1984

Illinois Turfgrass Research Report

Department of Horticulture and
Agricultural Experiment Station
University of Illinois at Urbana-Champaign

Horticulture Series 51, March 1985

Forward

This report presents the results for 1984 for turfgrass research projects conducted in Illinois. Contributors to the report include scientists from the Departments of Horticulture and Plant Pathology and the Office of Agricultural Entomology at the University of Illinois and the Department of Crop and Soil Sciences at Southern Illinois University. We hope the information presented in this research report will aid turfgrass managers throughout Illinois when making management decisions.

Turfgrass research in the state of Illinois would not be possible without the continuous and generous support of the Illinois turfgrass industry. Thanks and appreciation are due to all individuals, organizations and businesses that support and participate in our projects.

Jean Haley

Jean Haley, Editor

David Wehner

David Wehner, Associate Editor

ACKNOWLEDGEMENTS

We would like to express thanks to the following companies and organizations for their support of our turfgrass research program during 1984 through their contributions of time, materials, or funding.

American Hoechst Corporation
Beckman Turf & Irrigation
Benck's Turf Nursery
Cantigny Gardens & Museums
Central Illinois Golf Course Superintendents Association
Chicago District Golf Foundation
CIBA-GEIGY Corp.
W. A. Cleary
Sean M. Daley
John Deer & Company
DuPage County Extension Office
E. I. Du Pont de Nemours & Co.
Elanco Products
Estech General Chemicals Corp.
BFC Chemicals, Inc.
Glencoe Golf Club
Hawkeye Chemicals
H.& E. Sod Nursery, Inc.
Hardy Turf, D. A. Hoerr $ sons
Illinois Lawn Equipment, Inc.
Illinois Turfgrass Foundation
Indian Lakes Resort
Ed Keeven Sod Co., Inc.
Lakeshore Equipment & Supply
Lebanon Chemical Corp.
Lincolnshire Fields Country Club
3M
Mallinckrodt Inc.
Melamine Chemical
Midwest Association of Golf Course Superintendants
Mobay Chemical Corporation
Monsanto Co.
Mueller Turf Nursery
Nice 'N Green
Noram Chemicals, Inc.
Northrup King Co.
Northwestern Illinois Golf Course Superintendents Association
Olin Corporation
Pure Seed Testing, Inc.
Quad-State Golf Course Superintendents Association
Quality Turf Nurseries
Red Hen Turf Farm, Inc.
Rhone-Poulenc, Inc.
Rock Island County Extension Office
O. M. Scott and Sons

Seaboard Seed Co.
SDS Biotech
Silver Lake Country Club
Southern Illinois Golf Course Superintendents Association
Stauffer Chemical Co.
Thornton's Sod Nursery
Toro Co.
TUCO
Tyler Enterprises
Union Carbide
University of Illinois Athletic Association
Velsicol Chemical Company
Benedict O. Warren
Warren's Turf Nursery, Inc.

This report was compiled and edited by Jean E. Haley, Assistant Horticulturist, Department of Horticulture, University of Illinois.

Papers in this research report are not for publication except by written permission of the author(s).

TABLE OF CONTENTS

TABLE OF CONTENTS

USDA NATIONAL KENTUCKY BLUEGRASS TRIAL

T. W. Fermanian, J. E. Haley, and D. J. Wehner

INTRODUCTION

Kentucky bluegrass (Poa pratensis) is the primary turfgrass used for home lawns in most of Illinois. The many available cultivars of Kentucky bluegrass differ considerably in characteristics such as quality, color, density, texture, stress tolerance, resistance to disease and insect infestation. The turf program at the University of Illinois is one of 35 participants in a nationwide Kentucky bluegrass evaluation trial. This evaluation will examine the long term performance of 84 Kentucky bluegrass cultivars under a variety of environmental conditions and cultural programs. At the Urbana research facility a trial has been established on a silt loam soil. A duplicate trial has been established on a pure sand soil at our Kilbourne facility. The soil at these sites differs primarily in nutrient and moisture holding capacity.

Urbana

MATERIALS AND METHODS

The Urbana evaluation was established September 15, 1980. Plot size is 5 x 6 feet and each cultivar is replicated 3 times. Prior to establishment, the area was fertilized with 1 lb N/1000 sq ft (12-12-12). After seeding, plots were covered with Soil Guard, a synthetic spray mulch and irrigated as needed. In 1981 the area received a total of 4 lb N/1000 sq ft (12-12-12) and in 1982 the area was fertilized with a total of 3 lb N/1000 sq ft (18-5-9). During the 1983 and 1984 growing season the area was treated with 4 lb N/1000 sq ft (18-5-9). No preemergence crabgrass control herbicide was used. The area was irrigated as needed to prevent wilt.

In 1983 half of each 6 x 5 foot plot was treated with the growth retardant amidochlor (Limit®) at a rate of 2.0 lb ai/A. In 1984 the same half of each plot was treated with 2.5 lb ai/A of amidochlor. This was to determine any differences in response to the growth regulator among the cultivars. The turf was allowed to grow for 2 weeks without mowing. Turfgrass height and seedhead production were evaluated. The results of this investigation are listed in the report "Kentucky Bluegrass Response to the Application of Limit®, a Plant Growth Retardant", page 55.

RESULTS

During 1983 turfgrass quality was fair to good with quality the highest during June and September. Although the plots were irrigated, quality declined during July and August because of heat and drouth stress. Several cultivars that did not recover from the stress are Lovegreen, Charlotte, Dormie, and S-21. Cool weather pythium affected the early spring performance of many varieties. Varieties exhibiting the greatest susceptibility to pythium were Piedmont, Wabash, K3-162, S. D. Common, Kenblue and Monopoly. Dollar spot disease was a problem in late July. The cultivars A20-6A, A20-6, Escort, Harmony, Charlotte, Nugget, and Dormie showed the most injury from this disease.

Turfgrass cultivars differed widely in their performance throughout the 1984 growing season (Table 1). In general, turfgrass quality was fair to excellent with quality the highest during April and June. Good quality was maintained throughout the summer. There were no major disease problems during 1984.

Kilbourne

MATERIALS AND METHODS

The trial at the Illinois River Sand Field, Kilbourne, was established April 6, 1981. Dolomitic limestone was applied to the area at 1.5 tons/A in the fall 1980. Prior to seeding, fertilizer was applied as 34-0-0 (1.6 lb N/1000 sq ft), 0-44-0 (110 lb/A), 0-0-60 (280 lb/A) and potassium magnesium sulfate (180 lb/A). Both complete analysis fertilizers (water soluble nitrogen source) and slow-release nitrogen fertilizers were applied throughout 1981, totaling 6.5 lb N/1000 sq ft. Granular Tupersan, a preemergence crabgrass herbicide was applied at seeding at a rate of 6 lb ai/A. A second application of Tupersan WP was made on May 18, 1981 at a rate of 6 lb ai/A. Basagran at 1 quart/A was applied on September 19 and September 28, to control nutsedge. Irrigation is essential for turf growing in a pure sand soil. Although excessive rainfall characterized the 1981 growing season, plots were still irrigated to prevent moisture stress. Plots were irrigated as follows: 3.0"/April in 10 applications, 1.3"/May in 5 applications, 2.8"/June in 4 applications, 3.4"/July in 4 applications, 4.2"/August in 5 applications and 2.5"/September in 3 applications.

During the 1982 growing season the turf was fertilized with a 12-12-12 analysis fertilizer. Applications were made in April, June, August, and October at a rate of 0.6 lb N/1000 sq ft per application. The preemergence herbicide siduron (Tupersan) was applied at a rate of 6 lb ai/A on April 28 and June 9. Plots were irrigated to prevent moisture stress as follows: 3.0"/May in 5 applications, 1"/June in 1 application, 6.0"/July in 4 applications, and 6.0"/August in 6 applications.

In 1983 the turf was fertilized with approximately 5.8 lb N/1000 sq ft during the growing season. Fertilizers and rates used include 12-12-12 at 0.5 lb N/1000 sq ft on May 5 and 0.6 lb N/1000 sq ft on June 6, July 5 and August 1; 18-5-9 at a rate of 0.9 lb N/1000 sq ft August 17 and 31; Nitroform (38-0-0) at 1 lb N/1000 sq ft on May 5; and IBDU (31-0-0) at a rate of 0.7 lb N/1000 sq ft on August 1. The area was irrigated during the season as follows: 5.05"/May in 4 applications, 4.5"/June in 4 applications, 7.4"/July in 6 applications, 4.1"/August in 5 applications and 2.4"/Sept. in 3 applications.

In 1984 the turfgrass at Kilbourne was fertilized May 15 with IBDU (31-0-0) at 1.25 lb N/1000 sq ft and nitroform (38-0-0) at 0.6 lb N/1000 sq ft. On June 11 and June 18 ammonium nitrate (33.5-0-0) was applied at 0.5 lb N/1000 sq ft. The turf was treated with Lorsban® to control sod webworm on June 1.

Irrigation for the 1984 growing season was as follows: 5.55"/June in 7 applications, 4.05"/July in 7 applications and 6.40"/August in 6 applications.

RESULTS

With a few exceptions, quality was better during the 1983 growing season than in previous years. Although July and August were drouthy most cultivar quality remained fair to good. The availability of frequent, deep irrigation prevented any drouth injury to the turf and kept the plants from becoming dormant. There were no disease problems at this site during the 1983 season.

In 1984 turfgrass quality was fair to good (Table 2). Highest turfgrass quality was found during July, August and September. Sod webworm infestation was a problem during late May. Many cultivars were resistant to this insect infestation. Those cultivars most seriously damaged by the insect were Vantage, Barblue, Piedmont, Wabash, A-34, Argyle, S.D. Common, Kenblue, Challenger and the experimental varieties K3-179 and K3-162.

Table 1. Evaluation of Kentucky bluegrass cultivars during the 1984 growing season - Urbana.[1]

Cultivar	All Dates[2]	Quality[3]			
		4/10	6/29	8/02	9/13
Mystic (P141)	8.6	9.0	9.0	8.0	8.3
I-13	8.6	7.7	9.0	9.0	8.7
A20-6A	7.9	8.0	8.0	8.0	7.7
Eclipse	7.9	6.7	8.0	8.7	8.3
WW AG 478	7.9	5.0	9.0	9.0	8.7
PSU-173	7.9	7.3	8.3	8.0	8.0
PSU-150	7.8	7.0	8.0	8.0	8.3
H7	7.8	7.3	7.7	8.0	8.3
Wabash	7.8	9.0	7.3	7.3	7.3
Ram I	7.8	6.0	8.3	8.3	8.3
Plush	7.8	7.3	7.7	8.3	7.7
Somerset (SH-2)	7.7	7.7	8.0	7.3	7.7
A20-6	7.7	6.3	8.0	8.0	8.3
225	7.7	7.7	8.3	8.0	6.7
Nugget	7.6	5.0	8.7	8.7	8.0
Birka	7.6	7.0	7.7	8.0	7.7
Midnight (1528T)	7.6	6.3	8.3	8.3	7.3
WW AG 480	7.6	7.7	8.0	7.3	7.3
Cello	7.6	7.0	8.7	7.3	7.3
A20	7.5	7.0	7.7	8.0	7.3
PSU 190	7.5	7.3	7.3	8.3	7.0
Enmundie	7.5	6.7	7.3	8.0	8.0
K3-179	7.5	7.0	7.7	7.3	8.0
Sydsport	7.5	7.7	8.3	7.0	7.0
Kimona	7.5	5.3	7.7	8.7	8.3
Adelphi	7.5	7.3	8.0	7.3	7.3
Trenton	7.3	8.3	7.0	7.3	6.7
A-34	7.3	7.7	7.3	7.3	7.0
WW AG 463	7.3	7.0	7.0	7.7	7.7
Escort	7.2	6.0	7.3	8.0	7.7
Bono	7.2	6.7	7.0	8.0	7.3
239	7.2	8.7	6.3	7.7	6.3
Rugby	7.2	8.3	7.0	6.7	7.0
CEB VB 3965	7.2	7.0	7.0	6.7	8.0
Parade	7.2	8.3	6.3	7.0	7.0

(continued)

Table 1. Evaluation of Kentucky bluegrass cultivars during the 1984 growing season - Urbana (continued).[1]

Cultivar	All Dates[2]	Quality[3] 4/10	6/29	8/02	9/13
Cheri	7.2	7.0	7.7	7.3	6.7
Glade	7.2	6.0	8.0	7.3	7.3
NJ 735	7.1	6.7	7.0	7.3	7.3
K1-152	7.1	7.7	7.7	6.7	6.3
Admiral	7.1	8.3	7.0	6.7	6.3
Piedmont	7.1	7.7	6.7	7.0	7.0
Merion	7.0	7.7	7.3	6.3	6.7
K3-178	7.0	8.0	6.7	6.7	6.7
Baron	7.0	6.7	7.0	7.3	7.0
Mosa	7.0	5.3	7.7	7.7	7.3
Banff	7.0	8.7	6.7	6.7	6.0
Mona	6.9	8.7	7.0	6.0	6.0
Majestic	6.8	7.7	8.0	5.3	6.3
Shasta	6.8	7.0	7.0	6.3	7.0
Bonnieblue	6.8	7.0	7.0	7.0	6.3
Argyle	6.8	8.7	5.7	6.7	6.0
America	6.8	6.7	7.3	6.0	7.0
K3-162	6.8	8.0	5.3	6.7	7.0
Victa	6.8	6.7	7.0	6.7	6.7
Vanessa	6.8	5.3	7.3	7.0	7.3
Welcome	6.8	6.3	8.0	5.7	7.0
Monopoly	6.8	4.7	7.3	7.3	7.7
Vantage	6.8	8.7	5.7	6.7	6.0
Columbia	6.7	8.3	6.7	6.0	5.7
Challenger (N535)	6.7	6.7	7.7	6.7	5.7
Bayside	6.6	7.7	6.7	5.7	6.3
Barblue	6.6	7.7	7.0	5.3	6.3
Geronimo	6.6	7.0	6.7	6.3	6.3
MER PP 300	6.6	5.7	7.0	7.0	6.7
Bristol	6.5	7.0	7.0	6.0	6.0
Fylking	6.4	6.3	7.0	6.0	6.3
Touchdown	6.3	6.7	7.3	6.3	5.0
MLM 18011	6.3	6.0	7.3	6.0	6.0
Charlotte	6.3	6.7	7.0	6.3	5.3
Aspen	6.3	6.7	7.0	5.7	6.0

(continued)

Table 1. Evaluation of Kentucky bluegrass cultivars during the 1984 growing season - Urbana (continued).[1]

Cultivar	All Dates[2]	Quality[3] 4/10	6/29	8/02	9/13
Nassau (243)	6.3	7.7	6.7	6.0	5.0
Harmony	6.2	5.7	7.0	5.7	6.7
Lovegreen	6.2	6.0	8.0	5.3	5.7
Merit	6.2	6.3	7.0	6.3	5.3
Apart	6.2	7.7	6.0	5.7	5.7
SV-01617	6.2	5.3	7.0	5.7	6.7
Enoble	6.2	4.7	6.3	6.3	7.3
Holiday	6.2	5.0	7.3	6.0	6.3
BA-61-91	6.1	5.3	6.7	6.3	6.0
MER PP 43	6.1	7.7	6.0	6.0	4.7
Kenblue	5.9	8.3	4.7	5.3	5.3
Dormie	5.9	7.7	5.7	5.0	5.3
S.D. Common	5.8	8.3	4.3	5.3	5.3
S-21	5.8	8.0	4.0	5.7	5.7
$LSD_{0.05}$	0.7	1.3	1.0	1.5	1.6

[1]All values represent the mean of 3 replications.

[2]Values represent the mean of 12 scores obtained from 3 replications and 4 evaluation dates.

[3]Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

Table 2. Evaluation of Kentucky bluegrass cultivars during the 1984 growing season - Kilbourne.[1]

Cultivar	All Dates[2]	Quality[3] 4/20	5/02	6/08	7/13	8/17	9/20	Sod Webworm Damage[4] 5/30
Banff	7.5	7.7	6.0	7.0	8.7	7.3	8.3	6.0
K1-152	7.3	7.7	5.7	7.0	8.3	7.3	8.0	6.3
Trenton	7.3	7.7	5.0	7.0	8.0	7.7	8.7	6.3
WW AG 463	7.2	7.3	5.0	6.7	8.3	7.3	8.3	6.3
A20-6A	7.1	8.0	6.0	6.0	8.3	7.3	7.0	4.3
Mona	7.1	8.0	6.0	7.0	8.3	6.7	6.7	5.3
Cello	7.1	7.0	5.0	6.3	8.0	8.0	8.3	5.0
239	7.1	7.3	5.3	6.3	7.7	7.7	8.3	4.7
PSU-173	7.0	7.0	4.7	6.0	8.0	8.3	8.3	4.7
K3-178	7.0	7.7	5.7	7.7	8.0	7.0	6.0	6.3
Challenger (N535)	6.9	7.3	5.7	4.7	7.7	8.3	8.0	2.0
Escort	6.9	7.0	5.7	6.7	7.3	7.0	8.0	5.3
I-13	6.9	8.0	5.3	6.0	7.0	7.7	7.7	2.7
Sydsport	6.9	7.0	5.0	6.3	7.3	7.7	8.3	5.0
Rugby	6.9	7.7	5.3	6.7	8.0	7.0	7.0	5.0
Plush	6.9	6.3	5.3	5.7	8.3	7.7	8.3	5.0
H-7	6.9	7.0	5.3	6.0	6.7	7.7	8.7	5.7
Touchdown	6.9	7.0	5.0	5.7	8.0	7.7	8.0	3.7
Monopoly	6.9	6.7	4.7	6.3	8.0	7.7	8.0	4.7
Shasta	6.9	7.0	5.7	5.7	7.3	7.7	8.0	5.3
America	6.8	7.0	5.3	6.7	8.7	7.0	6.3	5.0
Enmundie	6.8	6.7	5.3	6.3	8.0	8.0	6.7	5.7
Columbia	6.8	7.3	5.3	6.7	8.0	7.3	6.3	4.7
225	6.8	7.3	5.0	5.0	8.0	7.7	8.0	5.7
Bono	6.8	6.3	5.3	5.3	7.7	8.0	8.0	4.0
SV-01617	6.8	6.0	4.7	6.3	7.7	7.7	8.3	5.3
Eclipse	6.8	7.0	4.7	6.0	7.7	7.3	8.0	4.7
Ram I	6.8	6.7	5.0	6.7	8.0	7.3	7.0	5.7
A-34	6.8	7.0	5.0	5.0	7.7	7.7	8.3	1.7
Aspen	6.8	6.7	5.7	6.0	8.0	7.3	7.0	5.0
Majestic	6.8	6.7	5.3	6.7	8.3	7.0	6.7	5.0
Adelphi	6.7	6.7	6.0	6.3	8.0	7.0	6.3	3.7
PSU-150	6.7	6.7	5.3	6.3	7.0	7.3	7.7	4.3
Admiral	6.7	7.0	5.0	6.7	7.7	6.7	7.3	6.7
Bristol	6.7	6.7	5.7	6.3	8.0	7.0	6.7	5.0

(continued)

Table 2. Evaluation of Kentucky bluegrass cultivars during the 1984 growing season - Kilbourne (continued)[1].

Cultivar	All Dates[2]	Quality3 4/20	5/02	6/08	7/13	8/17	9/20	Sod Webworm Damage[4] 5/30
Mystic (P141)	6.7	7.0	4.3	5.0	8.0	8.0	7.7	3.0
Somerset (SH-2)	6.7	6.7	5.7	5.7	7.3	7.0	7.7	5.3
Bonnieblue	6.7	6.7	5.7	6.0	8.0	7.3	6.3	4.0
A20-6	6.7	6.7	5.3	5.0	7.7	7.7	7.7	3.3
Vanessa	6.6	5.7	5.3	6.0	6.7	8.0	8.0	6.0
CEB VB 3965	6.6	6.3	5.0	6.7	7.0	7.3	7.3	5.3
WW AG 480	6.6	7.7	5.7	6.0	8.0	6.3	6.0	3.7
A20	6.6	6.7	5.0	5.0	7.3	7.7	8.0	3.7
MLM 18011	6.6	6.7	5.3	6.0	7.0	7.0	7.7	4.3
Parade	6.6	6.7	5.3	6.3	7.3	7.0	6.7	3.3
Apart	6.6	5.3	5.3	5.7	7.3	7.7	8.0	4.3
Birka	6.5	6.0	5.0	7.0	8.0	6.7	6.3	5.7
Kimono	6.5	6.0	5.7	6.3	8.3	7.0	5.7	5.7
Enoble	6.4	5.7	5.3	6.0	7.7	7.3	6.7	5.3
Cheri	6.4	6.3	5.7	5.7	7.0	6.0	7.7	4.7
Midnight (1528T)	6.4	5.7	5.3	6.0	8.3	6.3	6.7	3.7
NJ 735	6.4	7.0	5.3	5.3	7.0	6.7	7.0	4.0
Merit	6.4	5.3	4.7	6.0	7.0	7.3	8.0	6.0
Mosa	6.4	5.7	5.0	6.3	6.3	7.3	7.7	5.3
Holiday	6.3	5.7	5.0	5.3	7.0	7.0	8.0	4.0
Nassau (243)	6.3	6.0	5.0	6.3	8.0	6.7	6.0	6.0
K3-179	6.3	7.7	5.7	5.0	7.0	7.0	5.7	2.3
Glade	6.3	6.3	5.3	5.3	8.0	7.0	5.7	2.7
Baron	6.2	5.7	5.0	5.3	7.7	6.7	7.0	6.0
MER PP 300	6.2	5.7	4.7	5.7	7.3	6.7	7.3	4.3
Bayside	6.2	7.0	5.3	5.3	6.3	6.7	6.7	2.7
Wabash	6.2	4.7	4.7	4.7	7.7	7.7	8.0	1.7
Piedmont	6.2	6.0	4.7	4.3	6.3	7.7	8.0	2.0
Merion	6.2	7.0	5.7	5.3	7.0	6.0	6.0	4.3
PSU-190	6.2	5.7	5.0	5.0	7.3	6.7	7.3	3.3
Victa	6.1	5.7	5.3	5.7	7.0	6.3	6.7	5.0
Welcome	6.1	4.7	4.7	5.3	8.7	6.7	6.3	3.7
Geronimo	6.0	6.7	5.0	6.3	6.0	5.7	6.3	5.0
BA-61-91	6.0	5.3	4.7	5.3	7.0	7.0	6.7	4.0
WW AG 478	5.9	5.3	3.7	5.7	7.7	6.7	6.3	4.0

(continued)

Table 2. Evaluation of Kentucky bluegrass cultivars during the 1984 growing season - Kilbourne (continued)[1].

Cultivar	All Dates[2]	Quality[3] 4/20	5/02	6/08	7/13	8/17	9/20	Sod Webworm Damage[4] 5/30
Nugget	5.9	4.7	5.0	6.7	7.7	6.0	5.3	5.0
Fylking	5.8	6.0	5.0	4.7	7.3	5.7	6.0	3.0
Lovegreen	5.7	4.3	4.3	5.0	7.7	5.7	7.3	3.7
Barblue	5.7	7.3	5.7	5.7	5.3	5.7	4.7	2.3
Harmony	5.6	4.3	4.3	5.3	6.3	6.7	6.7	3.0
Charlotte	5.6	5.3	4.7	5.0	7.7	5.7	5.0	3.3
Vantage	5.5	6.7	4.3	4.0	5.3	6.0	6.7	2.3
Dormie	5.5	5.3	5.0	4.7	6.0	5.7	6.3	2.7
MER PP 43	5.4	4.7	5.3	6.3	6.3	4.7	5.3	4.3
K3-162	5.2	5.7	4.3	3.7	6.3	4.7	6.3	1.0
Argyle	4.9	6.0	5.0	3.3	6.0	3.3	5.7	1.3
S-21	4.4	4.7	4.0	4.3	4.3	4.7	4.7	3.7
Kenblue	4.4	4.7	3.0	2.7	4.3	5.3	6.3	1.0
S.D. Common	4.0	4.7	4.0	3.7	3.7	3.7	4.3	1.0
$LSD_{0.05}$	0.7	1.1	0.9	1.6	1.6	1.8	NS	2.2

[1]All values represent the mean of 3 replications.

[2]Values represent the mean of 18 scores obtained from 3 replications and 6 evaluation dates.

[3]Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

[4]Insect evaluation are made on a 1-9 scale where 9 = no visible turf damage from insect infestation and 1 = complete necrosis of the turf.

USDA NATIONAL PERENNIAL RYEGRASS CULTIVAR EVALUATION AT URBANA

J. E. Haley, T. W. Fermanian, and D. J. Wehner

INTRODUCTION

In the past, perennial ryegrass has been included in seed mixtures as a temporary lawn or nursegrass. In Illinois, deterioration of the turf during the summer months has prevented perennial ryegrass from becoming an important permanent turfgrass. Improved varieties with better color, density, mowing quality, and disease resistance have challenged the traditional image of perennial ryegrass. The turf program at the University of Illinois is participating in a USDA national perennial ryegrass test. This nationwide test will evaluate the performance of perennial ryegrass cultivars under a broad range of climate and cultural programs.

MATERIALS AND METHODS

The Urbana trial, established September 8, 1982, includes 50 perennial ryegrass cultivars, some that are experimental and others that are commercially available (Table 1). Plots measure 5 x 6 feet and each cultivar is replicated 3 times. All plots are mowed at 2.0 inches and receive 4 lb N/1000 sq ft/year (18-5-9). The ryegrass is irrigated as needed to prevent wilt.

RESULTS

In 1983, early spring density evaluations reflected turf resistance to cool weather pythium and injury from winter stress. Density, for most cultivars, was generally poor to fair with Gator, Blazer, NK 80389, Fiesta, and Manhattan/Blazer being the most dense. Cultivars performed the best in spring and fall with the highest quality observed in November. Although the plots were irrigated, several cultivars performed very poorly during drouth stressed August. They include Elka, Cupido, Pippin and Linn.

In early spring of 1984 snow mold was a problem for the perennial ryegrass turf (Table 1). Many cultivars, including Acclaim, Crown, Cupido, Regal, Fiesta, Linn,and the experimental varieties IA 728, 2EE, HE168, NK 79307, and HE178 were especially hard hit by the disease. Perennial ryegrass quality was highest during May, June and September. As in 1983, turfgrass quality deteriorated during the month of August.

Table 1. Evaluation of perennial ryegrass cultivars during the 1984 growing season.[1]

Cultivar	All Dates[2]	Quality[3] 4/27	5/29	6/29	8/01	9/07	Snow Mold[4] 4/10
GT II	7.4	5.7	8.3	7.3	7.3	8.3	5.0
Gator	7.3	6.7	8.0	8.3	6.7	7.0	6.0
Tara (BT I)	7.3	6.0	8.3	7.3	6.7	8.0	4.7
SWRC-1	7.2	5.7	8.3	8.3	6.7	7.0	4.3
Palmer	7.2	6.3	7.3	7.7	7.0	7.7	6.0
Prelude	7.2	6.0	7.7	8.0	7.3	7.0	4.3
Yorktown	7.1	5.0	8.0	8.0	6.7	8.0	4.0
Blazer	7.1	6.3	8.0	7.7	6.7	7.0	4.7
M382	7.1	6.0	7.7	7.7	6.0	8.0	5.3
Elka	7.0	6.0	8.7	7.7	5.7	7.0	5.3
Diplomat	6.9	5.3	7.7	7.3	6.7	7.3	4.3
Barry	6.8	5.7	8.0	6.3	6.7	7.3	4.0
Ranger	6.7	4.7	7.7	7.3	6.3	7.7	3.7
Manhattan	6.7	5.3	8.0	7.3	5.7	7.3	5.7
Manhattan II	6.7	5.3	7.3	7.0	6.0	8.0	4.7
Prelude/Blazer	6.7	5.7	6.7	7.3	6.7	7.3	4.7
LP 702	6.7	4.7	7.3	8.0	6.7	7.0	4.3
HR-1	6.7	6.0	6.3	7.3	6.3	7.3	4.3
Omega	6.7	5.7	6.7	7.0	6.3	7.7	5.0
282	6.6	4.7	7.3	7.0	6.3	7.7	3.7
Dasher	6.6	5.0	7.3	7.0	6.3	7.3	4.0
Manhattan II/Blazer	6.6	5.3	7.0	7.0	6.3	7.3	4.3
Manhattan II/Fiesta	6.6	5.3	7.3	7.0	6.3	7.0	4.3
Cockade	6.5	5.3	7.7	6.7	5.7	7.0	4.7
NK 80389	6.5	4.3	8.0	7.0	5.7	7.3	4.0
Derby	6.4	5.0	6.7	7.0	6.3	7.0	4.3
WWE 19	6.3	6.0	8.0	6.7	4.7	6.3	5.3
Pennant	6.3	6.0	6.0	6.3	6.3	7.0	5.0
Premier	6.3	6.0	6.0	7.3	6.7	5.7	4.7
LP 210	6.3	5.0	7.0	7.0	5.3	7.0	4.3
Fiesta	6.3	4.3	6.3	7.0	6.7	7.0	3.3
LP 792	6.2	4.7	6.7	7.0	6.0	6.7	4.0
Cigil	6.2	5.3	6.7	6.7	5.3	7.0	4.3
2ED	6.1	5.7	5.7	6.7	6.0	6.7	4.7
IA 728	6.1	4.3	6.0	7.3	6.3	6.7	3.3

(continued)

Table 1. Evaluation of perennial ryegrass cultivars during the 1984 growing season (continued).[1]

Cultivar	All Dates[2]	Quality[3] 4/27	5/29	6/29	8/01	9/07	Snow Mold[4] 4/10
Regal	6.0	4.3	6.3	6.3	6.0	7.0	3.3
Cupido	5.9	4.7	7.7	6.7	4.3	6.3	3.3
HE168	5.9	3.7	5.7	7.0	6.0	7.3	3.0
Pennfine	5.8	5.0	6.0	6.3	5.3	6.3	4.7
NK 79309	5.8	4.7	6.0	6.0	5.3	7.0	4.3
NK 79307	5.7	3.7	6.7	6.3	5.3	6.7	2.7
HE178	5.7	4.0	6.3	6.0	5.7	6.7	2.7
Delray	5.7	5.0	5.3	6.0	5.7	6.3	4.3
2EE	5.5	4.7	4.7	6.3	5.7	6.3	3.3
Acclaim	5.5	4.0	5.3	6.0	5.3	7.0	3.3
LP 736	5.4	3.7	5.3	6.0	5.7	6.3	3.7
Crown	5.4	4.7	5.0	5.3	5.0	7.0	3.3
Citation	5.4	5.3	5.0	5.3	5.7	5.7	5.7
Pippin	4.5	4.0	5.7	5.7	3.3	4.0	3.7
Linn	2.8	3.0	3.0	3.7	2.7	1.7	3.3
$LSD_{0.05}$	0.6	1.3	1.2	1.0	1.1	1.5	1.5

[1] All values represent the mean of 3 replications.

[2] Values represent the mean of 15 scores obtained from 3 replications and 5 evaluation dates.

[3] Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

[4] Disease evaluations are made on a 1-9 scale where 9 = no visible evidence of disease and 1 = complete necrosis.

USDA NATIONAL PERENNIAL RYEGRASS CULTIVAR EVALUATION AT CARBONDALE

H. L. Portz

INTRODUCTION

Perennial ryegrass has been included in seed mixtures with Kentucky bluegrass and red fescue as a temporary component in initial seeding. Summer heat and drought and disease in southern Illinois usually severely thins most perennial ryegrasses. Improved cultivars with with better disease resistance and heat tolerance may be better adapted and therefore are being tested as part of a USDA National trial.

MATERIALS AND METHODS

The Belleville location was established on October 12, 1982 and included 49 perennial ryegrass cultivars, some commercial and others experimental. Plots were 2m x 1m with 3 replications. No irrigation was used for establishment or in subsequent years. The ryegrass was mowed at 2 inches and received 3 lbs of N/1000 sq ft annually.

RESULTS

Coverage by spring, 1983 was only fair with LP-702, Manhattan, HR-1, Gator and GT-II achieving a 70% stand or better by April 10, 1983 (Table 1). The 1983 drought, thinned stands severely and in 1984, quality remained low and with another dry year, the perennial ryegrass further deteriorated. Some recovery was noted in August with CP 210, 282 and NK 79309 showing the best color return. The perennial ryegrasses cannot be considered as long lived perennials in southern Illinois, especially without irrigation. They might be used in a mixture with Kentucky bluegrass (no more than 20 - 25%) as temporary cover and erosion control or can be seeded annually in heavy wear areas of lawns or athletic turfs.

Table 1. Establishment and stand of perennial ryegrass cultivars from 1983 to 1984 at the Belleville research center, Illinois.

Cultivar	Percent Cover[1] 4/19/83	Stand[2] 9/29/83	Quality[3] 4/15/84	Stand[2] 8/09/84	Drought Recovery[4] 8/09/84	Quality[3] 11/07/84
Palmer	63	5.7	5.2	5.0	4.3	4.8
Diplomat	45	3.7	4.5	3.7	4.3	3.5
Prelude	55	5.7	5.2	4.7	4.0	3.7
Barry	53	4.3	4.7	4.3	3.8	3.3
Yorktown	67	3.7	4.5	4.7	3.8	3.3
LP 736	60	3.7	5.5	4.8	4.0	4.7
LP 702	75	4.0	4.7	4.7	4.0	4.8
Crown	55	3.7	4.8	4.5	4.0	3.3
CP 210	55	2.7	4.0	3.7	5.5	3.7
Acclaim	63	2.7	4.8	3.8	4.3	3.5
HE 178	48	3.0	4.3	4.0	4.7	3.8
HE 168	50	3.7	4.8	4.3	3.3	3.7
Ranger	60	4.0	5.2	3.8	3.5	3.7
Blazer	63	4.3	4.5	4.3	3.8	3.3
Fiesta	50	4.3	4.7	4.3	4.0	3.5
Dasher	60	3.7	5.0	3.7	3.5	3.8
LP 792	62	3.7	5.5	4.2	4.0	3.0
WWE 19	59	3.3	5.0	4.2	4.2	4.2
Cockade	63	3.7	4.8	4.5	4.5	4.5
Cigil	40	3.0	4.2	4.0	4.3	4.3
2 EE	38	4.0	4.5	4.2	5.0	5.0
Manhattan	77	4.0	5.0	4.5	4.0	4.0
Manhattan II	52	3.0	4.8	3.7	4.7	4.7
282	40	3.0	5.3	4.0	5.3	5.3
Citation	55	3.7	5.7	4.2	3.5	3.5
Omega	58	4.0	5.3	4.0	3.7	3.7
2 ED	33	3.7	4.3	3.3	4.5	4.5
NK 80389	68	4.0	4.3	4.3	3.5	3.5
NK 79309	37	3.3	4.7	3.8	5.2	5.2
Pennant	62	4.3	5.3	4.8	4.2	4.2
Premier	57	4.3	5.0	4.5	4.3	4.3
SWRC-1	40	5.0	4.7	4.5	5.0	5.0
M 382	62	3.7	4.0	4.2	4.7	4.7
HR-1	73	5.3	5.7	5.2	4.2	4.2
Linn	23	2.3	3.3	3.5	4.7	4.7

(continued)

Table 1. Establishment and stand of perennial ryegrass cultivars from 1983 to 1984 at Belleville research center, Illinois (continued).

Cultivar	Percent Cover[1] 4/19/83	Stand[2] 9/29/83	Quality[3] 4/15/84	Stand[2] 8/09/84	Drought Recovery[4] 8/09/84	Quality[3] 11/07/84
Pennfine	62	3.3	5.0	4.0	3.7	3.7
Delray	53	3.3	4.8	4.0	4.7	4.7
NK 79307	42	3.3	4.8	3.8	3.7	3.7
Cupido	57	3.3	5.3	3.8	4.7	4.7
Regal	43	3.0	4.3	4.0	4.2	4.2
Derby	65	3.7	4.3	3.8	4.2	4.2
IA 728	48	4.7	5.0	4.0	4.3	4.3
Elka	52	3.3	4.0	3.7	4.2	4.2
Gator	77	3.7	5.3	4.5	4.2	4.2
BT-I	62	4.3	4.8	4.3	4.5	4.5
GT-II	70	4.7	5.0	4.7	4.2	4.2
Pippin	28	2.3	3.8	3.0	3.3	3.3
Hunter	45	4.7	3.5	3.7	3.8	3.8
Common	58	3.0	4.7	4.0	4.7	4.7

[1]Percent cover represents the percent of plot area covered by turfgrass plants.

[2]Stand evaluations are made on a 1-9 scale, where 9 = excellent stand of turfgrass and 1 = complete necrosis.

[3]Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

[4]Drought recovery evaluations are made on a 1-9 scale, where 9 = complete recovery from severe drought, 1 = complete necrosis.

USDA NATIONAL FINE FESCUE CULTIVAR EVALUATION

T. W. Fermanian, J. E. Haley, and D. J. Wehner

INTRODUCTION

Fine fescue is a term that generally is used to refer to several fine leaf turfgrasses of the Festuca genus. Fine fescues include red or creeping fescue (Festuca rubra), chewings fescue (Festuca rubra var. commutata), sheeps fescue (Festuca ovina) and hard fescue (Festuca ovina var. duriuscula). Red fescue performs well as a turfgrass under shade and has a stoloniferous habit. Chewings, sheeps and hard fescue grow well in sunny dry areas as low maintenance turfs. These fescues have a bunch type growth habit. New cultivars have been developed to improve the adaptability and quality of the fineleaf fescues. The University of Illinois turf program is participating in the USDA national fineleaf fescue test. This test evaluates the performance of 47 cultivars of creeping red, chewings, sheep, and hard fescue in central Illinois (Table 1). Identical tests have been established at other universities nationwide to examine the cultivars under a broad range of climates and cultural programs.

MATERIALS AND METHODS

The Urbana trial, established September 27, 1983, includes 47 fineleaf fescue cultivars, some that are experimental and others that are commercially available. Plots measure 5 x 6 feet and each cultivar is replicated 3 times. Plots were seeded at 3.6 lb seed per 1000 sq ft (50 grams seed/30 sq ft). Prior to seeding the area was fertilized with 1 lb N/1000 sq ft (18-9-5). The seeded area was covered with a straw mulch that was removed when the seedlings emerged. In 1984 the area was fertilized with 18-5-9 at 4 lb N/1000 sq ft. The turf was treated several times with a fungicide to control leaf spot and irrigated as needed to prevent wilt. It should be noted that the evaluation site is in full sun. This might effect the performance of the creeping red fescue cultivars which are better adapted to light or medium shade.

Fineleaf fescue quality was highest in May and steadily declined over the growing season (Table 2). Helminthosporium leaf spot appeared in late June and remained a problem throughout the summer although the area was treated with fungicides. Cultivars less effected by the disease were Epsom, Aurora, Enjoy and the experimental varieties FRI-FRT-83-1, BAR fO 81-225, and 4LS. Over the years the plots will be further evaluated for quality, disease resistance, density, cold tolerance and drouth tolerance.

Table 1. USDA fineleaf fescue cultivars.

Chewings fescue

Atlanta	Epsom	Magenta
Banner	HF 9-3	Mary
Beauty	Highlight	Shadow
Center	Ivalo	Tamara
CF-2	Jamestown	Tatjana
Checker	Koket	Waldorf
Enjoy	Longfellow	Wilma

Creeping red fescue

Boreal	Flyer	Robot
Ceres	Logro	Ruby
Commodore	Lovisa	Wintergreen
Ensylva	Pennlawn	430
Estica	Pernille	

Hard fescue

Aurora	Reliant	ST-2
BAR Fo 81-225	Scaldis	Valda
Biljart	Spartan	Waldina

Sheeps fescue

4LS

Unknown fescue species

FRI-Frt 83-1
entry no. 47

Table 2. Evaluation of fine fescue cultivars during the 1984 growing season.[1]

Cultivar	All Dates[2]	Quality[3] 4/20	5/23	6/28	7/31	9/07	Leaf Spot[4] 6/28
Longfellow	6.2	5.3	7.3	7.0	6.0	5.3	5.0
FRI FRT 83-1	6.1	5.7	7.7	7.3	5.7	4.0	7.3
Aurora	5.7	5.0	6.3	6.7	5.7	4.7	7.0
Spartan	5.4	4.7	5.7	7.0	5.3	4.3	5.7
Estica	5.3	5.7	6.7	7.3	5.0	1.7	6.3
HF 9-3	5.3	5.7	7.7	6.7	3.3	3.0	6.0
430	5.2	5.3	6.3	5.3	5.0	4.0	4.7
Epsom	5.2	5.0	7.0	7.3	3.7	3.0	7.3
Beauty	5.2	6.7	8.0	6.0	2.7	2.7	5.7
Reliant	5.1	5.0	5.7	5.3	5.7	4.0	5.3
Biljart	5.1	4.0	5.7	6.3	5.7	4.0	6.0
Scaldis	5.1	5.0	5.7	6.0	5.0	3.7	6.0
Jamestown	5.1	6.0	6.7	6.0	4.0	2.7	5.7
4FL	5.1	5.3	6.7	7.0	3.0	3.3	5.3
Enjoy	5.1	4.7	7.0	7.0	3.3	3.3	7.0
CF-2	5.1	5.7	6.7	5.7	4.3	3.0	5.0
Mary	5.1	5.7	7.3	6.0	3.3	3.0	5.0
ST-2	5.0	5.0	6.3	6.3	4.3	3.0	6.0
Waldina	4.9	5.0	6.3	6.0	4.3	3.0	6.0
Wilma	4.9	5.7	7.0	6.0	3.3	2.3	6.0
Magenta	4.9	5.3	7.0	5.7	3.3	3.0	4.7
Checker	4.9	6.7	7.0	5.3	3.0	2.3	6.3
Flyer	4.8	5.0	5.7	6.0	4.0	3.3	4.7
Koket	4.8	6.0	6.3	6.0	3.0	2.7	5.7
Pennlawn	4.8	5.3	7.0	5.7	4.0	2.0	5.0
Ensylva	4.8	5.7	6.0	5.0	4.3	3.0	4.7
Banner	4.8	5.3	6.0	5.7	4.0	3.0	5.3
Atlanta	4.7	5.7	6.7	5.7	2.7	2.7	4.3
Tamara	4.7	5.3	6.7	5.0	3.7	2.7	5.7
Pernille	4.7	5.7	5.3	4.3	4.7	3.3	5.3
Shadow	4.7	5.7	6.3	5.3	3.3	2.7	5.0
Lovisa	4.6	5.0	6.7	6.3	3.3	1.7	5.7
Boreal	4.5	5.0	6.3	4.7	3.7	3.0	4.7
Valda	4.5	4.0	5.3	5.0	5.0	3.3	6.3
Waldorf	4.5	4.7	7.0	5.3	2.7	3.0	5.0

(continued)

Table 2. Evaluation of fine fescue cultivars during the 1984 growing season (continued).[1]

Cultivar	All Dates[2]	Quality[3] 4/20	5/23	6/28	7/31	9/07	Leaf Spot[4] 6/28
4LS	4.5	4.0	5.3	6.0	4.3	3.0	7.0
Tatjana	4.2	6.7	5.7	4.0	2.3	2.3	4.0
Ceres	4.2	4.3	5.0	4.0	5.0	2.7	4.7
Ivalo	4.1	5.7	6.0	5.0	2.3	1.7	4.3
BAR Fo 81-225	4.1	3.0	3.7	3.7	5.0	5.0	6.7
Wintergreen	3.9	5.3	6.3	4.3	2.0	1.7	4.7
Ruby	3.9	5.7	5.3	3.3	2.3	3.0	3.0
Robot	3.9	4.3	5.3	4.0	2.3	3.3	4.0
Highlight	3.9	5.0	6.3	4.3	2.0	1.7	4.3
Unknown entry 47	3.7	6.0	4.0	3.0	2.7	3.0	2.7
Commodore	3.6	5.3	4.7	3.3	2.0	2.7	3.3
Center	3.3	2.7	2.7	4.3	3.7	3.3	5.7
$LSD_{0.05}$	0.5	1.0	1.1	1.1	1.3	1.0	1.6

[1]All values represent the mean of 3 replications.

[2]Values represent the mean of 15 scores obtained from 3 replications and 5 evaluation dates.

[3]Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

[4]Disease evaluations are made on a 1-9 scale where 9 = no visible evidence of disease and 1 = complete necrosis.

USDA NATIONAL TALL FESCUE CULTIVAR EVALUATION AT BELLEVILLE

H. L. Portz

INTRODUCTION

Tall fescue is increasing in popularity especially since newer, finer-textured and denser cultivars are available. These cultivars are being tested at many locations in the U.S. They are being observed for vigor, density, drought tolerance, texture, and other characteristics so that one can better select cultivars suited to each region.

MATERIALS AND METHODS

The Belleville location was established on September 29, 1983 and included 30 tall fescue cultivars both commercial and experimental. Plots were 2m x 1m with 3 replications. Irrigation was used only for establishment. The tall fescue was mowed at 2 inches and received 3 lbs of N/1000 sq ft annually.

RESULTS

The seedling vigor was noted by height one month after seeding. Adventure, Fostorina, Ky-31 and Barcel were all 10 or more centimeters (4 + inches) as shown in Table 1.

Cover in March was good but did not reflect some of the winter damage since very adequate moisture kept weak or dead seedlings looking alive. Many seedlings did not make it through the dry summer to August and quality and density were only fair. The cultivars showing the best quality in November were Rebel, Olympic, Jaguar and Arid. The trial will be continued without irrigation in 1985.

Table 1. Evaluation of tall fescue cultivars, 1983 (established) and 1984.

Cultivar	10/27/83 Height[1]	10/27/83 Density[2]	3/19/84 Spring Greenup[3]	3/19/84 Percent Cover[4]	8/09/84 Quality[5]	11/07/84 Quality[5]
Johnstone	8.3	5.3	7.1	72.0	6.2	5.8
Rebel	9.5	5.3	6.6	68.7	6.2	6.7
Clemfine	9.0	5.7	6.8	70.0	5.5	6.0
Willamette	8.7	5.3	7.0	70.8	5.8	6.3
Mer Fa 83-1	9.3	5.7	7.0	79.1	5.8	6.3
1S1 CJ	8.2	4.7	6.7	72.5	5.8	6.2
Houndog	8.3	4.7	6.9	75.0	6.2	6.2
Brookston	7.7	5.0	7.1	72.5	5.8	6.5
Falcon	8.7	5.7	6.9	76.6	6.0	6.5
Maverick	8.5	5.0	6.9	72.5	6.0	6.0
Mustang	8.7	5.7	6.7	71.6	6.0	6.3
Adventure	10.7	6.3	7.0	70.8	6.0	6.5
TF 813	8.0	5.0	7.0	73.3	6.0	6.3
Olympic	8.5	5.3	6.8	74.1	6.0	6.7
Jaguar	8.3	5.3	7.0	75.0	6.3	6.7
5 GL	8.7	5.7	7.0	75.8	6.2	6.2
Apache	7.7	5.0	7.0	72.5	6.3	6.5
5 L 4	7.5	5.0	7.5	71.6	5.5	6.5
Finelawn	8.8	5.3	7.1	70.8	6.0	6.5
Kenhy	6.5	3.3	7.3	71.6	4.3	5.7
Ky-31	10.3	6.0	6.8	72.5	5.2	6.0
Syn-Ga-1	9.3	5.7	8.3	72.5	6.3	6.2
KS 78-4	7.7	4.0	6.9	70.8	6.2	6.2
Arid	9.7	6.0	6.8	70.8	6.2	6.7
NK 81425	9.3	5.7	6.6	71.6	5.5	6.2
NK 82508	8.5	6.0	7.5	72.5	6.2	6.0
Tempo	9.3	6.0	6.8	75.0	5.5	6.3
Barcel	10.0	6.0	6.7	73.0	5.7	5.8
Fostorina	10.8	6.0	6.6	75.8	5.3	6.2
Unknown	8.8	5.3	7.0	74.1	5.8	6.3

[1]Height refers to the average height in cm of the turfgrass plants.

[2]Density evaluations are made on a 1-9 scale where 9 = very dense turf and 1 = poor turfgrass density.

[3]Spring greenup evaluations are made on a 1-9 scale where 9 = very dark turf color and 1 = dormant turfgrass.

[4]Percent cover represents the percent of the plot covered by turfgrass plants.

[5]Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

TALL FESCUE CULTIVAR EVALUATION UNDER TWO MAINTENANCE LEVELS

T. W. Fermanian, J. E. Haley, and D. J. Wehner

INTRODUCTION

In Illinois, tall fescue (Festuca arundinacea) is primarily used on low maintenance sites like roadways and playgrounds. Tall fescue has excellent heat, drouth and wear tolerance but a coarse texture prevents its use in areas where a high quality turf is needed and a bunch type growth habit prevents its use in mixtures with other turf species. Improved "turf" type tall fescue cultivars with finer texture and improved cold tolerance have recently been introduced.

MATERIALS AND METHODS

In order to examine the performance of these "turf" type tall fescue cultivars, an evaluation trial was established in Urbana, September 20, 1982. The trial contains 21 "turf type" tall fescue cultivars (experimental and commercially available), one "forage type" (K-31), five tall fescue-Kentucky bluegrass mixes, two tall fescue-perennial ryegrass mixes and one tall fescue blend. Plot size is 5 x 6 feet and each cultivar is replicated three times. The trial is duplicated in order to evaluate the cultivars at two levels of cultural maintenance. Under maintenance level I, the turf is not irrigated. It is fertilized only once in the fall with 1 lb N/1000 sq ft (18-5-9). Under maintenance level II, the turf is irrigated and fertilized four times per year with 1 lb N/1000 sq ft (18-5-9). All turf is maintained at 2.5 inch height of cut.

RESULTS

Despite high temperatures and drouthy conditions tall fescue performance was good for those cultivars maintained without irrigation (Table 1). The exceptions to this were the tall fescue-perennial ryegrass mixes. Quality was highest during May and June and deteriorated slightly in late summer. Plots maintained with irrigation and high fertilization exhibited excellent quality throughout the summer, although there was a slight decline in performance in late August (Table 2).

Table 1. Evaluation of tall fescue cultivars during the 1984 growing season, maintained with no irrigation and low fertilization.[1]

Cultivar	All Dates[2]	Quality[3]				
		4/20	5/31	6/27	7/31	9/13
Jaguar	7.1	6.0	9.0	7.3	5.7	7.3
5 M4-82	7.0	6.3	8.0	7.0	6.3	7.3
52H	6.9	6.3	8.0	7.3	6.0	7.0
Rebel/Newport	6.9	7.0	8.0	7.0	5.7	6.7
Olympic + 5% PST 483	6.7	5.7	8.7	7.0	5.3	7.0
Rebel/Bonnieblue	6.7	6.7	8.0	7.0	5.3	6.7
Olympic + 10 PST 483	6.7	6.3	8.0	6.7	6.0	6.3
Rebel	6.6	7.0	8.3	6.0	5.0	6.7
K 82142	6.6	5.7	7.7	7.0	5.7	7.0
52W	6.5	5.0	9.0	7.7	5.0	6.0
Mustang	6.5	5.0	8.3	6.7	5.7	6.7
Rebel/Baron	6.5	6.3	7.7	6.7	5.3	6.3
K 79628	6.4	5.3	7.7	7.0	5.3	6.7
Galway	6.4	5.7	7.0	6.3	6.0	7.0
Olympic	6.3	5.3	7.3	6.3	5.7	7.0
ISI BK 2	6.3	5.7	7.3	6.3	5.7	6.7
Falcon	6.3	6.0	7.3	6.0	5.3	7.0
SYN GA	6.3	5.3	7.7	6.3	5.3	7.0
TF805	6.3	5.7	8.0	6.3	5.3	6.0
Marathon	6.3	5.3	7.3	6.0	5.7	7.0
Houndog	6.2	6.0	7.0	6.0	5.7	6.3
Clemfine/Olympic	6.2	5.3	7.3	6.0	5.7	6.7
Brookston	6.1	5.3	8.0	6.3	5.0	6.0
Clemfine	6.1	5.0	7.0	6.3	5.3	6.7
NK 81452	6.1	4.7	8.0	6.3	5.3	6.0
Barcel	6.0	6.7	7.0	5.7	4.7	6.0
K-31	5.9	5.3	7.0	6.0	5.3	6.0
BEL SYN 22	5.7	5.3	6.0	5.7	5.3	6.0
Rebel/Fiesta	5.5	7.0	6.3	4.0	4.0	6.0
Rebel/Blazer	5.2	7.0	6.7	3.7	3.7	5.0
$LSD_{0.05}$	0.4	0.9	0.6	1.1	0.8	0.8

[1] All values represent the mean of 3 replications.

[2] Values represent the mean of 15 scores obtained from 3 replications and 5 evaluation dates.

[3] Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

Table 2. Evaluation of tall fescue cultivars during the 1984 growing season, maintained with irrigation and high fertilization.[1]

Cultivar	All Dates[2]	Quality[3] 4/20	5/31	6/27	7/31	9/13
5 M4-82	8.5	7.3	9.0	9.0	8.0	9.0
Jaguar	8.3	6.7	9.0	9.0	8.0	9.0
Rebel	8.2	8.0	8.3	9.0	7.3	8.3
Rebel/Newport	8.1	7.3	8.3	9.0	7.7	8.3
Falcon	8.1	8.0	9.0	8.7	7.3	7.3
Olympic	8.1	7.3	8.7	8.3	7.3	8.7
Rebel/Bonnieblue	8.0	6.7	8.3	8.7	7.3	9.0
Mustang	8.0	8.0	8.3	8.3	7.0	8.3
Olympic + 10% PST 483	8.0	7.0	9.0	8.3	7.7	8.0
TF 805	7.9	6.7	8.7	9.0	7.0	8.3
Olympic + 5% PST 483	7.9	7.7	8.3	8.7	7.0	8.0
SYN GA	7.9	7.3	8.0	9.0	7.0	8.0
52 H	7.9	6.7	8.0	8.0	8.0	8.7
Rebel/Baron	7.9	7.0	8.0	9.0	7.3	8.0
Clemfine/Olympic	7.8	7.7	8.0	8.3	7.0	8.0
Houndog	7.7	7.7	7.3	8.7	7.3	7.7
52 W	7.6	4.7	8.7	8.7	7.3	8.7
Marathon	7.6	6.7	8.7	8.0	7.0	7.7
K 82142	7.5	7.3	8.3	8.3	6.3	7.3
Clemfine	7.5	7.0	7.7	8.0	6.7	8.0
K 79628	7.5	7.0	8.0	8.3	6.7	7.3
NK 81452	7.5	7.0	8.3	7.7	7.0	7.3
Galway	7.4	7.7	7.7	7.7	6.7	7.3
Brookston	7.4	7.0	8.0	8.3	6.3	7.3
ISI BK 2	7.2	7.0	7.0	8.0	6.7	7.3
K-31	7.1	7.0	8.0	7.0	6.3	7.0
Rebel/Fiesta	7.0	6.3	8.0	7.0	6.0	7.7
Barcel	6.9	7.0	7.7	7.0	5.7	7.0
Rebel/Blazer	6.8	5.7	9.0	6.3	5.3	7.7
BEL SYN 22	6.8	6.7	6.7	7.3	6.0	7.3
$LSD_{0.05}$	0.4	1.1	0.9	0.8	1.0	0.8

[1]All values represent the mean of 3 replications.

[2]Values represent the mean of 15 scores obtained from 3 replications and 5 evaluation dates.

[3]Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

TALL FESCUE SEEDING RATES AND CULTIVAR COMPARISONS

H. L. Portz

INTRODUCTION

Tall fescue has long been recognized for its drought, heat and wear tolerance and its multiple uses for forage, roadside stabilization and athletic areas. In the transition zone, it is a major low maintenance turfgrass for lawns and parks too. And, with newer cultivars of finer texture and greater density than Ky-31, it is gaining rapidly in popularity. Excessively high seeding rates are often suggested, however, to further increase turf density, prevent clumping and maintain finer texture. The purpose of these studies is to evaluate several tall fescue cultivars separately and with Kentucky bluegrass at different seeding rates to determine adapatability to low maintenance regimes. Experiment 1 was established in April, 1982 at the Horticulture Research Center (HRC) at Carbondale. Experiment 2 was established in October, 1983 at the Belleville Research Center (BRS) near Scott Air Force Base.

MATERIALS AND METHODS

The trial at HRC included Ky-31, Galway, Houndog, Olympic and Rebel tall fescues at 1, 3 and 5 lbs of seed/1000 sq ft and 0.1, 0.3 and 0.5 lbs (10% of mixture) respectively of a Kentucky bluegrass blend over the end five feet of each 15 foot plot. Experiment 2 at BRC include Ky-31 and Regal at 3, 5, 7 and 9 lbs of seed/1000 sq ft and 0.5 lbs of Kentucky bluegrass blend on 1/3 of each plot. Irrigation was used on both experiments only for establishment. Cutting height was 2 1/4 inches and 3 lbs N/1000 sq ft was applied annually.

RESULTS

The results of Experiment 1 indicated a more rapid establishment (seedling count) for the 5 lb rate in five weeks but coverage in twenty-two weeks was similar for all seeding rates (82.1 - 84.8%) as noted in Table 1. Tall fescue plots containing Kentucky bluegrass (TF+KB) showed somewhat superior coverage and quality in the establishment year but, after droughts in 1983 and 1984, there were no significant differences (Table 1).

The drought tolerance of Ky-31 and Galway was better than Olympic or Rebel in both 1983 and 1984 (Table 2). Tall fescues at the highest seeding rate (5 lbs) were less drought tolerant than lower rates in 1983.

The initial establishment and density of tall fescue in Experiment 2 was better for the higher rates of 7 and 9 lbs (Table 3). By spring, however, all rates except the lowest (3 lbs) showed nearly equal cover, and in quality ratings in August and November, there was little difference in the 5, 7, and 9 lb seeding rates. In conclusion, low seeding rates of 3 or 5 lbs appear sufficient for most lawns, especially when considering a low maintenance program without irrigation.

Table 1. Evaluation of tall fescue alone and in mixtures with Kentucky bluegrass, 1982 and 1984.[1]

Seeding Rate Per 1000 sq ft	Percent Cover[2] 1982 TF	Percent Cover[2] 1982 TF+KB	Quality[3] 1982 TF	Quality[3] 1982 TF+KB	Quality[3] 1984 TF	Quality[3] 1984 TF+KB
Average over all cultivars						
1 pound	80.6a	82.1b	4.1b	4.2b	5.9a	5.9a
3 pounds	82.3a	84.4a	4.3a	4.5a	6.2a	6.0a
5 pounds	82.1a	84.8a	4.3a	4.4a	6.1a	5.9a

Type of Mix	Percent Cover[2] 1982	Quality[3] 1982	Quality[3] 1984
Average over all seeding rates and cultivars or mixes			
Tall fescue only	81.7b	4.2b	6.1a
Tall fescue + Kentucky bluegrass	83.8a	4.5a	5.9a

[1]Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Duncan's Multiple-Range test.

[2]Percent cover represents the percent of the plot covered by turfgrass plants.

[3]Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

Table 2. Drought tolerance and quality ratings of five tall fescue cultivars at three different seeding rates, HRC 1983-84.[1]

Cultivar	Seeding Rate lbs/1000 sq ft	Drought Tolerance[2] Sept. 83	Quality[3] April 84	Drought Tolerance[2] July 84
Ky-31	1	6.6	5.5	6.2
Ky-31	3	5.7 a	6.2	6.0 a
Ky-31	5	4.8	6.0	5.8
Galway	1	5.7	5.5	5.8
Galway	3	5.9 ab	6.0	6.0 ab
Galway	5	5.3	5.8	5.5
Houndog	1	5.2	6.2	5.5
Houndog	3	5.0 bc	6.3	5.2 c
Houndog	5	5.1	6.3	5.5
Olympic	1	5.2	6.2	5.2
Olympic	3	5.1 c	6.2	5.7 c
Olympic	5	4.6	6.2	5.2
Rebel	1	5.2	6.2	5.3
Rebel	3	4.9 c	6.2	5.5 c
Rebel	5	4.7	6.3	5.3

[1] All values represent the mean of 3 replications. Means for each cultivar in the same column with the same letter are not significantly different at the 0.05 level as determined by Duncan's Multiple-Range test.

[2] Drought tolerance evaluations are made on a scale of 1-9, where 9 = no drought stress visible and 1 = complete dormancy or necrosis.

[3] Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

Table 3. Tall fescue seeding rate experiment. Established 28 September, 1983 at BRC.

Cultivar	Seeding Rate lbs/1000 sq ft	Density[1] 10/27/83	Percent Cover[2] 4/15/84	Quality[3] 8/09/84	Quality[3] 11/7/84
Ky-31	3	4.7	71.2	5.5	5.0
Ky-31	5	5.5	76.2	6.0	5.5
Ky-31	7	6.0	78.7	6.0	5.5
Ky-31	9	6.8	80.0	6.1	6.0
Rebel	3	4.2	65.0	5.6	5.9
Rebel	5	5.0	72.5	6.5	6.2
Rebel	7	5.8	71.2	6.4	6.4
Rebel	9	5.8	71.2	6.0	6.1

[1] Density evaluations are made on a scale of 1-9, where 9 = very dense turf and 1 = poor turfgrass density.

[2] Percent cover represents the percent of the plot covered by turfgrass plants.

[3] Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

REGIONAL CULTIVAR EVALUATION

T. W. Fermanian and J. E. Haley

INTRODUCTION

Turfgrass cultivar recommendations in Illinois are generally made from data obtained from turfgrass evaluation trials at the Urbana or Kilbourne research facilities. However, Illinois is a state over 400 miles long, with a wide range of temperatures, precipitation and soil conditions. A cultivar suited to central Illinois may not be suited to northern or southern Illinois. With this in mind, cultivar evaluation trials were established in Rock Island County, September 10, 1981 and DuPage County, September 23, 1981. Cultivars established at these sites are as follows:

Kentucky bluegrass

Adelphi	Mystic	Victa
America	Parade	WTN-A20
Aspen	Ram I	WTN-A-34
Baron	Rugby	WTN-H7
Bonnieblue	Shasta	WTN-I13
Columbia	Sydsport	
Haga	Touchdown	

Perennial ryegrass

Blazer	Goalie	Pennant
Dasher	Lesco's CBS blend	Pennfine
Diplomat	Loretta	Premier
Fiesta	Manhattan	Yorktown

Tall fescue

Falcon	Mustang	Rebel
K-31	Olympic	Shannon

Fine fescue

Agram	Jamestown	Scaldis
Biljart	Pennlawn	Waldina

RESULTS

In Rock Island the quality of Kentucky bluegrass cultivars improved throughout the summer and was highest in June and July (Table 1). Helminthosporium leaf spot was a problem with some varieties in April. Those cultivars which showed the greatest resistance to the disease were A20, H7 and I-13.

Most of the perennial ryegrass cultivars maintained fair to good quality throughout the summer. Highest quality was found in June and September. There was no difference of incidence of leaf spot found among the cultivars.

All tall fescue cultivars exhibited good to excellent quality throughout the season, although the performance of Mustang and Olympic was generally better than other cultivars tested. Of all the species evaluated, the tall fescue varieties showed the greatest resistance to leaf spot.

In 1984 the performance of the fineleaf fescues was only fair. The hard fescues, Biljart, Scaldis and Waldina, were the most susceptible to Helminthosporium leaf spot. Over all evaluation dates there was no significant difference among cultivar performance.

The evaluation in DuPage County suffered from snow mold damage in the 1981-1982 winter and did not fully recover during the 1982, 1983 or 1984 growing seasons. Except where noted, quality ratings for all turfgrass species were poor to fair with little difference exhibited among cultivars within a species (Table 2). Kentucky bluegrass performance was highest in July with quality dropping off in August and September. Perennial ryegrass performance was highest in July and September. Of all species tested, the tall fescue cultivars maintained the best quality over all dates. Tall fescue quality was especially high during August and September. The fine fescue varieties exhibited the lowest quality of all tested species over all evaluation dates.

At both locations the turfgrass Puccinellia distans (L.) Parl. cv. 'Fults' or weeping alkaligrass exhibited very poor quality. Although it has poor quality, this grass is salt tolerant and can be used to stabilize areas with a high concentration of salts in the soil. This can be useful along roadways that are salted during the winter.

Table 1. Regional cultivar evaluation - Rock Island County.[1]

Cultivar	All Dates[2]	Quality[3] 5/02	6/08	7/13	8/17	9/20	Leaf Spot[4]
Kentucky Bluegrass							
I-13	8.3a	7.0a	9.0a	8.7a	8.3a	8.7a	7.7a
H7	8.0a	7.0a	8.3ab	8.0ab	7.7a-c	9.0a	7.0ab
A20	7.5b	6.3a-c	8.3ab	8.3ab	7.3a-c	7.0b	7.0ab
America	7.4bc	6.3a-c	7.7b-d	8.3ab	7.7a-c	7.0b	6.3a-c
Aspen	7.3b-d	6.3a-c	8.0a-c	7.7bc	7.7a-c	6.7bc	6.3a-c
A-34	7.1b-e	6.0b-d	8.7ab	8.7a	6.0de	6.3b-d	5.7b-d
Bonnieblue	7.0c-e	5.7c-e	7.7b-d	8.0ab	7.7a-c	6.0b-e	6.7a-c
Haga	7.0c-e	5.3de	8.0a-c	8.0ab	7.0b-d	6.7bc	6.3a-c
Parade	6.9d-f	5.0ef	7.7b-d	8.0ab	7.3a-c	6.7bc	5.7b-d
Touchdown	6.9d-f	6.7ab	8.3ab	7.7bc	6.7c-e	5.3d-f	6.3a-c
Rugby	6.9d-f	6.3a-c	7.7b-d	8.0ab	7.0b-d	5.7c-e	6.3a-c
Columbia	6.9d-f	5.0ef	8.0a-c	8.0ab	7.0b-d	6.3b-d	5.3c-e
Sydsport	6.8ef	5.0ef	7.7b-d	7.7bc	7.3a-c	6.3b-d	5.3c-e
Adelphi	6.7e-g	6.0b-d	6.7d-f	7.0cd	8.0ab	6.0b-e	5.3c-e
Ram 1	6.5f-h	4.3fg	6.3e-g	7.7bc	7.7a-c	6.7bc	4.7de
Baron	6.3g-i	5.3de	7.0c-e	7.0cd	7.0b-d	5.3d-f	5.7b-d
Victa	6.1h-j	5.0ef	6.7d-f	7.0cd	7.0b-d	5.0ef	6.0b-d
Shasta	6.0ij	5.7c-e	5.7f-h	7.0cd	6.7c-e	5.0ef	6.0b-d
Vantage	5.8j	4.3fg	5.3gh	6.7de	7.3a-c	5.3d-f	4.0e
Mystic	5.0k	4.0g	5.0h	6.0e	5.7e	4.3f	5.3c-e
$LSD_{0.05}$	0.5	1.0	1.1	1.0	1.1	1.1	1.4
Perennial Ryegrass							
Manhattan	7.5a	5.7a	9.0a	7.7	6.7bc	8.7	5.3
Loretta	7.3a	4.3ab	8.7ab	7.0	8.0a	8.3	4.7
Yorktown II	7.1ab	4.3ab	8.7ab	6.7	7.3ab	8.3	5.7
Blazer	7.1ab	4.0bc	8.0a-c	7.3	7.3ab	8.7	6.0
Diplomat	6.0bc	3.0bc	7.7b-d	6.7	7.3ab	8.3	5.0
Lesco's CBS Blend	6.5bc	3.3bc	7.0cd	6.3	7.0a-c	9.0	5.7
Premier	6.5cd	3.3bc	7.3cd	6.3	7.0a-c	8.3	5.3
Pennant	6.5cd	4.0bc	7.0cd	6.0	6.7bc	8.7	5.3
Pennfine	6.5cd	3.3bc	7.0cd	7.0	7.0a-c	8.0	5.3
Fiesta	6.2c-e	2.7c	7.0cd	6.0	7.0a-c	8.3	5.7
Dasher	5.9de	3.0bc	6.7d	5.7	6.0cd	8.3	5.7
Goalie	5.7e	3.3bc	6.7d	5.3	5.3d	8.0	4.3
$LSD_{0.05}$	0.5	1.5	1.0	NS	1.3	NS	NS

(continued)

Table 1. Regional cultivar evaluation - Rock Island County (continued).[1]

Cultivar	All Dates[2]	Quality[3] 5/02	6/08	7/13	8/17	9/20	Leaf Spot[4]
Tall Fescue							
Mustang	8.1a	5.0	8.7a	9.0	8.7	9.0	7.7
Olympic	8.0a	5.3	8.3ab	8.7	8.7	9.0	8.3
Rebel	7.5b	3.3	8.3ab	8.7	8.3	8.7	7.3
Falcon	7.4b	4.3	7.7bc	8.3	8.0	8.7	6.7
K-31	7.2b	4.7	7.3c	8.0	7.7	8.3	7.3
Shannon	7.2b	4.3	7.7bc	8.0	8.0	8.0	7.3
$LSD_{0.05}$	0.5	NS	0.7	NS	NS	NS	NS
Fine Fescue							
Waldina	5.7	6.3	5.7	5.3	5.7	5.3	4.3b
Scaldis	5.5	6.0	5.0	5.3	5.7	5.3	4.7b
Biljart	5.4	5.0	5.0	5.0	5.3	6.7	4.7b
Pennlawn	5.1	5.0	3.3	5.3	6.3	5.3	6.0a
Agram	5.0	5.7	4.7	5.3	5.0	4.3	6.0a
Jamestown	4.7	5.0	4.3	5.3	5.0	3.7	6.7a
$LSD_{0.05}$	NS	NS	NS	NS	NS	NS	1.3
Local Mixes							
Fast & Fine	7.1a	6.0	7.7a	7.7a	7.3	6.7a	6.0
Teskes' Seed	6.8a	5.0	7.3a	7.7a	7.7	6.3a	6.0
Golf Lawn Mix	6.7a	5.3	6.7ab	7.7a	7.7	6.3a	5.7
Evergreen Lawn Mix	6.1b	5.3	5.7bc	6.7b	7.3	5.3b	4.3
Prevail Low Maintenance Mix	5.7b	5.3	5.0c	6.3b	7.0	5.0b	5.3
$LSD_{0.05}$	0.4	NS	1.4	0.9	NS	1.0	NS

[1]All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2]Values represent the mean of 15 scores obtained from 3 replications and 5 evaluation dates.

[3]Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

[4]Disease evaluations are made on a 1-9 scale where 9 = no visible evidence of disease and 1 = complete necrosis.

Table 2. Regional cultivar evaluation - Du Page County.[1]

Cultivar	All Dates[2]	Quality[3] 4/20	6/07	7/12	8/16	9/26
Kentucky Bluegrass						
A-34	4.7a	5.0ab	4.0	7.3a	3.7ab	3.3
Rugby	4.7a	4.7a-c	6.0	6.3ab	3.0b-d	3.3
Columbia	4.7a	5.3a	4.3	6.0bc	4.0a	3.7
Haga	4.5ab	5.0ab	5.7	6.0bc	2.7cd	3.3
I-13	4.5ab	4.3a-d	5.3	6.3ab	3.3a-c	3.3
Parade	4.5ab	5.0ab	5.0	6.3ab	2.7cd	3.7
H7	4.5ab	5.0ab	4.3	6.3ab	3.3a-c	3.7
Merit	4.5ab	3.3d	4.3	5.7b-d	3.7ab	5.3
Bonnieblue	4.4a-c	5.0ab	5.0	6.3ab	2.7cd	3.0
Victa	4.2a-d	4.0b-d	4.7	6.3ab	3.3a-c	2.7
Aspen	4.2a-d	4.3a-d	5.3	5.7b-d	2.7cd	3.0
Vantage	4.1a-d	3.7cd	4.3	5.0cd	3.3a-c	4.3
Adelphi	4.1a-d	4.0b-d	5.0	5.3b-d	3.0b-d	3.0
Sydsport	4.1a-d	4.7a-c	4.3	5.7b-d	2.7cd	3.0
A20	4.0b-d	4.3a-d	4.7	6.0bc	2.7cd	2.3
Baron	4.0b-d	4.0b-d	4.3	6.0bc	3.0b-d	2.7
Touchdown	4.0b-d	5.0ab	3.3	6.0bc	2.7cd	3.0
Shasta	3.9b-d	4.3a-d	5.0	4.7d	2.7cd	3.0
Ram 1	3.9b-d	3.7cd	4.7	5.7b-d	2.3d	3.3
Mystic	3.8cd	3.3d	4.7	6.0bc	2.3d	2.7
America	3.7d	4.7a-c	3.7	4.7d	2.7cd	2.7
$LSD_{0.05}$	0.6	1.3	NS	1.3	1.0	NS
Perennial Ryegrass						
Loretta	5.5a	4.3	4.0	7.7	4.3	7.3
Pennant	5.1ab	3.7	5.7	6.7	3.7	6.0
Blazer	5.1ab	4.3	4.3	6.7	3.3	7.0
Premier	5.1ab	4.3	4.7	6.7	4.0	6.0
Manhattan	5.1ab	3.3	5.0	6.7	3.3	7.0
Dasher	4.9bc	4.0	5.0	5.3	4.3	5.7
Yorktown II	4.8bc	3.7	4.3	6.3	3.7	6.0
Fiesta	4.8bc	3.7	6.0	5.7	3.3	5.3
Diplomat	4.7bc	3.7	5.7	5.3	3.3	5.7
Pennfine	4.7bc	4.0	5.0	6.3	3.3	5.0
Lesco's CBS blend	4.7bc	4.0	5.0	5.7	3.3	5.3
Goalie	4.3c	3.7	4.7	5.0	3.0	5.0
$LSD_{0.05}$	0.6	NS	NS	NS	NS	NS

(continued)

Table 2. Regional cultivar evaluation - Du Page County (continued).[1]

Cultivar	All Dates[2]	Quality[3] 4/20	6/07	7/12	8/16	9/26
Tall Fescue						
Falcon	5.9	3.7	4.7	6.3	7.7	7.3
Shannon	5.9	4.7	3.7	6.3	7.3	7.3
Rebel	5.7	4.0	2.3	6.7	7.7	8.0
K-31	5.7	4.3	3.7	6.3	7.0	7.0
Olympic	5.3	4.0	2.3	6.3	6.3	7.7
$LSD_{0.05}$	NS	NS	NS	NS	NS	NS
Fine Fescue						
Scaldis	3.5a	2.7a	5.3	3.3	3.0a	3.3a
Biljart	3.1ab	2.3a	3.7	3.0	3.3a	3.0ab
Pennlawn	2.6bc	2.7a	4.0	2.7	1.7b	2.0bc
Agram	2.5c	1.0b	5.7	2.0	1.7b	2.0bc
Waldina	2.4c	1.0b	5.0	1.7	1.3b	3.0ab
Jamestown	2.1c	1.3b	4.3	2.3	1.3b	1.3c
$LSD_{0.05}$	0.5	0.9	NS	NS	0.9	1.3
Mixes						
Baron/Pennfine	5.1	4.0	4.3	6.7	4.0	6.3
Columbia/ Manhattan	5.1	3.7	5.0	6.7	4.3	5.7
Adelphi/ Pennfine	4.9	5.0	4.7	6.7	4.0	4.3
Victa/Yorktown	4.8	3.7	4.7	6.3	3.7	5.7
$LSD_{0.05}$	NS	NS	NS	NS	NS	NS

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Values represent the mean of 15 scores obtained from 3 replications and 5 evaluation dates.

[3] Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

BENTGRASS BLENDS FOR PUTTING GREEN TURF

D. J. Wehner and J. E. Haley

INTRODUCTION

There are advantages and disadvantages associated with using vegetatively propagated bentgrass selections for putting green turf. The main advantage is that the putting green will be very uniform since every plant is genetically identical to every other plant. The main disadvantage is that any factor which affects the given cultivar can affect the entire green. Disease outbreaks have the potential of being more severe on vegetatively propagated areas because the susceptibility of all plants is basically the same. Seeded bentgrass cultivars offer an advantage over vegetative strains in that they are genetically more diverse. A seeded variety may be composed of several different individuals which possess agronomically similar characteristics.

Blending two or more bentgrass varieties to gain genetic diversity is a sound principle in theory. Problems may arise however because the two varieties may not have similar enough growth rates or morphological characteristics. Past attempts to blend vegetatively propagated bentgrass varieties have not always been successful. Swirling or excessive grain has sometimes occurred on these areas. After seeing severely damaged Toronto greens it was felt that an evaluation of blends of seeded bentgrass cultivars would be worthwhile. This would be an attempt to produce a quality putting surface and at the same time increase the genetic diversity of the stand.

MATERIALS AND METHODS

All possible two-way blends of the cultivars Penncross, Penneagle, Seaside, and Emerald were established at the Ornamental Horticulture Research Center in Urbana August 21, 1981. Each blend and the four individual components were established in 6 x 10 ft plots with three replications. The turf is maintained at a 0.25 inch height of cut and irrigated as necessary to prevent wilt. During the growing season the turf is fertilized with 4.75 lb N/1000 sq ft and is on a preventative fungicide program. The area was lightly topdressed 4 times during the growing season with a 8-1-1 sand - soil - peat mixture.

RESULTS

There was no difference in rate of establishment among the components and blends. In 1982 and 1983 turfgrass quality was highest in plots containing Penneagle, alone or in a blend. In 1983 Seaside and Emerald had a higher incidence of dollar spot prior to fungicide application and had poorer color throughout the season. In 1984, the same trends were apparent (Table 1). At this time no cultivar segregation is apparent in the blends; however, plots will be evaluated over several years to see if any segregation occurs.

Table 1. Evaluation of creeping bentgrass cultivars and blends for the 1984 growing season.[1]

	Quality[2]					All Dates[3]
	4/10	5/23	6/30	7/31	9/18	
Penneagle	7.7a	7.7a	8.3a	9.0a	9.0a	8.3a
Penncross-Penneagle	6.0c-e	7.0ab	8.0a	9.0a	8.0a-c	7.6bc
Penneagle-Emerald	6.7a-c	7.0ab	8.0a	9.0a	9.0a	7.9ab
Penneagle-Seaside	7.3ab	7.0ab	7.0b	8.0b	8.7ab	7.6bc
Penncross	6.3b-d	6.7ab	7.0b	8.3ab	7.7b-d	7.2cd
Penncross-Emerald	6.0c-e	6.0bc	7.0b	7.7bc	7.7b-d	6.9de
Penncross-Seaside	6.0c-e	6.0bc	6.7bc	7.7bc	7.3c-e	6.7d
Emerald	5.0e	5.3c	6.0cd	7.0cd	6.7d-f	6.0ef
Emerald-Seaside	5.0e	5.3c	5.7d	6.3de	6.3ef	5.7fg
Seaside	5.3de	5.3c	5.3d	5.7e	6.0f	5.5g
$LSD_{0.05}$	1.3	1.0	0.8	0.4	1.1	0.4

[1]All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2]Quality evaluations are made on a 1-9 scale, where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

[3]Values represent the mean of 15 scores obtained from 3 replications and 5 evaluation dates.

FAIRWAY BENTGRASS MANAGEMENT STUDY

D. J. Wehner and J. E. Haley

INTRODUCTION

Creeping bentgrass has not been widely utilized for golf course fairways because of its aggressive nature and requirement for high levels of maintenance. However, annual bluegrass, which is a predominant component of many golf course fairways and is susceptible to heat and drought injury, can also require high levels of maintenance to produce quality turf. The purpose of this research is to evaluate the creeping bentgrass cultivars Prominent, Penncross, Penneagle, Seaside, Emerald, and Highland colonial bentgrass under varying levels of fairway management.

MATERIALS AND METHODS

The large blocks of each cultivar which were established in 1981 have been split so that half the area is receiving a preventative fungicide program while the other half receives no fungicide. Perpendicular to the fungicide strips are cultivation treatments consisting of vertical mowing, core cultivation, or no cultivation. These treatments are applied in June. The plots are monitored for turfgrass quality, thatch buildup, and disease severity. Plots are mowed at 5/8" and given 3 lbs nitrogen/1000 sq ft/yr as 18-5-9.

RESULTS

During 1982, the first year of the study, major quality differences started to appear in June with the incidence of dollar spot. Fungicide treated plots had higher quality ratings than the nonsprayed plots until October when dollar spot activity subsided. Lower overall quality ratings for Penncross and Penneagle resulted from their poorer mowing quality during very warm weather. Emerald lacked the vigor to prevent crabgrass from becoming a problem and thus, received lower quality ratings.

In 1983, dollar spot was not a serious problem on the plots because of the warm dry summer. The plots that were vertical mowed received lower quality ratings because they were damaged and the hot weather restricted recovery. The cultivars Penneagle, Penncross, Seaside, and Prominent received the highest quality ratings throughout the year. There was a higher percentage of crabgrass in plotsthat were core cultivated.

In 1984, dollar spot again was not a serious problem on the plots because of the warm dry summer. The cultivars Penneagle and Penncross received the highest quality ratings throughout the year although Penneagle quality was low in June following cultivation (Table 1). Highland, because of its poor heat tolerance, and Emerald, because of its poor vigor, received lower quality ratings in 1983 and 1984

Table 1. Evaluation of creeping bentgrasses maintained as fairway turf.[1]

	Quality[2]				
Treatment	4/10	5/24	6/29	8/08	9/18
Fungicide					7.7a
No Fungicide					4.4b
$LSD_{0.05}$					0.4
Prominent	5.0b	6.2b	5.3b	5.9bc	6.0bc
Seaside	5.9a	6.8b	5.4b	6.3b	5.8bc
Penncross	5.6ab	8.1a	6.0a	7.0a	6.4ab
Penneagle	5.8a	8.4a	4.9bc	7.0a	7.1a
Highland	5.8a	5.9b	4.4c	4.9d	5.0c
Emerald	4.0c	4.9c	5.0bc	5.6c	6.0bc
$LSD_{0.05}$	0.7	1.0	0.6	0.6	1.0
Core cultivation			5.4a		
Vertical mowing			5.0b		
No cultivation			5.1b		
$LSD_{0.05}$			0.2		

[1] All values represent the mean of 4 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

EARLY ESTABLISHMENT OF ZOYSIAGRASS BY SEED

H. L. Portz and M. J. Dozier

INTRODUCTION

Zoysiagrass is warm season turfgrass that has excellent turf qualities for the transition zone. Formerly it was necessary to propagate vegetatively by sod, plugs or stolons. Research in Korea and recently in the U.S. at SIU - Carbondale and USDA - Beltsville has shown that KOH or NaOH - scarified seeds (S) germinate up to 80% and subsequent light treatment provided a pregerminated seed (SL). S seed or SL seed will establish good stands in one season. Normally, one must wait until warm weather in late May or June for seeding, and then dry weather may require extensive irrigation. The purpose of this study was to test the use of clear polyethylene and other covers to provide warm temperatures and conserve moisture so early seeding establishment would allow earlier use for renovated golf course fairways.

MATERIALS AND METHODS

The total experimental area (edge of a golf course fairway) was treated with glyphosate (Roundup®). One half of the area was then disked and leveled; the other half was not tilled. On April 28, 1984 S and SL Korean Common zoysiagrass seed was dropseeded at 1/2 lb/1000 sq ft. The total area was verticut twice and all plots were treated with siduron (Tupersan®) at 6 lb ai/A. Temperatures on the soil surface and moisture at 3 cm were monitored under the various covers and bare ground. The covers were clear polyethylene, Lustor strips and tobacco netting on the prepared seedbed and only Lustor strips on the verticut only plots.

RESULTS

Results showed that SL germinated quicker than S seed (Table 1). Both S and SL seed under polyethylene and Lustor strip covers germinated and established more seedlings than under the netting or with no cover. There were more seedlings in the verticut only plots covered with Lustor strips than in the uncovered plots. The polyethylene and Lustor strip covers provided a warmer temperature during the cool spring for seed germination. Tensiometer readings shown in Table 2 represent moisture levels with low readings indicating very adequate moisture. Readings remained constant until May 10 after which the tobacco netting and uncovered plots began to show lower moisture levels (higher readings). Nine weeks after seeding there was sufficient zoysiagrass ground cover and firmness to allow moderate golf play on the verticut only plots.

Table 1. Seedling establishment of treated zoysiagrass under various covers, seeded 28 April, 1984 at Jackson Country Club, Carbondale, IL.

	Seedlings per 625 sq cm[1]			Temperature[2]	
	Prepared Seedbed		Verticut Only	Low	High
Cover + Seed Treatment	17 May	7 June	7 June	1 May	
Polyethelene + S*	16	29		12	51
Polyethelene + SL**	36	34			
Lustor Strips + S	12	25	29	11	51
Lustor Strips + SL	22	31	34		
Tobacco Netting + S	8	17		6	41
Tobacco Netting + SL	8	29			
No Cover + S	1	12	15	5	38
No Cover + SL	0	16	14		

[1]Seedlings per 625 sq cm represent the number of seedlings counted in this area.

[2]Temperature is recorded as degrees centigrade.

*S represents seed that has been scarified with NaOH.

**SL represents seed that has been scarified with NaOH and pregerminated with light treatment.

Table 2. Tensiometer readings taken in the top 3 cm under various covers.

	Tensiometer Reading[1]			
Cover	28 April	3 May	10 May	17 May
Polyethelene	5	5	5	10
Lustor Strips	5	3	5	12
Tobacco Netting	7	5	15	40
No Cover	3	5	20	25

[1]Low tensiometer readings indicate adequate moisture and high readings indicate lower soil moisture content.

ZOYSIAGRASS CUTTING MANAGEMENT

H. L. Portz and V. R. Patterozzi

INTRODUCTION

Meyer zoysiagrass is commonly cut at 1/2 inch for golf course fairways and this medium textured, dense cultivar provides a good playing surface. Korean Common, however, is coarse textured and is not as dense. It has been observed at SIU - Carbondale that, when cut at 1/2 inch, the density and cover are not sufficient to perch the ball and considerable weed encroachment occurred. In South Korea, however, this Korean zoysiagrass is cut at 3/4 inch on fairways and provides an excellent playing surface. The purpose of this study was to test different fertility levels to determine if adequate density could be maintained at a 3/4 or 1 1/4 inch cutting height.

MATERIALS AND METHODS

A three year old stand of Korean Common zoysiagrass has been mowed at 3/4 inch and 1 1/2 inch (for lawn purposes) with 1, 3 and 5 lbs of N/1000 sq ft applied per season. Nitrogen carriers were urea and ureaform and applications were at 1/2 lb for the lowest and medium rate and 1 lb at the highest rate. The plots were irrigated throughout the summer as needed.

RESULTS

Initial results in 1984 indicate a very good ball surface at the 3/4 height with the 3 and 5 lb N (Table 1). Somewhat excessive growth was noted in November with the 5 lb rate. There also was better fall color under the 3/4 inch than the 1 1/4 inch cutting height. More weeds were noted in the 3/4 inch plots and will need to be killed (glyphosated) before greenup of zoysiagrass in the spring (between March 1 and March 15).

Table 1. Density of 'Korean Common' zoysiagrass under two cutting heights and three nitrogen rates.

Nitrogen Carrier	Rate N lb/1000 sq ft	Density[1] 7/21/84 3/4 in	7/21/84 1 1/4 in	9/20/84 3/4 in	9/20/84 1 1/4 in	11/2/84 3/4 in
Control	0	5.2	6.3	5.0	5.3	5.3
Urea	1	5.2	6.2	6.2	6.1	6.8
Urea	3	6.5	6.8	6.2	5.8	6.2
Urea	5	6.3	6.8	6.8	7.3	7.7*
UF	1	5.0	6.2	5.0	5.5	4.8
UF	3	5.8	6.5	6.2	6.2	6.0
UF	5	6.0	7.0	7.5	6.5	8.0*

[1] Density evaluations are made on a 1-9 scale where 9 = excellent turfgrass density and 1 = very poor turfgrass density.

*Indicates somewhat excessive growth.

MONITORING ANNUAL BLUEGRASS HEAT TOLERANCE

D. L. Martin and D. J. Wehner

Midsummer stress of annual bluegrass (Poa annua) is a serious problem on many golf courses in the midwest. Annual bluegrass successfully competes with the more desirable turfgrasses such as creeping bentgrass and Kentucky bluegrass during the cool seasons of the year, establishing itself as a component of many golf course turfs. During the stressful summer months annual bluegrass suffers discoloration and density reduction, leading to reduction in the quality of the turf. The purpose of this study is to monitor the heat tolerance of annual bluegrass during the growing season.

MATERIALS AND METHODS

The annual bluegrass stand used in this study was established in the fall of 1983 from pre-existing seed in the soil. The monitored area was mowed at a 1 inch height of cut 2-3 times per week. The fertility regime was approximately 4 lbs of nitrogen/1000 sq ft/year. Tensiometers were used to monitor soil moisture conditions so that irrigation was properly timed.

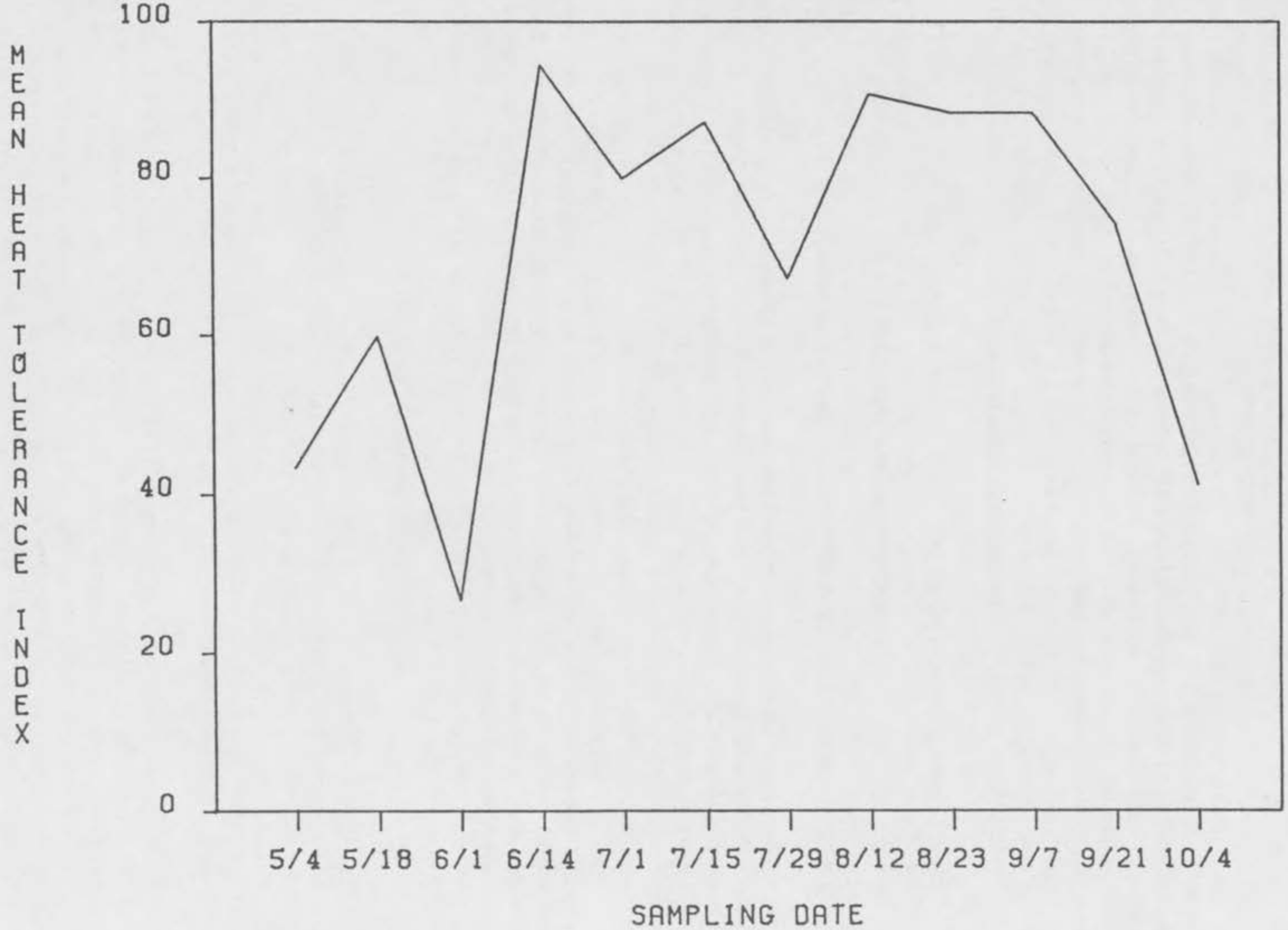
Four plugs were taken from the sampling area every 2 weeks. The plugs were taken to the Horticulture Field Laboratory where sample plants were subjected to high temperatures in a temperature controlled water bath for 30 minutes. The treatment temperatures used were 40, and 42 through 48° C inclusive in one degree increments. The annual bluegrass plants were then allowed to recover for 2 weeks in the greenhouse before all surviving and newly generated tissue was dried and weighed. The weights of treated plants expressed as a percentage of the weights of nontreated control plants provided a relative heat tolerance index for each treatment date. The heat tolerance index scale range from 0 to 100. The higher the index number, the greater the heat tolerance of the plants. Sampling of the monitoring area began on May 4, 1984.

RESULTS AND DISCUSSION

Analysis of this first year's data is not complete at present. The mean heat tolerance index obtained from plants treated at 40, 42 and 43° C is plotted in Figure 1. This graph suggests that the heat tolerance of annual bluegrass varies over the course of the growing season. Additional research will involve examining the role of temperature and soil moisture in conditioning the heat tolerance of annual bluegrass.

In a related experiment, annual bluegrass samples from 14 locations throughout Illinois are being screened for relative heat tolerance. The screening test is similar to that previously described for monitoring annual bluegrass heat tolerance. Preliminary data from the screening experiment suggest that there may be significant variation in heat tolerance among annual bluegrass populations from different geographical locations within Illinois. Further research will be aimed at examining whether the differences in heat tolerance are related to latitudinal distribution of the populations within the state.

Figure 1. Heat tolerance indices of annual bluegrass over 1984 growing season.[1]



[1]The heat tolerance index is the mean of recovery weights from plants treated at 40, 42 and 43 C expressed as a percentage of the weight of non-heated control plants.

ANNUAL BLUEGRASS CONTROL IN CREEPING BENTGRASS

J. E. Haley and D. J. Wehner

Annual bluegrass (Poa annua) is often a major component of golf course turf. It competes well with creeping bentgrass and Kentucky bluegrass when irrigation is frequent, nitrogen levels are high, and mowing heights are low. Even when mowing heights are 0.25 inches or less, annual bluegrass is able to produce large amounts of seed. Annual bluegrass is often considered undesirable golf turf. It is suceptible to winter damage and is difficult to maintain as a quality turf during the stressful summer months. The purpose of this study was to evaluate flurprimidol or EL-500 (Cutless®) as a control of annual bluegrass in a mature creeping bentgrass putting green.

MATERIALS AND METHODS

The study was established April 18, 1984 in Urbana, IL. The north end of the experimental plot is a Penncross creeping bentgrass turf and the south end is a Toronto creeping bentgrass turf with 5% to 20% annual bluegrass infestation. The growth retardant, EL-500, was evaluated at 1.0 lb ai/A. Applications were made 4 times, 2 weeks apart at 0.25 lb ai/A; 2 times, 4 weeks apart at 0.50 lb ai/A; or 1 time at 1.00 lb ai/A. All treatments were applied in the spring and fall to different test plots. A standard treatment of EL-500 at 1.25 lb ai/A applied in mid June was included. An untreated check was also included in the test. Dates of application are listed in Table 1. Plots are monitored for phytotoxicity and will be evaluated in the spring for percent of annual bluegrass per plot.

RESULTS

Although turf in the El-500 treated plots exhibited a change in color (the turf darkened) no leaf blade injury or direct kill of the turf was apparant. Quality in these plots was not significantly different than untreated plots (Table 1). The discoloration increased as the rate per application increased and was more persistant in the fall application of 0.50 lb ai/A when turf growth and recovery was slower. This discoloration did not effect turf quality during the summer.

Table 1. Evaluation of Cutless® (EL-500) as a control of annual bluegrass in creeping bentgrass turf - quality ratings.[1]

Treatment	Rate (lb ai/A)/Application Date									Penncross Quality[2]		
	4/18	5/03	5/17	6/01	6/13	9/06	9/21	10/5	10/18	5/23	7/31	9/18
EL-500	0.25	0.25	0.25	0.25						6.7ab	9.0	9.0
EL-500	0.50		0.50							6.3bc	9.0	8.7
EL-500	1.00									6.0c	9.0	8.7
EL-500					1.25					7.0a	8.7	7.7
EL-500						0.25	0.25	0.25	0.25	7.0a	9.0	8.7
EL-500						0.50		0.50		7.0a	8.7	7.7
EL-500						1.00				7.0a	8.3	8.3
Control	--	--	--	--	--	--	--	--	--	7.0a	9.0	8.7
$LSD_{0.05}$										0.5	NS	NS

Treatment	Rate (lb ai/A)/Application Date									Toronto Quality[2]		
	4/18	5/03	5/17	6/01	6/13	9/06	9/21	10/5	10/18	5/23	7/31	9/18
EL-500	0.25	0.25	0.25	0.25						5.3	7.7	7.3
EL-500	0.50		0.50							5.3	7.0	7.0
EL-500	1.00									5.0	7.0	7.0
EL-500					1.25					6.0	7.3	7.0
EL-500						0.25	0.25	0.25	0.25	5.3	7.0	7.0
EL-500						0.50		0.50		5.3	7.3	7.0
EL-500						1.00				5.0	7.3	7.0
Control	--	--	--	--	--	--	--	--	--	6.0	7.3	7.0
$LSD_{0.05}$										NS	NS	NS

[1]All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2]Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

EVALUATION OF HERBICIDES FOR POSTEMERGENCE CONTROL OF CRABGRASS

J. E. Haley and D. J. Wehner

INTRODUCTION

The evaluation of postemergence herbicides for crabgrass (Digitaria sp.) control on established turf is a continuing process. Periodic evaluations are necessary to determine the suitability of new materials and formulations for use on turf. The evaluation of herbicides used for crabgrass control in other crops but not labeled for turf is also necessary to determine their potential for use on turfgrass.

MATERIALS AND METHODS

The herbicides evaluated in this trial were two experimental compounds, HOE A25 01 (American Hoechst Corporation) at rates of 0.12, 0.18, 0.25 and 0.35 lb ai/A; and XRM 4763 (Dow Chemical Corporation) at rates of 0.5 and 1.5 lb ai/A. Treatments were applied July 18, 1984 to a common Kentucky bluegrass turf with an infestation of crabgrass at the 1 to 4 tiller stage of growth. Plot size was 3 x 10 feet and materials were applied at 40 gallons per acre. XRM 4763 was applied with crop oil at the rate of 1 qt crop oil/A. The area was irrigated as needed to prevent wilt.

RESULTS

Plots were rated for per cent cover of the plot with crabgrass on July 31 and August 29 (Table 1). Best postemergence control of crabgrass was obtained two weeks following treatment with HOE A25 01 at the 0.25 and 0.35 lb ai/A rates. Six weeks following application crabgrass control in all HOE A25 01 plots was excellent. Some control of crabgrass was seen with XRM 4763 at the 1.5 lb ai/A rate 2 weeks following application, however 6 weeks after treatment crabgrass cover in these plots had increased and there was no significant difference in crabgrass cover between these treatments and the untreated check.

Table 1. Evaluation of herbicides for postemergence control of crabgrass in a Kentucky bluegrass turf.[1]

Material	Rate lb ai/A	Percent Cover with Crabgrass[2] 7/31	8/29
XRM 4763*	0.5	60.0a	86.7a
XRM 4763*	1.5	33.3b	75.0a
HOE A 2501	0.12	25.0bc	11.7b
HOE A 2501	0.18	13.3bc	8.3b
HOE A 2501	0.25	8.3c	3.3b
HOE A 2501	0.35	6.7c	4.3b
Control	---	71.7a	98.3a
$LSD_{0.05}$		22.3	30.1

[1]All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2]Percent cover with crabgrass represents the percent of plot area covered by crabgrass plants.

*XRM 4763 treatments were applied in a solution containing crop oil at a rate of 1 quart crop oil per acre.

EVALUATION OF HERBICIDES FOR BROADLEAF WEED CONTROL IN TURF

J. E. Haley and D. J. Wehner

INTRODUCTION

The high cost of pesticide development has prohibited the introduction of new herbicides which are used exclusively for broadleaf weed control in turfgrass stands. Manufacturers are evaluating new formulations of standard turfgrass herbicides or seeking data to expand the label of products which have proven efficacious on large scale crops. The purpose of this research was to evaluate the herbicides Probe® (methazole), Banvel® (dicamba) and Trimec® (2,4-D, MCPP and dicamba) for control of broadleaf plantain (Plantago major L.), buckhorn plantain (Plantgo lanceolate L.) and white clover (Trifolium repens L.) in a mixed Kentucky bluegrass - tall fescue turfgrass stand.

MATERIALS AND METHODS

Treatments consisted of sprays containing individual herbicides or combinations of herbicides. Herbicides were applied June 4, 1984 in 40 gallons of water per acre. Plot size was 3 x 10 feet and each treatment was replicated 3 times. An untreated control was included within each replication. Weed evaluations were made on a scale of 1-9, where 9 = a large, healthy weed population and 1 = no weeds present. Ratings were made June 25, July 7 and September 9, 1984.

RESULTS

On all evaluation dates the best control of all weed species present was obtained with the herbicide Trimec®, a combination of 2,4-D, MCPP and dicamba (Table 1). Some control of plantain was evident with Banvel® (dicamba) and with some combinations of Probe® and Banvel®. Excellent control of white clover was obtained with Banvel® and all combinations of Probe® and Banvel®.

Table 1. Post-emergence control of broadleaf weeds 3, 5 and 15 weeks following herbicide application.[1]

Material	Rate lb ai/A	Weed Control[2] Plantain 6/25	Plantain 7/10	Plantain 9/17	White Clover 6/25	White Clover 7/10	White Clover 9/17
Probe®	0.38	9.0a	8.3ab	9.0a	9.0a	7.7b	9.0a
Probe®	0.63	8.0ab	5.7cd	7.3ab	6.3b	4.7c	7.3a
Probe®	1.13	8.0ab	6.0cd	7.0ab	4.3c	2.0d	4.7b
Probe® + Banvel®	0.38 + 0.13	8.3ab	5.0de	6.0b	1.0e	1.3d	1.3c
Probe® + Banvel®	0.63 + 0.19	7.7b	7.0bc	9.0a	1.0e	1.0d	1.7c
Probe® + Banvel®	1.13 + 0.38	5.3c	4.7de	7.7ab	1.0e	1.0d	1.0c
Banvel®	0.19	6.3c	5.3c-e	7.0ab	3.0cd	1.3d	2.7bc
Banvel®	0.38	6.3c	3.7e	5.7b	1.7de	1.3d	1.0c
Trimec®	1.66	2.7d	1.3f	1.3c	1.3e	1.0d	1.0c
Control	----	9.0a	9.0a	9.0a	9.0a	9.0a	9.0a
$LSD_{0.05}$		1.2	1.9	2.4	1.6	1.0	2.6

[1]All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2]Weed evaluations are made on a scale of 1-9, where 9 = no control of the weed species and 1 = no weeds present.

THE USE OF POSTEMERGENCE HERBICIDES ON TALL FESCUE

J. E. Haley and T. W. Fermanian

INTRODUCTION

Two herbicides currently under development for postemergence broadleaf weed control in tall fescue turf are Telar® (chlorsulfuron) and DPX T6376 (Escort®). Both herbicides are used at very low rates making them cost effective for weed control with an added potential as growth regulators. These traits are especially important for herbicides used on tall fescue turf where low maintenance is a key consideration. Herbicides that control broadleaf weeds and at the same time reduce turf growth and seedhead production would be useful to the turfgrass industry. The object of this study was to determine the effect of these materials on turfgrass phytotoxicity, stand thinning and seedhead production. Since Telar® and DPX T6376 are both resistant to degradation in the soil, the carry over of herbicide from one season to the next is of concern. This study will extend over three years to measure the long term effects of repeated applications.

MATERIALS AND METHODS

The products tested were Telar® at 0.19, 0.56 and 1.31 oz ai/A and DPX T6376 at 0.24, 0.48 and 0.72 oz ai/A. These were applied in a 0.25% v/v solution of surfactant X77. Also included in the test was the treatment of 2,4D (1.0 lb ai/A) plus Banvel® (at 0.25 lb ai/A) as a standard for broadleaf weed control. Treatments were replicated 3 times. All materials were applied May 11, 1984 to 3 x 10 feet plots of tall fescue turf using a CO_2 propelled backpack sprayer at a spray volume of 40 gallons/A. Plots were not mowed following application until September.

RESULTS

Tall fescue plots were evaluated for damage from herbicides 2, 3, 4, 5 and 7 weeks after treatment (Table 1). In general, turf treated with DPX T6376 had more injury than turf treated with Telar®, although the highest rate of Telar® produced serious injury for several weeks. Turf injury with Telar® at 0.19 and 0.56 oz ai/A was mild to moderate. Some injury was seen with the 2,4D - Banvel® combination but this was never significantly different than the control. All rates of DPX T6376 gave excellent control of seedhead production. Good to excellent control of seedhead production was found with all rates of Telar®. No control of seedhead production was seen with the 2,4D - Banvel® combination.

Table 1. The evaluation of phytotoxic effects of post emergence herbicides on tall fescue.[1]

Material	Rate oz ai/A	Phytotoxicity[3] All Dates[2]	2 WAT 5/24	3 WAT 5/31	4 WAT 6/06	5 WAT 6/13	7 WAT 6/29	Percent Seedheads[4] 6/05
Telar®	0.19	8.3b	9.0a	8.0ab	7.3b	8.3a	9.0a	11.7b
Telar®	0.56	7.3c	9.0a	7.0bc	5.3c	7.0b	8.3a	6.7c
Telar®	1.31	5.7d	8.3b	7.0bc	4.0d	3.7d	5.3bc	2.0d
DPX T6376	0.24	7.0c	9.0a	6.3b-d	5.0c	6.3b	8.3a	1.0d
DPX T6376	0.48	5.7d	8.3b	5.7cd	4.0d	4.7c	6.0b	0.7d
DPX T6376	0.72	4.6e	7.0c	5.0d	3.0e	3.7d	4.3c	0.0d
2,4D + Banvel®	1.0 lb ai/A + 0.25 lb ai/A	8.7ab	9.0a	7.7ab	9.0a	9.0a	9.0a	100.0a
Control	---	9.0a	9.0a	9.0a	9.0a	9.0a	9.0a	100.0a
$LSD_{0.05}$		0.5	0.5	2.0	0.8	1.0	1.0	2.5

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Values represent the mean of 15 scores obtained from 3 replications and 5 evaluation dates.

[3] Phytotoxicity evaluations are made on a 1-9 scale where 9 = no visible phytotoxic effects and 1 = necrotic.

[4] Percent seedheads represents the average percent of turfgrass plants bearing seedheads.

EFFECTS OF SOIL TEMPERATURE AND MOISTURE ON THE RATE OF DECOMPOSITION OF THE PREEMERGENCE HERBICIDE DCPA

J. Choi and T. W. Fermanian

INTRODUCTION

The use of a preemergence herbicide for annual grass control in turf is a standard procedure in turfgrass management. Information on the fate of preemergence herbicides in turf is minimal. Microbial activity is generally considered to be the primary mechanism for the degradation of these herbicides. The activity levels of soil microbial populations is directly related to soil temperature and moisture levels.

A study was initiated to correlate the rate of Dacthal® (DCPA) degradation with varying temperature and moisture levels. Six temperatures (10, 15, 20, 25, 30, 35° C) and three moisture levels (15, 30, 60 g H_2O) added to 150 g of air dried soil were chosen.

MATERIALS AND METHODS

Treatments were prepared by evenly mixing soil with Dacthal® (Technical grade, 98.6%) at the rate of 33.6 microgram/g dry soil (equivalent to 10 lb ai/A incorporated to a depth of 2.5 cm). The treated soils were placed in erlenmyer flasks and plugged with cotton to minimize evaporation but not impede the respiration of microorganisms.

Constant temperature chambers were built using styrofoam boxes with heating wire installed under the hardware cloth rack. Boxes were kept in a refrigerated room (4° C). The desired temperature was maintained by electronic temperature controller using a thermocoupler as the sensor. Moisture levels were obtained by adding a predetermined weight of water to the soil. The wettest treatment was almost at a saturation level, and the following levels had 50% and 25% H_2O (by weight) of the wettest treatment.

Soil samples (10 g) were removed weekly from each treatment and stored in a freezer until subsequent analyses for the remaining DCPA. The methods of Branham, 1984 were used for the extraction and analyses of all treatments.

RESULT

Treatment samples have been collected over a ten week period, however, all analysis has not been completed. Following studies will be carried out to correlate the rate of Dacthal degradation with the activity of soil microorganisms.

REFERENCE

Bruce E. Branham, 1983. The Fate of DCPA and Diazinon in Turf Using Model Ecosystems. Ph.D. Thesis. Dept. of Horticulture. U. of Illinois.

KENTUCKY BLUEGRASS CULTIVAR RESPONSE TO THE APPLICATION OF LIMIT®, A PLANT GROWTH RETARDANT

T. W. Fermanian and J. E. Haley

INTRODUCTION

While the response of several cultivars of Kentucky bluegrass to amidochlor (Limit®) has been evaluated for the past several years, many cultivars of Kentucky bluegrass have not been tested. Because of the variability in growth habit and response to cultural practices exhibited by the wide range of bluegrass varieties, there is a need to also evaluate their response to growth retardants. Meeting these objectives would require the use of an area where multiple cultivars were growing in isolated plots. The USDA Kentucky bluegrass trial planted in September 15, 1980 provided an ideal location to evaluate individual cultivar responses to the application of amidochlor. Due to space limitations, plot size was inherently small. This experiment, however, provided valuable information for future evaluation of cultivar response to plant growth retardants.

MATERIALS AND METHODS

The USDA Kentucky bluegrass trial consists of 84 cultivars each replicated three times. On May 5, 1983 half of each 6 x 5 foot plot was treated with amidochlor at a rate of 2.0 lb ai/A. These same plots were treated again on May 7, 1984 with amidochlor at 2.5 lb ai/A. Treatments were made using a CO^2 propelled backpack sprayer at a spray volume of 40 gallons per acre. During the growing season the area was fertilized with 4 lb N/1000 sq ft (18-5-9). No preemergence herbicides were used. The area was irrigated as needed to prevent wilt.

RESULTS

Each Kentucky bluegrass cultivar growth response to the application of amidochlor was evaluated by measuring the mean plant height prior to mowing. In 1983 height measurements were taken four weeks after the treatment was applied. In general, most cultivars showed a significant reduction in the growth rate as compared to their untreated half. In the case of BA-61-91, Baron, Birka, Bristol, Enmundie, Glade, Harmony, Holiday, Merit, Nugget, PSU 191, S. D. Common, Vanessa, Victa, Welcome, and Midnight (1528T), no differences in the growth rate could be measured. Quality ratings in 1983 were recorded both three weeks and seven weeks after treatment. With a few exceptions, most cultivars did not show any loss in quality as compared to their untreated half. A20-6, MER PP 300, and Piedmont showed a significant reduction in quality for both dates of evaluation. While the disease dollar spot (Sclerotinia homoeocarpa) was observed after the period of activity had ended, no differences were found between treated and untreated portions of the same cultivar.

During the 1984 growing season mean plant height was evaluated four weeks following plant growth retardant treatment. Although the mean height of the treated turfgrass was lower than the mean height of the untreated turf several cultivars did not show a significant reduction in growth (Table1). Cultivars which did not show a significant effect (reduced growth) include Adelphi, A20, A20-6, BA-61-91, Cello, Challenger (N535), Escort, H7, I-13, Mer PP 300, Mona, Mosa, Nugget, Parade, Piedmont, Plush, PSU-190, S-21, S.D. Common, Shasta, Sydsport, Touchdown, Vanessa, Welcome and WW AG 478. It should be noted that BA-61-91, Nugget, S.D. Common, Vanessa and Welcome exhibited no significant growth reduction for the second year.

Seedhead production was also evaluated during the 1984 growing season. The estimated portion of each plot cover with seedheads is listed in Table 2. Seedhead production in non-treated plots ranged from slightly less than 4% to 100% cover. This would indicate the ability of Limit® to reduce seedhead numbers was not related to seedhead production.

The results of this study indicate that there is tremendous variation among Kentucky bluegrass cultivars for susceptibility to the effect of plant growth retardants. This study will be followed up in future years to evaluate the long range effects of plant growth retardant use.

Table 1. The effect of Limit® on the height of 84 Kentucky bluegrass cultivars evaluated June 6, 1984.[1]

Cultivar	Treatment	Height	Cultivar	Treatment	Height
CEB VB 3965	Mon 4621	5.6*	BA-61-91	Mon 4621	6.5
	Control	10.4		Control	9.0
Banff	Mon 4621	6.2*	Barblue	Mon 4621	6.5*
	Control	13.4		Control	11.2
Victa	Mon 4621	6.2*	WW AG 480	Mon 4621	6.5*
	Control	8.7		Control	11.1
Bristol	Mon 4621	6.2*	Bonnieblue	Mon 4621	6.6*
	Control	9.8		Control	10.5
America	Mon 4621	6.3*	SV-01617	Mon 4621	6.6*
	Control	9.5		Control	12.5
Merion	Mon 4621	6.3*	K3-178	Mon 4621	6.6*
	Control	11.8		Control	12.0
Cello	Mon 4621	6.4	MER PP 300	Mon 4621	6.6
	Control	9.3		Control	9.4
Baron	Mon 4621	6.4*	Ram 1	Mon 4621	6.6*
	Control	9.3		Control	8.7
WW AG 478	Mon 4621	6.4	A20-6	Mon 4621	6.6
	Control	7.9		Control	9.2
Mosa	Mon 4621	6.4	Challenger	Mon 4621	6.6
	Control	10.9		Control	11.3
Admiral	Mon 4621	6.4*	Apart	Mon 4621	6.7*
	Control	10.6		Control	11.8
Columbia	Mon 4621	6.4*	Sydsport	Mon 4621	6.7
	Control	11.6		Control	9.7
Merit	Mon 4621	6.4*	239	Mon 4621	6.7*
	Control	9.2		Control	11.8
K1-152	Mon 4621	6.5*	I-13	Mon 4621	6.7
	Control	10.8		Control	9.7

(continued)

Table 1. The effect of Limit® on the height of 84 Kentucky bluegrass cultivars evaluated June 6, 1984 (continued).[1]

Cultivar	Treatment	Height	Cultivar	Treatment	Height
Aspen	Mon 4621	6.7*	Mona	Mon 4621	7.0
	Control	9.5		Control	10.6
Midnight	Mon 4621	6.7*	NJ 735	Mon 4621	7.0*
	Control	9.6		Control	11.1
Mystic	Mon 4621	6.7*	Touchdown	Mon 4621	7.0
	Control	8.7		Control	9.6
Somerset	Mon 4621	6.8*	A20-6A	Mon 4621	7.0*
	Control	8.7		Control	10.9
Fylking	Mon 4621	6.8*	WW AG 463	Mon 4621	7.0*
	Control	12.1		Control	9.8
Bono	Mon 4621	6.8*	Enoble	Mon 4621	7.1*
	Control	11.0		Control	11.3
Glade	Mon 4621	6.8*	Nassau	Mon 4621	7.1*
	Control	10.2		Control	11.2
Nugget	Mon 4621	6.9	Eclipse	Mon 4621	7.1*
	Control	9.6		Control	10.2
Adelphi	Mon 4621	6.9	A-34	Mon 4621	7.2*
	Control	9.1		Control	11.2
H7	Mon 4621	6.9	Kenblue	Mon 4621	7.2*
	Control	9.2		Control	12.6
K3-179	Mon 4621	6.9*	PSU-150	Mon 4621	7.3*
	Control	11.6		Control	11.5
MLM-18011	Mon 4621	6.9*	Vanessa	Mon 4621	7.3
	Control	11.5		Control	10.2
Welcome	Mon 4621	7.0	Wabash	Mon 4621	7.3*
	Control	9.4		Control	11.7
Cheri	Mon 4621	7.0*	Lovegreen	Mon 4621	7.3*
	Control	8.8		Control	10.7

(continued)

Table 1. The effect of Limit® on the height of 84 Kentucky bluegrass cultivars evaluated June 6, 1984 (continued).[1]

Rugby	Mon 4621	7.3*	S.D. Common	Mon 4621	7.6
	Control	12.6		Control	11.7
225	Mon 4621	7.3*	Vantage	Mon 4621	7.7*
	Control	10.0		Control	13.5
Charlotte	Mon 4621	7.4*	PSU-190	Mon 4621	7.7
	Control	12.2		Control	11.0
A-20	Mon 4621	7.4	Birka	Mon 4621	7.9*
	Control	9.6		Control	10.6
Piedmont	Mon 4621	7.4	Harmony	Mon 4621	7.9*
	Control	11.5		Control	11.3
Plush	Mon 4621	7.4	Holiday	Mon 4621	7.9*
	Control	10.2		Control	10.3
Escort	Mon 4621	7.5	S-21	Mon 4621	8.0
	Control	11.4		Control	10.3
PSU-173	Mon 4621	7.5*	Parade	Mon 4621	8.0
	Control	12.3		Control	11.3
Trenton	Mon 4621	7.5*	Dormie	Mon 4621	8.1*
	Control	13.3		Control	12.3
Kimono	Mon 4621	7.6*	Geronimo	Mon 4621	8.1*
	Control	10.8		Control	13.2
Argyle	Mon 4621	7.6*	Monopoly	Mon 4621	8.1*
	Control	14.5		Control	12.3
Shasta	Mon 4621	7.6	MER PP 43	Mon 4621	8.3*
	Control	11.9		Control	13.0
Enmundie	Mon 4621	7.6*	K3-162	Mon 4621	8.7*
	Control	10.7		Control	13.3
Majestic	Mon 4621	7.6*	Bayside	Mon 4621	9.2*
	Control	11.8		Control	13.7

[1] Height refers to the average of height in cm of the turfgrass plants. Plants were treated May 7, 1984

*Means are significantly different at the 0.05 level as determined by a T test of mean pairs.

Table 2. The effect of Limit® on the seedhead production of 84 Kentucky bluegrass cultivars evaluated June 5, 1984.[1]

Cultivar	Treatment	Percent Seedheads	Cultivar	Treatment	Percent Seedheads
H7	Mon 4621	0*	A20-6	Mon 4621	3.7*
	Control	13.3		Control	10.0
Glade	Mon 4621	0.3	Bono	Mon 4621	3.7*
	Control	10.0		Control	16.7
I-13	Mon 4621	0.3	Plush	Mon 4621	4.0*
	Control	3.7		Control	13.3
Wabash	Mon 4621	0.3*	PSU-150	Mon 4621	4.7
	Control	8.3		Control	10.0
Welcome	Mon 4621	0.3*	Charlotte	Mon 4621	7.0*
	Control	5.0		Control	13.3
Mystic	Mon 4621	1.0*	S.D. Common	Mon 4621	7.0
	Control	8.3		Control	16.7
Touchdown	Mon 4621	1.0*	PSU-173	Mon 4621	7.7
	Control	11.7		Control	16.7
K3-162	Mon 4621	1.7	Barblue	Mon 4621	8.3*
	Control	8.3		Control	58.3
Kimono	Mon 4621	2.0*	Bayside	Mon 4621	8.3
	Control	9.3		Control	18.3
WW AG 478	Mon 4621	2.0	Birka	Mon 4621	8.3
	Control	23.3		Control	25.0
Fylking	Mon 4621	2.3*	Somerset	Mon 4621	8.3*
	Control	10.0		Control	38.3
Ram 1	Mon 4621	2.3*	Sydsport	Mon 4621	8.3
	Control	15.0		Control	26.7
SV-01617	Mon 4621	2.3*	Cello	Mon 4621	8.7*
	Control	15.0		Control	26.7
Midnight	Mon 4621	3.3*	Nugget	Mon 4621	8.7
	Control	11.7		Control	21.7

(continued)

Table 2. The effect of Limit® on the seedhead production of 84 Kentucky bluegrass cultivars evaluated June 5, 1984 (continued).[1]

Cultivar	Treatment	Percent Seedheads	Cultivar	Treatment	Percent Seedheads
Admiral	Mon 4621	10.0*	Bonnieblue	Mon 4621	15.0
	Control	33.3		Control	28.3
K3-179	Mon 4621	10.0*	Cheri	Mon 4621	15.0
	Control	18.3		Control	28.3
Adelphi	Mon 4621	11.7	K1-152	Mon 4621	15.0*
	Control	26.7		Control	48.3
Kenblue	Mon 4621	11.7	Argyle	Mon 4621	16.7
	Control	13.3		Control	18.3
Lovegreen	Mon 4621	11.7	Eclipse	Mon 4621	16.7
	Control	30.0		Control	20.0
Majestic	Mon 4621	11.7*	MER PP 43	Mon 4621	16.7
	Control	30.0		Control	38.3
Merion	Mon 4621	11.7*	Banff	Mon 4621	18.3*
	Control	43.3		Control	88.3
NJ 735	Mon 4621	11.7*	Challenger	Mon 4621	18.3
	Control	28.3		Control	20.0
Piedmont	Mon 4621	11.7	WW AG 463	Mon 4621	18.3
	Control	16.7		Control	70.0
A34	Mon 4621	13.3	A20-6A	Mon 4621	20.0
	Control	20.0		Control	36.7
A20	Mon 4621	13.3	PSU-190	Mon 4621	20.0
	Control	43.3		Control	21.7
Enmundie	Mon 4621	13.3	225	Mon 4621	20.0*
	Control	16.7		Control	36.7
Vantage	Mon 4621	13.3*	Monopoly	Mon 4621	21.7*
	Control	21.7		Control	50.0
WW AG 480	Mon 4621	13.3*	Parade	Mon 4621	21.7
	Control	30.0		Control	40.0

(continued)

Table 2. The effect of Limit® on the seedhead production[1] of 84 Kentucky bluegrass cultivars evaluated June 5, 1984 (continued).

Cultivar	Treatment	Percent Seedheads	Cultivar	Treatment	Percent Seedheads
America	Mon 4621	23.3*	Aspen	Mon 4621	31.7*
	Control	78.3		Control	66.7
Dormie	Mon 4621	23.3*	Geronimo	Mon 4621	31.7
	Control	53.3		Control	28.3
Enoble	Mon 4621	23.3*	MLM-18011	Mon 4621	31.7
	Control	63.3		Control	60.0
S-21	Mon 4621	23.3	Mona	Mon 4621	31.7*
	Control	36.7		Control	85.0
Trenton	Mon 4621	23.3*	Nassau	Mon 4621	31.7*
	Control	88.3		Control	90.0
Apart	Mon 4621	25.0	K3-178	Mon 4621	36.7*
	Control	56.7		Control	93.3
Harmony	Mon 4621	25.0	Shasta	Mon 4621	36.7*
	Control	38.3		Control	100.0
Rugby	Mon 4621	26.7*	Victa	Mon 4621	36.7
	Control	96.7		Control	46.7
239	Mon 4621	26.7	BA-61-91	Mon 4621	38.3
	Control	83.3		Control	58.3
Holiday	Mon 4621	28.3	Columbia	Mon 4621	38.3*
	Control	46.7		Control	100.0
Mosa	Mon 4621	28.3	Baron	Mon 4621	40.0
	Control	33.3		Control	51.7
mail					
Vanessa	Mon 4621	28.3	Bristol	Mon 4621	40.0
	Control	38.3		Control	80.0
CEB VB 3965	Mon 4621	30.0	MER PP 300	Mon 4621	50.0
	Control	43.3		Control	50.0
Escort	Mon 4621	30.0	Merit	Mon 4621	50.0
	Control	43.3		Control	70.0

1Percent seedheads represents the average percent of turfgrass plants bearing seedheads. Plants were treated May 7, 1984.

*Means are significantly different at the 0.05 level as determined by a T test of each mean pair.

TIMING OF APPLICATION OF PLANT GROWTH RETARDANTS ON KENTUCKY BLUEGRASS TURF

T. W. Fermanian and J. E. Haley

INTRODUCTION

In recent years, many new chemical compounds have been evaluated for their ability to regulate turfgrass growth. The two components of growth most affected are vegetative shoot growth and seedhead production. For many compounds, the regulating effects on these two components have been inconsistent from year to year. Some of this inconsistency can be contributed to improper timing for the application of these materials.

In general, the timing of an application of a turfgrass growth retardant should coincide with full greenup of the turf in the spring, but precede the emergence of seedheads from the leaf sheath. The time interval, or application window, between these two events differs with each turfgrass species. For Kentucky bluegrass, the application window is generally three to four weeks. Since turf growth is largely controlled by temperature, the application window changes from year to year according to the prevailing climate.

The accumulation of average daily temperature (degree days) has been used as a technique to reflect the total temperature or heat over a turf over a period of time. This technique was used in a study initiated on April 4, 1984 to investigate the relationship between total heat and effectiveness of turfgrass growth retardant applications.

MATERIALS AND METHODS

A standard meteorlogical technique (single sine wave function) for accumulation of heat units (similar to degree days) was utilized for timing. Application dates were April 11 (16.6 HU), May 2 (72.0 HU), May 7 (90.3 HU), May 15 (137.6 HU), May 19 (166.3 HU), and May 24 (210.5 HU). All treatments were applied on each of these dates to separate plots of Kentucky bluegrass turf. Treatments and rates included amidochlor (Limit®) at 2.5 lb ai/A, amidochlor at 1.25 lb ai/A plus flurprimidol (EL-500 or Cutless®) at 0.5 lb ai/A, Mon 4624 at 1.75 lb ai/A (Mon 4624 is a mixture of 2.5 lb/gal Limit® and 1.0 lb/gal PP-333), Cutless® at 1.25 lb ai/A, mefluidide (Embark®) at 0.38 lb ai/A and paclobutrazol (PP-333) at at 1.25 lb ai/A. A mowed control and an unmowed control were included in each group of treatments. All treatments for each application date were replicated three times. Materials were applied with a CO_2 propelled backpack sprayer at a spray volume of 40 gallons per acre. Plot size was 3 x 10 feet. Except for the mowed control plots the turf in all other treatments was left uncut. The area was irrigated as needed to prevent wilt.

RESULTS

All plots were evaluated for quality weekly for five weeks after treatment (Table1 through Table 6). No change in quality was found for any treatment or date of application for the first week after treatment. All retarded turf exhibited reduced quality for the second through fifth week after treatment for the 16.6 HU applications (Table 1). Both Embark® and Mon 4624 treated turf showed the poorest quality for applications at or after 137.6 HU (Table 4 through Table 6).

Mean turf (canopy) height was measured at two ,three and four weeks after treatment for each application date (Table 1 through Table 6). Generally, all PGR treatments at all dates of applicaton provided some reduction in growth. Cutless® treated turf exhibited delayed growth reduction for applications at 16.6, 137.6, 166.3 and 210.5 HU Table 1, Table 4 through Table 6). When applied after 200 HU the efficacy of all PGR's was greatly reduced.

A count of seedheads was made on June 7 for all plots (Table 1 through Table 6). This evaluation ranged from two weeks after treatmnet for the 210.5 HU plots to eight weeks after treatment for the 16.6 HU plots. Embark® was shown to be an effective suppressent of seedhead expansion when applied prior to 100 HU (Figure 1). Limit®, while providing good seedhead control when applied at 16.6 HU, was inconsistant later in the season. Application techniques are critical with the use of Limit®. The 72 HU application of Limit® did not receive irrigation or rainfall soon enough to activate the PGR. Evaluations of the timing of Limit® on seedhead suppression will be continued in 1985.

All other PGRs or combinations were ineffective in suppressing seedhead development in general. It is important to note the reduction in seedhead numbers for all plots in Figure 1. after 137.6 HU. Some of the seedheads present on the turf were removed through mowing prior to treatment.

Table 1. Plant growth retardant application and timing evaluation for treatments applied at 16.6 heat units (April 11, 1984).[1]

		Height[2]			Seedheads/ sq ft[3]	Quality[4]				
Material	Rate lb ai/A	2 WAT 4/25	3 WAT 5/02	4 WAT 5/09	6/07	1 WAT 4/18	2 WAT 4/25	3 WAT 5/02	4 WAT 5/09	5 WAT 5/17
Limit®	2.50	4.8c	4.7cd	4.3d	31.0bc	5.3	5.0c	5.0de	4.0d	3.7de
Limit® + Cutless®	1.25 + 0.50	5.3bc	5.6bc	6.0bc	54.0b	5.0	5.0c	5.7cd	5.0bc	4.0cd
Mon 4624	1.75	5.2bc	5.1cd	4.8cd	56.0b	5.0	5.3bc	5.0de	4.3cd	3.3de
Cutless®	1.25	5.6a-c	6.4b	6.6b	127.0a	5.7	6.0a	6.3bc	5.7b	5.0b
Embark®	0.38	5.0c	4.3d	4.2d	3.3c	5.3	4.0d	4.3e	3.7d	3.0e
PP-333	1.25	5.9ab	6.5b	6.4b	140.7a	5.7	6.0a	6.3bc	5.3b	4.7bc
Unmowed control	--	6.3a	7.8a	8.8a	174.7a	5.7	5.7ab	7.0ab	6.7a	8.0a
Mowed control	--					5.0	5.7ab	7.7a	7.3a	7.3a
$LSD_{0.05}$		0.8	1.1	1.5	47.9	NS	0.6	0.8	0.9	1.0
CV		8.5	11.0	14.5	32.1	9.0	6.9	7.8	10.2	11.5

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Height refers to the average height in cm of the turfgrass plants.

[3] Seedheads per square foot refers to the average number of seedheads counted in each square foot of each plot.

[4] Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

Table 2. Plant growth retardant application and timing evaluation for treatments applied at 72.0 heat units (May 2, 1984).[1]

Material	Rate	Height[2]			Seedheads/ sq ft[3]	Quality[4]				
		2 WAT	3 WAT	4 WAT		1 WAT	2 WAT	3 WAT	4 WAT	5 WAT
	lb ai/A	5/17	5/22	5/29	6/07	5/09	5/17	5/23	5/29	6/06
Limit®	2.50	9.7ab	9.2b	10.1b	103.3ab	7.3	7.0ab	6.0bc	6.7ab	4.7b
Limit® + Cutless®	1.25 + 0.50	8.7b	10.2ab	9.8b	73.7bc	7.0	6.7b	6.0bc	5.7bc	4.7b
Mon 4624	1.75	8.7b	9.2b	9.8b	77.3a-c	7.7	7.7a	6.0bc	6.3ab	4.3b
Cutless®	1.25	9.0b	10.3ab	10.5ab	99.7a-c	7.3	7.3ab	6.7ab	6.3ab	5.0b
Embark®	0.38	7.2c	7.2c	6.5c	6.7d	7.0	5.7c	5.3c	4.7c	3.3c
PP-333	1.25	10.1a	11.0a	10.5ab	72.3c	8.0	6.7b	6.7ab	6.0ab	4.3b
Unmowed control	--	9.6ab	10.8a	12.0a	104.7a	7.3	7.0ab	6.7ab	7.0a	6.0a
Mowed control	--					7.7	7.7a	7.3a	6.7ab	6.0a
$LSD_{0.05}$		1.1	1.3	1.6	30.8	NS	0.9	0.8	1.0	0.8
CV		6.8	7.8	9.0	22.5	6.0	7.6	7.3	9.4	9.2

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Height refers to the average height in cm of the turfgrass plants.

[3] Seedheads per square foot refers to the average number of seedheads counted in each square foot of each plot.

[4] Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

Table 3. Plant growth retardant application and timing evaluation for treatments applied at 90.3 heat units (May 7 1984).[1]

		Height[2]			Seedheads/ sq ft[3]	Quality[4]				
	Rate	2 WAT	3 WAT	4 WAT		1 WAT	2 WAT	3 WAT	4 WAT	5 WAT
Material	lb ai/A	5/22	5/29	6/07	6/07	5/15	5/23	5/29	6/06	6/13
Limit®	2.50	8.8ab	8.9bc	8.8a-c	51.7cd	7.0	6.3bc	6.0bc	4.3bc	5.0b
Limit® + Cutless®	1.25 + 0.50	8.6a-c	9.0bc	9.9ab	104.0b	6.7	5.7c	5.0d	4.3bc	4.7bc
Mon 4624	1.75	8.0c	8.6bc	7.9cd	91.7bc	7.0	6.0bc	5.7cd	3.7cd	4.0cd
Cutless®	1.25	8.1bc	9.3ab	8.3b-d	127.7ab	6.7	6.3bc	6.3a-c	4.7b	4.7bc
Embark®	0.38	7.0d	7.7c	7.0d	20.7d	6.3	5.7c	5.0d	3.0d	3.7d
PP-333	1.25	8.5bc	9.2b	8.6a-d	126.7ab	7.0	6.3bc	6.7ab	4.7b	5.0b
Unmowed control	--	9.4a	10.5a	10.0a	161.7a	7.0	6.7ab	6.7ab	5.7a	6.7a
Mowed control	--					6.7	7.3a	7.0a	6.0a	6.0a
$LSD_{0.05}$		0.8	1.2	1.7	51.6	NS	0.8	0.7	0.9	0.7
CV		5.3	7.7	10.8	29.8	6.3	6.8	6.4	11.6	8.2

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Height refers to the average height in cm of the turfgrass plants.

[3] Seedheads per square foot refers to the average number of seedheads counted in each square foot of each plot.

[4] Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

Table 4. Plant growth retardant application and timing evaluation for treatments applied at 137.6 heat units (May 15, 1984).[1]

		Height[2]			Seedheads/ sq ft[3]	Quality[4]				
	Rate	2 WAT	3 WAT	4 WAT		1 WAT	2 WAT	3 WAT	4 WAT	5 WAT
Material	lb ai/A	5/29	6/07	6/15	6/07	5/23	5/29	6/06	6/13	6/22
Limit®	2.50	8.1bc	7.5bc	7.2	110.3	7.0	6.3b	4.7b	4.3cd	5.0bc
Limit® +	1.25									
Cutless®	+ 0.50	9.0ab	8.3ab	7.8	129.3	6.7	5.7c	4.3bc	4.3cd	5.3b
Mon 4624	1.75	7.9bc	7.3bc	8.2	132.0	6.7	5.7c	3.7c	3.7de	4.0d
Cutless®	1.25	8.7ab	8.1b	8.1	129.7	7.0	6.0bc	4.3bc	5.0bc	5.0bc
Embark®	0.38	7.2c	6.4c	6.7	93.7	6.3	6.0bc	3.7c	3.3e	4.0d
PP-333	1.25	8.6ab	7.9b	8.1	117.7	7.0	6.3b	4.7b	4.7bc	4.3cd
Unmowed control	--	9.3a	9.4a	9.4	164.7	7.3	7.0a	6.0a	6.0a	7.0a
Mowed control	--					7.0	7.0a	5.7a	5.3ab	5.7b
$LSD_{0.05}$		1.1	1.2	NS	NS	NS	0.6	1.0	0.8	0.8
CV		7.5	8.6	15.1	18.3	5.4	5.5	12.1	10.0	9.0

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Height refers to the average height in cm of the turfgrass plants.

[3] Seedheads per square foot refers to the average number of seedheads counted in each square foot of each plot.

[4] Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

Table 5. Plant growth retardant application and timing evaluation for treatments applied at 166.3 heat units (May 19, 1984).[1]

Material	Rate	Height[2]			Seedheads/ sq ft[3]	Quality[4]				
	lb ai/A	2 WAT 5/29	3 WAT 6/07	4 WAT 6/15	6/07	10 DAT 5/29	18 DAT 6/06	25 DAT 6/13	34 DAT 6/22	41 DAT 6/29
Limit®	2.50	8.4a	8.3	8.0bc	70.7b	6.3	4.3b-d	4.7b	5.0c	5.7bc
Limit® + Cutless®	1.25 + 0.50	8.6a	8.1	8.7ab	62.7b	5.7	4.3b-d	4.3b	5.0c	5.3c
Mon 4624	1.75	7.4c	7.5	7.3bc	88.0b	6.0	3.7cd	3.3c	4.0d	3.7d
Cutless®	1.25	8.8a	8.5	8.2a-c	87.0b	6.7	5.0ab	4.7b	5.3bc	5.3c
Embark®	0.38	7.7bc	7.0	6.9c	90.0ab	6.0	3.3d	3.3c	4.0d	5.0c
PP-333	1.25	8.3ab	8.3	7.5bc	119.3a	6.7	4.7a-c	4.3b	5.0c	4.7cd
Unmowed control	--	8.8a	8.8	9.6a	72.0b	6.3	5.0ab	6.0a	7.0a	7.0a
Mowed control	--					6.3	5.7a	5.7a	6.0b	6.7ab
$LSD_{0.05}$		0.7	NS	1.4	30.0	NS	1.0	1.0	0.9	1.1
CV		4.8	7.8	9.8	20.0	6.4	13.3	12.2	9.8	11.8

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Height refers to the average height in cm of the turfgrass plants.

[3] Seedheads per square foot refers to the average number of seedheads counted in each square foot of each plot.

[4] Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

Table 6. Plant growth retardant application and timing evaluation for treatments applied at 210.5 heat units (May 24, 1984).[1]

Material	Rate lb ai/A	Height[2] 2 WAT 6/07	Height[2] 3 WAT 6/15	Height[2] 4 WAT 6/29	Seedheads/sq ft[3] 6/07	Quality[4] 5 DAT 5/29	Quality[4] 13 DAT 6/06	Quality[4] 20 DAT 6/13	Quality[4] 29 DAT 6/22	Quality[4] 36 DAT 6/29
Limit®	2.50	7.0	6.3	8.0b	41.0	6.7	5.0	4.7	5.0b-d	5.0b
Limit® + Cutless®	1.25 + 0.50	7.9	7.1	7.5bc	45.0	7.0	5.3	5.3	5.3bc	5.0b
Mon 4624	1.75	7.7	7.4	7.6bc	41.0	6.7	5.3	5.0	4.7cd	4.7b
Cutless®	1.25	7.4	7.8	8.5ab	39.3	6.7	5.3	5.3	6.0ab	5.3b
Embark®	0.38	6.9	6.9	6.6c	35.7	6.3	4.7	4.0	4.0d	3.7c
PP-333	1.25	7.4	7.4	7.6bc	27.0	7.0	5.7	5.3	5.3bc	5.3b
Unmowed control	--	8.2	7.8	9.7a	32.3	6.7	5.7	5.3	7.0a	7.0a
Mowed control	--					6.7	6.0	5.0	5.7bc	6.7a
$LSD_{0.05}$		NS	NS	1.4	NS	NS	NS	NS	1.0	0.8
CV		9.9	11.7	9.9	52.5	6.2	10.3	10.1	11.0	8.3

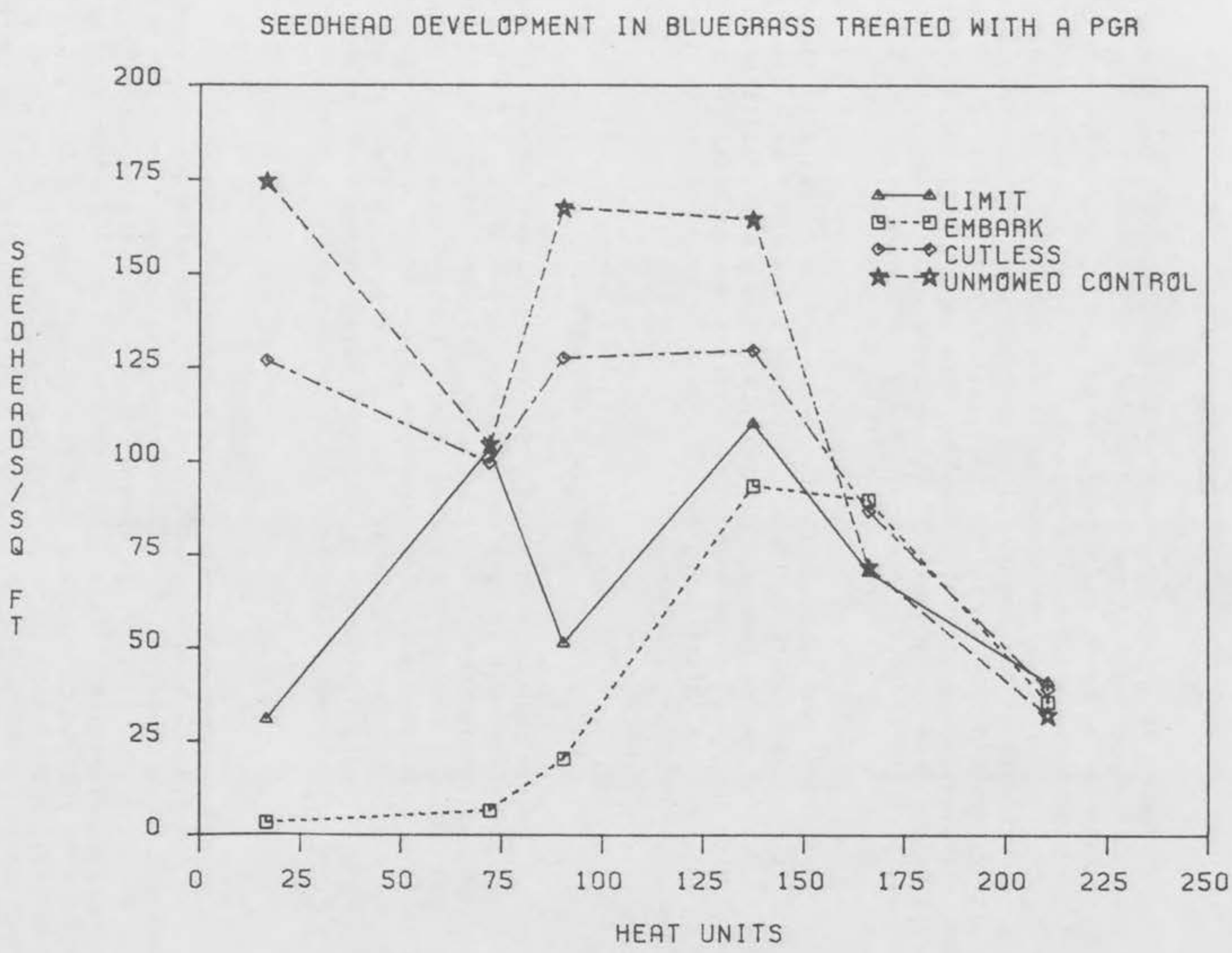
[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Height refers to the average height in cm of the turfgrass plants.

[3] Seedheads per square foot refers to the average number of seedheads counted in each square foot of each plot.

[4] Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

Figure 1. Seedhead development in Kentucky bluegrass treated with plant growth regulators.



EMBARK® APPLICATION TECHNIQUES

T. W. Fermanian and J. E. Haley

INTRODUCTION

The plant growth retardant mefluidide (Embark®) has been shown to be an effective suppressant of seedhead production in annual bluegrass (Poa annua) when applied at low rates (0.06 to 0.125 lb ai/A). Currently, Embark® displays good seedhead suppression at the rate of 0.125 lb ai/A. At this rate, little growth suppression of annual bluegrass is evident. At twice the rate of 0.25 lb ai/A, growth rate of Poa annua will be much reduced with possible injury resulting. This narrow margin for application error can present a problem with normal application techniques. For boom application, any variation in speed or nozzle height from the ground will either under or over apply the material. This can result in either little activity or mild to severe injury to the Poa annua turf.

Embark® has little activity in the soil and generally has a very short half life once applied to the soil. This can be as short as one to two days. Embark®, therefore, in theory could be applied on a parts/million basis or to "drip" with the final concentration on leaf surface determining the effective rate. A study was initiated on May, 7 1984 to examine alternative application technology for applying Embark®.

MATERIALS AND METHODS

Embark® was applied May 7, 1984 to 6 x 10 feet plots of common Kentucky bluegrass turf at various concentrations along with 2 rates using a standard application technique. Treatments included concentrations of 50 ppm, 100 ppm, 150 ppm, 200 ppm and 250 ppm of Embark® applied in a volume of solution sufficient to totally cover leaf surfaces. Treatments made using standard application techniques were Embark® at 0.25 and 0.38 lb ai/A. These were made with a CO_2 propelled backpack sprayer at a spray volume of 40 gallon /A. All Embark® treatments were mixed in a surfactant solution of 0.5% v/v of XM12.

RESULTS

Turfgrass height was measured weekly for a period of 7 weeks after treatments were applied. At the same time, height measurements were taken, an estimation of turf quality was also obtained. Analysis of turfgrass height measurements indicated little difference in the ability of Embark® to reduce turf growth when applied on either a part per million basis or in a timed application (Table 1). Suppression of growth was excellent for all treatments with an average reduction in height of 35% seven weeks after treatment. The estimated quality of the turf remained similar for all treatments for the first four weeks after application. Beginning in the fifth week, reduced quality was found for treatments in excess of 100 parts per million (Figure 1). Treatments of 200 parts per million or greater showed significant injury for the following three weeks with gradual recovery later in the season (Table 2). The fifty part per million treatment showed similar quality to the standard 0.38 lb ai/A timed application with similar ability to supress growth. The quality of all treatments was low and further investigation is necessary to determine the optimum concentration for a part per million based application. Further applications will be made in the 1985 growing season.

Table 1. The evaluation of turfgrass height following the use of Embark® applied May 7, 1984 at different concentrations rates and spray volumes.[1]

		Height[2] (cm)						
		1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT	7 WAT
Material	Rate	5/17	5/24	5/31	6/07	6/15	6/22	6/28
Embark®	50 ppm	4.6	4.7b	4.7b	4.6b	4.8b	5.3bc	5.7b
Embark®	100 ppm	4.4	4.6bc	4.3b	4.3bc	4.5b	5.3bc	6.2b
Embark®	150 ppm	4.4	4.6bc	4.4b	4.3bc	4.4b	5.0bc	5.7b
Embark®	200 ppm	4.5	4.5b-d	4.6b	4.3bc	4.5b	5.2bc	5.6b
Embark®	250 ppm	4.2	4.3cd	4.4b	4.1c	4.4b	4.6c	5.1b
Embark®	0.25 lb ai/A	4.6	4.5b-d	4.7b	4.4bc	4.9b	6.2b	6.2b
Embark®	0.38 lb ai/A	4.6	4.2d	4.6b	4.1c	4.6b	5.6bc	6.0b
Control	---	5.0	5.7a	6.8a	7.7a	7.4a	9.4a	9.4a
$LSD_{0.05}$		NS	0.3	0.7	0.4	0.9	1.3	1.2
CV		6.5	3.8	8.0	4.9	10.2	13.1	10.8

Table 2. The evaluation of turfgrass quality following the use of Embark® applied May 7, 1984 at different concentrations rates and spray volumes.[1]

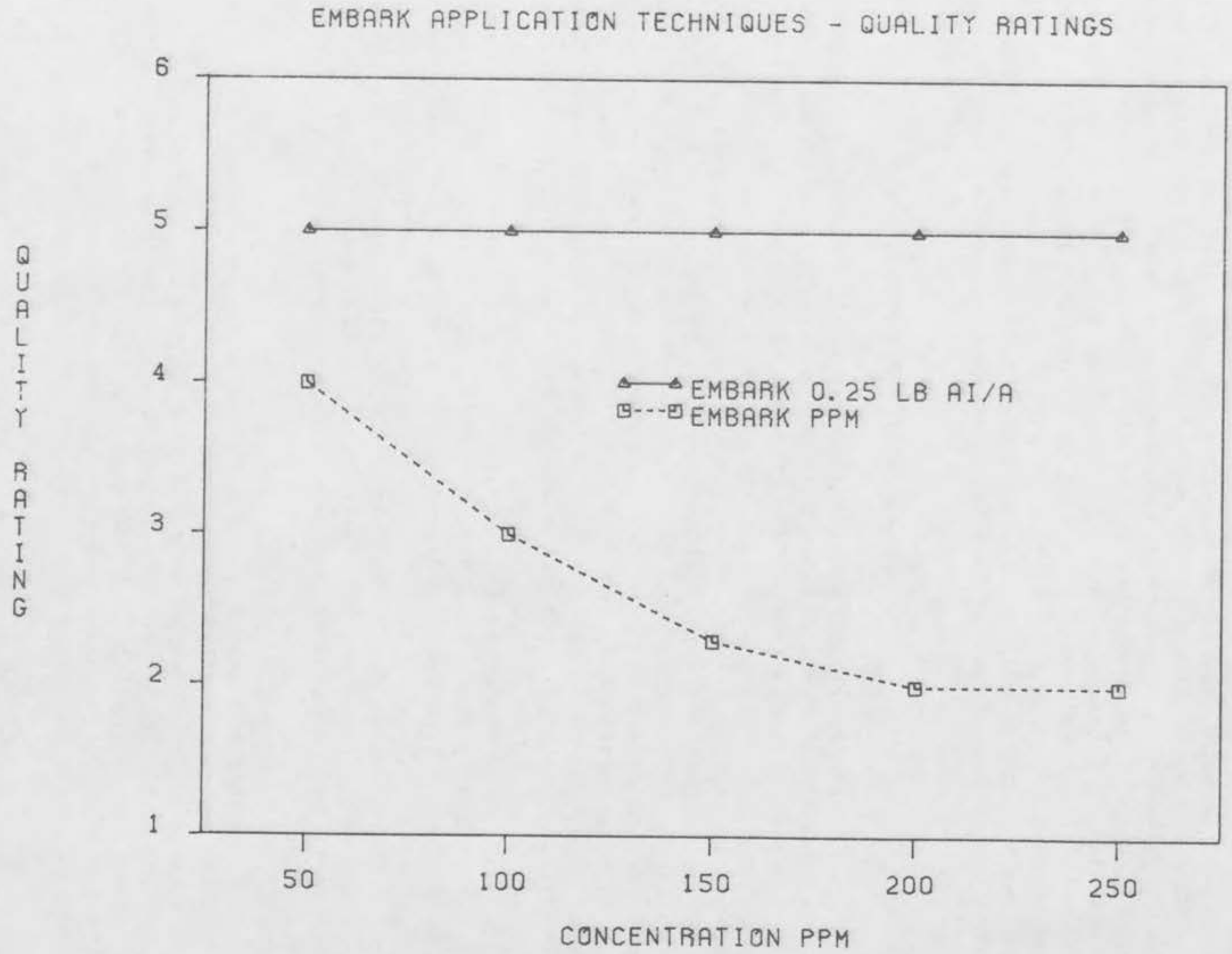
		Quality[3]						
		1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT	7 WAT
Material	Rate	5/17	5/24	5/31	6/06	6/13	6/22	6/29
Embark®	50 ppm	5.0	8.0b	6.3b	4.7b	4.0c	3.7b-d	5.3b-d
Embark®	100 ppm	5.0	7.7bc	5.7bc	4.0bc	3.0d	4.0b-d	6.3bc
Embark®	150 ppm	4.7	7.0cd	5.0cd	4.0bc	2.3e	3.3c-e	5.3b-d
Embark®	200 ppm	5.0	6.3de	5.0cd	3.7c	2.0e	2.7de	5.0cd
Embark®	250 ppm	4.7	5.7e	4.7d	3.3c	2.0e	2.0e	4.0d
Embark®	0.25 lb ai/A	5.3	8.0b	5.7bc	4.7b	5.0b	5.0b	7.0b
Embark®	0.38 lb ai/A	5.3	7.7bc	6.3b	4.0bc	4.0c	4.3bc	6.0bc
Control	---	5.3	9.0a	9.0a	9.0a	9.0a	9.0a	9.0a
$LSD_{0.05}$		NS	0.9	0.8	0.8	0.4	1.7	2.0
CV		15.9	6.6	7.8	9.2	5.2	22.4	18.8

[1]All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2]Height refers to the average height in cm of the turfgrass plants.

[3]Quality evaluations are made on a 1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

Figure 1. Quality ratings for turf treated with Embark® using different PGR concentrations and application methods.



LIQUID NITROGEN RESIDUAL STUDY

D. L. Martin and D. J. Wehner

INTRODUCTION

Several new nitrogen sources are available to the lawn care industry. The main characteristic of these materials is that there is a reduced potential for turfgrass burn when applying them compared to a liquid urea solution. Questions exist as to whether or not they provide a longer residual response than a standard application of urea. The purpose of this study was twofold: first to determine if these new sources provide a longer response than a standard application of urea; and second to evaluate turf response to these materials applied four times per year at eight week intervals. Sulfur Coated Urea and Nitroform were included in this study as slow release sources for comparison.

MATERIALS AND METHODS

This experiment was initiated June 21, 1983 on a Kentucky bluegrass stand composed of the cultivars Bristol, Bonnieblue and Parade. The turfgrass stand was established in the fall of 1982. Each treatment was replicated four times as a 3 x 12 foot plot in a randomized complete block design. The liquid treatments were applied to the plots with a CO_2 pressurized backpack sprayer. The spray volume applied was 4 gallons per 1000 sq ft, using an 8015E nozzle. Granular materials were applied by hand. The dates of the 1983 treatments were June 28, and August 24. In 1984, the fertilizer treatments were applied on May 10, July 9, September 7, and November 11. The first application of 1984 was made later than the ideal date due to the necessity of taking preapplication greenup ratings. The third application was delayed due to inclement weather.

The nitrogen sources applied as liquids in this study include Melamine 55-0-0 (formerly Super 60), Urea (46-0-0), FLUF (18-0-0), FAN (20-0-0), Cleary's 16-2-4, FLUF + Trugreen, Formolene (30-0-2), Mello 15-3-6, and Nitroform (38-0-0). Trugreen is a micronutrient fertilizer. Materials applied as granulars included Sulfur Coated Urea (CIL 32-0-0) and Oxamide (32-0-0). A control treatment which received no nitrogen source was included in each replication. All fertilizer treatments were applied at 1 lb actual nitrogen per 1000 sq ft in both years of this study.

Color and growth rates were monitored on a weekly basis in this study. Color was rated visually, using a scale of 1-9, where 9 = very dark green and 1 = straw color. Growth rates were measured on the basis of fresh clipping weights. Clippings were not returned to the plots after being weighed. After the treatments were applied, the plots were irrigated to wash material from the leaves into the soil. Irrigation practices in the study duplicated those of a home lawn situation, with the plots receiving irrigation to avoid wilting of the turfgrass.

RESULTS AND DISCUSSION

Color ratings taken from the experimental plots in 1984 appear in Table 1. Spring greenup ratings were taken for 4 weeks prior to the first application in 1984. Color ratings from Oxamide treated turf were significantly higher than those for the non-treated control turf for 3 of the 4 weeks that spring greenup was monitored. All treatments including Oxamide failed to provide satisfactory spring greenup. Mean color ratings from turfgrass treated with materials other than Oxamide were in general inconsistent in their ranking during the four weeks that spring greenup was monitored. The failure of all treatments to provide the turf with satisfactory preapplication greenup was probably due to the extended period of time since the last application of materials in 1983.

Turf treated with the water soluble materials such as urea, Mello 15-3-6, FAN, and Formolene usually demonstrated the quickest greenup following fertilizer applications in 1984. Turf treated with the flowable ureaformaldehydes such as FLUF, FLUF + micronutrients and Cleary's 16-2-4 showed a more moderate greenup response. The color ratings obtained from turf treated with FLUF + micronutrients and Cleary's 16-2-4 were usually higher than the ratings taken from turf treated with FLUF, but the differences in ratings were usually not statistically significant. Sulfur Coated Urea and Oxamide consistently had the highest color ratings throughout 1984. The mean color ratings taken from Nitroform treated turf increased in rank in 1984 over their rank in 1983. Turfgrass treated with Melamine 55-0-0 showed a quick increase in color ratings similar to that obtained from turfgrass treated with the water soluble nitrogen sources. However, the color ratings taken from Melamine 55-0-0 treated turf declined in value more quickly than those taken from turf treated with the water soluble materials. Seldom did color ratings taken from turfgrass treated with materials other than Sulfur Coated Urea and Oxamide rank significantly higher than color ratings from turfgrass treated with urea in 1984. Clipping weight trends closely followed those trends previously discussed for color ratings. Figure 1 shows the mean clipping weights from turfgrass plots treated with urea, FLUF, Formolene and Oxamide in 1984.

Unlike the 3 previous applications in 1984, the water soluble nitrogen containing materials failed to provide a quick increase in turfgrass color ratings following the 4th application. This observation was probably due to the slow growth rate of the turfgrass caused by the cold temperatures prevailing at that time. Due to the cold temperatures, the color ratings for all treatments following the 4th application remained much the same as those during the latter weeks of the 3rd application.

Table 1. Color response of Kentucky bluegrass to various fertilizer treatments applied May 10, July 9, September 7, and November 11, 1984.[1]

Nitrogen Source	Color Ratings[2] 4/18	4/25	5/02	5/10	5/16	5/23	5/30	6/06	6/13	6/22	6/27
Melamine 55-0-0	3.5b	5.0bc	5.5b	5.8a	7.5a	6.3b	7.0b-d	5.8b	6.3b-d	5.5c	4.8b
Urea	3.8ab	4.8c	5.8ab	5.8a	7.5a	7.3a	7.8a	7.0a	7.0a	6.8a	5.0b
FLUF	3.8ab	5.0bc	5.8ab	5.8a	7.0a-c	6.0b-c	6.0e	5.8b	6.3b-d	6.3a-c	5.0b
FAN	3.5b	4.8c	5.5b	5.8a	7.5a	7.0a	7.8a	6.8a	6.5a-c	6.3a-c	4.8b
Cleary's 16-2-4	3.8ab	5.3a-c	5.8ab	5.8a	7.3ab	6.3b	7.3a-c	6.5a	6.8ab	6.8a	4.8b
Oxamide	4.3a	5.8a	6.0a	6.0a	6.5b-d	4.8ef	5.3f	5.3b	5.8d	6.5ab	5.5a
FLUF + Trugreen	3.8ab	5.3a-c	5.8ab	5.8a	7.3ab	6.0bc	6.8cd	5.8b	6.8ab	6.8ab	5.0b
Formolene	3.8ab	5.0bc	5.5b	5.8a	7.5a	7.3a	7.5ab	6.5a	6.8ab	6.5ab	5.0b
Mellow 15-3-6	3.8ab	5.0bc	5.5b	5.8a	7.5a	7.5a	7.8a	6.8a	6.8ab	5.8bc	5.0b
Nitroform	4.0ab	6.0a	5.5b	5.8a	6.3cd	5.3de	6.0e	5.3b	6.0cd	6.3a-c	5.0b
CIL-SCU	3.8ab	5.5a-c	5.8ab	6.0a	5.8d	5.5cd	6.5de	5.8b	7.0a	6.5ab	5.8a
Control	3.5b	4.8c	5.5b	5.8a	5.8d	4.5f	5.0f	4.5c	4.8e	4.3d	4.0c

Nitrogen Source	Color Ratings[2] 7/05	7/16	7/23	7/29	8/07	8/13	8/20	8/27	9/03	9/19	9/26
Melamine 55-0-0	5.0c	6.3d	6.0de	6.0d	5.8d	6.0d	6.5cd	6.5de	6.0d	7.5ab	7.5ab
Urea	5.8ab	7.0b	7.0b	7.0b	6.5bc	6.5cd	6.5cd	6.5de	6.0d	8.0a	7.8a
FLUF	5.0c	6.3d	6.3c-e	6.5b-d	6.3b-d	6.5cd	6.8b-d	6.8cd	6.3cd	7.5ab	7.8a
FAN	5.3bc	6.8bc	6.0de	6.3cd	5.8d	6.0d	6.3d	6.3e	6.0d	7.8a	7.8a
Cleary's 16-2-4	5.8ab	6.8bc	6.5b-d	6.5b-d	6.5bc	6.3cd	6.5cd	6.5de	6.5b-d	7.5ab	8.0a
Oxamide	6.0a	6.5cd	5.8e	6.8bc	7.8a	7.5a	7.8a	8.0a	8.3a	7.8a	8.0a
FLUF + Trugreen	6.0a	6.8bc	6.5b-d	6.5b-d	6.0cd	6.3cd	6.5cd	6.5de	6.3cd	7.8a	7.8a
Formolene	5.8ab	7.0b	6.8bc	6.8bc	6.3b-d	6.3cd	6.3d	6.5de	6.0d	8.0a	8.0a
Mellow 15-3-6	5.8ab	7.0b	6.8bc	6.8bc	6.8b	6.3cd	6.5cd	6.5de	6.3cd	8.0a	8.0a
Nitroform	5.8ab	6.3d	5.8e	6.0d	6.3b-d	6.8bc	7.0bc	7.0bc	6.8bc	7.0b	7.8a
CIL-SCU	6.0a	8.0a	8.0a	8.0a	8.0a	7.3ab	7.3ab	7.3b	7.0b	8.0a	8.0a
Control	3.4d	5.3e	5.0f	5.0e	5.0e	5.3e	5.5e	5.3f	5.3e	5.3c	7.0b

(continued)

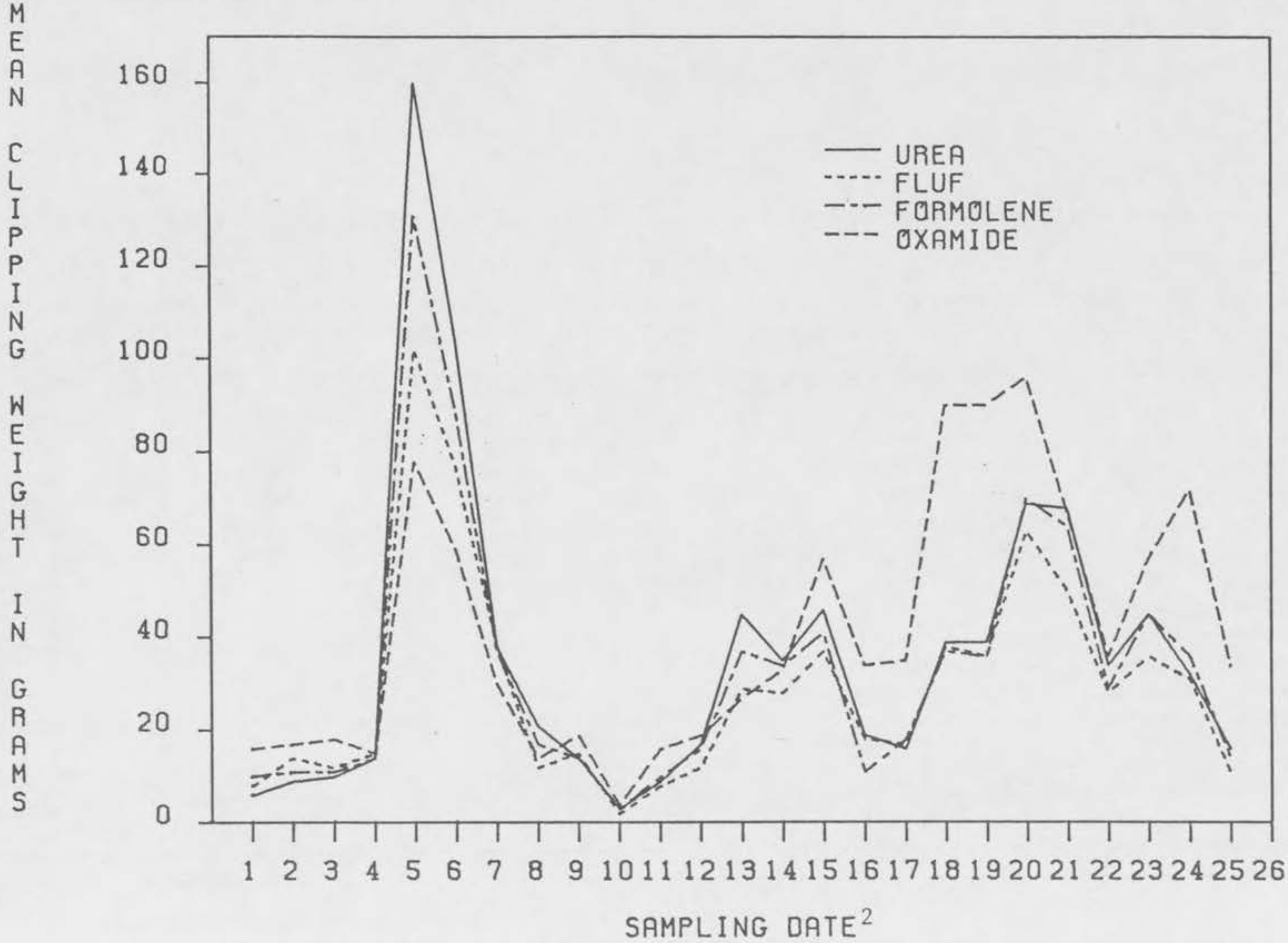
Table 1. Color response of Kentucky bluegrass to various fertilizer treatments applied May 10, July 9, September 7, and November 11, 1984 (continued).[1]

Nitrogen	Color Ratings[2]								
Source	10/03	10/10	10/18	10/24	10/31	11/07	11/16	11/23	10/30
Melamine 55-0-0	7.8bc	6.5c	6.3bc	6.0c	6.0d	6.3c-e	5.5bc	4.5de	5.5d
Urea	8.3ab	7.0b	6.5b	6.0c	6.0d	6.5cd	5.3cd	4.8c-e	6.3cd
FLUF	7.8bc	6.8bc	6.3bc	6.0c	6.0d	6.0de	5.3cd	4.8c-e	6.3cd
FAN	8.0ab	6.8bc	6.3bc	6.0c	6.0d	6.3c-e	4.8d	4.5de	5.5d
Cleary's 16-2-4	8.3ab	6.8bc	6.3bc	6.0c	6.0d	6.8bc	5.5bc	5.0cd	6.5bc
Oxamide	8.8a	7.8a	8.0a	7.5a	7.8a	8.0a	7.0a	6.0a	7.8a
FLUF + Trugreen	8.8a	7.0b	6.5b	6.0c	6.3cd	6.5cd	5.5bc	5.0cd	5.8cd
Formolene	8.0ab	7.0b	6.5b	6.5b	6.3cd	6.5cd	5.5bc	4.8c-e	6.3cd
Mellow 15-3-6	8.5ab	7.0b	6.3bc	6.0c	6.0d	6.0de	4.8d	4.5de	5.8cd
Nitroform	7.8bc	7.0b	6.5b	6.3bc	6.5c	6.5cd	6.0b	5.3bc	6.3cd
CIL-SCU	8.8a	8.0a	7.8a	6.3bc	7.0b	7.3b	6.0b	5.8ab	7.3ab
Control	7.0c	6.0d	5.5c	6.0c	6.0d	5.8e	4.8d	4.3e	5.5d

[1]All values represent the mean of 4 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2]Color evaluations are made on a scale of 1 to 9, where 9 = very dark green and 1 = straw color.

Figure 1. Mean clipping weights of turf treated with urea, FLUF, Formolene and Oxamide in 1984.[1]



[1]All values represent the mean of 4 replications.

[2]Sampling date 1 = 4/25/84.

THE EVALUATION OF LATE FALL FERTILIZATION

D. J. Wehner and J. E. Haley

INTRODUCTION

The idea behind late fall fertilization is to keep the shoot of the grass plant green as it enters winter. Because air temperatures in late fall restrict shoot growth, the food manufactured by the shoot is placed in reserve or used for root growth resulting in a healthier plant. Also, less fertilization is needed in early spring because the previous year's application promotes rapid greenup. The practice of late fall fertilization got started in the transition zone where it is possible to keep turf green almost all year. Northern turfgrass managers have found that late fall fertilization also works well in the cool humid regions of the country. The purpose of this study is to evaluate fertilizer programs with and without a late fall application of nitrogen. In addition, several different nitrogen sources are being evaluated for application in late fall.

MATERIALS AND METHODS

The trial was established September 7, 1982 on a 3 month old stand of Baron Kentucky bluegrass and on an adjacent 3 month old stand of Newport Kentucky bluegrass. The materials being evaluated are urea, 45-0-0; IBDU, 31-0-0 and CIL-SCU, 32-0-0. Materials are applied as lbs nitrogen/1000 sq ft as follows:

Trt.	First Mowing	June 1	July 15	Sept. 1	Nov. 1
1.	1.25 urea	1.0 urea	0.75 urea	1.0 urea	0
2.	0	1.0 urea	0.75 urea	1.0 urea	1.25 urea
3.	0	1.0 urea	0.75 urea	1.0 urea	1.25 SCU
4.	0.5	1.0 urea	0.75 urea	1.25 urea	0
5.	0	2.0 IBDU	0	2.0 IBDU	0
6.	0	2.0 SCU	0	2.0 SCU	0
7.	0	2.0 IBDU	0	0	2.0 IBDU
8.	0	2.0 SCU	0	0	2.0 SCU
9.	0	1.0 IBDU	0	1.0 IBDU	1.5 IBDU
10.	0	1.0 SCU	0	1.0 SCU	1.5 SCU
11.	control	control	control	control	control

Plot size is 3 x 12 feet and materials are applied by hand.

RESULTS

The results from both cultivars show similar trends with the exception that the Newport plots started active growth earlier in the spring than the Baron plots. The highest ratings for spring greenup were assigned to plots that had received a November application of urea, a September application of IBDU, or a November application of Sulfur Coated Urea (SCU) (Table 3 and Table 4). Apparently, there was not enough carryover from the September SCU application to provide maximum spring greenup. The June turf quality ratings for plots treated with two applications of IBDU per year were lower than turf receiving other treatments because of the lag between IBDU application and measurable turfgrass response (Table 1 and Table 2). Throughout the rest of the growing season, all treatments provided acceptable turfgrass response and there were few significant differences between programs. We expect to maintain this study for three or four years to determine if any trends develop due to long term use of a particular program or source.

Table 1. The evaluation of a late fall fertilization program on a Newport Kentucky bluegrass.[1]

	lb N/1000 sq ft						Quality[3]					
Material	First Mowing	6/01	7/15	9/01	11/1	All Dates[2]	4/10	5/01	6/11	6/27	8/01	9/21
Urea	1.25	1.0	0.75	1.0		7.0b	5.7e	5.7d	7.0a	7.0b	8.7ab	8.0a
Urea		1.0	0.75	1.0	1.25	7.0b	7.7bc	7.0bc	6.0bc	6.7bc	8.7ab	8.0a
Urea +		1.0	0.75	1.0		7.3a	8.0ab	7.7ab	6.3ab	6.7bc	9.0a	8.0a
SCU					1.25							
Urea	0.5	1.0	0.75	1.25		6.7c	6.3de	6.3cd	6.0bc	6.3bc	7.7cd	7.3a-c
IBDU		2.0		2.0		6.1e	7.0cd	7.0bc	4.0ef	5.3d	7.7cd	6.7b-d
SCU		2.0		2.0		6.5cd	6.7d	6.3cd	5.3cd	7.0b	7.7cd	7.7ab
IBDU		2.0			2.0	6.0e	6.3de	6.3cd	4.7de	5.3d	7.0de	6.3cd
SCU		2.0			2.0	7.2ab	8.7a	8.0a	6.7ab	8.0a	8.0bc	5.7d
IBDU		1.0		1.0	1.5	6.3de	7.7bc	7.0bc	4.7de	6.0cd	6.7e	6.0d
SCU		1.0		1.0	1.5	6.5cd	7.7bc	7.3ab	5.3cd	7.0b	6.3e	6.3cd
Control						3.2f	3.0f	3.0f	3.3f	3.0e	4.0f	3.0e
$LSD_{0.05}$						0.3	0.8	0.8	0.8	0.8	0.8	1.1

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Values represent the mean of 18 scores obtained from 3 replications and 6 evaluation dates.

[3] Quality evaluations are made on a 1-9 scale, where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

Table 2. The evaluation of a late fall fertilization program on a Baron Kentucky bluegrass.[1]

	lb N/1000 sq ft						Quality[3]					
Material	First Mowing	6/01	7/15	9/01	11/1	All Dates[2]	4/10	5/01	6/11	6/27	8/01	9/21
Urea	1.25	1.0	0.75	1.0		7.0cd	4.3e	5.0de	7.0a	8.0b	8.7ab	8.3a
Urea		1.0	0.75	1.0	1.25	7.3bc	7.0ab	7.3a	6.3ab	7.3c	9.0a	8.0ab
Urea +		1.0	0.75	1.0		7.3b	6.7bc	6.7b	7.0a	7.0c	9.0a	8.3a
SCU					1.25							
Urea	0.5	1.0	0.75	1.0		6.4e	4.3e	4.7e	6.0bc	7.3c	8.3a-c	8.0ab
IBDU		2.0		2.0		6.4e	6.3bd	6.7b	4.7de	6.0d	8.0b-d	7.7a-c
SCU		2.0		2.0		6.6e	5.7d	5.7c	5.7bc	7.3c	8.0b-d	8.3a
IBDU		2.0			2.0	5.8f	4.3e	5.3cd	4.7d-e	6.0d	7.7cd	7.0cd
SCU		2.0			2.0	7.7a	7.7a	7.3a	7.0a	9.0a	8.7ab	6.7d
IBDU		1.0		1.0	1.5	5.9f	6.0cd	5.7c	4.3e	6.0d	6.3e	6.7d
SCU		1.0		1.0	1.5	6.9d	7.0ab	6.7b	5.3cd	8.0b	7.3d	7.3b-d
Control						3.1g	3.0f	3.0f	3.0f	3.0e	4.0f	3.0e
$LSD_{0.05}$						0.3	0.7	0.6	0.7	0.5	0.7	0.9

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Values represent the mean of 18 scores obtained from 3 replications and 6 evaluation dates.

[3] Quality evaluations are made on a 1-9 scale, where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

Table 3. The evaluation of a late fall fertilization program on a Newport Kentucky bluegrass turf.[1]

	lb N/1000 sq ft					Color[2]								
Material	First Mowing	6/01	7/15	9/01	11/1	4/11	4/18	4/25	5/02	5/09	5/14	5/22	5/29	6/07
Urea	1.25	1.0	0.75	1.0		4.3bc	5.7e	6.7c	7.0b	8.0a	8.0a	7.3a	7.0a	8.0a
Urea		1.0	0.75	1.0	1.25	5.7a	7.7ab	8.0a	8.3a	7.0b	6.0cd	5.0c	4.3d	6.0d
Urea +		1.0	0.75	1.0		5.3ab	7.3a-c	8.0a	8.0a	7.0b	6.0cd	5.0c	5.0b-d	6.7c
SCU					1.25									
Urea	0.5	1.0	0.75	1.25		4.0c	6.0de	6.7c	7.7ab	7.3b	7.0b	6.3b	5.7b	7.3b
IBDU		2.0		2.0		5.0a-c	7.0a-d	8.0a	8.0a	8.0a	7.0b	5.3c	4.3d	6.0d
SCU		2.0		2.0		5.0a-c	6.7b-e	7.7ab	8.0a	7.0b	6.0cd	5.0c	4.3d	6.0d
IBDU		2.0			2.0	4.3bc	6.3c-e	7.0bc	8.0a	7.0b	6.3c	5.7bc	4.7cd	6.3cd
SCU		2.0			2.0	5.7a	8.0a	8.0a	8.0a	7.0b	6.0cd	5.3c	5.3bc	6.7c
IBDU		1.0		1.0	1.5	5.7a	7.7ab	7.7ab	8.0a	7.0b	6.0cd	5.0c	4.7cd	6.0d
SCU		1.0		1.0	1.5	5.7a	7.7ab	8.0a	8.0a	7.0b	6.0cd	5.3c	4.7cd	6.0d
Control						2.0d	3.7f	4.3d	4.3c	4.7c	5.7d	5.7bc	4.3d	5.0e
$LSD_{0.05}$						1.1	1.1	0.8	0.8	0.4	0.4	0.8	0.8	0.6

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Color evaluations are made on a scale of 1-9, where 9 = very dark green and 1 = straw color.

(continued)

Table 3. The evaluation of a late fall fertilization program on a Newport Kentucky bluegrass turf (continued).[1]

	lb N/1000 sq ft					Color[2]								
Material	First Mowing	6/01	7/15	9/01	11/1	6/15	6/22	6/29	7/02	7/09	7/13	7/22	7/29	8/06
Urea	1.25	1.0	0.75	1.0		8.0a	7.0b	7.0b	6.7bc	6.3c	6.3c	8.0a	8.0a	8.0a
Urea		1.0	0.75	1.0	1.25	7.0b	7.0b	7.0b	6.3cd	6.0c	6.3c	7.3b	7.3ab	7.3a-c
Urea +		1.0	0.75	1.0		7.0b	7.0b	6.7b	6.3cd	6.0c	6.0c	8.0a	8.0a	8.0a
SCU					1.25									
Urea	0.5	1.0	0.75	1.25		6.7bc	7.0b	6.7b	6.3cd	6.0c	6.0c	8.0a	8.0a	8.0a
IBDU		2.0		2.0		5.0d	5.0c	5.7c	6.0d	6.0c	6.3c	6.3c	7.7ab	7.7ab
SCU		2.0		2.0		8.0a	8.0a	7.7a	8.0a	8.0a	8.0a	8.0a	7.0b	6.7cd
IBDU		2.0			2.0	5.0d	5.0c	6.0c	6.3cd	6.3c	6.3c	6.3c	7.7ab	8.0a
SCU		2.0			2.0	8.0a	8.0a	8.0a	8.0a	8.0a	8.0a	8.0a	7.7ab	7.0bc
IBDU		1.0		1.0	1.5	5.0d	5.0c	6.0c	6.0d	6.0c	6.0c	6.0c	7.0b	6.7cd
SCU		1.0		1.0	1.5	6.3c	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	6.0d
Control						4.0e	4.0d	4.0d	4.0e	4.0d	4.0d	4.0d	5.7c	4.7e
$LSD_{0.05}$						0.4	0.0	0.5	0.6	0.4	0.6	0.5	0.7	0.9

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Color evaluations are made on a scale of 1-9, where 9 = very dark green and 1 = straw color.

(continued)

Table 3. The evaluation of a late fall fertilization program on a Newport Kentucky bluegrass turf (continued).[1]

	lb N/1000 sq ft					Color[2]								
Material	First Mowing	6/01	7/15	9/01	11/1	8/13	8/20	8/27	9/03	9/10	9/18	9/24	10/02	10/11
Urea	1.25	1.0	0.75	1.0		7.0b	7.3ab	6.3b	6.3b-d	5.0c	8.0a	8.0a	6.7ab	7.0b
Urea		1.0	0.75	1.0	1.25	7.0b	7.3ab	6.3b	6.7a-c	5.0c	7.7a	8.0a	7.0a	7.0b
Urea + SCU		1.0	0.75	1.0		7.3ab	7.0bc	6.0bc	6.0cd	5.0c	8.0a	8.0a	7.0a	7.0b
Urea	0.5	1.0	0.75	1.25		7.0b	6.3c	6.0bc	6.3b-d	5.0c	7.3ab	8.0a	6.7ab	7.0b
IBDU		2.0		2.0		8.0a	8.0a	8.0a	7.3a	6.7a	6.7bc	7.0bc	6.3a-c	7.0b
SCU		2.0		2.0		6.7bc	6.7bc	6.0bc	6.3b-d	5.0c	7.3ab	8.0a	6.7ab	8.0a
IBDU		2.0			2.0	8.0a	8.0a	8.0a	7.3a	6.3a	6.3cd	6.7cd	5.7bc	5.3d
SCU		2.0			2.0	6.7bc	7.0bc	6.3b	6.3b-d	5.0c	5.7d	6.0e	5.3c	5.0d
IBDU		1.0		1.0	1.5	6.7bc	6.3c	7.3a	7.0ab	5.7b	5.7d	6.3de	6.0a-c	6.0c
SCU		1.0		1.0	1.5	6.0c	6.3c	5.3cd	5.7de	5.0c	6.0cd	7.3b	6.0a-c	6.7b
Control						4.7d	5.0d	5.0d	5.0e	4.0d	4.3e	5.0f	3.3d	4.0e
$LSD_{0.05}$						0.7	0.7	0.7	0.9	0.5	0.9	0.5	1.0	0.4

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Color evaluations are made on a scale of 1-9, where 9 = very dark green and 1 = straw color.

Table 4. The evaluation of a late fall fertilization program on a Baron Kentucky bluegrass turf.[1]

	lb N/1000 sq ft					Color[2]								
Material	First Mowing	6/01	7/15	9/01	11/1	4/11	4/18	4/25	5/02	5/09	5/14	5/22	5/29	6/07
Urea	1.25	1.0	0.75	1.0		2.3c	4.0e	5.0ef	6.3d	8.0a	8.0a	8.0a	7.0a	8.0a
Urea		1.0	0.75	1.0	1.25	5.0ab	6.7a	7.7a	8.0a-c	7.0bc	7.0cd	6.3c	5.0c	6.0c
Urea +		1.0	0.75	1.0		4.7ab	6.0a-c	6.3b-d	8.0a-c	7.0bc	7.0cd	6.3c	5.7bc	7.0b
SCU					1.25									
Urea	0.5	1.0	0.75	1.25		2.7c	4.0e	5.7de	7.3b-d	7.7ab	7.7ab	7.3ab	6.0b	7.0b
IBDU		2.0		2.0		4.3ab	5.7bc	6.0c-e	8.3ab	7.3a-c	6.7d	6.3c	5.0c	6.0c
SCU		2.0		2.0		4.0b	5.3cd	5.7de	7.3b-d	6.7c	6.0e	5.3d	5.0c	6.0c
IBDU		2.0			2.0	2.7c	4.3e	5.3de	7.0cd	7.0bc	7.3bc	6.3c	5.7bc	6.0c
SCU		2.0			2.0	5.3a	6.3ab	7.0a-c	8.7a	7.7ab	7.3bc	7.0bc	5.7bc	7.0b
IBDU		1.0		1.0	1.5	4.0b	4.7de	6.0c-e	8.0a-c	7.3a-c	7.0cd	6.3c	5.3bc	6.0c
SCU		1.0		1.0	1.5	5.0ab	5.7bc	7.3ab	8.3ab	7.3a-c	6.7d	6.7bc	5.0c	6.3c
Control						2.0c	3.0f	4.0f	4.3e	5.0d	6.0e	5.3d	5.3bc	5.3d
$LSD_{0.05}$						1.1	0.8	1.1	1.0	0.7	0.6	0.8	0.8	0.4

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Color evaluations are made on a scale of 1-9, where 9 = very dark green and 1 = straw color.

(continued)

Table 4. The evaluation[1] of a late fall fertilization program on a Baron Kentucky bluegrass turf (continued).

	lb N/1000 sq ft					Color[2]								
Material	First Mowing	6/01	7/15	9/01	11/1	6/15	6/22	6/29	7/02	7/09	7/13	7/22	7/29	8/06
Urea	1.25	1.0	0.75	1.0		8.0a	8.0a	7.3ab	7.3b	7.0b	6.0bc	8.0a	8.0ab	8.0a
Urea		1.0	0.75	1.0	1.25	7.3b	7.3ab	7.3ab	7.0b	7.0b	6.3ab	7.3b	8.3a	7.3a-c
Urea +		1.0	0.75	1.0		7.0b	7.0b	7.0bc	7.0b	7.0b	6.0bc	8.0a	8.0ab	8.0a
SCU					1.25									
Urea	0.5	1.0	0.75	1.25		7.3b	7.3ab	7.0bc	7.0b	7.0b	6.0bc	8.0a	8.3a	8.0a
IBDU		2.0		2.0		5.0d	6.0c	6.3cd	7.0b	7.0b	6.0bc	6.3c	7.7ab	7.7ab
SCU		2.0		2.0		8.0a	8.0a	8.0a	8.0a	8.0a	6.7a	8.0a	7.3bc	6.7cd
IBDU		2.0			2.0	5.3d	6.0c	6.3cd	7.0b	7.0b	5.7c	6.3c	7.7ab	8.0a
SCU		2.0			2.0	8.0a	8.0a	8.0a	8.0a	8.0a	6.7a	8.0a	8.3a	7.0bc
IBDU		1.0		1.0	1.5	5.0d	5.7c	6.0d	7.0b	7.0b	5.7c	6.0c	6.7c	6.7cd
SCU		1.0		1.0	1.5	6.3c	7.0b	7.3ab	7.0b	7.0b	6.0bc	7.0b	6.7c	6.0d
Control						4.0e	4.0d	4.0e	4.7c	5.3c	4.3d	4.0d	5.0d	4.7e
$LSD_{0.05}$						0.6	0.7	0.7	0.4	0.3	0.6	0.5	0.8	0.9

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Color evaluations are made on a scale of 1-9, where 9 = very dark green and 1 = straw color.

(continued)

Table 4. The evaluation of a late fall fertilization program on a Baron Kentucky bluegrass turf (continued).[1]

	lb N/1000 sq ft					Color[2]								
Material	First Mowing	6/01	7/15	9/01	11/1	8/13	8/20	8/27	9/03	9/10	9/18	9/24	10/02	10/11
Urea	1.25	1.0	0.75	1.0		7.0c	7.0bc	6.0c	6.3bc	5.3b	7.7a	8.0a	7.0ab	7.3a-d
Urea		1.0	0.75	1.0	1.25	7.0c	7.0bc	6.3c	6.0c	5.0bc	8.0a	8.0a	6.7a-c	7.3a-d
Urea +		1.0	0.75	1.0		7.3bc	7.0bc	6.0c	6.0c	5.0bc	8.0a	8.0a	6.7a-c	7.0b-d
SCU					1.25									
Urea	0.5	1.0	0.75	1.25		7.3bc	7.0bc	6.3c	6.3bc	5.3b	7.3ab	8.0a	7.0ab	8.0ab
IBDU		2.0		2.0		8.0a	8.0a	8.0a	8.0a	7.3a	7.3ab	7.3b	6.7a-c	7.7a-c
SCU		2.0		2.0		7.0c	7.0bc	6.0c	6.0c	5.0bc	8.0a	8.0a	7.3a	8.3a
IBDU		2.0			2.0	8.0a	8.0a	8.0a	8.0a	7.0a	5.7c	7.0b	6.3bc	6.7c-e
SCU		2.0			2.0	7.7ab	7.3b	6.3c	6.7bc	5.0bc	5.7c	6.0c	6.0c	5.7e
IBDU		1.0		1.0	1.5	7.7ab	8.0a	7.3b	7.0b	6.7a	6.3bc	6.3c	6.0c	6.3de
SCU		1.0		1.0	1.5	7.0c	6.7c	6.0c	6.0c	5.0bc	6.0c	7.0b	6.7a-c	7.7a-c
Control						5.7d	5.0d	5.0d	5.0d	4.3c	4.3d	5.0d	4.3d	3.7f
$LSD_{0.05}$						0.6	0.4	0.6	0.7	0.7	1.1	0.4	0.8	1.0

[1] All values represent the mean of 3 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Least Significant Difference test.

[2] Color evaluations are made on a scale of 1-9, where 9 = very dark green and 1 = straw color.

PLANT PATHOLOGY RESEARCH

H. T. Wilkinson

The new turfgrass pathology research program completed its second full year of research during 1984. Several areas of research have been started and results are promising. With only two years of field data, the final analyses of this research is not possible at this time, but will be available in 1985. A brief description of the research program in progress will comprise the remainder of this progress report.

A major addition to the turfgrass pathology program is Mr. Robert Avenius as an Assistant Plant Pathologist. Mr. Avenius is a native of New York and received a B.S. degree in pest management and an M.S. degree in plant pathology from the University of Wisconsin, Madison, WI. Mr. Avenius also has considerable working experience in golf course operations and was a sod farm manager in Washington state.

RECOVERY OF BENTGRASS (Agrostis palustris) INFECTED WITH Sclerotinia homoeocarpa

The rate, extent and longevity of bentgrass recovery from infection by S. homoeocarpa was measured following combined treatments of fungicides and nitrogen fertilizers. The objective of this research is to establish a program to reduce the development of dollar spot and allow the grass plants to recover to a high quality turf. The program sought should reduce chemical rates and have a reduced effect on the general soil microorganisms. To date results indicate that bentgrass turf, with initial disease development of 30 to 40% (area) of dollar spot, can fully recover in 2-3 weeks with the combined applications of 0.2 lb nitrogen/1000 sq ft and fungicides applied at less than one fourth the recommended rate for the therapeutic use. While additional research is necessary, I am optimistic that integrating disease control practices will both reduce disease effectively and promote a strong turfgrass ecosystem that will itself act to reduce future disease development.

INTERFACING OF SOD AND SOIL

An extensive and long term research program has started which is examining the factors involved with the interfacing of sod with Illinois soils. Using an apparatus that measures the root strength of laid sod, several questions are being addressed which could result in recommendations for establishing lasting sodded lawns. For example, is it more useful to use mineral-sod on some soils and peat-sod on other soils? Does the age of sod affect its ability to root? How does the sod temperature affect sod interfacing? This research will require a minimum of three years in order to establish sufficient information upon which recommendations can be offered.

The sod interfacing study has been expanded to include an investigation of the influence of fertilizer types on sod interfacing. Several types of fertilizers, several ages of sod, several rates of fertilizers, two soil types, and two cultivation methods are included in this study. The duration of the study will be 3-4 years.

DISEASE ETIOLOGIES

Four diseases are currently under investigation to determine their etiology.

Yellow ring of Poa pratensis is now known to be caused by Trechispora alnicola. This pathogen continues to be a problem in bluegrass turf older than 2 years and heavily thatched. Chemicals and biological agents are being explored for their effectiveness in reducing the incidence and severity of this disease.

"Zoysia patch", a very new and unfamiliar disease of Zoysia japonicum occurs in the Mississippi valley area bordering southwestern Illinois. Research is being conducted to establish the cause of the disease and develop an effective control.

A "new" disease has appeared on Poa annua in Illinois. The causal agent has been isolated but, it has not been conclusively identified. Research is being conducted to determine the conditions under which this disease develops.

The fourth disease under investigation is an unknown blight on P. pratensis, first observed in Long Island, NY. The causal organism has been isolated but not definitively identified.

BIOLOGICAL CONTROL OF GRASS PATHOGENS

Pythium and Gaeumannomyces species which attack various grass species are antagonized by bacteria that inhabit the soil. These bacteria are being investigated for their potential use as control agents for these pathogens. This work is slow but could result in lasting, safe and inexpensive controls for these serious pathogens of turf.

This year the construction of a new disease research facility has been started. This facility will permit several serious diseases to be studied under field conditions. The completion of this facility is the fall of 1984.

1984 TURFGRASS INSECT SITUATION IN ILLINOIS

Roscoe Randell

INSECT SITUATION

Spring was delayed by below normal temperatures. Development of overwintering and spring migrating insects was delayed as much as three weeks.

The summer months in many areas of Illinois were unseasonably dry followed by excessive rainfall in the early fall months.

Sod webworms

Adults inspected in mid summer were diseased and larval populations decreased throughout the summer to very low numbers to overwinter. The microsporidia disease, when present, effectively reduces high numbers.

Annual white grubs

Adult emergence from droughty soil and unsuccessful egg laying and hatch reduced larval damage in late summer. Damage by white grubs has decreased both in 1983 and 1984, primarily due to unfavorable soil conditions at adult emergence and egg laying.

Black turfgrass ataenius

Egg laying was late due to a cold spring. Some larval damage appeared in early and mid July in northeastern Illinois.

Black cutworm

Adult moth migration into the state was light in 1984. First damage appeared in late May.

Greenbug

This aphid was only observed in the extreme northern counties in the state during late July and August. Damage was moderate in this area.

INSECTICIDES

There were effective insectides available for controlling turf insects in 1984. Diazinon, Dylox, Proxol, Dursban, Oftanol, Orthene, Turcam, Aspon, and

Sevin were used on certain pest insects. Triumph will probably be labeled for use in 1985.

WEATHER DATA FOR URBANA STATION

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	GRASS MIN	SOIL MAX	SOIL MIN	PRECIPITATION (INCHES)	RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01APR84	49	29	39	36	47	38	0	100	54	LIGHT
02APR84	54	34	43	37	54	41	0	100	46	LIGHT
03APR84	55	46	43	37	54	41	0.2	100	46	
04APR84	50	39	44	39	50	44	0.18	100	100	NO DEW
05APR84	52	40	44	42	49	45	0.83	100	86	NO DEW
06APR84	56	34	45	40	52	43	0	100	46	LIGHT
07APR84	57	34	45	40	54	41	0 1.21	100	36	MODERATE
08APR84	58	41	47	43	59	50	0.09	100	32	NO DEW
09APR84	46	42	45	42	50	48	0.31	90	80	NO DEW
10APR84	57	40	45	42	50	47	0.06	100	76	
11APR84	63	37	49	44	59	46	0	80	51	NO DEW
12APR84	65	38	51	44	60	51	0	100	50	NO DEW
13APR84	61	48	49	46	51	46	0.46	100	60	NO DEW
14APR84	65	43	50	46	56	50	0 0.92	100	40	NO DEW
15APR84	53	44	49	47	53	51	0.16	100	76	NO DEW
16APR84	48	40	48	45	52	48	0.09	100	96	NO DEW
17APR84	46	36	46	42	49	44	0.08	100	64	NO DEW
18APR84	48	37	44	42	48	44	0.05	100	58	NO DEW
19APR84	47	39	44	42	48	43	0	100	70	LIGHT
20APR84	52	37	48	42	54	44	0	100	66	LIGHT
21APR84	58	46	48	43	55	44	0.62 1.0	100	54	NO DEW
22APR84	53	41	46	44	51	48	1.29	100	88	NO DEW
23APR84	51	39	46	44	50	48	0.06	100	100	NO DEW
24APR84	46	35	46	43	50	46	0.1	100	84	LIGHT
25APR84	63	44	51	43	60	46	0	100	58	LIGHT
26APR84	73	53	53	47	65	52	0	100	44	NO DEW
27APR84	76	60	58	51	70	50	0	100	66	NO DEW
28APR84	75	47	60	56	70	60	0 1.46	100	44	NO DEW
29APR84	73	61	60	54	70	52	0	90	44	
30APR84	68	44	56	54	63	56	0.22	100	60	NO DEW
TOTAL							4.8			
AVERAGE	57.3	41.6	48.1	43.9	55.1	46.9		98.7	62.5	
ACCUMULATIVE TOTAL							14.1			

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	GRASS MIN	SOIL MAX	SOIL MIN	PRECIPITATION (INCHES)	RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01MAY84	57	34	55	49	57	34	0	100	54	LIGHT
02MAY84	63	48	55	49	65	49	0	90	36	NO DEW
03MAY84	71	42	57	52	70	55	0	100	48	NO DEW
04MAY84	63	50	54	50	56	45	0.1	100	96	MODERATE
05MAY84	56	45	53	51	54	52	0.03 0.35	100	50	NO DEW
06MAY84	64	49	57	51	59	52	0.02	100	50	NO DEW
07MAY84	67	52	56	54	59	55	0	100	50	MODERATE
08MAY84	67	41	57	52	61	55	0	78	60	
09MAY84	65	41	54	48	57	52	0	74	28	NO DEW
10MAY84	63	43	53	48	58	51	0	96	44	LIGHT
11MAY84	69	59	53	50	57	45	0	84	34	NO DEW
12MAY84	70	49	54	53	58	55	0.04 0.06	100	34	NO DEW
13MAY84	73	54	58	53	66	55	0.27	100	28	NO DEW
14MAY84	79	41	57	53	64	56	0	100	26	MODERATE
15MAY84	84	55	58	53	67	55	0	78	28	NO DEW
16MAY84	67	38	60	50	67	57	0	70	30	MODERATE
17MAY84	72	44	60	50	67	52	0	86	22	NO DEW
18MAY84	77	52	61	54	66	58	0	78	30	NO DEW
19MAY84	86	58	65	56	69	60	0 0.27	82	38	NO DEW
20MAY84	86	58	67	61	69	63	2.34	100	40	WET
21MAY84	68	59	63	61	65	63	0.08	100	70	WET
22MAY84	74	63	64	60	66	62	0.26	100	82	WET
23MAY84	78	55	66	61	68	61	0.23	100	56	MODERATE
24MAY84	69	49	69	60	69	60	0	100	42	MODERATE
25MAY84	75	58	67	60	70	59	0	90	46	NO DEW
26MAY84	71	53	63	61	63	60	1.39 4.3	100	80	NO DEW
27MAY84	66	52	66	61	68	61	0	98	50	LIGHT
28MAY84	65	56	63	60	63	60	0.21	100	56	
29MAY84	60	51	60	51	61	54	0	100	74	LIGHT
30MAY84	58	43	60	50	61	54	0.03	100	40	MODERATE
31MAY84	69	48	63	55	66	50	0	86	32	LIGHT
TOTAL							5			
AVERAGE	69.4	49.7	59.6	54.1	63.4	54.8		93.2	46.9	
ACCUMULATIVE TOTAL							19.1			

WEATHER DATA FOR URBANA STATION

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	GRASS MIN	SOIL MAX	SOIL MIN	PRECIPITATION (INCHES)		RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01JUN84	73	49	60	50	73	57	0		98	32	LIGHT
02JUN84	83	61	67	59	75	60	0	0.24	79	38	NO DEW
03JUN84	86	60	69	61	78	65	0		92	36	NO DEW
04JUN84	82	55	74	64	83	70	0		98	26	NO DEW
05JUN84	83	62	70	65	77	69	0		100	50	NO DEW
06JUN84	87	71	73	65	80	68	0		92	48	NO DEW
07JUN84	88	53	74	68	81	72	0.04		100	44	NO DEW
08JUN84	84	59	71	68	76	72	0		90	50	NO DEW
09JUN84	87	58	71	69	76	72	0.01	0.05	100	60	NO DEW
10JUN84	89	72	75	69	89	72	0.08		100	40	NO DEW
11JUN84	89	62	84	72	88	70	0		94	36	
12JUN84	86	64	79	69	86	72	0		100	70	NO DEW
13JUN84	92	70	77	65	84	75	0		100	40	NO DEW
14JUN84	92	66	77	71	83	75	0		100	40	
15JUN84	84	53	79	68	85	71	0	0.08	74	38	NO DEW
16JUN84	81	59	73	68	79	71	0		86	32	
17JUN84	90	73	76	70	82	73	0		86	40	NO DEW
18JUN84	91	73	78	73	84	77	0		96	46	NO DEW
19JUN84	90	69	81	73	86	76	0		82	36	NO DEW
20JUN84	89	69	82	74	89	60	0		82	39	NO DEW
21JUN84	92	68	82	72	88	75	0		100	34	NO DEW
22JUN84	79	66	82	72	88	75	0.03		100	80	NO DEW
23JUN84	90	65	80	72	84	75	0.76	0.79	100	48	NO DEW
24JUN84	89	63	82	74	85	74	0.03		96	48	NO DEW
25JUN84	80	60	80	71	86	72	0		94	34	NO DEW
26JUN84	83	58	80	71	87	72	0		86	30	NO DEW
27JUN84	84	60	75	68	80	72	0.25		100	45	
28JUN84	84	62	78	72	87	74	0		98	40	
29JUN84	84	63	77	70	84	73	0.03	0.31	100	36	NO DEW
30JUN84	78	54	72	70	84	72	0		100	42	NO DEW
TOTAL							1.23				
AVERAGE	85.6	62.6	75.9	68.4	82.9	71			94.1	42.6	
ACCUMULATIVE TOTAL							20.33				

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	GRASS MIN	SOIL MAX	SOIL MIN	PRECIPITATION (INCHES)		RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01JUL84	82	72	77	70	82	72	0		100	50	LIGHT
02JUL84	81	61	77	70	83	74	0		100	44	LIGHT
03JUL84	85	62	82	74	90	67	0		100	65	
04JUL84	89	62	80	72	85	70	0		95	45	
05JUL84	77	66	74	71	76	73	0.2		100	74	NO DEW
06JUL84	83	63	79	71	80	70	0.05	0.25	100	42	NO DEW
07JUL84	78	53	79	70	81	69	0		100	42	NO DEW
08JUL84	75	54	75	69	80	69	0		92	40	LIGHT
09JUL84	77	63	78	70	82	68	0		95	40	
10JUL84	95	74	84	70	85	70	0		100	50	
11JUL84	93	68	83	73	90	77	0.23		100	44	NO DEW
12JUL84	79	63	77	71	79	71	0		98	54	
13JUL84	86	63	81	70	86	71	0	0.23	92	44	
14JUL84	88	65	83	72	89	73	0		100	44	
15JUL84	90	67	82	75	89	79	0.5		100	36	
16JUL84	84	73	81	73	82	72	0		90	54	NO DEW
17JUL84	84	59	79	71	84	71	0		100	44	NO DEW
18JUL84	82	58	78	69	84	71	0		94	38	NO DEW
19JUL84	78	53	79	69	85	70	0		100	40	NO DEW
20JUL84	83	64	81	69	87	70	0.22	0.72	100	42	NO DEW
21JUL84	88	62	80	70	73	71	0		100	68	
22JUL84	86	67	80	72	85	76	0		100	54	MODERATE
23JUL84	88	64	79	78	83	74	0		100	46	LIGHT
24JUL84	89	67	84	74	91	77	0		100	40	
25JUL84	88	66	80	72	88	77	0.09		100	44	LIGHT
26JUL84	80	64	78	71	82	73	1.29		100	64	NO DEW
27JUL84	73	57	72	67	74	66	0.31		100	78	LIGHT
28JUL84	78	59	75	66	75	69	0	1.69	100	50	NO DEW
29JUL84	77	56	76	69	82	68	0.3		100	40	MODERATE
30JUL84	79	59	76	69	78	68	0		88	42	LIGHT
31JUL84	80	60	77	68	86	67	0		100	42	
TOTAL							3.19				
AVERAGE	83.1	62.7	78.9	70.8	83.1	71.4			98.2	48.4	
ACCUMULATIVE TOTAL							23.52				

WEATHER DATA FOR URBANA STATION

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	SOIL TEMPERATURE GRASS MIN	SOIL TEMPERATURE SOIL MAX	SOIL TEMPERATURE SOIL MIN	PRECIPITATION (INCHES)		RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01AUG84	81	61	77	71	84	70	0		100	44	LIGHT
02AUG84	85	66	80	71	87	72	0		100	44	MODERATE
03AUG84	87	67	79	76	81	73	0.24		100	50	
04AUG84	87	67	80	75	82	74	0.62	1.16	100	74	NO DEW
05AUG84	83	68	76	75	78	75	0.64		100	64	NO DEW
06AUG84	85	64	80	75	82	76	0		100	62	MODERATE
07AUG84	88	68	81	74	88	73	0.07		100	60	LIGHT
08AUG84	91	71	83	77	90	74	0		98	55	LIGHT
09AUG84	89	64	82	75	90	77	0		100	54	HEAVY
10AUG84	90	68	84	73	90	76	0.03		100	55	LIGHT
11AUG84	87	63	81	75	89	78	0	0.74	100	44	NO DEW
12AUG84	82	63	79	74	86	77	0		100	58	MODERATE
13AUG84	88	61	79	73	87	76	0		96	48	HEAVY
14AUG84	83	62	79	72	91	69	0		100	38	LIGHT
15AUG84	85	61	82	76	87	74	0		100	38	LIGHT
16AUG84	87	63	80	72	87	74	0		100	46	LIGHT
17AUG84	91	67	81	73	90	76	0		100	40	NO DEW
18AUG84	80	65	76	74	80	75	0.05	0.05	100	64	NO DEW
19AUG84	83	59	79	72	85	76	0		100	50	LIGHT
20AUG84	80	57	77	71	85	73	0		100	40	LIGHT
21AUG84	80	56	80	72	86	72	0		100	55	NO DEW
22AUG84	85	63	80	71	85	72	0.73		100	44	HEAVY
23AUG84	85	53	79	70	81	69	0		100	38	LIGHT
24AUG84	76	52	73	67	81	67	0		100	50	LIGHT
25AUG84	77	54	74	67	81	61	0	0.73	100	46	NO DEW
26AUG84	79	53	76	69	83	71	0		100	42	MODERATE
27AUG84	83	56	76	69	85	72	0		100	36	LIGHT
28AUG84	87	67	74	70	80	71	0		100	50	NO DEW
29AUG84	93	68	80	71	88	73	0		100	46	HEAVY
30AUG84	91	70	83	71	89	74	0		100	58	NO DEW
31AUG84	88	55	83	71	89	74	0	0	64	28	NO DEW
TOTAL							2.38				
AVERAGE	85	62.3	79.1	72.3	85.4	73			98.6	49.1	
ACCUMULATIVE TOTAL							25.9				

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	SOIL TEMPERATURE GRASS MIN	SOIL TEMPERATURE SOIL MAX	SOIL TEMPERATURE SOIL MIN	PRECIPITATION (INCHES)		RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01SEP84	84	59	78	73	81	68	0		94	40	
02SEP84	93	72	84	77	90	76	0		92	40	
03SEP84	88	64	85	76	88	72	0		96	46	
04SEP84	71	49	77	73	76	62	0		95	55	
05SEP84	74	52	75	70	76	65	0.15		96	46	
06SEP84	70	51	75	64	76	63	0		100	60	
07SEP84	72	59	75	67	79	74	0		100	42	
08SEP84	85	62	77	68	83	65	0	0.15	100	39	
09SEP84	80	49	71	64	74	65	0.5		100	55	
10SEP84	75	62	70	67	75	69	0		100	64	
11SEP84	81	66	72	69	76	68	0.29		100	66	
12SEP84	81	62	72	68	75	68	0		100	46	MODERATE
13SEP84	85	69	73	69	76	67	0		100	62	MODERATE
14SEP84	86	62	75	71	82	70	0.01		100	50	LIGHT
15SEP84	65	45	72	63	73	61	0.43	1.23	100	60	MODERATE
16SEP84	65	40	66	60	67	57	0		100	40	MODERATE
17SEP84	65	42	66	59	70	57	0		100	34	MODERATE
18SEP84	69	42	67	61	70	58	0		94	38	
19SEP84	73	48	67	60	74	58	0		100	36	HEAVY
20SEP84	82	53	68	61	77	61	0		100	40	LIGHT
21SEP84	82	54	69	63	78	65	0		100	40	LIGHT
22SEP84	85	60	71	65	80	68	0	0	98	36	NO DEW
23SEP84	76	60	67	66	72	68	0.3		100	54	MODERATE
24SEP84	76	66	68	66	73	68	0		97	67	
25SEP84	79	65	68	66	73	68	0		95	60	
26SEP84	78	37	65	62	68	54	0		95	60	
27SEP84	58	39	64	62	64	52	0		100	50	
28SEP84	52	40	62	60	61	55	0		95	60	
29SEP84	59	34	62	60	61	55	0	0.3	95	50	
30SEP84	68	31	59	54	62	52	0		100	35	
TOTAL							1.68				
AVERAGE	75.2	53.1	70.7	65.5	74.3	63.6			98.1	49	
ACCUMULATIVE TOTAL							27.58				

WEATHER DATA FOR URBANA STATION

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	GRASS MIN	SOIL MAX	SOIL MIN	PRECIPITATION (INCHES)		RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01OCT84	62	29	59	55	62	52	0		100	48	
02OCT84	65	37	63	48	62	45	0		95	40	
03OCT84	66	36	56	51	64	51	0		92	30	LIGHT
04OCT84	78	47	60	53	69	51	0		86	28	LIGHT
05OCT84	75	45	60	55	67	57	0		100	36	LIGHT
06OCT84	75	56	60	55	67	57	0		100	42	LIGHT
07OCT84	68	56	60	59	63	61	0.05		100	64	MODERATE
08OCT84	64	60	60	59	63	61	0.26		100	98	NO DEW
09OCT84	72	60	70	64	72	63	0.35		100	60	
10OCT84	74	55	67	66	69	62	0		100	75	HEAVY
11OCT84	74	59	65	63	68	62	0		96	52	
12OCT84	74	60	66	62	71	61	0		100	58	MODERATE
13OCT84	78	62	66	62	71	61	0.35	1.01	100	60	
14OCT84	70	60	71	65	72	63	0.02		100	70	
15OCT84	73	62	71	64	72	65	0		100	65	
16OCT84	74	52	66	61	67	60	0.06		100	68	MODERATE
17OCT84	76	44	62	61	64	58	0		100	48	LIGHT
18OCT84	62	43	65	55	64	54	0		100	42	LIGHT
19OCT84	72	50	61	56	63	53	0.35		100	46	LIGHT
20OCT84	62	38	60	52	61	51	0.01	0.44	100	36	LIGHT
21OCT84	54	45	57	53	56	49	1		99	88	
22OCT84	54	42	56	50	55	45	0		94	62	
23OCT84	57	39	53	49	52	47	0		88	40	LIGHT
24OCT84	56	36	51	49	53	41	0		100	40	MODERATE
25OCT84	60	41	53	49	57	46	0.25		100	36	
26OCT84	63	49	54	51	56	50	0.08		100	100	HEAVY
27OCT84	74	56	57	54	61	55	0.02	1,35	100	68	MODERATE
28OCT84	76	50	60	57	64	58	0		100	52	MODERATE
29OCT84	56	43	60	53	60	51	0		100	68	LIGHT
30OCT84	58	45	55	54	55	51	0		100	56	LIGHT
31OCT84	60	51	56	54	57	53	0.06	0.06	100	76	MODERATE
TOTAL							2.86				
AVERAGE	67.2	48.6	60.6	56.1	63.1	54.6			98.4	56.5	
ACCUMULATIVE TOTAL							30.44				

21.14

WEATHER DATA FOR KILBOURNE STATION

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	SOIL TEMPERATURE GRASS MIN	SOIL TEMPERATURE SOIL MAX	SOIL TEMPERATURE SOIL MIN	PRECIPITATION (INCHES)	RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01APR84	49	30	44	42	47	40	0	90	38	
02APR84	55	38	49	44	50	43	0	100	35	
03APR84	55	42	49	44	50	43	0	100	50	
04APR84	47	40	44	42	47	45	0.39	100	75	
05APR84	41	39	44	42	47	45	0.1	100	75	
06APR84	58	36	45	40	53	47	0	98	43	
07APR84	59	34	47	44	55	43	0	80	35	
08APR84	60	43	49	47	57	46	0.18	95	40	
09APR84	48	42	47	46	52	45	0.3	100	70	
10APR84	55	44	47	46	52	45	0.02	100	70	
11APR84	60	39	50	48	55	46	0	85	35	
12APR84	66	51	54	48	61	48	0	95	40	NO DEW
13APR84	65	50	45	42	59	52	0.17	100	54	
14APR84	65	45	49	46	55	50	0	100	65	
15APR84	54	45	50	44	53	48	0.01	100	75	
16APR84	51	45	49	45	54	50	0.25	100	91	
17APR84	47	41	47	43	51	48	0.05	100	55	
18APR84	55	33	46	41	49	45	0	100	75	
19APR84	50	36	50	43	55	44	0.01	100	55	
20APR84	56	35	50	45	55	49	0	100	75	
21APR84	57	46	52	49	56	48	0.56	100	50	
22APR84	52	41	51	48	54	46	1.15	96	60	
23APR84	46	38	48	47	48	45	0.2	100	85	
24APR84	43	36	43	40	46	41	0	100	85	
25APR84	71	48	63	43	68	40	0	76	29	NO DEW
26APR84	75	61	68	53	72	50	0	69	51	NO DEW
27APR84	81	67	71	58	77	52	0	85	47	NO DEW
28APR84	83	46	60	55	65	50	0	100	50	
29APR84	64	49	62	54	68	50	0.2	100	50	
30APR84	70	45	71	54	74	50	0.06	69	41	NO DEW
TOTAL							3.65			
AVERAGE	57.9	42.8	51.5	46.1	56.2	46.5		94.6	56.6	
ACCUMULATIVE TOTAL							8.60			

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	SOIL TEMPERATURE GRASS MIN	SOIL TEMPERATURE SOIL MAX	SOIL TEMPERATURE SOIL MIN	PRECIPITATION (INCHES)	RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01MAY84	57	35	64	52	65	48	0	87	37	MODERATE
02MAY84	66	48	68	52	71	48	0	72	28	NO DEW
03MAY84	72	55	70	57	73	53	0.01	92	37	HEAVY
04MAY84	55	46	64	57	59	52	0.04	90	80	HEAVY
05MAY84	61	47	56	50	59	51	0.08	100	75	
06MAY84	67	46	57	48	65	49	0	100	45	
07MAY84	66	55	65	54	66	51	0	93	53	LIGHT
08MAY84	66	40	69	56	71	51	0	60	45	NO DEW
09MAY84	55	43	61	54	63	50	0	54	29	NO DEW
10MAY84	65	40	69	54	72	49	0	86	35	LIGHT
11MAY84	76	51	66	57	69	53	0	90	34	MODERATE
12MAY84	66	52	60	55	61	54	0.1	100	50	
13MAY84	74	60	65	56	70	53	0.1	100	35	
14MAY84	79	46	76	57	78	53	0.06	100	45	
15MAY84	69	43	77	60	80	56	0	92	33	HEAVY
16MAY84	72	33	75	59	78	54	0	79	25	LIGHT
17MAY84	71	47	77	60	81	53	0	79	22	NO DEW
18MAY84	81	51	79	63	83	58	0	82	30	NO DEW
19MAY84	88	62	81	66	87	62	0	84	35	NO DEW
20MAY84	80	56	88	60	70	60	1.1	100	60	
21MAY84	72	62	80	69	84	66	0.39	92	58	MODERATE
22MAY84	80	67	79	69	80	65	0	89	59	MODERATE
23MAY84	78	54	75	66	81	65	0.03	90	60	
24MAY84	73	48	81	65	81	60	0	90	33	HEAVY
25MAY84	79	62	81	65	84	59	0.02	88	36	HEAVY
26MAY84	75	52	68	64	70	60	1.4	100	70	
27MAY84	67	50	70	64	72	60	0	100	50	
28MAY84	65	54	79	64	80	58	0.15	92	61	HEAVY
29MAY84	47	36	61	53	80	48	0	92	68	HEAVY
30MAY84	63	43	71	53	74	48	0	85	34	LIGHT
31MAY84	72	43	77	58	80	51	0	92	27	HEAVY
TOTAL							3.48			
AVERAGE	69.6	49.3	70.6	58.6	73.8	54.8		88.7	44.8	
ACCUMULATIVE TOTAL							12.08			

WEATHER DATA FOR KILBOURNE STATION

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	GRASS MIN	SOIL MAX	SOIL MIN	PRECIPITATION (INCHES)	RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01JUN84	74	50	65	60	68	52	0	90	35	NO DEW
02JUN84	85	63	83	67	87	62	0	82	37	NO DEW
03JUN84	85	52	74	62	80	60	0	90	40	
04JUN84	83	55	80	73	91	66	0	80	45	NO DEW
05JUN84	84	66	80	73	84	69	0	77	47	NO DEW
06JUN84	89	70	86	73	90	70	0.01	90	40	HEAVY
07JUN84	89	70	87	77	91	70	0	81	44	NO DEW
08JUN84	82	71	93	76	83	73	0	90	58	HEAVY
09JUN84	83	65	78	72	80	70	0.75	100	60	
10JUN84	81	70	74	70	80	68	0	85	50	
11JUN84	88	62	93	76	96	72	0.06	90	66	HEAVY
12JUN84	87	71	91	76	96	71	0	77	37	NO DEW
13JUN84	90	71	90	80	95	76	0	84	40	NO DEW
14JUN84	91	66	92	81	97	78	0	88	39	MODERATE
15JUN84	89	59	91	81	95	77	0	50	33	NO DEW
16JUN84	76	68	76	70	83	72	0.3	100	48	
17JUN84	90	70	75	66	84	69	1.5	100	55	
18JUN84	92	75	92	77	95	77	0.03	77	43	NO DEW
19JUN84	90	64	96	82	100	79	0	90	43	LIGHT
20JUN84	89	64	93	81	95	78	0	88	34	NO DEW
21JUN84	93	69	95	81	98	78	0	80	30	NO DEW
22JUN84	87	72	88	84	89	79	0	89	52	HEAVY
23JUN84	95	70	94	81	98	78	0.06	92	39	HEAVY
24JUN84	87	61	77	74	85	70	0.02	100	70	
25JUN84	83	59	92	77	93	71	0.04	92	34	HEAVY
26JUN84	87	63	92	78	97	73	0	90	33	HEAVY
27JUN84	83	67	82	78	97	72	0.02	90	49	HEAVY
28JUN84	83	58	89	76	88	70	0	90	36	HEAVY
29JUN84	87	60	88	74	90	71	0	89	60	HEAVY
30JUN84	80	55	75	70	85	72	0	100	50	
TOTAL							2.79			
AVERAGE	86.1	64.5	85.4	74.9	89.7	71.4		87.4	44.9	
ACCUMULATIVE TOTAL							14.87			

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	GRASS MIN	SOIL MAX	SOIL MIN	PRECIPITATION (INCHES)	RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01JUL84	75	51	78	69	80	65	0	100	50	
02JUL84	83	56	91	75	92	69	0	96	39	MODERATE
03JUL84	86	61	88	76	91	71	0	91	34	MODERATE
04JUL84	88	62	82	70	87	68	0	95	45	
05JUL84	77	63	88	75	91	70	0.06	95	77	HEAVY
06JUL84	86	65	90	78	91	70	0.01	93	40	HEAVY
07JUL84	78	48	80	70	83	68	0	85	40	
08JUL84	74	52	80	70	87	68	0	95	65	
09JUL84	78	60	78	68	84	67	0	95	40	
10JUL84	97	75	85	70	85	70	0	100	50	
11JUL84	95	65	78	70	95	79	0	100	55	
12JUL84	85	65	77	70	81	69	0	95	50	
13JUL84	87	65	84	72	88	70	0	95	50	
17JUL84	79	61	91	78	99	71	0	87	37	HEAVY
18JUL84	79	55	85	71	95	72	0	88	45	
19JUL84	77	50	92	78	95	72	0	91	38	HEAVY
20JUL84	81	67	91	78	96	71	0.01	87	37	HEAVY
21JUL84	85	67	84	75	93	76	0	100	65	
22JUL84	90	71	85	74	91	75	0	100	45	
23JUL84	90	74	85	76	89	78	0	100	45	
24JUL84	90	70	85	78	90	76	0	95	43	
25JUL84	75	63	76	72	76	68	0.3	67	53	
26JUL84	77	60	80	71	83	74	0.1	100	45	
27JUL84	72	56	76	72	78	69	0.55	100	70	
28JUL84	79	60	80	68	84	71	0	95	60	
29JUL84	79	56	82	67	86	70	0	100	55	
30JUL84	78	51	89	73	95	67	0	93	33	HEAVY
31JUL84	83	59	83	72	86	70	0	100	48	
TOTAL							1.03			
AVERAGE	82.3	61	83.7	72.7	88.3	70.9		94.2	48.4	
ACCUMULATIVE TOTAL							15.09			

WEATHER DATA FOR KILBOURNE STATION

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	GRASS MIN	SOIL MAX	SOIL MIN	PRECIPITATION (INCHES)	RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01AUG84	86	64	80	73	85	71	0	100	51	
02AUG84	82	62	87	78	96	72	0	90	46	LIGHT
03AUG84	88	63	90	80	96	73	0	90	36	LIGHT
04AUG84	86	63	90	80	91	77	0	90	47	MODERATE
05AUG84	85	64	92	82	93	74	0	90	49	HEAVY
06AUG84	87	69	90	81	94	77	0	88	45	LIGHT
07AUG84	90	68	93	82	97	79	0	88	42	LIGHT
08AUG84	94	70	84	78	98	81	0	96	50	NO DEW
09AUG84	89	66	94	84	96	81	0	90	43	LIGHT
10AUG84	91	63	93	84	96	80	0	90	42	LIGHT
11AUG84	87	63	85	78	86	73	0	95	44	
12AUG84	85	64	85	78	85	75	0	95	50	
13AUG84	84	57	95	84	97	79	0	91	40	LIGHT
14AUG84	84	53	94	81	91	77	0	93	38	LIGHT
15AUG84	86	60	93	80	94	75	0	90	34	MODERATE
16AUG84	90	54	93	81	92	78	0	88	36	LIGHT
17AUG84	92	68	93	82	93	80	0	91	38	LIGHT
18AUG84	74	66	86	80	81	75	0.07	90	86	HEAVY
19AUG84	80	60	78	75	80	70	0	94	68	
20AUG84	78	54	89	77	88	70	0	92	36	HEAVY
21AUG84	79	54	88	75	90	69	0	91	39	HEAVY
22AUG84	83	67	86	76	89	69	0	88	43	HEAVY
23AUG84	85	50	90	79	95	70	0	90	35	HEAVY
24AUG84	74	47	86	77	88	68	0	92	37	HEAVY
25AUG84	77	55	78	68	88	64	0	100	34	HEAVY
26AUG84	80	52	89	77	86	70	0	92	37	NO DEW
27AUG84	81	64	86	76	89	74	0	82	37	NO DEW
28AUG84	85	67	85	79	87	74	0	87	47	NO DEW
29AUG84	92	69	91	82	94	77	0	90	44	NO DEW
30AUG84	93	66	92	82	95	79	0	87	44	NO DEW
31AUG84	88	51	81	70	89	73	0	100	46	
TOTAL							0.07			
AVERAGE	85	61.1	88.3	78.7	90.9	74.3		91.3	44	
ACCUMULATIVE TOTAL							15.97			

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	GRASS MIN	SOIL MAX	SOIL MIN	PRECIPITATION (INCHES)	RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01SEP84	87	65	79	74	84	68	0	92	36	
02SEP84	98	70	84	78	90	76	0	92	38	
03SEP84	83	62	84	76	85	73	0.02	97	48	
04SEP84	68	49	77	73	74	64	0	95	60	
05SEP84	77	52	77	72	75	62	0	95	45	
06SEP84	73	50	70	62	76	63	0	100	50	
07SEP84	75	68	70	62	74	61	0	100	50	
08SEP84	90	64	77	68	84	64	0	100	40	
09SEP84	70	64	70	65	73	65	0.6	96	56	
10SEP84	75	65	70	65	73	65	0.02	100	60	
11SEP84	79	60	75	64	72	65	0.1	100	60	
12SEP84	77	60	80	67	82	65	0	95	65	
13SEP84	90	72	81	74	87	72	0	92	47	
14SEP84	84	63	80	72	83	67	0.2	98	58	
15SEP84	66	44	74	62	73	59	0.15	97	75	
16SEP84	65	40	68	59	66	53	0	95	40	
17SEP84	67	45	68	60	67	54	0	97	38	
18SEP84	69	43	68	64	69	60	0	93	38	
19SEP84	74	51	70	63	72	58	0	95	35	
20SEP84	84	60	72	67	82	64	0	90	40	
21SEP84	87	56	71	63	81	66	0	100	60	
22SEP84	85	55	73	68	80	64	0	96	46	
23SEP84	70	65	72	67	73	66	0.5	98	68	
24SEP84	80	67	74	69	77	68	0	94	52	
25SEP84	88	70	74	69	77	68	0	95	60	
26SEP84	73	36	70	60	70	52	0.2	95	70	
27SEP84	56	42	66	62	65	51	0	100	50	
28SEP84	53	40	62	60	61	55	0	95	60	
29SEP84	60	36	62	60	61	55	0	95	50	
30SEP84	56	32	59	54	62	52	0	100	35	
TOTAL							1.79			
AVERAGE	75.3	54.9	72.6	66	74.9	62.5		96.2	51	
ACCUMULATIVE TOTAL							17.76			

WEATHER DATA FOR KILBOURNE STATION

DATE	TEMPERATURE MAX	TEMPERATURE MIN	SOIL TEMPERATURE GRASS MAX	GRASS MIN	SOIL MAX	SOIL MIN	PRECIPITATION (INCHES)	RELATIVE HUMIDITY MAX	RELATIVE HUMIDITY MIN	DEW
01OCT84	62	33	59	55	62	52	0	100	48	
02OCT84	67	37	63	48	62	45	0	95	40	
03OCT84	69	46	63	55	70	45	0	100	40	
04OCT84	78	48	65	61	72	58	0	90	30	
05OCT84	76	54	66	62	68	59	0	90	40	
06OCT84	75	60	65	59	65	57	0	100	50	
07OCT84	70	60	60	57	63	58	0.56	100	60	
08OCT84	68	59	65	62	64	60	1.14	100	80	
09OCT84	74	60	72	65	70	.	0.2	100	60	
10OCT84	75	60	64	61	68	63	0	100	80	
11OCT84	68	49	62	60	67	66	0	99	62	HEAVY
12OCT84	67	49	64	62	66	65	0	100	80	HEAVY
13OCT84	69	47	64	61	67	66	0	98	60	HEAVY
14OCT84	72	60	69	62	70	65	0.1	100	70	
15OCT84	73	64	70	65	71	65	0.02	100	70	
16OCT84	77	53	68	65	70	60	0.08	100	69	
17OCT84	74	42	68	65	67	59	0.6	100	45	
18OCT84	60	47	65	59	67	52	0	100	48	
19OCT84	69	48	64	59	66	57	0.65	99	59	
20OCT84	60	39	62	57	60	52	0	95	55	
21OCT84	53	43	57	53	55	49	0.5	98	82	
22OCT84	54	34	56	53	55	48	0	95	60	
23OCT84	55	35	56	53	55	48	0	95	50	
24OCT84	55	33	54	50	55	46	0	99	48	
25OCT84	59	45	62	54	61	50	0	100	47	
26OCT84	60	50	60	55	61	53	0.08	100	80	
27OCT84	68	66	60	57	62	53	0	100	80	
28OCT84	77	50	63	60	65	55	0	100	60	
29OCT84	67	45	60	54	62	45	0	100	67	
30OCT84	62	45	62	57	62	54	0	100	57	
31OCT84	57	45	60	55	60	50	0.2	100	75	
TOTAL							4.13			
AVERAGE	66.8	48.6	62.8	58.1	64.1	55.2		98.5	59.7	
ACCUMULATIVE TOTAL							21.89			