1985 Iowa Turfgrass Research Report

Cooperative Extension Service
Iowa State University
Ames, Iowa 50011

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Introduction

The following research report is the fifth 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, and 1984 field days.

The first cultivar and management studies at the field research area were seeded in August of 1979, and many of these investigations are now in their sixth 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. We would like to thank Tri-State Turf and Irrigation Company and the Toro Company for providing irrigation equipment for the new site at cost to Iowa State University.

The expansion which 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, and the Iowa Professional Lawn Care Association. We would like to thank each of you who helped to develop the program over the past six years.

We would also like to acknowledge Kenneth Diesburg, Brian Maloy, Zachary Reicher, Mike Null, Richard Moore, Paul Johnson, Scott Harvey, and all the others who have been employed at the field research area in the past year for their efforts in building the program.

Edited by Nick Christians, associate professor, turfgrass science; Michael Agnew, assistant professor, turfgrass extension; and Gene Hettel, extension communications specialist.

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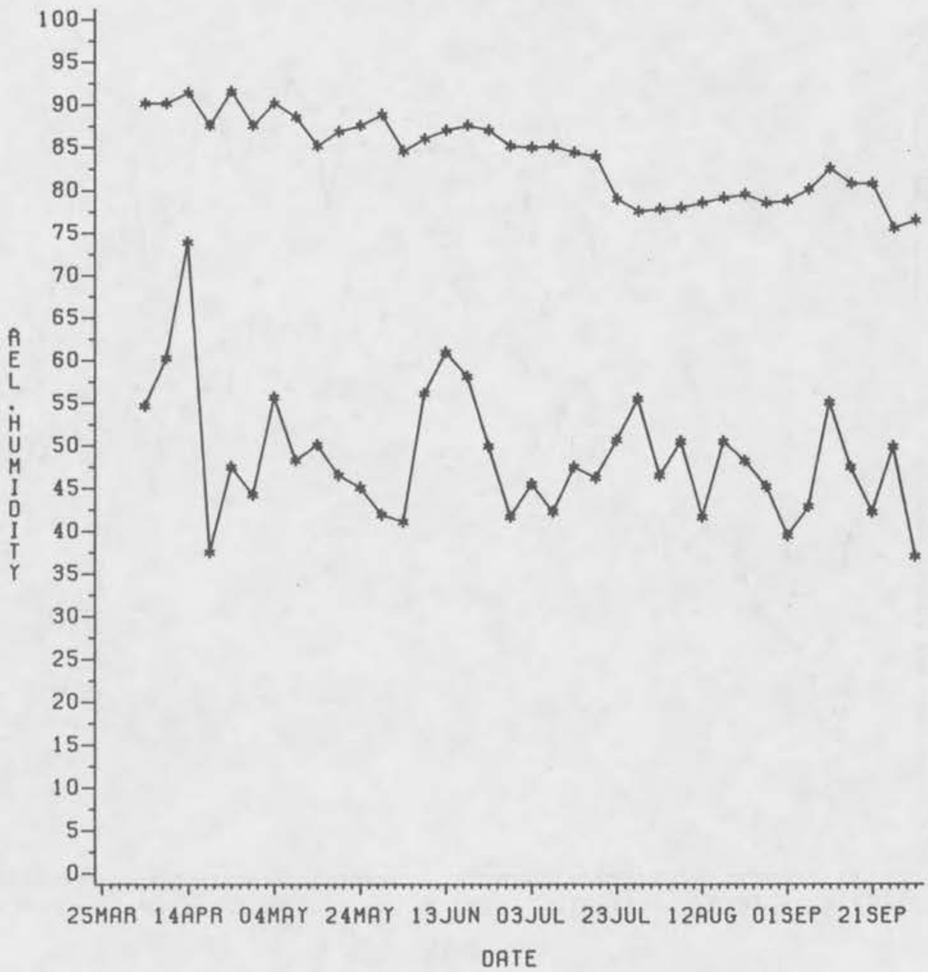
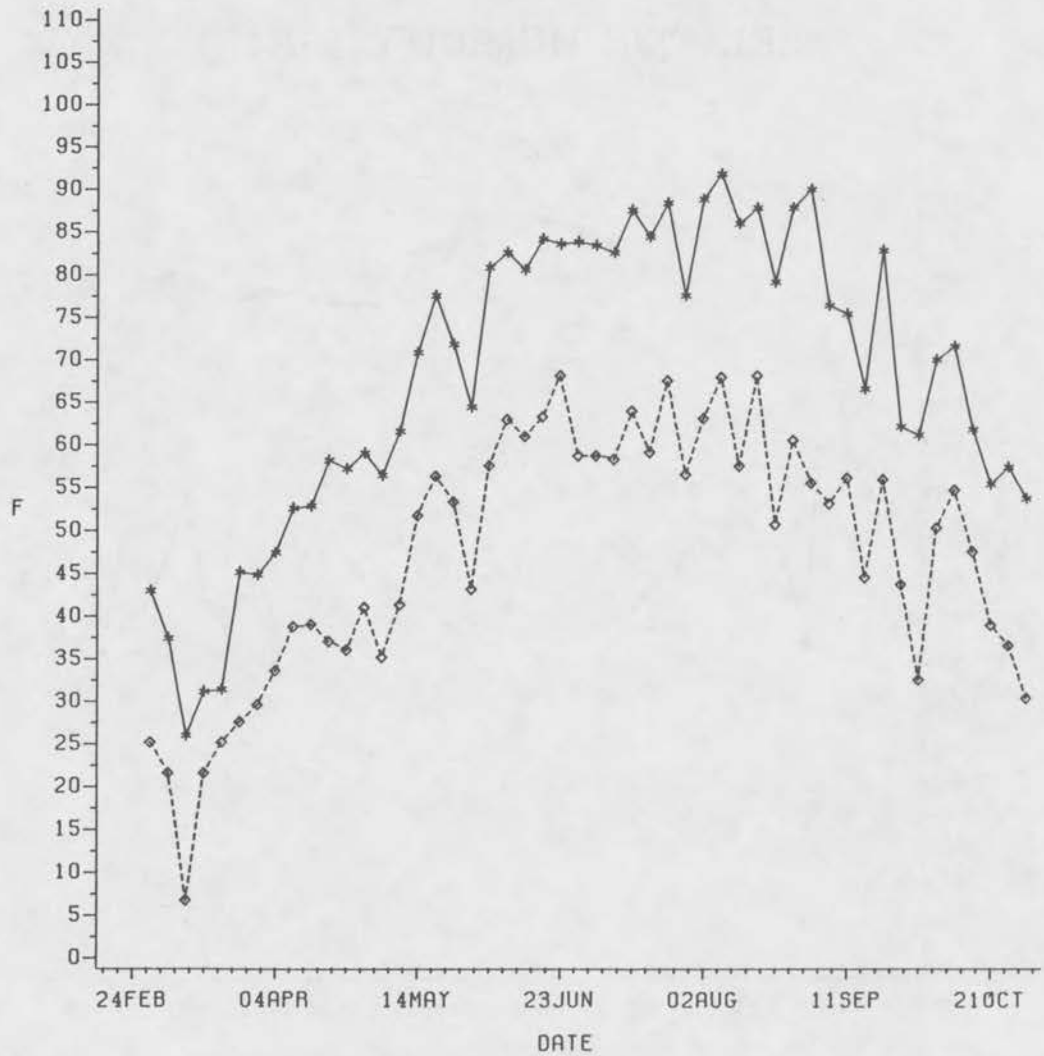
Environmental Data

RELATIVE HUMIDITY 1984



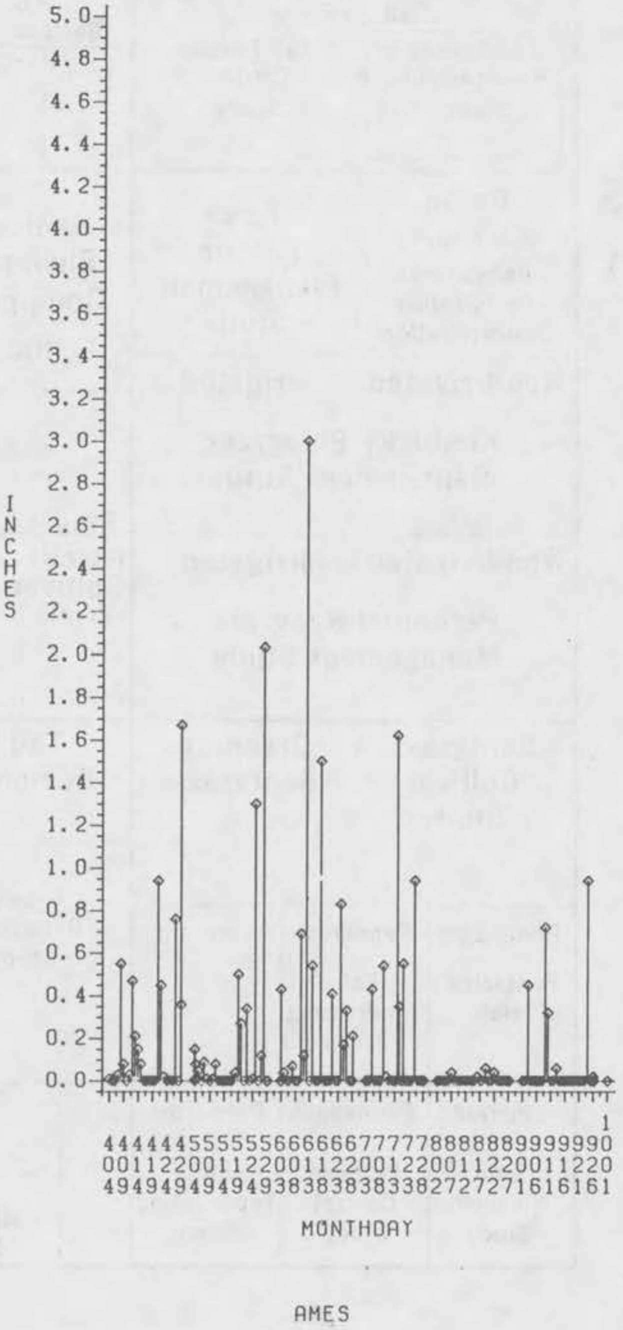
MAXIMUM EQUALS STAR SYMBOL
MINIMUM EQUALS DASHED LINE AND DIAMOND SYMBOL
AMES-5 DAY AVERAGES

TEMPERATURE 1984

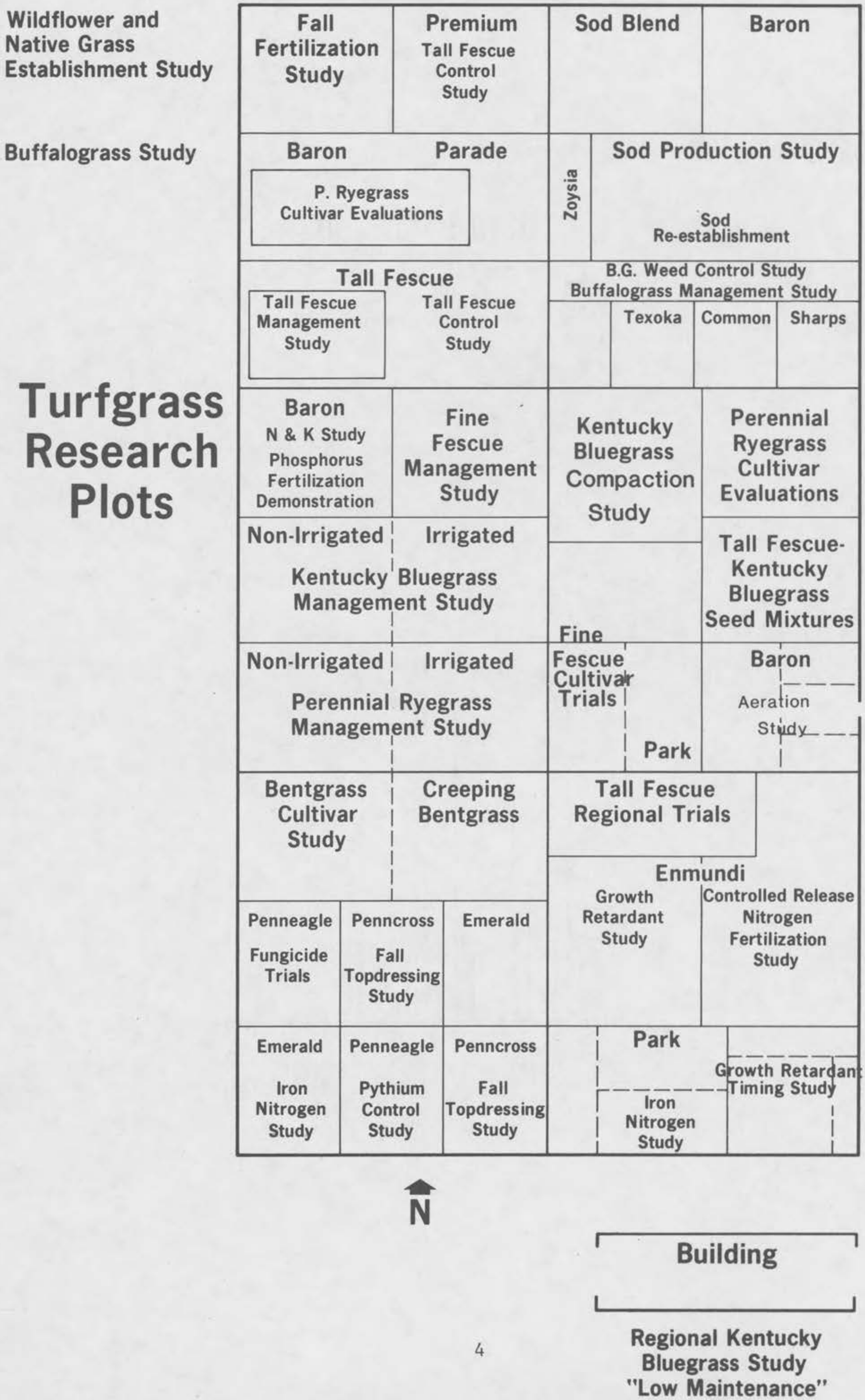


MAXIMUM EQUALS STAR SYMBOL
MINIMUM EQUALS DASHED LINE AND DIAMOND SYMBOL
AMES-5 DAY AVERAGES

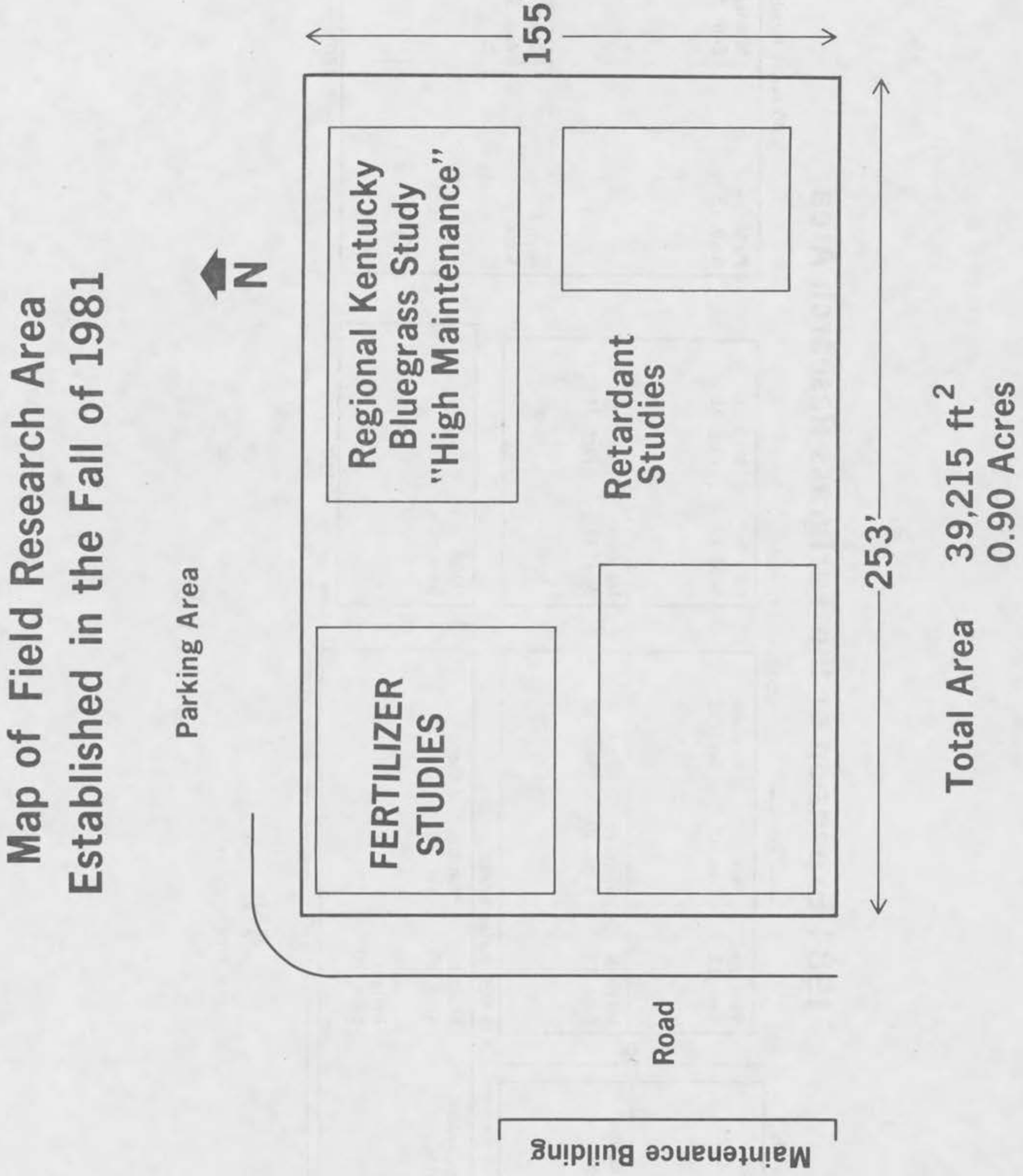
RAINFALL 1984



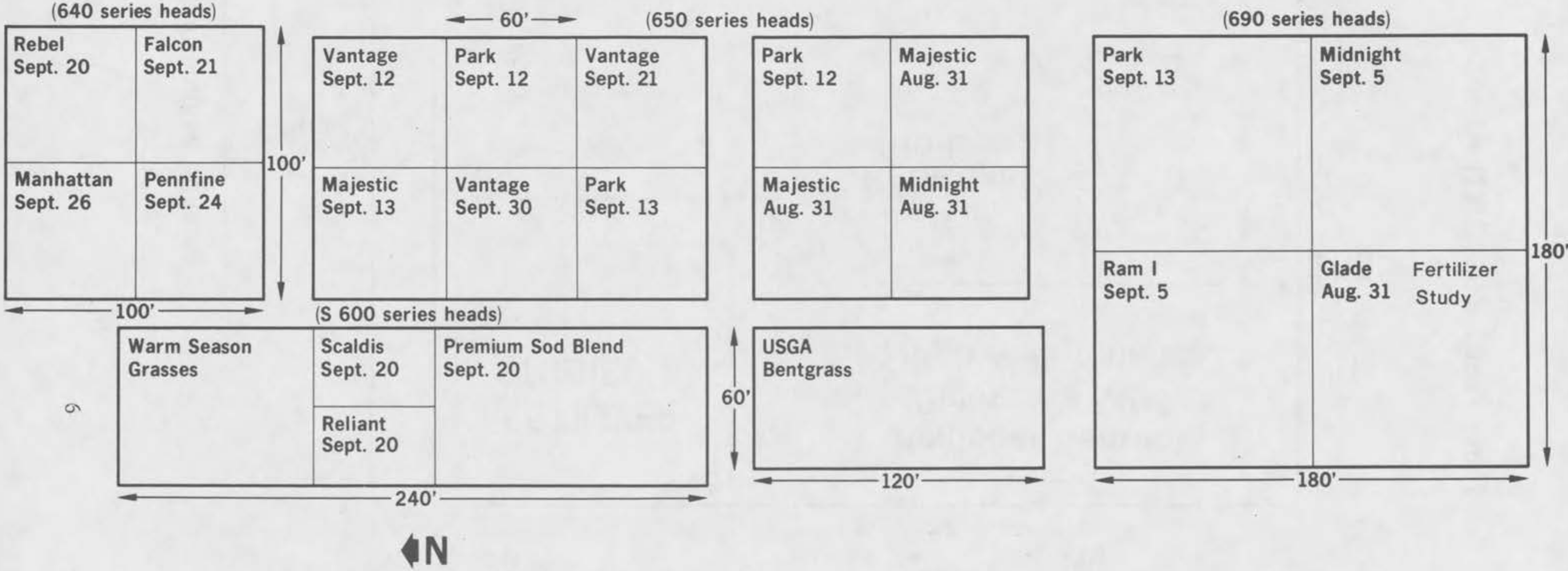
Turfgrass Research Plots



New Field Research Areas



1984 Expansion of the Turfgrass Research Area



Total Area = 2.7 acres

The 1984 Results of High- and Low-Maintenance Kentucky Bluegrass Regional Cultivar Trials

N. E. Christians

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

Two separate trials are underway at Iowa State University. One is a high-maintenance study which receives 4 lb N/1000 ft^2/yr and is irrigated as needed, and the other is a low-maintenance study that receives 1 lb N/1000 ft^2 in September and 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 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 which would be used in a park, school yard, or other low-maintenance area. The low-maintenance study was established in September 1980 and the high-maintenance study in August 1981.

Majestic was the highest rated Kentucky bluegrass cultivar in 1984 in the high-maintenance trial (Table 1). Majestic was also the top rated cultivar in 1983. Other high rated cultivars in 1984 included Merit, Midnight, Bonnieblue, and Ram-I.

The highest rated cultivars in the low-maintenance trials were K3-162, S-21, South Dakota Common, Kenblue, and Vantage (Table 2). Note that these cultivars were among the poorest in the high-maintenance trial. It should also be noted that Majestic ranked 67th in the low-maintenance trial, Merit ranked 52nd, and Midnight ranked 30th. Only Ram-I had a fairly high ranking in both high- and low-maintenance trials.

The choice of cultivars clearly depends on the type of care the area is likely to receive after establishment, and proposed use should be carefully considered before cultivars are selected.

Table 1. The 1984 quality ratings for the high-maintenance regional Kentucky bluegrass test established in fall 1981.

Cultivar	Apr	May	June	July	Aug	Sept	Oct	Mean
1. Majestic	6.7	8.3	7.7	7.3	7.3	7.3	7.0	7.4
2. Merit	6.0	7.0	7.7	7.3	7.3	7.0	8.7	7.3
3. Midnight	5.0	6.0	8.0	7.7	7.7	8.3	8.3	7.3
4. Bonnieblue	7.3	6.3	7.7	6.7	7.0	7.3	8.3	7.2
5. Ram-I	5.3	6.7	6.7	7.3	7.7	8.3	8.0	7.1
6. N535	6.3	8.3	7.3	7.3	6.3	6.0	7.3	7.0
7. Bristol	6.3	7.0	7.3	6.7	6.7	7.3	8.0	7.0
8. Eclipse	6.7	7.0	7.0	6.0	7.7	7.0	7.3	7.0
9. Glade	5.0	6.0	7.0	6.3	6.7	8.3	8.7	6.9
10. PSU-150	6.3	7.7	7.0	5.7	7.3	7.0	7.3	6.9
11. Mer pp 300	5.7	7.3	6.7	6.7	6.7	7.0	8.3	6.9
12. Nassau	6.0	6.3	6.0	6.3	6.7	7.3	8.7	6.8
13. Baron	5.0	6.3	7.0	6.7	7.3	7.3	8.0	6.8
14. Enmundi	5.7	7.3	6.7	6.0	7.0	7.0	7.0	6.7
15. BA-61-91	5.3	6.7	7.7	7.3	6.3	6.7	7.0	6.7
16. Adelphi	6.3	7.3	7.0	5.7	6.3	5.7	8.0	6.6
17. Victa	5.3	6.7	7.7	6.0	6.3	6.3	7.7	6.6
18. Fylking	6.0	5.3	7.0	6.7	6.3	7.0	7.0	6.5
19. CEB VB 3965	5.3	7.0	7.0	5.7	7.3	5.7	7.3	6.5
20. 239	6.0	6.3	5.7	6.0	6.7	7.3	7.0	6.4
21. SV-01617	5.0	5.7	6.3	6.7	7.0	7.3	6.7	6.4
22. Aspen	6.0	7.3	6.7	6.3	6.3	5.7	6.7	6.4
23. MLM-8011	5.3	8.3	7.3	5.7	6.0	6.0	6.3	6.4
24. Sydsport	6.7	5.3	6.3	6.0	7.3	6.3	6.7	6.4
25. Barblue	5.7	7.7	6.7	5.7	6.3	6.3	6.7	6.4
26. Nugget	5.3	5.7	7.3	6.0	7.0	6.0	6.7	6.3
27. Kimono	4.7	6.3	7.0	6.0	7.0	5.7	7.3	6.3
28. Admiral	6.0	6.0	6.3	5.7	6.7	6.7	6.7	6.3
29. Escort	5.3	6.0	7.0	6.0	6.7	6.3	6.7	6.3
30. K3-179	6.7	5.7	6.7	6.0	6.3	6.0	7.0	6.3
31. Birka	5.3	5.7	6.7	6.0	6.7	6.0	7.3	6.2
32. Cheri	6.0	6.0	6.0	5.7	7.0	5.7	7.0	6.2
33. PSU-1733	6.3	6.7	6.3	5.7	6.0	5.0	7.7	6.2
34. Parade	5.7	5.7	6.0	5.7	7.3	6.7	6.3	6.2
35. Bono	5.3	5.3	6.7	5.0	6.0	8.0	7.0	6.2
36. Mosa	5.0	6.0	7.0	6.7	6.3	5.7	6.7	6.2
37. Columbia	5.7	5.7	6.3	5.7	6.3	6.0	7.7	6.2
38. Argyle	6.7	4.7	6.3	5.3	7.0	6.7	6.3	6.1
39. Shasta	6.0	6.3	6.0	5.7	6.0	5.7	7.0	6.1
40. K3-178	6.3	6.0	5.7	6.0	5.7	6.0	7.3	6.1
41. Trenton	5.7	6.3	6.0	5.3	6.3	6.0	6.7	6.0
42. Rugby	6.0	6.7	5.7	5.0	6.0	5.7	6.7	6.0

(Continued on next page)

Table 1. (Continued)

Cultivar	Apr	May	June	July	Aug	Sept	Oct	Mean
43. Banff	5.7	6.7	6.0	5.3	6.3	5.3	6.3	6.0
44. Dormie	6.7	7.0	7.0	6.0	6.0	4.3	5.3	6.0
45. Geranimo	6.0	5.7	6.7	6.0	6.3	5.3	6.0	6.0
46. WW Ag 478	4.3	6.0	7.0	6.3	6.0	6.0	6.7	6.0
47. Charlotte	5.3	5.7	6.0	6.0	5.7	7.3	6.0	6.0
48. Apart	5.7	5.3	6.3	5.7	6.3	6.0	6.3	6.0
49. Mer pp 43	6.3	5.0	6.3	5.0	6.3	5.3	7.3	6.0
50. Mystic	6.3	5.7	6.3	6.0	6.7	5.0	6.3	6.0
51. K1-152	6.7	6.0	6.0	5.3	5.7	5.3	6.7	6.0
52. Holiday	4.3	6.7	6.3	6.3	6.3	5.3	6.0	5.9
53. Touchdown	5.0	6.0	5.3	5.3	6.7	6.7	6.3	5.9
54. Vanessa	5.7	6.0	6.7	5.3	6.3	5.7	5.7	5.9
55. Piedmont	7.7	5.0	5.3	5.0	6.3	5.3	6.7	5.9
56. A-34	7.3	5.3	6.7	5.0	5.7	5.0	6.3	5.9
57. Mona	5.3	6.3	5.7	5.3	6.7	5.3	6.7	5.9
58. PSU-190	6.0	5.0	5.3	6.0	6.0	6.3	6.0	5.8
59. Welcome	5.0	5.7	5.7	5.7	5.7	6.0	6.7	5.8
60. WW ag 480	5.7	5.3	6.3	5.0	7.0	5.0	6.3	5.8
61. A 20	5.0	7.0	7.0	5.3	5.3	4.3	6.7	5.8
62. SH-2	5.7	6.3	6.3	5.3	5.7	4.3	6.7	5.8
63. Merion	5.7	5.7	5.7	5.7	6.3	5.3	6.0	5.8
64. Bayside	6.3	5.3	5.7	5.7	6.0	5.7	6.0	5.8
65. 225	5.3	5.7	5.7	5.7	5.3	5.3	7.3	5.8
66. Monopoly	5.7	5.3	5.3	5.3	6.0	4.7	7.7	5.7
67. Plush	4.3	5.7	6.3	6.0	7.0	4.3	6.0	5.7
68. WW Ag 463	5.0	6.0	5.3	5.3	6.3	5.7	6.3	5.7
69. Harmony	4.3	5.3	6.7	5.3	6.7	5.0	6.7	5.7
70. Vantage	7.3	4.7	6.0	4.7	5.7	5.0	6.7	5.7
71. Enable	5.3	5.7	5.7	5.3	6.0	5.7	6.3	5.7
72. NJ 735	6.0	5.7	5.7	5.0	6.7	5.0	6.0	5.7
73. Wabash	8.0	5.7	5.3	5.0	5.0	4.3	6.0	5.6
74. S-21	7.0	4.7	5.0	4.0	6.0	5.3	7.3	5.6
75. A 20-Ga	5.7	6.3	6.0	5.0	5.3	4.7	6.3	5.6
76. K3-162	8.0	4.3	5.0	4.0	4.7	6.3	6.7	5.6
77. A 20-6	5.3	6.7	6.3	4.7	5.7	4.3	5.7	5.5
78. H-7	5.3	6.0	6.0	5.0	5.0	4.0	5.7	5.3
79. I-13	5.3	5.7	6.0	5.0	4.7	4.3	6.3	5.3
80. S D Common	6.3	4.3	4.3	4.0	5.7	6.0	6.3	5.3
81. Cello	5.3	5.7	5.3	5.0	5.3	4.0	5.7	5.2
82. Lovegreen	5.0	5.7	6.3	4.7	5.3	4.3	5.3	5.2
83. American	4.3	5.7	5.3	5.0	4.3	5.0	6.3	5.1
84. Kenblue	6.7	4.3	4.3	3.7	5.3	5.3	5.3	5.0
LSD 0.05	1.3	1.3	1.2	1.2	1.4	1.5	1.6	0.7

Table 2. The 1984 quality ratings for the low-maintenance regional Kentucky bluegrass test established in the fall of 1980.

Cultivar	Apr	May	June	July	Aug	Sept	Oct	Mean
1. K3-162	7.7	7.0	4.7	6.7	5.0	4.7	6.3	6.0
2. S-21	6.7	7.0	5.0	6.7	4.3	5.0	6.3	5.9
3. S D Common	6.7	6.0	4.3	6.7	4.3	5.3	6.3	5.7
4. Kenblue	6.7	5.3	4.7	6.0	5.3	5.0	6.3	5.6
5. Vantage	7.0	6.7	4.3	5.7	5.0	4.7	5.7	5.6
6. Argyle	7.0	6.0	4.3	5.7	4.7	4.7	5.3	5.4
7. Monopoly	4.7	4.7	5.7	5.3	5.3	4.7	5.0	5.0
8. Ram-I	5.0	4.7	6.3	5.0	4.7	5.3	5.3	5.0
9. Fylking	5.3	5.3	6.0	5.3	4.3	4.3	4.7	5.0
10. Piedmont	6.7	5.7	4.3	5.0	4.0	4.0	5.0	5.0
11. Mosa	4.7	4.7	5.0	5.0	5.3	4.3	5.3	4.9
12. Wabash	5.7	6.3	5.0	4.7	3.3	3.3	5.0	4.8
13. PSU-190	4.0	4.0	5.0	5.0	5.0	4.3	6.0	4.8
14. N535	5.3	5.7	5.7	5.3	4.7	3.0	3.7	4.8
15. PSU-173	4.7	4.3	5.0	5.7	4.3	3.7	5.0	4.7
16. Parade	4.7	5.0	4.3	5.3	4.7	3.7	5.3	4.7
17. Touchdown	5.0	4.7	5.0	5.0	4.3	3.3	5.3	4.7
18. Vanessa	4.3	4.7	5.0	5.0	5.0	3.7	5.3	4.7
19. Mer pp 300	5.0	4.7	5.7	5.3	4.3	3.7	4.3	4.7
20. Kimono	3.7	4.0	5.3	4.7	5.0	4.7	4.7	4.6
21. Baron	3.7	4.3	5.7	5.3	4.3	4.0	5.0	4.6
22. Enmundi	5.0	4.3	6.0	5.3	4.3	3.0	4.3	4.6
23. WW Ag 463	4.3	4.3	5.0	5.7	5.0	3.0	4.7	4.6
24. K3-178	4.7	5.0	5.3	4.7	4.7	3.7	4.3	4.6
25. Plush	4.0	4.0	5.7	4.7	5.0	4.3	4.0	4.5
26. MLM-18011	5.0	4.3	5.3	5.3	4.0	3.7	4.0	4.5
27. CEB VB 3965	4.3	3.7	5.0	5.3	4.3	4.0	4.7	4.5
28. Aspen	4.7	4.3	6.0	5.3	4.0	3.7	3.7	4.5
29. WW Ag 478	5.0	3.7	6.0	5.3	4.3	3.0	4.3	4.5
30. Midnight	4.7	4.7	5.3	5.0	4.7	3.0	4.3	4.5
31. BA-61-91	5.0	5.3	5.3	5.3	3.7	3.0	3.7	4.5
32. Trenton	4.0	4.7	5.3	5.3	4.3	3.3	3.7	4.4
33. Charlotte	5.0	4.7	4.7	4.7	3.7	3.7	4.3	4.4
34. SU-01617	4.3	4.7	5.7	5.0	3.3	3.3	3.7	4.3
35. Geronimo	4.3	5.3	5.0	5.0	3.7	3.0	4.0	4.3
36. Welcome	4.3	4.3	5.3	5.0	4.0	3.7	3.7	4.3
37. Harmony	4.3	4.0	4.7	5.3	3.7	3.3	4.7	4.3
38. A-34	4.7	5.7	4.3	4.7	3.3	3.3	4.3	4.3
39. Eclipse	4.7	4.0	4.7	5.3	4.3	3.3	4.0	4.3
40. K3-179	5.3	5.0	5.0	5.3	3.7	2.7	3.3	4.3
41. Barblue	5.3	3.7	5.0	5.3	3.3	3.3	4.3	4.3
42. Birka	4.7	5.0	6.0	5.0	3.3	3.0	2.7	4.2

(Continued on next page)

Table 2. (Continued)

Cultivar	Apr	May	June	July	Aug	Sept	Oct	Mean
43. 239	5.3	4.7	5.0	4.7	3.3	2.7	3.7	4.2
44. PSU-150	4.3	4.7	5.7	5.0	3.3	3.7	3.0	4.2
45. Banff	4.3	4.0	5.0	4.7	4.0	3.0	4.3	4.2
46. Dormie	5.0	4.7	4.7	4.7	4.0	3.0	3.7	4.2
47. Merion	5.0	4.3	4.7	4.7	3.7	3.0	4.0	4.2
48. K1-152	5.0	4.3	5.0	4.3	4.0	3.3	3.3	4.2
49. Adelphi	4.3	4.3	4.7	4.7	4.0	3.0	3.7	4.1
50. Glade	4.3	4.7	5.3	5.3	3.3	2.7	3.0	4.1
51. Cheri	4.0	4.3	4.7	4.7	3.3	3.3	4.3	4.1
52. Merit	4.3	4.7	3.7	4.7	4.0	4.0	3.7	4.1
53. Sydsport	4.3	4.0	5.0	4.3	3.7	3.0	4.3	4.1
54. Bayside	4.7	5.3	5.0	4.3	2.7	3.3	3.3	4.1
55. Mystic	4.7	4.0	4.7	4.3	3.7	3.3	4.0	4.1
56. Aspen	4.0	4.0	5.7	4.3	4.0	2.7	3.7	4.0
57. WW Ag 480	4.7	4.0	4.0	4.0	3.7	3.3	4.3	4.0
58. Bonnieblue	4.3	4.0	4.3	4.3	3.3	3.3	4.3	4.0
59. Shasta	4.0	4.3	4.7	4.7	3.7	2.7	3.7	4.0
60. Apart	4.7	4.3	4.3	4.7	3.0	2.7	4.7	4.0
61. Mer pp 43	4.0	3.7	4.7	5.0	3.7	3.3	3.7	4.0
62. Enable	3.5	3.3	4.8	4.0	4.0	3.5	5.0	4.0
63. 225	5.3	4.7	4.3	5.0	3.3	2.7	3.0	4.0
64. Admiral	4.7	4.0	5.3	4.7	3.7	3.0	3.0	4.0
65. Escort	4.3	4.0	5.3	5.0	3.7	2.7	3.3	4.0
66. Rugby	4.3	4.3	4.7	4.7	3.7	2.7	3.0	3.9
67. Majestic	4.0	4.3	4.3	4.7	3.3	3.0	3.3	3.9
68. H-7	4.0	3.7	4.0	4.3	3.3	3.0	4.7	3.9
69. Victa	3.7	3.7	3.7	4.0	4.0	4.3	4.0	3.9
70. Holiday	3.7	3.7	5.7	4.7	3.3	2.3	3.0	3.8
71. Cello	4.0	3.7	5.0	4.7	3.3	2.7	3.3	3.8
72. Nugget	4.0	3.3	4.7	5.0	3.3	2.3	3.0	3.7
73. A20-6	3.7	3.3	4.7	4.0	3.7	3.7	3.0	3.7
74. American	3.0	2.5	4.0	4.5	3.5	3.5	4.0	3.6
75. I-13	4.0	3.7	4.0	4.7	3.3	2.3	3.0	3.6
76. Columbia	3.7	3.7	4.3	4.0	3.7	3.0	3.0	3.6
77. NJ 735	3.7	3.0	3.7	4.0	4.0	2.7	4.0	3.6
78. Nassau	3.3	3.7	4.3	4.3	3.0	2.7	3.0	3.5
79. A20	3.7	3.3	3.7	4.3	2.7	3.3	3.3	3.5
80. A20-6A	4.0	3.7	4.0	4.0	3.0	2.0	3.0	3.4
81. Mona	3.7	3.0	3.7	4.0	3.7	2.3	3.3	3.4
82. Lovegreen	3.3	3.0	4.0	4.0	3.3	2.7	3.7	3.4
83. Bristol	3.3	3.0	4.3	3.7	3.7	2.7	3.3	3.4
84. SH-2	4.0	3.3	4.0	4.0	3.0	2.3	3.0	3.4
LSD 0.05	1.7	1.6	1.6	1.4	1.4	1.4	1.6	1.0

Kentucky Bluegrass Cultivar Evaluations

N. E. Christians

The 49 Kentucky bluegrass cultivars located in section two of the turfgrass research area were seeded in the fall of 1979. These plots were fertilized at a rate of 4 lb N/1000 ft^2 (urea) in both the 1980 and 1981 seasons and with 4 lb N/1000 ft^2 (SCU) in 1982, 1983, and 1984. No insecticides or fungicides have been used on the area. Irrigation was applied as needed to prevent drought. The results of the 1984 evaluations are listed in Table 3.

The values listed under each month are the averages of ratings made on three replicated plots. 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 1984 season. The cultivars are then listed in descending order of average quality.

Midnight received the highest overall rating in 1984. It was followed in order by Ram-I, Aspen, K3-160, Cheri, and Glade. The lowest rated cultivars in this trial included (WTN) H-7 and A-34. It is surprising that A-34 ranks so low in this trial. This cultivar has proved to be very well adapted to many parts of the midwest. It is important that local testing results be used in making decisions on which cultivars to use.

Table 3. The 1984 quality ratings for the Kentucky bluegrass cultivars established in the fall of 1979.

	Cultivar	Quality Ratings						
		May	June	July	Aug	Sept	Oct	Mean
1.	Midnight	7.7	9.0	9.0	8.0	9.0	8.0	8.4
2.	Ram I	6.7	7.3	7.7	7.0	8.3	8.3	7.6
3.	Aspen	6.7	7.3	7.7	6.3	8.0	8.0	7.3
4.	K3-160	6.7	8.3	7.3	6.0	7.3	8.0	7.3
5.	Cheri	6.7	7.0	6.7	7.3	8.3	8.0	7.3
6.	Glade	7.0	8.3	7.3	6.7	6.7	7.7	7.3
7.	Fanfare	7.0	8.3	6.0	6.0	8.3	7.7	7.2
8.	Vantage	5.7	7.7	8.0	7.7	7.0	7.0	7.2
9.	Bristol	6.7	7.0	6.7	7.0	7.3	8.3	7.2
10.	Adelphi	7.0	8.3	6.7	6.3	7.3	7.3	7.2
11.	Arista	6.7	7.7	6.0	6.7	7.7	7.7	7.1
12.	Victa	6.3	7.3	6.3	7.0	7.7	7.7	7.1
13.	Bonnieblue	6.3	6.7	7.3	7.0	7.7	7.7	7.1
14.	SUO	7.3	7.7	7.0	6.3	7.3	7.0	7.1
15.	P-164	7.0	7.3	7.3	6.7	6.7	7.0	7.0
16.	America	8.0	6.3	6.0	7.0	7.0	7.3	6.9
17.	Baron	6.3	8.3	6.0	6.7	7.3	6.7	6.9
18.	Enmund	7.0	7.7	6.0	7.3	6.7	7.0	6.9
19.	Aquilla	6.0	8.0	6.0	6.7	8.0	6.7	6.9
20.	Merion	5.7	7.3	6.7	6.7	7.7	7.0	6.8
21.	Kimono	6.3	7.0	6.3	7.0	7.0	7.0	6.8
22.	Escort	6.7	7.7	6.0	7.3	6.0	7.3	6.8
23.	Sydsport	6.0	7.3	7.3	6.3	6.7	6.3	6.7
24.	Senic	6.3	7.0	7.0	7.0	6.0	7.0	6.7
25.	Touchdown	6.0	7.0	7.0	6.3	6.7	7.0	6.7
26.	Sving	6.7	7.0	6.3	6.3	7.3	6.3	6.7
27.	Nugget	7.7	7.3	6.3	6.0	6.0	7.0	6.7
28.	N-535	6.0	7.3	7.0	6.7	6.7	6.3	6.7
29.	Fylking	5.7	7.0	6.3	6.7	7.7	7.0	6.7
30.	Merit	5.7	8.0	6.3	6.3	7.3	6.3	6.7
31.	Columbia	6.3	5.3	6.3	6.7	7.7	7.0	6.6
32.	Plush	7.0	6.7	6.3	5.7	6.7	7.0	6.6
33.	Barbie	5.7	7.0	6.0	6.3	7.0	6.3	6.4
34.	Common	5.7	7.0	6.3	6.7	5.7	6.7	6.3
35.	Park	5.7	6.3	6.3	6.3	6.0	7.3	6.3
36.	Pennstar	6.7	6.0	7.0	6.0	6.3	6.0	6.3
37.	A-20-6	7.3	7.0	5.3	5.0	6.7	6.7	6.3
38.	A-20	7.0	6.7	5.3	5.0	6.7	6.7	6.2
39.	Birka	6.3	6.3	5.7	6.0	6.0	7.0	6.2
40.	Rugby	6.3	6.3	5.7	5.7	6.3	6.7	6.2
41.	Parade	5.7	6.0	5.7	5.7	6.7	7.0	6.1
42.	BFB-35	6.7	6.3	5.0	5.3	6.3	6.7	6.1
43.	Wabash	5.3	6.7	5.7	5.0	7.3	6.3	6.1
44.	Majestic	5.7	6.0	6.3	6.0	6.0	6.0	6.0
45.	Trenton	5.7	5.3	5.7	5.3	7.0	6.3	5.9
46.	(WTN) IS-13	6.3	6.7	5.3	5.3	5.3	6.7	5.9
47.	K76-86-4	5.3	5.3	5.7	6.0	6.7	6.3	5.9
48.	A-34	6.0	6.7	5.3	5.3	6.3	6.0	5.9
49.	(WTN) H-7	6.0	6.7	5.0	5.0	5.0	6.3	5.7
	LSD 0.05	1.1	1.4	1.4	1.3	1.6	1.5	0.7

Regional Perennial Ryegrass Cultivar Evaluation

K. L. Diesburg and N. E. Christians

This trial is part of a national study coordinated by the USDA. It was established during September 1982, in conjunction with several identical trials across the country. The purpose is to identify regional adaptation of the 48 cultivars tested. Cultivars are evaluated each month of the growing season for turf quality and disease infestation. The average yearly performance of a cultivar is most important.

The trial is maintained with 4 lb N/1000 ft^2 through the growing season and is irrigated as needed. Standard, single applications of preemergence herbicide in May and broadleaf herbicide in September are used to prevent weeds. The entire area is maintained at a 2-inch mowing height.

Differences in turf quality among cultivars were least in April (Table 4). By June, the greatest differentiation among cultivars had occurred. The only cultivars superior over the whole season were Manhattan II, M382, Repell, and BT-I.

Table 4. Turf quality[a] and disease ratings of perennial ryegrass cultivars.

Cultivar	April	May	June	July	Aug	Sept	Oct	Nov	Mean
1. Manhattan II	6.0	8.0	9.0	8.0	8.7	7.7	9.0	6.3	7.8
2. M 382	5.7	6.3	9.0	8.3	7.7	8.3	9.0	6.3	7.6
3. Repell	6.0	7.7	8.0	6.7	8.7	7.3	8.7	5.0	7.3
4. BT-I	5.0	7.3	8.7	7.3	8.0	6.7	9.0	5.3	7.2
5. SWRC-1	5.7	6.0	7.7	6.7	8.0	7.7	8.7	5.7	7.0
6. HR-1	5.3	6.3	7.3	7.3	7.7	8.0	8.7	5.3	7.0
7. Palmer	6.3	6.3	8.0	6.7	8.0	6.3	8.0	5.7	6.9
8. Prelude	6.0	6.3	7.7	7.0	8.0	6.3	8.3	5.7	6.9
9. Yorktown II	6.3	6.7	7.7	6.3	7.7	6.3	8.3	5.7	6.9
10. LP 702	6.7	7.3	7.3	6.7	7.3	6.0	7.7	5.7	6.8
11. Ranger	6.0	6.7	7.7	5.7	7.7	6.3	8.3	6.0	6.8
12. Fiesta	7.0	5.7	7.0	7.0	8.0	6.3	8.3	5.0	6.8
13. 282	5.7	7.7	7.7	6.0	7.0	7.3	8.0	5.3	6.8
14. Gator	6.0	7.3	7.0	6.7	7.3	6.3	8.3	5.0	6.8
15. Blazer	6.3	6.3	7.7	5.3	7.7	6.3	7.7	5.7	6.6
16. Regal	5.0	5.7	7.7	7.3	7.0	7.0	8.0	5.0	6.6
17. Birdie	6.3	6.7	7.3	6.7	8.3	5.0	8.3	4.3	6.6
18. HE 178	4.7	6.7	8.3	6.7	8.0	5.7	7.7	4.0	6.5
19. Diplomat	5.7	5.7	7.0	5.7	7.7	6.7	7.7	5.3	6.4

(Continued on next page)

Table 4. (Continued)

	Cultivar	April	May	June	July	Aug	Sept	Oct	Nov	Mean
20.	Acclaim	5.0	5.3	7.3	7.3	8.0	6.0	7.3	5.0	6.4
21.	Omega	5.3	6.7	7.3	6.0	7.3	6.3	7.3	4.7	6.4
22.	Derby	5.3	6.0	7.3	6.0	8.0	6.7	7.7	4.3	6.4
23.	IA 728	4.0	6.7	7.3	7.0	8.3	5.3	8.0	4.3	6.4
24.	Manhattan	6.7	6.7	7.3	4.3	7.0	5.7	7.7	5.0	6.3
25.	Barry	5.7	5.3	7.7	6.0	6.7	5.7	8.0	4.3	6.2
26.	HE 168	6.3	5.3	7.7	7.0	8.0	4.0	7.0	4.3	6.2
27.	Dasher	5.7	5.3	6.7	5.3	7.3	6.3	8.0	4.7	6.2
28.	Pennfine	4.3	4.3	7.3	7.3	8.7	5.7	7.7	4.3	6.2
29.	LP 736	5.0	5.0	7.7	6.3	7.0	6.0	7.3	4.7	6.1
30.	WWE 19	7.0	6.3	6.7	4.7	7.7	4.3	7.0	5.0	6.1
31.	Cockade	5.3	6.7	6.7	4.7	7.0	5.3	7.3	5.7	6.1
32.	NK 80389	4.7	5.3	7.7	5.0	7.3	6.0	8.3	4.3	6.1
33.	Pennant	5.0	4.7	6.7	6.0	8.0	6.0	7.7	5.0	6.1
34.	Elka	4.3	6.3	8.0	5.3	6.7	5.0	8.3	4.7	6.1
35.	LP 792	4.7	5.3	7.0	6.0	7.7	5.0	7.7	4.3	6.0
36.	Cigil	5.3	5.3	7.3	5.3	7.3	4.7	8.0	4.3	6.0
37.	2 EE	5.3	4.7	7.0	6.3	7.3	6.7	6.7	3.7	6.0
38.	Citation	5.0	4.3	7.3	6.3	7.0	5.3	7.7	5.3	6.0
39.	Premier	4.7	4.3	6.7	6.0	6.3	6.3	7.7	5.7	6.0
40.	2 ED	3.0	4.0	7.7	7.0	7.3	6.3	7.7	4.0	5.9
41.	NK 79309	4.3	5.3	7.0	6.0	6.3	6.3	7.3	4.7	5.9
42.	NK 79307	2.7	4.0	7.7	6.7	7.3	6.7	8.0	4.3	5.9
43.	Crown	4.7	5.0	7.3	5.7	7.0	4.7	7.3	4.3	5.8
44.	LP 210	5.7	6.7	6.3	5.3	7.3	4.0	6.7	4.3	5.8
45.	Delray	3.3	4.0	7.7	5.7	7.7	4.7	7.7	3.3	5.5
46.	Cupido	6.0	6.0	6.3	3.3	6.3	3.3	6.3	4.7	5.3
47.	Pippin	5.7	5.0	6.3	6.0	5.3	3.3	5.3	3.3	5.0
48.	Linn	2.3	2.0	4.0	2.7	4.3	2.7	4.0	2.0	3.0
	Experiment Mean	5.3	5.8	7.3	6.1	7.4	5.9	7.7	4.8	6.3
	LSD (α = 0.05)	1.8	2.0	1.1	1.6	1.3	1.7	0.9	1.3	0.8

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

Perennial Ryegrass Cultivar Evaluations

N. E. Christians

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.

Yorktown, Diplomat, Regal, and Citation received the highest overall quality ratings in 1984. However, there was little observable difference among the first 13 cultivars listed (Table 5). NK-100 and Linn received the lowest ratings in 1984.

Table 5. The 1984 quality ratings for 22 perennial ryegrass cultivars established in 1979.

	Quality Ratings						
Cultivar	May	June	July	Aug	Sept	Oct	Mean
1. Yorktown	6.3	7.0	6.7	8.0	8.3	6.7	7.2
2. Diplomat	5.7	7.0	6.3	8.0	7.3	7.0	6.9
3. Regal	5.7	8.0	6.3	6.3	6.7	7.7	6.8
4. Citation	6.3	6.3	7.3	6.3	7.7	7.0	6.8
5. Belle	6.0	7.7	6.3	7.3	7.0	6.7	6.8
6. Fiesta	5.3	6.3	7.7	7.0	7.7	6.0	6.7
7. Medalist North	5.0	6.7	6.7	6.3	8.0	6.3	6.5
8. Delray	5.0	6.7	6.7	7.3	6.7	6.7	6.5
9. Derby	5.0	6.7	5.7	7.7	7.3	6.7	6.5
10. Blyes	6.3	5.0	6.3	7.0	7.7	6.3	6.4
11. Loretta	7.3	7.3	5.3	6.3	6.3	5.7	6.4
12. Elka	7.3	6.0	5.3	6.3	7.3	5.3	6.3
13. Pennfine	5.3	7.0	6.0	6.7	6.0	6.3	6.2
14. Caravelle	5.7	5.7	6.0	7.0	6.0	6.0	6.1
15. Manhattan	5.3	5.0	5.3	7.0	6.0	6.0	5.8
16. K5-88	4.3	5.7	5.7	5.7	6.3	6.7	5.7
17. K5-94	5.0	4.3	5.3	5.7	7.0	6.7	5.7
18. Goalie	5.3	3.7	5.7	6.0	6.7	5.7	5.5
19. J186 R24D	5.0	4.3	5.0	5.7	6.3	5.0	5.2
20. NK-200	5.0	4.7	5.0	4.3	6.0	6.0	5.2
21. Linn	3.3	5.3	3.3	5.3	5.3	5.0	4.6
22. NK-100	3.7	4.0	4.0	4.3	5.7	5.0	4.4
LSD 0.05	1.4	1.9	1.7	1.6	1.6	1.7	0.9

Fine Fescue Cultivar Trial

K. L. Diesburg and N. E. Christians

This trial has produced its second year of data after being established in fall 1982. The purpose is to identify regional adaptation of the 32 cultivars and blends tested. Cultivars are evaluated each month of the growing season for turf quality and disease infestation. The average yearly performance of a cultivar is most important.

The trial is maintained at a 2-inch mowing height with 4 lb N/1000 ft^2 through the growing season and is irrigated as needed. A standard single application of phenoxy herbicides in September is used to prevent weeds.

Disease damaged several of the cultivars in this study in 1983 and 1984. The symptoms observed were not typical of any of the common turfgrass diseases. The pathogens identified in the diseased areas were Rhizoctonia sp., Sclerotinia sp., and Collectotrichum sp. The most susceptible cultivars were Ruby, Pennlawn, Fortress, Ensylva, Duar, Banner, and Jamestown (Table 6). All other entries had varied degrees of disease resistance with NK79189, NK80347, and Checker showing the least damage. Poor initial stands plus diseases resulted in nearly complete loss of stand in some plots. The open areas were subsequently replaced by invading bluegrass. Table 6 shows that Tournament, Duar, Scaldis, Waldina, and NK80348 had the most bluegrass infestation.

Experiment means in Table 7 indicate the average performance of all cultivars. Fine fescues in central Iowa generally have lower turf quality in August and best turf quality in October. The November data were taken after heavy frosts. They show that NK79189, Jamestown, Banner-Checker, Shadow, and NK80346 were able to hold their color better than the other cultivars.

The best cultivar through the growing season was Shadow followed closely by Scaldis-Atlanta, Checker, and Barfalla. The LSD for growing season means indicates, however, that the top 27 cultivars were not statistically different from one another. Monthly data show that Scaldis-Atlanta excelled in early spring, NK79189 was superior in early summer; Dawson did well in late spring and early fall; and Jamestown was best throughout fall. Barfalla ranked high from April through October retaining its high turf quality in the heat of mid-summer while Shadow and Checker had lower quality during August.

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

Cultivar		Turf Quality								
		April	May	June	July	Aug.	Sept	Oct.	Nov.	Mean[b]
Shadow	C[c]	8.0	7.3	7.3	7.0	6.3	6.3	8.3	5.7	7.0
Checker	C	7.0	7.3	7.3	7.7	6.3	7.3	8.0	4.7	7.0
Barfalla	C	7.7	7.3	7.0	7.7	7.0	6.7	7.3	5.0	7.0
Scaldis-Atlanta		8.3	8.3	7.3	6.0	6.7	7.0	7.3	4.7	7.0
Jamestown	C	7.7	6.7	7.3	5.0	4.7	8.7	8.7	6.3	6.9
Dawson	CR	7.7	8.3	9.0	4.7	4.7	8.3	8.7	4.0	6.9
NK79189	CR	4.0	7.0	8.3	7.7	6.0	7.7	8.3	6.3	6.9
FOF-WO	S	7.3	8.0	6.7	6.3	6.0	7.0	6.7	5.3	6.7
Koket	C	8.0	6.7	6.3	5.7	7.0	7.3	7.7	5.0	6.7
NK79191	CR	7.0	6.3	6.3	7.3	7.0	7.7	7.3	4.7	6.7
NK80346	CR	6.3	6.3	8.0	7.0	6.0	7.0	7.3	5.7	6.7
Banner-Checker		7.3	7.7	7.0	4.7	5.3	6.7	8.3	6.3	6.7
Atlanta	C	7.7	7.3	7.3	5.0	5.0	7.3	8.0	5.3	6.6
NK80345	CR	6.7	7.3	9.0	5.3	6.0	7.7	7.3	3.3	6.6
Aurora	H	7.3	7.3	5.7	5.7	5.0	7.7	8.0	5.0	6.5
Ensylva	CR	7.3	5.3	8.3	5.3	4.7	7.0	8.7	5.0	6.5
Agram	C	6.7	6.3	6.0	7.3	6.3	7.7	7.7	4.3	6.5
Biljart	H	7.3	7.0	6.3	6.3	5.7	7.3	7.3	4.7	6.5
Banner	C	7.3	6.7	7.7	5.3	4.3	6.7	8.3	5.3	6.5
Fortress	CR	7.0	4.3	7.0	6.3	5.7	7.7	8.0	5.0	6.4
NK80347	CR	6.0	7.0	6.7	7.0	6.7	6.7	6.7	4.0	6.3
NK80348	CR	4.7	7.0	7.3	7.3	7.3	6.3	7.0	3.3	6.3
Dawson-Pennlawn		5.0	5.7	7.0	7.0	7.0	5.7	7.7	5.3	6.3
NK79190	CR	6.0	7.0	7.0	7.0	6.0	6.0	7.7	2.7	6.2
Waldina	H	7.0	6.7	4.7	7.0	5.7	5.3	6.0	4.7	5.9
Highlight	C	6.7	6.3	6.3	5.3	5.3	6.0	7.7	3.3	5.9
Scaldis	H	6.7	7.0	5.0	6.7	6.0	5.7	6.0	3.7	5.8
Wintergreen	C	5.7	6.0	5.7	4.3	4.3	6.7	8.0	4.7	5.7
Pennlawn	CR	6.7	4.7	5.7	5.3	5.7	6.0	7.0	4.7	5.7
Tournament	H	5.3	5.7	4.0	5.7	5.7	3.7	5.0	2.0	4.6
Ruby	CR	4.7	4.7	5.0	5.0	5.7	4.3	5.7	2.0	4.6
Duar	H	3.0	2.0	2.7	6.3	6.3	3.0	3.3	1.3	3.5
Experiment Mean		6.6	6.5	6.6	6.2	5.9	6.6	7.3	4.5	6.3
LSD ($\alpha = 0.05$)		1.8	1.7	1.8	3.2	2.5	2.5	2.4	2.1	1.3

[a] Quality rated on a scale of 1 - 9; 9 = best quality and 1 = poorest quality.

[b] Average of monthly quality ratings.

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

Table 7. Disease ratings[a] and percent of plot area invaded by Kentucky bluegrass in fine fescue cultivars and blends.

		Disease[b]			Bluegrass
Cultivar		May	June	Mean	Percent
Shadow	C[c]	8.0	6.7	7.3	0
Checker	C	8.3	7.7	8.0	0
Barfalla	C	7.7	7.3	7.5	0
Scaldis-Atlanta		8.7	6.7	7.7	0
Jamestown	C	7.3	5.0	6.2	0
Dawson	CR	8.0	5.3	6.7	0
NK79189	CR	9.0	7.3	8.2	3
FOF-WC	S	9.0	6.3	7.7	20
Koket	C	8.3	6.7	7.5	0
NK79191	CR	6.0	7.0	6.5	7
NK80346	CR	7.0	6.0	6.5	7
Banner-Checker		7.7	5.0	6.3	0
Atlanta	C	8.0	5.0	6.5	0
NK80345	CR	8.7	6.0	7.3	3
Aurora	H	8.3	6.3	7.3	17
Ensylva	CR	6.3	5.3	5.8	0
Agram	C	7.3	7.0	7.2	0
Biljart	H	8.3	7.3	7.8	13
Banner	C	6.7	5.3	6.0	0
Fortress	CR	5.3	6.0	5.7	0
NK80347	CR	8.3	7.7	8.0	17
NK80348	CR	8.0	7.0	7.5	27
Dawson-Pennlawn		6.0	7.7	6.8	0
NK79190	CR	7.3	7.0	7.2	13
Waldina	H	8.3	7.3	7.8	33
Highlight	C	7.7	5.3	6.5	0
Scaldis	H	8.7	7.0	7.8	40
Wintergreen	C	9.0	4.0	6.5	0
Pennlawn	CR	4.3	5.0	4.7	0
Tournament	H	7.7	7.3	7.5	53
Ruby	CR	4.0	5.3	4.7	0
Duar	H	5.3	6.7	6.0	40
Experiment Mean		7.5	6.3	6.9	9
LSD ($\alpha = 0.05$)		1.4	3.2	1.8	29

[a] Disease rated on a scale of 1 - 9; 9 = no disease and 1 = most disease.
[b] Symptoms due to a combination of Rhizoctonia sp., Sclerotinia sp., and Collectotrichum sp.
[c] 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 also divided into two fertilizer treatments: 1 and 3 lb N/1000 ft^2, applied as IBDU. The study was established on September 8, 1979, and is irrigated as needed.

The quality ratings in Table 8 are the means of monthly observations taken from May to October averaged over both mowing heights. Cultivar plots treated with 3 lb N/1000 ft^2/yr were observed to have higher quality ratings than those receiving 1 lb N/1000 ft^2/yr for each of the grasses at both the 1- and 2-inch mowing heights.

Reliant, Dawson, Atlanta, and Scaldis were the best cultivars at all nitrogen levels and mowing heights. Atlanta performed best at 3 lb N/1000 ft^2/yr at the 2-inch mowing height and Reliant was the best cultivar at the 1-inch mowing height.

Table 8. 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	4.2[b]	5.3	4.7	5.8	5.0
2. Scaldis Hard Fescue	5.4	6.8	5.3	6.6	6.0
3. Ruby Red Fescue	3.1	4.3	3.9	5.1	4.1
4. Atlanta Chewings Fescue	5.2	7.2	5.5	7.6	6.4
5. K5-29 Red Fescue	3.2	4.3	3.8	5.0	4.1
6. Dawson Red Fescue	5.6	7.0	5.9	7.3	6.5
7. Reliant Hard Fescue	5.8	7.7	5.8	7.4	6.7
8. Ensylva Red Fescue	4.3	5.6	4.8	6.4	5.3
9. Highlight Chewings Fescue	3.8	4.2	4.3	4.6	4.2
10. Jamestown Chewings Fescue	5.0	6.6	5.2	6.6	5.8

[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.

Tall Fescue Management Study

K. L. Diesburg and N. E. Christians

This study includes Kentucky 31 and four improved cultivars of tall fescue; Falcon, Houndog, Mustang, and Rebel. It was seeded in September 1982, but late spring freezing in 1983 delayed establishment. The first year in which all managements could be done was 1984. Each cultivar is maintained at 2- and 3-inch mowing heights and is fertilized with urea at 0, 2, and 4 lb N/1000 ft^2/year.

Each of the improved cultivars had better turf quality than Kentucky 31. Rebel and Mustang produced the highest quality turf followed closely by Falcon and Houndog. Rebel excelled in the cooler temperatures of spring and fall while Mustang performed best in the heat of summer (Table 9).

All cultivars produced higher quality turf at the 2-inch clipping height. Performance levels of Falcon and Houndog were closer to Rebel and Mustang at the 2-inch rather than at the 3-inch clipping height. Kentucky 31 had poor turf quality throughout the growing season, but its ratings did not drop as much as those of the improved cultivars going from the 2-inch to 3-inch clipping height.

Each increment of applied N caused an improvement in turf quality for all cultivars (Table 10). Greater improvement was shown from 0 to 2 than from 2 to 4 lb N/1000 ft^2. As the fertility level increased, the improvement of turf quality going from the 3-inch to 2-inch clipping height was more apparent. This interaction was most apparent during April, July, and September.

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. The improved cultivars also responded very well to the 2-inch clipping height showing finer leaf texture and higher leaf density. Kentucky 31 responded with finer leaves, but leaf density decreased with a net small improvement of turf quality.

A 3 to 3 1/2-inch clipping 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 new improved 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 coming years will allow assessment of the persistence level of each cultivar given these management treatments.

Table 9. Means of turf quality ratings[a] for tall fescue cultivars at two clipping heights over all fertility levels.

Cultivar	Clipping Height (inches)	Ratings								
		April	May	June	July	Aug	Sept	Oct	Nov	Mean
Rebel	2	5.2	5.8	6.2	5.3	5.8	5.3	5.3	3.3	5.3
	3	3.9	4.9	6.0	4.4	4.9	4.7	4.4	2.6	4.5
Mustang	2	4.9	5.9	5.8	5.4	6.2	5.1	5.1	2.9	5.2
	3	3.7	4.8	6.0	4.7	4.6	4.7	4.2	2.2	4.3
Falcon	2	5.0	5.9	6.4	5.6	5.4	5.1	5.1	2.6	5.1
	3	3.4	4.8	6.0	4.4	4.6	4.4	4.4	1.9	4.2
Houndog	2	5.2	5.7	6.0	4.9	5.9	5.6	5.0	2.9	5.2
	3	3.4	4.4	5.9	4.3	4.4	4.7	4.0	2.3	4.2
Kentucky 31	2	4.4	4.3	5.0	4.0	5.0	4.9	4.3	2.2	4.3
	3	3.2	4.0	4.8	3.4	4.8	3.7	3.7	1.9	3.7
Experiment Mean		4.2	5.0	5.8	4.7	5.2	4.8	4.6	2.5	4.6
LSD ($\alpha = 0.05$)		0.5	0.6	0.5	0.5	0.5	0.3	0.6	0.5	0.3

[a] Ratings based on a scale of 1 - 9; 9 = best, 5 = acceptable, 1 = worst quality turf.

Table 10. Season means of turf quality ratings for tall fescue cultivars at two clipping heights and three fertility levels.

Cultivars	Clipping Heights (inches)	Applied N (lb/1000 ft^2) 0	2	4	Mean	Cultivar Mean
Rebel	2	3.7	5.5	6.7	5.3	
	3	3.2	4.7	5.5	4.5	4.9
Mustang	2	3.8	5.4	6.4	5.2	
	3	3.2	4.5	5.3	4.3	4.8
Falcon	2	3.6	5.4	6.4	5.1	
	3	3.0	4.4	5.3	4.2	4.7
Houndog	2	3.7	5.5	6.2	5.2	
	3	2.9	4.5	5.2	4.2	4.7
Kentucky 31	2	3.0	4.5	5.4	4.3	
	3	2.5	3.9	4.7	3.7	4.0
Experiment Mean		3.2	4.8	5.7	4.6	
LSD (α = 0.05) between cultivars		0.6			0.3	0.2
LSD (α = 0.05) between clipping heights		0.7			0.4	
LSD (α = 0.05) between fertility levels		0.6				

Bentgrass Management Study

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.

The spring of 1984 was very wet and the late summer was hot and dry, although conditions were not nearly as hot or as dry as the 1983 season. Penncross maintained the best season-long quality in 1984 (Table 11). It was followed in order by Penneagle, Emerald, Prominent, Kingstown, and Seaside. Only Penncross and Penneagle maintained an acceptable quality over the entire season. Each of the cultivars increased in quality as the N rate was increased from 0.5, to 0.8, to 1.2 lb N/growing month (Table 12). However, the increase in quality between 0.8 to 1.2 lb N was generally not worth the additional application of nitrogen. Based on these results, the 0.8 lb N/growing month treatment would be the recommended rate. The 0.5 lb N/month rate was too low for most cultivars.

Table 11. The 1984 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	5.8	6.8	6.8	7.3	7.4	6.5	6.8
2. Penneagle	4.8	5.3	5.7	7.3	6.8	6.5	6.0
3. Emerald	4.6	5.2	5.1	6.9	7.2	5.4	5.7
4. Prominent	4.5	5.3	4.8	5.5	6.5	5.2	5.3
5. Kingstown	4.4	4.9	5.1	6.2	5.2	5.2	5.2
6. Seaside	4.2	4.4	4.0	4.8	4.8	3.7	4.3
LSD 0.05	0.6	1.3	1.2	1.1	1.3	0.9	0.6

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

Table 12. The effects of fertility level on the quality of six bentgrass cultivars.

	lb N/growing		
Cultivar	0.5	0.8	1.2
1. Emerald	5.2	5.8	6.1
2. Kingstown	4.8	5.2	5.5
3. Penncross	6.2	7.0	7.1
4. Penneagle	5.8	6.1	6.2
5. Prominent	4.8	5.5	5.6
6. Seaside	4.0	4.0	5.0

LSD 0.05 for comparison of fertility levels within cultivar.

Nitrogen X 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 (as triple super phosphate) and 0.5 lb N/1000 ft^2 (as ammonium nitrate) were applied. The area is maintained in lawn condition including 2-inch mowing, pre- and postemergent weed control, and irrigation as needed. No insecticides or fungicides have been applied to the area.

The study is arranged as a complete factorial with four levels of N (0, 2, 3, and 4 lb/1000 ft^2/year) and four levels of K (0, 2, 3, and 4 lb/1000 ft^2/year). 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 began in April 1981, and have continued with applications split over late April, May, late August, and September.

Monthly ratings of turf quality and fresh weights of clippings are presented in Table 13. Benefit from K was not as great as that from comparable amounts of N. The beneficial effect from increasing N application levels was highly significant throughout the season for both turf quality and clipping weight. Higher levels of applied K seemed to cause slightly better turf quality in every month, but the differences were not significant. Likewise clipping weights were numerically higher with increased rates of K, especially between the 0- and 2-pound treatments, but differences were not significant.

The need for a proper balance of N and K can be seen in Table 14. Although there was little interaction between N and K, optimum stimulation of grass growth from increments of applied N seemed to occur at 3 lb K/1000 ft^2. Likewise optimum stimulation of grass growth from increments of applied K seemed to occur at 3 lb N/1000 ft^2.

Turf quality was reduced to such an extent at low N levels that Kentucky bluegrass stands were thin enough to allow germination and establishment of crabgrass.

Table 13. Mean effects of Nitrogen (N) and Potassium (K) on vegetative growth of Kentucky bluegrass.

N	K	Fresh Clipping Weights					
		Aug 7	Aug 24	Sept 14	Oct 3	Oct 20	Mean
		grams					
4	4	81.7	67.7	84.2	43.6	49.3	65.3
4	3	97.0	84.7	90.0	65.0	66.5	80.6
4	2	65.3	56.0	69.5	38.7	49.1	55.7
4	0	79.0	61.3	85.9	48.2	53.4	65.6
3	4	57.0	62.0	65.3	53.6	76.2	62.8
3	3	36.0	46.0	63.2	47.1	58.3	50.1
3	2	51.0	61.7	62.8	52.0	62.4	58.0
3	0	17.7	25.0	41.2	32.3	42.2	31.7
2	4	22.0	25.7	23.4	16.3	29.2	23.3
2	3	29.0	29.0	24.4	22.0	36.8	28.2
2	2	64.7	32.7	27.4	22.8	38.2	37.2
2	0	12.0	17.0	12.3	6.8	20.8	13.8
0	4	7.0	11.0	11.0	3.9	5.5	7.7
0	3	4.3	6.0	6.4	2.9	2.8	4.5
0	2	5.0	12.0	5.4	1.7	3.2	5.5
0	0	5.7	8.3	5.5	2.9	2.5	5.0
Experiment Mean		39.6	37.9	42.4	28.7	37.3	37.2
LSD ($\alpha = 0.05$)		28.3	21.1	21.3	17.8	15.7	18.7

Table 14. Mean affects of Nitrogen (N) and Potassium (K) on turf quality and crabgrass infestion of Kentucky bluegrass.

		Turf Quality Ratings[a]									
N	K	April	May	June	July	Aug	Sept	Oct	Nov	Mean	July 24 Crabgrass Ratings[b]
4	4	6.3	7.3	8.7	7.7	6.0	5.7	6.0	3.7	6.4	1.0
4	3	6.3	8.0	9.0	8.3	6.3	6.7	6.7	4.7	7.0	1.3
4	2	6.3	7.3	9.0	8.3	7.3	6.0	5.7	4.7	6.8	1.0
4	0	6.3	7.0	8.7	8.3	7.0	6.3	7.0	4.3	6.9	1.0
3	4	5.7	5.3	8.0	7.0	6.3	7.7	7.7	5.7	6.7	1.3
3	3	7.0	5.3	7.7	7.3	5.7	7.3	7.7	4.7	6.6	1.3
3	2	6.0	5.7	7.0	6.0	6.0	7.3	7.3	4.7	6.2	1.3
3	0	6.3	5.3	7.3	6.3	5.3	7.7	7.0	5.3	6.3	2.0
2	4	5.3	5.0	6.3	5.3	4.7	5.7	6.7	5.0	5.5	2.7
2	3	6.0	4.7	7.3	6.0	5.7	6.0	6.3	4.3	5.8	1.0
2	2	6.0	5.3	6.7	5.7	4.3	5.7	6.7	4.7	5.6	2.7
2	0	5.7	5.0	6.0	4.3	3.7	4.3	5.0	3.3	4.7	2.7
0	4	3.7	3.7	3.7	3.0	3.3	3.7	3.7	2.7	3.4	4.3
0	3	3.7	4.0	3.0	3.0	2.3	3.0	3.3	2.0	3.0	4.7
0	2	3.0	2.7	3.0	2.7	2.3	2.7	2.7	1.7	2.6	6.0
0	0	3.3	3.3	3.3	3.0	2.7	3.0	3.0	1.7	2.9	6.0
Experiment Mean		5.4	5.3	6.5	5.8	4.9	5.5	5.8	3.9	5.4	2.5
LSD (α= 0.05)		0.6	0.5	0.7	0.8	0.7	0.7	0.6	0.8	0.4	0.9

[a] Ratings based on a scale of 1 - 9; 9 = best, 6 = acceptable, 1 = poorest turf.

[b] Ratings based on a scale of 1 - 9; 9 = 100%, 5 = 50%, 1 = 0% crabgrass stand.

The Reduction of Ammonia Volatilization from Turfgrass Areas Treated with Surface-Applied Urea

Y. Joo and N. E. Christians

Surface-applied urea involves the risk of considerable nitrogen (N) loss to the atmosphere as gaseous ammonia. Rapid enzymatic hydrolysis may lead to the formation of free ammonia, which leads to reduced N recovery by the plant.

The objectives of this field test were to observe the effects of the urease inhibitor Phenylphosphoro-diamidate (PPD) and the effects of Magnesium chloride on foliar burn and growth of Kentucky bluegrass turf treated with surface-applied urea.

The cation Mg is believed to inhibit the rapid conversion of urea to ammonia gas. The study was designed in a split-plot with repeated treatments and measurements. The main plots included liquid urea applied at 0, 1, and 2 lb N/1000 ft^2. The subplots included control, PPD at 1 and 2% of the weight of N, and Mg at 25% of the weight of N. The treatments were applied four times June through September. The degree of damage to turfgrass foliage was visually estimated after 3 days following each application. The rating scale used ranged from 1 to 9; 9 = no visual burn. Ratings of five or less were considered unacceptable.

There appeared to be little difference in foliar burn, however, various effects of inhibitors were observed in treatments (Fig. 1). In the heat of July, the Mg treatment resulted in significant foliar burn in the 2 lb N/1000 ft^2 plots, but it reduced burn significantly in the 1- and 2-lb N/1000 ft^2 treatments in the relatively cool temperatures of September.

Visual turf quality ratings and fresh weight of clippings were made weekly for a total of five times after each application. There were positive effects of PPD and Mg on the turf quality in September, but those effects were not significant across all application dates.

The fresh weight of clippings averaged over the 5-week period following treatment with 2% PPD was observed to increase 20 to 30% at the 1- and 2-lb N/1000 ft^2 treatments in August and September. This result indicates that 2% PPD can have an effect on the N use efficiency of surface-applied urea on Kentucky bluegrass turf.

Mg showed a 13% to 25% increase of clipping yield at the 1-lb N/1000 ft^2 rate in August and September, but a 20% decrease at the 2-lb N/1000 ft^2 rate in August. This result indicates that the cation Mg may have a positive effect on the reduction of ammonia volatilization and increase urea N efficiency with low concentration under cool temperature conditions. However, Mg may increase phytotoxicity of fertilizer solutions at high concentrations in times of environmental stress.

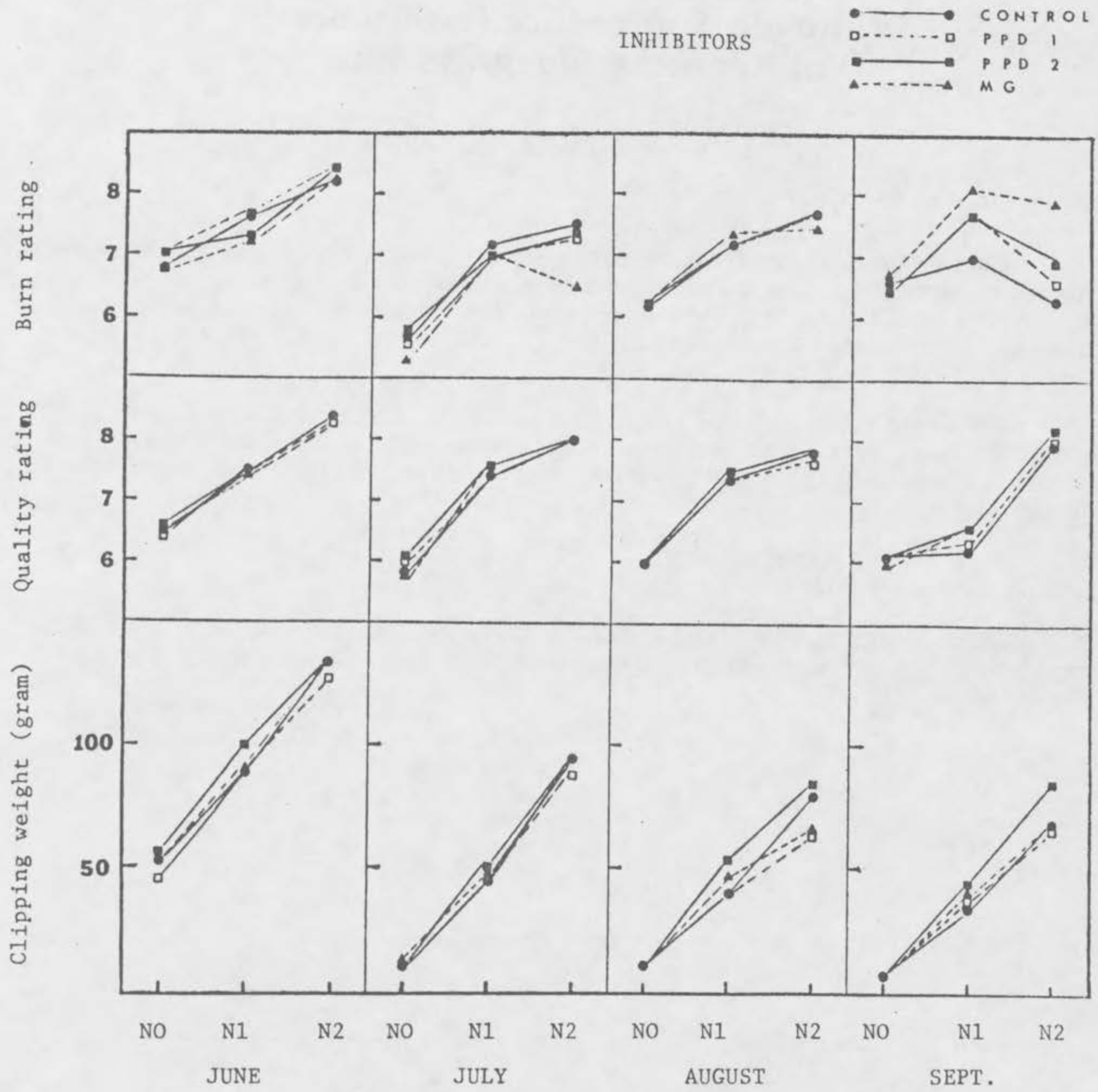


Fig. 1. The effects of inhibitors on foliar burn, quality and clipping weight (fresh) of Kentucky bluegrass turf treated with surface-applied urea.

Liquid urea was applied at 0 (NO), 1 lb N/1000 ft^2 (N1), and 2 lb N/1000 ft^2 (N2).

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

M. L. Agnew and N. E. Christians

In this study, eight granular nitrogen (N) sources are being evaluated for maintenance fertilization. The turf is Glade Kentucky bluegrass which was established in September 1984 and is maintained at a cutting height of 2 inches. A randomized complete block design with three replications is being used. Plot size is 3.5 x 7 feet.

The treatments include seven slow-release N sources applied at 4 lb N/1000 ft^2/year split into two equal applications of N. In addition, one urea treatment was applied at 4 lb N/1000 ft^2/year split into four equal applications.

The dates of fertilizer applications are May 1 and August 15. The urea treatments were applied on June 1 and September 15.

Measurements to be taken include visual quality every 2 weeks. Particular attention will be given to disease development, density of turf, and color of turf.

Table 15. List of treatments.

Treatment Number	Fertilizer Source	Date of N Application	lb N per 1000 ft^2
1	Urea	May 1	1
		June 1	1
		August 15	1
		September 15	1
2	IBDU (Estech)	May 1	2
	(31-0-0)	August 15	2
3	SCU (Andersons)	May 1	2
	(32-0-0)	August 15	2
4	SCU (Lesco)	May 1	2
	(37-0-0)	August 15	2
5	Methylene Urea (OMS)	May 1	2
	(41-0-0)	August 15	2
6	UF (Blue Chip)	May 1	2
		August 15	2
7	PCU (Estech)	May 1	2
	(100 day release-rate)	August 15	2
8	Azolone (Noram)	May 1	2
	(38-0-0)	August 15	2

Evaluation of Liquid Fertilizer Programs on Three Kentucky Bluegrass Cultivars

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

The purpose of this study is to compare programming concepts and goals of 12 liquid fertilizer programs on three Kentucky bluegrass cultivars. Treatments (Table 16) were initiated in the spring of 1985 and will be continued for several years. The turf is maintained at a cutting height of 2 inches, with all clippings removed.

The treatments include a comparison of a balanced, heavy May, and late-fall liquid program. A nonfertilized control and heavy spring fertilizer have been added for comparison purposes only. Each treatment is replicated 3 times for Park, Vantage, and Majestic Kentucky bluegrass in 5' x 10' plots.

Measurements to be taken include visual quality, carbohydrate reserves, clippings, root density, and thatch development.

Table 16. List of treatments.

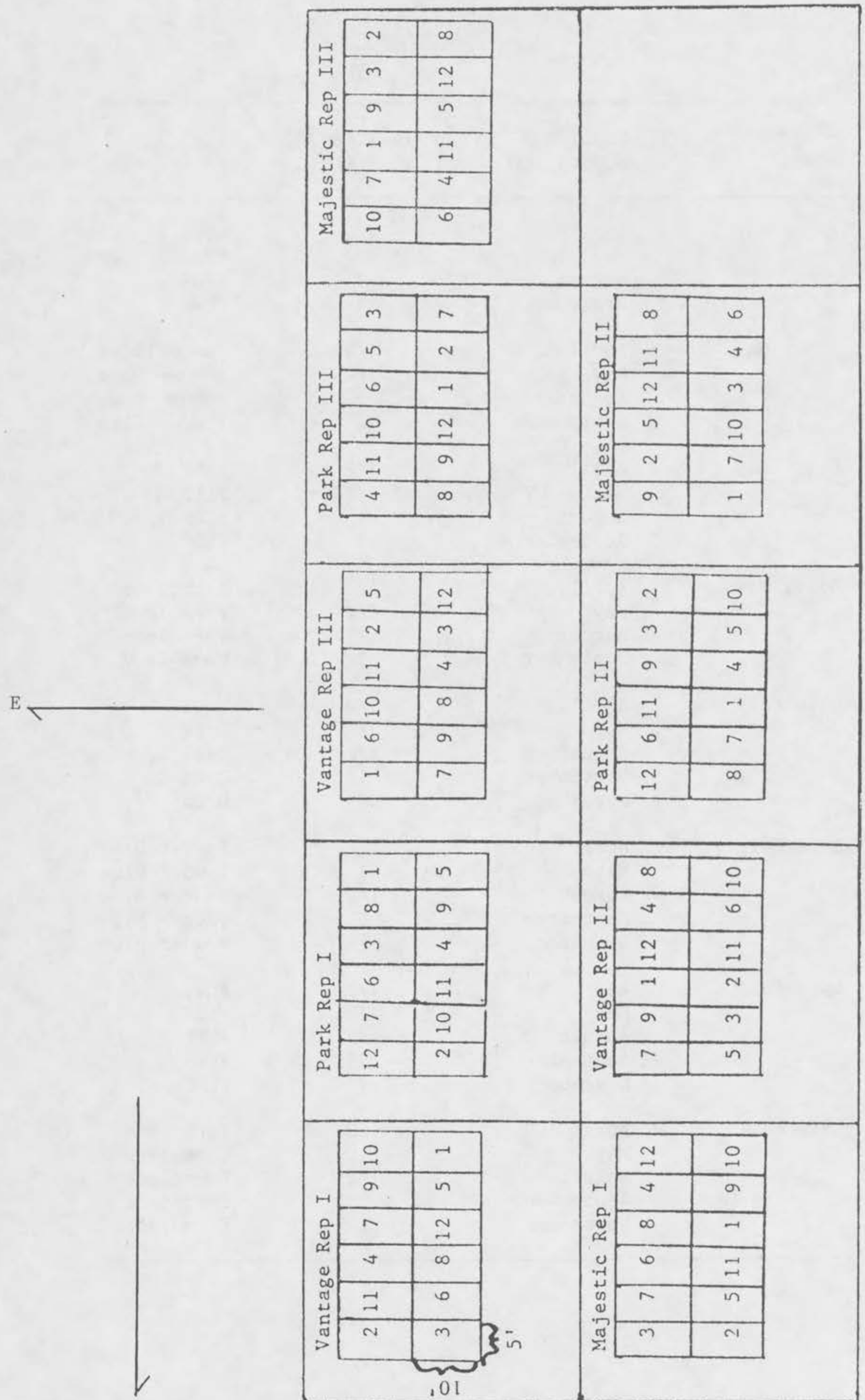
Treatment Number	Program Name	Date of N Application	lb N per 1000 ft^2	N Carrier
1	Balanced	April	1	Urea
		May	1	Urea
		August	1	Urea
		September	1	Urea
2	Balanced	April	1	Powder Blue
		May	1	Powder Blue
		August	1	Powder Blue
		September	1	Powder Blue
3	Balanced	April	1	FLUF
		May	1	FLUF
		August	1	FLUF
		September	1	FLUF
4	Balanced	April	1	Formolene
		May	1	Formolene
		August	1	Formolene
		September	1	Formolene

(Continued on next page)

Table 16. (Continued)

Treatment Number	Program Name	Date of N Application	lb N per 1000 ft^2	N Carrier
5	Heavy May	April	1/2	Urea
		May	1 1/2	Urea
		August	1	Urea
		September	1	Urea
6	Heavy May	April	1/2	Powder Blue
		May	1 1/2	Powder Blue
		August	1	Powder Blue
		September	1	Powder Blue
7	Heavy May	April	1/2	FLUF
		May	1 1/2	FLUF
		August	1	FLUF
		September	1	FLUF
8	Heavy May	April	1/2	Formolene
		May	1 1/2	Formolene
		August	1	Formolene
		September	1	Formolene
9	Late Fall	April	1/2	Urea
		May	1	Urea
		August	1/2	Urea
		September	1	Urea
		November	1	Urea
10	Late Fall	April	1/2	Powder Blue
		May	1	Powder Blue
		August	1/2	Powder Blue
		September	1	Powder Blue
		November	1	Powder Blue
11	Late Fall	April	1/2	FLUF
		May	1	FLUF
		August	1/2	FLUF
		September	1	FLUF
		November	1	FLUF
12	Late Fall	April	1/2	Formolene
		May	1	Formolene
		August	1/2	Formolene
		September	1	Formolene
		November	1	Formolene

Figure 2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N
Vantage Rep I
2 11 4 7 9 10
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10'
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Park Rep I
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Majestic Rep III
10 7 1 9 3 2
6 4 11 5 12 8
Majestic Rep I
3 7 6 8 4 12
2 5 11 1 9 10
Vantage Rep II
7 9 1 12 4 8
5 3 2 11 6 10
Park Rep II
12 6 11 9 3 2
8 7 1 4 5 10
Majestic Rep II
9 2 5 12 11 8
1 7 10 3 4 6

1984 Preemergence Annual Grass Control Study

N. E. Christians

The treatments for the 1984 preemergence annual grass control study were applied on April 27, 1984, with follow-up applications applied on May 30. The area chosen for the study was a lawn area on the ISU campus which is heavily infested with crabgrass. Goosegrass (Eluisine indica) was also seeded into the area prior to treatment at a rate of 1 lb seed/1000 ft^2. Individual plots measured 5 X 5 feet. The study was conducted with four replications. On April 29, 2.2 inches of rainfall were recorded near the study sight. This was followed by unusually wet conditions with more than 15 inches of rain recorded in May and June.

The materials used in the study included Dowco 356, an experimental from Dow Chemical; Devrinol, an experimental from Stauffer Chemical; plus Dacthal, Betasan, Benefin, and Oxadiazon which are labeled preemergence materials for turf (see Table 17 for rates and treatment combinations).

Phytotoxicity ratings, based on a scale of 9 - 1, where 9 = no damage, 6 = acceptable, and 1 = dead turf, were made 18 days after treatment (observations of the study area prior to the 18th day indicated that no ratings were warranted). At this time, only the plots treated with Devrinol showed signs of damage. Of the three formulations, the wettable powder appeared to damage the turf most. Only plots treated with the 3 lb a.i./acre rate of the Devrinol wettable powder were judged to be unacceptable. The damage had recovered by the 25th day following treatment and no further damage was observed during the summer.

First crabgrass seedlings were observed in protected areas of ISU campus on May 3. It was not until May 10 that crabgrass began to appear on the study area. The Dowco 356 material was not effective in controlling crabgrass in this investigation (Table 17). The single application of Dacthal significantly reduced crabgrass, although some crabgrass plants remained in these plots. A follow-up application of Dacthal at 7.5 lb a.i./acre was required for complete control.

The Devrinol WP significantly reduced crabgrass at all rates; however, the material could not be judged to be entirely effective. The DF and G Devrinol material were effective only at the 3.0-lb rate and again, even at that rate, control was not satisfactory. Where Devrinol was combined with Betasan (treatments 7, 8, 12, and 13) crabgrass numbers were significantly reduced, but control was not as complete as where Betasan was applied alone at the 10 lb a.i./acre rate.

Oxadiazon was an effective crabgrass control in 1984 at both the 3- and 4-lb a.i./acre rate and there was no apparent phytotoxicity associated with this product.

The Benefin combined with a 23-3-5 fertilizer (a commercially available material from U.S. Steel Agri-Chemicals) was not effective where single applications at the 2-lb rate were used. However, this material was effective when followed up by a 1.5 lb a.i./acre application 33 days after initial treatment.

The germination of goosegrass was quite poor in the 1984 season and no consistent results on goosegrass control were obtained.

Table 17. Phytotoxicity ratings and crabgrass counts for the 1984 preemergence herbicide trials.

Treatment	lb a.i./acre	Phytotoxicity 18 days After Application	Number of Crabgrass Plants Per Plot
1. Control	----	9.0[b]	161
2. Dowco 356	0.38	9.0	86
3. Dowco 356	0.50	9.0	184
4. Dowco 356	1.00	9.0	130
5. Dacthal	10.5	9.0	37
6. Dacthal	10.5 + 7.5	9.0	1
7. Betasan 4E/ Devrinol WP	5.0/1.0	9.0	32
8. Betasan 4E/ Devrinol WP[a]	5.0/1.5	9.0	12
9. Devrinol WP	1.5	8.8	56
10. Devrinol WP	2.0	7.3	22
11. Devrinol WP	3.0	5.5	48
12. Betasan 4E/ Devrinol DF	5.0/1.0	9.0	55
13. Betasan 4E/ Devrinol DF	5.0/15	9.0	28
14. Devrinol DF	1.5	8.8	129
15. Devrinol DF	2.0	8.3	87
16. Devrinol DF	3.0	7.6	66
17. Devrinol G	1.5	9.0	85
18. Devrinol G	2.0	6.8	127
19. Devrinol G	3.0	7.8	11
20. Betasan 4E	10.0	8.8	6
21. Benefin (23-3-5)	2.0	9.0	56
22. Benefin (23-3-5)	2.0 + 1.5	9.0	11
23. Oxadiazon	3.0	9.0	8
24. Oxadiazon	4.0	9.0	2
LSD 0.05		1.2	84

[a] WP, DF, and G indicate wettable powder, dry flowable, and granular, respectively.

[b] Based on a scale of 9 - 1, where 9 = no damage, 6 = acceptable, and 1 = dead turf.

1984 Postemergence Annual Grass Control Study

J. Webb and N. E. Christians

Crabgrass has long been a problem in the turfgrass industry. Traditionally, turfgrass experts have used preemergence herbicides to control annual grasses, but they often face the problem of missed application deadlines. Once an application deadline is passed, turf specialists are faced with the task of finding an effective postemergence herbicide. Until recently, no postemergence material has proven to be truly effective for annual grass control. One of the most commonly used postemergents is MSMA, but when used alone, it has not proven to be completely effective. A new product, Acclaim (Hoe-A25 01), being tested by the American Hoechst Corporation is proving to be effective in postemergent crabgrass control and an experimental from Dow Chemical (Dowco 356) has also shown potential for use as a postemergence. The purpose of this study was to compare various postemergence treatments in annual grass control. Acclaim and Dowco 356 were compared to more tradional treatments of MSMA and other postemergence materials.

Application dates of June 15, July 2, July 12, and July 20, represented four different seasonal stages of postemergent crabgrass growth (Table 18). June 15 was the two- to four-leaf crabgrass stage, July 2, the three-leaf to two-tiller stage; July 12, the one-to four-tiller stage, and July 20, the mature stage. Chemicals were applied at recommended rates to 5 X 5 foot plots in three replications. Liquid solutions were dispersed through a hand-held boom. The area used was a lawn area heavily infested with crabgrass. Goosegrass (Eluisine indica) was seeded into the area on April 27 at a rate of 1 lb seed/1000 ft^2.

Crabgrass percentage cover was estimated on August 8. The counting of the crabgrass plants on the plots was completed on August 24. Crabgrass percentage cover was again estimated on September 19. Phytoxicity observations were performed on each area 2 and 4 weeks after each application.

The germination of goosegrass was insufficient for data collection; however, there was very good germination of crabgrass. No phytotoxicity was observed on the Kentucky bluegrass at any time during the study. Some plots contained creeping bentgrass. The Dowco 356 appeared to damage the bentgrass where it was present in the Dowco 356 plots.

Based on the August 8 ratings, the Hoe-A25 01 (Acclaim) was very effective in controlling crabgrass at the 0.12- and 0.18-lb a.i./acre rate when applied on July 2 (the three-leaf to one-tiller stage) and on July 12 (the one- to four-tiller stage) The 0.08 rate was not sufficient to control crabgrass at any of the application dates. The June 15 two- to four-leaf stage) was too early and the plots were reinfested by late germinating crabgrass.

The MSMA alone was not effective in controlling crabgrass; however, when it was combined with the preemergence materials Betasan and Dacthal, control was complete. This would indicate the crabgrass in the plots treated with MSMA alone was the result of late season germination.

The Dowco 356 was effective in controlling crabgrass at the 1.5-lb a.i./acre rate at the June 15 application date only. It was not effective on crabgrass at the July 2 or the July 20 application dates, although crabgrass cover was reduced at the 2- and 3-lb application rates following the July 20 application.

The Hoe-A25 01 (Acclaim) material appears to be a very effective postemergence crabgrass control. Further tests combining this material with preemergence materials should be conducted next year. The Dowco 356 material was less effective in this test; however, 1984 was a very wet year and this material may prove effective under more normal conditions.

Table 18. Results of the 1984 postemergence crabgrass control study.

Treatment	lb a.i./ acre	Material per Plot[b]	Crabgrass Percent Cover August 8	Crabgrass Count August 24	Crabgrass Percent Cover Sept 19
1. Control	----	----	20	67[b]	33
2. Hoe-A25 01[a]	0.08	.17 ml	23	98	40
3. Hoe-A25 01	0.12	.26 ml	8	22	10
4. Hoe-A25 01	0.18	.38 ml	3	7	10
5. Hoe-A25 01	0.08	.17 ml	12	43	30
6. Hoe-A25 01	0.12	.26 ml	0	1	0
7. Hoe-A25 01	0.18	.38 ml	0	0	10
8. Hoe-A25 01	0.08	.17 ml	7	54	13
9. Hoe-A25 01	0.12	.26 ml	0	1	3
10. Hoe-A25 01	0.18	.38 ml	2	2	20
11. MSMA	2.0	.75 ml	13	75	18
12. Dowco 356	1.0	1.1 ml	10	15	20
13. Dowco 356	1.5	1.6 ml	3	5	17
14. Dowco 356	1.0	1.1 ml	5	8	5
15. Dowco 356	1.5	1.6 ml	8	13	20
16. Betasan/MSMA	5/2	2.7/.72	0	0	8
17. Dacthal/MSMA	10.5/2.0	3.65g/.72	0	0	2
18. Dowco 356	1.0	1.1 ml	22	63	42
19. Dowco 356	2.0	2.2 ml	5	43	18
20. Dowco 356	3.0	3.3 ml	5	30	18
LSD 0.05			15	N.S.	27

N.S. Not significant.

[a] Hoe-A25 01 = 1.00 lb a.i./gal.
[b] Data represent counts done in 5 X 5 foot plots.

Treatments -- 2, 3, 4, 11, 12,, 13, 16, 17 -- applied June 15
Treatments -- 5, 6, 7, 14, 15 -- applied July 2
Treatments -- 8, 9, 10 -- applied July 12
Treatments -- 18, 19, 20 -- applied July 20

All treatments were applied in the equivalent of 4 gal distilled water/1000 ft^2.

1984 Broadleaf Weed Control and Postemergence Crabgrass Control Study

N. E. Christians

The 1984 postemergence annual grass and broadleaf weed control study was conducted at the North Dakota Avenue Cemetery in west Ames. The Kentucky bluegrass on this area was established more than 40 years ago and no herbicides have been used on the site. There is a uniform stand of bluegrass which is heavily infested with crabgrass and dandelions.

The treatments included 1) EH 795 and EH 805 (Quadmec) which are experimental materials from PBI/Gordon containing 2,4-D, MCPP, and Dicamba for broadleaf weed control + MSMA for crabgrass control; 2) EH 765, an experimental trimec material from PBI/Gordon containing 2,4-D, MCPP, and Dicamba; 3) EH 791 (Trimec ester) an ester formulation of PBI/Gordon's trimec; 4) Trimec, the commercially available form; 5) XRM-4755, an experimental material from Dow Chemical which contains triclopyr and 2,4-D; and 6) Formula 40, a 2,4-D material commercially available from Dow. Only the EH 795 and EH 805 would be expected to provide satisfactory postemergence control of crabgrass. Plot areas measured 5 x 10 feet and the study was conducted in four replications.

The materials were applied on April 27, 1984, a clear day with wind speeds below 5 mph. The temperature at application was 82^{o} F.

Phytotoxicity ratings were made on July 1, 1984 (Table 19). The Quadmec materials discolored the Kentucky bluegrass at this initial observation date. By July 10, the bluegrass had completely recovered. The EH 765 also initially discolored the bluegrass, which was surprising, but a recheck of the data indicated this was a real effect. These plots too had recovered by July 10. None of the materials produced an unacceptable phytoxicity.

Crabgrass control ratings were performed on July 21. Because of variability among the replications, no significant differences in crabgrass control were found among treatments. The crabgrass was in the one- to two-leaf stage at application and many of the materials provided some slight reduction in crabgrass cover. The EH 795 (Quadmec) at 5.02-lb a.i./acre, reduced crabgrass infestations by 50%; however, none of the MSMA containing compounds were truly effective in controlling crabgrass. This was an area with a very heavy infestion of crabgrass and rainfall was especially heavy during the spring and early summer months which may have contributed to the poor control.

All of the materials were effective in reducing dandelions and white clover. The Quadmec materials were not as effective in controlling dandelions as the trimec materials, although both were effective in controlling clover. The XRM-4755 provided poor control at the 0.5-lb a.i./acre rate. The 1.0-lb rate was more effective, but only the 1.5-lb rate was truly effective against both species. The Formula 40 was effective against both dandelions and clover, although sufficient clover remained in the Formula 40 plots to indicate it may not be as effective against this species.

Table 19. Weed control in the 1983 broadleaf herbicide study.

	Treatment	lb a.i./acre	Phyto-toxicity	Crab-grass	Dande-lion	White Clover
1.	EH 795 'Quadmec'	4.69	6[a]	14[b]	5[c]	0
2.	EH 795 'Quadmec'	5.02	7	50	36	0
3.	EH 805 'Quadmec'	4.69	6	30	5	0
4.	EH 805 'Quadmec'	5.02	8	23	10	0
5.	EH 765 'Trimec'	1.13	7	20	1	0
6.	EH 765 'Trimec'	2.25	6	23	1	0
7.	EH 791 'Trimec ester'	1.20	9	10	2	0
8.	EH 791 'Trimec ester'	1.60	9	20	1	0
9.	Trimec	0.83	9	15	6	3
10.	XRM-4755	0.5	9	0	80	74
11.	XRM-4755	1.0	9	23	7	12
12.	XRM-4755	1.5	9	18	4	1
13.	Formula 40	3.0	9	28	3	14
14.	Control	---	9	0	258	203
	LSD 0.05		2	N.S.[d]	40	34

[a] Rating of phytotoxicity on Kentucky bluegrass, where 9 = no damage, 1 = dead turf, and 6 = acceptable.

[b] Crabgrass control is based on a rating scale with 100 = complete control and 0 = no control.

[c] Dandelion and white clover data represent counts of the number of plants in the 5 x 10 foot plots.

[d] N.S. = not significant at the 0.05 level.

Rubigan Field Study—1984

M. C. Gaul and N. E. Christians

Annual bluegrass (Poa annua) has presented turf managers with serious problems for many years. Research has ranged from complete eradication to seedhead suppression, to the development of programs to manage Poa annua as a turf species. Rubigan, produced by the Elanco Company, is a systemic fungicide labeled for controlling many common turfgrass diseases. It has also been labeled for the gradual reduction of annual bluegrass (Poa annua). At Iowa State University, research is being conducted using Rubigan to control Poa annua in creeping bentgrass and Kentucky bluegrass. Objectives of this study include determining appropriate rates of Rubigan for controlling Poa annua and observing any phytotoxic effects which may occur on the desired turfgrass species.

The field study was initiated on June 13, 1984, at two locations in Ames, Iowa. The first location was at the Iowa State University Golf Course on the east end of the practice putting green. The second location was on a Kentucky bluegrass fairway on Homewood Golf Course. Both sites contained healthy populations of Poa annua.

Treatments included rates of 0.05, 0.10, 0.15, 0.20, and 0.25 oz a.i./1000 ft^2. Each treatment was applied to a 5 X 5 foot plot and replicated three times. The treatments were applied in 326 ml of water (equivalent to 150 gal/acre) at 20 psi using a hand-held boom operated in four different directions to ensure uniform coverage. Each treatment was applied eight times over a period of 3 months until cumulative amounts ranging from 0.40 to 2.0 oz a.i./1000 ft^2 were reached.

Data were taken at periodic intervals during the study and included only quality ratings. The quality ratings were determined on a scale from 9 - 1, with 9 = best quality, 6 = acceptable, and 1 = dead turf. Clipping weights were not taken because species were so dispersed throughout the plots that separation would have been impossible.

Responses in this study varied with species and treatment rates. In the bentgrass study, both creeping bentgrass and Poa annua showed increasing phytotoxicity (decreased quality ratings) with increasing rates of Rubigan (Table 20). Overall mean quality ratings ranged from 7.9 to 5.4 for bentgrass while Poa annua ratings ranged from 7.7 to 6.3. Phytotoxicity developed on the bentgrass which appeared as an aqua-green wilted condition. This condition was very minor at the lower rates but increased significantly at higher rates. Phytotoxicity was not as severe on Poa annua and generally included a slight chlorotic condition. In terms of recovery, the Poa annua was quick to recover while the bentgrass still showed some phytotoxicity up to two months after the last application.

On the Kentucky bluegrass site, phytotoxic results were not nearly as severe as on the bentgrass site (Table 21). Overall mean quality ratings on the Kentucky bluegrass ranged from 8.8 to 9.0 while for Poa annua the ratings ranged from 3.2 to 2.5. In trying to explain the low ratings for the Poa annua it must be noted that this study was located on a nonirrigated fairway. The summer heat stress period was in full swing approximately 1 month after the initial application and as a result the Poa annua population was greatly weakened. By August the Poa annua population was dead while the Kentucky bluegrass remained reasonably healthy at all treatment levels. Discoloration of the Kentucky bluegrass was very minimal and what stress did appear on the turf was probably due to heat and lack of water. Poa annua disappearance could be attributed to many factors -- heat, lack of water, or Rubigan. With the onset of the cool, wet temperatures of late September, favorable for annual bluegrass germination, the amount of Poa annua to germinate appeared less than that present at the beginning of the study and was very slow to germinate compared with control plots. This suggests that possibly Rubigan was creating a preemergent growth effect on the Poa annua.

Poa annua is a very diverse plant species. As stated in the Rubigan Product Information Bulletin, Poa annua is capable of producing regionally adapted biotypes which differ both morphologically and physiologically. Central Iowa is known for its unpredictable weather. Fast moving weather fronts are capable of producing a variety of conditions including very hot summers, freezing winters, and varying amounts of precipitation. It is logical, therefore, to expect Poa annua biotypes to have developed in response to local climatic conditions. In this study, especially on the bentgrass putting green where low mowing and daily irrigation favors Poa annua, we believe we are dealing with some very stubborn Poa annua biotypes -- possibly biotypes which have developed a somewhat perennial lifecycle, in which case, Rubigan would be ineffective.

With the warm weather of spring, we will be examining our plots to observe how the Poa annua has survived the cold winter months. We believe that perhaps the Rubigan may have weakened the Poa annua population enough to decrease winter survival. We also plan on using infrared film to detect any changes in the Poa annua populations. This study will be repeated in 1985 on turfgrass stands composed primarily of Poa annua with better data expected. Currently we are conducting a greenhouse study using Rubigan on two different Poa annua biotypes and creeping bentgrass cv. 'Penncross'. One biotype was obtained from the bentgrass field study and the other from the Kentucky bluegrass field study. Morphological differences can be observed between the two. Data being taken includes quality ratings, clipping weights, and seedhead counts.

Table 20. Rubigan field study at the practice putting green, Iowa State University Golf Course, Ames, Iowa. The first application was June 13, 1984, the final application was September 19, 1984.

Treatment (oz/ 1000 ft^2 a.i.)	Total a. i.	Total Rubigan	Turf Quality[a]											
			July 24		Aug 25		Sept. 3		Sept. 14		Oct. 5		Mean	
			B[b]	P[c]	B	P	B	P	B	P	B	P	B	P
Control	0.0	0.0	8.0	7.6	8.6	8.0	8.6	8.0	8.6	9.0	9.0	8.6	8.6	8.2
0.05	0.40	0.80	7.3	7.6	8.3	7.3	8.3	7.6	7.3	7.6	8.3	7.6	7.9	7.6
0.10	0.80	1.60	7.6	7.6	8.0	7.6	8.3	7.0	7.3	7.6	7.3	7.6	7.7	7.7
o.15	1.20	2.40	7.6	7.6	7.3	7.6	7.6	7.6	6.0	7.3	6.6	7.6	7.0	7.6
0.20	1.60	3.20	7.6	7.0	7.0	7.3	8.0	7.0	6.0	7.6	6.3	8.0	7.0	7.6
0.25	2.00	4.00	6.0	6.0	6.3	6.0	6.3	7.0	4.0	6.3	4.6	6.3	5.4	6.1

[a] Turf quality ratings as follows: 9 = best quality, 6 = acceptable, 1 = dead turf.
[b] Creeping bentgrass.
[c] *Poa annua*.

Table 21. Rubigan field study at the Kentucky bluegrass fairway, Homewood Golf Course, Ames, Iowa. The first application was June 13, 1984, the final application was September 20, 1984.

Treatment (oz/ 1000 ft^2 a.i.)	Total a. i.	Total Rubigan	Turf Quality[a]									
			July 11		Aug. 13		Sept. 20		Oct. 5		Mean	
			K[b]	P[c]	K	P	K	P	K	P	K	P
Control	0.0	0.0	9.0	7.6	9.0	1.0	8.3	1.0	9.0	1.0	8.8	2.6
0.05	0.40	0.80	9.0	7.6	9.0	1.0	8.3	1.0	9.0	1.0	8.8	2.6
0.10	0.80	1.60	9.0	7.6	9.0	1.0	9.0	1.0	9.0	1.0	9.0	2.6
0.15	1.20	2.40	9.0	6.3	9.0	1.0	9.0	1.0	9.0	1.0	9.0	2.3
0.20	1.60	3.20	9.0	7.0	9.0	2.6	9.0	2.0	9.0	1.0	9.0	3.2
0.25	2.00	4.00	9.0	7.0	9.0	1.0	8.0	1.0	9.0	1.0	8.8	2.5

[a] Turf quality ratings are as follows: 9 = best quality, 6 = acceptable, 1 = dead turf.
[b] Kentucky bluegrass.
[c] *Poa annua*.

Selective Control of Tall Fescue in Kentucky Bluegrass Turf with Chlorsulfuron

B. M. Maloy and N. E. Christians

In the present study, a chemical, called chlorsulfuron, which has shown some potential as a selective control of tall fescue in Kentucky bluegrass turf, was tested in field studies. The purpose of the field experiments was 1) to determine the effects of the chlorsulfuron on tall fescue and Kentucky bluegrass, 2) to establish the tolerance levels for both species to the chemical under field conditions, 3) to test single vs split applications of chlorsulfuron, and 4) to study the effects of chlorsulfuron on Kentucky bluegrass seed germination.

Kentucky bluegrass is the most important and widely utilized cool-season turfgrass of the midwest. Due to its medium to fine leaf texture and rhizomatous growth habit, it forms a turf of high shoot density. Tall fescue, another cool-season turfgrass common to the transition zone, has a wider leaf texture and bunch-type growth habit which forms a turf of low-shoot density. In the cooler regions, however, because of its low-temperature hardiness, tall fescue plants will thin out until only coarse textured plants that eventually become weeds remain within a Kentucky bluegrass area. Therefore, tall fescue often disrupts the uniformity of a bluegrass turf. This disruption may occur when a poor-quality seed mix is used which is contaminated with fescue seed. The only current methods for controlling tall fescue in Kentucky bluegrass turf are mechanically digging the tall fescue plants or using nonselective herbicides. Glyphosate is the best nonselective choice because of its short residual activity. However, these herbicides are all nonselective, killing all growing tissues including surrounding desirable grasses. To date, there are no selective controls of perennial grass weeds in Kentucky bluegrass turf.

The field experiments were initiated on June 28, 1983, at the Iowa State University turf research plots north of Ames, Iowa. Two studies were established. One in tall fescue (Kentucky 31) and the second in a premium sod blend of Kentucky bluegrass. The studies consist of twelve 5 X 5 foot plots replicated three times. In both studies, each 5 X 5 foot plot was divided in the middle with bluegrass on one side and tall fescue on the other. The plots were established by interchanging strips of sod (2 1/2 X 5 feet) between the two areas. The study was arranged as a split-plot with chlorsulfuron treatments as main plots and species as subplots (Fig. 3).

Treatments included single rates of 0.25, 0.50, 1, 2, 3, and 4 oz/acre and split rates of 0.25 + 0.25, 0.50 + 0.50, 1 + 1, 2 + 2, and 3 + 3 oz/acre. Each treatment was applied in 326 ml of water at 20 psi with a hand-held boom operated in four different directions to ensure uniform coverage. The single application and first of the split application rates was applied July 11, 1983, while the second application of the split rates was applied July 25, 1983.

The Kentucky bluegrass was maintained at a height of 2 inchs while the tall fescue was cut at 3 inchs. At quarterly intervals throughout the growing season, 1 lb N/1000 ft^2 (sulfer-coated urea) was applied to the experiments. Water was applied by the sprinkler irrigation system as needed to prevent moisture stress.

Data taken weekly during the experiment included fresh clipping weights and quality ratings. The quality ratings were determined on a scale from 9 to 1; with 9 = best quality and 1 = dead turf.

After all of the data had been collected from the summer experiment, glyphosate was sprayed over the entire study 1 year from the date that the chlorsulfuron treatments had been applied. Two weeks later all the above ground tissue was mowed to 1-inch in height. A Jacobson overseeder was used to reseed Kentucky bluegrass seed at the rate of 1 1/2 lb/1000 ft^2 into the chlorsulfuron residual plots. The experiment was irrigated daily for 2 weeks until germination was observed and then irrigated regularly to prevent moisture stress.

The second experiment that had been initiated on June 28, 1983, in a Kentucky bluegrass premium sod blend area was allowed to establish for 3 months. On October 1, 1983, the same single application and first of the split application rates was made. On October 15, 1983, the second application of the split rates was applied. The management practices and data collection were uniform throughout both experiments.

The responses varied with species and treatment rates. The Kentucky bluegrass showed a much higher tolerance to the chemical with no decrease in quality at the highest single and split application rates in both experiments. However, as the chlorsulfuron rate increased the clipping weight significantly decreased (Fig. 4). This observation suggests that chlorsulfuron has some growth retarding effects on Kentucky bluegrass. The tall fescue showed a very low tolerance to the chemical and both quality and clipping weights were severely affected at single rates of 141 g/ha and split rates of 141 + 141 g/ha and greater. Growth inhibition and above ground burn occurred at the lower rates, however, the tall fescue recovered from damage at 71 g/ha single rate and 71 + 71 g/ha split rate.

Chlorsulfuron effects on turfgrass quality appeared within 2-3 weeks of application in Experiments 1, whereas in Experiment 2, death of the tall fescue plants was slow (within 4-5 weeks) and was preceded by chlorosis, necrosis, growth inhibition, and terminal bud death. The heaviest chlorsulfuron treatments affected plants sooner than the lighter rates. The differences observed between Experiment 1 and 2 are probably due to differences in environmental conditions. The lethal effect on tall fescue at higher rates of chlorsulfuron was not reflected in the quality or clipping weight data because of the progressive nature of the damage after application.

In the tall fescue plots where the heaviest rates of chlorsulfuron were applied, it was noted that some plants were withstanding the treatments. These plants were later identified as orchardgrass. The seed used to establish the tall fescue sod area at the Iowa State University research farm was foundation seed of Kentucky 31 Tall Fescue which has been contaminated with orchardgrass. The amount of orchardgrass in the tall fescue plots was significant, affecting quality and clipping weight data. Kentucky bluegrass was also noted to exist as a contaminant in the tall fescue sod which was not controlled in the tall fescue plots at the heavier chlorsulfuron rates. These two species did not make up a large percentage of the tall fescue plots, however, after death of the tall fescue plants, counts of these two species seem to expand quickly without competition from the fescue.

Kentucky bluegrass seed germinated 10-14 days after planting it into the chlorsulfuron treated plots 1 year from the application date for both experiments. Kentucky bluegrass visually covered 90% of all plots regardless of rate. It would be interesting to further evaluate Kentucky bluegrass germination in chlorsulfuron residual much sooner than these experiments took into account.

The data from these experiments indicate that chlorsulfuron has the potential for being a selective control for tall fescue in Kentucky bluegrass.

Figure 3

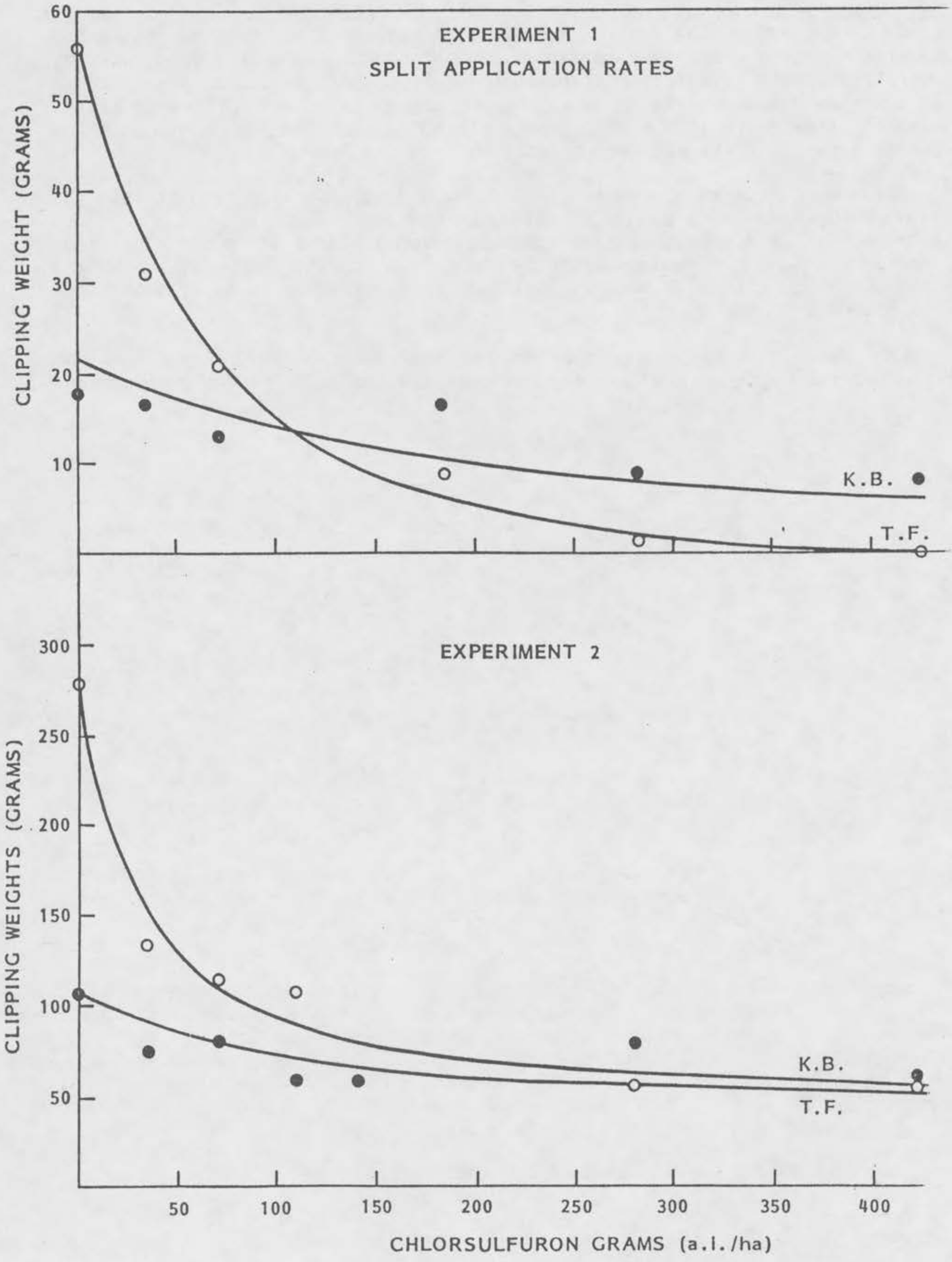
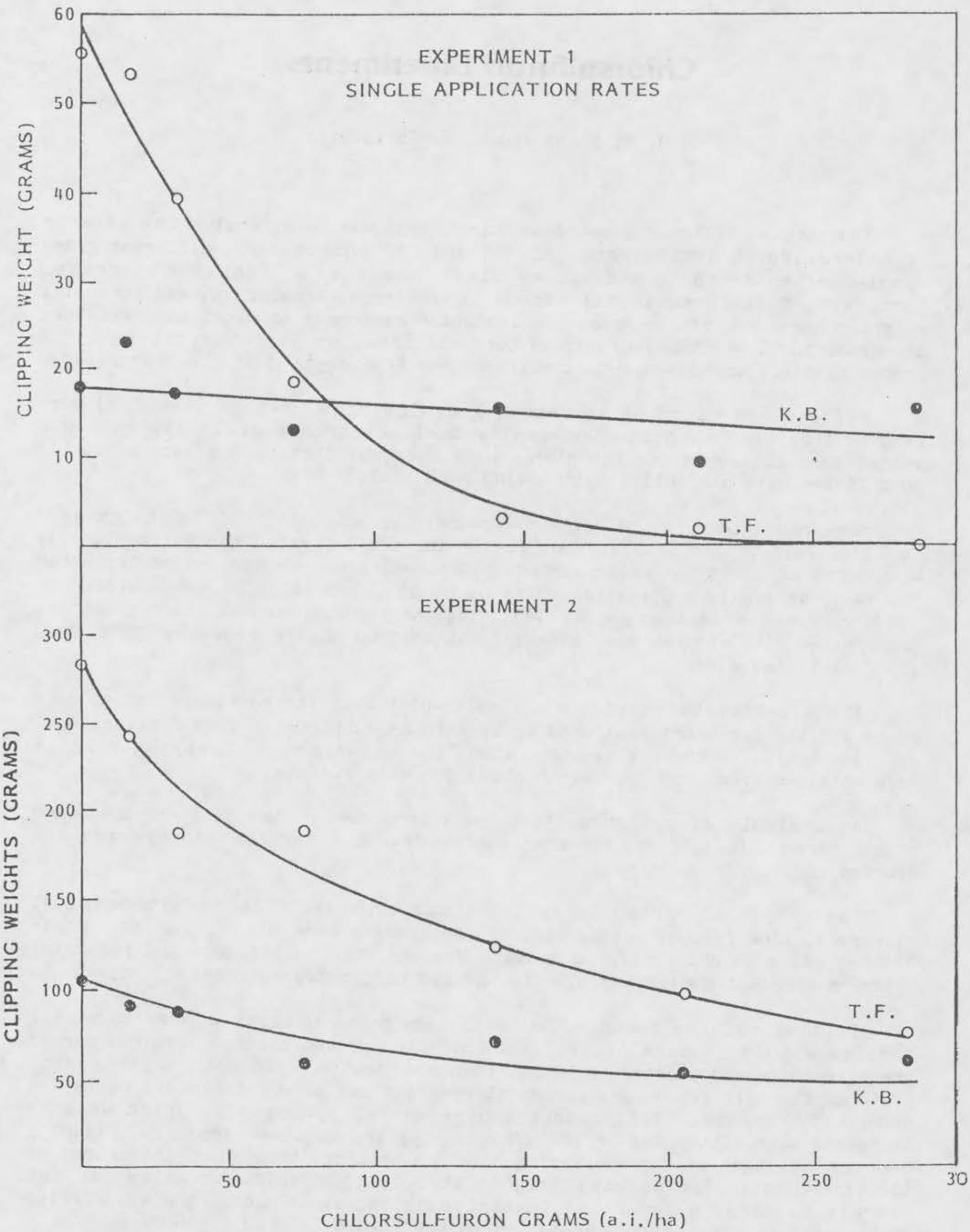

EXPERIMENT 1
SPLIT APPLICATION RATES
CLIPPING WEIGHT (GRAMS)
60
50
40
30
20
10
K.B.
T.F.
EXPERIMENT 2
CLIPPING WEIGHTS (GRAMS)
300
250
200
150
100
50
K.B.
T.F.
50
100
150
200
250
300
350
400
CHLORSULFURON GRAMS (a.i./ha)

Figure 4



EXPERIMENT 1
SINGLE APPLICATION RATES
CLIPPING WEIGHT (GRAMS)
60
50
40
30
20
10
K.B.
T.F.
EXPERIMENT 2
CLIPPING WEIGHTS (GRAMS)
300
250
200
150
100
50
T.F.
K.B.
50
100
150
200
250
30
CHLORSULFURON GRAMS (a.i./ha)

Chlorsulfuron Experiments

B. M. Maloy and N. E. Christians

The purpose of these greenhouse experiments was to determine the effects of chlorsulfuron at the rates of 141 and 282 g/ha on seven different grass species often found in a Kentucky bluegrass turf. Annual bluegrass, bentgrass, fine fescue, tall fescue, quackgrass, bromegrass, and perennial ryegrass are a few of the grass species which may occur as weeds in a Kentucky bluegrass turf. Kentucky bluegrass turf has shown no phytotoxicity when in preceding field experiments chlorsulfuron has been applied at the same rates.

Fifteen sod plugs of the seven grass species (3-inch diameter) were removed from the Iowa State University turf research plots. All soil was washed from the roots and the plants were reestablished in 3 x 3-inch plastic pots filled with a Nicollet soil having a pH of 7.2.

Greenhouse temperature regimes were maintained at 16 to 18^{o} C (night)/21 to 23^{o} C (day). The pots were uniformly surface-irrigated three times weekly with 50 ml of distilled water per pot. Chlorsulfuron was applied on September 30, 1983, at single application rates of 0, 141, and 282 g/ha. On October 3, 1984, the experiment was repeated using the same procedure. Each treatment was applied with a spray-mist atomizer attached to an air pressure pump in 2 ml of distilled water.

The experimental design was a split-plot with the seven species as main plots and the three chlorsulfuron treatments as subplots in five replications. Data was collected three times throughout the experiments. Clipping weights were obtained from each pot 1-inch above the soil surface.

An analysis of variance (ANOVA) was performed on the data and the means of the three chlorsulfuron treatments of each of the seven grass species are denoted in (Fig. 5).

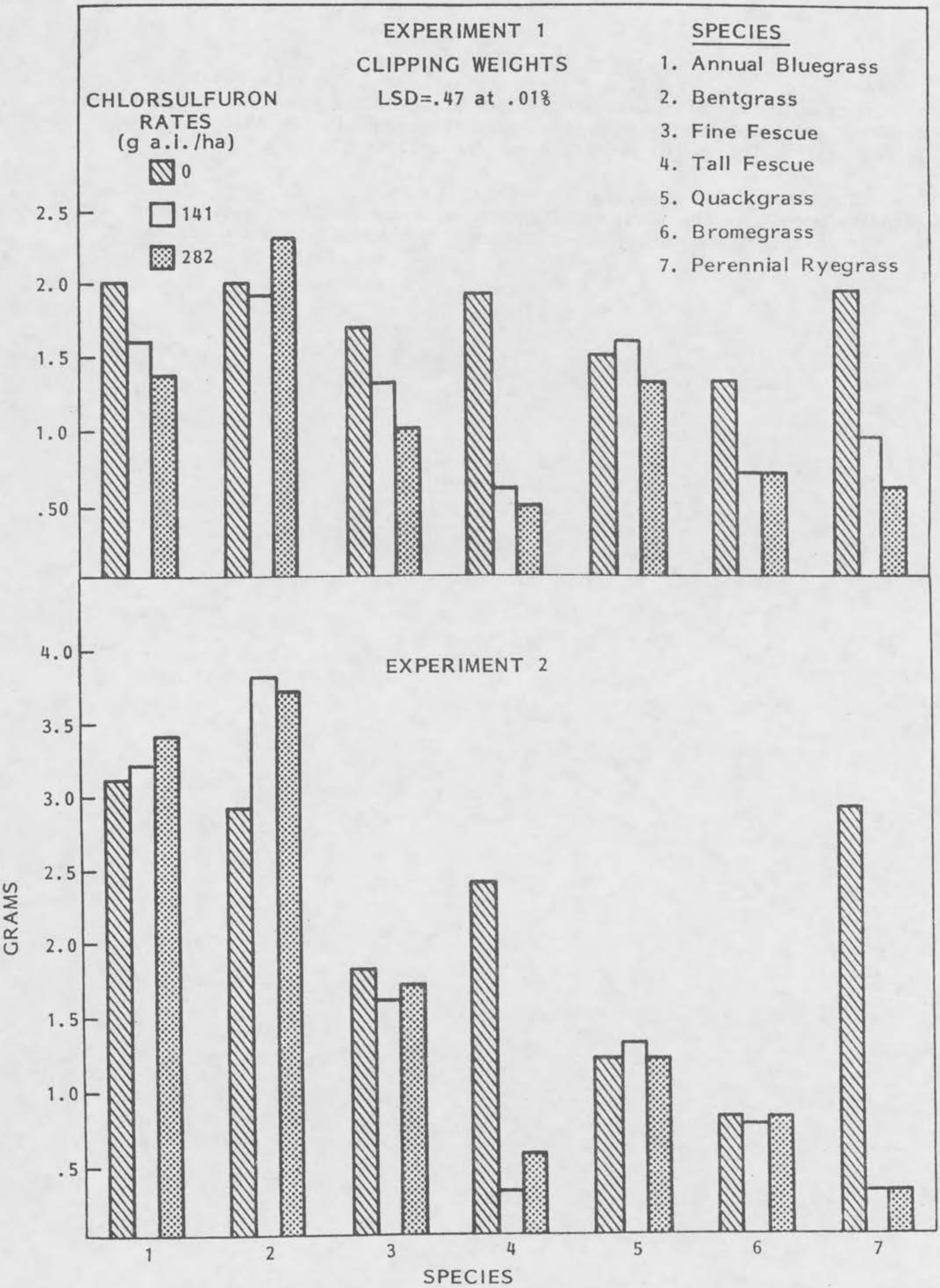
The responses varied among the grass species. The bentgrass, annual bluegrass, fine fescue, quackgrass, and bromegrass were more tolerant of the 141 and 282 g/ha chlorsulfuron rates. However, the tall fescue and perennial ryegrass were extremely sensitive to the two chlorsulfuron rates.

Initial chlorsulfuron effects on turfgrass quality appeared on all species within 3 weeks of application. The treated species appeared darker green in color and shorter in height than the controls in both experiments. Death of the tall fescue and perennial ryegrass was slow (within 4-5 weeks) in both experiments. Tall fescue and perennial ryegrass clipping weights decreased when either 141 or 282 g/ha was applied to these species. Figure 2 denotes averages of three clipping sessions obtained throughout the course of the experiment. The species weights at both chlorsulfuron rates did not average to zero, because the initial clipping session of these two species contributed to the averages presented in the figure.

Tall fescue is shown to have a higher clipping weight at the 282 g/ha as compared to the 141 g/ha, however, this can be attributed to Kentucky bluegrass which was a contaminant in two of the five replications for tall fescue. Since Kentucky bluegrass is not controlled by chlorsulfuron, its weight contributed to the overall means for tall fescue.

Bentgrass clipping weight actually increased with applications of chlorsulfuron. At the beginning of both experiments, the treated plants were shorter in height and darker green in color as compared to the controls.

Figure 5


EXPERIMENT 1
CLIPPING WEIGHTS
LSD=.47 at .01%
CHLORSULFURON RATES (g a.i./ha)
0
141
282
SPECIES
1. Annual Bluegrass
2. Bentgrass
3. Fine Fescue
4. Tall Fescue
5. Quackgrass
6. Bromegrass
7. Perennial Ryegrass
2.5
2.0
1.5
1.0
.50
EXPERIMENT 2
4.0
3.5
3.0
2.5
2.0
1.5
1.0
.5
GRAMS
1
2
3
4
5
6
7
SPECIES

Effects of Five Growth Retardants on the Vegetative Growth of Kentucky Bluegrass—1983-1984

K. L. Diesburg and N. E. Christians

Two field experiments were combined to compare the effects of Ethrel (4.0 lb a.i./A), EL 500 (1.0), Embark (0.4), PP-333 (0.4), and Limit (2.5) (Monsanto 4621) on leaf and stem growth of Kentucky bluegrass at three different seasonal stages of growth. Effects were studied on Baron in 1983 and Premium Sod Blend in 1984. The experiments were conducted on a silty clay loam soil. Fertilizer was applied as urea at 4 lb N/1000 ft^2/year. Water irrigation was used to prevent drought stress. In both years, chemicals were applied around May 10, June 17, and September 22, representing spring reproductive, summer, and fall vegetative stages, respectively. Liquid solutions were applied to 5 X 5 foot plots through a hand-held boom with three nozzles passing 3 feet above the ground with pressurized CO_2 in a tank strapped to the operator's back.

A split-split-plot design was used with years as whole plots, application dates as subplots, and chemicals a sub-sub-plots replicated three times within each year. Plots were mowed immediately prior to application and once more 1 week afterward. Canopy heights were measured from the soil surface 4 weeks after treatment. Leaf length, leaf number, and internode number and length were measured and counted from nine representative shoots per plot and then averaged. Subjective ratings of toxicity were based on turf color with 9 = best color and 1 = brown. Ratings of seedhead formation were also subjective with 1 = most heading and 9 = no heads.

Canopy heights averaged over all treatments and seasons, differed between the 2 years (1983: 7.2 cm vs 1984: 7.5 cm). Among seasons averaged over both years they were highest in spring (8.7 cm), lower in summer (7.4 cm), and lowest in fall (6.8 cm). Canopy heights were lower in summer 1984 (6.5 cm) than in summer 1983 (8.3 cm) while the reverse occurred in fall of those years (1983: 6.1 cm. vs 1984: 7.4 cm). This juxtaposition could be due to the difference in response of Baron and Premium Sod Blend to leaf growth inhibition or it may have been due to differences in environmental conditions between the 2 years.

All chemically treated plots exhibited lower canopy heights than that of the control (Table 23). Embark was most effective followed by Ethrel. EL 500, PP-333, and Limit were least effective. In both years, Embark caused cessation of growth within a week after application with resumption of growth within 5 weeks (Fig. 1). The effects of Ethrel were not apparent until about the third week after application. From that point until more than 10 weeks after application, it produced the lowest canopy heights of all treatments. Effects of EL 500 and PP-333 were delayed even further than Ethrel's, becoming evident between only the third to fourth week after application. Limit appeared to have a long range effect, causing canopy heights nearly the same as those of Ethrel 10 weeks after treatment. In seasonal performance over both years, Embark and Limit performed best in spring with Ethrel being slightly less effective and EL 500 and PP-333 least effective (Table 23). In summer and fall, Embark and Ethrel were most effective while Limit, EL 500, and PP-333 were least effective.

Toxicity levels averaged over all treatments and seasons did not differ between the 2 years (1983: 6.6 vs 1984:7.4). Toxicity levels among seasons averaged over both years were lower in the fall (6.5) with spring and summer being similar at 7.6 and 7.4, respectively. EL 500 was the only chemical to show no toxicity over all seasons and years (Table 24). PP-333 caused only slight discoloration while Ethrel and Limit showed a little more, but nothing objectionable. Embark severely damaged the leaves and apical meristems causing the turf to turn brown. Toxicity from Limit and Embark were seen 1 week after application and remained through the fourth week after which the turf began to recover. Recovery from Embark was through growth of lateral meristems. Toxic effects from Ethrel were not evident until 3 weeks after application and remained until the sixth week.

The only chemical to perform differently between years averaged across seasons was Embark. In 1983, it was significantly more toxic than in 1984. Likewise, Embark caused unacceptable turf quality in all seasons averaged over years. It showed higher quality in spring compared to summer and fall. Limit lowered spring turf quality close to the level of Embark. The damage was less in summer and fall. Ethrel allowed top quality turf in spring with slightly lower quality in summer and noticeably lower quality in fall. EL 500 and PP-333 allowed top quality turf in spring and summer with only slight damage in fall.

In 1983, Embark did not cause variable toxicity levels across seasons while in 1984, it was least toxic in spring, more toxic in summer, and even more toxic in fall. Limit's effects were also nonvariable in 1983, and variable in 1984, giving lowest quality turf in spring, slightly better turf in fall, and good quality turf in summer. Ethrel, EL 500, and PP-333 performed similarly across seasons in both years.

Carryover effects through winter, of chemicals applied in fall 1983, were studied in spring 1984 (Table 25). Embark eliminated spring heading in this case, while all other chemicals were ineffective. Spring green-up of these plots showed that the toxic effects of Embark, PP-333, and Limit were still apparent. Ethrel was the only chemical to remain active in leaf growth inhibition.

Leaf lengths and numbers were determined by averaging samples taken 28 and 45 days after summer treatments in both years. Over all chemical treatments there were similar numbers of leaves absent between 1983 and 1984 but shorter leaves were observed in 1984, compared to 1983 (Table 26). Each chemical affected leaf growth differently. With EL 500, PP-333, and Limit the accumulated length of all five leaves was not drastically reduced compared to the control, rather Leaf 1 and Leaf 2 were significantly shorter, Leaf 3 was similar, and with the exception of Limit, Leaf 4 was longer. Leaf 5 was usually absent. There seems to have been a slight redistribution of leaf area away from newly produced leaves toward older leaves with EL 500 and PP-333 but not with Limit. This redistribution phenomenon appears to have been very strong with Ethrel where lengths of Leaf 1 - 5 were similar averaging 3.2 cm. Embark was also unique in that Leaf 1 - 3 were short while Leaf 4 and 5 were usually absent.

The data indicating number of leaves absent show that EL 500, PP-333, and Limit were similar to the control in usually having Leaf 1 - 3 present with Leaf 4 absent about half the time and Leaf 5 absent most of the time. With Embark, Leaf 1 - 3 were absent one third of the time while Leaf 4 and 5 were absent most of the time. With Ethrel a few leaves were missing only in 1984, at Leaf 4 and 5.

There were a few isolated differences of chemical effects on leaf length between the two years. At Leaf 1, EL 500, PP-333, and Limit caused shorter leaves than that of the control in 1983, but there was no difference in 1984. At Leaf 4, Ethrel and EL 500 resulted in similar leaf lengths in 1983, at around 3.0 cm while in 1984, all treatments with the exception of Embark had leaves of that length. The number of leaves absent at Leaf 1 - 4 did not vary much between the two years for any treatment with the exception of Embark. It caused fewer leaves to be absent at Leaf 1 and 2 and more leaves to be absent at Leaf 3 and 4 in 1984, compared to 1983.

Shoot elongation beyond that observed in control plants occurred in both years with Ethrel treatments, only (Table 25).

Data over two growing seasons indicate that all chemicals, with the exception of Limit, were fairly stable across the three dates of application in the inhibition of leaf growth of Kentucky bluegrass. Limit was very effective in spring and less so in summer and fall. Ethrel and Embark were consistently very effective while EL 500 and PP-333 were not. All chemicals were sensitive, however, to environmental variation in terms of toxicity. Those chemicals with a higher degree of toxicity (i.e. Embark, Limit, and Ethrel) appeared to be the most sensitive. For instance, during summer 1983, plants suffered from more heat stress than in summer 1984. Embark was most toxic during summer and fall of 1983. Limit and Ethrel were unique in that they were most toxic in spring and fall, respectively, in both years. Regardless of their sensitivity, the chemicals that were most toxic were the ones most effective in inhibiting leaf growth. Ethrel was unique, also, in that it caused the highest level of growth inhibition over a ten week period while allowing very good turf quality. Since it was also the only chemical to cause stem elongation in the shoot, perhaps it acts by shifting growth away from the leaves in favor of the stem. This could be beneficial in terms of allowing healthy, dense turf while inhibiting leaf elongation. A potential advantage provided by Embark and Ethrel was shown in their ability to inhibit spring heading and early spring leaf growth, respectively, when applied the previous fall. Both could be a great help to turf managers who lack time for intensive spring mowing.

Table 23. Mean canopy heights of Kentucky bluegrass four weeks after growth retardant treatments in 1983 and 1984 at three dates of application.

Growth Retardant	Rate (lb a.i./ acre)		Spring May 10	Summer Jun 18	Fall Sep 22	Yearly Average	Grand Mean 83-84
			cm				
Ethrel	4.0	1983		7.3	5.0	6.2	
		1984	8.0	5.3	6.3	6.6	
							6.4
EL 500	1.0	1983		9.3	7.0	8.2	
		1984	9.3	7.0	7.0	7.8	
							7.9
Embark	0.4	1983		5.7	5.0	5.3	
		1984	6.7	5.0	5.3	5.7	
							5.5
PP-333	0.4	1983		8.3	6.7	7.5	
		1984	9.0	6.7	7.7	7.8	
							7.7
Limit	2.5	1983		8.7	6.3	7.5	
		1984	7.7	7.7	8.0	7.8	
							7.7
Control	---	1983		10.7	6.7	8.7	
		1984	11.3	7.7	10.0	9.7	
							9.3
LSD (α = 0.05) within a year				1.1		0.8	
LSD (α = 0.05) between dates				1.9			
LSD (α = 0.05) between years				2.4		1.7 (NS)	
LSD (α = 0.05)							0.5

Table 24. Mean toxicity ratings[a] of Kentucky bluegrass four weeks after growth retardant treatments in 1983 and 1984 at three dates of application.

Growth Retardant	Rate (lb a.i./ acre)	Year	Spring May 10	Summer Jun 18	Fall Sep 22	Yearly Average	Grand Mean 83-84
Ethrel	4.0	1983		8.0	5.0	6.5	
		1984	8.0	7.0	6.3	7.1	
							6.9
EL 500	1.0	1983		9.0	7.6	8.3	
		1984	9.0	8.3	7.3	8.2	
							8.3
Embark	1.4	1983		2.0	2.0	2.0	
		1984	5.3	4.7	4.0	4.7	
							3.6
PP-333	1.4	1983		8.3	7.3	7.8	
		1984	9.0	8.7	7.3	8.3	
							8.1
Limit	2.5	1983		7.3	6.7	7.0	
		1984	6.3	8.3	7.3	7.3	
							7.2
Control	---	1983		8.3	7.7	8.0	
		1984	8.3	9.0	9.0	8.8	
							8.5
LSD (α = 0.05) within a year				0.8		0.6	
LSD (α = 0.05) between dates				0.9			
LSD (α = 0.05) between years				1.2		0.9 (NS)	
LSD (α = 0.05)							0.4

[a] Ratings based on color; 9 = best, 6 = acceptable, 1 = brown.

Table 25. Means of 1983-1984 heading ratings of Kentucky bluegrass in response to spring-applied growth retardants. Mean heading ratings, toxicity ratings, and canopy heights during spring 1984 in response to carry over effects from 1983 fall-applied growth retardants. Mean internode lengths and numbers in Kentucky bluegrass shoots averaged over samples taken 28 and 45 days after June 12, 1983, treatment with growth retardants.

Growth Retardant	Rate lb a.i./ acre)	1983-1984 Heading[a]	Carryover Heading[a]	Carryover Turf Color[b]	Carryover Canopy Height	Internode Length	Internode Number
					cm	cm	
Ethrel	4.0	2.5	1.3	7.3	7.0	0.5	3.3
EL 500	1.0	1.8	1.7	6.0	11.0	0.1	0.2
Embark	0.4	8.7	8.0	4.3	10.7	0.1	0.6
PP-333	0.4	2.5	1.0	5.0	10.7	0.1	0.2
Limit	2.5	7.5	3.0	5.0	9.0	0.1	0.4
Control	---	2.8	1.0	6.0	9.3	0.0	0.0
LSD (α = 0.05)		1.7	2.0	1.5	3.2	0.1	0.4

[a] Ratings with 9 = no heads and 1 = full heading.

[b] Ratings based on color; 9 = best, 6 = acceptable, 1 = brown.

Result of 1984 Turfgrass Disease Control Trials

L. E. Sweets

Selected fungicides were tested in field trials for efficacy of control of Bipolaris leaf spot (Bipolaris sorokinianum) on bluegrass and dollar spot (Sclerotinia homeocarpa) on bentgrass. Trials were conducted on the Turfgrass Research Plots at the Horticulture Research Station, Ames, Iowa.

Fungicides were applied to Penneagle bentgrass maintained at a 5/32-inch cutting height and Park bluegrass maintained at 2-inch cutting height. Fungicides were applied with a modified bicycle sprayer at 30 lb psi and a dilution rate of 5 gal/1000 ft^2. The experimental design was a randomized block plan with four replicates. The plots were 4 X 5 feet. Fungicides were applied on a 7, 14, 21, or 30-day schedule. Applications began on June 6, 1984, and continued through September 26, 1984. Plots were evaluated for percent diseased turf on July 18, and August 15, 1984.

Dollar Spot on Penneagle Bentgrass

The purpose of this study was to evaluate the relative efficacy of standard and experimental fungicides in the control of dollar spot. Fungicides included in the trial along with rates of application and spray schedules are given in Table 26. The trial was conducted in an area with a history of dollar spot and Rhizoctonia brown patch. Disease ratings for dollar spot were made on July 18 and August 15. Ratings were made on the basis of the percent of diseased turf per plot. Specific rating results are presented in Table 26.

Bipolaris Leaf Spot on Park Bluegrass

The purpose of this trial was to compare the relative efficacy of standard and experimental fungicides in the control of Bipolaris Leaf Spot. Although the trial was located in an area with a history of leaf spot, little leaf spot developed in the trial area during 1984. Ratings showed little disease and no statistical differences between plots. None of the plots showed symptoms of phytotoxicity from fungicides applied.

Table 26. Rates, spray schedules and efficiency of fungicides tested in dollar spot trial.

Treatment Number	Product	Time Interval Between Spray (Days)	Rate of Formulated Product ($oz/1000\ ft^2$)	Disease Rating[a] July 20	August 11
1	Daconil 2787	7-14	3.0 oz	2.5 bc	28.75 abc
2	Daconil 2787	7-14	6.0 oz	3.75 abc	12.50 c
3	Chipco 26019	14-21	1.5 oz	13.75 abc	37.50 ab
4	Chipco 26019	14-21	2.0 oz	5.00 abc	16.25 bc
5	Bayleton 25DF	30	2.0 oz	7.5 abc	17.50 bc
6	Bayleton 25DF	30	1.0 oz	12.50 abc	22.50 bc
7	Bayleton 25DF	14	0.5 oz	8.75 abc	22.50 bc
8	Bayleton 0.5%G	30	50.0 oz	2.50 bc	26.25 abc
9	Bayleton 9.5%G	14	25.0 oz	6.25 abc	28.75 abc
10	Dyrene 4F	14	8.0 oz	21.25 ab	22.50 bc
11	Banner	21	1.0 oz	8.75 abc	15.00 bc
12	Mancozeb 80W	21	8.0 oz	10.00 abc	20.00 bc
13	Banner/Mancozeb	21	3.0 oz	5.00 abc	11.25 c
14	Banner/ Chlorothalonil	21	3.0 oz	6.25 abc	18.75 bc
15	DPX H6573	14	.75 oz	10.00 abc	22.50 bc
16	DPX H6573	14	1.25 oz	8.75 abc	17.50 bc
17	Tersan 1991	14	1.0 oz	15.00 abc	28.75 abc
18	Duosan	14	3.0 oz	2.50 bc	31.25 abc
19	Vorlan	14	2.0 oz	15.00 abc	46.25 a
20	Check			22.50 a	23.75 abc

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

Sod Reestablishment Study

N. E. Christians

On September 19, 1980, a sod establishment study that included Glade, Parade, Ram I, Rugby, and Touchdown Kentucky bluegrass was established at the research station. Each cultivar planting measured 20 X 12 feet and the study was arranged in a randomized complete block design with four replications. Data were collected on this study until September 1982 when sod strength measurements were taken, the investigation was terminated, and the results were reported in an earlier research publication. The study area was maintained with 4 lb N/1000 ft^2/yr and mowed at a 2-inch mowing height during the 1983 season.

All sod was removed uniformly from the study area on May 19, 1984, at a cutting depth of 0.5 inches. The area was watered immediately after harvest to prevent desiccation of the severed rhizomes. The entire study area was fertilized with 1 lb N/1000 ft^2 in May, August, and September of 1984 and the area was irrigated to prevent drought stress. The objectives of this part of the study are to observe the reestablishment of the five cultivars from rhizomes and to determine if Kentucky bluegrass cultivars differ in their reestablishment rate after harvest.

Parade and Ram I were the slowest to recover after harvest and Rugby was intermediate (Fig. 6). Glade and Touchdown recovered most rapidly with plots established to these cultivars showing 70% cover by October 13, 1984. The data listed here are preliminary and more complete data, including sod strength measurements, will be collected in 1985.

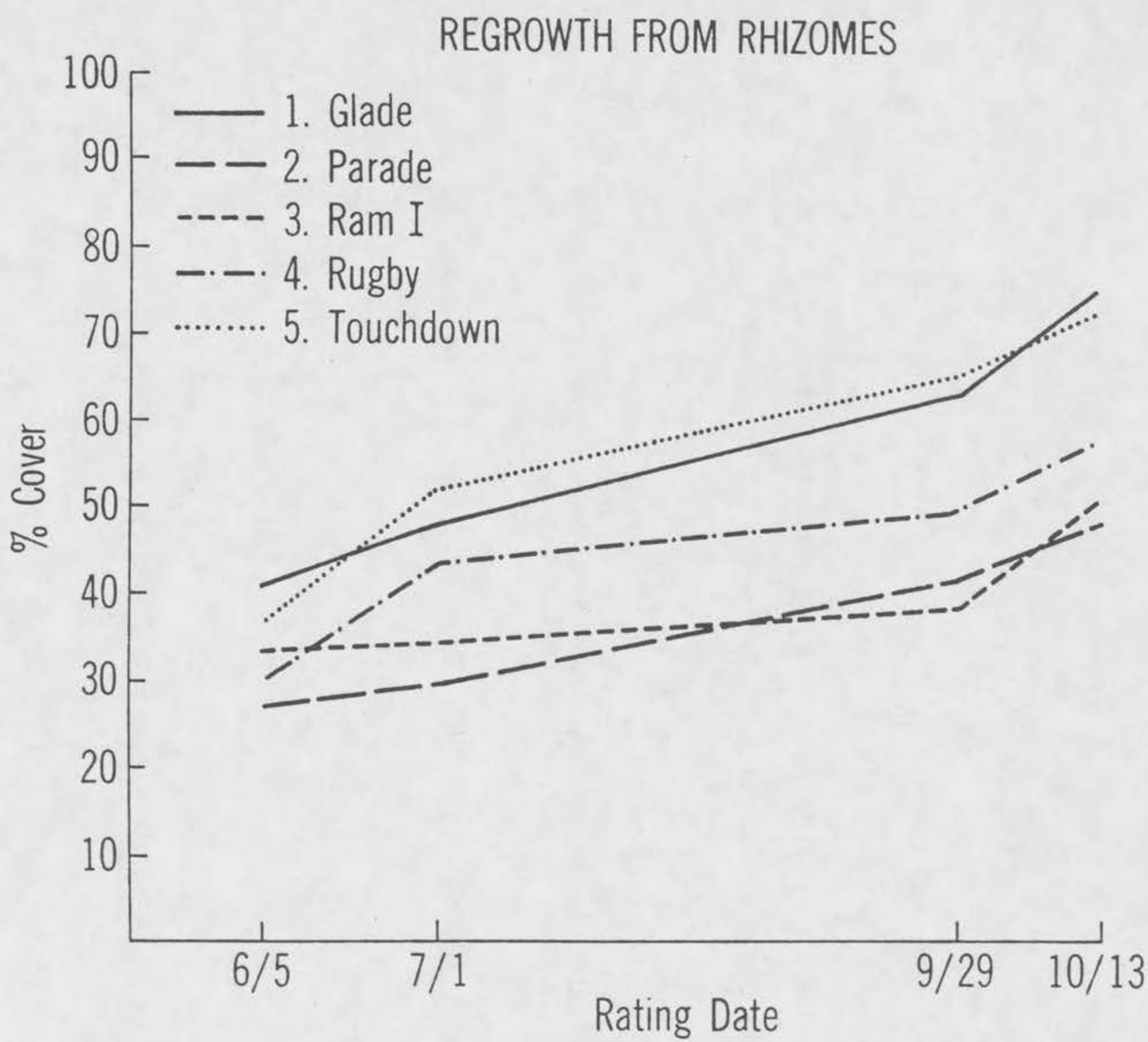


Figure 6, The regrowth of five Kentucky bluegrass cultivars from rhizomes following harvest on May 19, 1984.

Dormant Seeding Study

K. L. Diesburg

The optimum time to sow cool season turfgrasses in Iowa is from mid-August to mid-October. Seedlings benefit from cool night temperatures, adequate rainfall, and freedom from annual weed competition from September to November. Their roots can continue to grow at a very slow rate through the winter if they have snow cover for insulation. The plants complete their establishment in spring forming a mature turf capable of tolerating the heat and drought stress of summer.

Even though 2 months in early fall seems like ample time in which to sow turfgrass, the seasonal deadline is often missed, possibly because fall directs our thinking toward harvest and preparation for winter rather than planting and nursing a young crop. What is the next option if one finds that early November has come and gone and the grass seed is still in the bag? The usual course is to wait until next April or May to sow and accept the consequences of summer heat and drought. Annual weeds are usually a problem as well, even with the aid of Siduron preemergent herbicide.

In this experiment, another option was tested; planting seed when it is too late for fall germination. This can be called dormant seeding, implying that the seeds lie inactive in snow or soil as long as they are below $0^{o}C$. They could have a low activity rate in 0 - $10^{o}C$, imbibing water and enlarging the embryo in preparation for germination as soon as the soil becomes warm enough.

Two Kentucky bluegrass cultivars (Rugby and Park) were tested at four planting dates; the 6th of November, December, February, and March, at a seeding rate of 0.6 lb seed/1000 ft^2. A third cultivar (Parade) had been previously planted on September 22. Establishment was excellent so it was used for comparison to the experimental plots. Starter fertilizer (15-25-10) was applied to the whole trial in November at a rate of 3.2 lbs material/1000 ft^2. In November the seed was raked into bare soil, whereas in December, February, and March it was worked into snow and ice.

Rugby and Park did not differ from one another in establishment at any planting date treatment. Their establishment was better in the November seeding than in any other seeding date (Table 22). The stand from the September seeding of Parade, however, looked better than any treatment in the experiment. When planted in November, the stands of Rugby and Park were already covering the ground by April 26. This is about the time spring seeding can first be done after the soil has dried enough to be worked. Stands from the other three planting dates started out poorly but improved gradually through the growing season. From June to September, annual weeds were so thick, ratings could not be taken. By October 17, stands from February and March seeding dates were comparable to those of November.

Even though the soil was too cold in November for germination, the seed could still be raked into it. Soil temperatures at a 2-inch depth ranged from 2 to $12^{o}C$ through November, remained below $0^{o}C$ from December to February 10, and ranged between 0 and 12°C from February 11 through April. During the times above 0°C, seed incorporated into the soil could imbibe moisture and complete the early stages of germination. This can be called "pregermination." As soon as the soil temperatures went above 10°C, the seeds could quickly complete the final stages of germination and emerge from the soil, thus avoiding the usual delays necessary in a spring seeding for working the soil, imbibition, and release from dormancy. Stands in the December, February, and March seedings were not good because most of their seeds were trapped in the snow and ice, unable to take advantage of the above zero soil temperatures.

The results from this experiment indicate that a dormant seeding in November is preferable to the other dormant seeding dates tested, but it most likely would not be as successful as an early fall planting.

Table 22. Mean establishment ratings and seedling counts of Kentucky bluegrass cultivars at five planting dates.

Planting Date	Cultivar	Ratings[a] Apr 26	May 25	Oct 3	Oct 17	Mean	Stand[b]
Sept 22	Parade	9.0	9.0	9.0	9.0	9.0	---
Nov 6	Rugby	7.0	7.0	7.0	8.0	7.2	177
	Park	8.0	7.5	7.5	8.0	7.7	162
Dec 6	Rugby	3.0	3.5	3.5	4.5	3.6	24
	Park	3.0	3.0	4.0	5.0	3.7	48
Feb 6	Rugby	3.0	4.0	5.0	6.0	4.5	42
	Park	4.0	4.0	6.0	6.0	5.0	75
March 6	Rugby	2.0	4.0	3.5	5.5	3.8	42
	Park	3.0	3.5	5.0	7.0	4.6	48
Experiment Mean		4.4	4.9	5.3	6.4	5.2	79
LSD ($\alpha = 0.05$)		0.0	1.4	1.9	1.1	0.9	30

[a] Ratings based on a scale of 1 - 9; 9 = plot completely covered, 5 = plot half covered, 1 = no plants.

[b] Stand estimated by counting the number of seedlings in a random square foot three times per plot.

Influence of Soil Compaction on 49 Kentucky Bluegrass Cultivars

M. L. Agnew

The 49 Kentucky bluegrass cultivars located in section two of the turfgrass reaserch area were seeded in the fall of 1979. These plots were fertilized at a rate of 4 lb N/1000 ft^2/year (urea) in both the 1980 and 1981 seasons and with 4 lb N/1000 ft^2/year (SCU) in 1982, 1983, and 1984. No insecticides or fungicides have been used on the area. Irrigation was applied as needed to prevent drought.

In 1985, this cultivar trial was used to evaluate the effects of soil compaction on the growth and development of 49 Kentucky bluegrass cultivars. Compaction was applied with a smooth power roller which exerted a static pressure of 2.5 Kg cm^{-2} (35.5 in^{-2}).

Measurements to be taken include thatch development, root density, shoot density, clippings, and visual quality. With this information, we should be able to give better cultivar recommendations for heavy traffic areas.

Introducing the Iowa State University Personnel Affiliated with the Turfgrass Research Program

DR. MICHAEL AGNEW	Assistant Professor, Turfgrass Extension. Horticulture Department.
DR. NICK CHRISTIANS	Associate Professor, Turfgrass Science. Research and Teaching. Horticulture Department.
MISS CHARLEEN CIACCIO	Turfgrass Graduate Student, Horticulture Department M.S. (Hodges).
MR. KEN DIESBURG	Turfgrass Graduate Student and Research Associate, Horticulture Department Ph.D. (Christians).
MR. MICHAEL GAUL	Turgrass Graduate Student, Horticulture Department M.S. (Christians).
DR. CLINT HODGES	Professor, Turfgrass Science. Research and Teaching. Horticulture Department.
MR. YOUNG JOO	Turfgrass Graduate Student, Horticulture Department Ph.D. (Christians).
DR. DONALD LEWIS	Associate Professor, Extension Entomologist. Entomology Department.
MR. BRIAN MALOY	Turfgrass Graduate Student, Horticulture Department M.S. (Christians). Graduated - Spring 1985
DR. JAMES MIDCAP	Associate Professor, Ornamental Horticulture Extension. Horticulture Department.
MR. RICK MOORE	Field and Lab Technician. Horticulture Department.
MR. PAUL NORMAN	Irrigation Technician. Horticulture Department.
MR. MIKE NULL	Field Technician. Horticulture Department.
MR. ZACHARY REICHER	Field and Lab Technician. Horticulture Department.
MISS MEI-YU SU	Turfgrass Graduate Student. Horticulture Department M.S. (Hodges).
DR. LAURA SWEETS	Associate Professor, Extension Plant Pathologist. Plant Pathology Department.

COMPANIES AND ORGANIZATIONS that have made donations to the Research Program

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Brayton Chemical Company
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Britt Tech Corporation
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CIBA-Geigy Corporation
Agriculture Division
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Lincoln, Nebraska 68501

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Omaha, Nebraska 68103

Elanco Products Company
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Halsey, Oregon 97348

Iowa Golf Course Superintendents Association

Iowa Professional Lawn Care Association

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Milwaukee, Wisconsin 53201

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4346 South 90th
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* 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 Christians