are not significantly different at the 0.05 level.

Table 4. Percentage *Poa annua* cover[1] in creeping bentgrass on a soil-based green treated for the 2001 Dimension Safety study.

	Material	Rate lb a.i./A	May 15	May 23	June 1	June 6	June 15	July 3	July 11
1.	Untreated control	NA	7.3	10.3	11.7	11.7	10.0	2.3	2.3
2.	Dimension (10-3-10) 0.164% a.i.	0.25	2.3	4.0	6.7	16.7	15.0	2.3	2.3
3.	Dimension (10-3-10) 0.164% a.i.	0.50	4.0	5.7	8.3	13.3	16.7	2.3	2.3
4.	Dimension (10-3-10) 0.164% a.i.	1.00	1.0	3.7	5.0	10.0	15.0	1.0	1.0
	$LSD_{0.05}$		NS	NS	NS	NS	NS	NS	NS

	Material	Rate lb a.i./A	July 16	July 24	Aug 3	Aug 10	Aug 24	Aug 28	Sept 5	Mean
1.	Untreated control	NA	5.0	2.3	0.3	0.3	0.0	0.0	1.0	4.6
2.	Dimension (10-3-10) 0.164% a.i.	0.25	6.7	2.3	0.3	0.3	0.0	0.0	2.3	4.4
3.	Dimension (10-3-10) 0.164% a.i.	0.50	6.7	4.0	0.0	0.0	0.0	0.0	3.7	4.8
4.	Dimension (10-3-10) 0.164% a.i.	1.00	5.0	3.7	0.0	0.0	0.0	0.0	2.3	3.4
	$LSD_{0.05}$		NS	NS	NS	NS	--	--	NS	NS

[1]These data represent the percentage area per plot covered by *Poa annua*

Materials applied on May 1, 2001

NS = means are not significantly different at the 0.05 level.

-- = means comparisons tests are not valid for these data.

Table 5. Percentage *Poa annua* seedhead formation[1] in creeping bentgrass on a sand-based green treated for the 2001 Dimension Safety study.

	Material	Rate lb a.i./A	May 15	June 15	July 11	July 24	Mean
1.	Untreated control	NA	36.7	25.0	0.0	6.7	17.1
2.	Dimension (10-3-10) 0.164% a.i.	0.25	20.0	10.0	3.3	18.3	12.9
3.	Dimension (10-3-10) 0.164% a.i.	0.50	31.7	46.7	20.0	18.3	29.2
4.	Dimension (10-3-10) 0.164% a.i.	1.00	38.3	35.0	50.0	26.7	37.5
	$LSD_{0.05}$		NS	5.8	9.6	14.2	12.0

[1]These data represent the percentage of *Poa annua* plants per plot that were forming seedheads.
Materials applied on May 1, 2001
NS = means are not significantly different at the 0.05 level.

Table 6. Recovery from core aerification[1] in creeping bentgrass on a soil-based green treated for the 2001 Dimension Safety study.

	Material	Rate lb a.i./A	August 24	August 28	Mean
1.	Untreated control	NA	8.0	9.0	8.5
2.	Dimension (10-3-10) 0.164% a.i.	0.25	7.3	9.0	8.2
3.	Dimension (10-3-10) 0.164% a.i.	0.50	7.0	9.0	8.0
4.	Dimension (10-3-10) 0.164% a.i.	1.00	3.3	7.3	5.3
	$LSD_{0.05}$		0.9	0.6	0.6

[1]The recovery from aerification was assessed using a 9 to 1 scale with 9 = full recovery, 5 = 50% recovery, 1 = no recovery.
Materials applied on May 1, 2001

Table 7. Probabilities for > T comparing percentage *Poa annua* cover in creeping bentgrass on a sand-based green treated for the 2001 Andersons Dimension Safety Study.

Material	May 15	May 23	June 1	June 6	June 15	June 24	June 29	July 3	July 11
Untreated control vs treatments	0.1851	0.9983	**0.0486**	**0.0610**	**0.0915**	0.2731	0.8425	0.1009	0.0883
Untreated control vs Dimension @0.25 lb a.i./A	0.8376	06140	0.1961	0.5102	0.1085	0.2231	0.7463	0.3153	0..0252
Untreated control vs Dimension @0.50 lb a.i./A	0.1377	0.7351	0.1107	0.1308	0.4796	0.8284	1.0000	**0.0710**	0.1485
Untreated control vs Dimension @1.00 lb a.i./A	0.0761	0.8652	**0.0355**	**0.0198**	0.0645	0.2231	0.8710	0.1944	0.1070
Dimension @0.25 lb a.i./A vs untreated & other treatments	0.1145	0.4186	0.9242	0.2896	0.3293	0.3529	0.7422	0.8841	0.7879
Dimension @0.25 lb a.i./A vs untreated control	0.1024	0.4096	0.6922	03343	0.3014	0.3007	0.7463	0.3153	0.8207
Dimension @0.25 lb a.i./A vs Dimension @0.50 lb a.i./A	0.1024	0.4096	0.6922	0.3343	0.3014	0.3007	0.7463	0.3153	0.8207
Dimension @0.25 lb a.i./A vs Dimension @1.00 lb a.i./A	**0.0567**	0.5050	0.2590	**0.0498**	0.7193	1.0000	0.8710	0.7275	0.6525
Dimension @0.50 lb a.i./A vs untreated & other treatments	0.2438	0.5860	0.5845	0.6031	0.4650	0.4344	0.8425	0.1537	0.5296
Dimension @0.50 lb a.i./A vs untreated control	0.1377	0.7351	0.1107	0.1308	0.4796	0.8244	1.0000	0.0710	0.1485
Dimension @0.50 lb a.i./A vs Dimension @0.25 lb a.i./A	0.1024	0.4096	0.6922	0.3343	0.3014	0.3007	0.7463	0.3153	0.8207
Dimension @0.50 lb a.i./A vs Dimension @1.00 lb a.i./A	0.6836	0.8652	0.4378	0.2111	0.1824	0.3007	0.8710	0.4927	0.8207
Dimension @1.00 lb a.i./A vs untreated & other treatments	**0.0931**	0.7857	0.1002	**0.0293**	0.1412	0.3468	0.9460	0.6796	0.3318
Dimension @1.00 lb a.i./A vs untreated control	**0.0761**	0.8652	**0.0355**	**0.0198**	0.0645	0.2231	0.8710	0.1944	0.1070
Dimension @1.00 lb a.i./A vs Dimension @0.25 lb a.i./A	**0.0567**	0.5050	0.2590	**0.0498**	0.7193	1.0000	0.8710	0.7275	0.6525
Dimension @1.00 lb a.i./A vs Dimension @0.50 lb a.i./A	0.6836	0.8652	0.4378	0.2111	0.1824	0.3007	0.8710	0.4927	0.8207

Table 8. Probabilities for > T comparing percentage *Poa annua* cover in creeping bentgrass on a sand-based green treated for the 2001 Andersons Dimension Safety Study.

Material	July 24	Aug 3	Aug 10	Aug 15	Aug 24	Aug 28	Sept 5	Mean
Untreated control vs treatments	0.2798	0.8115	0.3158	**0.0245**	0.1388	0.1509	0.7773	0.4979
Untreated control vs Dimension @0.25 lb a.i./A	0.4198	0.7811	0.5087	**0.0340**	0.1880	0.3153	0.8349	0.4486
Untreated control vs Dimension @0.50 lb a.i./A	0.7825	0.7811	0.5087	0.1795	0.5742	0.3153	0.7814	0.8483
Untreated control vs Dimension @1.00 lb a.i./A	0.1340	0.2891	0.2530	**0.0229**	**0.0828**	0.1177	0.8349	0.4807
Dimension @0.25 lb a.i./A vs untreated & other treatments	0.8311	0.4970	0.9618	0.1920	0.5026	0.8943	0.9551	0.5712
Dimension @0.25 lb a.i./A vs untreated control	0.5847	1.0000	1.0000	0.2699	0.4072	1.0000	0.9445	0.5638
Dimension @0.25 lb a.i./A vs Dimension @0.50 lb a.i./A	0.5847	1.0000	1.0000	0.2699	0.4072	1.0000	0.9445	0.5638
Dimension @0.25 lb a.i./A vs Dimension @1.00 lb a.i./A	0.4198	0.1963	0.5945	0.7715	0.5742	0.4927	1.0000	0.9551
Dimension @0.50 lb a.i./A vs untreated & other treatments	0.4999	0.4970	0.9618	0.6284	0.4881	0.8943	0.8655	0.7058
Dimension @0.50 lb a.i./A vs untreated control	0.7825	0.7811	0.5087	0.1795	0.5742	0.3153	0.7814	0.8483
Dimension @0.50 lb a.i./A vs Dimension @0.25 lb a.i./A	0.5847	1.0000	1.0000	0.2699	0.7072	1.0000	0.9445	0.5638
Dimension @0.50 lb a.i./A vs Dimension @1.00 lb a.i./A	0.1990	0.1963	0.5945	0.1795	0.1880	0.4927	0.9445	0.6009
Dimension @1.00 lb a.i./A vs untreated & other treatments	0.1498	0.1474	0.3685	0.0946	0.1402	0.2296	0.9558	0.6283
Dimension @1.00 lb a.i./A vs untreated control	0.1340	0.2891	0.2530	0.0229	0.0828	0.1177	0.8349	0.4807
Dimension @1.00 lb a.i./A vs Dimension @0.25 lb a.i./A	0.4198	0.1963	0.5945	0.7715	0.5742	0.4927	1.0000	0.9551
Dimension @1.00 lb a.i./A vs Dimension @0.50 lb a.i./A	0.1990	0.1963	0.5945	0.1795	0.1880	0.4927	0.9445	0.6009

Table 9. Probabilities for > T comparing percentage *Poa annua* cover in creeping bentgrass on a soil-based green treated for the 2001 Andersons Dimension Safety Study.

Material	May 15	May 23	June 1	June 6	June 15	July 3	July 11	July 16
Untreated control vs treatments	0.2398	0.2773	0.2612	0.6623	0.5676	0.7454	0.7454	0.4825
Untreated control vs Dimension @0.25 lb a.i./A	0.3190	0.3351	0.3517	0.2948	0.6721	1.0000	1.0000	0.3903
Untreated control vs Dimension @0.50 lb a.i./A	0.4962	0.4694	0.5260	0.7152	0.5748	1.0000	1.0000	0.3903
Untreated control vs Dimension @1.00 lb a.i./A	0.2180	0.3123	0.2270	0.7152	0.6721	04454	04454	1.0000
Dimension @0.25 lb a.i./A vs untreated & other treatments	0.6585	0.6270	0.7003	0.2082	0.9085	0.7454	0.7454	0.4762
Dimension @0.25 lb a.i./A vs untreated control	0.7297	0.7920	0.7480	0.4732	0.8870	1.0000	1.0000	1.0000
Dimension @0.25 lb a.i./A vs Dimension @0.50 lb a.i./A	0.7297	0.7920	0.7480	0.4732	0.8870	1.0000	1.0000	1.0000
Dimension @0.25 lb a.i./A vs Dimension @1.00 lb a.i./A	0.7818	0.9578	0.7480	0.1768	1.0000	0.4454	0.4454	0.3903
Dimension @0.50 lb a.i./A vs untreated & other treatments	0.9046	0.9520	0.8900	0.8751	0.7302	0.7454	0.7454	0.4762
Dimension @0.50 lb a.i./A vs untreated control	0.4962	0.4694	0.5260	0.7152	0.5748	1.0000	1.0000	0.3903
Dimension @0.50 lb a.i./A vs Dimension @0.25 lb a.i./A	0.7297	0.7920	0.7480	0.4732	0.8870	1.0000	1.0000	1.0000
Dimension @0.50 lb a.i./A vs Dimension @1.00 lb a.i./A	0.5387	0.7520	0.5260	0.4732	0.8870	0.4454	0.4454	0.3903
Dimension @1.00 lb a.i./A vs untreated & other treatments	0.3813	0.5668	0.3741	0.3169	0.9099	0.3559	0.3559	0.4762
Dimension @1.00 lb a.i./A vs untreated control	0.2180	0.3123	0.2270	0.7152	0.6721	0.4454	0.4454	1.0000
Dimension @1.00 lb a.i./A vs Dimension @0.25 lb a.i./A	0.7818	0.9578	0.7480	0.1768	1.0000	0.4454	0.4454	0.3903
Dimension @1.00 lb a.i./A vs Dimension @0.50 lb a.i./A	0.5387	0.7520	0.5260	0.4732	0.8870	0.4454	0.4454	0.3903

Table 10. Probabilities for > T comparing percentage *Poa annua* cover in creeping bentgrass on a soil-based green treated for the 2001 Andersons Dimension Safety Study.

Material	July 24	Aug 3	Aug 10	Aug 24	Aug 28	Sept 5	Mean
Untreated control vs treatments	0.6505	0.4762	0.4762	-------	-------	0.2743	0.8327
Untreated control vs Dimension @0.25 lb a.i./A	1.0000	1.0000	1.0000	-------	-------	0.4881	0.9249
Untreated control vs Dimension @0.50 lb a.i./A	0.5419	0.3903	0.3903	-------	-------	0.1901	0.9474
Untreated control vs Dimension @1.00 lb a.i./A	0.6236	0.3903	0.3903	-------	-------	0.4881	0.6341
Dimension @0.25 lb a.i./A vs untreated & other treatments	0.6505	0.4762	0.4762	-------	-------	1.0000	0.9537
Dimension @0.25 lb a.i./A vs untreated control	0.5419	0.3903	0.3903	-------	-------	0.4881	0.8728
Dimension @0.25 lb a.i./A vs Dimension @0.50 lb a.i./A	0.5419	0.3903	0.3903	-------	-------	0.4881	0.8728
Dimension @0.25 lb a.i./A vs Dimension @1.00 lb a.i./A	0.6236	0.3903	0.3903	-------	-------	1.0000	0.7010
Dimension @0.50 lb a.i./A vs untreated & other treatments	0.5854	0.4825	0.4825	-------	-------	0.2743	0.7507
Dimension @0.50 lb a.i./A vs untreated control	0.5419	0.3903	0.3903	-------	-------	0.1901	0.9474
Dimension @0.50 lb a.i./A vs Dimension @0.25 lb a.i./A	0.5419	0.3903	0.3903	-------	-------	0.4881	0.8728
Dimension @0.50 lb a.i./A vs Dimension @1.00 lb a.i./A	0.9014	1.0000	1.0000	-------	-------	0.4881	0.5894
Dimension @1.00 lb a.i./A vs untreated & other treatments	0.7282	0.4825	0.4825	-------	-------	0.9931	0.5688
Dimension @1.00 lb a.i./A vs untreated control	0.6236	0.3903	0.3903	-------	-------	0.4881	0.6341
Dimension @1.00 lb a.i./A vs Dimension @0.25 lb a.i./A	0.6236	0.3903	0.3903	-------	-------	1.0000	0.7010
Dimension @1.00 lb a.i./A vs Dimension @0.50 lb a.i./A	0.9014	1.0000	1.0000	-------	-------	0.4881	0.5894

Dimension + Turf Enhancer/TGR Safety on Bentgrass/*Poa annua* Greens Study

B. R. Bingaman, T. R. Oster, and N. E. Christians

This study was designed to measure turf quality and *Poa annua* population reductions on Bentgrass/*Poa annua* greens treated with paclobutrazole and dithiopyr concurrently. This study was conducted at Veenker Golf Course in Ames, IA on a sand-based practice green heavily infested with *Poa annua*. In the study area, the percentage cover of *Poa annua* was approximately 60%. Individual plot size was 5 x 5 ft and three replications were run.

Two fertilizer/herbicide treatments and an untreated control were included. One treatment consisted of Dimension 0.164% (10-3-10) applied concurrently with Turf Enhancer 0.13% (14-0-28) on May 1 and Turf Enhancer applied alone at 28 day intervals on June 8 and June 28, 2001. For the second treatment Dimension 0.164% (10-3-10) was combined with TGR 0.34% (15-0-29) on May 1, 2001 and TGR was applied alone eight weeks later on June 28, 2001. All granular materials were applied using a 'shaker dispenser' to ensure uniform coverage.

Turf quality was monitored from May 10 through September 5 (Table 1). Quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable and 1 = worst quality. *Poa annua* control was recorded from May 10 through September 5 (Table 2). *Poa annua* populations were determined by estimating the percentage area per plot covered by *Poa annua*. In addition, differences in the percentage of *Poa annua* seedhead production per plot were noted for May 15 and July 24 (Table 3).

Data were analyzed using the Statistical Analysis System (SAS Institute Inc., 1989-1996) and the Analysis of Variance (ANOVA) procedure. Treatment effects on *Poa annua* populations and visual quality were tested using Fisher's Least Significant Difference (LSD) means comparison test. In addition, *Poa annua* percentage cover means were compared using orthogonal contrasts in the General Linear Model (GLM) procedure (Table 4).

There was significant improvement in treated bentgrass quality on May 10, July 3, August 10, and August 15 as compared with the untreated control (Table 1). On other dates, numerical increases in quality ratings were noted but these were not statistically different. Treatment with TGR produced a definite color response in the bentgrass but not the *Poa annua*. The dark green bentgrass was in stark contrast to the lime green of the *Poa annua* and produced 'mottled or spotted' plots as compared to the untreated control and bentgrass treated with Turf Enhancer. Quality ratings on June 6 and June 15 reflect the distinct differences among the treatments but they are not statistically significant.

Populations of *Poa annua* were reduced in treated bentgrass from June 1 through July 3 as compared with the untreated control but the reductions were not statistically significant on all dates (Table 2). After July 3, *Poa annua* die-back resulted in greatly reduced populations in treated and untreated bentgrass and treatment effects are not significant.

Percentage *Poa annua* seedhead production data were taken when there was a large amount of seedhead formation on the practice green. On May 15, there were no statistical differences among the treated and untreated bentgrass (Table 3). On July 24, there were more seedheads in bentgrass treated with Dimension + Turf Enhancer than in bentgrass treated with Dimension + TGR or untreated.

The orthogonal contrasts show that on some collection dates *Poa annua* populations in treated bentgrass plots were significantly different when compared individually with the untreated bentgrass or the other treatment (Table 4).

Table 1. Visual quality[1] of creeping bentgrass on a sand based green treated for the 2001 Dimension + TGR/Turf Enhancer Safety Study.

	Material	May 10	May 15	May 23	June 1	June 6	June 15	June 21	June 29	July 3
1.	Untreated control	7.0	5.0	6.3	7.0	8.0	8.0	7.7	7.3	8.0
2.	Dimension (10-3-10).164% a.i. + Turf Enhancer (14-0-28) 0.13%	8.7	9.0	8.0	8.3	7.0	7.0	7.7	8.3	8.7
3.	Dimension (10-3-10) .164% a.i. + TGR (15-0-29) 0.34% a.i.	8.0	7.0	8.0	8.7	9.0	9.0	8.0	8.7	7.0
	$LSD_{0.05}$	0.8	---	1.2	0.9	---	---	NS	NS	0.8

	Material	July 11	July 24	Aug 2	Aug 10	Aug 15	Aug 24	Aug 31	Sept 5	Mean
1.	Untreated control	9.0	9.0	7.7	7.0	7.3	8.0	9.0	8.7	7.6
2.	Dimension (10-3-10).164% a.i. + Turf Enhancer (14-0-28) 0.13%	9.0	8.0	7.7	7.7	7.7	8.3	9.0	8.7	8.2
3.	Dimension (10-3-10) .164% a.i. + TGR (15-0-29) 0.34% a.i.	7.0	8.0	7.7	9.0	9.0	8.3	9.0	8.7	8.2
	$LSD_{0.05}$	---	---	NS	0.8	1.3	NS	---	NS	NS

[1]Visual quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, 1 = worst quality.
Turf enhancer (14-0-28) was applied initially with Dimension (10-3-10) on May 1 and then by itself on June 8 and June 28, 2001.
TGR (15-0-29) was applied initially with Dimension (10-3-10) on May 1 and by itself eight weeks later on June 28, 2001.

Table 2. Percentage *Poa annua* cover[1] in creeping bentgrass on a sand based green treated for the 2001 Dimension + TGR/Turf Enhancer Safety Study.

	Material	May 15	May 23	June 1	June 6	June 15	June 21	June 29	July 3
1.	Untreated control	40.0	33.3	35.0	35.0	40.0	28.3	25.0	16.7
2.	Dimension (10-3-10).164% a.i. + Turf Enhancer (14-0-28) 0.13%	41.7	30.0	20.0	23.3	23.3	11.7	6.7	10.0
3.	Dimension (10-3-10) .164% a.i. + TGR (15-0-29) 0.34% a.i.	56.7	46.7	15.0	18.3	33.3	18.3	11.7	13.3
	$LSD_{0.05}$	NS	NS	11.3	11.9	NS	7.6	14.4	NS

	Material	July 11	July 24	Aug 2	Aug 10	Aug 15	Aug 31	Sept 5	Mean
1.	Untreated control	13.3	15.0	15.0	20.0	15.0	8.3	4.0	21.8
2.	Dimension (10-3-10).164% a.i. + Turf Enhancer (14-0-28) 0.13%	11.7	25.0	23.3	18.3	16.7	8.3	2.3	18.1
3.	Dimension (10-3-10) .164% a.i. + TGR (15-0-29) 0.34% a.i.	16.7	16.7	15.0	11.7	11.7	10.0	3.7	19.5
	$LSD_{0.05}$	NS	NS	NS	NS	NS	NS	NS	NS

[1]These figures represent the percentage area per plot covered by *Poa annua*.
Turf enhancer (14-0-28) was applied initially with Dimension (10-3-10) on May 1 and then by itself on June 8 and June 28, 2001.
TGR (15-0-29) was applied initially with Dimension (10-3-10) on May 1 and by itself eight weeks later on June 28, 2001.

Table 3. Percentage *Poa annua* seedhead production[1] in creeping bentgrass on a sand based green treated for the 2001 Dimension + TGR/Turf Enhancer Safety Study.

	Material	May 15	July 24	Mean
1.	Untreated control	17.0	4.0	10.5
2.	Dimension (10-3-10).164% a.i. + Turf Enhancer (14-0-28) 0.13%	18.3	50.0	34.2
3.	Dimension (10-3-10) .164% a.i. + TGR (15-0-29) 0.34% a.i.	26.7	13.3	20.0
	$LSD_{0.05}$	NS	16.0	17.9

[1]These figures represent the percentage of *Poa annua* per plot forming seedheads.

Turf enhancer (14-0-28) was applied initially with Dimension (10-3-10) on May 1 and then by itself on June 8 and June 28, 2001.

TGR (15-0-29) was applied initially with Dimension (10-3-10) on May 1 by itself eight weeks later on June 28, 2001.

Table 4. Probabilities for > T[1] comparing percentage *Poa annua* cover in turf treated for the 2001 Anderson's Dimension/TGR/Turf Enhancer Safety Study.

Material	May 15	May 23	June 1	June 6	June 15	June 21	June 29	July 3
Dimension + Turf Enhancer vs untreated control	0.9056	0.6213	**0.0213**	**0.0535**	**0.0872**	**0.0036**	**0.0241**	0.2746
Dimension + Turf Enhancer vs Dimension + TGR	0.3191	**0.0557**	0.2879	0.3099	0.2475	**0.0705**	0.3892	0.5614
Dimension + TGR vs untreated control	0.2751	**0.0993**	**0.0080**	**0.0179**	0.4181	**0.0213**	**0.0618**	0.5614

Material	July 11	July 24	Aug 2	Aug 10	Aug 15	Aug 31	Sept 5
Dimension + Turf Enhancer vs untreated control	0.8185	0.1401	**0.0816**	0.6433	0.4818	1.000	0.5823
Dimension + Turf Enhancer vs Dimension + TGR	0.5032	0.2005	**0.0816**	0.1161	0.0808	0.4818	0.6575
Dimension + TGR vs untreated control	0.6499	0.7747	1.0000	**0.0668**	0.1963	0.4818	0.9106

[1]These figures represent the probabilities that a greater value for T would occur by chance alone and were produced using the General Linear Model procedure and orthogonal contrasts.

Turf enhancer (14-0-28) was applied initially with Dimension (10-3-10) on May 1 and then by itself on June 8 and June 28, 2001.

TGR (15-0-29) was applied initially with Dimension (10-3-10) on May 1 and by itself eight weeks later on June 28, 2001.

Field Evaluation of Roundup Ready® Creeping Bentgrass

Shui-zhang Fei and Rodney A. St. John

Roundup Ready creeping bentgrass offers great promise for the golf industry because it will allow for more selective, effective and thus, simplified control of aggressive annual and perennial weeds in golf course turf. Weeds that can be easily controlled with Roundup® brand herbicides include annual bluegrass, roughstalk bluegrass, bermudagrass and many other grassy and broadleaf weeds. A greenhouse study of Roundup Ready creeping bentgrass at Iowa State University has demonstrated that key morphological data and pollen longevity of Roundup Ready creeping bentgrass are essentially the same as its conventional counterpart except the roundup ready phenotype.

The purpose of this research was to evaluate the performance of Roundup Ready creeping bentgrass under field conditions. This research was established on September 13, 2001 with three replications of 5x5 ft (25 ft^2) plots for each cultivar. A 2 feet border area between plots was seeded with perennial ryegrass. The experimental design was a randomized complete block with split plot. Seven conventional cultivars of Crenshaw, Penncross, Penneagle, Providence, Backspin, A4 and L93 were used along with two leading Roundup Ready creeping bentgrass lines ASR 333 and ASR368. The trial was fertilized with 1 lb N/1000 ft^2 and 1 lb P/1000 ft^2 during the establishment.

Three weeks after seedling emergence, half of each plot received roundup application at a rate of 32 oz /acre. Data on turf quality, weed development and other morphological characteristics after the roundup application are not available at this time.

Corsair Perennial Ryegrass Control Study

B. R. Bingaman, T. R. Oster, and N. E. Christians

The objective of this study was to screen Corsair for removal of perennial ryegrass from a ryegrass/creeping bentgrass area maintained at fairway height. This study was conducted at Veenker Golf Course in Ames, IA on the border area between a bentgrass fairway and the adjacent ryegrass/Kentucky bluegrass rough. The bluegrass rough contained approximately 50% ryegrass. The experimental design was a randomized complete block and three replications were conducted. Individual plot size was 5 x 5 ft. The plots were arranged so one half of the plot was covered by bentgrass and the other by bluegrass/ryegrass turf.

Corsair was applied at 1, 2, and 3 oz/A on August 8 using a carbon dioxide backpack sprayer equipped with TeeJet #8006 nozzles at a spray pressure of 30-40 psi. The herbicide was mixed with water to a volume equivalent to 3 gal/1000 ft^2.

Ryegrass damage was recorded on August 10, August 16 and August 23. Damage was assessed using a 9 to 1 scale with 9 = no damage, 5 = 50% ryegrass mortality, and 1 = 100% ryegrass mortality (Table 1). Phytotoxicity on bentgrass was rated using a 9 to 1 scale with 9 = no damage, 5 = 50% bentgrass damaged, and 1 = 100% bentgrass damaged. Bentgrass damage data were taken from August 10 through October 19 (Table 2). Kentucky bluegrass quality was monitored for possible phytotoxicity from August 10 through October 19 (Table 3). Turf quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst quality.

Ryegrass control was determined by estimating the percentage cover per individual plot (Table 4). These data were taken initially on August 23 to assess the amount of ryegrass killed. Subsequent cover data were taken to monitor if there was any regrowth.

Percentage cover data were taken for bentgrass to reflect the amount of mortality in the treated plots (Table 5). These data were taken from August 10 through September 19.

The percentage bluegrass/ryegrass cover also was monitored from August 10 through October 19 (Table 6). These figures reflect the spread of bluegrass throughout the areas devoid of ryegrass in the treated plots.

Data were analyzed using the Statistical Analysis System (SAS Institute Inc., 1989-1996) and the Analysis of Variance (ANOVA) procedure. Treatment effects on turf populations and turf quality were examined using Fisher's Least Significant Difference (LSD) test.

There was no damage on ryegrass until approximately 12 days post treatment (Table 1). Yellowing was beginning on August 20 and by August 23, the treated ryegrass was 'brown' and dead. The bluegrass/ryegrass areas of each treated plot were monitored through October 19 and there was no regrowth of ryegrass (Table 4). There were no phytotoxic symptoms on the treated bluegrass (Table 3). Bluegrass spread into the bare areas of the treated plots and by September 28, plots treated with Corsair at 1.0 and 2.0 oz/A were similar to the untreated controls in turfgrass percentage cover (Table 6).

On August 23, significant levels of damage were observed on the treated bentgrass (Table 2). Damage was not significant on bentgrass treated with Corsair at 1 oz/A on August 23 and August 30 as compared with the untreated controls. However, bentgrass treated at 2.0 and 3.0 oz/A exhibited significant levels of damage as compared with the untreated controls on August 23 through September 6. As much as 50% of the bentgrass treated with Corsair at 3.0 oz/A was damaged and suffered severe browning and some mortality. By September 21, the effects of Corsair on percentage cover and bentgrass quality were no longer recorded (Tables 2 and 5). Bentgrass had moved into the bare areas of the treated plots and some of the damaged bentgrass had regrown from the crowns.

This study will be monitored through the spring and summer of 2002 for possible regrowth of perennial ryegrass.

Table 1. Damage on perennial ryegrass[1] treated for the 2001 Riverdale Corsair Ryegrass Control Study.

	Material	Rate oz/A	August 10	August 16	August 23	Mean
1.	Untreated	NA	9.0	9.0	9.0	9.0
2.	Corsair	1.0	9.0	9.0	1.0	6.3
3.	Corsair	2.0	9.0	9.0	1.0	6.3
4.	Corsair	3.0	9.0	9.0	1.0	6.3
	$LSD_{0.05}$		NS	NS	NS	NS

[1]Damage was assessed using a 9 to 1 scale with 9 = no damage, 5 = 50% ryegrass mortality, and 1 = 100% ryegrass mortality.

Table 2. Damage on creeping bentgrass[1] treated for the 2001 Riverdale Corsair Ryegrass Control Study.

	Material	Rate oz/A	August 10	August 16	August 23	August 30	September 6	September 13	September 21	September 28	October 12	October 19	Mean
1.	Untreated	NA	9.0	9.0	8.3	8.3	9.0	9.0	9.0	9.0	9.0	9.0	8.9
2.	Corsair	1.0	9.0	9.0	8.0	7.0	7.7	8.7	9.0	9.0	9.0	9.0	8.5
3	Corsair	2.0	9.0	9.0	6.3	5.3	7.0	8.7	9.0	9.0	9.0	9.0	8.1
4.	Corsair	3.0	9.0	9.0	5.7	5.0	6.3	8.3	9.0	9.0	9.0	9.0	7.9
	$LSD_{0.05}$		NS	NS	2.2	2.1	0.7	NS	NS	NS	NS	NS	0.2

[1]Damage was assessed using a 9 to 1 scale with 9 = no damage, 5 = 50% bentgrass damaged, and 1 = 100% bentgrass damaged.
NS = Means are not significantly different at the 0.05 level.

Table 3. Turf quality of Kentucky bluegrass[1] treated for the 2001 Riverdale Corsair Ryegrass Control Study.

	Material	Rate oz/A	August 10	August 16	August 23	August 30	September 6	September 13	September 21	September 28	October 12	October 19	Mean
1.	Untreated	NA	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
2.	Corsair	1.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
3.	Corsair	2.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
4.	Corsair	3.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	$LSD_{0.05}$		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

[1]Turf quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst quality.
NS = Means are not significantly different at the 0.05 level.

Table 4. Percentage perennial ryegrass cover[1] in Kentucky bluegrass/ryegrass treated for the 2001 Riverdale Corsair Ryegrass Control Study.

	Material	Rate oz/A	August 23	September 21	September 28	October 12	October 19	Mean
1.	Untreated	NA	53.3	53.3	51.7	43.3	41.7	48.7
2.	Corsair	1.0	0.0	0.0	0.0	0.0	0.0	0.0
3.	Corsair	2.0	0.0	0.0	0.0	0.0	0.0	0.0
4.	Corsair	3.0	0.0	0.0	0.0	0.0	0.0	0.0
	$LSD_{0.05}$		5.8	5.8	2.9	5.8	2.9	3.1

[1]Damage was assessed using a 9 to 1 scale with 9 = no damage, 5 = 50% ryegrass mortality, and 1 = 100% ryegrass mortality.

Table 5. Percentage creeping bentgrass cover[1] in plots treated for the 2001 Riverdale Corsair Ryegrass Control Study.

	Material	Rate oz/A	August 10	August 16	August 23	August 30	September 6	September 13	September 21	September 28	October 12	October 19	Mean
1.	Untreated	NA	99.0	99.0	90.0	96.3	99.0	99.0	100.0	100.0	100.0	100.0	98.2
2.	Corsair	1.0	99.0	99.0	95.0	86.7	90.0	96.3	100.0	100.0	98.3	100.0	96.4
3.	Corsair	2.0	99.0	99.0	58.3	73.3	76.7	96.3	100.0	100.0	100.0	100.0	90.3
4.	Corsair	3.0	99.0	99.0	63.3	56.7	75.0	91.7	96.7	96.7	100.0	100.0	87.8
	$LSD_{0.05}$		NS	NS	36.3	23.0	15.5	4.3	2.9	2.9	NS	NS	5.7

[1]These data represent the percentage area per plot covered by creeping bentgrass.
NS = Means are not significantly different at the 0.05 level.

Table 6. Percentage turfgrass cover (Kentucky bluegrass and perennial ryegrass)[1] in plots treated for the 2001 Riverdale Corsair Ryegrass Control Study.

	Material	Rate oz/A	August 10	August 16	August 30	September 6	September 13	September 21	September 28	October 12	October 19	Mean
1.	Untreated	NA	100.0	100.0	93.3	88.3	96.3	96.7	100.0	100.0	100.0	93.9
2.	Corsair	1.0	100.0	100.0	55.0	68.3	71.7	75.0	80.0	93.3	86.7	81.1
3.	Corsair	2.0	100.0	100.0	51.7	60.0	73.0	78.3	85.0	86.7	86.7	80.1
4.	Corsair	3.0	100.0	100.0	30.0	38.3	55.0	58.3	65.0	78.3	76.7	66.9
	$LSD_{0.05}$		NS	NS	NS	27.8	22.8	25.1	25.6	NS	NS	17.7

[1]These data represent the percentage area per plot covered by Kentucky bluegrass and perennial ryegrass.
NS = Means are not significantly different at the 0.05 level.

Ronstar: Demonstration of Efficacy of Various Granular Formulations

B. R. Bingaman and N. E. Christians

This preemergent study was designed to evaluate the efficacy of commercial granular Ronstar formulations, new Ronstar prototypes and comparable rates of Ronstar on fertilizer carriers. The research was conducted at the Horticulture Research Station north of Ames, IA in established 'common' Kentucky bluegrass with a history of crabgrass infestations. The soil was a Nicollet (fine-loamy, mixed, mesic Aquic Hapludoll) with 2.5% organic matter, 66 ppm K, 9 ppm P, and a pH of 7.6.The design was a randomized complete block. Three replications were conducted and individual plot size was 5 x 5 ft. Irrigation was used to supplement rainfall and to maintain the turf in good growing condition. Experimental formulations and commercial products containing Ronstar were screened with an untreated control. Pendimethalin 60WDG was included as a treated control for comparisons (Table 1).

Early preemergence materials were applied on April 27 and 'normal' preemergence materials were applied on May 25. The Lesco fertilizer formulation with Ronstar did not arrive until May 4. The early application of this material (treatment #3) was made on May 4. The 'normal' application was made with the other treatments on May 25. All applications were made before crabgrass germination and were 'watered in'. Granular materials were applied using 'shaker dispensers' to ensure uniform application. Sprayables were applied using a carbon dioxide backpack sprayer equipped with TeeJet #8006 nozzles at a spray pressure of 30-40 psi. Liquid formulations were mixed with water to a volume equivalent to 3 gal/1000 ft^2.

Crabgrass germination in the untreated controls was noted on July 11 but the plants were not large enough to assess. Crabgrass infestation data were taken beginning July 25 and ending on August 28 (Table 3). Populations were estimated as the percentage coverage per plot. These data were converted to express crabgrass control as compared with the untreated controls (Table 5). Turf quality was monitored throughout the season and data were taken weekly from May 9 through August 28 (Tables 1 and 2). Quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst quality. There was no phytotoxicity on the bluegrass.

Data were analyzed using the Statistical Analysis System (SAS Institute Inc., 1989-1996) and the Analysis of Variance (ANOVA) procedure. Treatment effects on weed populations and visual quality were tested using Fisher's Least Significant Difference (LSD) test.

Ronstar formulations with fertilizer improved turf quality as compared to the other treated and untreated turf in May and June (Tables 1 and 2). These differences were significant for all weeks except May 1 and June 6. After June 27, the nitrogen response was gone and turf quality was similar for all treated and untreated turf.

All herbicide formulations reduced crabgrass populations significantly as compared with the untreated control (Tables 3 and 4). Crabgrass control levels were similar in all treated plots except on August 28 when significant differences among the treatments were recorded. There was significantly less crabgrass in turf treated with either Lesco fertilizer + Ronstar or TADS 14596 as compared with Pendimethalin 60WDG and the untreated control. Mean population values were similar for all treatments and were significantly lower than the untreated control. The best numerical control was provided by Lesco fertilizer + Ronstar but this level was not different from that produced by the other herbicides.

Table 1. Turf quality of Kentucky bluegrass treated for the 2001 Aventis Preemergence Annual Grass Study (May 1-July 3).

	Material	Rate	Visual quality									
		lb a.i./A	May 1	May 8	May 15	May 22	June 1	June 6	June 15	June 22	June 27	July 3
1.	Untreated control	NA	7.0	6.0	6.3	6.0	6.3	6.0	6.0	5.0	5.0	6.0
2.	Ronstar G 2.0% a.i.	3.0	7.0	6.0	6.3	6.0	6.0	6.0	6.0	5.0	5.0	6.0
3.	Lesco fertilizer w/Ronstar (0.95% a.i./A)	3.0	7.0	6.7	8.0	8.3	8.0	8.3	6.7	6.7	6.7	6.0
4.	Scotts 21-0-20 fertilizer w/1.5% Ronstar	3.0	9.0	9.0	9.0	9.0	9.0	9.0	8.3	7.0	7.0	6.0
5.	Ronstar (Regal 2% a.i.)	3.0	7.0	6.0	6.0	6.0	6.0	6.0	6.0	5.0	5.0	6.0
6.	TADS 14595 2.0% a.i.	3.0	7.0	6.0	6.0	6.0	6.0	6.3	6.0	5.0	5.0	6.0
7.	TADS 14596 2.0% a.i.	3.0	7.0	6.0	6.0	6.0	6.0	6.0	6.3	5.0	5.0	6.0
8.	TADS 14597 2.0% a.i.	3.0	7.0	6.0	6.0	6.0	6.0	6.0	6.0	5.0	5.0	6.0
9.	Pendimethalin 60WDG	1.5	7.0	6.0	6.0	6.0	6.0	6.0	6.0	5.0	5.0	6.0
	$LSD_{0.05}$		---	0.3	0.6	0.3	0.4	--	0.6	0.3	0.3	---

[1]Turf quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst turf quality.
Early applications were made on April 27, and normal preemergent applications were made on May 25, 2001.
(Treatment #3 applied on May 4, 2001 and May 25, 2001)

Table 2. Turf quality of Kentucky bluegrass treated for the 2001 Aventis Preemergence Annual Grass Study (July 11 - August 28).

			Visual quality								
	Material	Rate lb a.i./A	July 11	July 17	July 25	Aug 3	Aug 9	Aug 16	Aug 21	Aug 28	Mean
1.	Untreated control	NA	7.0	7.0	7.0	8.0	8.0	9.0	9.0	9.0	6.9
2.	Ronstar G 2.0% a.i.	3.0	7.0	7.0	7.0	8.0	8.0	9.0	9.0	9.0	6.9
3.	Lesco fertilizer w/Ronstar (0.95% a.i./A)	3.0	7.0	7.0	7.0	8.0	8.0	9.0	9.0	9.0	7.6
4.	Scotts 21-0-20 fertilizer w/1.5% Ronstar	3.0	7.0	7.0	7.0	8.0	8.0	9.0	9.0	9.0	8.1
5.	Ronstar (Regal 2% a.i.)	3.0	7.0	7.0	7.0	8.0	8.0	9.0	9.0	9.0	6.8
6.	TADS 14595 2.0% a.i.	3.0	7.0	7.0	7.0	8.0	8.0	9.0	9.0	9.0	6.9
7.	TADS 14596 2.0% a.i.	3.0	7.0	7.0	7.0	8.0	8.0	9.0	9.0	9.0	6.9
8.	TADS 14597 2.0% a.i.	3.0	7.0	7.0	7.0	8.0	8.0	9.0	9.0	9.0	6.9
9.	Pendimethalin 60WDG	1.5	7.0	7.0	7.0	8.0	8.0	9.0	9.0	9.0	6.8
	$LSD_{0.05}$		---	---	---	---	---	---	---	---	0.1

[1]Turf quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst turf quality.
Early applications were made on April 27, and normal preemergent applications were made on May 25, 2001.
(Treatment #3 applied on May 4, 2001 and May 25, 2001)

Table 3. Percentage crabgrass cover[1] in Kentucky bluegrass treated for the 2001 Aventis Preemergence Annual Grass Study.

	Material	Rate lb a.i./A	July 11	July 17	July 25	Aug 3	Aug 9	Aug 16	Aug 21	Aug 28	Mean
1.	Untreated control	NA	1.0	5.0	6.7	15.0	21.7	21.7	33.3	35.0	17.4
2.	Ronstar G 2.0% a.i.	3.0	0.0	0.0	0.3	0.3	5.0	5.0	5.0	5.0	2.6
3.	Lesco fertilizer w/Ronstar (0.95% a.i./A)	3.0	0.0	0.0	0.0	2.0	2.3	2.3	2.3	2.3	1.4
4.	Scotts 21-0-20 fertilizer w/1.5% Ronstar	3.0	0.0	0.0	0.0	1.0	2.3	2.3	3.7	5.0	1.8
5.	Ronstar (Regal 2% a.i.)	3.0	0.0	0.0	0.3	3.7	5.3	5.3	7.0	8.3	3.8
6.	TADS 14595 2.0% a.i.	3.0	0.0	0.0	0.3	2.0	4.0	4.0	6.7	5.0	2.8
7.	TADS 14596 2.0% a.i.	3.0	0.0	0.0	0.0	2.0	3.7	3.7	3.7	2.3	1.9
8.	TADS 14597 2.0% a.i.	3.0	0.0	0.0	2.0	3.3	6.7	6.7	6.7	6.7	4.0
9.	Pendimethalin 60WDG	1.5	0.0	0.0	0.0	1.7	3.7	3.7	7.0	10.0	3.3
	$LSD_{0.05}$		--	--	2.2	5.7	6.2	6.2	7.2	6.1	3.4

[1]These data represent the percentage area per plot covered by crabgrass.

Early applications were made on April 27, and normal preemergent applications were made on May 25, 2001.

(Treatment #3 applied on May 4, 2001 and May 25, 2001)

Table 4. Percentage crabgrass control[1] in Kentucky bluegrass treated for the 2001 Aventis Preemergence Annual Grass Study.

	Material	Rate lb a.i./A	July 11	July 17	July 25	Aug 3	Aug 9	Aug 16	Aug 21	Aug 28	Mean
1.	Untreated control	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.	Ronstar G 2.0% a.i.	3.0	100.0	100.0	95.0	97.8	77.0	77.0	85.0	85.7	85.2
3.	Lesco fertilizer w/Ronstar (0.95% a.i./A)	3.0	100.0	100.0	100.0	86.7	89.2	89.2	93.0	93.3	91.9
4.	Scotts 21-0-20 fertilizer w/1.5% Ronstar	3.0	100.0	100.0	100.0	93.3	89.2	89.2	89.0	85.7	89.7
5.	Ronstar (Regal 2% a.i.)	3.0	100.0	100.0	95.0	75.6	75.4	75.4	79.0	76.2	78.4
6.	TADS 14595 2.0% a.i.	3.0	100.0	100.0	95.0	86.7	81.6	81.6	80.0	85.7	84.2
7.	TADS 14596 2.0% a.i.	3.0	100.0	100.0	100.0	86.7	83.1	83.1	89.0	93.3	89.0
8.	TADS 14597 2.0% a.i.	3.0	100.0	100.0	70.1	77.8	69.3	69.3	80.0	81.0	77.0
9.	Pendimethalin 60WDG	1.5	100.0	100.0	100.0	88.9	83.1	83.1	80.0	71.4	81.3
	$LSD_{0.05}$		--	--	32.6	38.3	28.6	28.6	21.6	17.5	19.8

[1]These data represent the percentage reductions in crabgrass cover as compared with the untreated controls.
Early applications were made on April 27, and normal preemergent applications were made on May 25, 2001.
(Treatment #3 applied on May 4, 2001 and May 25, 2001)

Effects of Application Timing with ZPP1560 on Spectrum of Weed Control in Turf

B. R. Bingaman and N. E. Christians

This study was designed to evaluate the spectrum of weed control provided by ZPP1560 as compared with Roundup RTU and to determine the effect of weed height (timing of application) on weed control. It was conducted at the Horticulture Research Station north of Ames, IA in old planting beds consisting of 'common' Kentucky bluegrass infested with a variety of broadleaf weed species. The soil was a Nicollet (fine-loamy, mixed, mesic Aquic Hapludoll) with 3.2% organic matter, 71 ppm K, 22 ppm P, and a pH of 7.95. Among the plots, there was a uniform distribution of weed species that covered approximately 20% of the area in each plot. The predominate species were dandelion and clover.

The experimental design was a randomized complete block. Three replications were conducted and individual plot size was 5 x 10 ft. An experimental formulation ZPP1560 RTU from Syngenta was screened with Roundup RTU (Table 1).

The first applications were made on May 18 when the weeds were 3 - 5 inches in height. The second applications were made on July 27 when the dandelions and clover were approximately 7- 9 inches in size. The treatments were 'ready to use' formulations and were not diluted for applications. They were applied using a carbon dioxide backpack sprayer equipped with TeeJet #8006 nozzles at a spray pressure of 30-40 psi.

The efficacy of the materials was measured by estimating the percentage area per plot covered by dead plants. The first data were taken on May 22, four days following the initial applications (Table 1). Once regrowth had begun in the treated plots, the percentage of weed cover also was recorded. For these data, estimations were made of the total area per plot covered by green weeds (Table 2). Crabgrass infestations were determined by estimating the percentage of crabgrass cover per plot (Table 3). Weed and crabgrass cover data were taken from June 28 through September 13. In addition, weed populations were recorded by species at the end of the season by estimating the percentage cover per plot (Table 4). Dandelion and clover were the predominate broadleaf species. Redroot pigweed, black medic, and spurge plants were found in two of the fifteen individual plots but the populations were less than 1% of the area.

Data were analyzed using the Statistical Analysis System (SAS Institute Inc., 1989-1996) and the Analysis of Variance (ANOVA) procedure. Treatment effects on percentage dead area and weed coverage were compared using Fisher's Least Significant Difference (LSD) means comparison test.

First application:

When applied to 3 - 5" weeds, Roundup produced faster 'kill' than ZPP1560. On May 22 (four days post treatment), there was a significantly larger area of dead plants in plots treated with Roundup than in either those treated with ZPP1560 or in untreated (Table 1). By May 29, there was total 'kill' of plant material in plots treated with the herbicides.

Weeds began to grow in the treated plots approximately four weeks post treatment and on June 21 there were significantly more weeds in the plots treated with Roundup as compared with plots treated with ZPP1560 and plots untreated. Weed coverage was similar for both herbicides after June 28 and the percentage weed cover was > 97% for July 11 through September 13. The predominate weed species covering the previously treated plots was crabgrass. Percentage crabgrass cover was similar in treated plots but was significantly higher than in untreated plots (Table 3). There were no differences in dandelion numbers on September 13 among the treated and untreated plots (Table 4). There was no clover in the previously treated plots on September 13.

Second application:

When larger weeds (7-9") were treated, similar levels of plant death at four days post treatment were produced for the herbicides. Total 'kill' of all plant material in these plots was recorded on August 9.

Live weeds were first noted in the treated plots on August 21 and by September 13, there were similar levels of weed cover in the treated plots (Table 2). Percentage weed cover was 26.7% for ZPP1560 and 20.0% for Roundup. Crabgrass and dandelion populations also were similar in the treated plots on September 13 (Tables 3 and 4).

Table 1. Percentage dead area[1] in turfgrass treated for the 2001 Syngenta Weed Control Study.

	Material	Weed height at application	May 22	May 29	June 8	June 15	June 21	July 11	July 17
1.	Untreated control	NA	0.0	0.0	0.0	0.0	0.0	0.0	1.7
2.	ZPP1560	3-5"	41.7	100.0	100.0	100.0	60.0	0.0	1.3
3.	Roundup 0.96% a.i.	3-5"	75.0	100.0	100.0	100.0	71.7	0.0	2.7
4.	ZPP1560	7-9"	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.	Roundup 0.96% a.i.	7-9"	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	$LSD_{0.05}$		15.5	---	---	---	11.4	---	NS

	Material	Weed height at application	July 30	Aug 9	Aug 16	Aug 21	Aug 28	Sept 13	Mean
1.	Untreated control	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.	ZPP1560	3-5"	0.0	0.0	0.0	0.0	0.0	0.0	31.0
3.	Roundup 0.96% a.i.	3-5"	0.0	0.0	0.0	0.0	13.3	0.0	35.6
4.	ZPP1560	7-9"	85.0	100.0	100.0	100.0	90.0	66.7	41.8
5.	Roundup 0.96% a.i.	7-9"	80.0	100.0	100.0	100.0	91.3	80.0	42.7
	$LSD_{0.05}$		13.8	---	---	---	20.7	20.2	2.2

[1]These data represent the percentage area in each plot covered by dead plants.
*Ready to use formulation applied at 100 gallons/A to provide 'too wet' coverage.
First applications (3-5" weed height) were made on May 18 and second applications (7-9" weed height) on July 27, 2001
NS = means are not significantly different at the 0.05 level.

Table 2. Percentage weed cover in turfgrass treated for the 2001 Syngenta Weed Control Study.

	Material	Weed height at application	June 28	July 3	July 11	July 17	July 25	Aug 9
1.	Untreated control	NA	30.0	33.3	36.7	38.3	61.7	61.7
2.	ZPP1560	3-5"	70.0	70.0	100.0	98.7	100.0	100.0
3.	Roundup 0.96% a.i.	3-5"	66.7	66.7	100.0	97.3	100.0	100.0
4.	ZPP1560	7-9"	50.0	51.7	31.7	38.3	60.0	0.0
5.	Roundup 0.96% a.i.	7-9"	28.3	28.3	28.3	35.7	63.3	0.0
	$LSD_{0.06}$		34.0	32.6	19.3	23.6	24.2	10.6

	Material	Weed height at application	Aug 16	Aug 21	Aug 28	Sept 13	Mean
1.	Untreated control	NA	61.7	61.7	50.0	53.3	48.8
2.	ZPP1560	3-5"	100.0	100.0	100.0	100.0	93.9
3.	Roundup 0.96% a.i.	3-5"	100.0	100.0	100.0	100.0	93.1
4.	ZPP1560	7-9"	0.0	1.0	10.0	26.7	26.9
5.	Roundup 0.96% a.i.	7-9"	0.0	1.0	8.7	20.0	21.4
	$LSD_{0.05}$		10.6	10.6	6.4	12.9	9.9

[1]These data represent the percentage area in each plot covered by green, healthy weeds.

*Ready to use formulation applied at 100 gallons/A to provide 'too wet' coverage.

First applications (3-5" weed height) were made on May 18 and second applications (7-9" weed height) on July 27, 2001

Table 3. Percentage crabgrass cover[1] in turfgrass treated for the 2001 Syngenta Weed Control Study.

	Material	Weed height at application	June 28	July 3	July 25	Sept 13	Mean
1.	Untreated control	NA	28.3	33.3	25.0	16.7	25.8
2.	ZPP1560	3-5"	65.0	70.0	98.3	85.0	79.6
3.	Roundup 0.96% a.i.	3-5"	63.3	66.7	98.3	85.0	78.3
4.	ZPP1560	7-9"	26.7	28.3	43.3	5.0	25.8
5.	Roundup 0.96% a.i.	7-9"	25.0	25.0	31.7	3.7	21.3
	$LSD_{0.05}$		20.3	17.1	33.2	11.4	15.0

[1]These data represent the percentage area in each plot covered by crabgrass.
*Ready to use formulation applied at 100 gallons/A to provide 'too wet' coverage.
First applications (3-5" weed height) were made on May 18 and second applications (7-9" weed height) on July 27, 2001

Table 4. Percentage dandelion and clover cover on September 13 in turfgrass treated for the 2001. Syngenta Weed Control Study.

	Material	Weed height at application	Dandelion	Clover
1.	Untreated control	NA	15.0	16.7
2.	ZPP1560	3-5"	16.7	0.0
3.	Roundup 0.96% a.i.	3-5"	15.0	0.0
4.	ZPP1560	7-9"	13.3	0.0
5.	Roundup 0.96% a.i.	7-9"	11.7	1.7
	$LSD_{0.05}$		NS	6.3

[1]These data represent the percentage area in each plot covered by either dandelion or clover.
*Ready to use formulation applied at 100 gallons/A to provide 'too wet' coverage.
First applications (3-5" weed height) were made on May 18 and second applications (7-9" weed height) on July 27, 2001.
NS = means are not significantly different at the 0.05 level.

Monsanto 78365 Demonstration for Summer Fastburn Symptomology in Turfgrass

B. R. Bingaman and N. E. Christians

This study was designed to demonstrate at the 2001 Turf Field Day the fastburn symptomology capability of MON 78265 at one, two, three and seven days post treatment and to compare this symptomology to that of Roundup Pro Dry.
This study was conducted at the Horticulture Research Station north of Ames, IA. The plot was in established area of premium Kentucky bluegrass sod mix. The soil was a Nicollet (fine-loamy, mixed, mesic Aquic Hapludoll) with 4.1% organic matter, 93 ppm K, 11 ppm P, and a pH of 6.75. The experimental design was a randomized complete block. Three replications were conducted and individual plot size was 5 x 5 ft.

Experimental MON 78365, Roundup Pro Dry, and Roundup Pro Dry + Scythe 1EC were applied at various intervals before ISU Turfgrass Field Day on August 2 (Table 1). The 14 day before field day treatments were made on July 19, 7 days before on July 26, 3 days before on July 30, 2 days before on July 31, and 1 day before on August 1. All materials were applied using a carbon dioxide backpack sprayer equipped with TeeJet #8006 nozzles at a spray pressure of 30-40 psi. Liquid formulations were mixed with water to a volume equivalent to 3 gal/1000 ft^2.

Efficacy of the formulations was assessed by estimating the amount of 'brown' (dead and dying) plant material per plot. These percentage data were taken from July 24 through September 26 (Table 1). The Statistical Analysis System (SAS Institute Inc., 1989-1996) and the Analysis of Variance (ANOVA) procedure were used to analyze the data. Treatment effects were examined with Fisher's Least Significant Difference (LSD) means comparison test.

By July 30, turf areas treated with Roundup Pro Dry at 14 days before field day were totally brown and turf treated with MON 78365 on July 26 was 81.7% brown (Table 2). Turf treated with Roundup Pro Dry alone or Roundup Pro Dry plus Scythe on July 26 had 76.7 and 56.7% brown area, respectively.

There were significant differences in brown areas among the treatments on August 3, one day after field day. Dead areas were similar for the treatments applied seven days before field day. The three days before field day treatments also were similar with 78.3% brown area for MON 78365 and 68.3% for Roundup Pro Dry plus Scythe. The symptomology on turf treated two days before field day showed distinct differences. Treatment with MON 78365 resulted in 76.7% brown area and Roundup Pro Dry plus Scythe produced 61.7% brown-out. However, turf treated with Roundup Pro Dry alone had only 16.7% brown area. Percentage brown areas in turf treated with the one day before field day applications were 66.7 and 43.3% for MON 78365 and Roundup Pro Dry plus Scythe, respectively.

From August 9 through August 28, there was 100% brown-out in all treated turf. Regrowth of plant material was noted on September 13 but by September 26, brown areas in treated turf were still greater than 91% for all materials.

Table 1. Timing and rates of application for nonselective herbicides used in the 2001 Monsanto 78365 Demonstration Study.

	Material	Rate a.i./A	Timing of application (days prior to Field Day- Aug 2) 14 days July 19	7 days July 26	3 days July 30	2 days July 31	1 day Aug 1
1.	Untreated control	NA	NA	NA	NA	NA	NA
2.	MON 78365 66.6%	6 lb		XXXXX			
3.	MON 78365 66.6%	6 lb			XXXXX		
4.	MON 78365 66.6%	6 lb				XXXXX	
5.	MON 78365 66.6%	6 lb					XXXXX
6.	Roundup Pro Dry 64.9%	6 lb	XXXXX				
7.	Roundup Pro Dry 64.9%	6 lb		XXXXX			
8.	Roundup Pro Dry 64.9%	6 lb				XXXXX	
9.	Roundup Pro Dry 64.9%	6 lb		XXXXX			
	+ Scythe 1EC	12 qts					
10.	Roundup Pro Dry 64.9%	6 lb			XXXXX		
	+ Scythe 1EC	12 qts					
11.	Roundup Pro Dry 64.9%	6 lb				XXXXX	
	+ Scythe 1EC	12 qts					
12.	Roundup Pro Dry 64.9%	6 lb					XXXXX
	+ Scythe 1EC	12 qts					

Table 2. Percentage dead area[1] in turfgrass treated for the 2001 Monsanto 78365 Demonstration Study.

	Material	Days before Field Day	July 24	July 30	Aug 3	Aug 9	Aug 16	Aug 22	Aug 28	Sept 13	Sept 20	Sept 26	Mean
1.	Untreated control	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.	MON 78365 66.6%	7	----	81.7	98.3	100.0	100.0	100.0	100.0	99.3	99.0	97.7	99.3
3.	MON 78365 66.6%	3	----	----	78.3	100.0	100.0	100.0	100.0	99.7	99.3	99.0	97.0
4.	MON 78365 66.6%	2	----	----	76.7	100.0	100.0	100.0	100.0	99.7	99.0	99.0	96.8
5.	MON 78365 66.6%	1	----	----	66.7	100.0	100.0	100.0	100.0	99.3	99.0	97.7	95.3
6.	Roundup Pro Dry 64.9%	14	73.3	100.0	100.0	100.0	100.0	100.0	100.0	96.3	96.3	95.0	98.5
7.	Roundup Pro Dry 64.9%	7	----	76.7	93.3	99.7	100.0	100.0	100.0	97.7	99.0	97.7	98.4
8.	Roundup Pro Dry 64.9%	2	----	----	16.7	98.3	100.0	100.0	100.0	99.7	96.7	99.0	88.9
9.	Roundup Pro Dry 64.9% + Scythe 1EC	7	----	56.7	86.7	98.3	100.0	100.0	100.0	95.0	97.7	91.3	96.1
10.	Roundup Pro Dry 64.9% + Scythe 1EC	3	----	----	68.3	100.0	100.0	100.0	100.0	99.3	99.0	96.3	95.4
11.	Roundup Pro Dry 64.9% + Scythe 1EC	2	----	----	61.7	99.3	100.0	100.0	100.0	99.7	99.0	94.7	94.3
12.	Roundup Pro Dry 64.9% + Scythe 1EC	1	----	----	43.3	98.3	100.0	100.0	100.0	99.7	99.3	99.0	92.5
	$LSD_{0.05}$				17.3	2.2	--	--	--	3.1	3.4	4.9	2.3

[1]These data represent the percentage area per plot covered by 'brown' plant material.

Fourteen days before field day applications were made on July 19, 7 days on July 26, 3 days on July 30, 2 days on July 31, and 1 day on August 1, 2001.

Data from August 3 through September 26 are included in calculations for the mean 'brown' area.

Broadleaf Herbicide Study "Lontrel & Confront"

F. Valverde and D.D. Minner

Introduction

Weeds cause problems is general appearance and visual quality of lawns. A single weed in a lawn may be considered a problem for the intended use of that area. Thus it becomes obvious that any method that helps to eliminate or decrease the population of weeds is a point of interest and it requires attention.

Due to the perennial crop cycle in most turf grasses, herbicides that are selective to different weed species are necessary. Lontrel and Confront are selective herbicides in turf species aimed to control several broad leave species. The objective of this study is to test the effectiveness of these two products controlling some broadleaves and to observe their effects on the crop itself.

Materials and Methods

This herbicide study was conducted on a mature stand of common Kentucky bluegrass at the Horticulture farm of Iowa State University from May to August of 2001. The site was located 6 miles north of Ames, Iowa.

Two different herbicides, Confront and Lontrel at two different concentrations were applied over Kentucky Bluegrass (*Poa pratensis*) plots. The study followed a complete randomized block design with 5 treatments including control and 4 replications. Each replication had 5 plots of 5x5 ft. separated by a 2 ft. border between them. Replications were separated by 2 ft. The area had a very uniform and dense population of White Clover (*Trifolium repens*) and Dandelion (*Taraxacum officinale*). Other weeds were present in the surrounding area but in a very limited number and not evenly distributed. Black Medic (*Medicago lupulina*) also appeared inside the study area but in such scarce level that no statistical analysis was performed; however data is shown at the end.

Treatments were applied using a backpack CO_2 sprayer on May 15. Lontrel was applied at 0.5 and 1.0 PT PR/A, Confront was applied at 1.0 and 2.0 PT PR/A. Control plots only received a water spray.

Visual assessment of turf and weeds was conducted at 2, 4, 6 and 10 weeks after treatment application. The variables recorded were % cover of each of the present weed species and also the turf crop. An injury index was established and recorded for the same species. This index ranged from 0 (no injury) to 10 (dead but still present).

Percent weed control was calculated using the percent cover of each of the weeds in each treatment-plot compared to the control-plot in its respective replication at the time of evaluation.

Analysis of variance and LSD were calculated for each the recorded variables. Raw data and statistical tests appear in the appendix tables at the end of this report.

Results

Crop Injury

Kentucky bluegrass in the study area remained actively growing during the entire study with no evidence of turf injury by treatments or environmental conditions.

White Clover

The percent control of White Clover appears in table 1. Both Lontrel and Confront provided good control of white clover. Two weeks after the application of herbicides there was already 50-70% reduction on weed populations. Their effects increased during the 4 and 6 week after application surpassing the 90% of control. By the 10^{th} week new plants of white clover appeared although in very limited numbers. There was a significant difference between control and herbicides along the duration of the trial. But there were only significant differences between herbicides on the last two readings for Lontrel 0.5 compared to the other treatments. Lontrel 0.5 showed a lower degree of control.

Table 1. Percent of control (*) on White Clover (*Trifolium repens*) and Dandelion (*Taraxacum officinale*) observed in Kentucky Bluegrass (*Poa pratensis*) plots on 4 different dates after herbicide application.

Treatments	Number of weeks after application							
	2	4	6	10	2	4	6	10
	White Clover % Control				Dandelion % Control			
Lontrel 0.5 PT PR/A	72.0	93.3	88.8	80.0	40.0	56.7	75.0	-20.0
Lontrel 1.0 PT PR/A	54.0	96.9	94.2	91.7	37.5	74.5	94.4	100.0
Confront 1.0 PT PR/A	57.1	95.0	95.6	93.6	6.3	65.6	85.0	72.5
Confront 2.0 PT PR/A	62.5	97.8	96.9	87.9	12.5	84.4	95.7	90.0
Control	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prob	0.0033	0.0000	0.0000	0.0000	0.2302	0.0001	0.0000	0.0000
LSD 0.05	32.39	5.40	4.16	8.48	44.31	22.04	5.81	23.83
C.V. %	9.57	10.23	0.80	1.74	33.40	6.76	1.20	7.13

(*) Percent control based on percentage of species in treated plots vs. control plots.

Dandelion

In contrast as shown in table 1, the effect of treatments on Dandelion were evident only after the 4th week. Even though there are some evidence of effect by the 2nd week, this was not significantly different from the control as indicated by the anova. Four weeks after application herbicides showed between 55 and 85 % of control compared to the non-treated plots and they were significantly different against control but not among them. The effect of herbicides are more clear by the 6th week where they not only show significant differences against control but also between chemicals and their rates of application.

At the lowest rate applied Confront gave better control of dandelion than Lontrel. At the highest rate Confront and Lontrel provided similar dandelion control and both resulted in about 95% of the control.

By the last reading date, Lontrel 0.5 was not significantly different than the control, however Lontrel 1.0 showed a perfect (100%) control of dandelion. Confront at both rates showed a very similar behavior as the previous reading date. However, there were already indications of new plants of dandelion growing at this time.

Total Weed Control

As it can be observed in table 2, weed populations were dense at the starting point. More than 50% of the plots were covered with weeds at the onset of the trial. Four weeks after treatment application on control plots, in average weed populations had over 80% of the area covered. This makes even more dramatic the observed effect of herbicides. The analysis of variance showed significant differences between treated and non treated plots at all four reading dates, being the difference much clearer at 6 weeks after treatment application.

Table 2. Percent of total weed cover observed in Kentucky Bluegrass (*Poa pratensis*) plots on 4 different dates after herbicide application.

Weeds % Coverage	2 weeks after applic.	4 weeks after applic.	6 weeks after applic.	10 weeks after applic.
Lontrel 0.5 PT PR/A	22.0	15.0	7.3	10.0
Lontrel 1.0 PT PR/A	30.3	14.0	4.3	4.3
Confront 1.0 PT PR/A	33.8	16.3	6.3	9.8
Confront 2.0 PT PR/A	28.8	7.3	2.8	6.8
Control	52.5	81.3	65.0	57.0
Prob.	0.0030	0.0000	0.0000	0.0000
LSD 0.05	12.97	12.04	11.19	15.24
C.V. %	5.63	6.53	9.50	12.60

There were significant differences between herbicides-rates during the 2 first readings but not at 6 or 10 weeks after treatment application. In the first reading Lontrel 0.5 showed the best control with only a 22% cover of weeds in average. Four weeks after treatment Confront 2.0 is significantly better than the rest of treatments with only 7% of weed cover. Although there are no significant differences among herbicides 6 weeks after application, Confront 2.0 showed the minimum percent cover of weeds during the whole trial. Control plots also showed a decrease in the percent cover of weeds after the 2 reading, maybe as a product of the dry conditions that were present during most of June and July.

Conclusions

Two major points can be extracted from this trial.

First is the effective control of dandelion and white clover by Lontrel and Confront without any injury to Kentucky bluegrass.

Second, although not statistally significant, the high rate of Confront gave the greatest level of weed control

Also it was observed that white clover was affected by herbicides some time sooner than dandelion. Dandelion was harder to eliminate and new plants were coming back at week 10. A second application later during the summer season may be considered.

Fine Tuning Calcium Chloride – Urea Ratios for De-Icer Purposes

F.J. Valverde; D.D. Minner

Introduction

In areas where winters are characterized by the large amount of snowfall, it is a common practice to use "de-icers" as a mean to clear pathways, sidewalks and streets. The nature and characteristics of these products vary widely. However it is a common effect among all of them the damage they cause to turf areas due to the increased salinity in the surroundings of the treated area.

Previous trials have defined a mixture of calcium chloride and urea as one of the most effective de-icers with minimum damage to turf species. Nevertheless this does not mean that areas treated with this product are exempt of injury.

It has brought to attention that varying the ratio between urea and calcium chloride could possibly decrease the negative effect on turf without decreasing considerably the melting capabilities of the de-icer.

The objective of this study is to compare the effect that different mixtures of calcium chloride and urea applied on winter can have on turf quality and appearance during spring time.

Materials and Methods

This de-icer study was conducted at the Horticulture farm of Iowa State University from December 2000 until June 2001. The site was located 6 miles north of Ames, Iowa.

Different mixtures of calcium chloride and urea were applied over Kentucky Bluegrass (*Poa pratensis*) plots. The study followed a complete randomized block design with 8 treatments (Table 1) including control and 3 replications. Each replication had 8 plots of 4x2 ft. separated by a 1 ft. border between them. Replications were separated by 2 ft.

Each treatment was applied weekly during 9 weeks starting on December 15. To reach a concentration of 2.5% W/V (Brine solution), 2 liters of water was used in each application. This simulated a 1/10 inch water film over the grass.

Treatments were initially applied using a backpack CO_2 sprayer, however due to the extreme cold conditions a hand sprayer was used in the last 6 applications. Control plots only received a water spray. Also it must be noted that due to the particularity of the site and weather conditions it was required to remove the snow from the treated plots in the first 3 applications. The accumulation of snow at that point reached over 12 inches, which would not allow a uniform application of treatments. A snow blower and a brush were used for this purpose.

Table 1. Total amount and ratio of calcium chloride and urea applied over 8 ft^2 in each of the 9 applications.

Treatment	$CaCl_2$		Urea	
	%	gr/plot	%	gr/plot
1	70	35.0	30	15.0
2	75	37.5	25	12.5
3	80	40.0	20	10.0
4	85	42.5	15	7.5
5	90	45.0	10	5.0
6	95	47.5	5	2.5
7	100	50.0	0	0
8	0	0	0	0

Treatments were evaluated on 4 different dates, March 26, April 14, May 9 and June 1. The variables recorded were color, percentage coverage of turf plants coverage and % coverage of turf plants with seed heads. The index of color was based on a scale of 1 to 10 where 1 refers to total brown or white color and 10 dark even green; 6 is considered the least acceptable green. The other 2 indexes are referred on a percentage basis.

Analysis of variance and LSD were calculated for each of the recorded variables. In June 1 plant samples were collected for total nitrogen. Results of those test will be submitted at a later date of this report.

Results

To better understand the results shown in this report, it is necessary to consider that the winter of 2000-2001 in the Ames area had over 100 days with permanent snow cover. The surrounding area where the treatments were applied maintained over 6 inches of snow since early December until late March. Temperatures were very low for a long period of time.

The readings of turf color appear in table 2. As expected after a long cold winter, the first reading indicated that most of the plants were completely brown,. At this moment plots that received a larger amount of urea were significantly different to those with very little or none urea applied. Also it can be noted that control plots had statically better appearance than the treated ones.

Near 3 weeks later in a second reading , the results have varied very little. Due to the still cold temperatures, no new growth was expected. Results are very similar to the previous date. Control plots are still statically with better color than the treated ones.

Table 2. Observed color in $CaCl_2$-Urea plots at 4 different dates during spring of 2001.

$CaCl_2$/Urea ratio	March 26	April 14	May 9	June 1
70/30	1.00	1.00	3.00	9.67
75/25	1.67	1.00	2.33	8.67
80/20	1.33	1.67	2.67	8.33
85/15	2.00	1.67	2.00	7.00
90/10	1.67	1.33	2.00	7.33
95/5	2.00	2.00	2.33	6.00
100/0	2.00	1.67	2.00	4.00
Control	3.00	3.00	6.00	6.00
Prob.	0.0007	0.0013	0.0000	0.0001
LSD 0.05	0.648	0.752	0.926	1.6157

In May 9, during the third reading it can be appreciated that plants already started to grow and new green tissue is already present. Again there were significant differences between the treatment with the largest amount of urea and the one with 100% $CaCl_2$, however the relationship is inverse to the 2 previous readings. In this case the treatment with the larger amount of urea show a better color than any other treatment (excluding control). Although the increment on the 70/30 treatment is higher enough to be the best treatment in this reading, the increment in the control plots are far better. Two major points can be extracted from this observation. The first is that the availability of extra nitrogen in the high urea treatments may be already stimulating new growth. However the damage inflicted by the de-icer is still greater than the benefit obtained at this point.

In the last reading, after a considerable improvement in growing conditions, treatments with at least 20% of urea had significantly better color than the control. Treatments with 15,10 and 5 % of urea improved considerably from last reading however they were not significantly different than the control. Control plots did not show an improvement from previous readings, which may be attributed to low levels of nitrogen available in the soil. Treatments with no nitrogen added and high calcium chloride are statically with worse color than any other treatment.

It is clear at this point that supplemental nitrogen in the de-icer mix has overcome the damage inflicted previously. Due to the lack of color development in the last period of time by the control plots it is believed that the area in which the trial was applied has a very limited source of nitrogen. Other areas with higher levels of nitrogen may not have shown differences between control and de-icer applications.

Other variables recorded were percentage of coverage and percentage of area cover with seed heads (table 3). In May 9, the percent coverage followed the same pattern observed in color for the same date. The tendency (excluding control) showed a better coverage in plots with higher ratio of urea; although there were no significant differences between treatments that contained urea. The only significant difference appears between the treatment with 100% $CaCl_2$ and all the others.

Table 3. Percentage turf coverage and percentage of area cover with seed heads.

$CaCl_2$/Urea ratio	% Turf Coverage May 9	% Coverage Seed heads June 1
70/30	96.67	28.33
75/25	91.67	11.67
80/20	90.00	18.33
85/15	91.67	16.67
90/10	85.00	10.00
95/5	86.67	13.33
100/0	60.00	10.00
Control	100.00	88.33
Prob.	0.0006	0.0000
LSD 0.05	13.26	14.32

Control plots showed a 100% coverage at this time, indicating again that even the safest mixture of $CaCl_2$ and urea had a detrimental effect on the plants.

A very interesting phenomenon occurred in the treated area and surroundings. Towards the end of May the turf started to produce seed heads in a very dense fashion. Some differential effect on the treatments was observed and this variable was recorded and shown in table 3.

Before looking at the numbers it was believed that areas with low nitrogen could be the ones having the largest amount of seed heads due to a stressed condition. After looking at the analysis of variance this idea was not clear any more. Results indicate that the largest amount of seed heads appeared in control plots, however within treatments the one with higher ratio of urea showed the highest number of seed heads.

It is still possible that the low available nitrogen has triggered the higher amount of seed heads in the control plots. In the case of de-icer treatments differences may be due to the differential damage observed in previous dates and not directly to nitrogen availability. This point will be cleared when results from total nitrogen come from the laboratory.

As an extra note, during the first readings, it was appreciated that even the control plots of the study were in a worse state of color and quality that the area next to them, where no snow was removed. Its is believed that the long and cold winter affected extensively the treated area. The layer of snow that remained around the study could have protected the turf, therefore its greener color and denser condition.

Conclusions

There are significant differences even between small variations in the ratios of urea and $CaCl_2$.

Under the conditions of this study the mixture of 30% urea and 70% $CaCl_2$ seems to be the least damaging of the options. Also this ratio seems to be the one with higher benefits and better color development.

Benefits if there are, are not expected to be evident until late spring.

Brown Patch Fungicide Trial

Mark L. Gleason, Stephen N. Wegulo, Sara J. Helland, and John P. Newton

Trials were conducted at Veenker Golf Course on the campus of Iowa State University. Fungicides, selected for activity against brown patch, were applied to creeping bentgrass maintained at 0.16-inch cutting height, using a modified bicycle sprayer at 30 psi and a dilution rate of 5 gal per 1,000 sq ft. The experimental design was a randomized complete block with four replications. All plots measured 4 ft x 5 ft. Fungicide treatments were all applied on 21 Jun, then re-applied at recommended intervals on 2, 5, 12, and 20 Jul.

Brown patch symptoms were first observed on 27 Jun. Most products suppressed brown patch and dollar spot significantly in comparison to the unsprayed control on 6 Aug. No phytotoxicity symptoms were observed during the trial.

Fungicide products, application rates and intervals, and brown patch and dollar spot severity at the Veenker Golf Course, 2001

Product and rate per 1,000 sq ft	Interval (days)	Brown Patch* 6/27/01	Brown Patch 7/11/01	Brown patch 7/24/01	Brown patch 8/6/01	Dollar Spot** 6/27/01	Dollar spot 7/11/01	Dollar spot 7/24/01	Dollar spot 8/6/01
Unsprayed check..........................	--	1.3	3.5	3.8	3.8	3.3	10.3	9.3	16.5
Eagle G (XF-00023) 4.0z..................	14	1.0	2.3	3.8	0.8	12.5	20.1	14.0	1.0
Eagle G (XF-00023) 8.0z..................	28	2.3	1.5	2.5	2.5	4.0	6.0	7.4	5.5
Eagle G (XF-00024) 2.5z..................	14	0.3	1.0	2.3	1.3	8.0	15.1	14.0	9.8
Eagle G (XF-00024) 5.0z..................	28	0.5	1.8	2.5	0.5	7.4	14.0	9.9	5.0
Eagle/Daconil (XF-00044) 3.5 oz.....	14	0.5	3.3	3.3	3.5	11.5	20.5	21.5	20.0
Eagle/Daconil (XF-00044) 7.0 oz.....	28	0.5	2.0	1.5	0.5	10.3	16.3	5.1	10.1
Golden Eagle 4.0 oz.....................	14	1.5	1.3	2.3	1.5	10.0	10.5	11.9	4.8
Golden Eagle 4.0 oz.........................	28	1.3	1.5	2.5	2.3	2.5	7.5	8.1	9.6
Banner MAXX 2.0 oz	14	1.0	0.0	0.0	0.0	3.4	0.4	1.7	0.0
Bayleton 0.5G 1.5 oz........................	14	1.0	0.0	0.0	0.5	8.9	1.2	0.0	0.0
Daconil 82.5 WDG 3.2 oz..............	14	1.0	0.0	0.5	1.0	4.5	2.3	0.8	1.8
Confidential 2.0 fl oz........................	7	2.3	0.3	0.3	0.3	15.0	7.5	1.3	4.5
Confidential 4.0 fl oz........................	7	2.0	2.0	4.5	2.0	4.8	8.5	9.0	9.0
Confidential 2.0 fl oz........................	7	1.3	2.3	2.3	1.5	4.8	11.3	11.5	0.0
Confidential 4.0 fl oz........................	7	0.5	2.3	2.3	0.5	0.8	3.1	1.5	4.0
Confidential 2.0 fl oz........................	7	1.5	1.8	1.3	0.3	19.3	25.8	17.0	1.8
Confidential 4.0 fl oz........................	7	1.8	1.3	2.5	0.8	9.5	10.5	11.0	23.8
Confidential 2.0 fl oz.....................	7	1.3	2.0	1.5	0.5	3.5	11.0	10.8	11.3
Confidential 4.0 fl oz..........................	7	1.3	3.3	2.0	0.3	8.8	13.0	12.0	13.8
Confidential 2.0 fl oz.....................	7	1.3	2.3	2.5	1.5	8.8	17.5	10.5	13.8
Confidential 4.0 fl oz........................	7	2.8	1.3	2.5	2.0	10.8	17.5	16.5	4.5
Daconil Ultrex 82.5 WDG 3.2 oz...... +Primo MAXX 1 MEC 0.15 fl oz	14	1.0	0.3	0.0	1.0	10.0	2.3	0.3	2.3
Daconil Ultrex 82.5 WDG 3.2 oz...... +Banner MAXX 1.3 MEC 0.5 fl oz +Primo MAXX 1 MEC 0.15 fl oz	14	0.8	0.0	0.0	0.0	1.6	0.1	0.4	0.0
Heritage 50WG 0.2 oz.................... +Banner MAXX 1.3 MEC 0.5 fl oz +Primo MAXX 1 MEC 0.15 fl oz	14	0.5	0.0	0.0	0.0	3.8	0.6	0.1	0.3
Banner MAXX 1.3 MEC 1.0 fl oz..... +Primo MAXX 1 MEC 0.2 fl oz	14	1.3	0.0	0.3	0.0	6.1	1.3	0.3	0.0
Heritage 50WG 0.2 oz.................. +Banner MAXX 1.3 MEC 0.5 fl oz	14	0.0	0.0	0.0	0.0	4.3	0.8	0.2	0.5
MSD (K=100)* **		**2.8**	**4.0**	**2.4**	**2.1**	**17.9**	**14.5**	**20.6**	**12.2**

*Mean disease severity rating; 0= no disease, 1= 1-5%, 2= 6-10%, 3= 11-25%, 4= 26-50%, 5= >50% of plot symptomatic n= 4
**% of plot symptomatic. n= 4.
***Minimum significant difference from the Waller-Duncan k-ratio test (K = 100).

Dollar Spot Fungicide Trial

Mark L. Gleason, Stephen N. Wegulo, Sara J. Helland, and John P. Newton

Trials were conducted at the Iowa State University Horticulture Station near Gilbert. Fungicides were applied to creeping bentgrass maintained at 0.16-inch cutting height, using a modified bicycle sprayer at 30 psi and a dilution rate of 5 gal per 1,000 sq ft. The experimental design was a randomized complete block with four replications. All plots measured 4 ft x 5 ft. The entire plot was inoculated with pathogen-infested rye grain on 8 Jun. Spray applications were initiated on 15 Jun in all subplots, then re-applied at recommended intervals on 5 and 13 Jul. The spray regime was suspended on 13 Jul because of absence of dollar spot symptoms. The entire plot was inoculated again on 14 Aug. All subplots were sprayed on this date and on 28 Aug.

Dollar spot symptoms were first observed on 27 Jun. Most products suppressed dollar spot significantly in comparison to the unsprayed control on 27 Jun and on 23 and 31 Aug. No phytotoxicity symptoms were observed during the trial.

Fungicide products, application rates and intervals, and dollar spot severity at the ISU Horticulture Station, 2001

Product and rate per 1,000 sq ft	Interval (days)	Severity (%)		
		6/27/01	8/23/01	8/31/01
Unsprayed check	---	1.88	5.50	5.88
Eagle G (XF-00023) 4.0 oz	14	0.25	3.63	7.75
Eagle G (XF-00023) 8.0 oz	28	0.58	2.80	4.75
Eagle G (XF-00024) 2.5 oz	14	0.38	2.38	5.75
Eagle G (XF-00024) 5.0 oz	28	0.53	2.25	6.50
Golden Eagle 4.0 oz	14	0.10	2.75	4.88
Golden Eagle 8.0 oz	28	0.65	2.13	3.80
Banner MAXX 2.0 oz	14	1.00	0.43	0.15
Bayleton 0.5G 1.5 oz	14	0.43	0.43	0.05
Daconil 82.5WDG 3.2 oz	14	0.58	1.03	0.50
Chipco Triton 1.67SC 0.75 fl oz	14	0.40	1.25	0.65
Chipco Triton 1.67SC 1.0 fl oz	14	0.90	0.40	0.23
Chipco Triton 1.67SC 2.0 fl oz	14	0.18	0.35	0.08
LSD(0.05)		**1.19**	**2.03**	**5.40**

Bermuda Species Traffic Study

D.D. Minner and F.J. Valverde

Introduction

Seeded bermudagrass has been used in northern climates to repair worn athletic fields during the summer (Gaussion et al., 2001). The basic idea is to produce a fast crop of biomass on exposed-bare-soil areas of an athletic field. Football practice fields re-established this way during the summer are superior to weedy and sparsely covered fields by the end of August or start of the fall football season . The bermuda may die in the winter, but there is a net gain of biomass cover. The following study continues these philosophy by evaluating bermudagrass varieties and mixtures with cool season grasses.

Objective

To evaluate seeded and sprigged bermudagrass varieties to repair intensively trafficked areas of northern athletic fields.
To evaluate mixtures of cool and warm season grasses.

Methods

This study was established at the Horticulture Research Farm in Ames Iowa on 11 July 2001. The trial combined 12 combinations of grass species and 2 levels of traffic, for a total of 24 treatments. The experimental design was a randomized complete block with split-plot arrangement. Whole plots consisted of grass species and split plots were traffic levels. There were 3 replications for a total of 72 sample units of 2 ft x 12 ft. The species or combinations of species and the establishment method used appear in table 1.

Table 1. Description of species and cultivars and establishment method.

Treat.	Species A	Planting time	Species B	Planting time	Establishment method
1	Yukon	Jul-11	~~~	~~~	Seed
2	Primo	Jul-11	~~~	~~~	Seed
3	Primo	Jul-11	Perennial Rye	Jul-11	Seed
4	Primo	Jul-11	Creeping Bentgrass	Jul-11	Seed
5	Primo	Jul-11	Kentucky Bluegrass	Jul-11	Seed
6	Primo	Jul-11	Perennial Rye	Aug-21	Seed
7	Zoysia	Jul-11	~~~	~~~	Seed
8	Westwood	Jul-11	~~~	~~~	Sprigging
9	Quickstand	Jul-11	~~~	~~~	Sprigging
10	Creeping Bentgrass	Jul-11	~~~	~~~	Seed
11	Perennial Rye	Jul-11	~~~	~~~	Seed
12	Kentucky Bluegrass	Jul-11	~~~	~~~	Seed

Traffic treatments were applied with a GA-SWC traffic simulator (Carrow et al., 2001) on 11 September with 2 and 4 passes each Monday, Wednesday and Friday during the first month. From October 8 to November 1, traffic simulation was increased from 2/4 passes to 3/6 passes each day.

The variables measured were % turf cover, turf color and turf quality. Data was collected monthly, from 23 July to 2 November 2001. Plant samples were collected on 4 November to measure biomass.

Results

Table 2. Percent turf cover for various grass combinations and two levels of traffic. Traffic was applied from 11 Sepetember to 1 November 2001.

Species	Traffic Lev	7/23/2001	8/21/2001	9/11/2001	9/24/2001	10/8/2001	11/2/2001
		% cover					
Yukon	2x	23	85	88	97	98	90
Primo		27	100	100	100	100	100
Primo + PR1		50	98	100	100	100	98
Primo + CB		35	100	100	100	100	93
Primo + KB		22	100	100	100	100	100
Primo + PR2		22	100	100	100	100	97
Zoysia		5	0	33	0	0	0
Westwood		38	98	100	100	100	100
Quickstand		43	100	100	100	100	100
Creeping B.		30	27	58	77	78	48
Perennial R.		47	62	82	93	95	97
Kentucky B.		22	0	8	0	0	15
Yukon	4x	23	85	88	100	98	90
Primo		27	100	100	98	100	88
Primo + PR1		50	98	100	98	98	87
Primo + CB		35	100	100	98	98	77
Primo + KB		22	100	100	100	98	80
Primo + PR2		22	100	100	98	97	78
Zoysia		5	0	33	0	0	0
Westwood		38	98	100	100	100	87
Quickstand		43	100	100	100	100	92
Creeping B.		30	27	58	58	45	15
Perennial R.		47	62	82	87	92	78
Kentucky B.		22	0	8	0	0	2

Table 3. Turf color* observed in different species under traffic stress.

Species	8/21/2001	9/24/2001	10/8/2001	11/2/2001
Yukon	8.3	8.5	5.6	1.7
Primo	7.0	7.5	4.8	1.0
Primo + PR1	7.5	8.7	6.8	6.4
Primo + CB	7.0	7.6	4.8	1.3
Primo + KB	7.0	7.7	4.8	1.3
Primo + PR2	7.3	8.2	5.3	2.3
Zoysia	0.0	0.0	0.0	0.0
Westwood	8.2	8.0	4.8	1.3
Quickstand	8.2	7.4	4.7	1.0
Creeping B.	2.5	7.8	6.7	5.8
Perennial R.	9.0	9.3	8.7	8.3
Kentucky B.	0.0	0.0	0.0	3.0

*Color ratings based on a scale of 1-10, where 10 is the most desirable green and 6 the least acceptable; 1 is completely discolorated grass

Literature cited

Carrow, R.N., R.R. Duncan, J.E. Worley and R.C. Shearman. 2001. Turfgrass traffic (soil compactation plus wear) simulator response of *Paspalum vaginatum* and *Cynodon* spp. p. 253-258. *In* K. Carey (ed.). Int. Turf. Soc. Research J. Vol. 9.

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Kentucky Bluegrass Traffic Study

D.D. Minner and F.J. Valverde

Objective

To determine the effect that different traffic schedules have on Kentucky bluegrass performance. Specifically we were interested in determining if the same amount of traffic caused more injury if it was applied all-at-once (one day per week) or spread out over time (a little each day).

Methods

The study was conducted at the Horticulture Research Farm in Ames Iowa during summer and fall of 2001. Six different traffic regimes were applied to Kentucky Bluegrass (Table 1) with a GA-SWC Traffic simulator (Carrow et al., 2001). The experimental design was a randomized complete block with 7 treatments and 3 replications. Each small plot was 2 ft x 12 ft. Traffic simulation started on 1 August and ended on 7 November, 2001.

Table 1. Traffic schedule followed on Kentucky bluegrass during fall 2001.

Number of passes/week	Number of passes per day				
	Monday	Tuesday	Wednesday	Thursday	Friday
5 dispersed	1	1	1	1	1
10 dispersed	2	2	2	2	2
15 dispersed	3	3	3	3	3
5 concentrated	0	0	0	0	5
10 concentrated	0	0	0	0	10
15 concentrated	0	0	0	0	15
Control	0	0	0	0	0

Percent turf cover and quality were evaluated monthly. Sometimes conditions were too wet to operate the traffic simulator. Traffic not done during those days accumulated to the next available day.

Results

Table 2. Kentucky bluegrass cover as affected by traffic schedule

Traffic schedule	8/28/01	9/11/01	9/24/01	10/8/01	11/21/01	Overall
	% Turf cover					
Control	100	100	100	100	100	100.0
5 dispersed	93	93	95	96	92	93.8
10 dispersed	73	73	75	83	63	73.7
15 dispersed	57	52	63	57	35	52.7
5 concentrated	98	96	97	95	95	96.1
10 concentrated	93	88	77	85	85	85.7
15 concentrated	63	62	50	50	55	56.0
					Prob.	0.0000
					$LSD_{0.05}$	2.83

Table 3. Kentucky bluegrass quality as affected by traffic schedule

Traffic schedule	8/21/01	8/28/01	9/11/01	9/24/01	10/8/01	11/21/01	Overall
	Quality						
Control	10.0	10.0	10.0	10.0	9.2	9.3	9.8
5 dispersed	8.3	8.3	8.0	8.7	7.7	6.8	8.0
10 dispersed	6.7	7.0	6.3	6.0	6.0	4.0	6.0
15 dispersed	6.7	5.7	4.7	5.7	3.7	2.3	4.8
5 concentrated	8.7	8.7	8.3	8.3	7.2	7.5	8.1
10 concentrated	8.0	7.7	7.3	6.7	6.3	6.3	7.1
15 concentrated	6.0	5.8	5.3	4.7	3.3	3.3	4.8
						Prob	0.0000
						$LSD_{0.05}$	0.336

Quality 1-10 (10 most desirable situation, 1 not suitable for sport)

Turf cover decreased as the amount of traffic increased. At 10 and 15 passes per week more turf cover occurred with concentrated traffic compared to disperse traffic (table 2). Similar situation occurs on turf quality (table 3). Although this is not evident in the data, there may have been a complicating factor caused by the unpredictable rainfall events. Traffic treatments applied during wetter conditions may have caused more damage. In 2001 we will conduct the same levels of traffic under wet vs. dry conditions by controlling rainfall with tarps.

Literature cited

Carrow, R.N., R.R. Duncan, J.E. Worley and R.C. Shearman. 2001. Turfgrass traffic (soil compaction plus wear) simulator response of *Paspalum vaginatum* and *Cynodon* spp. p. 253-258. *In* K. Carey (ed.). Int. Turf. Soc. Research J. vol. 9.

Species Traffic Study

F.J. Valverde and D.D. Minner

Introduction

Turfgrass species are often ranked according to their wear resistance from high to low: tall fescue > perennial rye > Kentucky bluegrass > fine fescue > creeping bentgrass > colonial bentgrass > rough bluegrass. However recuperative capacity from high to low may rank: creeping bentgrass > Kentucky bluegrass > rough bluegrass > tall fescue > perennial rye > fine fescue>colonial bentgrass (Turgeon, 2002).

In practice however athletic fields are a system of management techniques and reestablishment by seeding or sodding. Instead of evaluating the rate at which an established species declines or recovers during traffic, we are interested in evaluating how the whole grass system, seeding included, responds to traffic. Basically, what is the net performance of a species when continual attempts at reseeding are considered.

Objective

To study the interaction between overseeding and traffic stress on established species.

Methods

The study was conducted at the Horticulture Research Farm in Ames Iowa. Seeded in September of 2000 this study consisted in establishing 6 different species before the end of the spring. After species were succesfully established, they received traffic stress with a GA-SWC Traffic simulator (Carrow et al., 2001). Each species received two different regimes of traffic, 2 and 4 passes 3 days per week. The trial followed a complete randomized block design for a total of 12 treatments and 4 replications. Each small plot has 2 ft x 15 ft. Traffic simulation started on 20 April and ended 15 May. Plots were reseeded after this traffic period. Traffic reinitiated 2 weeks later, stopped on 15 June and were reseeded again. Percent turf cover and turf color were evaluated on 28 June 2001.

Table 1. Treatment description and seed rate

Species	Traffic level	Seed rate lb/1000 sq.ft
Unique Kentucky Bluegrass	2/4 passes 3 times per week	3
Catalina Perennial Rye	2/4 passes 3 times per week	10
Millenium Tall fescue	2/4 passes 3 times per week	10
Cindy Fine Fescue	2/4 passes 3 times per week	5
Poa Supina	2/4 passes 3 times per week	3
Penncross Creeping Bentgrass	2/4 passes 3 times per week	2

Results

The preliminary data of 2001 appear in table 2. The study will be continued and a final report will be made in 2002.

Table 2. Percent turf cover and turf color measured on 28 June 2001 after repeated traffic.

Species	% cover		Color	
	Traffic levels			
	2x	4x	2x	4x
Unique Kentucky bluegrass.	94	84	8.6	8.4
Catalina Perennial Rye	84	74	8.9	8.9
Millenium Tall fescue	85	78	8.3	8.0
Cindy Red Fescue	81	74	8.0	7.5
Poa Supina	98	89	8.1	7.9
Penncross Creeping bentgrass.	81	70	8.0	7.8

*Color ratings based on a scale of 1-10, where 10 is the most desirable green and 6 the least acceptable; 1 is completely discolorated grass

Literature cited

Turgeon, A.J. 2002. Turfgrass management, 6th ed. New Jersey. Prentice Hall. 400 p.

Carrow, R.N., R.R. Duncan, J.E. Worley and R.C. Shearman. 2001. Turfgrass traffic (soil compactation plus wear) simulator response of *Paspalum vaginatum* and *Cynodon* spp. p. 253-258. *In* K. Carey (ed.). Int. Turf. Soc. Research J. vol. 9.

1991 Corn Gluten Meal Crabgrass Control Study - Year 11

B. *R. Bingaman and N. E. Christians*

Corn gluten meal (CGM) has been screened for efficacy as a natural product herbicide and fertilizer in turf on the same plot since 1991. The study is being conducted at the Iowa State University Research Station north of Ames, IA in an area of 'Parade' Kentucky bluegrass. The soil in this experimental area is a Nicollet (fine-loamy, mixed, mesic Aquic Hapludoll) with an organic matter content of 4.6%, a pH of 6.45, 3 ppm P, and 144 ppm K.

Individual experimental plots are 5 x 5 ft and there are 5 treatments with 3 replications. The experimental design is a randomized complete block. Corn gluten meal is applied each year to the same plots at 0, 20, 40, 60, 80, 100, and 120 lbs/1000 ft^2 (Table 1). Because corn gluten meal is 10% N, these rates are equivalent to 0, 2, 4, 6, 8, 10, and 12 lb N/1000 ft^2. The CGM is applied each year in a single early-spring preemergence application using 'shaker dispensers'. The materials are watered-in with the irrigation system. Supplemental irrigation is used to provide adequate moisture to maintain the grass in good growing condition. In 2001, applications were made on April 26.

Turf quality was monitored from May 8 through September 13 (Tables 1 and 2). It was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst turf quality. Weed populations were measured by either counting the number of plants or estimating the percentage area coverage per individual plot. Crabgrass infestations were determined by counting the number of plants per individual plot. Plants in the 1 to 3 leaf stage were found in June 12 but the growth rate was very slow because of the high temperatures and low rainfall. The crabgrass plants were large enough to count by July 27 and subsequent data were taken on August 9, August 16, August 28, and September 13. Dandelion populations were assessed by counting the number of plants per individual plot. Clover populations were determined by estimating the percentage area of each plot covered by clover. Dandelion and cover data were taken from May 8 through September 13 (Tables 4 and 6).

Data were analyzed with the Statistical Analysis System (SAS , Version 6.12) and the Analysis of Variance (ANOVA) procedure. Effects of CGM on turf quality and weed control were examined using Fisher's Least Significant Difference (LSD) means comparison tests. To better express weed control, weed population data were converted to percentage reductions as compared to the untreated controls.

At spring greenup in May, there were differences between treated and untreated turf and by mid May, the differences were more pronounced (Table 1). Quality differences between CGM treated turf and untreated turf were significantly different for the entire season but on some dates, the quality of turf treated at various CGM levels was not different from the untreated control. By mid to late August, turf quality deteriorated because of low rainfall amounts. Some rainfall improved turf quality by early September.

Treatment with CGM resulted in numeric reductions in crabgrass populations for the entire season. The differences were not statistically significant because there were large variations in counts among the replications for the treatments (Tables 2 and 3). There was no crabgrass in turf treated at 40 lb/1000 ft^2 and greater for the entire season (Table 2). In 2002, crabgrass control was equal to or better than in previous years at all CGM levels except at 20 lb/1000 ft^2 (Table 8).

Dandelion counts were significantly reduced by CGM for the entire season as compared to the untreated controls (Tables 4 and 5). Mean reductions were at least 92.3% for CGM at 40 lb/1000 ft^2 and higher and greater than 96% for CGM at 60 lb/1000 ft^2 and higher. In 2002, CGM at 20 and 40 lb/1000 ft^2 reduced dandelion populations more than in 1997, 1998, 1999, and 2000 (Table 9). Dandelion control at the other CGM rates was equal to or greater than in previous years.

Percentage clover cover was significantly reduced in turf treated with CGM as compared with the untreated controls for the entire 2002 season (Tables 6 and 7). Mean reductions in clover cover were > 77% as compared with the untreated controls in turf treated with CGM at all levels except 20 and 40 lb/1000 ft^2. Clover control in 2001 was similar to that in previous years except at 40 lb/1000 ft^2 (Table 10). Control at this CGM level was not as good as in 1994, 1996, 1997, 1998, 1999, and 2000.

Table 1. Visual quality[1] of Kentucky bluegrass treated in the 1991 Corn Gluten Meal Weed Control Study.

	Material	lbs CGM /1000 ft^2	lbs N /1000 ft^2	May 8	May 15	May 22	June 1	June 8	June 15	June 21	June 27
1	Untreated control	0	0	6.0	5.3	5.7	5.7	5.7	5.3	5.3	6.3
2	Corn gluten meal	20	2	6.7	6.7	7.0	7.0	6.7	6.3	6.3	6.3
3	Corn gluten meal	40	4	7.0	7.7	7.7	7.7	7.0	7.3	7.3	7.0
4	Corn gluten meal	60	6	7.7	8.0	8.0	8.7	7.3	8.0	8.0	7.0
5	Corn gluten meal	80	8	7.7	7.3	7.7	8.7	8.0	9.0	8.7	7.3
6	Corn gluten meal	100	10	8.0	9.0	8.7	8.7	8.3	9.0	9.0	8.3
7	Corn gluten meal	120	12	8.3	8.7	8.3	8.7	8.3	9.0	9.0	8.3
	$LSD_{0.05}$			1.5	1.3	1.1	1.2	1.1	1.0	0.8	0.9

[1]Turf quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst turf quality.
NS = means are not significantly different at the 0.05 level.

	Material	lbs CGM /1000 ft^2	July 3	July 11	July 16	July 27	Aug 9	Aug 16	Aug 21	Aug 28	Sept 4	Sept 13	Mean
1	Untreated control	0	5.7	5.3	5.3	6.3	6.0	6.0	6.3	7.0	6.3	6.0	5.9
2	Corn gluten meal	20	6.3	5.7	5.3	6.0	5.7	6.3	6.3	7.0	7.7	6.7	6.4
3	Corn gluten meal	40	7.0	7.3	6.7	6.7	5.7	6.3	6.7	7.0	8.0	6.3	7.0
4	Corn gluten meal	60	7.0	7.7	7.3	7.3	6.0	6.3	7.3	7.3	8.0	6.7	7.4
5	Corn gluten meal	80	7.3	7.7	7.7	7.0	7.0	6.3	6.7	7.3	9.0	7.7	7.7
6	Corn gluten meal	100	8.3	9.0	8.3	8.0	6.7	6.7	7.7	7.7	9.0	8.0	8.2
7	Corn gluten meal	120	7.3	8.3	7.7	7.7	6.0	6.3	7.0	7.3	8.7	7.7	7.9
	$LSD_{0.05}$		1.4	1.0	1.0	1.0	NS	NS	0.8	NS	0.6	0.9	0.4

[1]Turf quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst turf quality.
NS = means are not significantly different at the 0.05 level.

Table 2. Crabgrass counts[1] in Kentucky bluegrass treated in the 1991 Corn Gluten Meal Weed Control Study.

	Material	lbs CGM /1000 ft^2	July 27	August 9	August 16	August 28	September 13	Mean
1	Untreated control	0	8.3	7.3	13.3	20.0	20.0	13.8
2	Corn gluten meal	20	3.3	4.3	10.0	11.7	11.7	8.2
3	Corn gluten meal	40	0.0	0.0	0.0	0.0	0.0	0.0
4	Corn gluten meal	60	0.0	0.0	0.0	0.0	0.0	0.0
5	Corn gluten meal	80	0.0	0.0	0.0	0.0	0.0	0.0
6	Corn gluten meal	100	0.0	0.0	0.0	0.0	0.0	0.0
7	Corn gluten meal	120	0.0	0.0	0.0	0.0	0.0	0.0
	$LSD_{0.05}$		NS	NS	NS	NS	NS	NS

[1]These values represent the number of crabgrass plants per plot covered.
NS = means are not significantly different at the 0.05 level.

Table 3. Percentage crabgrass count reductions[1] in Kentucky bluegrass treated in the 1991 Corn Gluten Meal Weed Control Study.

	Material	lbs CGM /1000 ft^2	July 27	August 9	August 16	August 28	September 13	Mean
1	Untreated control	0	0.0	0.0	0.0	0.0	0.0	0.0
2	Corn gluten meal	20	59.8	40.6	24.8	41.7	41.7	40.6
3	Corn gluten meal	40	100.0	100.0	100.0	100.0	100.0	100.0
4	Corn gluten meal	60	100.0	100.0	100.0	100.0	100.0	100.0
5	Corn gluten meal	80	100.0	100.0	100.0	100.0	100.0	100.0
6	Corn gluten meal	100	100.0	100.0	100.0	100.0	100.0	100.0
7	Corn gluten meal	120	100.0	100.0	100.0	100.0	100.0	100.0
	$LSD_{0.05}$		NS	NS	NS	NS	NS	NS

[1]These values represent percentage reductions in the number of crabgrass plants per plot as compared to the untreated control.
NS = means are not significantly different at the 0.05 level.

Table 4. Dandelion counts[1] in Kentucky bluegrass treated in the 1991 Corn Gluten Meal Weed Control Study.

	Material	lbs CGM /1000 ft^2	May 8	June 15	June 27	July 11	July 27	Aug 9	Aug 16	Aug 28	Sept 13	Mean
1	Untreated control	0	34.3	37.0	30.7	28.7	29.7	25.0	23.3	30.7	33.3	30.3
2	Corn gluten meal	20	20.3	14.0	13.0	13.0	13.3	12.0	11.7	20.0	16.3	14.9
3	Corn gluten meal	40	3.3	1.3	3.0	2.7	1.7	2.7	2.3	2.3	1.7	2.3
4	Corn gluten meal	60	3.3	0.7	3.0	1.3	0.3	0.0	0.7	0.3	1.3	1.2
5	Corn gluten meal	80	3.0	1.3	1.7	0.7	0.7	0.0	0.7	0.0	1.0	1.0
6	Corn gluten meal	100	2.0	1.3	0.7	1.0	0.7	0.0	2.0	1.3	0.7	1.1
7	Corn gluten meal	120	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.2
	$LSD_{0.05}$		17.5	17.4	14.1	14.7	15.1	13.5	10.2	20.2	14.0	14.5

[1]These values represent the number of dandelion plants per plot.

Table 5. Percentage dandelion count reductions[1] in Kentucky bluegrass treated in the 1991 Corn Gluten Meal Weed Control Study.

	Material	lbs CGM /1000 ft^2	May 8	June 15	June 27	July 11	July 27	Aug 9	Aug 16	Aug 28	Sept 13	Mean
1	Untreated control	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Corn gluten meal	20	40.9	62.2	57.7	54.7	55.1	52.0	79.9	34.9	51.0	51.0
3	Corn gluten meal	40	90.3	96.4	90.2	90.7	94.4	89.3	90.0	92.4	95.0	92.3
4	Corn gluten meal	60	90.3	98.2	90.2	95.4	98.9	100.0	97.1	98.9	96.0	96.0
5	Corn gluten meal	80	91.3	96.4	94.6	97.7	97.8	100.0	97.1	100.0	97.0	97.0
6	Corn gluten meal	100	94.2	96.4	97.8	96.5	97.8	100.0	91.4	95.7	98.0	96.5
7	Corn gluten meal	120	97.1	100.0	100.0	100.0	100.0	100.0	100.0	98.9	99.0	99.4
	$LSD_{0.05}$		50.8	47.1	45.8	51.4	50.9	53.8	43.7	65.7	42.2	47.8

[1]These values represent percentage reductions in the number of dandelion plants per plot as compared to the untreated control.
NS = means are not significantly different at the 0.05 level.

Table 6. Percentage clover cover[1] in Kentucky bluegrass treated in the 1991 Corn Gluten Meal Weed Control Study.

	Material	lbs CGM /1000 ft^2	May 8	June 15	June 27	July 11	July 27	Aug 9	Aug 16	Aug 28	Sept 13	Mean
1	Untreated control	0	23.3	41.7	25.0	33.3	16.7	15.0	15.0	16.7	41.7	25.4
2	Corn gluten meal	20	15.0	11.7	15.0	12.0	8.7	8.3	7.0	13.3	15.0	11.1
3	Corn gluten meal	40	13.3	8.7	13.3	13.3	11.7	3.7	8.3	6.7	10.0	8.7
4	Corn gluten meal	60	8.3	5.3	8.3	5.3	5.3	3.7	5.0	5.3	11.7	5.8
5	Corn gluten meal	80	0.7	1.0	0.7	0.0	0.7	0.3	0.7	0.3	3.7	0.9
6	Corn gluten meal	100	8.3	2.3	8.3	2.3	2.3	0.7	0.7	1.7	5.3	3.0
7	Corn gluten meal	120	2.0	0.3	2.0	2.0	2.0	0.7	3.3	1.7	2.3	1.8
	$LSD_{0.05}$		NS	12.8	5.7	15.3	10.9	8.7	9.1	10.6	14.6	9.9

[1]These values represent the area per plot covered by clover.
NS = means are not significantly different at the 0.05 level.

Table 7. Percentage clover cover reductions[1] in Kentucky bluegrass treated in the 1991 Corn Gluten Meal Weed Control Study.

	Material	lbs CGM /1000 ft^2	May 8	June 15	June 27	July 11	July 27	Aug 9	Aug 16	Aug 28	Sept 13	Mean
1	Untreated control	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Corn gluten meal	20	35.6	72.0	65.3	64.0	48.1	44.4	53.3	20.2	64.0	56.4
3	Corn gluten meal	40	42.8	79.2	90.7	60.0	30.1	75.6	44.4	60.1	76.0	65.9
4	Corn gluten meal	60	64.2	87.2	90.7	84.0	68.1	75.6	66.7	68.1	72.0	77.1
5	Corn gluten meal	80	97.1	97.6	96.0	100.0	96.0	97.8	95.6	98.0	91.2	97.4
6	Corn gluten meal	100	64.2	94.4	85.3	93.0	86.0	95.6	95.6	90.0	87.2	88.0
7	Corn gluten meal	120	91.4	99.2	92.0	94.0	88.0	95.6	77.8	90.0	94.4	92.9
	$LSD_{0.05}$		NS	30.8	22.9	45.9	65.3	57.7	60.4	63.4	34.9	39.0

[1]These values represent percentage reductions in the clover cover per plot as compared to the untreated control.
NS = means are not significantly different at the 0.05 level.

Table 8. Comparisons of the mean crabgrass count reductions[1] in Kentucky bluegrass treated in the 1991 Corn Gluten Meal Weed Control Study for 1991 through 2000.

	Material	lbs CGM /1000 ft^2	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	Untreated control	0	0	0	0	0	0	0	0	0	0	0	0
2	Corn gluten meal	20	58	85	91	70	36	15	0	0	0	63	41
3	Corn gluten meal	40	86	98	98	97	88	97	79	91	99	100	100
4	Corn gluten meal	60	97	98	93	98	93	85	82	92	99	100	100
5	Corn gluten meal	80	87	93	93	87	75	69	54	56	95	98	100
6	Corn gluten meal	100	79	94	95	86	75	87	79	83	96	99	100
7	Corn gluten meal	120	97	100	100	98	84	97	82	76	97	100	100
	$LSD_{0.05}$		26	44	31	39	40	60	NS	NS	68	NS	NS

[1]These values represent reductions in crabgrass plants per plot as compared with the untreated controls.
NS = means are not significantly different at the 0.05 level.

Table 9. Comparisons of the mean percentage dandelion count reductions[1] in Kentucky bluegrass treated in the 1991 Corn Gluten Meal Weed Control Study for 1994 through 2000.

	Material	lbs CGM /1000 ft^2	1994	1995	1996	1997	1998	1999	2000	2001
1	Untreated control	0	0	0	0	0	0	0	0	0
2	Corn gluten meal	20	71	49	33	24	5	1	33	51
3	Corn gluten meal	40	100	77	75	76	72	77	90	92
4	Corn gluten meal	60	100	89	79	84	83	92	96	96
5	Corn gluten meal	80	98	96	95	93	91	94	96	97
6	Corn gluten meal	100	100	98	96	88	89	97	97	96
7	Corn gluten meal	120	100	100	100	97	97	99	99	99
	$LSD_{0.05}$		50	65	60	61	37	25	49	48

[1]These values represent the reductions in dandelion counts per plot as compared with the untreated controls.

Table 10. Comparisons of the mean percentage clover cover reductions[1] in Kentucky bluegrass treated in the 1991 Corn Gluten Meal Weed Control Study for 1994 through 2000.

	Material	lbs CGM /1000 ft^2	1994	1995	1996	1997	1998	1999	2000	2001
1	Untreated control	0	0	0	0	0	0	0	0	0
2	Corn gluten meal	20	81	56	71	63	27	40	69	56
3	Corn gluten meal	40	90	64	82	87	84	82	79	66
4	Corn gluten meal	60	98	93	93	95	85	82	79	77
5	Corn gluten meal	80	100	76	90	95	93	92	94	96
6	Corn gluten meal	100	94	84	92	76	90	90	90	88
7	Corn gluten meal	120	90	93	93	93	90	88	92	93
	$LSD_{0.05}$		NS	48	29	26	21	27	28	39

[1]These values represent reductions in percentage clover cover per plot as compared with the untreated controls.
NS = means are not significantly different at the 0.05 level.

1995 Corn Gluten Meal Rate Weed Control Study - Year 7

B. R. Bingaman and N. E. Christians

Corn gluten meal (CGM) is being screened for efficacy as a natural product herbicide in turf. This long-term study was begun in 1995 at the Iowa State University Horticulture Research Station north of Ames, IA. The experimental plot is in established 'Ram 1' Kentucky bluegrass. The soil is a Nicollet (fine-loamy, mixed, mesic Aquic Hapludoll) with an organic matter content of 4.8%, a pH of 7.1, 6 ppm P, and 170 ppm K. Prior to treatment in 1995, the percentage broadleaf weed cover within the study perimeter exceeded 50%.

The experimental design is a randomized complete block design. Individual experimental plots are 10 x 10 ft with three replications. Each year corn gluten meal is applied to the same plots at a yearly rate of 40 lb CGM/1000 ft^2 (equivalent to 4 lb N/1000 ft^2) using four different regimes of single and split applications for a total of five treatments (Table 1). Four applications of 10 lb/1000 ft^2, split applications of 20 lb/1000 ft^2, an initial application of 30 lb plus a sequential of 10 lb/1000 ft^2, and a single application of 40 lb/1000 ft^2 are included with an untreated control.

Initial applications for 2001 were made on April 26 before crabgrass germination. It was 80° F and sunny with a slight wind. The second application of treatment 2 was made on June 25 under cloudy skies with a high temperature of 83° and a slight S wind. The third application of treatment 2 and the second of treatments 3 and 4 were made on August 6. It was 86° and sunny with a 10 mph wind from the south. There was no rain until August 4 and only 2.43" of rainfall for the entire month of August. The final application of treatment 2 was made on September 12. It was 75 deg and sunny with a southerly wind at 15-20 mph. Temperatures remained above normal for the entire spring and summer and rainfall amounts were below normal.

The experimental plot was checked for phytotoxicity after each treatment. Turf quality data were taken weekly from spring greenup on May 8 through September 13. Visual quality was measured using a 9 to 1 scale with 9 = best and 6 = lowest acceptable, and 1 = worst quality (Table 1).

Crabgrass was first observed on June 12 but because of the hot temperatures and low rainfall, the growth rate was very slow. Population assessments could not be made until July 27. Subsequent data were recorded on August 9, August 16, August 28, and September 13 (Table 2).

Broadleaf data were taken from May 8 through September 13. Dandelion and clover were the predominate broadleaf weed species within the experimental plot. Dandelion populations were measured by counting the number of plants per plot (Tables 4). Clover infestations were estimated by determining the percentage area in each individual plot covered by clover (Tables 6).

Data were analyzed with the Statistical Analysis System (SAS, Version 6.12) and the Analysis of Variance (ANOVA) procedure. Means comparisons were made with Fisher's Least Significant Difference test (LSD). Crabgrass, clover, and dandelion population data were converted to percentage reductions as compared with the untreated controls (Table 3, 5, and 7).

The 2001 growing season was hot and extremely dry. As a result there was less response to the nitrogen in the corn gluten meal than in previous years. Supplemental irrigation was used as required to keep the bluegrass from entering dormancy. In spite of the growing conditions, turf quality was significantly better in bluegrass treated with CGM than in the untreated control for most of the season (Table 1). By September 5, the turf was dormant but rainfall in late October resulted in significant greening so additional data were taken on October 27. On this date, turfgrass that received sequential applications (treatments 2, 3, and 4) had better quality than the untreated control and treated turf that received only an initial CGM treatment. Mean visual quality of bluegrass treated with CGM was better than the untreated controls.

Crabgrass populations were reduced by CGM at all application rates as compared with the untreated controls (Table 2). The best crabgrass control was in turf treated with split applications of 20 lb CGM but this level of control was not statistically different from the other CGM treatments and the untreated control. Mean reductions in crabgrass counts were > 94% in turf treated with 2 applications of 20 lb CGM or 30 lb followed by 10 lb CGM as compared with the untreated control (Table 3).

The level of crabgrass control was lower at 10 lb CGM (four applications) than in 2001 (Tables 8 and 9). Split applications of 20 lb CGM provided 100% crabgrass reductions in 2001 and 2000 as compared to 45, 33, 50, 86, and 95% in 1995, 1996, 1997, 1998, and 1999, respectively. A single 40 lb CGM application decreased crabgrass counts by 94% in 2001.

Dandelion numbers were significantly lower in all CGM treated turf as compared with the untreated controls for the entire 2001 season (Table 4). The best dandelion control was in turf treated with split applications of 20 lb CGM but this level was not different from the other CGM treatments. Dandelion reductions were similar for all CGM treatments and ranged from mean reductions ranged from 72.5 to 83.4% (Table 5).

Dandelion control was slightly lower in 2001 than in 2000 (Table 10). Split applications of 20 lb CGM provided 83% control in 2001 but the level was 85 and 88% in 1999 and 2000, respectively.

Clover cover was significantly lower throughout the season in all CGM treated bluegrass as compared with the untreated controls. Clover populations were significantly lower in all CGM treated turf than in untreated on all data collection dates (Table 6). Mean reductions for all CGM treatments were > 91% and all were statistically different from the untreated controls (Table 7).

Clover control in 2001 was approximately equal to the level of control recorded in 2000 and 1999 (Table 11). At all CGM treatment levels, clover populations were lower than in treated bluegrass for 1996 through 1998.

Table 1. Turf quality[1] of Kentucky bluegrass treated with corn gluten meal for the 1995 Corn Gluten Meal Rate Weed Control Study.

	Material	Rate lb product/1000 ft^2	May 8	May 15	May 22	June 1	June 8	June 15	June 21	June 27	July 3	July 11
1.	Untreated control	NA	6.0	6.0	6.0	6.0	6.0	5.0	6.0	6.0	6.0	5.0
2.	Corn gluten meal	10 lb 10 lb 10 lb 10	8.7	7.0	7.0	7.7	7.3	7.0	7.3	7.0	7.0	7.0
3.	Corn gluten meal	20 lb 20	8.7	8.0	7.7	8.0	7.3	8.0	7.3	8.0	8.0	8.0
4.	Corn gluten meal	30 lb 10	7.7	8.7	8.7	9.0	8.0	8.3	8.3	8.0	8.0	8.3
5.	Corn gluten meal	40	8.3	9.0	8.3	8.7	8.7	8.7	8.7	8.7	8.0	8.3
	$LSD_{0.05}$		1.0	0.5	1.2	0.7	1.3	0.8	1.4	1.1	1.3	1.8

	Material	Rate lb product/1000 ft^2	July 16	July 27	August 9	August 16	August 21	August 28	September 13	Mean
1.	Untreated control	NA	6.0	5.0	5.7	6.0	6.0	7.0	7.0	5.9
2.	Corn gluten meal	10 lb 10 lb 10 lb 10	7.3	7.7	7.7	7.7	7.7	8.7	9.0	7.6
3.	Corn gluten meal	20 lb 20	7.7	8.0	8.0	8.7	8.7	8.0	8.0	8.0
4.	Corn gluten meal	30 lb 10	8.0	7.7	7.3	7.7	8.0	7.3	7.7	8.0
5.	Corn gluten meal	40	8.3	8.3	7.7	8.3	8.3	7.3	7.7	8.3
	$LSD_{0.05}$		1.6	1.6	1.1	1.4	1.2	NS	0.8	0.4

[1]Turf quality was assessed using a 9 to 1 scale with 9 = best, 6 = lowest acceptable, and 1 = worst turf quality.

Initial applications were made on April 26. Sequential applications of treatment 2 were made on June 25, August 6, and September 12. Sequential applications of treatments 3 & 4 were made on August 6.

NS = means are not significantly different at the 0.05 level.

Table 2. Crabgrass counts[1] in Kentucky bluegrass treated with corn gluten meal in the 1995 Corn Gluten Meal Rate Weed Control Study.

	Material	Rate lb product/1000 ft^2	July 27	August 9	August 16	August 28	September 13	Mean
1.	Untreated control	NA	10.0	14.0	26.0	30.7	32.3	18.8
2.	Corn gluten meal	10 lb 10 lb 10 lb 10	3.3	5.7	9.0	8.3	8.3	5.8
3.	Corn gluten meal	20 lb 20	0.3	0.0	0.0	0.0	0.0	0.1
4.	Corn gluten meal	30 lb 10	0.3	0.3	2.3	1.7	1.7	1.1
5.	Corn gluten meal	40	1.7	2.0	3.0	3.7	4.3	2.4
	$LSD_{0.05}$		4.0	9.1	22.9	29.6	28.3	15.2

[1]These values represent the number of crabgrass plants per plot.
NS = means are not significantly different at the 0.05 level.

Table 3. Crabgrass count reductions[1] in Kentucky bluegrass treated with corn gluten meal in the 1995 Corn Gluten Meal Rate Weed Control Study.

	Material	Rate lb product/1000 ft^2	July 27	August 9	August 16	August 28	September 13	Mean
1.	Untreated control	NA	0.0	0.0	0.0	0.0	0.0	0.0
2.	Corn gluten meal	10 lb 10 lb 10 lb 10	66.7	59.5	65.4	72.9	74.2	68.4
3.	Corn gluten meal	20 lb 20	96.7	100.0	100.0	100.0	100.0	99.7
4.	Corn gluten meal	30 lb 10	96.7	97.6	91.0	94.6	94.8	94.2
5.	Corn gluten meal	40	83.3	85.7	88.5	88.1	86.6	86.6
	$LSD_{0.05}$		40.0	63.9	88.0	96.3	87.5	83.3

[1]These values represent the percentage reduction in crabgrass plants per plot as compared with the untreated control.
NS = means are not significantly different at the 0.05 level.

Table 4. Dandelion counts[1] in Kentucky bluegrass treated with corn gluten meal in the 1995 Corn Gluten Meal Rate Weed Control Study.

	Material	Rate lb product/1000 ft^2	May 8	June 15	June 27	July 3	July 11	July 27	Aug 9	Aug 16	Aug 28	Sept 13	Mean
1.	Untreated control	NA	61.7	50.0	63.3	62.7	58.3	48.3	45.3	47.3	50.7	56.7	54.4
2.	Corn gluten meal	10 lb 10 lb 10 lb 10	12.3	14.3	20.3	16.3	15.7	13.0	14.3	11.3	12.7	19.0	14.9
3.	Corn gluten meal	20 lb 20	11.3	6.0	6.3	4.3	6.7	13.3	7.0	8.0	11.0	16.3	9.0
4.	Corn gluten meal	30 lb 10	9.0	10.3	14.7	12.7	11.0	14.0	9.3	9.7	13.3	18.3	12.2
5.	Corn gluten meal	40	18.3	10.0	17.3	15.3	9.7	10.3	13.7	12.0	18.7	19.7	14.5
	$LSD_{0.05}$		18.8	12.6	24.2	23.0	16.0	17.8	20.0	19.4	26.6	25.6	18.5

[1]These data represent the number of dandelion plants per plot.

Table 5. Dandelion count reductions[1] in Kentucky bluegrass treated with corn gluten meal in the 1995 Corn Gluten Meal Rate Weed Control Study.

	Material	Rate lb product/1000 ft^2	May 8	June 15	June 27	July 3	July 11	July 27	Aug 9	Aug 16	Aug 28	Sept 13	Mean
1.	Untreated control	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.	Corn gluten meal	10 lb 10 lb 10 lb 10	80.0	71.3	67.9	74.0	73.1	73.1	68.4	76.0	75.0	66.5	72.5
3.	Corn gluten meal	20 lb 20	81.6	88.0	90.0	93.1	88.6	72.4	84.5	83.1	78.3	71.2	83.4
4.	Corn gluten meal	30 lb 10	85.4	79.3	76.8	79.8	81.1	71.0	79.4	79.6	73.7	67.7	77.5
5.	Corn gluten meal	40	70.3	80.0	72.6	75.5	83.4	78.6	69.8	74.6	63.2	65.3	73.3
	$LSD_{0.05}$		30.5	25.1	38.2	36.6	27.4	36.9	44.2	41.0	52.5	45.2	33.9

[1]These data represent the number of dandelion plants per plot.

Table 6. Percentage clover cover[1] in Kentucky bluegrass treated with corn gluten meal in the 1995 Corn Gluten Meal Rate Weed Control Study.

	Material	Rate lb product/1000 ft^2	May 8	June 15	June 27	July 3	July 11	July 27	Aug 9	Aug 16	Aug 28	Sept 13	Mean
1.	Untreated control	NA	26.7	40.0	45.0	45.0	61.7	55.0	45.0	53.3	56.7	55.0	48.3
2.	Corn gluten meal	10 lb 10 lb 10 lb 10	0.3	0.3	0.0	2.0	2.0	1.7	3.7	2.0	1.0	3.7	1.7
3.	Corn gluten meal	20 lb 20	0.7	0.7	2.3	2.0	0.7	1.7	0.7	0.7	2.3	2.0	1.4
4.	Corn gluten meal	30 lb 10	3.7	3.3	3.7	2.0	5.3	8.3	1.7	1.7	3.3	5.3	3.8
5.	Corn gluten meal	40	5.0	2.0	3.3	5.0	6.7	3.3	5.0	2.0	5.0	5.0	4.2
	$LSD_{0.05}$		9.0	15.8	16.5	10.1	15.0	18.3	18.0	22.5	25.3	22.4	15.5

[1]These figures represent the percentage of each plot covered by clover.

Table 7. Percentage clover cover reductions[1] in Kentucky bluegrass treated with corn gluten meal in the 1995 Corn Gluten Meal Rate Weed Control Study.

	Material	Rate lb product/1000 ft^2	May 8	June 15	June 27	July 3	July 11	July 27	Aug 9	Aug 16	Aug 28	Sept 13	Mean
1.	Untreated control	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.	Corn gluten meal	10 lb 10 lb 10 lb 10	98.8	99.2	100.0	95.6	96.8	97.0	91.9	96.2	98.2	93.3	96.5
3.	Corn gluten meal	20 lb 20	97.5	98.3	94.8	95.6	98.9	97.0	98.5	98.7	95.9	96.4	97.2
4.	Corn gluten meal	30 lb 10	86.3	91.7	91.9	95.6	91.4	84.8	96.3	96.9	94.1	90.3	92.1
5.	Corn gluten meal	40	81.3	95.0	92.6	88.9	89.2	93.9	88.9	96.2	91.2	90.9	91.2
	$LSD_{0.05}$		33.8	39.6	36.7	22.4	24.2	33.3	40.0	42.3	44.6	40.8	32.1

[1]These figures represent the percentage reductions in clover cover per plot as compared to the untreated control.

Table 8. Crabgrass counts[1] in Kentucky bluegrass treated in the 1995 Corn Gluten Meal Rate Weed Control Study for 1996 through 1999.

	Material	Rate lb product/1000 ft^2	1996	1997	1998	1999	2000	2001
1.	Untreated control	NA	4	36	19	102	33	19
2.	Corn gluten meal	10 lb 10 lb 10 lb 10	7	19	11	33	5	6
3.	Corn gluten meal	20 lb 20	3	18	3	5	0	0
4.	Corn gluten meal	30 lb 10	1	14	4	17	2	1
5.	Corn gluten meal	40	5	37	9	10	3	2
	$LSD_{0.05}$		NS	NS	NS	NS	21	15

[1]These values represent the number of crabgrass plants per plot.
NS = means are not significantly different at the 0.05 level.

Table 9. Percentage crabgrass count reductions[1] in Kentucky bluegrass treated in the 1995 Corn Gluten Meal Rate Weed Control Study for 1995 through 1999.

	Material	Rate lb product/1000 ft^2	1995	1996	1997	1998	1999	2000	2001
1.	Untreated control	NA	0	0	0	0	0	0	0
2.	Corn gluten meal	10 lb 10 lb 10 lb 10	28	0	48	42	67	85	68
3.	Corn gluten meal	20 lb 20	45	33	50	86	95	100	100
4.	Corn gluten meal	30 lb 10	44	67	61	78	86	93	94
5.	Corn gluten meal	40	54	0	0	53	90	92	87
	$LSD_{0.05}$		NS	NS	NS	NS	NS	63	83

[1]These values represent the percentage reductions in crabgrass plants per plot as compared with the untreated controls.
NS = means are not significantly different at the 0.05 level.

Table 10. Percentage dandelion count reductions[1] in Kentucky bluegrass treated in the 1995 Corn Gluten Meal Rate Weed Control Study for 1996 through 2001.

	Material	Rate lb product/1000 ft^2	1996	1997	1998	1999	2000	2001
1.	Untreated control	NA	0	0	0	0	0	0
2.	Corn gluten meal	10 lb 10 lb 10 lb 10	48	50	66	69	78	73
3.	Corn gluten meal	20 lb 20	50	60	59	85	88	83
4.	Corn gluten meal	30 lb 10	28	28	69	76	80	78
5.	Corn gluten meal	40	50	58	62	79	79	73
	$LSD_{0.05}$		NS	NS	21	38	38	34

[1]These values represent the percentage reductions in dandelion plants per plot as compared with the untreated controls.
NS = means are not significantly different at the 0.05 level.

Table 11. Percentage clover cover reductions[1] in Kentucky bluegrass treated in the 1995 Corn Gluten Meal Rate Weed Control Study for 1996 through 2001.

	Material	Rate lb product/1000 ft^2	1996	1997	1998	1999	2000	2001
1.	Untreated control	NA	0	0	0	0	0	0
2.	Corn gluten meal	10 lb 10 lb 10 lb 10	45	65	74	96	97	97
3.	Corn gluten meal	20 lb 20	69	82	72	99	97	97
4.	Corn gluten meal	30 lb 10	90	92	64	99	95	92
5.	Corn gluten meal	40	92	83	93	100	95	91
	$LSD_{0.05}$		NS	58	49	71	31	32

[1]These values represent the percentage reductions in clover cover per plot as compared with the untreated controls.
NS = means are not significantly different at the 0.05 level.

Anti-Desiccant Winter Protection of Creeping Bentgrass Putting Greens

D.D. Minner and F.J. Valverde

Introduction

The three major types of winter turf injury are direct low temperature stress, winter desiccation, and low temperature fungi. Frozen conditions in the absence of snow cover can cause a slow but constant lost of moisture. This type of winter injury known as desiccation is especially damaging during sunny and windy conditions. It is known that artificial barriers between the grass and the environment can positively decrease the physiological damage. Protective covers or tarps are often placed over the turf just prior to ground freeze and are not removed in the spring until the surface thaws. For most winter conditions turf covers speed spring green-up and reduce winter injury.

An alternative to using plastic or any other kind of covers in turfgrass is the use of anti-desiccants. These substances decrease the rate at which plant tissue would lose water.

The objective of this study was to determine the effect that anti-desiccants applied before winter would have on the quality of turfgrass at springtime.

Materials and Methods

The study was initiated November 15, 2001 at the Horticulture Research Station on a USGA sand based putting green containing a mature stand of 'Penncross' creeping bentgrass. The trial had eight treatments (Table 1) and 3 replications. Each treatment was applied using a CO_2 sprayer on an area of 5 x 5 ft^2. The Evergreen Turf Cover was placed on the same day that anti-desiccant treatments were applied.

Table 1. Description of products and application rates.

	Treatments	Rate (oz/1000ft^2)		Treatments	Rate (oz/1000ft^2)
1	GLAD	42	5	Transfilm	8
2	GLAD	17	6	Wilt-Pruf	42
3	GLAD	11	7	Cover Evergreen	~
4	GLAD	8	8	Control	~

No other practice or treatment was applied to the trial. A foot of snow was on top of the trial for about 90 days. The first rating of the trial was done the 26 of March, and every ten days after that, for a total of 4 ratings. Turf color was visually evaluated using a scale from 1-10, where 1 is white-brown color and 10 dark green.

Results

The winter of 2000 – 2001 produced record snow cover with just over 90 days of snow cover between December and March. The extensive snow cover eliminated any chance of injury from winter desiccation. Grey Snow Mold was generally extensive throughout the state, but there was only minimal injury on this particular bentgrass research site.

Table 1 shows the summary of four evaluation dates in the spring. Turf color was used to evaluate the amount of winter injury as well as the rate of spring green-up. Normal spring green-up began during the first week of April. The untreated control and the Evergreen cover were used for comparison with the anti-desiccant materials. The Evergreen cover provided better turf color than the non-treated control. Lower turf color ratings for the anti-desiccant materials seemed to be associated with a lighter tan color of the turfgrass blades. There was no rate effect among the GLAD treatments.

Table 2. Turf quality for various anti-desiccant treatments. Higher values represent less winter injury.

		Turf Quality at each given date				
Treatment	**Rate oz/sqft**	**3/26**	**4/4**	**4/14**	**4/24**	**Avg**
GLAD	42	2.3	2.7	4.3	5.0	3.5
GLAD	17	3.7	3.0	4.3	4.7	4.2
GLAD	11	2.3	2.3	3.7	4.7	3.2
GLAD	8	3.3	3.3	5.0	5.7	4.3
Transfilm	8	2.3	2.3	3.7	4.3	3.3
Wilt-Pruf	42	3.3	2.7	4.7	5.7	4.1
Evergreen cover	--	7.0	7.0	7.0	8.0	7.2
Control	--	4.0	4.0	5.0	5.0	4.6
$LSD_{0.05}$		**1.9**	**2.3**	**2.2**	**1.7**	**1.7**

While there were no significant differences between the control and any of the anti-desiccant materials, there appeared to be a non-statistical trend. This trend indicated that the anti-desiccant materials resulted in lower turf color ratings than the non-treated control. By 4 May all of the grass treated with anti-desiccants had recovered to a level equal to the non-treated control and the trend ceased to exist.

The anti-desiccant materials used in this trial did not improve the spring performance of putting green turf following the winter. The winter of 2000-2001 did not produce winter desiccation conditions.

Direct Heat Stress Effects on Creeping Bentgrass

Deying Li, David D. Minner, and Nick E. Christians

While direct high temperature damage is often suspected in the loss of creeping bentgrass on golf course greens in the summer, little data is available on this subject. It is known that as supraoptimal temperatures are reached, grasses become more susceptible to biotic- or abiotic- stresses. High soil temperatures inhibit many physiological activities of roots cells and disturb the normal functions of roots such as water uptake, nutrients uptake, hormonal transportation, and photosynthates distribution. High temperatures also cause leaf injuries and accelerate leaf senescence (DiPaola & Beard 1992; Huang, et al., 2000, 2001).

Sometimes, soil temperatures can be so high that direct injury occurs to the plant. This type of injury is classified as "direct heat stress" (Minner, 1981; Wehner & Watschke, 1981).

The exact scenario under which direct heat stress happens is not clear. It has been documented that a temperature gradient can be established above a turfgrass cover and that the surface temperature of the mat can be significantly higher than the air temperature just above the surface (Waterhouse, 1950). The objectives of this study were to investigate whether "direct heat stress" occurs on creeping bentgrass maintained under green conditions in central Iowa, to identify the forms of damage that occur, and to describe quantitatively the conditions that lead to the damage.

Materials and Methods

The experiment was conducted at the horticultural research station north of Ames, IA. "Crenshaw" creeping bentgrass was established at a rate of 2 lbs seed/1000ft^2 on Sept. 14, 2000, on a sand-based green constructed with 30 cm of sand on top of a 10 cm gravel layer. The green has a drainage system consisting of 10-cm-diam. drainage pipes placed at 10 m intervals. Starter fertilizer 1, 0.5, and 0.5 lbs/1000 ft^2 of N, P_2O_5, and K_2O, respectively, was applied at the time of seeding.

At the time of seeding, six 5' by 5' plots were established on the area by topdressing a 0.5-cm layer of Profile, Quick dry; Zeolite, Axis, mason sand, and a mixture of sand and peat (90% /10% v/v) over the surface. This was done to create conditions of different thermal properties on the surface of the green. The experiment was a randomized complete block design with three replications. Temperatures at three locations in each plot were measured at 0, 1 and 6 inches with thermal couples every 15 minutes for three consecutive days (Aug 11 to Aug 15). Water content was measured with a time domain refelectometer (TDR) in the top 5 cm of the soil media.

Results and Discussion

Mat temperature was 23.4 to 27.5 °F higher than the air temperature (Table 1). When the air temperature reached 86.9 °F°, the mat temperature reached 115 °F. We closely observed the creeping bentgrass shoots that were directly in contact with the soil surface and found that a banding of injured tissue occurred to many of the plants at this temperature. We refer to this phenomenon as "heat girdling". Some of this type of heat stress penetrated through surrounding leaves and sheaths, deeper into the center of the shoots and when the new leaf emerged, the girdling was observed on the emerging leaf blades (Fig. 1).

Further investigation on turf plugs taken from these field plots and maintained in the greenhouse showed that heat girdling generally happens when soil mat temperature reached 118 °F (48 °C). Exact air temperature at which such soil mat temperature happens depends on the soil water content and soil thermal diffusivity. However, once the soil mat temperature gets to the threshold temperature, it takes less than one hour to cause heat girdling to the bentgrass shoots.

Further research is needed to correlate air temperature and soil temperature for different root zone materials with different thermal properties and water holding capacities in order to predict threshold air temperatures and the amount of time required for direct heat stress. At this point we may conclude that direct heat stress such as heat girdling could occur during high temperature periods in central Iowa. We also believe that soil properties can affect the degree of injury. In the next phase of this work, we will address practical measures that can be taken to reduce heat stress damage on greens.

Table 1. Root-zone surface temperatures observed when air temperature reached 86.9 °F (30.5 °C) on August 12, 2001.

Treatment	Maximum mat temperature °F(°C)	Volumetric Water content @ 5 cm %
Sand	110.3(43.5)	12.6
10% Peat/90% sand (v/v)	112.1(44.5)	16.4
Profile	110.8(43.8)	15.1
Axis	114.4(45.8)	12.9
Zeolite	110.8(43.8)	14.6

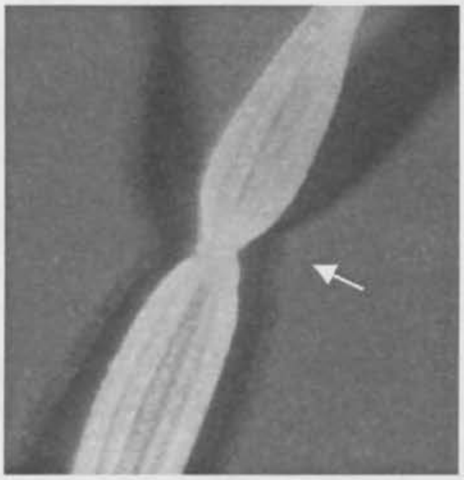

Fig. Heat girdled band on youngest leaf shown 3 days after injury occurred on Axis treatment. Leaf continued to grow and injured area became visible.

Sand-Based Sport Field Stability Study

Deying Li, D.D. Minner, and N.E. Christians

Sports turf is an important area of turfgrass application. Unlike golf courses, most of the sports turf fields require more stable playing surface to support the activities of players and facilities, and to provide protection against sports injuries. The quality of playing surface is a function of turfgrass and soil media (Canaway and Baker, 1993). Surface quality is usually expressed as friction, traction, stiffness, and resilience when the interaction between the surface and player is the main concern. It also can be evaluated from the ball bounce resilience and rolling resistance or ball speed when information about the behavior of sport facilities on a playing surface is needed (Bell et al., 1985; Baker et al., 1988; McClements and Baker, 1994). Of all the qualities of playing surface, perhaps the safety of the players is the most important consideration when constructing and evaluating a sports field. Many sports injuries are related to varying degree of surface stability (Valiant, 1988; Powell and Schootman, 1993; Waddington and McNitt, 1995). To assess the risk requires knowledge from many disciplines including the sports ground mechanics, which is not well understood because of very limited research. The objective of this study was to evaluate the relative importance of sand particle size, particle-size distribution, particle shape and roundness, plant roots and root-zone water content in the stability of a sand-based sport field surface.

Materials and Methods

The study was established on an existing sand-based sport turf area at the Horticultural Research Station. The root zones were excaved to form 5 X 10 ft plots 6 inches deep. Five treatments, Hallet mason sand, Hallet concrete sand, Sidlley Proangle sand, Bunker white sand, and Hallet mason sand + 15% soil (v/v) were filled in the plots and compacted with a Whacker vibrating compactor for ten passes. The experiment design is a randomized complete block, with three replications.

Sand angle at repose, particle-size distribution, particle shape/roundness (Li, 2001) was analyzed before loading materials to the plots (Table 1). On June 25 2001, half of each plot was planted with washed sod and half seeded with Kentucky bluegrass 'Unique'. The turf has been mowed once a week at 5 cm. The turf received 159 kg ha^{-1} N, 35 kg ha^{-1} P, and 96 kg ha^{-1} K in three months period after sodding. Water content was measured by TDR each time surface stability was evaluated. Playing surface parameters were evaluated both before and after turf establishment. The playing surface was evaluated by measuring the penetration with a penetrometer, surface hardness with a B&K 2500 vibration analyzer (Rogers and Waddington, 1990) and traction with a cleated torque wrench device (Canaway and Bell, 1986). Bulk density also was measured to determine the compaction status. Two month into the turf establishment grass root and thatch dry mass was quantified in addition to other measurements.

Preliminary Results

Adding soil to Hallet mason sand did not increase penetration resistance. Penetration resistance increased after sodding for all materials except silica sand (Table 2).

On 27 July 2001 (32 days after sodding) there was a noticeable increase in G_{max}A. Thereafter, G_{max}A decreased with no explanation (Table 2).

Hallet mason sand had significantly greater traction than Hallet concrete or silica sand. Adding soil to mason sand did not increase traction (Table 3).

For each sand material there was an optimum water content that maximized penetration resistance. Sand source (angularity) played a more important role in maximizing penetration resistance than adding 15% soil to mason sand.

Two months after sodding traction, measured by the torque wrench method, did not correlate with many of the plant mass or sand property measurements in this study (Table 3).

Table 1. Particle size analysis of the sand sources used in the study.

	Retained on sieve size (mm)									
	4	2	1	0.5	0.25	0.15	0.106	0.053	silt	clay
	%									
Hallet mason sand	0	1.9	10.6	45.9	32.9	7.3	1.1	0.3	0.1	0.0
Hallet concrete sand	5.6	11.8	16.7	35.5	22.1	6.5	0.8	0.2	0.1	0.0
Sidlley ProAngle	0	1.1	15.4	35	28.3	13.8	4	1.5	0.5	0.0
Silica sand	0	0	0	20.8	73.5	5	0.4	0.1	0	0.0
Hallet mason sand + 15 % soil	0	0.3	1.1	8.5	46	32.2	4.1	1.4	5.5	1

Table 2. Mechanical properties of various sand sources after establishment with washed Kentucky bluegrass sod.

Treatment	Penetrometer resistance (lbs)	G_{max} A	Torque (NM)
	9-27-01	9-27-01	8-25-01
Hallet mason sand	172	19.60	51.3
Hallet concrete sand	147	18.42	43.3
Sidlley Proangle	223	21.62	46.0
Silica sand	94	12.73	41.7
Hallet mason sand + 15% soil	168	19.73	48.3
$LSD_{0.05}$	18	2.06	5.6

G_{max} A-Maximum deceleration. Average of five readings measured at five different locations, one drop per location.

Table 3. Correlation coefficients between sand properties, plant mass, and playing surface parameters measured on 25 Aug. 2001, two months after sodding.

	Sand properties					Plant mass		Surface parameters			
	Ang.	Cu	I_g	I_r	Water	Root	Thatch	Penet. Res.	$G_{max}A$	$G_{maxs}B$	Torque
Ang.	1.00	**0.72****	**0.72****	0.16	0.07	-0.04	0.32	0.47	0.38	0.26	-0.01
Cu		1.00	**0.69****	**0.64****	-0.11	-0.02	**0.63***	**0.80****	**0.63***	0.48	0.15
I_g			1.00	0.08	-0.33	-0.26	0.24	0.19	0.09	-0.04	-0.32
I_r				1.00	-0.23	-0.04	**0.60***	**0.76****	0.48	0.41	0.05
Water					1.00	**0.75****	-0.03	0.25	0.47	0.30	**0.66****
Root						1.00	-0.02	0.30	0.41	0.11	0.44
Thatch							1.00	**0.76****	0.42	**0.65****	0.15
Res. Penet.								1.00	**0.81****	**0.69****	0.41
$G_{max}A$									1.00	**0.63***	0.49
$G_{maxs}B$										1.00	**0.53***
Torque											1.00

Ang.-Angle at repose at non compacted condition.
Cu -Coefficient of uniformity.
I_g -Gradation index.
I_r - Index of particle surface roughness.
Penet. Res. -Resistance of penetrometer penetration.
G_{max} A-Maximum deceleration. Average of five readings measured at five different locations, one drop per location.
G_{max} B-Maximum deceleration. Average of five readings measured at same location, five drops per location.

Conclusions

At this point it appears that multiple parameters, as opposed to a single type of measurement, will be required to accurately assess the stability of sand-based sport fields.

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Monsanto Company
Ossian Inc.
PBI/Gordon Corporation
Pickseed West Incorporated
Profile Products
Rainbird Irrigation Company
Rhone-Poulenc Chemical Company
Riverdale Chemical Company
Rohm and Haas Co.
The Scotts Company
Seeds West Inc.
Standard Golf Company
SubAir
Syngenta
TeeJet Spray Products
Terra Chemical Corporation
Textron
The Toro Company
Tri State Turf & Irrigation Co.
True Pitch, Inc.
Turf-Seed, Inc.
United Horticultural Supply
United Seeds Inc.
Weathermatic Corporation
Williams Lawn Seed Company