1987 Iowa Turfgrass Research Report

Cooperative Extension Service
Iowa State University
Ames, Iowa 50011

FG-453 | June 1987

Introduction

The following research report is the seventh yearly publication of the results of turfgrass research projects performed at Iowa State University. The first was published for the 1981 field day, which was held June 18, of that year. The others were published in conjunction with the 1982, 1983, 1984, 1985, and 1986 field days.

The first cultivar and management studies at the field research area were seeded in August 1979, and many of these investigations are now in their eighth season. The area has been expanded every year and by 1983 there were 4.2 acres of irrigated and approximately 3.0 acres of non-irrigated research area. Funding was obtained in 1983 to add 2.7 acres of irrigated research plots to the existing site. This construction was completed in the spring of 1985. Several new studies were initiated on this area in the 1985 and 1986 seasons and a map showing the location of these studies can be found in this report.

The expansion that has taken place since 1979 would not have been possible without the cooperation of the Iowa Agriculture Experiment Station, the Iowa Turfgrass Institute, the Iowa Golf Course Superintendent's Association, the Iowa Professional Lawn Care Association, and the Iowa Turfgrass Producers and Contractors (ITPAC) organization.

We would also like to acknowledge Kenneth Diesburg, Richard Moore, Young Joo, Michael Burt, Zachary Reicher, Jim Walser, Dan Weidemeir, Jeff Ryan, Pat Gradoville, Paul Johnson, Paul Dayton, and all the others employed at the field research area in the past year for their efforts in building the program.

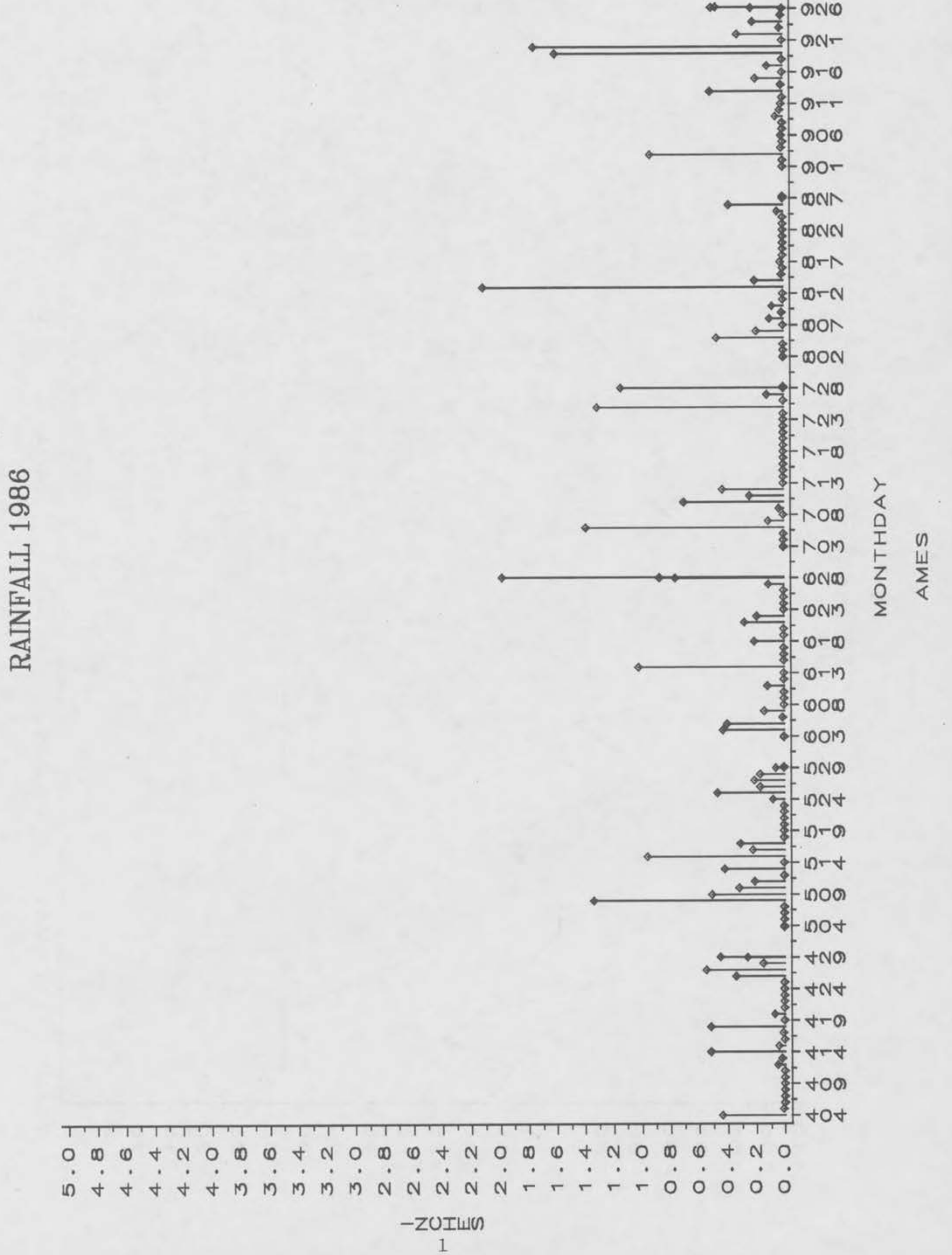
A special thanks goes to Betty Hempe for her work on typing this publication.

Edited by Nick Christians, associate professor, turfgrass science; Michael Agnew, assistant professor, turfgrass extension; and Elaine Edwards, extension communication specialist.

Table of Contents

Environmental Data

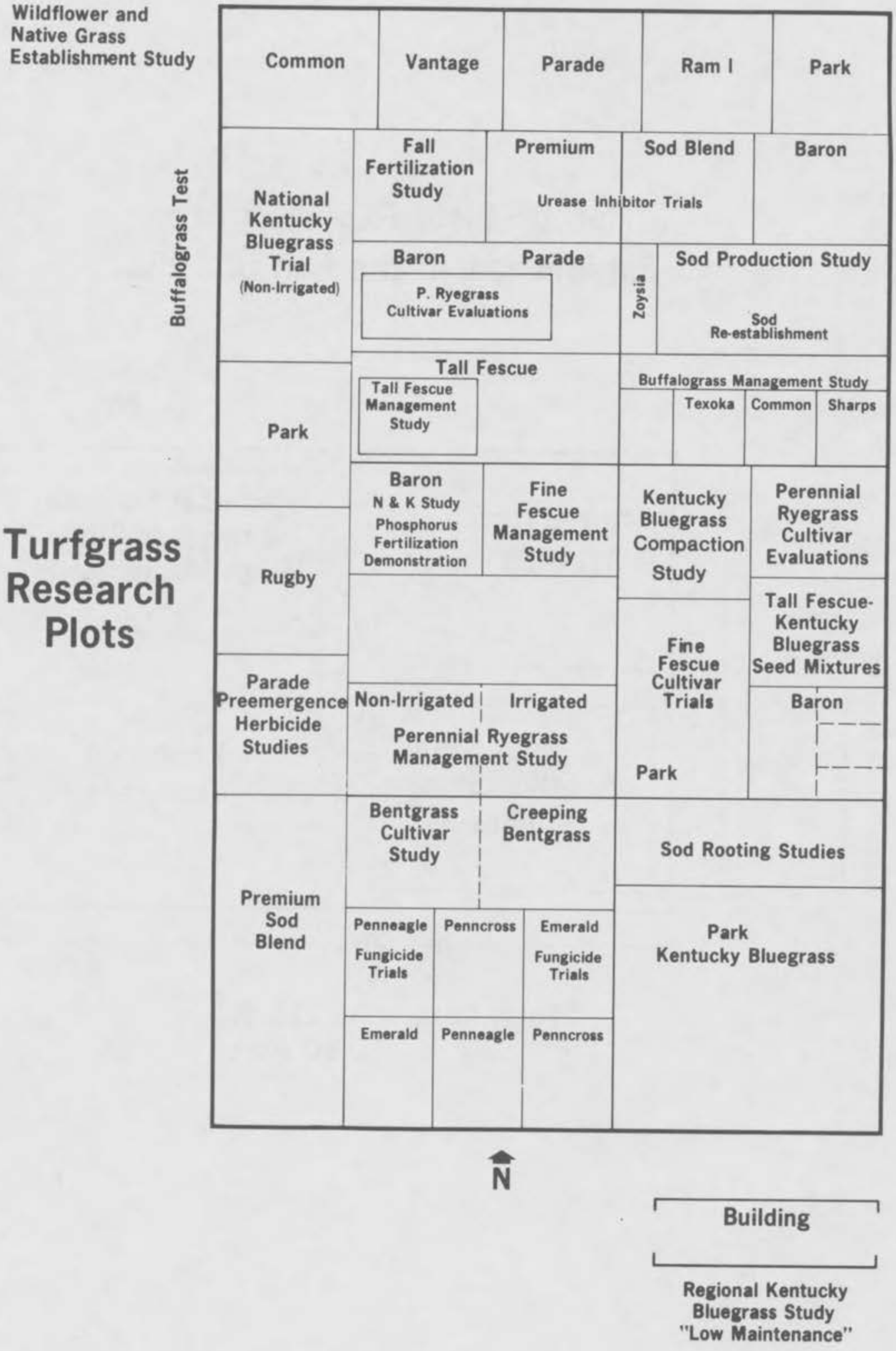
RAINFALL 1986



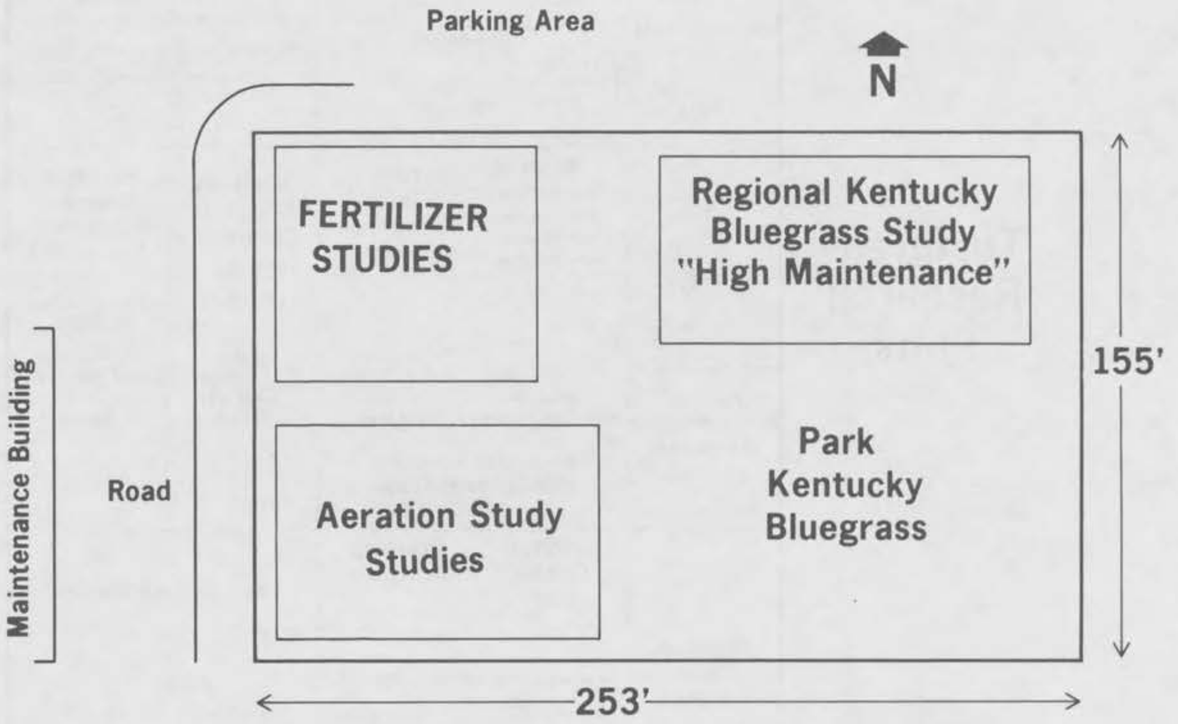
AMES

TEMPERATURE 1986

Turfgrass Research Area Maps

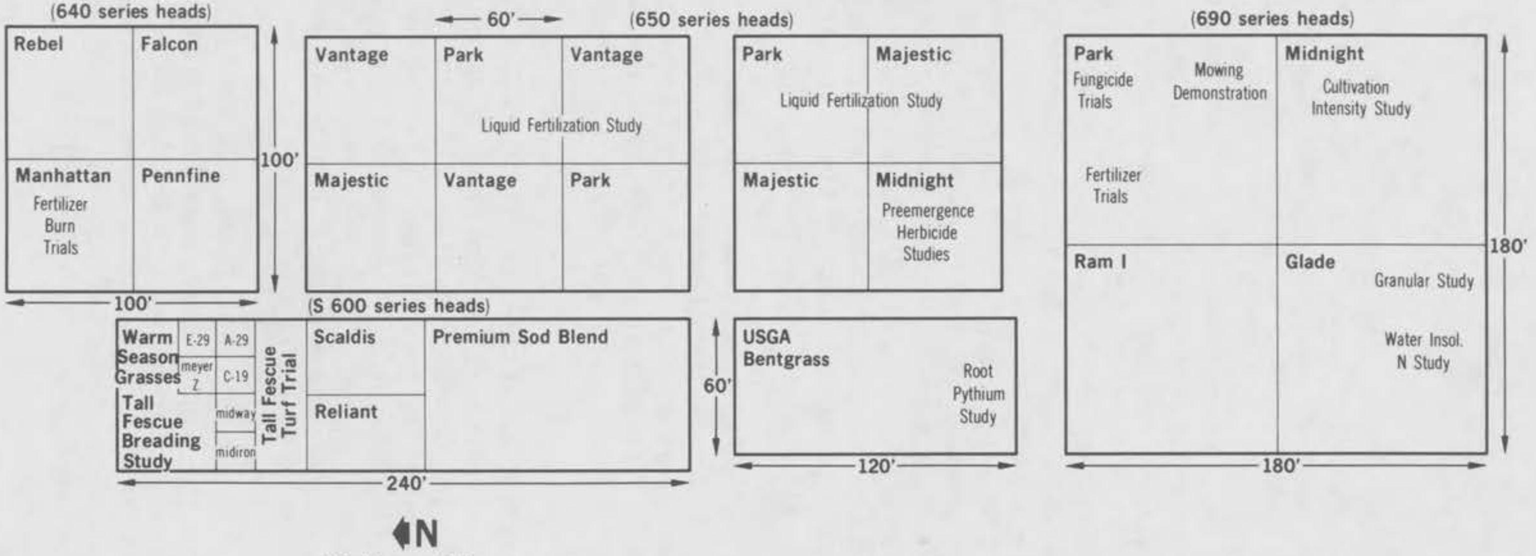


Map of Field Research Area Established in the Fall of 1981



Total Area 39,215 ft^2
0.90 Acres

1984 Expansion of the Turfgrass Research Area



Total Area = 2.7 acres

Results of High- and Low-Maintenance Kentucky Bluegrass Regional Cultivar Trials—1986

N. E. Christians

In 1980, the United States Department of Agriculture (USDA) initiated a regional Kentucky bluegrass cultivar trial that is presently being conducted at most of the northern agricultural experiment stations. The test consists of 84 cultivars, with each cultivar replicated three times.

Three separate trials are underway at Iowa State University. One is a high-maintenance study established in 1981 that receives 4 lb N/1000 ft^2/yr and is irrigated as needed; another is a low-maintenance study established in 1980 that receives 1 lb N/1000 ft^2/yr in September and is not irrigated. The third trial was established in 1985 and receives 4 lb N/1000 ft^2/yr but is not irrigated. The objective of the high-maintenance study is to investigate the performance of the 84 cultivars under a cultural regime similar to that used on irrigated home lawns in Iowa. The objective of the low-maintenance study is to observe the performance of the 84 cultivars under conditions similar to those that would be used in a park, school yard, or other low-maintenance areas. The objective of the third study is to observe the response of the cultivars under conditions similar to those found in a non-irrigated lawn that receives a standard lawn care program. Data collection for the third study will begin in 1987 and no data appears in this report.

The values listed under each month in tables 1 and 2 are the averages of ratings made on three replicated plots for the high- and low-maintenance studies. Yearly means of all the months in which data were taken are listed in the last column. The first cultivar received the highest average rating for the entire 1985 season. The cultivars are then listed in descending order of average quality.

The least significant difference (LSD) value listed at the bottom of each column is a statistical value that can be used to further evaluate the data. For cultivars to be considered different from one another, their mean quality ratings must exceed the LSD value. For example, the yearly means for the high-maintenance cultivars must exceed 0.6, the LSD for that column (Table 1). RAM-1 with a mean reading of 7.5 performed better than Merit with a reading of 6.8. However, the performance of RAM-1 was statistically the same as Glade which had a yearly mean of 7.3.

RAM-1, Glade, Kimono, Adelphi, Cheri, WW Ag 478, and Midnight were the best of the cultivars in the high-maintenance trial (Table 1). Most of these cultivars have consistently performed well over the past few years and can be considered to be among the best cultivars for Iowa conditions on high-maintenance sites. It should be noted that most of the cultivars performed satisfactorily because of the very mild weather conditions in 1986.

In past years, cultivars that performed well under high-maintenance conditions did not do as well under low-maintenance conditions. Conversely, many of the poorer cultivars in high-maintenance areas were the best in the low-maintenance study. The 1986 season was so wet that this trend was not as apparent as in past years. The low-maintenance trial was not subjected to moisture stress at any time during the summer.

K3-162, PSU-173, WW Ag 463, Plush, SH-2, and Cheri were the top rated cultivars in the low-maintenance trial (Table 2). Many cultivars that ranked in the upper 25 positions in 1986 have been ranked much lower in dryer years. In choosing cultivars for low maintenance conditions, data from several years should be considered.

Table 1. The 1986 quality ratings for the high-maintenance regional Kentucky bluegrass test established in the fall 1981.

	Cultivar	May	June	July	Aug	Sept	Oct	Mean
1.	RAM-1	7.0	8.0	6.7	8.3	8.3	7.0	7.5
2.	Glade	7.3	6.0	5.7	8.3	8.0	7.3	7.3
3.	Kimono	6.3	6.0	7.7	6.7	8.0	7.7	7.3
4.	Adelphi	7.0	7.0	7.3	7.3	7.0	7.3	7.2
5.	Cheri	7.0	6.3	7.3	6.7	7.7	7.3	7.2
6.	WW Ag 478	6.7	7.3	7.3	7.7	7.7	6.7	7.2
7.	Midnight	6.0	7.3	7.0	8.7	8.0	6.3	7.2
8.	243	7.7	6.7	6.7	7.7	7.3	6.3	7.1
9.	MLM-18011	7.3	6.7	6.0	7.0	7.7	7.3	7.1
10.	Bonnieblue	7.0	7.0	7.0	7.0	8.0	6.7	7.1
11.	Enmundi	5.7	6.7	7.0	7.3	7.7	7.3	7.0
12.	Fylking	6.7	6.0	6.3	6.7	7.3	7.3	6.9
13.	Rugby	7.0	7.3	6.3	6.3	7.7	7.3	6.9
14.	Holiday	6.7	6.7	6.7	6.7	7.7	7.0	6.9
15.	A20-6	6.3	7.3	7.7	6.0	7.0	7.7	6.9
16.	N535	7.0	6.3	6.7	7.0	7.3	6.3	6.9
17.	Mona	7.0	7.0	6.0	6.3	7.7	7.3	6.9
18.	Escort	7.0	6.3	6.3	7.3	7.3	6.7	6.9
19.	PSU-150	6.7	5.0	7.0	7.0	7.7	5.7	6.8
20.	Merit	6.7	6.0	6.7	7.0	7.3	6.3	6.8
21.	Shasta	6.7	7.0	6.3	6.7	7.7	6.7	6.8
22.	Sydsport	6.7	7.7	7.0	6.7	7.0	6.7	6.8
23.	SV-01617	6.3	6.3	5.3	7.3	7.7	7.0	6.7
24.	Aspen	6.7	6.7	6.7	5.7	7.3	7.0	6.7
25.	Mosa	6.7	6.3	6.3	6.7	7.3	6.7	6.7
26.	A20	6.7	7.3	7.7	6.0	6.3	7.0	6.7
27.	I-13	6.0	7.7	8.0	6.0	6.3	7.0	6.7
28.	Barblue	7.7	6.3	6.7	5.7	7.0	6.3	6.7
29.	Birka	6.7	5.3	6.7	6.3	7.0	6.3	6.6
30.	PSU-173	6.7	5.7	6.7	5.7	7.0	7.0	6.6
31.	Plush	6.7	7.3	7.3	6.3	6.3	6.3	6.6
32.	Banff	7.0	7.0	6.0	5.3	7.7	7.0	6.6
33.	America	7.0	5.7	7.0	6.0	7.0	6.0	6.6
34.	A20-6A	5.0	7.0	7.0	6.3	7.3	7.3	6.6
35.	Columbia	6.3	7.3	6.3	7.0	6.3	7.0	6.6
36.	Merion	6.7	7.3	7.0	7.0	6.0	6.3	6.6
37.	K3-178	6.3	6.7	6.3	7.0	6.3	7.0	6.6
38.	K1-152	5.7	7.3	7.0	6.0	7.0	7.3	6.6
39.	239	6.3	6.7	6.3	6.3	7.0	6.3	6.5
40.	PSU-190	6.7	6.3	6.3	6.3	7.3	5.7	6.5
41.	Baron	6.7	5.7	6.0	7.0	7.3	5.7	6.5
42.	Parade	6.7	7.0	6.0	7.0	6.7	6.3	6.5
43.	Trenton	6.0	6.7	6.7	6.0	7.0	7.0	6.5
44.	Dormie	6.0	6.3	7.0	6.0	7.0	6.3	6.5
45.	CEB VB 3965	7.3	7.0	6.3	6.0	6.7	6.3	6.5

Table 1. The 1986 quality ratings for the high-maintenance regional Kentucky bluegrass test established in the fall 1981. (continued)

	Cultivar	May	June	July	Aug	Sept	Oct	Mean
46.	WW Ag 480	5.7	7.3	6.0	6.0	7.3	7.3	6.5
47.	Harmony	6.7	6.7	6.7	6.0	6.3	6.7	6.5
48.	Majestic	6.0	7.3	6.3	6.0	7.3	6.7	6.5
49.	Bristol	6.3	7.3	6.0	6.3	7.7	6.0	6.5
50.	SH-2	6.0	6.7	6.7	5.7	7.0	7.0	6.5
51.	BA-61-91	5.7	7.7	6.0	6.7	7.3	6.7	6.5
52.	P-141 (Mystic)	7.0	7.3	6.3	6.3	6.3	6.7	6.5
53.	Admiral	5.7	6.3	7.0	6.3	7.0	6.3	6.5
54.	K3-179	6.3	6.7	6.0	6.7	6.7	6.7	6.5
55.	Geronimo	6.7	5.3	6.3	5.7	7.7	5.7	6.4
56.	Charlotte	6.7	6.0	5.0	7.3	7.7	5.3	6.4
57.	Bayside	6.7	6.3	5.7	6.3	7.0	6.3	6.4
58.	Monopoly	6.0	7.3	6.7	5.7	6.7	6.3	6.3
59.	Nugget	6.3	6.7	6.0	6.3	6.7	6.3	6.3
60.	Touchdown	5.7	5.7	4.7	7.0	7.7	6.7	6.3
61.	Welcome	5.7	6.3	6.3	6.7	7.0	5.7	6.3
62.	WW Ag 463	6.7	6.7	6.7	5.7	6.3	6.0	6.3
63.	Vanessa	6.3	6.3	6.0	6.0	6.7	6.3	6.3
64.	Cello	6.0	6.0	6.0	5.7	6.3	7.7	6.3
65.	A-34	7.0	6.7	6.0	5.7	6.7	6.3	6.3
66.	Mer pp 300	6.7	6.7	6.3	6.0	6.7	6.0	6.3
67.	NJ 735	7.0	6.7	5.7	6.0	7.0	6.0	6.3
68.	Eclipse	4.3	5.3	7.0	6.7	7.0	6.3	6.3
69.	Argyle	5.7	6.3	7.0	5.7	7.0	5.7	6.2
70.	H-7	5.7	7.3	6.7	5.0	6.0	7.7	6.2
71.	Enoble	5.3	6.0	6.0	6.7	6.7	6.3	6.2
72.	S-21	6.7	5.0	6.3	5.7	6.0	5.7	6.1
73.	Bono	7.0	6.0	6.3	5.7	5.7	6.0	6.1
74.	Kenblue	6.3	4.7	5.7	6.3	6.0	6.0	6.1
75.	Apart	5.7	6.7	5.3	6.3	6.7	6.7	6.1
76.	Victa	6.0	7.3	6.3	6.0	6.7	5.7	6.1
77.	225	5.3	7.0	6.0	6.0	6.0	7.3	6.1
78.	Vantage	5.7	6.7	7.0	5.7	6.3	5.3	6.0
79.	S.D. Common	7.7	5.7	5.3	5.3	6.0	5.7	6.0
80.	Wabash	5.3	7.3	6.3	5.3	6.7	6.0	5.9
81.	Piedmont	5.7	7.3	6.7	5.3	6.0	5.7	5.9
82.	K3-162	6.7	4.7	4.7	6.3	5.3	5.3	5.7
83.	Mer pp 43	6.0	6.0	5.7	5.3	5.7	4.7	5.5
84.	Lovegreen	6.7	5.7	4.7	5.3	5.3	4.0	5.2
	LSD 0.05	1.7	1.5	1.5	1.4	1.3	1.3	0.6

Quality based on a scale of 9 to 1; 9 = best quality, 6 = acceptable quality, and 1 = poorest quality.

Table 2. The 1986 quality ratings for the low-maintenance regional Kentucky bluegrass test established in the fall 1980.

Cultivar	May	June	July	Aug	Sept	Oct	Mean
1. K3-162	6.3	5.0	6.0	6.7	6.3	7.3	6.3
2. PSU-173	6.0	6.3	5.3	5.7	5.7	6.0	5.8
3. WW Ag 463	4.3	6.7	5.3	5.0	6.3	7.0	5.8
4. S-21	6.0	4.7	5.0	6.0	6.3	6.0	5.7
5. Plush	3.3	7.0	6.0	5.7	5.7	5.3	5.5
6. SH-2	4.7	6.3	5.0	5.0	5.7	6.3	5.5
7. Cheri	5.0	6.3	5.7	4.7	5.7	5.3	5.4
8. Baron	4.0	6.3	5.3	5.0	6.0	5.7	5.4
9. MLM-18011	4.0	7.3	4.7	5.3	5.3	5.7	5.4
10. CEB VB 3965	4.3	5.7	6.0	5.3	4.7	6.7	5.4
11. Midnight	3.7	6.3	5.3	5.7	5.7	6.0	5.4
12. S. D. Common	5.7	4.7	5.0	6.0	5.3	5.7	5.4
13. Glade	5.7	6.0	5.0	4.0	5.7	5.7	5.3
14. Wabash	6.0	5.3	4.7	4.7	4.3	6.7	5.3
15. PSU-150	5.3	5.3	4.3	5.3	5.0	6.3	5.3
16. Aspen	3.7	6.0	5.0	5.0	5.7	6.3	5.3
17. Kenblue	5.3	4.3	5.3	6.3	6.0	4.7	5.3
18. America	4.3	6.0	5.0	5.3	5.0	6.3	5.3
19. N535	3.7	6.0	5.0	5.3	5.7	6.3	5.3
20. Victa	4.3	6.3	5.0	4.3	6.0	6.0	5.3
21. Barblue	3.7	5.7	5.3	5.3	5.7	6.0	5.3
22. RAM-1	2.7	7.0	5.3	5.0	6.0	5.3	5.2
23. Holiday	4.3	6.3	4.3	4.0	5.3	6.7	5.2
24. 243	3.7	5.7	4.7	5.3	5.7	5.7	5.1
25. Nugget	3.3	6.3	4.7	5.3	5.0	6.0	5.1
26. PSU-190	4.0	6.3	4.7	5.0	5.7	5.0	5.1
27. Trenton	4.0	6.7	5.0	4.3	5.0	5.7	5.1
28. Touchdown	4.3	5.3	5.0	4.3	5.7	6.0	5.1
29. Vanessa	4.7	6.3	4.7	4.3	5.0	5.3	5.1
30. Majestic	4.3	6.3	5.0	4.0	5.3	5.7	5.1
31. K3-178	4.7	5.3	4.7	4.3	5.0	6.7	5.1
32. Adelphi	3.7	6.0	4.7	4.7	5.3	5.7	5.0
33. Fylking	4.0	5.7	5.3	5.0	5.0	5.0	5.0
34. Mer pp 300	4.0	5.3	4.0	5.0	5.3	6.3	5.0
35. Mer pp 43	3.3	5.0	5.0	5.3	5.7	5.7	5.0
36. Enoble	3.7	5.7	4.3	5.7	4.7	6.0	5.0
37. Merion	5.0	5.0	5.3	4.3	5.0	5.3	5.0
38. Geronimo	4.3	5.3	5.0	4.3	5.3	5.3	4.9
39. Welcome	3.0	5.7	5.0	5.7	4.7	5.7	4.9
40. Cello	4.0	5.0	5.7	4.3	5.0	5.3	4.9
41. WW Ag 478	3.7	5.3	4.7	4.7	5.0	6.0	4.9
42. Piedmont	4.7	5.3	4.0	4.3	5.0	6.0	4.9
43. A20-6	4.3	6.0	4.7	4.3	4.3	6.0	4.9
44. BA-61-91	3.0	6.0	5.0	4.7	5.0	6.0	4.9
45. K1-152	3.3	5.7	4.3	4.7	5.0	6.3	4.9

Table 2. The 1986 quality ratings for the low-maintenance regional Kentucky bluegrass test established in the fall 1980. (continued)

	Cultivar	May	June	July	Aug	Sept	Oct	Mean
46.	Kimono	4.7	5.7	5.0	5.0	4.3	4.3	4.8
47.	Parade	5.7	5.3	3.3	4.0	5.0	5.7	4.8
48.	Rugby	4.7	6.0	4.0	4.0	4.3	6.0	4.8
49.	Mona	3.3	6.0	4.7	4.3	5.3	5.3	4.8
50.	Bristol	3.0	5.7	4.3	4.0	5.7	6.0	4.8
51.	NJ 735	3.0	5.7	4.7	4.0	5.7	6.0	4.8
52.	225	4.3	5.7	4.0	4.3	4.3	6.0	4.8
53.	Cheri	4.0	6.3	4.3	4.0	4.0	5.7	4.7
54.	Enmundi	3.3	6.0	4.0	4.3	5.3	5.3	4.7
55.	SV-01617	3.0	6.0	4.3	4.3	4.7	5.7	4.7
56.	Banff	3.0	5.7	4.3	4.0	6.0	5.3	4.7
57.	Bono	5.7	5.0	3.3	4.0	4.3	5.7	4.7
58.	Argyle	5.3	5.0	4.7	5.0	4.0	4.3	4.7
59.	Charlotte	3.3	6.0	4.7	4.7	4.3	5.3	4.7
60.	A20-6A	4.3	6.0	4.3	3.3	4.3	5.7	4.7
61.	Columbia	3.3	5.7	4.0	4.3	5.7	5.3	4.7
62.	Lovegreen	3.0	5.3	4.7	4.3	5.0	5.7	4.7
63.	Admiral	3.7	5.3	4.3	4.0	4.0	6.7	4.7
64.	Eclipse	4.3	5.7	3.3	4.3	5.0	5.7	4.7
65.	K3-179	3.3	5.3	4.3	4.0	5.0	6.0	4.7
66.	Birka	5.0	5.3	3.7	4.3	4.3	5.0	4.6
67.	Dormie	4.3	5.0	4.0	3.7	5.3	5.3	4.6
68.	Vantage	5.7	4.7	3.3	4.0	4.7	5.3	4.6
69.	Merit	3.7	5.7	4.0	4.7	4.7	5.0	4.6
70.	A20	3.7	5.3	5.0	4.3	4.3	5.0	4.6
71.	I-13	3.7	7.0	4.0	3.3	4.0	5.7	4.6
72.	Shasta	3.7	5.7	3.7	3.3	5.3	6.0	4.6
73.	Apart	4.0	5.0	4.7	4.3	4.7	5.0	4.6
74.	A-34	4.7	4.7	4.3	4.0	4.3	5.3	4.6
75.	Sydsport	3.0	5.7	4.7	4.0	4.7	5.3	4.6
76.	Bayside	5.7	5.3	4.0	3.3	4.0	5.0	4.6
77.	239	3.7	6.0	4.0	3.7	4.7	5.0	4.5
78.	Harmony	4.3	4.7	3.3	3.7	4.7	5.0	4.5
79.	Mosa	3.3	5.7	4.3	4.0	4.7	5.0	4.5
80.	Bonnieblue	3.3	5.3	5.0	3.7	4.7	5.0	4.5
81.	WW Ag 480	2.7	6.0	4.7	3.3	5.3	4.3	4.4
82.	H-7	3.7	6.0	4.3	3.7	3.7	5.0	4.4
83.	P141 (Mystic)	3.3	6.3	4.7	3.3	4.3	4.7	4.4
84.	Escort	4.7	6.3	4.3	3.0	3.7	4.7	4.4
	LSD 0.05	1.5	1.3	1.8	1.5	1.7	1.4	0.8

Quality based on a scale of 9 to 1; 9 = best quality, 6 = acceptable quality, and 1 = poorest quality.

Cedar Rapids High-Maintenance Kentucky Bluegrass Trials

M. A. Loan, P. A. Petersen, N. E. Christians, and M. L. Agnew

With the cooperation of Iowa State University, the first Kentucky bluegrass trial was established in August 1985 at the turf farm of Blue Grass Enterprises located northwest of Cedar Rapids, Iowa, on Blairs Ferry Road.

When Iowa State University received the 1980 USDA Regional Kentucky bluegrass cultivar trials it was short two cultivars, SH-2 (Somerset) and Barblue, that were replaced with Gnome and Georgetown. In August 1985, with the help of Dr. Michael Agnew, Iowa State University extension turfgrass specialist and Patty Petersen, extension horticulture associate, Linn County, the 84 cultivars were seeded into individual plots measuring 4 feet by 6 feet and replicated twice. A starter fertilizer had been applied at 2 lb P_2O_5/1000 ft^2 (7-28-28) prior to seeding and after seeding the plots were irrigated twice a day for three weeks. An application of 1 lb N/1000 ft^2 (20-10 10) was made in September.

After eight days, Kenblue and Cello had germinated in both replications. Others to germinate quickly were Merit, Plush, Vantage, Welcome, Bayside, Vanessa, Mona, Mystic, and Georgetown.

The plots made it through the 1985 winter just fine and the growing season in 1986 was fairly normal. The plots were maintained with 4 lb N/1000 ft^2 (20-10-10), mowed at 2 inches, and irrigated as needed. One application of broadleaf weed control was used in the spring to eliminate the winter annuals established at the time of seeding. During 1986, the turfgrass quality was average to good with the highest in July and September, that was expected the first full year after seeding. There were no major disease or insect problems in 1986.

The values listed under each month are the averages of the ratings on the two replicated plots (Table 3). Yearly means of all the months in which data were collected are listed in the last column.

Table 3. The 1986 quality ratings for the high-maintenance regional Kentucky bluegrass trials established at Blue Grass Enterprises in Cedar Rapids, Iowa, in the fall of 1985.

	Cultivar	Apr	June	July	Aug	Sept	Mean
1.	Enmundi	5.5	7.2	8.8	7.5	8.3	7.5
2.	Plush	6.0	6.4	7.8	7.3	8.3	7.2
3.	Bristol	4.5	6.6	8.5	7.0	9.0	7.1
4.	Classic/225	6.0	6.3	8.3	6.8	8.0	7.1
5.	WW Ag 463	6.0	6.7	7.8	6.8	7.8	7.0
6.	K3-178	5.5	6.7	7.8	6.8	8.3	7.0
7.	K3-179	5.5	6.4	8.0	6.8	8.3	7.0
8.	Vanessa	5.0	6.5	8.5	6.8	8.0	7.0
9.	Baron	5.0	6.9	8.0	6.5	8.3	6.9
10.	A-20	5.5	6.3	8.0	6.3	8.5	6.9
11.	239	6.0	5.8	7.8	6.8	8.0	6.9
12.	Midnight	4.5	6.6	8.5	6.5	8.3	6.9
13.	Wabash	4.5	6.4	8.8	7.3	7.3	6.9
14.	PSU-150	5.5	6.8	7.5	6.5	7.8	6.8
15.	Trenton	5.5	6.1	7.3	6.0	9.0	6.8
16.	MLM-18011	4.5	6.5	7.8	6.5	8.5	6.8
17.	Touchdown	5.0	6.0	8.3	6.5	8.0	6.8
18.	Cello	6.0	6.7	8.3	6.0	6.8	6.8
19.	PSU-190	5.5	6.0	8.3	6.8	7.0	6.7
20.	Sydsport	4.5	6.5	7.8	6.8	8.0	6.7
21.	Georgetown	5.5	5.6	8.0	6.5	8.0	6.7
22.	WW Ag 480	4.0	6.2	7.5	7.3	8.5	6.7
23.	Mosa	5.3	6.3	8.3	5.8	7.8	6.7
24.	Birka	5.0	7.0	8.0	6.3	7.0	6.7
25.	Majestic	5.0	5.2	7.5	6.8	8.8	6.7
26.	K1-152	5.0	6.5	7.8	6.0	8.0	6.7
27.	Victa	4.0	6.8	8.3	6.3	7.8	6.6
28.	Parade	5.0	6.2	7.5	6.0	8.3	6.6
29.	Geronimo	5.0	6.2	7.8	6.5	7.5	6.6
30.	Gnome	4.5	6.1	8.0	6.3	8.0	6.6
31.	RAM-1	4.0	6.3	7.5	6.5	8.3	6.5
32.	America	3.5	6.1	8.0	6.5	8.5	6.5
33.	Shasta	4.0	6.0	7.8	6.3	8.5	6.5
34.	Bayside	4.5	6.3	7.8	6.5	7.5	6.5
35.	Adelphi	4.0	5.9	7.8	6.8	8.0	6.5
36.	Glade	3.5	6.4	8.3	6.3	8.0	6.5
37.	Admiral	4.5	6.1	7.3	6.8	7.8	6.5
38.	Harmony	5.0	6.3	8.0	6.3	6.8	6.5
39.	Mona	4.8	6.1	7.7	6.3	7.5	6.5
40.	Bono	5.0	6.8	7.8	6.3	6.3	6.4
41.	H-7	5.0	5.3	7.3	6.3	8.0	6.4
42.	K3-162	5.0	6.6	7.5	6.0	6.8	6.4
43.	Welcome	5.5	6.0	8.0	5.8	6.5	6.4
44.	BA-61-91	3.5	5.9	7.8	6.5	8.0	6.3
45.	Columbia	4.5	4.8	7.3	7.0	8.0	6.3
46.	Escort	4.5	5.5	6.8	5.5	8.3	6.1
47.	Bonnieblue	5.0	5.4	7.8	5.5	7.8	6.3
48.	NJ 735	4.5	5.9	7.8	6.0	7.3	6.3

Table 3. The 1986 quality ratings for the high-maintenance regional Kentucky bluegrass trials established at Blue Grass Enterprises in Cedar Rapids, Iowa, in the fall of 1985. (continued)

	Cultivar	Apr	June	July	Aug	Sept	Mean
49.	Cheri	3.5	6.2	7.5	6.3	7.8	6.3
50.	Rugby	3.5	6.2	7.8	6.0	7.8	6.3
51.	WW Ag 478	5.0	4.0	8.5	5.8	8.0	6.3
52.	Challenger/N535	5.0	4.5	7.3	6.5	7.8	6.2
53.	A-34	4.5	5.8	7.5	5.8	7.5	6.2
54.	Mystic/P-141	5.0	5.9	8.3	6.0	5.8	6.2
55.	Holiday	4.0	6.4	7.8	6.0	6.8	6.2
56.	A-20-6A	4.0	6.1	7.8	6.0	7.0	6.2
57.	A-20-6	4.0	5.8	8.3	5.5	7.0	6.1
58.	Eclipse	3.5	6.1	8.0	6.0	7.0	6.1
59.	Kimono	4.5	5.0	7.5	6.0	7.5	6.1
60.	Escort	4.5	5.5	7.5	6.0	7.0	6.1
61.	Banff	3.5	5.4	7.5	6.5	7.5	6.1
62.	Vantage	5.5	5.8	7.5	4.8	6.8	6.1
63.	Merit	3.5	5.9	7.5	5.5	7.8	6.0
64.	PSU-173	3.5	6.3	7.5	5.8	7.0	6.0
65.	Mer pp 300	3.5	6.2	7.0	5.5	7.8	6.0
66.	S-21	4.5	6.2	7.3	5.0	6.8	6.0
67.	Nassau/243	2.5	6.4	6.8	6.0	7.8	5.9
68.	Argyle	4.0	4.8	8.0	5.8	6.8	5.9
69.	Enoble	5.0	5.3	7.3	5.3	6.5	5.9
70.	Monoply	4.0	6.2	6.8	6.0	6.3	5.9
71.	Apart	4.0	5.7	7.0	5.5	7.0	5.8
72.	Fylking	3.5	4.5	7.3	6.5	7.3	5.8
73.	Dormie	4.0	5.7	7.8	6.0	5.5	5.8
74.	Aspen	5.0	5.3	6.0	5.8	6.8	5.8
75.	Kenblue	5.5	5.4	6.8	5.3	5.5	5.7
76	SV-01617	3.0	5.2	6.8	5.5	7.5	5.6
77.	CEB VB 3965	3.5	5.1	7.3	5.3	6.8	5.6
78.	Piedmont	4.0	5.4	7.5	5.5	5.5	5.6
79.	Lovegreen	4.5	5.8	6.8	4.3	6.3	5.5
80.	Nugget	2.5	5.1	7.3	5.8	7.0	5.5
81.	Merion	4.0	4.4	7.3	6.0	5.8	5.5
82.	Mer pp 43	4.0	4.8	7.5	5.3	5.0	5.3
83.	Charlotte	3.5	4.0	6.5	5.0	7.5	5.3
84.	SD Cert	3.5	5.8	7.0	4.3	5.5	5.2
	LSD 0.05	1.8	1.7	1.4	1.5	1.9	1.4

Quality based on a scale of 9 to 1; 9 = best quality, 6 = acceptable quality, and 1 = poorest quality.

Regional Perennial Ryegrass Cultivar Evaluation

K. L. Diesburg and N. E. Christians

This is the fourth year of data from the trial established in the fall of 1982 in conjunction with several identical trials across the country coordinated by the USDA. The purpose of the trial is to identify regional adaptation of the 48 perennial ryegrass cultivars. Cultivars are evaluated each month of the growing season for turf quality and disease.

The trial is maintained at a 2-inch mowing height with 3-4 lb N/1000 ft^2 through the growing season and is irrigated when needed to prevent drought. Preemergence herbicide is applied once in the spring and broadleaf herbicide is applied once in September to control weeds.

The summer of 1986 was cooler than normal. It is possible the usual ranking of cultivars shifted against those that tolerate heat (Table 4).

The 48 cultivars can be divided into nine groups in decreasing level of turf quality:

1. Excellent throughout the growing season:

   LP 702
   SWRC-1
   HE 168
   Citation II
   Palmer

2. Slow spring green-up and excellent thereafter:

   Manhattan II
   Repell
   Tara
   Prelude

3. Good throughout the growing season:

   Diplomat
   Birdie
   Yorktown II
   Fiesta
   M382

4. Excellent in spring to fair in fall:

   Ranger
   Blazer
   Pennant
   WWE 19

5. Fair in spring to excellent in fall:

   Gator
   HE 178
   Elka

6. Fair in spring to good in fall:

Premier
Cigil
HR 1
Crown

7. Good in spring to fair in fall:

All Star
Omega
Manhattan
Pennfine
LP 792

8. Fair throughout the growing season:

Acclaim
Barry
NK80389
Ovation
Derby
Cockade
Cowbow
Dasher
LP 210
NK 79307
Citation
Delray
Cupido
Birdie II
Regal
NK79309

9. Poor throughout the growing season:

Pippin
Linn

Table 4 . Turf quality[a] of perennial ryegrass cultivars in 1986.

	Ratings[a]							
Cultivar	Apr	May	Jun	Jul	Aug	Sep	Oct	Mean
LP702	5.3	7.0	8.3	9.0	9.0	9.0	8.3	8.0
SWRC-1	4.3	7.3	8.7	9.0	8.7	9.0	8.0	7.9
HE 168	5.7	7.7	8.3	8.3	8.3	9.0	7.3	7.8
Palmer	4.3	7.3	8.0	8.3	8.7	8.3	8.7	7.7
Citation II (282)	5.0	7.3	8.7	8.7	8.7	8.7	7.0	7.7
Ranger	5.7	7.7	8.3	8.3	7.3	8.7	6.7	7.5
Blazer	5.3	7.3	8.0	9.0	8.0	8.0	6.7	7.5
Manhattan II	4.0	6.7	8.3	8.7	8.0	9.0	7.7	7.5
Repell (GT-II)	3.7	6.3	9.0	8.3	8.3	8.7	8.0	7.5
Pennant	4.7	7.3	7.7	8.7	8.3	8.3	6.7	7.4
Tara (BT-1)	3.7	6.0	8.3	8.3	8.3	9.0	7.7	7.3
Diplomat	5.7	7.3	7.3	7.7	7.3	8.0	7.3	7.2
Prelude	3.7	5.7	7.7	8.3	8.0	8.7	7.3	7.0
Yorktown II	4.7	7.0	7.7	6.7	8.0	8.3	7.0	7.0
HE 178	3.7	6.3	7.7	7.7	7.3	8.7	7.3	7.0
Fiesta	4.0	7.0	8.7	7.7	7.0	8.0	6.7	7.0
WWE 19	5.7	7.7	7.7	7.3	7.0	7.3	6.7	7.0
Gator	4.3	5.7	7.7	7.7	7.3	8.7	7.7	7.0
Birdie	4.3	6.7	7.7	8.3	7.3	8.0	6.7	7.0
Premier	4.3	6.3	7.3	8.0	7.3	7.7	7.0	6.9

Table 4. Turf quality[a] of perennial ryegrass cultivars in 1986. (continued)

	Ratings[a]							
Cultivar	Apr	May	Jun	Jul	Aug	Sep	Oct	Mean
M 382	3.7	6.7	8.0	7.7	7.3	7.7	7.3	6.9
All Star (IA 728)	3.7	6.7	8.0	8.3	7.0	8.0	6.3	6.9
Elka	4.0	6.3	7.7	6.7	7.0	8.7	7.7	6.9
Cigil	4.7	5.7	7.3	7.0	7.3	8.3	7.3	6.9
Omega	4.7	6.7	7.0	8.0	6.7	7.7	6.7	6.8
HR-1	3.3	6.3	7.3	8.0	7.7	8.0	6.7	6.8
Acclaim	4.3	6.3	7.3	7.3	6.7	7.7	7.0	6.7
Manhattan	5.0	8.0	7.3	6.7	6.0	7.3	6.3	6.7
Barry	3.3	6.3	7.7	7.3	7.0	8.3	6.3	6.6
Crown	3.7	6.7	7.3	7.0	6.7	8.0	7.0	6.6
LP 792	4.7	6.7	7.0	6.3	7.0	8.0	6.3	6.6
Pennfine	4.0	6.7	7.7	8.0	7.0	7.0	6.0	6.6
Ovation (LP 736)	4.0	6.3	7.3	7.0	6.3	7.7	7.0	6.5
NK80389	4.0	6.3	7.7	6.7	5.7	7.7	7.3	6.5
Cockade	4.3	6.3	6.7	6.3	6.7	8.0	6.3	6.4
Cowboy (2EE)	3.7	6.0	7.3	7.7	6.3	7.3	6.3	6.4
Derby	3.7	6.3	7.3	7.0	6.7	7.0	7.0	6.4
Dasher	3.7	5.3	7.3	7.7	7.0	7.7	5.7	6.3
LP 210	4.0	6.3	6.7	7.0	6.3	7.3	6.0	6.2
Citation	3.7	6.3	7.0	6.3	6.3	6.0	6.7	6.0
Birdie II (2 Ed)	2.7	5.0	7.0	7.7	6.3	7.0	6.3	6.0
Delray	3.7	6.0	7.3	6.7	6.0	6.7	5.7	6.0
NK79307	4.3	6.0	7.3	6.7	5.0	6.7	6.3	6.0
Cupido	3.7	5.3	7.3	7.3	5.0	6.3	6.7	6.0
NK79309	4.0	5.3	7.3	7.0	6.3	5.7	5.0	5.8
Regal	4.0	5.3	7.0	6.7	5.0	6.3	6.0	5.8
Pippin	2.7	3.7	6.0	5.3	4.0	6.0	5.3	4.7
Linn	3.0	3.0	4.7	4.3	3.3	4.0	4.0	3.8
Experiment Mean	4.2	6.4	7.5	7.5	7.0	7.7	6.8	6.7
LSD 0.05	1.7	2.1	1.1	1.5	1.6	1.2	1.1	1.0

[a] Quality based on a scale of 9 to 1; 9 = best quality, 6 = acceptable quality, and 1 = poorest quality.

Perennial Ryegrass Cultivar Evaluations

N. E. Christians

Summary

The 22 perennial ryegrass cultivars in this trial were among the first plots to be established after the renovation of the field research area in 1979. The study has been maintained since that time at a 2-inch mowing height and is fertilized with 4 lb N/1000 ft^2/yr. The area receives no fungicide or insecticide applications.

Belle, Fiesta, and Derby received the highest overall quality ratings in 1986. The first 12 cultivars received satisfactory ratings (Table 5). NK-100 and Linn received the lowest ratings in 1985.

Table 5. The 1986 quality ratings for 22 perennial ryegrass cultivars established in 1979.

		Quality Ratings						
	Cultivar	May	June	July	Aug	Sept	Oct	Mean
1.	Belle	8.3	7.7	8.3	6.3	7.3	7.0	7.5
2.	Fiesta	6.7	7.0	8.0	6.7	7.3	7.0	7.1
3.	Derby	7.0	8.0	7.7	7.0	6.7	5.7	7.0
4.	Elka	7.3	6.0	7.7	8.0	6.3	6.3	6.9
5.	Yorktown	6.7	7.7	7.3	6.3	6.7	7.0	6.9
6.	Blyes	6.3	7.0	7.7	6.0	7.3	6.7	6.8
7.	Loretta	6.3	7.3	5.3	7.7	7.0	7.3	6.8
8.	Diplomat	6.0	7.3	7.3	5.7	7.3	7.3	6.8
9.	K5-88	6.3	6.0	6.3	7.3	7.3	6.0	6.6
10.	Manhattan	6.3	6.0	6.7	7.0	7.3	6.3	6.6
11.	Delray	6.0	6.7	5.7	6.0	7.0	5.7	6.2
12.	Caravelle	6.3	7.3	5.0	5.3	6.7	5.3	6.0
13.	Citation	5.3	5.7	6.0	6.7	6.3	5.3	5.9
14.	K5-94	5.3	6.3	5.3	6.0	7.3	5.3	5.9
15.	Pennfine	6.3	7.7	5.3	5.3	6.3	4.7	5.9
16.	Med. North	5.0	7.3	6.0	4.3	6.0	5.7	5.7
17.	Regal	5.7	6.0	5.3	4.0	6.0	4.7	5.3
18.	J186 R24D	5.0	6.3	5.0	5.0	5.0	5.0	5.2
19.	Goalie	5.3	5.3	4.7	4.7	6.3	5.0	5.2
20.	NK-200	5.7	5.3	4.7	4.7	5.3	4.7	5.1
21.	NK-100	5.0	5.0	4.0	4.0	5.7	4.0	4.6
22.	Linn	4.3	3.7	3.7	3.0	5.0	4.7	4.1
	LSD 0.05	1.6	1.5	2.0	2.1	1.3	1.4	1.0

Quality based on a scale of 9 to 1; 9 = best quality, 6 = acceptable quality, and 1 = poorest quality.

Fine Fescue Cultivar Trial

K. L. Diesburg and N. E. Christians

This is the fourth year of data from the trial established in the fall of 1982. The purpose of the trial is to identify regional adaptation of the 32 fine fescue cultivars and blends tested. Cultivars are evaluated each month of the growing season for turf quality and disease.

The trial is maintained at a 2-inch mowing height with 3-4 lb N/1000 ft^2 through the growing season and is irrigated when needed to prevent drought. Preemergence herbicide is applied once in the spring and broadleaf herbicide is applied once in September to control weeds.

Disease is usually a problem at this site during the summer. At that time, the necessary conditions of hot days, warm nights, high humidity, and moist soil from irrigation combine, allowing pathogens to thrive. The summer of 1986 was moist and cool allowing pathogens to persist but not kill any turf. The ratings of most cultivars were, therefore, lower than usual throughout the season due to a brown understory in their canopy. This is reflected in the experiment mean for each month in table 6, that is lower in almost every case compared to 1985 when neither disease nor drought was a problem. The performance of the cultivars as a group was consistent across months except in April and October when they were close to winter dormancy.

Many of the cultivars have allowed the encroachment of Kentucky bluegrass since 1982. Waldina, Tournament, Pennlawn, NK79190, NK79191, NK80345, NK80347, NK80348, and Duar had 20-100 percent Kentucky bluegrass in two or three of their replications. This implies either lack of competitiveness to or compatibility with Kentucky bluegrass. The general effect of the bluegrass presence is improved turf quality.

The 32 cultivars can be divided into eight groups in decreasing level of turf quality:

1. Excellent throughout the growing season:

   Jamestown

2. Good in spring to excellent in fall:

   FOF-WC Waldina Scaldis Aurora

3. Excellent in spring to good in fall:

   Shadow Checker NK80345

4. Good throughout the growing season:

Dawson
Barfalla
Scaldis/Atlanta

5. Sensitive to environmental fluctuations:

Biljart
Ensylva
Tournament
Atlanta

6. Good in spring to fair in fall:

NK79189
NK80348
NK79190

7. Fair throughout the growing season:

Banner
Dawson/Pennlawn
Banner/Checker
Agram
Fortress
Wintergreen
Pennlawn
Koket
NK80346
NK79191

8. Fair to poor throughout the growing season:

NK80347
Duar
Ruby
Highlight

Table 6. Turf quality ratings of fine fescue cultivars and blends.

		Turf quality[a]								Blue-Grass
Cultivar		Apr	May	Jun	Jul	Aug	Sep	Oct	Mean	%
Jamestown	C[b]	6.3	8.3	8.3	8.0	8.3	8.3	6.7	7.8	30.0
Waldina	HF	7.3	7.7	7.0	8.0	8.3	8.7	6.7	7.7	43.3
Aurora	HF	6.3	7.0	8.3	7.7	9.0	8.3	7.0	7.7	34.7
FOF-WC	SF	6.0	8.3	8.0	7.7	8.0	8.3	7.7	7.7	35.0
Scaldis	HF	7.0	7.7	7.3	8.0	8.3	7.7	7.0	7.6	35.0
Shadow	C	6.0	8.7	8.0	8.3	7.7	7.7	6.3	7.5	6.7
Checker	C	5.7	8.7	8.0	8.0	7.7	8.0	5.7	7.4	2.3
Atlanta	C	6.3	8.3	7.0	8.0	7.0	8.0	6.7	7.3	0.3
Dawson	CR	5.0	8.0	8.3	7.7	7.3	8.3	6.7	7.3	0.0
Biljart	HF	5.7	8.0	8.3	8.0	7.0	7.3	7.0	7.3	23.3
Ensylva	CR	5.7	7.7	7.7	7.0	8.3	8.3	5.0	7.1	30.0
Barfalla	C	7.3	7.7	7.3	7.3	7.0	8.0	6.0	7.1	0.7
NK80345	CR	6.7	8.0	8.3	8.0	8.0	7.0	3.7	7.1	96.7
NK79189	CR	6.0	8.3	8.0	7.0	6.7	8.0	4.7	7.0	21.7
Scaldis/Atlanta		5.7	8.3	7.3	7.3	7.3	7.0	6.0	7.0	3.7
Tournament	HF	7.0	7.0	7.7	7.3	6.0	6.0	7.0	6.9	63.3
Banner	CF	5.3	7.0	6.7	7.3	7.0	7.0	6.3	6.7	3.3
Dawson/Pennlawn		4.7	7.0	8.7	6.3	7.0	7.3	5.7	6.7	23.3
Koket	C	5.3	7.0	6.7	7.0	7.0	7.0	5.3	6.5	5.0
Wintergreen	C	5.0	7.7	7.7	7.0	6.0	7.3	4.3	6.4	6.7
Agram	C	4.7	7.7	6.7	6.7	6.3	7.3	5.7	6.4	13.3
NK80346	CR	5.7	7.3	7.3	7.0	7.0	7.0	3.7	6.4	16.0
Fortress	CR	6.0	7.0	6.0	6.3	6.7	7.0	5.0	6.3	31.7
Pennlawn	CR	5.0	7.0	6.0	7.0	7.3	7.0	4.7	6.3	50.0
NK79191	CR	6.3	7.3	6.7	7.0	7.0	6.0	4.0	6.3	40.0
NK80348	CR	6.0	8.0	7.3	7.0	6.0	5.0	4.3	6.2	61.7
Banner/Checker		5.0	7.7	6.3	7.0	6.0	6.7	5.0	6.2	0.0
NK79190	CR	6.3	8.0	6.7	6.7	5.0	6.0	4.0	6.1	40.0
Highlight	C	4.3	7.0	7.7	6.0	5.7	5.7	6.0	6.0	26.7
NK80347	CR	5.7	7.3	7.3	5.0	5.7	7.0	4.0	6.0	61.7
Duar	HF	6.3	4.0	7.3	6.7	7.0	6.0	3.7	5.9	70.0
Ruby	CR	2.7	6.0	6.3	6.3	7.0	5.3	3.3	5.3	13.3
Experiment Mean		5.7	7.5	7.4	7.2	7.1	7.2	5.5	6.8	27.8
LSD = 0.05		1.7	0.9	1.5	1.5	1.2	1.3	1.5	0.7	47.9

[a] Quality based on a scale of 9 to 1: 9 = best quality, 6 = acceptable quality, and 1 = poorest quality.

[b] Chewings (C), creeping red (CR), sheep (S), or hard (H) fescue.

Fine Fescue Management Study

N. E. Christians

The fine fescue management study includes the following cultivars:

1. Pennlawn Red Fescue
2. Scaldis Hard Fescue
3. Ruby Red Fescue
4. Atlanta Chewings Fescue
5. K5-29 Red Fescue
6. Dawson Red Fescue
7. Reliant Hard Fescue
8. Ensylva Red Fescue
9. Highlight Chewings Fescue
10. Jamestown Chewings Fescue

Each cultivar is maintained at two mowing heights: 1 and 2 inches. Each plot is divided into two fertilizer treatments: 1 and 3 lb N/1000 ft^2, applied as IBDU. Each plot is irrigated as needed. The study was established on September 8, 1979.

The quality ratings in table 7 are the means of monthly ratings taken on replicated plots from May to October. As in 1985, Reliant and Scaldis Hard Fescue were the only grasses of the 10 in this study to maintain a satisfactory overall quality mean for the entire season.

At the 2-inch mowing height, only Reliant maintained a satisfactory quality rating of 6 or better at the 1 lb N/1000 ft^2/yr fertility rate. Scaldis was very close to an acceptable rating. At the 3 lb N/1000 ft^2/yr rate Reliant, Scaldis, and Atlanta maintained a satisfactory quality.

At the 1-inch mowing height, none of the grasses maintained a satisfactory quality at the 1 lb N/1000 ft^2/yr rate. Reliant, Scaldis, and Atlanta were the best cultivars at the 3 lb N/1000 ft^2/yr rate. This study has been in progress for seven seasons. The fact that any of these grasses have maintained an acceptable cover at a 1-inch mowing height for that length of time is surprising.

The cultivars listed as acceptable have consistently performed well during the study. There is a large difference between poorly rated cultivars and acceptable cultivars. The choice of fine fescue cultivars for this region should be made carefully, as many are not well adapted to Iowa conditions.

Table 7. The effects of mowing height and nitrogen fertilizer on the quality of 10 fine fescues.

		Mowing Height				
		1 inch		2 inch		
		N Rate		N Rate		Overall
		1 lb[a]	3 lb	1 lb	3 lb	Mean
1.	Pennlawn Red Fescue	4.1[b,c]	5.6	4.1	5.7	4.9
2.	Scaldis Hard Fescue	5.5	7.2	5.8	7.3	6.5
3.	Ruby Red Fescue	3.1	4.1	3.3	4.5	3.8
4.	Atlanta Chewings Fescue	5.5	7.2	5.3	6.7	6.2
5.	K5-29 Red Fescue	3.5	4.8	3.5	4.6	4.1
6.	Dawson Red Fescue	3.5	4.9	3.9	5.0	4.3
7.	Reliant Hard Fescue	5.8	7.7	6.2	7.5	6.8
8.	Ensylva Red Fescue	3.9	4.9	3.5	5.3	4.4
9.	Highlight Chewings Fescue	2.9	3.5	3.0	3.5	3.2
10.	Jamestown Chewings Fescue	4.3	6.1	4.4	5.9	5.2

[a] N rates are in lb N/1000 ft^2/yr. The N source is IBDU.

[b] Values are the means of monthly observations from May to October.

[c] Quality based on a scale of 9 to 1; 9 = best quality, 6 = acceptable quality; and 1 = poorest quality.

Tall Fescue Management Study

K. L. Diesburg and N. E. Christians

This is a report of the third year of data from the experiment. It is designed to compare the response of Falcon, Houndog, Kentucky 31, Mustang, and Rebel tall fescue at 0, 2, and 4 lb N/1000 ft4^{2}/yr and cutting heights of 2 and 3 inches. One pound of N was applied once during each month of May and September for the 2-lb treatment and during April, May, August, and September for the 4-lb treatment. In the strip-split plot arrangement all six combinations of the two management factors are placed in a 2 feet by 3 feet block within each cultivar with the five cultivars replicated three times. A single application each of DCPA in the spring and a phenoxy herbicide in the fall is sufficient to control weeds.

The 2-inch cut resulted in higher quality turf with all cultivars except Kentucky 31 where turf quality was similar between its two cutting managements (Table 8). The two increments in applied N, 0-2 lb and 2-4 lb, caused similar increases in turf quality for all cultivars except Houndog which responded less to the 0-2 lb increment.

Cultivar means and averages show that the four turf-type cultivars were similar to each other and superior to Kentucky 31 over all managements. There were four occasions in the high cut management, however, when Kentucky 31 had turf quality comparable to the others; April and September at all fertility levels, July at the low fertility level, and August at the high fertility level.

Improvement of turf quality at higher fertility levels for all cultivars was due primarily to better color resulting from higher chlorophyll content and less yellowing from disease. In addition, the turf-type cultivars showed finer leaf texture and higher leaf density at the 2-inch cutting height. Kentucky 31 responded with finer leaves, but leaf density decreased with a net smaller improvement of turf quality.

A 3- to 3 1/2-inch cutting height is traditionally recommended for Kentucky 31 tall fescue turf. This cultivar was released in 1943 for forage and land reclamation purposes. It is not as well adapted for turf as are the turf-type cultivars. The initial response of all perennial grasses to lower clipping height is more diminutive growth giving a finer texture. Only those adapted to the stress of close clipping will persist over many years. Data from future years will allow assessment of the persistence level of each cultivar.

Table 8. Turf quality of tall fescue cultivars at two clipping heights and three fertility levels.

Cultivar	Clip Hgt inch	N lb/ 1000 ft^2	Ratings[a]							
			Apr	May	Jun	Jul	Aug	Sep	Oct	Mean
Mustang	2	0	4.3	5.0	4.3	5.0	5.0	5.7	6.3	5.1
	2	2	4.0	4.3	7.3	7.3	6.0	6.3	6.7	6.0
	2	4	7.0	7.3	8.7	7.7	8.3	7.7	8.3	7.9
	3	0	3.3	3.7	4.0	3.7	4.7	4.3	5.3	4.1
	3	2	4.0	5.0	7.0	5.7	5.0	5.0	5.7	5.3
	3	4	6.3	7.7	8.3	7.0	6.3	6.0	7.7	7.0
	Average		4.8	5.5	6.1	6.1	5.6	5.8	7.2	5.9
Houndog	2	0	5.0	4.7	4.7	4.7	5.0	5.7	7.0	5.2
	2	2	5.7	5.7	7.0	7.3	6.0	6.7	7.0	6.5
	2	4	6.3	7.0	7.7	7.7	8.0	8.0	8.3	7.6
	3	0	3.7	4.0	3.7	3.7	3.7	4.3	6.0	4.1
	3	2	5.3	5.3	6.0	6.0	5.0	5.0	5.7	5.5
	3	4	5.3	6.7	7.3	7.0	6.0	6.0	7.3	6.5
	Average		5.2	5.6	6.1	6.1	5.6	5.9	6.9	5.9
Rebel	2	0	5.3	5.0	3.7	5.0	4.7	5.3	7.0	5.1
	2	2	5.0	5.0	7.0	6.7	5.3	6.3	7.0	6.0
	2	4	6.3	7.3	8.3	8.0	8.0	7.7	9.0	7.8
	3	0	4.7	4.7	3.7	4.0	4.3	4.3	6.0	4.5
	3	2	3.7	4.7	6.3	6.0	5.0	5.0	6.0	5.2
	3	4	5.7	6.7	7.3	7.0	6.0	6.0	8.0	6.7
	Average		5.1	5.6	6.1	6.1	5.6	5.8	7.2	5.9
Falcon	2	0	4.3	4.3	4.0	5.0	4.7	5.7	6.3	4.9
	2	2	4.7	4.7	6.7	6.3	6.0	6.3	7.0	6.0
	2	4	5.7	7.3	8.3	7.7	8.0	7.7	8.7	7.6
	3	0	4.3	4.3	4.0	4.0	4.3	4.7	5.3	4.4
	3	2	5.0	4.7	6.3	5.7	5.0	5.0	5.7	5.3
	3	4	6.7	7.3	7.7	6.7	6.3	6.0	8.0	7.0
	Average		5.1	5.4	6.2	5.9	5.7	5.9	6.8	5.9
Kentucky 31	2	0	4.0	3.0	3.3	4.3	3.7	4.0	5.3	4.0
	2	2	4.3	3.7	5.0	6.0	4.7	5.0	5.7	4.9
	2	4	6.3	6.0	6.3	6.7	6.7	5.7	7.7	6.5
	3	0	3.0	2.7	3.3	4.0	3.3	4.0	4.3	3.5
	3	2	5.0	4.0	5.0	5.0	4.0	4.7	5.0	4.7
	3	4	7.0	6.3	6.3	6.3	6.0	5.7	7.0	6.4
	Average		4.9	4.3	4.9	5.4	4.7	4.8	5.8	5.0
LSD cultivar averages			0.6	0.6	0.9	0.5	0.8	0.3	0.7	0.4
LSD managements			1.3	0.9	0.7	0.7	0.7	0.6	0.6	0.4

---

[a] Quality based on a scale of 9 to 1; 9 = best quality, 6 = acceptable quality, and 1 = poorest quality.

Bentgrass Management Study—1986

N. E. Christians

The bentgrass management study was established in the fall of 1980. It includes the following species and cultivars:

Species	**Cultivar**
1. *Agrostis stolonifera* Creeping Bentgrass	Emerald
2. *Agrostis canina* Velvet Bentgrass	Kingstown
3. *Agrostis stolonifera* Creeping Bentgrass	Penncross
4. *Agrostis stolonifera* Creeping Bentgrass	Penneagle
5. *Agrostis stolonifera* Creeping Bentgrass	Prominent
6. *Agrostis stolonifera* Creeping Bentgrass	Seaside

Each cultivar planting is split into three fertility levels: 0.5, 0.8, and 1.2 lb N/1000 ft^2/growing month. This results in a total N application rate of 3.5, 5.6, and 8.4 lb N/1000 ft^2/year. The area was managed as a golf course green, with a 3/32-inch mowing height and with applications of insecticides and fungicides as needed. Each cultivar is replicated four times.

Penncross ranked first in the trials, as it has the past several years (Table 9), with Emerald ranking second and Penneagle third. Penneagle dropped in ranking relative to Penncross in a comparison of 1985 and 1986 data. It is uncertain whether this is the result of a deterioration of the Penneagle area with time, or due to unusually wet conditions in 1986.

Kingstown ranked fourth, but this is due to the fact that much of the Kingstown velvet bentgrass died and surrounding bentgrasses began to take over the plots. Prominent and Seaside have survived the past six seasons, both performing poorly.

In 1985, the quality of bentgrass increased with each increment of applied nitrogen. In 1986, this improvement in quality with N level was not observed (Table 10). Both Penncross and Penneagle had numerically lower ratings at the higher rates although these differences were not statistically significant.

Table 9. The 1986 quality ratings[a] for six bentgrass cultivars with data averaged over four replications and three fertility levels.

Cultivar	May	June	July	Aug	Sept	Oct	Mean
1. Penncross	6.7	6.5	7.3	6.1	6.8	6.6	6.7
2. Emerald	5.6	6.5	6.7	6.3	5.7	6.2	6.2
3. Penneagle	5.6	6.7	6.5	5.0	6.1	5.3	5.9
4. Kingstown	5.7	5.9	5.6	6.1	4.8	5.6	5.6
5. Prominent	4.8	5.3	4.9	6.1	5.5	5.8	5.4
6. Seaside	4.3	4.8	5.4	6.0	5.1	5.6	5.2
LSD 0.05	0.8	1.0	1.0	1.6	1.0	0.8	0.5

[a] Quality based on a scale of 9 to 1; 9 = best quality, 6 = acceptable quality, and 1 = poorest quality.

Table 10. The effects of fertility level on the quality of six bentgrass cultivars.

	lb N/growing season		
Cultivar	0.5	0.8	1.2
1. Emerald	6.0	6.0	6.3
2. Kingstown	5.5	5.7	5.7
3. Penncross	6.9	6.5	6.6
4. Penneagle	6.2	5.9	5.5
5. Prominent	5.1	5.8	5.4
6. Seaside	5.0	5.0	5.5

LSD 0.05 for comparison of fertility levels within cultivar = 1.0.

Nitrogen × Potassium Study

K. L. Diesburg and N. E. Christians

This study was initiated to observe the effects of nitrogen (N) and potassium (K) on turf quality and vegetative growth of Kentucky bluegrass and to evaluate the interactions between these two nutrients.

The area was seeded with 'Baron' Kentucky bluegrass in September 1979. At the time of establishment, 1 lb P_2O_5/1000 ft^2 (triple super phosphate) and 0.5 lb N/1000 ft^2 (ammonium nitrate) were applied. The area is maintained in lawn condition including 2-inch mowing height, pre- and postemergent weed control, and irrigation as needed. No insecticides or fungicides have been applied.

The study is arranged in a complete factorial with four levels of N and K each at 0, 2, 3, and 4 lb/1000 ft^2/yr. A randomized complete block design is used with 16 treatments and three replications. Urea is the N source and KCl is the source of K. Treatments are split over April, May, late August, and September.

Monthly ratings of turf quality are presented in table 11. Benefit from K was not as great as from comparable amounts of N. The beneficial effect from increasing N application levels was highly significant throughout the season. Increases occurred between the 0- and 2-lb treatments and the 2- and 3-lb treatments but not between the 3- and 4-lb treatments. Higher levels of applied K, especially between the 2- and 3-lb treatments, caused better turf quality from June through September.

There was a significant interaction between N and K treatments this year for the first time since they were begun in 1980. The need for a proper balance of N and K can be seen in table 11. Turf quality was actually decreased with increments of applied K at 4 lb N/1000 ft^2. Optimum stimulation of turf quality from increments of applied K occurred at 0 lb N/1000 ft^2. Likewise, optimum improvement of turf quality from increments of applied N occurred at 0- and 2-lb K/1000 ft^2. Turf quality was not affected by increasing the N rate from 3- to 4- lb/1000 ft^2 at 3- or 4-lb K/1000 ft^2.

Table 11. Turf quality of Kentucky bluegrass in response to N and K treatments.

lb/1000 ft^2/year		Ratings[a]							
N	K	Apr	May	Jun	Jul	Aug	Sept	Oct	Mean
4	4	5.0	7.0	8.3	8.3	8.3	8.7	6.7	7.5
4	3	4.7	6.7	7.0	7.7	9.0	8.0	8.0	7.3
4	2	5.3	7.0	8.0	8.3	8.7	8.3	7.0	7.6
4	0	6.3	7.3	8.7	9.0	9.0	8.7	7.7	8.1
3	4	5.0	6.0	7.7	8.0	8.7	8.0	9.0	7.5
3	3	5.7	6.0	8.0	8.0	9.0	7.7	8.7	7.6
3	2	4.0	6.3	7.7	7.7	8.7	7.7	8.0	7.0
3	0	5.3	5.7	7.7	7.7	9.0	7.7	7.7	7.2
2	4	4.3	4.7	6.7	7.0	5.7	5.3	8.3	6.0
2	3	4.7	5.0	7.0	7.7	7.0	6.3	8.0	6.5
2	2	5.0	5.3	7.3	7.3	6.7	6.3	7.7	6.5
2	0	4.3	4.7	7.0	6.7	6.0	4.7	8.3	6.0
0	4	4.0	4.0	6.3	6.0	5.3	5.3	5.3	5.2
0	3	4.7	4.7	4.0	5.7	4.7	5.7	5.3	5.0
0	2	3.7	3.3	3.0	3.7	3.0	3.3	5.0	3.6
0	0	3.3	3.3	3.0	4.0	3.0	3.7	5.3	3.7
Experiment Mean		4.7	5.4	6.7	7.0	7.0	6.6	7.3	6.4
LSD 0.05		0.8	0.9	0.6	0.7	0.7	0.6	0.6	0.5

[a] Quality based on a scale of 9 to 1; 9 = best quality , 6 = acceptable quality, 1 = poorerst quality.

Evaluation of Different Granular Nitrogen Sources for Fertilization of Kentucky Bluegrass Turf

M. L. Agnew, N. E. Christians, and R. W. Moore

In this study, seven granular nitrogen (N) sources are being evaluated for maintenance fertilization. The turf, Glade Kentucky bluegrass, was established in September 1984, and maintained at a cutting height of 2 inches. A randomized complete block design with three replications is being used. Plot size is 3 1/2 feet by 7 feet.

The treatments include six slow-release N sources applied at 4 lb N/1000 ft^2/yr split into two equal applications. In addition, one urea treatment was applied at 4 lb N/1000 ft^2/yr split into four equal applications. Treatments were begun in the spring of 1985. The dates of fertilizer applications are May 1 and August 15. The additional urea treatments were applied on June 1 and September 15. Data taken during the summer of 1986 are listed in table 12. Urea, Sulfur Coated Urea (SCU)/Anderson, SCU/Lesco, and Plastic Coated Urea (PCU) treated plots consistently displayed the best visual quality. The urea treated plots greened-up earlier, while the PCU treated plots retained a greener color during the summer months. In addition, both urea and PCU retained excellent color through October. Once applied, both SCU treated plots had very good quality. An examination of clipping yields demonstrated that urea, both SCU treatments, methylene urea, and PCU all stimulated more above ground growth than IBDU and UF.

Treatments will be reapplied and further data will be collected in 1987.

Table 12. Effects of granular sources of N on visual quality and clipping yield.

Nitrogen Source	Visual Quality									Clipping Yields	
	3/24	4/19	5/30	6/25	7/25	8/26	9/12	10/20	Mean	5/30	9/12
Urea	7.0	8.5	7.4	8.0	7.0	8.3	7.0	9.0	7.8	57.9	74.7
IBDU	4.0	6.2	6.2	7.0	7.2	6.0	5.7	7.0	6.2	42.2	54.6
SCU/ Anderson	5.5	7.1	7.8	8.0	7.8	9.0	8.0	7.7	7.6	59.5	70.8
SCU/Lesco	4.0	7.1	7.9	7.7	7.8	9.0	7.7	7.7	7.4	60.3	80.0
Methylene urea/OMS	4.0	6.9	6.8	7.0	7.0	8.3	7.7	7.0	6.8	57.2	77.6
UF/Bluechip	4.0	6.1	5.5	6.5	7.3	7.3	6.0	6.7	6.2	38.2	64.0
PCU/Estech	6.0	8.0	6.8	8.3	8.8	8.0	7.7	9.0	7.8	50.4	72.8
LSD 0.05	0.5	0.3	0.6	0.2	0.5	0.6	0.8	1.0	0.3	6.9	12.8

Summer Slow-Release Nitrogen Sources Comparison Study

M. L. Agnew, N. E. Christians, R. W. Moore

The purpose of this study was to compare eight slow-release N sources for the summer application of nitrogen. The turf is Glade Kentucky bluegrass which was established in September 1984. Treatments were initiated in the spring of 1985 and will continue for several years. Individual treatment cells measured 5 feet by 5 feet and were randomized in a complete block design with three replications. The turf was mowed at 2 inches and water was applied to prevent drought stress.

Treatments include eight slow-release N sources applied at 2 lb N/1000 ft^2/season split into two equal applications on May 20 and August 10. Each treatment received 2 lb N/1000 ft^2/season of urea (46-0-0) split into two equal applications on April 10 and September 20. One additional treatment, which included combinations of Powder Blue and urea, was added for comparison (Table 13). Treatment four was Slo-release in 1985 and replaced by N-Sure in 1986.

Visual quality data was collected monthly except for September 1986 (Table 14). The April data is reflective of the materials applied the previous year. IBDU and SCU/CIL treatments provided the highest quality. The May data is reflective of the April urea treatment while the June treatment is reflective of the May slow release nitrogen sources. One exception is the N-Sure treatment. This treatment was not applied until June 6, thus the other N sources had two weeks to release nitrogen before N-Sure was applied. The July treatment demonstrated that SCU/TVA and SCU/CIL released nitrogen at greater rates during the warm month of July, whereas SCU/TVA, SCU/CIL and Fluf exhibited greater quality in August. The final application of urea evened out the quality of each treatment by October. Overall, the SCU/CIL and SCU/TVA treatments exhibited better turfgrass quality.

Clippings were collected from each plot in May and September (Table 14). There were no differences between any treatments. Further data will be collected in 1987 and 1988.

Table 13. List of treatments.

Treatment Number	Date of N Application	lbs N per 1000 ft^2	N Carrier
1	April 10	1	Urea
	May 20	1	Powder Blue
	August 10	1	Powder Blue
	September 20	1	Urea
2	April 10	1	Urea
	May 20	1	FLUF
	August 10	1	FLUF
	September 20	1	Urea
3	April 10	1	Urea
	May 20	1	Formolene
	August 10	1	Formolene
	September 20	1	Urea
4	April 10	1	Urea
	May 20	1	N-Sure
	August 10	1	N-Sure
	September 20	1	Urea
5	April 10	1	Urea
	May 20	1	IBDU
	August 10	1	IBDU
	September 20	1	Urea
6	April 10	1	Urea
	May 20	1	SCU - TVA
	August 10	1	SCU - TVA
	September 20	1	Urea
7	April 10	1	Urea
	May 20	1	SCU - CIL
	August 10	1	SCU - CIL
	September 20	1	Urea
8	April 10	1	Urea
	May 20	1	Azolone
	August 10	1	Azolone
	September 20	1	Urea
9	April 10	1/4 - 3/4	Powder Blue/Urea
	May 20	1/2 - 1/2	Powder Blue/Urea
	August 10	1/2	Powder Blue
	September 20	3/4 - 3/4	Powder Blue/Urea

Table 14. Comparison of slow-release nitrogen sources in summer fertilization.

Slow Release Nitrogen Source	Clipping Yield[a]		Visual Quality[b]					
	May	Sept	April	May	June	July	Aug	Oct
Powder Blue	47	57	7.3	7.7	6.8	7.0	7.3	8.0
Fluf	46	63	8.5	7.7	7.2	7.0	8.7	8.0
Formolene	41	57	6.8	8.0	7.5	7.0	8.3	8.0
N-Sure	48	61	7.8	7.0	6.2	7.0	8.3	8.0
IBDU	47	60	8.0	7.3	6.8	7.0	7.0	8.0
SCU/TVA	45	63	7.3	7.3	8.2	7.7	9.0	8.0
SCU/CIL	40	61	8.0	7.8	8.5	7.7	8.7	8.0
Azolone	46	61	7.0	7.0	7.0	7.0	7.7	8.0
Powder Blue/ Urea	43	58	7.3	6.0	7.5	7.0	7.0	8.0
LSD 0.05	NS	NS	0.7	0.8	0.5	0.5	0.9	NS

[a] Clippings collected in September are in grams per 1.63 m^2.

[b] Quality based on a scale of 9 to 1; 9 = best visual quality, 1 = poorest visual quality.

Evaluation of Liquid Fertilizer Programs on Three Kentucky Bluegrass Cultivars

R. W. Moore, M. L. Agnew, and N. E. Christians

This study compares 12 liquid fertilizer programs using four nitrogen sources on three Kentucky bluegrass cultivars. The treatments were started in the spring of 1985 and will continue for several years. The turf is maintained at a cutting height of 2 inches and all clippings are removed.

The four fertilizers include Urea, Powder Blue, Fluf, and Formolene. They were applied using different application schedules and three different application rates. Each schedule received 4 lb N/1000 ft^2/growing season. The balanced program received 1 lb N/1000 ft^2 in each of the months of April, May, August, and September. The heavy spring program received 1/2 lb N in April, 1 1/2 lb in May, and 1 lb N each in August and September. The late fall program required 1/2 lb N in April, 3/4 lb in May, 3/4 lb in August, 1 lb in September, and 1 lb in November.

The three cultivars of Kentucky bluegrass are Majestic (high-maintenance grass), Vantage (medium-maintenance grass), and Park (low-maintenance grass). Each cultivar was replicated three times, and each of the 12 fertilizer programs were randomized within each cultivar.

The data taken in 1986 include visual quality, clipping weight, carbohydrate reserves, and root density. Thatch development will also be measured as the study progresses.

The field was seeded in the fall of 1984 and sustained substantial winter damage. Therefore, the turfgrasses were not ready for ratings until late summer and early fall. In addition, early snows in 1985 prevented ratings in November.

In comparison of the cultivars (Table 15), the visual quality ratings were generally equal for Majestic, Vantage, and Park. However, Majestic produced only half as much clipping weight as Vantage or Park. This difference is not surprising since Majestic is a prostrate-growing cultivar.

In comparison of programs (Table 16), the late fall program had the best visual quality rating in the spring as did the heavy May program through the summer. The balanced, heavy May and late fall programs responded similarly in the fall. Clipping yields did not seem to be influenced by the programs but by other variables, such as materials and cultivars.

The individual fertilizer ratings demonstrated urea to green up earlier than Powder Blue, Formolene, or Fluf. Powder Blue, Formolene, and Fluf did, however, persist longer during the summer. Urea had the best overall visual quality rating followed by Formolene, Fluf, and Powder Blue (Table 17). Clipping yield data demonstrated urea to have the highest overall rating followed by Powder Blue, Formolene, and Fluf, respectively. The visual quality data suggest that the slow release nitrogen of the longer chain methylene ureas becomes more available during the summer.

In reviewing monthly interactions among the variables of cultivars, programs, and materials, the following conclusions were reached. In April, before the first application, the late fall program with urea demonstrated the best overall visual quality followed by Powder Blue, Formolene, and Fluf (Table 18). Cultivars and programs in April suggest that there were no significant differences in cultivars but that the overall visual quality rating was the best for the late fall program followed by the heavy spring and balanced programs, respectively (Table 19).

In May, interactions between cultivars and materials suggest that Majestic and Vantage retained their visual quality as Park's ratings decreased. Urea still maintained its visual quality advantage followed closely by Powder Blue, Formolene, and Fluf (Table 20). Interaction of programs and materials in May demonstrated that the balanced and late fall programs had the best visual quality, and urea continued to maintain a high quality rating. Powder Blue, Formolene, and Fluf also retained good visual quality, although ratings were lower than the April rating. The retention of good visual quality stems from the 1 lb N received in April on the balanced program and the carryover from the late fall application (Table 21).

Cultivar and material interactions in June demonstrated that Majestic had the best overall visual quality. Urea had a slightly better visual quality rating than Formolene, Fluf, and Powder Blue. This suggests that after the May application was applied, response from materials was relatively equal. Majestic responded more favorably than Vantage or Park to the four fertilizer materials (Table 22).

September interactions between materials and programs demonstrated heavy spring and balanced programs have better visual quality than the late fall. However, the late fall program received less nitrogen to date than the other two programs. Urea continued to have a good visual quality rating. Formolene and Fluf also maintained good visual quality ratings, while Powder Blue continued to show a lower rating due to its slower release characteristics (Table 23).

October comparisons of cultivars and materials demonstrated Majestic to have the best visual quality rating among the cultivars, whereas urea had the best quality rating of the fertilizer source (Table 24).

The comparison of clipping yield data using interactions of cultivars, programs, and materials demonstrated Majestic to have the least amount of clippings for most of the season (Table 25). Vantage and Park had comparable amounts throughout the season. Urea produced the most clipping yield during much of the season; however, Powder Blue produced the most clippings during July. This may be due to the fact that nitrogen from Powder Blue is released by microbial action which would be at a peak in July.

In comparison of programs and materials for the season, the balanced and heavy May programs demonstrated the best visual quality overall. The late fall application did result in good spring response, especially from urea and Powder Blue.

The rooting data collected in July of 1986 suggests no significant difference among cultivars or fertilizer materials. However, the late fall program produced significantly more roots in the 0-5 cm and 5-10 cm depth at the July 1986 testing date (Table 26). These data show the advantage of late fall fertilization in establishment of a greater amount of rooting in the following season.

The objective of this study is to observe the long-term effects of these fertilizer materials and programs on the response of the three cultivars. In future years, such variables as thatch development and carbohydrate status will be measured.

Table 15. 1986 visual quality and clipping yield for 3 Kentucky bluegrass cultivars.

	Visual Quality[a]							Clipping Yield[b]				
Cultivar	April	May	June	July	Sept	Oct	Mean	May	June	July	Sept	Oct
Vantage	6.7	6.8	7.2	6.3	6.5	7.5	6.8	153	36	98	75	88
Park	6.6	6.4	7.1	6.4	6.4	7.2	6.7	123	34	76	54	78
Majestic	6.7	6.7	7.7	6.6	7.5	8.3	7.3	70	30	32	31	47
LSD 0.05	NS	NS	NS	NS	0.30	0.23	0.13	11.5	3.2	7.5	4.3	4.8

[a] Quality based on a scale of 9 to 1; 9 = best quality, 6 = acceptable quality, and 1 = no live grass.

[b] Clipping weights are in grams/1.63 m^2.

Table 16. 1986 visual quality and clipping yields in 3 liquid fertilizer programs.

	Visual Quality[a]							Clipping Yield[b]				
Program	April	May	June	July	Sept	Oct	Mean	May	June	July	Sept	Oct
Balanced	6.3	6.8	7.3	6.7	7.0	7.6	7.0	117	31	66	55	73
Heavy spring	6.5	6.4	7.9	6.9	7.2	7.8	7.1	110	38	73	57	74
Late fall	7.1	6.7	6.8	5.8	6.3	7.5	6.7	118	30	67	48	65
LSD 0.05	0.20	0.18	0.16	0.29	0.30	0.23	0.13	11.5	3.3	7.6	4.3	4.8

[a] Quality based on a scale of 9 to 1; 9 = best quality, 6 = acceptable quality, and 1 = no live grass.

[b] Clipping weights are in grams/1.63 m^2.

Table 17. 1986 visual quality and clipping yields for 4 liquid fertilizers.

	Visual Quality[a]							Clipping Yield[b]				
Material	April	May	June	July	Sept	Oct	Mean	May	June	July	Sept	Oct
Urea	7.8	7.1	7.5	6.2	7.7	8.3	7.4	149	42	65	62	86
Powder Blue	6.5	6.8	7.0	6.9	5.5	6.1	6.5	114	32	85	46	52
Fluf	6.0	6.2	7.4	6.6	7.0	8.0	6.8	91	30	67	51	71
Formolene	6.3	6.4	7.4	6.0	7.1	8.2	6.9	107	29	57	54	75
LSD 0.05	0.27	0.20	0.19	0.34	0.34	0.26	0.16	13.3	3.8	8.7	5.0	5.5

[a] Quality based on a scale of 9 to 1; 9 = best quality, 6 = acceptable quality, and 1 = no live grass.

[b] Clipping weights are in grams/1.63 m^2.

Table 18. Interaction of program and material on visual quality during April.

Material	Balanced	Heavy Spring	Late Fall	Mean
Urea	7.5	7.4	8.5	7.8
Powder Blue	6.3	6.4	6.8	6.6
Fluf	5.7	6.0	6.2	6.0
Formolene	5.9	6.1	7.0	6.3
Mean	6.4	6.5	7.1	

Table 19. Interaction of cultivar and program on visual quality in April.

Program	Vantage	Park	Majestic	Mean
Balanced	6.2	6.3	6.5	6.0
Heavy spring	6.7	6.6	6.3	6.5
Late fall	7.2	6.9	7.2	7.1
Mean	6.7	6.6	6.7	

Table 20. Interaction of cultivar and material on visual quality during May.

Material	Vantage	Park	Majestic	Mean
Urea	7.0	6.8	7.5	7.1
Powder Blue	6.9	6.8	6.7	6.8
Fluf	6.4	6.1	6.1	6.2
Formolene	6.8	5.9	6.6	6.4
Mean	6.8	6.4	6.7	

Table 21. Interaction of program and material on visual quality during May.

Material	Balanced	Heavy May	Late Fall	Mean
Urea	7.5	6.5	7.2	7.1
Powder Blue	6.6	6.7	7.2	6.8
Fluf	6.2	6.1	6.2	6.2
Formolene	6.7	6.3	6.3	6.4
Mean	6.8	6.4	6.7	

Table 22. Interaction of cultivar and material on visual quality during June.

Material	Vantage	Park	Majestic	Mean
Urea	7.3	7.1	8.1	7.5
Powder Blue	7.1	6.9	7.2	7.1
Fluf	7.2	7.3	7.6	7.4
Formolene	7.3	6.9	7.9	7.4
Mean	7.2	7.1	7.7	

Table 23. Interaction of program and material on visual quality during September.

Material	Balanced	Heavy Spring	Late Fall	Mean
Urea	8.2	7.9	7.0	7.7
Powder Blue	5.3	5.6	5.4	5.4
Fluf	7.0	7.6	6.4	7.0
Formolene	7.4	7.6	6.3	7.1
Mean	7.0	7.2	6.3	

Table 24. Interaction of cultivar and material on visual quality during October.

Material	Vantage	Park	Majestic	Mean
Urea	8.0	8.0	8.8	8.3
Powder Blue	6.3	5.3	6.7	6.1
Fluf	7.7	7.7	8.7	8.0
Formolene	7.9	7.8	8.9	8.2
Mean	7.5	7.2	8.3	

Table 25. The effects of cultivar, fertilizer program, and fertilizer material on quality and yield.

	Cultivar											
	Vantage											
	Programs											
Data Collected	Balanced				Heavy Spring				Late Fall			
Visual Quality[a]	U[c]	PB	FL	FO	U	PB	FL	FO	U	PB	FL	FO
April	7.7	6.2	5.2	5.8	7.2	6.7	6.4	6.4	8.4	7.0	6.3	7.2
May	7.7	6.7	6.2	7.0	6.2	6.8	6.7	7.2	7.2	7.3	6.3	6.5
June	7.0	7.2	7.2	7.3	8.0	7.2	7.7	8.0	6.8	6.8	6.7	6.7
July	6.7	7.0	6.3	6.0	6.0	7.3	6.7	6.7	6.0	6.3	5.7	5.3
September	8.0	5.0	6.0	7.3	7.7	5.7	7.0	7.3	6.7	5.3	6.3	5.7
October	8.0	6.3	7.7	7.7	8.0	6.3	7.7	8.0	8.0	6.3	7.7	8.0
Clipping Yield[b]												
May	197	140	130	151	150	171	145	163	165	168	124	130
June	39	32	28	30	48	42	44	39	35	38	30	32
July	100	108	72	82	79	133	100	116	100	134	91	66
September	94	64	63	80	73	70	86	86	84	73	61	65
October	108	65	83	95	95	72	99	105	101	68	79	86

[a] Quality based on a scale of 9 to 1; 9 = best quality, 6 = acceptable quality, and 1 = dead grass.

[b] Clippings collected are in grams per 1.63 m^2.

[c] U = urea, PB = Powder Blue, FL = Fluf, and FO = Formolene.

Table 25. (continued).

	Cultivar											
	Park											
	Programs											
Data Collected	Balanced				Heavy Spring				Late Fall			
Visual Quality[a]	U[c]	PB	FL	FO	U	PB	FL	FO	U	PB	FL	FO
April	7.1	6.3	6.0	5.8	7.6	6.4	6.0	6.2	8.4	6.2	6.2	6.8
May	7.3	6.5	6.3	6.3	6.3	6.8	5.8	5.5	6.7	7.0	6.0	6.0
June	6.8	6.7	7.3	7.0	8.0	7.2	8.0	7.7	6.3	6.8	6.7	6.2
July	6.3	6.7	7.0	6.3	6.7	7.0	7.3	6.7	5.3	6.3	5.7	5.3
September	7.7	5.0	7.0	6.7	7.7	5.3	7.0	7.0	6.7	5.0	6.3	6.0
October	8.0	5.0	7.7	8.0	8.0	6.0	7.7	8.0	8.0	5.0	7.7	7.3
Clipping Yield[b]												
May	160	117	109	127	129	123	108	98	158	120	112	111
June	35	25	33	32	47	38	38	36	33	33	32	23
July	65	86	85	60	75	99	91	60	62	90	80	58
September	65	41	57	58	68	50	55	64	54	39	46	45
October	103	50	85	85	100	61	83	86	86	46	71	76

Table 25. (continued).

	Cultivar											
	Majestic											
	Programs											
Data Collected	Balanced				Heavy Spring				Late Fall			
Visual Quality[a]	U[c]	PB	FL	FO	U	PB	FL	FO	U	PB	FL	FO
April	7.8	6.3	5.8	6.0	7.6	6.1	5.7	5.8	8.7	7.2	6.0	6.9
May	7.6	6.7	6.2	6.7	7.0	6.3	5.8	6.5	7.8	7.2	6.2	6.5
June	8.3	7.2	7.8	8.0	8.8	7.3	8.3	8.5	7.2	7.0	6.5	7.3
July	7.0	7.0	7.3	6.7	6.7	7.7	7.7	6.7	5.3	7.0	5.7	5.0
September	9.0	6.0	8.0	8.3	8.3	6.3	8.7	8.3	7.7	6.0	6.7	7.3
October	9.0	6.3	9.0	9.0	8.7	7.0	9.0	9.0	8.7	6.7	8.0	8.0
Clipping Yield[b]												
May	131	57	32	53	85	41	28	78	164	85	32	51
June	47	27	25	24	48	25	25	24	42	28	16	23
July	44	39	33	24	29	35	35	24	37	41	20	26
September	41	28	34	31	44	23	30	30	34	24	27	27
October	61	40	48	55	61	34	51	46	55	34	37	43

Table 26. 1986 Rooting Data (July).

	Rooting Depth			
Program	0-5 cm	5-10 cm	10-15 cm	15-20 cm
Balanced	168.0[a]	65.5	43.1	32.1
Heavy Spring	160.5	68.6	46.0	38.1
Late Fall	182.3	76.6	50.1	33.9
LSD 0.05	.0153	.0072	NS	NS

[a] Rooting weights are in milligrans per 5-cm depth.

Preemergence Crabgrass Control Study—1986

Z. Reicher, N. E. Christians, and M. L. Agnew

Number one fairway of Homewood Golf Course in east Ames, Iowa, was the site for the 1986 preemergence crabgrass control study. The area was mowed just under an inch. The soil on the site is a clay loam with a pH of 8.5, a P level of 45 lb/acre, K level of 190 lb/acre, and organic matter content of 10.8 percent.

Treatments included Balan, Bensulide, Dacthal, Team, EL-107, Prodiamine, Prime +, Pennant, Regalstar, Ronstar 50 WP and 2 G, Pendimethalin, and Cinch. The treatments were applied on April 23, 1986. Immediately after application, the Ronstar materials on half of each treated plot were watered in with 1/2 inch of water.

The phytotoxicity ratings were 9 = no damage, 6 = acceptable turf, and 1 = dead turf. Only the Pennant and the Ronstar 50 WP showed phytotoxicity at any of the dates checked (Table 28). The half plots of the Ronstar 50 WP that were watered in immediately showed slightly less burn than those that were not, but still significant burning took place.

Crabgrass counts were made on July 17, 1986. A second count was taken on September 3, 1986, to check the length of control by the herbicides. All the herbicides were very effective in controlling the crabgrass at the July 17 count with the exception of the EL-107 (Table 27). In the September 3 check, none of the materials differed significantly in control, but Bensulide, Prodiamine, Prime + (2.4 lb ai/A), Ronstar 50 WP (1.5 and 2.0 lb ai/A), Pendimethalin (3.0 lb ai/A), and Cinch (1.0 lb ai/A) were still over 90% effective in controlling the crabgrass. This was a very wet year in Ames, and germination back into treated areas was expected.

Table 27. 1986 Preemergence Annual Weed Control Study.

				July 18		September 1	
Treatment			Rate lb ai/A	Avg. # Crabgrass Plants	% Control	Avg. # Crabgrass Plants	% Control
1. Control			---	63	0	50	0
2. Balan	2.5	G	2	2	97	12	77
3. Bensulide	4	E	7.5	0	100	1	99
4. Dacthal	75	WP	7.5	5	93	15	70
5. Dacthal	75	WP	10.5	0	100	11	79
6. Team	2	G	2	3	96	6	87
7. Team	2	G	3	1	99	5	89
8. Team	28	DF	2	11	82	19	63
9. Team	28	DF	3	4	95	25	50
10. EL-107	75	DF	0.5	20	69	37	26
11. EL-107	75	DF	1.0	12	82	19	62
12. Prodiamine	65	DWG	0.5	2	97	4	92
13. Prime +	1.2	E	1.2	1	99	5	90
14. Prime +	1.2	E	2.4	0	100	1	98
15. Pennant	5	G	2	5	92	7	85
16. Regalstar	1.5	G	2	2	97	5	90
17. Ronstar	50	WP*	1	0	100	7	85
18. Ronstar	50	WP*	1.5	2	98	2	97
19. Ronstar	50	WP*	2.0	0	100	5	91
20. Ronstar	2	G*	3.0	2	98	5	90
21. Pendimethalin	60	WP	1.5	1	99	9	82
22. Pendimethalin	60	WP	3.0	2	97	2	96
23. Cinch	0.5	G	0.75	3	95	10	79
24. Cinch	0.5	G	1.0	1	99	4	92
LSD 0.05				23	37	NS	NS

* Half of the plot is to be watered in with 1/2 inch water immediately after application.

Table 28. 1986 Preemergence Annual Weed Control Study (Phytotoxicity Readings).

Treatment			Rate lb ai/A	Phytotoxicity Readings		
				4/29	5/7	5/16
1. Control			---	9	9	9
2. Balan	2.5	G	2	9	9	9
3. Bensulide	4	E	7.5	9	9	9
4. Dacthal	75	WP	7.5	9	9	9
5. Dacthal	75	WP	10.5	9	9	9
6. Team	2	G	2	9	9	9
7. Team	2	G	3	9	9	9
8. Team	28	DF	2	9	9	9
9. Team	28	DF	3	9	9	9
10. EL-107	75	DF	0.5	9	9	9
11. EL-107	75	DF	1.0	9	9	9
12. Prodiamine	65	DWG	0.5	9	9	9
13. Prime +	1.2	E	1.2	9	9	9
14. Prime +	1.2	E	2.4	9	9	9
15. Pennant	5	G	2	9	4.7	2.3
16. Regalstar	1.5	G	2	9	9	9
17. Ronstar	50	WP*	1	4.7 5.7*	4.7 5.7*	8.7 8.7*
18. Ronstar	50	WP*	1.5	4 5 *	5 5.7*	8 8 *
19. Ronstar	50	WP*	2.0	3 4 *	4 5 *	4.7 4.7*
20. Ronstar	2	G*	3.0	9 9 *	9 9 *	9 9 *
21. Pendimethalin	60	WP	1.5	9	9	9
22. Pendimethalin	60	WP	3.0	9	9	9
23. Cinch	0.5	G	0.75	9	9	9
24. Cinch	0.5	G	1.0	9	9	9
LSD 0.05				.25	.71	.86

* Half of the plot is to be watered in with 1/2 inch water immediately after application.

Postemergence Annual Grass Control Study—1986

Z. Reicher, N. E. Christians, and M. L. Agnew

The 1986 postemergence annual grass control study was conducted between the second and seventh fairways of Homewood Golf Course located on the east side of Ames, Iowa. This area had a fairly thick stand of bluegrass mowed at 3 inches. The area had never been treated with preemergence herbicides and the crabgrass population was very high. The soil on the site is a clay loam with a pH of 8.05, a P level of 2 lb/A, K level of 190 lb/A, and organic matter content of 10.8 percent.

Treatments included American Hoechst's Acclaim in the 0.5 EW and 1 EC formulations at 0.18 and 0.35 lb ai/A and the 1 EC formulation in combinatin with Bensulide, Dacthal, Pendimethalin, Bromoxynil and 2,4-D, Turflon D, Riverdale's Triamine, and XRM-4814, an experimental from Dow. Other treatments were Dow's Tridiphane alone and with Pendimethalin, and Bensulide. Another Dow experimental, XRM-689, and two PBI Gordon experimentals, EH-795 and EH-845, were also included.

The materials were applied at the 3-leaf to 1-tiller stage of the crabgrass (June 11) and at the 3-leaf to 4-tiller stage (June 24). The herbicides were applied to a 5 feet by 5 feet plot with a boom sprayer in the equivalent of 120 gal water/A (treatments 14, 15, 16, and 17 were applied in 60 gal water/A).

Overall, the herbicides were very effective in controlling the crabgrass with 100 percent control very common, while less than 80 percent control was rare (Table 29). The Acclaim treatments, both alone and in combinations, showed good control except when mixed with Triamine. The 0.5 EW formulation of Acclaim worked equally well as the 1.0 EC formulation. The Tridephane was also effective alone and in combinations except with the low rate of XRM-4814. The PBI Gordon experimentals did not control the crabgrass effectively.

The phytotoxicity was rated as 9 = no damage, 6 = acceptable damage, and 1 = dead turf (Table 30). The phytotoxicity ratings were complicated by the inadvertent application of 3 pts/A of Turflon D over the experiment site on June 20.

The first phytotoxicity check made before the Turflon D application showed that only EH-795 and EH-845 reduced turf quality. After the Turflon D application, the Acclaim treatments showed some burn along with the EH-795 and EH-845, but recoverd by the final rating date. The last rating showed the two Acclaim formulations applied June 24 caused some phytotoxicity. Again, most of the phytotoxicity was probably enhanced if not caused by the Turflon D application. It is interesting to note that weed control was still in the range of 91-100 percent for the Acclaim and Tridiphane treatments made four days after the Turflon D application.

Table 29. 1986 Postemergence Annual Grass Control Study.

			Date Applied		July 18		September 1	
	Treatment	lb ai/A	6/11	6/24	Avg. # Crabgrass Plants	% Control	Avg. # Crabgrass Plants	% Control
1.	Control	---			57	0	56	0
2.	Acclaim*	0.18/	X		2	98	3	95
3.	Acc + Ben	0.18/7.5	X		1	99	0	100
4.	Acc + Dac	0.18/7.5	X		0	100	0	100
5.	Acc + Pen	0.18/1.5	X		0	100	0	100
6.	Acc	0.12	X		7	89	10	82
7.	Acc + Ben	0.12/7.5	X		0	100	0	100
8.	Acc + Dac	0.12/7.5	X		1	99	1	98
9.	Acc + Pen	0.12/1.5	X		0	100	0	100
10.	Acc + Brom + 2,4-D	0.18/0.25/ 0.25	X		1	99	3	95
11.	Acc + Turf D	0.18/0.375	X		2	96	6	90
12.	Acc + Tri**	0.18/0.375	X		23	61	20	64
13.	Acc + XRM-4814	0.18/3.0 (Pts/A)	X		9	84	11	80
14.	Acc 0.5 EW	0.18		X	1	99	4	93
15.	Acc 1 EC	0.18		X	6	89	7	87
16.	Acc 0.5 EW	0.35		X	3	95	6	90
17.	Acc 1 EC	0.35		X	1	98	5	91
18.	Acc 0.5 EW	0.18		X	5	91	9	84
19.	Acc 1 EC	0.18		X	1	98	5	91
20.	Acc 0.5 EW	0.35		X	5	92	5	91
21.	Acc 1 EC	0.35		X	0	100	3	94
22.	Tridiphane	1.5	X		1	98	1	98
23.	Tridiphane	2.0	X		0	100	1	99
24.	Tridi + Pen	1.0/2.0	X		1	98	1	98
25.	Tridi + Ben	1.0/5.0	X		0	100	0	100
26.	EF-689	0.5	X		12	79	13	78
27.	Tridi + XRM-689	1.0/0.25	X		0	100	3	95
28.	Tridi + XRM-689	1.5/0.5	X		0	100	2	96
29.	Tridiphane	1.5		X	0	100	4	92
30.	Tridiphane	2.0		X	0	100	3	95
31.	Tridi + Pen	1.0/2.0		X	10	84	11	80
32.	Tridi + Ben	1.0/5.0		X	2	97	4	92
33.	XRM-689	0.5		X	14	77	18	69
34.	Tridi + XRM-689	1.0/0.25		X	11	81	13	77
35.	Tridi + XRM-689	1.5/0.5		X	4	94	4	93
36.	EH-795	5 oz/1000	X		23	60	25	56
37.	EH-845	5 oz/1000	X		35	40	38	31
	LSD 0.05				21	37	21	37

* Plots measure 5 feet by 5 feet. Acclaim treatments 2 - 14 include the 1 EC formula-tion

** Includes 16.3% 2,4-D; 16.4% 2,4-DP; 16.2% MCPP.

Acclaim = Acc; Bensulide = Ben; Bromoxynil = Brom; Dacthal = Dac; Pendimethalin = Pen
Triamine = Tri; Tridiphane = Tridi; Turflon = Turf; Starane = Star.

Table 30. 1986 Phytotoxicity Annual Grass Control Study.

	Treatment	lb ai/A	Date Applied		Phytotoxicity Readings		
			6/11	6/24	6/18	6/27*	7/8*
1.	Control	---			9.0	9.0	9.0
2.	Acclaim**	0.18/	X		9.0	7.3	8.7
3.	Acc + Ben	0.18/7.5	X		9.0	7.3	9.0
4.	Acc + Dac	0.18/7.5	X		8.0	6.3	8.7
5.	Acc + Pen	0.18/1.5	X		8.0	5.3	9.0
6.	Acc	0.12	X		9.0	9.0	9.0
7.	Acc + Ben	0.12/7.5	X		9.0	9.0	9.0
8.	Acc + Dac	0.12/7.5	X		9.0	9.0	9.0
9.	Acc + Pen	0.12/1.5	X		9.0	8.7	9.0
10.	Acc + Brom + 2,4-D	0.18/0.25/ 0.25	X		9.0	7.3	9.0
11.	Acc + Turf D	0.18/0.375	X		8.0	7.3	8.7
12.	Acc + Tri***	0.18/0.375	X		9.0	9.0	9.0
13.	Acc + XRM-4814	0.18/3.0 (Pts/A)	X		9.0	9.0	9.0
14.	Acc 0.5 EW	0.18		X	9.0	9.0	7.7
15.	Acc 1 EC	0.18		X	9.0	9.0	7.7
16.	Acc 0.5 EW	0.35		X	9.0	9.0	6.3
17.	Acc 1 EC	0.35		X	9.0	9.0	5.7
18.	Acc 0.5 EW	0.18		X	9.0	9.0	7.0
29.	Acc 1 EC	0.18		X	9.0	9.0	8.3
20.	Acc 0.5 EW	0.35		X	9.0	9.0	7.0
21.	Acc 1 EC	0.35		X	9.0	9.0	5.0
22.	Tridiphane	1.5	X		9.0	9.0	9.0
23.	Tridiphane	2.0	X		9.0	9.0	9.0
24.	Tridi + Pen	1.0/2.0	X		9.0	9.0	9.0
25.	Tridi + Ben	1.0/5.0	X		9.0	9.0	9.0
26.	EF-689	0.5	X		9.0	8.0	9.0
27.	Tridi + XRM-689	1.0/0.25	X		9.0	9.0	9.0
28.	Tridi + XRM-689	1.5/0.5	X		9.0	9.0	9.0
29.	Tridiphane	1.5		X	9.0	9.0	9.0
30.	Tridiphane	2.0		X	9.0	9.0	9.0
31.	Tridi + Pen	1.0/2.0		X	9.0	9.0	9.0
32.	Tridi + Ben	1.0/5.0		X	9.0	8.7	9.0
33.	XRM-689	0.5		X	9.0	9.0	9.0
34.	Tridi + XRM-689	1.0/0.25		X	9.0	9.0	9.0
35.	Tridi + XRM-689	1.5/0.5		X	9.0	9.0	9.0
36.	EH-795	5 oz/1000	X		6.3	7.0	8.3
37.	EH-845	5 oz/1000	X		7.0	8.0	9.0
	LSD 0.05				1.2	1.4	1.0

* Three pts/A Turflan D, applied June 20.

** Plots measure 5 feet by 5 feet. Acclaim treatments 2 - 14 include the 1 EC formulation.

*** Includes 16.3% 2,4-D; 16.4% 2,4-DP; 16.2% MCPP.

Acclaim = Acc; Bensulide = Ben; Bromoxynil = Brom; Dacthal = Dac; Pendimethalin = Pen; Triamine = Tri; Tridiphane = Tridi; Turflon = Turf; Starane = Star.

Broadleaf Weed Control Study—1986

Z. Reicher, N. E. Christians, and M. L. Agnew

The 1986 broadleaf control study took place at the Iowa Arboretum, twenty miles west of Ames. The chosen area was not previously treated with herbicides and was heavily infested with dandelion (*Taraxacum officinale*), broadleaf plantain (*Plantago major*), common ragweed (*Ambrosia artemisfolia*), and white clover (*Trifolium repens*).

Treatments included EH-680, EH-791, EH-737, and Super Trimec from PBI Gordon; a Ciba Giegy experimental, CGA-52463; Riverdale's Triamine and Triester; and Dow's Turflon D and XRM-4814. Treatments were applied on June 18, 1986, a clear day with no wind. The temperature was 82°F and relative humidity was above 60 percent. There was no precipitation for 24 hours after application. Herbicide effects were evident by July 1 and final weed counts were taken on July 16.

All materials were effective in controlling the plantain, dandelion, and white clover except the CGA-52463. The ragweed populations were not consistent enough over the study to get accurate readings.

The experimentals from PBI Grodon proved to be effective broadleaf control along with the XRM-4814. Turflon D, Super Trimec, Triamine, and Triester also proved to be very effective.

Table 31. 1986 Postemergence Broadleaf Weed Control Study.

		Plantain		Dandelion		Ragweed		Clover	
Material	lb ai/A	Mean #/plot	% Cont	Mean #/plot	% Cont	Mean #/plot	% Cont	Mean #/plot	% Cont
1. Control	----	78	0	14	0	18	0	30	0
2. EH 680	1.69	15	81	2	90	0	100	1	99
3. EH 791	1.45	2	97	0	100	0	100	0	100
4. EH 737	1.69	21	74	0	100	0	100	0	100
5. CGA-52463	0.80	105	0	11	24	12	31	25	15
6. CGA-52463	1.07	116	0	4	71	21	0	17	43
7. CGA-52463	1.78	122	0	13	12	4	80	4	86
8. Triamine	1.50	22	73	0	100	1	98	4	89
9. Triamine	1.96	4	95	2	88	0	100	6	80
10. Triester	2 pt/A	24	70	0	100	9	48	4	89
11. Triester	3 pt/A	7	91	1	95	0	100	1	98
12. XRM-4814	1.24	4	95	1	93	1	94	0	100
13. XRM 4814	1.52	6	91	2	90	0	100	1	98
14. XRM 4814	1.76	3	97	7	52	0	100	4	89
15. Turflon D	1.12	2	98	9	36	0	100	2	94
16. Turflon D	1.50	9	86	0	98	0	100	1	98
17. Super Trimec	1.13	11	86	1	97	0	100	0	100
LSD 0.05		84	NS	8	56	NS	NS	14	46

Preemergence Herbicide Timing Studies—1986

M. L. Agnew and N. E. Christians

The purpose of this study was to investigate the effectiveness of five preemergence herbicides when applied on six dates ranging from late fall of 1985 to late spring of 1986. The herbicides used were Benefin, Bensulide, Bensulide/-Devrinol, Dacthal, and Pendimethalin. The herbicides were applied at rates of 2 lb ai/A (Benefin), 7.5 lb ai/A (Bensulide), 7.5 lb ai/A/1.5 lb ai/A (Bensulide/Devrinol), 10.5 lb ai/A (Dacthal), and 1.5 lb ai/A (Pendimethalin). Application dates included November 8, 1985, March 6, March 20, April 4, April 18, and May 6, 1986. On November 8, an additional treatment of Pendimethalin at a rate of 3.0 lb ai/A was added.

The area chosen for the study was a nonirrigated Kentucky bluegrass rough at Homewood Golf Course in Ames, Iowa. Individual plots measured 5 feet by 5 feet and each was replicated three times. The soil on the site is a clay loam with a pH of 8.5, P level of 2 lb/acre, K level of 190 lb/acre, and organic matter content of 10.8 percent.

The environmental conditions in 1986 can be classified as wet, warm, and humid. Perfect conditions for crabgrass germination were present by May 1, 1986.

On July 16 and September 2, 1986, the number of crabgrass plants per plot were recorded (Table 32). All treatments significantly reduced the number of crabgrass plants when compared with the nontreated control. However, the presence of 5 or more crabgrass plants per plot is considered unacceptable. The only treatments that provided adequate control were: Bensulide/Devrinol on March 20 and April 4; Dacthal on April 4, April 18, and May 6; and Pendimethalin on May 6. None of the materials provided satisfactory control when applied in the first week of March.

In addition to crabgrass counts on September 2, the number of prostrate spurge plants were also counted. The distribution of prostrate spurge throughout the plots and between replications were inconsistent. This is exemplified by the low number of spurge plants in the control and the relatively high number of spurge plants in other plots. None of the herbicides gave complete control of spurge although Betasan/Devrinol seems to have some potential. No spurge plants were found on plots treated with Dacthal on April 4, but they were present in plots treated on April 18.

The study will be repeated in the fall of 1986 and spring of 1987. The spring and summer of 1986 were very wet and it is possible that in a drier year, better control can be obtained with fall and early spring applications.

Table 32. Weed control in the 1986 preemergence annual grass timing control study.

Herbicide	Rate lb ai/acre	Date of Application	Crabgrass Count		Spurge Count
			July 16	Sept 2	Sept 2
Balan	2	11- 8-85	9.3	10.7	1.7
Balan	2	3- 6-86	12.3	13.0	1.7
Balan	2	3-20-86	20.3	20.3	5.3
Balan	2	4- 4-86	23.7	26.3	3.0
Balan	2	4-18-86	18.7	18.7	1.7
Balan	2	5- 6-86	24.7	25.7	0.0
Bensulide	7.5	11- 8-85	1.7	4.0	4.7
Bensulide	7.5	3- 6-86	8.3	11.0	2.3
Bensulide	7.5	3-20-86	1.3	1.3	9.0
Bensulide	7.5	4- 4-86	0.3	0.3	3.7
Bensulide	7.5	4-18-86	0.0	0.3	0.3
Bensulide	7.5	5- 6-86	0.7	3.0	0.3
Ben/Dev*	7.5/1.5	11- 8-85	8.0	8.0	2.7
Ben/Dev	7.5/1.5	3- 6-86	8.7	8.7	0.0
Ben/Dev	7.5/1.5	3-20-86	1.0	1.0	0.0
Ben/Dev	7.5/1.5	4- 4-86	2.0	2.0	0.0
Ben/Dev	7.5/1.5	4-18-86	33.0	33.0	9.0
Ben/Dev	7.5/1.5	5- 6-86	9.0	9.0	3.7
Dacthal	10.5	11- 8-85	8.0	8.7	1.7
Dacthal	10.5	3- 6-86	18.3	18.3	0.7
Dacthal	10.5	3-20-86	11.3	11.7	1.0
Dacthal	10.5	4- 4-86	4.0	5.7	0.0
Dacthal	10.5	4-18-86	4.0	4.0	2.0
Dacthal	10.5	5- 6-86	3.3	3.7	0.7
Pendimethalin	1.5	11- 8-85	14.0	14.0	1.0
Pendimethalin	1.5	3- 6-86	24.3	24.3	2.3
Pendimethalin	1.5	3-20-86	18.0	23.7	1.3
Pendimethalin	1.5	4- 4-86	7.0	8.7	0.0
Pendimethalin	1.5	4-18-86	12.7	14.3	2.3
Pendimethalin	1.5	5- 6-86	4.7	4.7	1.3
Pendimethalin	3.0	11- 8-85	6.0	7.0	1.3
Control			65.3	65.3	2.7
LSD 0.05			12.8	12.6	5.3

* Ben/Dev = Bensulide/Devrinol.

Effects of Preemergence Herbicides on Rooting of Kentucky Bluegrass—1986

Z. J. Reicher and N. E. Christians

The objective of this study was to investigate the effects of preemergence herbicides on rooting of Kentucky bluegrass. The herbicide treatments (expressed as lbs a.i.) were Bensulide at 7.5 and 14.0 lb/A, Dacthal at 10.5 and 15.0 lb/A, Balan at 1.6 and 2.4 lb/A, Ronstar at 2.0 and 4.0 lb/A, Pendimethalin at 1.5 and 3.0 lb/A, and Prodiamine at 0.5 and 1.0 lb/A. An experimental postemergence crabgrass control, Acclaim 1EC, was also included at 0.12 lb/A.

The experiment was divided into high-maintenance and low-maintenance regimes. The high-maintenance study took place on a 3-year-old stand of Midnight Kentucky bluegrass that received 4 lb N/yr and supplemental irrigation. The low-maintenance study was located on a 5-year-old Parade Kentucky bluegrass stand that received only 1 lb N/yr and no irrigation. Due to the relatively mild and wet summer, there was little difference between the two regimes. Both areas were mowed at 2 1/2 inches.

Chemicals were applied on April 25, 1986, and watered in with 2 1/2 inches of rain that evening. A core sampler was used to take rooting samples in late May, late June, and late July. Eight 6-inch deep samples were taken from each plot and divided into two segments by depth, 1-3 inches and 3-6 inches. This was done to check any rooting variability by depth due to the chemicals. The samples were washed through a series of screens to remove the sand and soil particles. Dry weights were taken after the samples were dried at 100°C for 24 hours and weighed. Total organic content of the roots was found by subtracting the ash weights from the oven dry weights. The sand and soil particles that could not be removed by washing were accounted for by measuring the total organic matter of the roots.

There were no significant reductions in rooting due to the herbicides either by depth or in total root weight on any of the three sampling dates (Tables 33 and 34). This could be due to the lack of heat and drought stress on the plants because of the mild summer. It has been established that herbicides cause more damage to the perennial grasses when they are under stress.

This was the second year of the study that will be repeated in 1987. In addition to the field studies, a number of greenhouse and *in vitro* studies are currently under way to further explore the effect of preemergence herbicides on rooting of Kentucky bluegrass.

Table 33. Average total weight in milligrams of eight root samples/plot in high-maintenance study.

Treatment	Rate lb ai/A	Total Root Weight		
		May 28	June 30	July 31
1. Control	----	587	661	554
2. Dacthal 75WP	10.5	621	641	552
3. Dacthal 75WP	15.0	599	719	494
4. Ronstar 2G	2.0	607	572	512
5. Ronstar 2G	4.0	597	766	541
6. Bensulide 4E	7.5	524	530	430
7. Bensulide 4E	14.0	580	608	524
8. Balan 2.5G	2.0	608	644	514
9. Balan 2.5G	3.0	647	574	538
10. Pendimethalin 65WP	1.5	614	548	536
11. Pendimethalin 65WP	3.0	634	557	505
12. Prodiamine 65WP	0.5	706	655	560
13. Prodiamine 65WP	1.0	695	680	647
14. Acclaim 1EC	0.12	593	589	543
LSD 0.05		NS	NS	NS

Table 34. Average total weight in milligrams of eight root samples/plot in low-maintenance study.

Treatment	Rate lb ai/A	Total Root Weight		
		May 28	June 30	July 31
1. Control	----	661	792	501
2. Dacthal 75WP	10.5	587	860	518
3. Dacthal 75WP	15.0	647	782	463
4. Ronstar 2G	2.0	655	825	444
5. Ronstar 2G	4.0	631	764	475
6. Bensulide 4E	7.5	598	841	525
7. Bensulide 4E	14.0	638	929	447
8. Balan 2.5G	2.0	619	811	477
9. Balan 2.5G	3.0	627	720	484
10. Pendimethalin 65WP	1.5	612	759	423
11. Pendimethalin 65WP	3.0	612	759	418
12. Prodiamine 65WP	0.5	617	911	568
13. Prodiamine 65WP	1.0	570	818	503
14. Acclaim 1EC	0.12	662	725	508
LSD 0.05		NS	NS	NS

Sod Rooting Study—1986

Z. J. Reicher and N. E. Christians

For controlling annual grasses in sod re-establishment, there are basically two alternatives; the first is to use preemergence herbicides immediately after laying to stop germination and the second is to use the postemergent selective herbicides to kill the crabgrass after it emerges. One postemergence herbicide is Acclaim by American Hoescht. The registration for Acclaim is still pending with the EPA but it is available under an experimental use permit. Acclaim will be labeled for use on grassy weeds such as crabgrass, goosegrass, and barnyard grass in several established turf species.

The objective of this study was to determine the effects of preemergence herbicide applications and timing of Acclaim applications on root growth of freshly laid sod. There was no crabgrass pressure on this site so weed control was not observed.

The study took place on an established Kentucky bluegrass sod blend of 25 percent each of the cultivars Adelphi, Glade, Parade, and Rugby. Herbicides tested were Acclaim 1 EC at .18 and .36 lb ai/A, Bensulide at 7.5 lb ai/A, Dacthal at 10.5 lb ai/A, and Pendimethalin at 1.5 lb ai/A. The Acclaim was applied at two and four weeks prior to sod cut and two and four weeks after sod laying. The preemerges were applied over the top of the freshly laid sod. The sod was cut on July 29 and moved to a prepared sod bed which was rototilled to a depth of 8 inches and raked level.

The rooting was measured with a technique modified from Beard (Agronomy Journal 61,497-499, 1975). Sod pieces were transplanted into wooden frames with 18 mesh fiberglass screen bottoms at the time of laying. The frames were constructed of 1 in x 2 in pine boards with inside dimensions of 12 in x 12 in. At each of the four corners, hook screws were placed for use as the point of attachment for the hydraulic lift apparatus.

The pump apparatus consisted of a hydraulic jack mounted on a steel plate. A bar mounted to a hinge on a pedestal at one side of the plate, attached to the pump cylinder at the center, and with an eye bolt on the other end being the attachment point for two woven steel cords. The ends of the cords were attached to the hook screws on the frames. The eye bolt was centered over the frame to insure a direct vertical lift. A gauge measuring hydraulic pressure in pounds per square inch (PSI) was attached to the pump to facilitate measurement of force at the point of root breakage from the soil.

After the screens were lifted, a visual measurement of rooting was also taken on a scale from 9 to 1, with 9 = visible roots through the entire screen, 5 = roots through 50 percent of the screen area, and 1 = no roots.

Screens were pulled on August 28 and September 26, four and eight weeks after sod laying, respectively. Note that the last treatments of Acclaim were not applied before the first sampling. In the first pulling, there was much variation among the treatments as seen in table 35, but there were no statistically significant differences in either pump readings or visual ratings. The second sampling revealed that the high rate of Acclaim at both the August 14 and August 29 applications, produced significantly lower rooting according to the pump readings.

Acclaim at .36 lb ai/A caused some shoot burn on all application dates. The phytotoxicity resulting from the July 2 and July 16 applications was probably enhanced by billbug activity in the plots. The August 14 and August 29 applications caused significantly more burning than the first two dates.

In summary, Acclaim at .18 lb ai/A compared favorably to the control and to the preemergence herbicides in root growth and burn potential. But caution should be used when applying Acclaim at .36 lb ai/A to freshly laid sod.

Table 35. Results from the 1986 Sod Rooting Study.

Treatment		lb ai/A	Timing	August 29		September 26	
				PSI	Visual	PSI	Visual
1.	Control	-----	----	115	4.4	179	8.0
2.	Acclaim	.18	7/ 2	83	4.7	212	7.3
3.	Acclaim	.36	7/ 2	171	5.3	125	6.3
4.	Acclaim	.18	7/16	146	5.0	210	8.0
5.	Acclaim	.36	7/16	178	4.3	185	7.7
6.	Bensulide	7.5	7/29	150	4.7	130	7.0
7.	Dacthal	10.5	7/29	86	4.7	237	8.7
8.	Pendimethalin	1.5	7/29	107	4.7	187	7.7
9.	Acclaim	.18	8/14	108	4.0	166	8.0
10.	Acclaim	.36	8/14	62	3.0	100	7.0
11.	Acclaim	.18	8/29	---	---	194	7.3
12.	Acclaim	.36	8/29	---	---	92	5.0
	LSD 0.05			NS	NS	67	NS

Evaluation of Fungicides for Control of Dollar Spot in Penncross Bentgrass—1986

M. L. Gleason

Trials were conducted on the Turfgrass Research Plots at the Horticulture Research Station of Iowa State University near Ames, Iowa. Fungicides were applied to Penncross bentgrass maintained at 5/32-inch cutting height with a modified bicycle sprayer at 30 psi and a dilution rate of 5 gal/1000 ft^2. The experimental design was a randomized block plan with four replications. The plots measured 4 feet by 5 feet. Fungicides were applied in a 14-, 21-, or 28-day schedule (Table 36). Applications began on June 3 and continued through September 10. Plots were evaluated for percent diseased turf on July 24 and August 29.

Disease ratings for dollar spot were made by counting the number of dollar spot infection centers per plot. Disease development was very slight throughout the season, although it gradually increased as the season advanced (Table 36). All chemically treated plots had significantly less disease than the check, but none differed significantly from the others. Most treatments had no disease throughout the season. PP523/surfactant at all three rates caused a marked greening of plots, particularly during late July. There were no symptoms of phytotoxicity with other materials.

Table 36. Evaluation of fungicides for control of dollar spot in Penncross bentgrass.

Treatment	Rate/1000 ft^2	Timing (Days)	Disease Ratings[a] July 24	Disease Ratings[a] August 29
Check	---	--	2.75 a	8.50 a
SN596 25DF	0.50 oz	21	0.50 b	0.25 b
SN596 25DF	1.00 oz	21	0 b	1.00 b
Prochloraz 40EC	4.50 oz	21	0 b	0 b
SN596 & Prochloraz	0.50 oz/1.5 oz	21	0.25 b	0.50 b
SN596 & Prochloraz	1.00 oz/3.0 oz	21	0 b	0 b
Chipco 26019	1.50 oz	21	0.25 b	0.75 b
Chipco 26019	2.00 oz	21	0.25 b	0.25 b
PP523 5% G/surfactant	4.0 g a.i.	14	0 b	0 b
PP523 5% G/surfactant	6.0 g a.i.	14	0 b	0 b
PP523 5% G/surfactant	8.0 g a.i.	14	0 b	0 b
Banner EC	1.00 oz	14	0 b	0 b
Bayleton 25 DF	0.25 oz a.i.	28	0 b	0 b
HWG 1608 25% WP	0.06 oz a.i.	21	0.25 b	0.75 b
HWG 1608 25% WP	0.12 oz a.i.	21	0 b	0 b
HWG 1608 25% WP	0.25 oz a.i.	21	0 b	0 b
Rubigan AS	0.20 oz a.i.	21	0.75 b	0 b
Vorlan	2.00 oz	14	0 b	0 b
Duosan	3.00 oz	14	0 b	0 b
Fungo	1.00 oz	14	0 b	0 b

---

[a] Average of ratings from four replicated plots. Based on number of dollar spot infection centers per plot.
Means in a column followed by the same letter do not differ significantly (DMRT, P = 0.05).

Evaluation of Fungicides for Control of *Bipolaris* Leaf Spot on Park Bluegrass—1986

M. L. Gleason

Trials were conducted on the Turfgrass Reasearch Plots at the Horticulture Research Station of Iowa State University near Ames, Iowa. Fungicides were applied to Park bluegrass maintained at a 1 1/2-inch cutting height with a modified bicycle sprayer at 30 psi and a dilution rate of 5 gal/1000 ft^2. The experimental design was a randomized block plan with four replications. Plots measured 4 feet x 5 feet. Fungicides were applied on a 14- or 21-day schedule (Table 37). Applications began on June 3 and continued through September 10. Plots were evaluated for percent diseased turf on July 24 and August 29.

Incidence of leaf spot was light until mid-season (July) and decreased in August. In the July 24 ratings, Prochloraz EC at a 4.5-oz rate gave the best control. With one exception, all the other treatments reduced disease severity significantly in comparison with the check. Disease pressure on August 24 was so low that differences among ratings on that date are probably meaningless. No plots showed phytotoxicity symptoms.

Table 37. Evaluation of fungicides for control of *Bipolaris* leaf spot in Park bluegrass.

			Disease Ratings[a]	
Treatment	Rate/1000 ft^2	Timing (Days)	July 24	August 29
Check	---	--	2.75 a	1.00 bc
Prochloraz 40EC	4.5 oz	14	0.25 d	0.75 bcd
Actidione TGF	0.34 oz	14	1.00 cd	1.00 bc
Prochloraz & Actidione TGF	1.5 oz/0.34 oz	14	1.00 cd	0.50 cd
Prochloraz & Actidione TGF	3.0 oz/0.34 oz	14	1.00 cd	1.00 bc
Prochloraz & Chlorothalonil	6.9 oz	14	1.00 cd	0.25 d
Banner EC	2.0 oz	14	1.00 cd	0.25 cd
Dyrene 4F	2.0 oz a.i.	14	1.00 cd	0.75 bcd
HWG 1608 25% WP	0.06 oz a.i.	21	1.50 bc	1.00 bc
HWG 1608 25% WP	0.12 oz a.i.	21	1.75 bc	2.00 a
HWG 1608 25% WP	0.25 oz a.i.	21	2.00 ab	1.50 b
Vorlan	2.0 oz	14	1.00 cd	0.75 bcd
Duosan	3.0 oz	14	1.00 cd	1.00 bc
PP523 5% G/surfactant	6.0 g a.i.	14	1.75 bc	1.25 b
PP523 5% G/surfactant	8.0 g a.i.	14	1.50 bc	1.00 b
PP523 5% G & chlorothalonil/surfactant	6.0 g a.i./ 85.0 g a.i.	14	1.25 bc	1.00 bc
PP523 5% G & chlorothalonil/surfactant	6.0 g a.i./ 56.6 g a.i.	14	1.75 bc	1.24 b
PP523 5% G & Manxate/ surfactant	6.0 g a.i./ 95.0 g a.i.	14	1.75 bc	1.00 bc
PP523 5% G & Manzate/ surfactant	6.0 g a.i./ 60.5 g a.i.	14	1.00 cd	1.25 b

---

[a] Rating represents mean disease severity. 1=trace, 2=light disease symptoms, 3=moderate disease symptoms.
Means in a column adjacent to the same letter do not differ significantly (DMRT, P = 0.05).

Influence of Endophyte Infection of Perennial Ryegrass on Tolerance to Drought Stress

M. L. Gleason, N. E. Christians, and M. L. Agnew

Several cultivars of perennial ryegrass (Lolium perenne) having a high incidence of infection by a seedborne endophytic fungus (Acremonium loliae) have recently been released commercially. A limited amount of evidence suggests that endophyte-infected perennial ryegrass grows better than endophyte-free plants under 'stress conditions'. This possible attribute is mentioned in advertisements promoting high-endophyte cultivars. What constitutes 'stress conditions' is not yet clearly defined. However, some preliminary, unpublished evidence from Rutgers University suggests that endophyte infection results in better growth under drought stress. For this reason, a project was initiated in 1986 at Iowa State University to assess the role of endophyte infection in drought stress tolerance. A grant from the Iowa Turfgrass Institute supported this research.

In comparing growth of endophyte-infected and endophyte-free plants, it is important to reduce other sources of variability as much as possible. A major source of this extraneous variability is genetic differences among individual grass plants. This study compared infected and uninfected plants derived from the same clones. To obtain endophyte-infected and endophyte-free plants from the same clone, tillers from the same mother plant were potted separately. Half of the tillers were treated for eight weeks with Benomyl (as a drench) to eliminate the fungus. This method produced 'same-clonal' plants with and without endophyte.

Plants originally derived from four mother plants were then potted in sandy loam soil to which 5 g/l Osmocote 14-14-14 had been added. Watering treatments encompassed a range of water availability to the plants: 0.2 bar (wet), 1 bar (moist), and 10 bars. Each pot was watered to saturation when daily weighing showed that the pot had dried to a weight corresponding to the bar value for the relevant treatment.

The experimental period was 7 1/2 weeks. At the end of that time, number of tillers, dry weight of roots, and dry weight of live and dead blades was measured for all plants. The experiment was conducted twice: in fall 1986, using the cultivar Repell; and in spring 1987, using the cultivar Manhattan II. Statistical analysis of data is not yet completed.

Summer Dormancy Study of Kentucky Bluegrass Cultivar

M. G. Burt and N. E. Christians

Kentucky bluegrass (Poa pratensis L.) cultivars are known to vary in their response to environmental conditions and cultural practices. At the Iowa State University Horticulture Research Station, three trials of the United States Department of Agriculture (USDA) Kentucky bluegrass cultivar evaluations have been established. Each trial consists of 84 cultivars, with each cultivar replicated over three 4 feet x 6 feet plots. The first was established in September 1980. It is a low-maintenance study that receives a September application of 1 lb N/1000 ft^2/yr and is not irrigated. The high-maintenance study was established in August 1981 and each plot within this trial receives 4 lb N/1000 ft^2/yr and supplemental irrigation as needed. The most recent trial was established in August 1985. It is a high-fertility, non-irrigated cultivar trial that receives no supplemental irrigation and 4 lb N/1000 ft^2/yr. The first data will be taken on the high-fertility, non-irrigated study during the 1987 growing season. Data have been taken on the low- and high-maintenance trials for the past several growing seasons. This data is summarized in the annual Iowa Turfgrass Research Report.

Data from the low-maintenance study were used to develop a summer dormancy investigation to study the mechanisms of summer-stress survival. Kentucky bluegrass cultivars were chosen based on their ratings in the low-maintenance cultivar trial. The final ranking of each cultivar was considered with special emphasis on the cultivar's performance during periods of heat and drought stress. Five cultivars were picked that consistently have been rated near the top, or best performing, in the low-maintenance study. These are K3-162, Kenblue, Vantage, S. D. Common, and S-21. Conversely, 5 cultivars were picked that consistently have been rated near the bottom in the Kentucky bluegrass low-maintenance trial. These are Bonnieblue, A-20, Columbia, Lovegreen, and I-13. Seed of these ten cultivars was acquired from the USDA National Turfgrass Evaluation program. The 10 cultivars were seeded into separate 12 in x 22 in wooden flats and these are currently being maintained in the Horticulture Department turfgrass greenhouse.

Grasses develop morphological and physiological adaptations that allow them to survive periods of summer heat and drought stress. The literature points to reasons that may help to explain the Kentucky bluegrass cultivar variability in the response to, and recovery from these stresses. Based on the literature, the following objectives were developed for this research. Objectives are to investigate: morphological differences concerning the number of post summer-dormancy active lateral buds or reproductive tillers for each cultivar; rooting depth differences among cultivars; carbohydrate reserve content of the stem bases and rhizomes of the cultivars; and geographic origin and purpose for the development and selection of each of the cultivars used in this study.

Information is currently being gathered on the geographic origin and purpose for the selection and development of each cultivar. The rooting depth study will be a greenhouse experiment using a polyethylene tube in PVC pipe. Drought stressed plants of the 10 cultivars will be harvested during the summer from the ISU Horticulture Research Station low-maintenance turfgrass plots to be utilized in the morphological and carbohydrate reserve laboratory analysis.

Comparison of Compaction Alleviation Products—1986

M. L. Agnew

A study was conducted in 1986 to compare the effectiveness of seven products and core cultivation, on their ability to alleviate soil compaction and to study the effects of compaction on plant growth. The study area was a one-year old stand of Midnight Kentucky bluegrass. The area was mowed at 2 inches and irrigated to prevent moisture stress. The area received 4 lb N/1000 ft^2/yr as sulfur-coated urea. The list of treatments is given in table 38.

Soil compaction was applied by a smooth power roller that exerted a static pressure of 2.5 kg cm^{-2} (35.5 lb in^{-2}). Compaction was applied twice in 1986, on May 16 and June 2.

Measurements taken in 1986 included visual quality, shoot density (number of shoots per 20 cm^2), verdure (total green shoot dry weight below clipping level for a 20 cm^2 area), bulk density (gm cm^{-3}), total porosity (percent), and air-filled porosity (percent).

After much review of the data and statistics, none of the data taken in 1986 (Table 39) showed any significant difference. This is both surprising and difficult to understand. The only two possible reasons for these results would be:

(1) Undecomposed roots in the samples that were left in the area prior to establishing the turf. The area was once a nursery for ornamental shrubs.

(2) The thatch layer was measured at 3/4 to 1 1/2 inches thick in places prior to compaction application. This could have cushioned the roller sufficiently to prevent the compaction from occurring.

The results are at best a disappointment for the amount of time and effort that was exerted on this study. Careful consideration of extraneous factors, such as thatch depth, buried debris, and soil texture, should be made before repeating this study.

Table 38. List of treatments for 1986 comparison of compaction alleviation products.

Treatment Number	Product Name	Rates (per 1000 ft^2)	Application Dates
1	Nutra-aide	12.8 oz/12.8 oz	5'22, 7'22
2	Nutra-aide	12.8 oz/12.8 oz/12.8 oz/12.8 oz	5/22, 6/22, 7/22, 8/22
3	Relief	12.8 oz/12.8 oz	5/22, 7/22
4	Relief	12.8 oz/12.8 oz/12.8 oz/12.8 oz	5/22, 6/22, 7/22, 8/22
5	Aqua-gro	8.0 oz/8.0 oz	5/22, 7/22
6	Aqua-gro	4.0 oz/4.0 oz/4.0 oz/4.0 oz	5/22, 6/22, 7/22, 8/22
7	Lesco-wet	8.0 oz/8.0 oz	5/22, 7/22
8	Lesco-wet	8.0 oz/4.0 oz/4.0 oz/4.0 oz	5/22, 6/22, 7/22, 8/22
9	Lesco-wet III	8.0 oz/8.0 oz	5/22, 7/22
10	Lesco-wet III	8.0 oz/4.0 oz/4.0 oz/4/0 oz	5/22, 6/22, 7/22, 8/22
11	Gypsum	50 lbs/50 lbs	5/22, 7/22
12	Gypsum	25 lbs/25 lbs/25 lbs/25 lbs	5/22, 6/22, 7/22, 8/22
13	Core aerator	2 passes/2 passes	5/22, 7/22
14	Core aerator	1 pass/1 pass/1 pass/1 pass	5/22, 6/22, 7/22, 8/22
15	Turftech	.36 oz/.36 oz	6/22, 8/22
16	Control		

Table 39. Plant and soil responses to chemical and cultivation treatments.

Chemical	Compaction	Shoot Density	Verdure	Bulk Density	Total Porosity	Air-filled Porosity
Nutra-aide	No	29	.35	1.35	48.1	17.8
(2 apps)	Yes	28	.40	1.36	47.4	17.0
Nutra-aide	No	28	.40	1.33	47.0	18.0
(4 apps)	Yes	26	.29	1.36	46.4	16.3
Relief	No	25	.33	1.36	48.9	18.5
(2 apps)	Yes	30	.38	1.38	46.3	16.0
Relief	No	27	.36	1.36	47.3	18.7
(4 apps)	Yes	22	.26	1.45	47.0	16.4
Aqua-gro	No	23	.36	1.39	46.1	16.7
(2 apps)	Yes	29	.33	1.36	45.8	16.0
Aqua-gro	No	29	.32	1.39	46.3	15.2
(4 apps)	Yes	30	.33	1.39	48.4	16.7
Lesco-wet	No	26	.37	1.36	44.9	15.0
(2 apps)	Yes	28	.36	1.38	46.2	15.1
Lesco-wet	No	32	.41	1.35	48.7	17.7
(4 apps)	Yes	32	.40	1.37	47.1	15.5
Lesco-wet III	No	26	.31	1.37	46.8	17.1
(2 apps)	Yes	23	.30	1.37	47.1	16.2
Lesco-wet III	No	35	.44	1.36	45.2	15.5
(4 apps)	Yes	24	.28	1.33	50.0	19.0
Gypsum	No	37	.40	1.36	46.3	15.8
(2 apps)	Yes	31	.41	1.45	47.7	16.2
Gypsum	No	32	.40	1.40	46.2	14.9
(4 apps)	Yes	32	.39	1.38	46.1	14.5
Core aeration	No	26	.31	1.42	47.3	15.9
(2 passes)	Yes	24	.31	1.33	48.5	16.4
Core aeration	No	25	.33	1.33	47.6	17.6
(4 passes)	Yes	30	.40	1.39	48.1	16.8
Turftech	No	30	.43	1.34	47.4	17.1
(2 apps)	Yes	21	.29	1.32	46.5	16.9
Control	No	32	.37	1.35	47.8	17.8
	Yes	30	.33	1.38	46.5	16.1
LSD 0.05		NS	NS	NS	NS	NS

Cultivation Equipment Comparison Study

M. L. Agnew, N. E. Christians, and R. W. Moore

In the fall of 1985, a cultivation study was initiated on an area that contained between 1 and 1 1/2 inches of thatch. The purpose of this study was to compare four core aerators and one vertical mower in their capabilities to remove excessive thatch from a bluegrass stand. The characteristics of each machine are listed in table 40. The turf is a Northrup King Premium Sod Blend, which was established in the fall of 1981. It is maintained at a cutting height of 2 inches.

The treatments include five machines and three levels of intensity of application. The three levels of intensity are no passes = 0X, 1 pass = 1X, and 2 passes = 2X. When there were no passes made over an area, this is referred to as a control. The cultivation was done in September of 1985 and the thatch depth was measured on September 5, 1986.

The initial thatch depth and the amount of thatch removed after one year is listed in table 41. The only treatment not to reduce thatch was the control for the Ryan Ride-aire. All other treatments, which include controls for other machines, decreased thatch.

There were no differences when comparing thatch removal by machine (Table 42). However, there was a trend that the Ryan Ren-O-Thin and Classen Turf Plugger demonstrated greater thatch removal. The Ryan Ren-O-Thin would physically remove the thatch, whereas the Classen Turf Plugger made 5/8 inch holes that could potentially help decrease thatch.

When comparing the number of passes made by the total of all machines (Table 43), there was no difference between 1X and 2X. However, the use of cultivation equipment did decrease the thatch layer over the 0X treatment. This indicates that 1 or 2 passes with any of the tested machines provided accelerated deterioration of the thatch layer.

This study is being terminated due to difficulties in obtaining all pieces of equipment. However, an intensity study was initiated in 1986 to look into the effect of timing and number of treatments per year of a core aerator and a verticutter and their ability to decrease thatch.

Table 40. Characteristics of five different pieces of cultivation equipment.

Equipment Name	Equipment Description
Ryan Ryan Ride-aire	Hollow tine, 3 1/2 inches center to center spacing, 1/2 inch tine diameter
Ryan Lawn-aire III	Spoon tine, 3 3/4 x 7 inches center to center spacing, 1/2 inch tine diameter
Ryan Lawn-aire IV	Hollow tine, 3 3/4 x 7 inches center to center spacing, 1/2 inch tine diameter
Classen Turf Plugger	Hollow tine, 7 x 7 inches center to center spacing, 5/8 inch tine diameter
Ryan Ren-O-Thin	Flail knives, 1 inch spacing, 1/8 inch blade thickness

Table 41. The effect of cultivation equipment and intensity on thatch removal on September 5, 1986.

Equipment Name	Number of Passes Over Area	Initial Thatch Depth (cm)[a]	Amount of Thatch Removed (cm)
Ryan Ride-aire	0X	2.67	-0.17[b]
Ryan Ride-aire	1X	2.67	0.33
Ryan Ride-aire	2X	2.67	0.67
Ryan Lawn-aire III	0X	3.50	1.00
Ryan Lawn-aire III	1X	3.50	1.40
Ryan Lawn-aire III	2X	3.50	1.50
Ryan Lawn-aire IV	0X	2.57	0.13
Ryan Lawn-aire IV	1X	2.57	0.50
Ryan Lawn-aire IV	2X	2.57	0.70
Classen Turf Plugger	0X	2.67	0.07
Classen Turf Plugger	1X	2.67	0.73
Classen Turf Plugger	2X	2.67	1.00
Ryan Ren-O-Thin	0X	3.17	0.83
Ryan Ren-O-Thin	1X	3.17	1.50
Ryan Ren-O-Thin	2X	3.17	2.00

[a] 1 inch = 2.54 cm

[b] A negative number indicates an increase in thatch depth.

Table 42. The effect of cultivation on thatch removed on September 5, 1986.

Equipment Name	Amount of Thatch removed (cm) without control
Ryan Ride-aire	0.67
Ryan Lawn-aire III	0.45
Ryan Lawn-aire IV	0.47
Classen Turf Plugger	0.81
Ryan Ren-O-Thin	0.92

Table 43. The effect of cultivation intensity on thatch removal on September 5, 1986.

Number of Passes over area	Amount of Thatch Removed (cm)
0X	0.37
1X	0.89
2X	1.17
LSD 0.05	0.44

Comparative Effectiveness of Insecticides Against Annual White Grubs—1986

D. L. Lewis and N. E. Christians

Damage to turfgrass by annual white grubs (Cyclocephala spp.) is a common, but spotty and locally severe problem in Iowa. Amount of damage varies greatly from place to place and from year to year, depending on several factors such as grass variety, cultural maintenance practices, irrigation, and weather. Root feeding by these masked chafer larvae characteristically causes grass to wilt, turn tan, and finally die, usually in late August or early September. Several granular and emulsifiable concentrate insecticide products are registered for white grub control. Timing of insecticide application is very important in achieving effective control of white grubs before damage becomes severe.

The objective of this study was to evaluate and compare the efficacy of several registered and experimental insecticides against annual white grubs infesting turfgrass.

The study was conducted on fairway and rough areas of the Hyperion Golf and Country Club located in Johnston, Iowa (Polk County). Two separate tests of the same design were conducted. In the first test the insecticide treatments were applied on August 5, 1986, and grub population counts were taken August 20, 1986. The second test treatments were applied on September 3, 1986, and the efficacy data collected on September 25. 1986.

The experimental design consisted of 15 treatment plots and one untreated check plot, randomly assigned in each of three replications. Each plot consisted of a 5 feet by 5 feet^2 area. All insecticides were applied at the rate specified on the manufacturer's label or product guidelines. Liquid insecticides were applied with a compressed gas, back-pack sprayer, connected to a hand-held, three-nozzle boom. The boom covered a 5 feet wide area, and diluted insecticide spray was applied to the test plots with alternating perpendicular passes over the treatment plot. The amount of water applied to each plot was the equivalent of 175 gal/acre. Granular insecticides were premeasured into round, cardboard containers and applied uniformly over the plot by shaking through a perforated lid. In the first study, the insecticides were watered into the turfgrass immediately after application with approximately 1/2 inch of irrigation. In the second test, irrigation was not necessary as application was made late in the day just prior to an evening shower in excess of one inch.

Annual white grub population counts were made approximately three weeks after treatment by randomly selecting sample sites within each plot, removing the sod, and counting all live white grubs found. The sod was lifted from the cut area, and the root mass carefully cut apart and examined for living grubs. The soil beneath the cut sod was scratched loose to a depth of two inches and similarly examined. The total number of white grubs found in each sample was recorded.

For the first study, three samples were taken in each plot. Each sample consisted of a plug cut with a standard 4-inch diameter golf green cup cutter. In the second study, four samples were taken in each plot. The samples were 6-inch squares of turfgrass cut loose with a long, sharp knife. Population counts in the samples were converted to number of white grubs per square foot for analysis and reporting.

The insecticides used in this project, the formulation, rate of application, and mean number of white grubs per square foot are given in table 44. Significant differences among treatments and between treatments and the untreated check are difficult to determine from these data, especially in the first test. Conclusions are difficult to draw because of low numbers of white grubs and large variation in population density among replications and among plots within replications. However, nonrestricted least significant difference (LSD) test values indicate there were significant reductions in white grub numbers in the treatment plots compared to the check plots.

In the first study, all treatments except the 2 lb rate of CGA-73102 apparently reduced white grub numbers compared to the control plots. The fact that CGA-73102 at the lower rate (1 lb ai/A) did show significant reduction further indicates that the white grub population was highly variable in the test area. This experimental product provided control at both the high- and low-rate in the second study.

The second study was initiated on an area that was heavily infested with white grubs prior to insecticide application. We consider the results in this test to be more reliable. In the second study, CGA-12223 was the only product to provide complete white grub control. Dursban 50W at the .5 lb rate was not effective in controlling white grubs although the 1 lb rate gave very good control (91 percent reduction). Dursban 4E and Dursban ME were effective at both tested rates. Mocap provided very good control at the low- and high-rate, whereas diazinon 4E yielded inconsistent results. Turcam 76WP was not effective in controlling white grubs in this test. This is surprising in light of other experiences with this product where excellent control has been achieved.

Table 44. Effects of commercially available and experimental insecticides on annual white grubs infesting turfgrass, Polk County, Iowa, 1986.

Insecticide / Formulation	Rate lb ai/A	Mean number white grubs per square foot First Study*	Second Study*
Control		12	11
CGA-73102 5G	1.0	1	2
CGA-73102 5G	2.0	8	2
CGA-12223 2G	2.0	0	0
Oftanol 2E	2.0	3	3
Dursban 50W	0.5	0	6
Dursban 50W	1.0	4	1
Dursban 4E	0.5	0	2
Dursban 4E	1.0	1	3
Dursban ME	0.5	0	2
Dursban ME	1.0	0	2
Mocap 10G	5.0	0	1
Mocap 10G	10.0	0	1
Diazinon 4E	2.7	0	3
Diazinon 4E	5.4	1	5
Turcam 76WP	2.1	3	6
LSD** 0.05		8.0	7.3

* Treatment data/population count date: First Study - August 5 / August 20. Second Study - September 3 / September 25

** nonrestricted LSD; model not significant at the 0.05 level.

Iowa State University Personnel Affiliated with the Turfgrass Research Program

DR. MICHAEL AGNEW	Assistant Professor, Extension Turfgrass Specialist. Horticulture Department.
MR. MICHAEL BURT	Turfgrass Graduate Student and Research Associate. Horticulture Department M.S. (Christians).
DR. NICK CHRISTIANS	Associate Professor, Turfgrass Science. Research and Teaching. Horticulture Department.
MR. KEN DIESBURG	Turfgrass Graduate Student and Research Associate. Horticulture Department Ph.D. (Christians).
DR. MARK GLEASON	Assistant Professor, Extension Plant Pathologist. Plant Pathology Department.
MR. ROBERT HARTZLER	Extension Weed Associate, Weed Science Department.
DR. CLINTON HODGES	Professor, Turfgrass Science. Research and Teaching. Horticulture Department.
MR. YOUNG JOO	Turfgrass Graduate Student and Research Associate. Horticulture Department Ph.D. (Christians).
DR. DONALD LEWIS	Associate Professor, Extension Entomologist. Entomology Department.
MR. RICHARD MOORE	Turfgrass Graduate Student and Research Associate. Horticulture Department M.S. (Christians/Agnew).
MR. ZACHARY REICHER	Turfgrass Graduate Student and Research Associate. Horticulture Department M.S. (Christians).

Companies and Organizations That Made Donations to the Iowa State University Turfgrass Research Program

Special thanks is expressed to the Big Bear Turf Equipment Company and Cushman Turf for providing a Cushman Truckster for use at the research area in 1986, to Tri-State Turf and Irrigation for providing a Greensmaster III Triplex Greensmower for use on the research green this year, and to the Toro Company and Tri-State Turf and Irrigation for providing a Toro 84 Triplex mower for use in 1986.

American Hoechst Corporation
Agricultural Chemicals Department
Route 1 - Box 7
Brownsdale, Minnesota 55918

The Andersons
Post Office Box 119
Maumee, Ohio 43537

Aquatrols Corporation of America
1432 Union Avenue
Pennsauken, New Jersey 08110

Arcadian Corporation
310 Clapp Farms Road
Greensboro, North Carolina 27406

Big Bear Turf Equipment Company
1840 Fuller Road
West Des Moines, Iowa 50265

Britt Tech Corporation
Post Office Box 216
Britt, Iowa 50423

Chesebrough-Pond's, Inc.
Research Laboratories
Trumbull Industrial Park
Trumbull, Connecticut 06611

CIBA-Geigy Corporation
Agriculture Division
Greensboro, North Carolina 27049

Classen Manufacturing
1403 Rouch Street
Norfolk, Nebraska 68701

Cushman Turf
5232 Cushman
Lincoln, Nebraska 68501

W. A. Cleary Corporation
1049 Somerset Street
Somerset, New Jersey 08873

D & K Turf Products
8121 Parkview Drive
Urbandale, Iowa 50322

Dow Chemical
10890 Benson - Suite 160
Shawnee Mission, Kansas 66210

Dupont Incorporated
1007 Market Street
Wilmington, Delaware 19898

Elanco Products Company
5600 South 42nd Street
Post Office Box 3008
Omaha, Nebraska 68103

Fermenta Plant Protection Company
Post Office Box 348
7528 Auburn Road
Painesville, Ohio 44077

GrassRoots Turf
6143 Southwest 63rd
Des Moines, Iowa 50321

Hawkeye Chemical Company
Post Office Box 899
Clinton, Iowa 52732

International Seeds
820 First Street
Post Office Box 168
Halsey, Oregon 97348

Iowa Golf Course Superintendents
Association

Iowa Professional Lawn Care
Association

Iowa Turf Producers and
Contractors

Iowa Turfgrass Institute

Lebanon Chemical Corporation
Country Club Fertilizer Division
Post Office Box 180
Lebanon, Pennsylvania 17042

LESCO Incorporated
300 South Abbe Road
Elyria, Ohio 44035

Loft-Kellogg Seed
322 East Florida Street
Post Office Box 684
Milwaukee, Wisconsin 53201

M & A Enterprises
4346 South 90th
Omaha, Nebraska 68127

Monsanto Company
Agricultural Products Division
800 North Lindbergh Boulevard
St. Louis, Missouri 63167

Nor-Am Chemical Company
3509 Silverside Road
Post Office Box 7495
Wilmington, Delaware 19803

PBI/Gordon Corporation
1217 West 12th Street
Post Office Box 4090
Kansas City, Missouri 64101-9984

Pickseed West Incorporated
Post Office Box 888
Tangent, Oregon 97389

Regal Chemical Company
Post Office Box 900
Alpharetta, Georgia 30201

Rhone-Poulenc Chemical Company
Black Horse Lane
Post Office Box 125
Monmouth Junction, New Jersey
08852

Riverdale Chemical Company
220 East 17th Street
Chicago, Illinois 60411

O. M. Scott and Sons
Marysville, Ohio 53040

Spraying Systems Company
N Avenue at Schmale Road
Wheaton, Illinois 60187

Stauffer Chemical Company
10250 Regency Circle
Omaha, Nebraska 68114

Par Ex
Swift Agricultural Products Corp.
518 Pauline Drive
Buffalo Grove, Illinois 60090

Terra Chemical Corporation
Box 218
Quimby, Iowa 51049

The Toro Company
Irrigation Division
Riverside, California 92500

Tri State Turf & Irrigation Co.
6125 Valley Drive
Bettendorf, Iowa 52722

Union Carbide
Agricultural Products
Ambler, Pennsylvania 19002

* In the rush to prepare this information for the field day report, some companies may have inadvertently been missed. If your company has provided financial or material support for the research program, and is not mentioned above, please contact me so your company name can be added in future reports.

Nick E. Christians

3

Cooperative Extension Service, Iowa State University of Science and Technology and the United States Department of Agriculture cooperating, Robert L. Crom, director, Ames, Iowa. Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914.