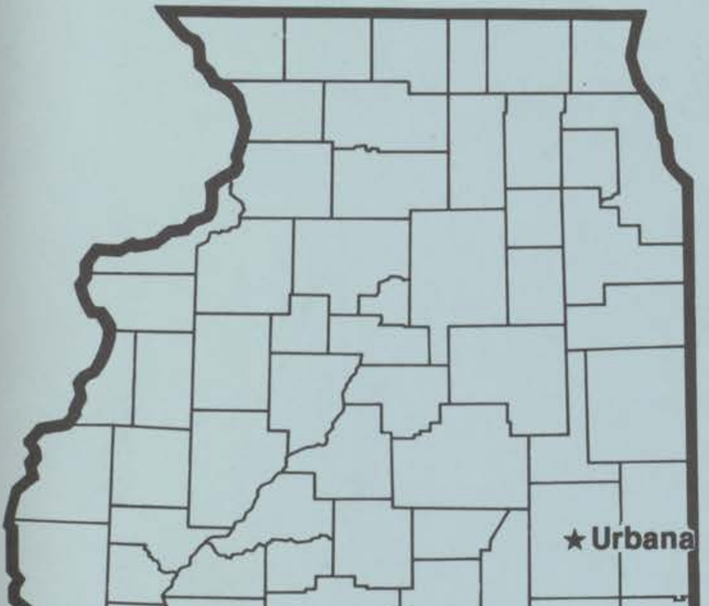
1986

Illinois Turfgrass Research Report



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Agricultural Experiment Station
University of Illinois at Urbana-Champaign

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Foreword

This report presents the 1986 results 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

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

UNDERSTANDING THE DATA

Most of the data presented in this report is subjected to statistical analysis. Statistical procedures are a combination of logic and arithmetic that allow us to interpret information gathered from experiments. We most frequently use Fisher's Least Significant Difference Test to explain our test data.

Fisher's Least Significant Difference Test is a statistical procedure that determines if the difference found between two treatments is due to the treatment or if the difference is simply due to random chance. For each set of data a value ($LSD_{0.05}$) is calculated at a chosen level of significance. If the difference between two treatment means is greater than this calculated value then it is said to be a 'significant difference' or a difference not due to random chance. For each set of data, a letter(s) is placed by each treatment mean to show its relationship to every other treatment mean. If two means have one or more letters in common, it is probable that any difference between them is not significant but is a result of random chance. The level of significance that we use is 0.05 ($LSD_{0.05}$). In other words, 95% of the time these treatments are compared this difference will occur. If no letters accompany the means and 'NS' is reported for the $LSD_{0.05}$ then no significant difference was found among the means in this group of data.

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BENTGRASS BLENDS FOR PUTTING GREEN TURF

J. E. Haley and D. J. Wehner

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 on 21 August 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 1986 growing season the turf was fertilized with 3.5 lb N/1000 sq ft and was 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.

During 1985 the best quality was observed with Penneagle and all blends containing Penneagle. Throughout the season the cultivars Seaside, Emerald and the Seaside/Emerald blend had the lowest quality of all cultivars and blends tested. Poor quality of all creeping bentgrass cultivars was observed in May prior to spring fertilization.

During the 1986 growing season Penneagle and all blends containing Penneagle continued to have the highest quality ratings. Test plots of Emerald, Seaside and the Emerald/Seaside blend showed further deterioration especially in late August.

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. The evaluation of creeping bentgrass cultivars and blends for the 1986 growing season.[1]

Cultivar/Blend	All Dates[2]	Quality[3] 4/24	6/11	7/17	8/21
Penneagle	7.9a	7.0a	8.0a	8.7a	8.0a
Penneagle/Emerald	7.8a	6.7ab	8.0a	8.7a	8.0a
Penncross/Penneagle	7.6a	6.7ab	8.0a	8.0ab	7.7a
Penneagle/Seaside	7.4a	6.0b-d	8.0a	8.0ab	7.7a
Penncross	6.5b	6.3a-c	6.7b	7.3bc	5.7b
Penncross/Seaside	6.1b	5.7c-e	6.0bc	6.3cd	6.3b
Penncross/Emerald	5.9b	5.7c-e	6.0bc	6.3cd	5.7b
Emerald	5.2c	5.3de	5.3c	6.0de	4.3c
Seaside	4.8c	5.3de	5.3c	5.0e	3.7c
Seaside/Emerald	4.7c	5.0e	5.3c	5.0e	3.7c
$LSD_{0.05}$	0.7	0.7	1.0	1.1	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 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.

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 plots that 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. Highland, because of its poor heat tolerance, and Emerald, because of its poor vigor, received lower quality ratings in 1983 and 1984.

Because of the severity of the crabgrass infestion in 1984, these plots were treated with bensulide in spring of 1985. Crabgrass did not become a problem even in the plots that received cultivation. Differences in the amount of annual bluegrass infestation started to appear during 1985. The percent annual bluegrass in the various cultivars reflects the trends in quality and density that have been seen the previous years. The cultivars with poorer quality and density had the highest percentage of annual bluegrass. The cultivars Penncross and Penneagle received the highest quality ratings in 1985 followed by Prominent and Seaside with Highland and Emerald receiving the lowest ratings.

In 1986, some of the same trends were apparent as found in earlier years. Probably the most noticeable change was the poor quality ratings for Penneagle in May and June (Table 1.). In past years, Penneagle has usually received a low rating for April but high ratings for the rest of the year. The low ratings in May and June may have been a result of the unusual winter conditions during 1985-1986. The percentage of annual bluegrass in the turf continued to increase during 1986 with the highest percentage infestation found in the Highland, Emerald, and Prominent plots (Table 1.). In 1985, the Highland plots contained an average of 23.5% annual bluegrass. Annual bluegrass was also more severe where vertical mowing was used as the cultivation treatment. This procedure is quite disruptive to the bentgrass turfs.

Table 1. The evaluation of creeping bentgrass maintained as a fairway turf.[1]

Treatment	Quality[2] 5/2	6/19	7/17	9/5	Percent Annual Bluegrass[3] 5/2
Fungicide	3.5	3.9	6.1a	6.3a	22.1
No Fungicide	4.4	4.0	4.1b	5.4b	10.1
$LSD_{0.05}$	NS	NS	1.0	0.4	NS
Highland	3.5bc	3.7b	3.5c	5.0	41.4a
Emerald	4.2ab	4.9a	4.7b	5.3	34.2ab
Prominent	4.0a-c	4.0ab	5.3ab	6.0	14.1bc
Seaside	4.2a	3.9b	5.3ab	6.2	4.1c
Penncross	4.3a	4.5ab	5.7a	6.4	1.8c
Penneagle	3.5c	2.4c	6.1a	6.3	1.1c
$LSD_{0.05}$	0.6	1.0	0.9	NS	20.8
Core Cultivation	4.1a	3.9	5.3a	6.0	15.2b
Vertical Mowing	4.1a	4.0	5.0b	5.7	18.5a
No Cultivation	3.7b	3.9	5.1ab	5.9	14.7b
$LSD_{0.05}$	0.3	NS	0.2	NS	2.9

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

[3]Percent annual bluegrass represents the area of each plot covered by annual bluegrass plants.

USDA NATIONAL KENTUCKY BLUEGRASS TRIAL - 1986

H. L. Portz, V. R. Patterozzi and A. Pennucci

INTRODUCTION

Kentucky bluegrass (Poa pratensis) is the major cool season turfgrass for home lawns in Illinois. However, the climate, soils and pests of southern Illinois place potentially severe stresses on most cultivars causing a decline in vigor and some stand thinning. New cultivars are being developed that are more disease resistant and tolerant of environmental stress. A total of 72 cultivars are being evaluated at Southern Illinois University. The USDA National Kentucky bluegrass trial is located in two adjacent areas with different maintenance levels. One high intensity management area is designed to duplicate golf course fairway or manicured lawn conditions, the other is a low maintenance are which mimics normal lawn usage.

MATERIALS AND METHODS

The two Kentucky bluegrass trials at SIUC were established 13 September 1985. Prior to seeding, the area was treated with glyphosate, plowed and allowed to lie fallow for most of 1985. The area was fertilized with 1.5 lb N/1000 sq ft (12-12-12). Three replicates are used in each trial area and plot size is 5 x 6 feet. After seeding, plots were covered with a light straw and irrigated as needed. Both trials were treated alike until well established in June, 1986 when underground irrigation was completed. The two levels of maintenance were: Low Maintenance - 2.25 inch cutting height, 2-3 lb N/1000 sq ft/year and no irrigation; High Maintenance - 1.25 inch cutting height, 4-5 lb N/1000 sq ft/year and irrigation as needed. Trimec was applied in spring, 1986 to control curled dock and other broadleaf weeds. RegalStar was applied to the high maintenance area in early May, 1986. Initial results of the two trials are reported here.

RESULTS

Stand/Vigor ratings were taken 2 November 1985 and indicated some erratic stands partially due to wheat seedling competition from the straw mulch (Table 1). Density was still low in May, 1986 but plots were improving in quality by late August. Rust (Puccinia spp) and cool season yellow patch (Rhizoctonia spp) were noted on some cultivars in the fall. Closer monitoring of diseases and other stress porblems will be undertaken in 1987.

Table 1. The evaluation of Kentucky bluegrass cultivars in 1985 and 1986 at SIUC.

	Stand/Vigor 11/02/85		Quality 5/20/86		Quality 8/28/86	
Culitivar	Low	High	Low	High	Low	High
Classic	6.7	5.0	5.7	5.7	6.3	6.5
Monopoly	5.7	6.0	6.0	5.7	7.0	7.0
Barzan	3.3	2.7	4.3	4.7	5.7	6.0
Gnome	4.3	3.7	5.0	4.0	5.3	6.5
Tendos	4.0	5.0	5.0	5.0	6.3	5.5
P-104	3.7	4.7	5.0	4.7	6.0	7.0
Ram 1	5.7	5.7	5.3	5.0	7.0	6.0
Compact	5.3	6.7	5.3	4.7	5.7	5.3
Joy	6.0	6.0	6.0	6.0	6.3	5.7
Sydsport	3.0	2.7	4.7	5.0	5.7	6.3
Haga	5.0	4.7	5.7	5.0	7.2	5.7
Georgetown	4.3	5.3	5.0	5.0	6.0	6.0
Somerset	6.0	6.0	5.3	5.0	6.3	6.7
Mystic	5.3	6.0	5.0	5.7	6.3	7.0
Baron	6.0	4.3	5.0	5.0	6.3	5.0
Able I	5.7	4.3	5.3	5.0	6.0	6.0
A-34	3.7	3.7	5.0	4.7	6.7	7.0
Merit	5.3	5.0	5.3	4.7	6.7	6.5
Bar VB 577	5.3	5.0	5.0	5.0	6.0	6.0
Annika	3.7	4.3	5.0	5.0	6.0	6.5
Conni	5.7	6.0	5.0	5.0	6.7	7.0
Kenblue	5.7	6.0	5.3	5.3	5.7	6.0
Bristol	3.7	4.7	4.7	5.0	6.3	7.0
Victa	6.3	5.3	5.7	5.0	6.7	7.5
Ba 70-139	4.3	5.3	4.7	4.7	7.0	7.0
Ba 70-242	3.0	3.7	4.7	4.7	5.7	6.5
Ba 72-441	5.7	5.3	5.7	4.0	5.7	6.0
Ba 72-492	4.0	4.7	5.0	5.0	6.0	7.0
Ba 72-500	3.7	5.3	5.0	5.0	6.3	6.7
Ba 73-626	5.0	5.0	5.0	4.7	6.0	6.0

(continued)

Table 1. The evaluation of Kentucky bluegrass cultivars in 1985 and 1986 at SIUC (continued).

	Stand/Vigor 11/02/85		Quality 5/20/86		Quality 8/28/86	
Culitivar	Low	High	Low	High	Low	High
Bar VB 534	3.3	6.3	5.0	5.3	5.7	6.7
Cynthia	5.3	4.7	5.0	5.0	5.3	7.0
ABGP Blend[1]	4.3	5.0	5.3	4.7	6.7	5.7
America	5.0	5.7	5.0	4.7	6.7	7.0
Ba 69-82	3.3	3.0	4.7	4.7	6.0	6.0
Ba 73-540	4.7	4.3	5.0	5.0	6.7	7.0
Parade	5.7	5.7	5.3	5.7	6.0	7.2
Asset	4.7	5.7	5.7	5.3	6.3	7.0
HV 97	2.7	4.7	4.7	4.7	5.7	5.5
Lofts 1757	5.0	5.3	4.7	5.0	5.0	6.3
Cheri	5.0	5.7	5.0	5.0	6.3	7.0
Eclipse	3.7	4.0	5.0	5.0	5.7	6.7
Liberty	3.0	4.0	4.7	5.3	5.0	5.7
Destiny	3.7	4.3	4.7	4.7	4.7	6.3
Dawn	4.3	4.7	4.3	5.0	5.3	7.0
Merion	4.0	4.0	5.0	4.7	6.0	x
Nassau	4.0	5.0	4.7	4.7	5.3	5.0
Amazon	4.3	4.7	5.0	5.0	4.3	8.0
239	5.7	4.3	5.7	4.7	6.7	7.0
Wabash	4.0	4.3	5.7	4.7	6.7	6.0
Julia	2.7	3.3	5.3	4.0	6.3	x
Ikone	4.3	4.0	5.3	5.0	5.3	7.0
Glade	4.0	3.7	5.0	4.7	6.7	5.0
Huntsville	4.7	5.3	5.3	4.7	6.0	5.5
B & A-34 Blend[2]	6.7	5.7	6.0	6.0	7.7	7.3
Aquilla	4.3	6.0	5.3	5.3	6.3	6.0
K1-152	4.0	5.3	5.7	5.3	5.7	5.0
Harmony	5.3	5.7	4.7	5.7	5.7	6.0
Welcome	5.0	5.7	5.7	5.3	4.7	5.5
Aspen	5.3	5.0	5.0	4.7	6.7	6.0

(continued)

[1]ABGP Blend is equal amounts of Adelphi, Baron, Glade and Parade.

[2]B & A-34 Blend is equal amounts of Baron and A-34.

Table 1. The evaluation of Kentucky bluegrass cultivars in 1985 and 1986 at SIUC (continued).

	Stand/Vigor 11/02/85		Quality 5/20/86		Quality 8/28/86	
Culitivar	Low	High	Low	High	Low	High
Rugby	4.0	5.7	5.0	5.0	6.3	7.0
Trenton	5.0	6.3	5.0	6.0	6.0	6.3
K3-178	5.7	6.3	6.0	5.3	6.7	6.0
Midnight	4.0	5.3	5.3	5.0	6.3	7.3
Challenger	4.7	5.3	4.7	5.0	5.7	6.0
Blacksburg	4.0	5.3	5.3	5.3	5.7	8.0
PST-CB1	4.3	5.7	5.0	5.0	6.0	6.5
South Dakota Cert.	6.7	5.7	6.0	6.0	6.3	6.7
WW Ag 468	5.3	4.7	5.0	5.3	6.3	6.5
WN Ag 491	5.3	6.3	5.3	5.7	6.3	8.0
WN Ag 495	5.3	5.3	5.3	5.3	4.3	7.0
WW Ag 496	5.7	4.3	5.0	4.7	5.7	8.0

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 trial. 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 8 September 1982, includes 50 perennial ryegrass cultivars, some that are experimental and others which are commercially available. Plots measure 5 x 6 feet and each cultivar is replicated 3 times. All plots are mowed at 2.0 inches. During the 1983 and 1984 growing seasons the turf received 4 lb N/1000 sq ft/year (18-5-9), during 1985 the turf was fertilized with 2 lb N/1000 sq ft and during 1986 3 lb N/1000 sq ft were applied. 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 drought stressed August. They include Elka, Cupido, Pippin and Linn.

In early spring of 1984 snow mold was a problem for the perennial ryegrass turf. 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.

In 1985 red thread was a problem in late July. Cultivars with an average red thread rating lower than 4.0 (indicating high susceptibility) were

HR1, Fiesta, M 382, Yorktown, Ranger, Elka, NK 80389, Pippin, Premier, Dasher, and Omega. Perennial ryegrass quality was lowest during July and August. In general, overall quality ratings for the 1985 growing season were lower than 1984.

No preemergence crabgrass control herbicide was applied to the area in 1986. Because of severe crabgrass infestation in most of the plots turf quality could not be evaluated after late June. In general, quality ratings were lower in late June than in early May (Table 1). Cultivars that performed well in late June include Yorktown, Gator, Prelude, Crown, Diplomat, Palmer, GT II, BT I and M382. Cultivars that showed some resistance to crabgrass infestation (10% crabgrass or less) are LP 702, Manhattan/Blazer, LP 792, NK 80389, HE 168, Palmer, GT II, BT I and M382.

Table 1. The evaluation of perennial ryegrass cultivars during the 1986 growing season.[1]

Cultivar	Quality[2]		% Crabgrass[3]	Cultivar	Quality[2]		% Crabgrass[3]
	5/08	6/23	7/29		5/08	6/23	7/29
Ranger	7.3a	6.3a-d	16.7g-i	HR-1	6.7a-c	6.0b-e	13.3hi
Yorktown	7.0ab	7.0ab	25.0e-i	Pennfine	6.7a-c	6.7a-c	33.3e-g
LP 702	7.0ab	6.3a-d	8.3i	LP 792	6.7a-c	6.0b-e	8.7i
IA 728	7.0ab	6.3a-d	23.3e-i	NK 80389	6.7a-c	6.7a-c	8.3i
Barry	7.0ab	6.0b-e	36.7ef	Fiesta/Manhattan II	6.7a-c	6.0b-e	15.0g-i
Pennant	7.0ab	6.7a-c	15.0g-i	Premier	6.7a-c	6.7a-c	25.0e-i
Gator	7.0ab	7.0ab	16.7g-i	HE 168	6.3a-c	6.7a-c	8.3i
Fiesta	7.0ab	6.0b-e	21.7e-i	HE 178	6.3a-c	6.3a-d	11.7hi
Prelude	7.0ab	7.0ab	23.33e-i	Palmer	6.3a-c	7.0ab	6.7i
WWE 19	7.0ab	6.0b-e	18.3f-i	Cockade	6.3a-c	6.7a-c	23.3e-i
SWRC-1	7.0ab	6.7a-c	11.7hi	Acclaim	6.3a-c	6.3a-d	18.3f-i
LP 210	7.0ab	5.3d-f	21.7e-i	GT II	6.3a-c	7.0ab	8.3i
Manhattan II/Blazer	7.0ab	6.7a-c	8.3i	Cupido	6.3a-c	6.3a-d	13.3hi
Cigil	6.7a-c	6.3a-d	11.7hi	Blazer	6.3a-c	6.3a-d	15.0g-i
Omega	6.7a-c	6.3a-d	21.7e-i	Manhattan	6.3a-c	5.7c-f	23.3e-i
Crown	6.7a-c	7.0ab	13.3hi	Citation	6.3a-c	4.7f	65.0c
Diplomat	6.7a-c	7.3a	15.0g-i	Elka	6.3a-c	6.0b-e	18.3f-i
Prelude/Blazer	6.7a-c	6.3a-d	13.3hi	Dasher	6.3a-c	6.0b-e	20.0f-i
LP 736	6.7a-c	6.3a-d	16.7g-i	Manhattan II	6.0b-d	6.3a-d	16.7g-i
Delray	6.7a-c	6.3a-d	56.7cd	BT I	6.0b-d	7.0ab	10.0i

(continued)

Table 1. The evaluation of perennial ryegrass cultivars during the 1986 growing season (continued).[1]

Cultivar	Quality[2]		% Crabgrass[3]	Cultivar	Quality[2]		% Crabgrass[3]
	5/08	6/23	7/29		5/08	6/23	7/29
2 ED	6.0b-d	6.0b-e	20.0f-i	Regal	5.7cd	6.3a-d	40.0de
Derby	6.0b-d	6.3a-d	33.3e-g	NK 79309	5.0d	5.0ef	85.0ab
282	6.0b-d	6.0b-e	23.3e-i	Pippin	5.0d	4.7f	86.7a
2 EE	6.0b-d	6.3a-d	30.0e-h	NK 79307	5.0d	6.0b-e	66.7bc
M382	5.7cd	7.0ab	10.3i	Linn	3.0e	3.3g	98.3a
$LSD_{0.05}$	1.0	1.1	18.6		1.0	1.1	18.6

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

[3]Percent crabgrass refers to the percent of the plot covered by crabgrass plants.

USDA NATIONAL FINE FESCUE CULTIVAR EVALUATION

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

INTRODUCTION

Fine fescue is a term generally 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), sheep fescue (Festuca ovina), and hard fescue (Festuca longifolia). Red fescue performs well as a turfgrass under shade and has a stoloniferous habit. Chewings, sheep, 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 trial. This trial 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 27 September 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 (1.7grams seed/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, in 1985 the area received 2 lb N/1000 sq ft and in 1986 the area was fertilize with 3.5 lb N/1000 sq ft. In 1984 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.

RESULTS

In 1984 fineleaf fescue quality was highest in May and steadily declined over the growing season. 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.

During 1985 quality was highest in April and July. Throughout the season, the chewings fescues, Longfellow and 4FL consistently exhibited good quality with the exception of August quality.

No preemergence crabgrass control herbicide was applied to the area in 1986. Because of severe crabgrass infestation in most of the plots turf quality could not be evaluated after late June. As in 1985, Longfellow and 4FL exibited high quality in May and June (Table 2). Other cultivars with good quality in late June include Shadow, Tamara, Enjoy, Center, FRI-FRT 83-1, Aurora, Bann, Biljart, Atlanta and Estica. Cultivars that showed some resistance to crabgrass invasion include Longfellow, 4FL, Center, FRI-FRT 83-1, Aurora, BAR FO 81-225, Flyer, Pernille and 430.

Over the years the plots will be further evaluated for quality, disease resistance, and drought 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
4FL		
Creeping red fescue		
Boreal	Flyer	Ruby
Ceres	Lovisa	Wintergreen
Commodore	Pennlawn	430
Ensylva	Pernille	
Estica	Robot	
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. The evaluation of fine fescue cultivars during the 1985 growing season.[1]

Cultivar	Quality[2] 5/08	Quality[2] 6/23	% Crabgrass[3] 7/29	Cultivar	Quality[2] 5/08	Quality[2] 6/23	% Crabgrass[3] 7/29
Longfellow	8.7a	7.7a-c	26.7h-j	Beauty	6.0d-h	6.3d-g	60.0a-f
4FL	8.0ab	8.0ab	21.7j	Robot	6.0d-h	4.3jk	63.3a-e
Shadow	7.7a-c	7.0b-e	55.0b-h	BAR FO 81-225	6.0d-h	5.3g-j	23.3ij
Cf-2	7.3a-d	6.3d-g	48.3d-j	Spartan	6.0d-h	6.0e-h	56.7b-g
Tamara	7.3a-d	7.3a-d	46.7d-j	ST-2	5.7e-h	6.3d-g	46.7d-j
Enjoy	7.3a-d	8.3a	36.7e-j	Boreal	5.7e-h	5.0h-k	31.7f-j
Reliant	7.0b-e	6.0e-h	43.3d-j	4 LS	5.7e-h	5.7f-i	31.7f-j
Pernille	7.0b-e	6.3d-g	30.0g-j	Flyer	5.3f-i	6.3d-g	26.7h-j
Center	7.0b-e	7.3a-d	28.3g-j	Magenta	5.3f-i	6.3d-g	60.0a-f
Mary	6.7b-f	6.7c-f	36.7e-j	Scaldis	5.3f-i	5.7f-i	45.0d-j
FRI-FRT 83-1	6.7b-f	8.0ab	25.0ij	Valda	5.3f-i	5.3g-j	55.0b-h
Aurora	6.7b-f	7.3a-d	28.3g-j	Ruby	5.3f-i	5.7f-i	50.0d-j
Banner	6.7b-f	6.0e-h	36.7e-j	Lovisa	5.0g-i	6.0e-h	51.7c-i
Biljart	6.7b-f	7.0b-e	38.3e-j	Commodore	5.0g-i	5.0h-k	56.7b-g
Koket	6.7b-f	6.3d-g	61.7a-e	Ensylva	5.0g-i	5.3g-j	60.0a-f
Waldorf	6.3c-g	6.3d-g	41.7e-j	Unknown	5.0g-i	5.3g-j	83.3ab
430	6.3c-g	6.3d-g	30.0g-j	Wilma	5.0g-i	5.7f-i	46.7d-j
Atlanta	6.3c-g	7.3a-d	43.3d-j	HF 9-3	5.0g-i	6.3d-g	43.3d-j
Estica	6.3c-g	7.3a-d	35.0e-j	Checker	4.7hi	5.3g-j	60.0a-f
Jamestown	6.3c-g	5.0h-k	71.7a-d	Pennlawn	4.7hi	6.0e-h	63.3a-e

(continued)

Table 2. The evaluation of fine fescue cultivars during the 1985 growing season (continued).[1]

Cultivar	Quality[2] 5/08	Quality[2] 6/23	% Crabgrass[3] 7/29	Cultivar	Quality[2] 5/08	Quality[2] 6/23	% Crabgrass[3] 7/29
Waldina	4.7hi	5.3g-j	56.7b-g	Ivalo	4.0ij	4.3jk	71.7a-d
Epsom	4.7hi	6.3d-g	51.7c-i	Wintergreen	2.7j	4.0k	80.0a-c
Ceres	4.7hi	5.0h-k	71.7a-d				
Highlight	4.0ij	4.7i-k	61.7a-e				
Tatjana	4.0ij	4.7i-k	88.3a				
$LSD_{0.05}$	1.4	1.1	28.8		1.4	1.1	28.8

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

[3]Percent crabgrass refers to the percent of the plot area covered by crabgrass plants.

ZOYSIAGRASS CUTTING MANAGEMENT

H.L. Portz and V.R. Patterozzi

INTRODUCTION

'Korean Common' zoysiagrass, a coarse-textured, vigorous seeded cultivar, is being utilized in southern Illinois on golf course fairways and lawns. Most management practices for zoysiagrass, however, are based upon the dense, slow-growing 'Meyer' cultivar. A cutting height of 1/2 inch and around 2 lbs of N/1000 sq. ft. are recommended for this medium-textured, thatch-prone cultivar. It has been observed at SIU-Carbondale that when Korean Common was cut at 1/2 inch, the density and cover were not sufficient to perch a golf ball and considerable weed encroachment occurred. As reported in the 1984 Illinois Turfgrass Research Report, a 3/4 inch height with 3 to 5 lbs N/1000 sq. ft. gave a very good ball surface.

MATERIALS AND METHODS

The Korean Common zoysiagrass was seeded in 1981 and cutting and fertility treatments were begun in 1984. There are three mowing heights; 3/4, 1 1/4 and 2 1/4 inches with 1, 3 and 5 lbs of N/1000 sq. ft. applied per season. Nitrogen carriers are urea and ureaformaldehyde UF and applications are at 1/2 lb for the lowest and medium rate and 1 lb at the highest rate applied monthly. There was no irrigation in 1986.

RESULTS

Results in 1986 were somewhat similar to those in 1984 and 1985 with a 3/4 inch cutting height and from 3 to 5 lbs of N/1000 sq. ft. giving a very good ball surface (Table 1 and 2). Lawn cutting heights of 1 1/4 and 2 1/4 inches provided very acceptable turf density and color except for early May when the previous year's dead top growth masked the new growth. Again, more weeds were noted in the lower N plots especially in the 3/4 inch plots. Response to nitrogen from Urea was somewhat better than from the slow-release carrier, UF at the 3 lb rate. However, there was a more uniform color throughout the season with UF at both the 3 and 5 lb rates.

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

Nitrogen Carrier	Rate lb/ 1000 sq. ft	5/16/86 3/4 in	5/16/86 1 1/4 in	5/16/86 2 1/4 in	6/4/86 3/4 in	6/4/86 1 1/4 in	6/4/86 2 1/4 in	8/18/86 3/4 in	8/18/86 1 1/4 in	8/18/86 2 1/4 in
Control	0	4.0[1]	5.3	5.5	5.0	6.0	7.0	6.0	7.0	9.0
Urea	1	6.0	6.7	6.5	5.7	6.3	7.0	6.7	7.7	8.0
Urea	3	6.7	7.0	7.0	7.3	7.7	7.0	8.7	8.7	8.5
Urea	4	8.0	7.7	7.0	7.7	8.0	8.0	9.0	9.0	9.0
UF	1	5.0	5.7	6.0	5.3	7.0	6.5	6.3	7.7	7.5
UF	3	6.3	6.7	6.5	6.7	7.3	6.5	6.7	8.0	8.0
UF	4	8.0	8.0	6.5	8.0	7.7	8.0	7.7	8.0	9.0

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

Table 2. Green color of Korean Common zoysiagrass under three cutting heights and three nitrogen rates.

Nitrogen Carrier	Rate lb/ 1000 Sq. ft	5/16/86 3/4	5/16/86 1 1/4	5/16/86 2 1/4	6/4/86 3/4	6/4/86 1 1/4	6/4/86 2 1/4	8/18/86 3/4	8/18/86 1 1/4	8/18/86 2 1/4
Control	0	4.0	5.0	4.5	5.0	6.0	5.6	5.0	5.3	6.0
Urea	1	5.3	6.7	5.5	6.0	6.7	6.5	6.7	6.7	7.0
Urea	3	6.3	7.0	6.0	6.7	7.0	6.5	8.0	7.7	8.0
Urea	5	8.0	8.0	8.0	8.0	8.0	8.5	9.0	9.0	9.0
UF	1	4.3	5.7	5.0	6.7	6.3	5.5	6.0	6.7	6.5
UF	3	5.0	5.7	5.5	6.7	6.3	6.0	6.3	7.0	6.5
UF	4	6.0	6.3	6.5	7.0	6.7	7.5	7.3	7.3	7.5

[1]Color evaluations are made on a 1-9 scale where 9 = excellent green color and 1 = very poor green color

DETERMINATION OF APPROPRIATE ZOYSIAGRASS MANAGEMENT REGIMES

J. C. Fech and T. W. Fermanian

INTRODUCTION

Zoysiagrass (Zoysia japonica Willd) is sometimes chosen as a low to medium maintenance turfgrass in central Illinois. However, efficient management regimes for central Illinois have not been adequately determined for this species. Components of typical management regimes include fertility level and mowing height. Research is necessary to determine appropriate combinations of these factors.

MATERIALS AND METHODS

The study was initiated on 23 April 1986 on a 3 year old stand of `Meyer' zoysiagrass. Treatments were designed to evaluate fertilizer rate and mowing height. Fertilizer treatments were split in half; the first half applied at 100% greenup and the second at the midpoint of the zoysiagrass growing season. No preemergence or postemergence herbicides were a part of the routine maintenance schedule.

Weekly quality ratings were taken to access differences among treatments. Initial and season-end thatch measurements were to be taken as well. Each plot is 5 x 5 feet and each treatment is repeated eight times in a split plot design.

RESULTS

The quality of zoysiagrass was significantly lower at the 1.0" mowing height than the 1.5" (Table 1). This pattern was evident throughout the growing season. As the rate of nitrogen was increased from 1-2 lb N, quality increased (Table 2). This tendency continued well into the growing season, tapering off at season's end. At this point, both levels of nitrogen produced the same effect, while nonfertilized plots remained significantly lower in quality.

Thatch levels were not found to be significantly different under the various levels of treatment. However, because of several significant interactions between mowing height and nitrogen level, additional analyses will be necessary to make appropriate management recommendations for zoysiagrass in central Illinois.

Table 1. Effect of mowing height on quality of zoysiagrass in 1986.[1]

Height of Cut	Quality[2]			
	6/18	7/16	8/20	9/17
1.0 inch	5.7b	5.4b	5.4b	5.5b
1.5 inches	7.2a	7.2a	7.4a	6.5a
$LSD_{0.05}$	0.4	0.3	0.2	0.4

Table 2. Effect of nitrogen rate on quality on zoysiagrass in 1986.[1]

Rate	Qualtiy[2]			
lb N/1000 sq ft	6/18	7/16	8/20	9/17
0	5.8c	5.8c	5.8c	5.5b
1	6.6b	6.3b	6.4b	6.1a
2	7.0a	6.8a	7.0a	6.5a
$LSD_{0.05}$	0.2	0.2	0.2	0.4

[1]All values represent the mean of 8 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 WITH COVERS

H. L. Portz and V. R. Patterozzi

INTRODUCTION

Establishment of zoysiagrass (Zoysia japonica) using NaOH- scarified seed has been practiced in Korea since 1975 and in the United States starting in 1980. Normally, one must wait until warm weather in late May or June for seeding and then dry weather may require extensive irrigation. Early research has shown that clear polyethylene and other covers will allow much earlier seeding dates, and no irrigation is needed until the covers are removed. This was the third year for testing covers at Southern Illinois University at Carbondale (SIUC), which included the fairways at Jackson Country Club. This early research and the extensive seeding on the golf course fairways with polyethylene covers was reported in the 1985 Illinois Turfgrass Research Report. The purpose of the 1986 experiment was to compare several different covers and removal times, monitor temperature and moisture and test different herbicides for early weed control.

MATERIALS AND METHODS

A 2800 sq ft plot area at SIUC's Horticulture Research Center (HRC) was treated twice with glyphosate to kill existing tall fescue and Kentucky bluegrass in early spring, 1986. One half the area was disked, the other half was not tilled but was lightly verticut to remove dead grass. The total area was fertilized with 2 lb P_2O_5/1000 sq ft. On 24 April, scarified 'Korean Common' zoysiagrass seed was dropseeded at 2 lb/1000 sq ft and verticut to assure good seed/soil contact. Plots were treated with siduron (Tupersan) at 6 lb ai/A. On 25 April, sheets of 4 mil clear polyethylene and spunbonded polyester (Remay) were laid over respective plots and secured with rods and staples. Small nail holes one foot apart were punched into the clear polyethylene on one half the polyethylene-covered plots. There were three replications of each treatment including a check (uncovered) for both the killed sod and fully prepared areas. On 30 April, a 40 pt Multiplex recorder was set up to monitor temperatures and eight tensiometers were installed. One half of each cover was removed on 9 May (2 weeks after seeding) and the remaining one half was removed on 30 May, 5 weeks after seeding. An additional experiment was conducted in the greenhouse to check different pre- and postemergence herbicides. Seedling establishment ratings and final percent stand were taken.

RESULTS

Results showed a distinct advantage for the clear polyethylene covers over the spunbonded polyester and the uncovered check (Table 1). There also was better establishment and final percent stand for the fully prepared seedbed vs the killed sod only (Table 1). Monitoring by tensiometers indicated better moisture for initial germination and seedling growth under the clear polyethylene covers through 7 May. After a 4 inch rain on 14 May and with frequent irrigation, moisture levels on all plots remained adequate (Table 2). The temperature modification with covers is noted in Table 3 and 4. There were higher soil surface temperatures with the clear polyethylene, without and with holes, as compared to the spunbonded polyester and uncovered bare soil. A maximum temperature of 53 C (127.4 F) in 8 May was recorded on one of the plots but this did not appear to damage seedlings. Also, leaving covers on for 5 weeks was not detrimental (Table 1) and the best final stand of 90% was obtained. Initial application of siduron followed by oxadiazon, trifluralin + benefin and pendimenthalin in 5-6 weeks after seeding gave good crabgrass control.

Table 1. Percent stand on 27 November of Korean Common zoysiagrass under various covers; seeded 24 April 1986 at the Horticulture Research Center, SIUC.

Cover	Killed Sod		Fully Prepared Sod	
	2 wks	5 wks	2 wks	5 wks
Clear polyethylene	21.7	55.0	40.0	90.0
Clear polyethylene w/holes	21.7	60.0	40.0	90.0
Spunbonded polyester	15.0	15.0	11.7	16.7
No cover	5.0	6.7	5.0	5.0

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

Cover	Under Covers			Covers Removed	
	5/02	5/07	5/12	5/14[1]	5/20
Clear polyethylene	0[2]	9.5	10.5	0	1.5
Clear polyethylene w/holes	6.0	7.0	16.0	0	0
Spunbonded polyester	7.0	11.5	13.5	0	3.5
No cover	12.5	18.0	18.5	0	7.5

[1]Four inches of rain and subsequent irrigation.

[2]Centibar readings; lowest represents wet conditions; higher indicates increasing dryness.

Table 3. Celsius temperatures at soil surface to 0.5 cm depth under various covers and air above at 0600 and 1300 hrs on selected days.

Cover	1 May		4 May		8 May	
	0600	1300	0600	1300	0600	1300
Clear polyethylene	20.3*	41.7	15.7	41.8	24.5	49.3
Clear polyethylene w/ holes	21.0	40.3	16.0	41.3	24.3	49.8
Spunbonded polyester	19.2	34.8	13.2	36.0	21.2	42.3
No cover	16.7	29.0	7.8	29.8	18.3	43.0
+5 cm	17.0	22.0	8.0	21.0	18.0	29.0
+150 cm	18.0	24.0	4.0	23.0	19.0	33.0

Table 4. Celsius temperature at surface and 0.5 cm depth under various covers and air at 0600and 1300 hrs and after removal of one half of each cover.

Cover	13 May		22 May		29 May	
	0600	1300	0600	1300	0600	1300
Clear polyethylene	21.2* (19.0)**	41.7 (33.0)	20.0 (14.5)	40.8 (30.5)	22.5 (19.0)	31.3 (32.5)
Clear polyethylene w/ holes	22.8 (18.0)	44.2 (31.0)	21.7 (13.0)	45.2 (26.0)	22.8 (18.0)	32.2 (29.0)
Spunbonded polyester	20.8 (18.0)	36.2 (31.5)	17.5 (13.5)	32.2 (28.0)	21.0 (18.0)	30.3 (29.0)
No cover	18.7	32.3	13.3	29.5	18.5	30.7
+5 cm	16.0	27.0	13.0	22.0	17.0	23.0
+150 cm	18.0	30.0	13.0	24.0	17.0	26.0

*Temperatures are given in Degrees Celsius.

**Temperatures in ( ) represent temperatures on one half of each plot where covers were removed 9 May.

DETERMINATION OF APPROPRIATE BUFFALOGRASS MANAGEMENT REGIMES

J. C. Fech and T. W. Fermanian

INTRODUCTION

Buffalograss, [Buchloe dactlyoides (Nutt.) Engelm.] is a low growing, sod forming, warm season grass which is native to the North American Great Plains. For many years, buffalograss has been used to pasture livestock and for soil conservation purposes. A growing interest is currently developing to use buffalograss as a turf. As a warm season species, it possesses physiological adaptations which facilitate efficient water use. Other positive considerations include a very low annual nitrogen requirement and a minimal mowing requirement.

Preemergence herbicides are an effective tool for the maintenance of turfgrasses. Information on preemergence herbicide effects on buffalograss is limited in scientific literature. In addition, optimal fertility levels and mowing frequencies under Illinois conditions have not been established. Research is necessary to determine an appropriate maintenance regime for buffalograss in Illinois.

MATERIALS AND METHODS

The study was initiated 25 April 1986 on a 2 year old stand of 'Sharps Improved' buffalograss. Treatments in the study were designed to evaluate fertilizer rate, herbicide rate, and mowing frequency. On the basis of research performed at the University of Nebraska-Lincoln, simazine was selected as the herbicide. Other studies at Colorado State University and the University of Nebraska-Lincoln indicate ranges of fertility and mowing frequency to test under Illinois conditions.

Rates of fertilizer tested included 0.5 and 1.0 lb N/1000 sq ft/yr. Herbicide rates used were 2 and 4 lbs ai/A simazine, while mowing frequency increments were unmowed, mowed once, and mowed monthly. The "mowed once" treatment was mowed 16 July 1986. The mowing height was 2" for the latter two mowing treatments.

Weekly quality ratings were taken to assess differences among treatments. In addition, percent crabgrass cover was estimated twice during the study. Each plot measured 4 x 6 feet and each treatment is repeated three times in a split plot design.

RESULTS

No significant differences were found among treatment levels when quality was analyzed, but certain trends were evident. Initially, the 4 lb rate of simazine /1.0 lb rate of nitrogen produced the highest ranking, while the 2 lb rate of simazine and 0.5 lb rate of nitrogen the lowest. As the season progressed, the 2 lb simazine/1.0 lb nitrogen and 4 lb simazine/0.5 lb nitrogen rates ranked higher than the other two treatments.

The percent of crabgrass present was significantly higher when unmowed and monthly mowed, than when mowed once (Table 1). This was evident on 13 August, but not on 17 September. This would indicate that the effect of mowing on crabgrass percentage wore off as the season progressed.

Crabgrass cover was significantly lower under the 4.0 lb simazine/0.5 lb nitrogen and the 2.0 lb simazine/1.0 lb nitrogen regimes than the 2 lb simazine/0.5 lb nitrogen regime. This result suggests that higher levels of simazine and lower levels of nitrogen favor buffalograss vigor over crabgrass encroachment.

These results are preliminary, and must be replicated over several years to make recommendations on specific management regimes for buffalograss in Illinois.

Table 1. The estimated percent crabgrass cover in buffalograss turf under various mowing regimes in 1986.[1]

Mowing Frequency	Percent Crabgrass Cover[2] 8/13	9/17
Unmowed	21.3a	22.0a
Mowed Once	6.7b	7.1a
Mowed Monthly	22.5a	24.2a
$LSD_{0.05}$	13.2	24.3

Table 2. The estimated percent crabgrass cover in buffalograss turf under various simazine and nitrogen levels regimes in 1986.[1]

Herbicide/Nitrogen Regime lb ai/A	lb/1000 sq ft	Percent Crabgrass Cover[2] 8/13	9/17
2 lbs simazine,	0.5 lb N	25.0a	26.7a
2 lbs simazine,	1.0 lb N	15.0bc	19.4ab
4 lbs simazine,	0.5 lb N	9.4c	10.6b
4 lbs simazine,	1.0 lb N	17.8ab	15.6ab
$LSD_{0.05}$		8.1	11.7

[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 crabgrass cover refers to the percent of the plot area covered by crabgrass plants. These were visual estimations.

PREEMERGENCE CONTROL OF CRABGRASS

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

INTRODUCTION

Preemergence herbicides for control of crabgrass have been available to turfgrass managers for many years. Periodically, new herbicides and new turf formulations of field crop herbicides are developed that need to be evaluated for crabgrass control and compared to the existing materials. The purpose of this research was to evaluate the new herbicides Team, Regal Star, EL 161, Pennant and Prime+ and new formulations of Balan and Ronstar for crabgrass control.

MATERIALS AND METHODS

The herbicides evaluated in this research were Dacthal (DCPA, SDS Biotech), Betasan (bensulide, Stauffer), Balan (benefin, Elanco), Team (benefin + trifluralin, Elanco), EL 161 (ethalfluralin, Elanco), Pre M (pendimethalin, LESCO), Ronstar (oxadiazon, Rhone Poulenc), Prime+ (Ciba Geigy), Pennant (metolachlor, Ciba Geigy), and Regal Star (oxadiazon + benefin, Regal Chemical Co.). Treatments were applied with a small plot sprayer in a volume of 40 gallons of water per acre. The percent crabgrass control in the plots when compared with the untreated check was rated twice following the application of the sprays (Table 1). The turf was Kentucky bluegrass; plot size was 3 x 10 feet with 3 replications of each treatment. The plots were mowed at 0.5 inch in height and irrigated frequently to insure excellent crabgrass germination.

RESULTS

Please keep in mind when interpreting the results that there was tremendous crabgrass pressure on our test area as evidenced by the large percentage of crabgrass (90 to 100 percent) in the untreated check plots The frequent irrigation was also ideal for the breakdown of the herbicides. This is evident by the lower level of crabgrass control found in 1986 from some of the standard herbicides than had been found in previous years.

On 2 July good crabgrass control was seen with all of the available industry standards and with most of the new herbicides and formulations with the exception of the dry flowable and dispersable powder formulations (Table 1). Balan 60DF, Team 28DF and EL 161 50DF provided less crabgrass control than the granular formulations. This trend could be observed on the 21 July rating date. Significant phytotoxicity was observed with Pennant 5G at the rate of 4 lb ai/A. Although not significant, phytotoxicity was observed with some of the other products that would indicate further evaluation.

Table 1. The evaluation of herbicides for preemergence control of crabgrass in a Kentucky bluegrass turf applied 11 April 1986.[1]

Material	Rate lb ai/A	% Crabgrass Control[2] 7/02	 7/21	Phytotoxicity[3] 5/09
Dacthal 75WP	10.5	90.5a-d	65.0f-i	9.0a
Betasan 4E	7.5	97.8a-c	88.3a-c	9.0a
Balan 2.5G	2.0	79.2d-f	60.0g-j	9.0a
Balan 2.5G	2 + 2*	100.0a	91.7ab	9.0a
Balan 60DF	2.0	65.0gh	31.7lm	9.0a
Balan 60DF	3.0	78.1d-g	50.0jk	9.0a
Team 2G	2.0	92.6a-c	71.7e-h	8.3a
Team 2G	3.0	97.2a-c	78.3b-f	8.3a
Team 28DF	2.0	64.9h	30.0lm	8.3a
Team 28DF	3.0	78.5d-f	36.7kl	9.0a
Ronstar 2G	3.0	99.6a	95.0a	8.3a
Ronstar 50WP	1.0	89.2a-d	76.7c-f	9.0a
Ronstar 50WP	1.5	99.0ab	86.7a-d	9.0a
Ronstar 50WP	2.0	100.0a	90.7ab	8.3a
Regal Star	3.5 lb cf/1000 sq ft	93.5a-c	83.3a-e	9.0a
Regal Star	4.5 lb cf/1000 sq ft	98.2ab	91.7ab	8.0a
Pre M 60WDG	1.5	86.2b-e	51.7i-j	8.7a
Pre M 60WDG	3.0	90.9a-d	73.3d-g	9.0a
EL 161 50DF	1.0	42.1i	18.3m	9.0a
EL 161 50DF	1.5	67.7f-h	30.0lm	9.0a
EL 161 50DF	2.0	79.1d-f	58.3h-j	8.3a
Pennant 5G	2.0	74.1e-h	33.3l	8.3a
Pennant 5G	4.0	84.8c-e	50.0jk	6.0b
Prime+ 1.2E	1.2	93.3a-c	83.3a-e	8.3a
check	---			9.0a
$LSD_{0.05}$		13.1	13.5	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]Percent crabgrass control represents percent control of the crabgrass plant in the plot when compared with the untreated check.

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

*The second application of Balan was made on 23 May 1986.

POSTEMERGENCE CONTROL OF CRABGRASS

D. J. Wehner and J. E. Haley

INTRODUCTION

Crabgrass (Digitaria sp.) is one of the most frequently occuring weeds in turf stands. It can be controlled by application of either preemergence or postemergence herbicides. The advantage of postemergence treatment is that herbicide use is reduced since applications are made only where the weed occurs. Preemergence herbicides are often applied on areas that do not have a crabgrass problem. A dense turf stand mowed at the proper height will discourage the invasion of crabgrass which reduces or eliminates the need for a preemergence application. The problem with postemergence treatment is that the primary herbicides used in this manner are organic arsenicals (DSMA, AMA, MSMA) which usually require retreatment and can be phytotoxic to the turfgrass stand. The purpose of this research was to evaluate new herbicides compared to a standard treatment with MSMA for postemergence control of crabgrass.

MATERIALS AND METHODS

The herbicides Curfew (tridiphane, Dow Chemical Co.) and Starane (fluroxypyr,Dow Chemical Co.); Acclaim (fenoxaprop, Hoechst Roussel Agri-Vet Co.); CGA 52463 (undisclosed, Ciba-Geigy); Daconate 6 (MSMA, Fermenta Plant Protection); EH 795 and EH 845 (mixtures of MSMA + 2,4-D + MCPP + dicamba, PBI Gordon's); and a combination of Curfew + Trimec and Curfew + Starane were applied at the rates and spray volumes indicated in Table 1 on 25 June 1986 to crabgrass in the 3 leaf to 1 tiller stage. Daconate 6 and EH 795 and EH 845 treatments were reapplied on 3 July 1986 and selected tridiphane treatments were reapplied on 18 July 1986. All treatments were applied with a small plot sprayer that delivered either 40 or 172 gallons of water per acre. Plots were 3 x 10 feet and there were three replications. The turfgrass stand was perennial ryegrass. The percent control of crabgrass in the plot was evaluated two times after application of the treatments. Irrigation was provided as needed to insure good germination and establishment of crabgrass.

RESULTS

The results of this study are presented in table 1. The treatments were applied to crabgrass in the 3 leaf to 1 tiller stage. The ratings taken on 10 July (data represents percent control of the crabgrass plants as compared to the check) indicate that most of the treatments provided good crabgrass contro. The best crabgrass control was found in plots that had been treated with Acclaim, EH 795, EH 845, Daconate 6, two applications of Curfew, and Curfew plus Trimec, Starane, or Acclaim.

The percent cover of crabgrass increased in the check plot between the 10 July and 24 July rating dates. This was due to additional crabgrass germination and development of the crabgrass into larger plants. The same trends illustrated in the 10 July ratings were apparent on the 24 July rating date with the exception that the crabgrass control decreased in plots receiving the lowest rate of Acclaim and the applications of Curfew by itself.

Table 1. The evaluation of herbicides for postemergence control of crabgrass in a perennial ryegrass - Kentucky bluegrass turf treated on 25 June 1986.[1]

Material	Rate lb ai/A	Spray Volume gpa	% Crabgrass Control[2] 7/10	7/24
Daconate 6	2.0 + 2.0*	40	100.0a	100.0a
Acclaim EW	0.18	40	95.6a-c	89.2a-c
Acclaim EC	0.18	40	96.1a-c	90.7a-c
Acclaim EW	0.18	172	97.8ab	88.8bc
Acclaim EC	0.18	172	90.6a-d	80.4cd
Acclaim EW	0.35	40	100.0a	100.0a
Acclaim EC	0.35	40	98.9a	97.1ab
Acclaim EW	0.35	172	100.0a	99.4ab
Acclaim EC	0.35	172	97.8ab	93.1ab
Curfew	1.0	40	69.4fg	64.5e
Curfew	1.0	172	76.1e-g	50.6f
Curfew	1.5	40	81.1d-f	88.9bc
Curfew	1.5	172	63.9g	69.8de
Curfew	2.0	40	69.4fg	91.1a-c
Curfew	2.0	172	83.3c-e	95.1ab
Curfew	1.0 + 1.0**	40	85.0b-e	97.1ab
Curfew	1.0 + 1.0**	172	83.9c-e	97.2ab
Curfew plus Trimec	2.0 plus 4 pt cf/A	40	85.0b-e	93.8ab
Curfew plus Trimec	2.0 plus 4 pt cf/A	172	83.9c-e	97.2ab
Curfew plus Acclaim EC	2.0 plus 0.12	40	98.9a	96.9ab
Curfew plus Acclaim EC	2.0 plus 0.12	172	91.7a-d	94.6ab
Curfew plus Acclaim EC	2.0 plus 0.25	40	98.9a	99.4ab
Curfew plus Acclaim EC	2.0 plus 0.25	172	100.0a	99.4ab
Curfew plus Starane	1.0 plus 0.5	40	87.2a-e	92.3ab
Curfew plus Starane	1.0 plus 0.5	172	88.9a-e	92.3ab
EH 795	5 oz + 5 oz cf/1000*	40	100.0a	99.0ab
EH 845	5 oz + 5 oz cf/1000*	40	98.9a	99.4ab
CGA 52463	1.8	40	33.3h	13.1g
$LSD_{0.05}$			12.8	11.1

[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 crabgrass control represents percent control of the crabgrass plant in the plot when compared with the untreated check.

*Second application was made on 3 July 1986.

**Second application was made on 18 July 1986.

EVALUATION OF PRODIAMINE FOR PREEMERGENCE CONTROL OF CRABGRASS AND WINTER ANNUALS

J. E. Haley and T. W. Fermanian

INTRODUCTION

Prodiamine (Sandoz Crop Protection) is a herbicide currently being evaluated at the University of Illinois as a preemergence crabgrass and winter annuals control. Very little is known about the effect Prodiamine has on turfgrass, especially the effect over several growing seasons. A trial was established 6 November 1984 to evaluate the potential phytotoxicity of Prodiamine applied over the long term and to examine its ability to control winter annuals and crabgrass.

MATERIALS AND METHODS

This evaluation consists of treatments of Prodiamine at 0.25, 0.38, 0.50, 0.75 and 2.0 lb ai/A and Dacthal at 5.25, 10.5 and 21.0 lb ai/A. Dacthal at the 1/2, 1 and 2 times recommended label rates was included as an industry standard for preemergence weed control. Herbicides were applied to one set of plots in the fall (6 November 1984 and 3 October 1985) and to another set of plots in the spring (20 April 1985 and 18 April 1986). An untreated check is included in each fall and spring application for all replications. Materials were applied using a small plot sprayer in a spray volume of 40 gallons of water per acre to 3 x 10 feet plots of common Kentucky bluegrass.

RESULTS

In 1986 crabgrass control was excellent with all spring applications of Dacthal and Prodiamine (Table 1). Crabgrass control was also good with fall applications of Prodiamine and excellent control was achieved with rates of 0.5, 0.75 and 2.0 lb ai/A. Turfgrass injury was found on some plots treated with prodiamine, especially with the fall applied rate of 2.0 lb ai/A. Unlike the injury observed in 1985, the 1986 injury remained throughout the growing season on the turf treated in the fall with 2.0 lb ai/A.

1986 SPRING EVALUATION

In 1986 a second study was established comparing Prodiamine with several industry standards.

MATERIALS AND METHODS

All treatments were applied on 18 April 1986 (Table 2). Where appropriate, second applications were made on 28 August 1986 for control of winter annuals. Materials were applied using a small plot sprayer in a spray volume of 40 gallons of water per acre. Plot size was 3 x 10 feet.

RESULTS

On 2 July crabgrass control was excellent for all materials (Table 2). Although later in July crabgrass control had decreased in all plots, control was still excellent in all plots treated with Prodiamine, Ronstar, Pre M, and Betasan. These plots will be further evaluated for phytotoxicity and weed control.

1986 FALL APPLIED EVALUATION

On 24 October 1986 a third Prodiamine evaluation was established to further evaluate the application of Prodiamine in the fall. Treatments and rates are given in Table 3. Treatments will be evaluated for weed control and phytotoxicity.

Table 1. The evaluation of prodiamine, applied in the spring and fall, for control of crabgrass and winter annuals.[1]

Material	Rate lb ai/A	Application Time[4]	% Crabgrass Control[2] 7/02/86	% Crabgrass Control[2] 7/24/86	Phytotoxicity[3] 7/21/86
Dacthal	5.25	Spring	100.0a	86.8ab	9.0a
Dacthal	10.5	Spring	100.0a	95.0a	8.7ab
Dacthal	21.0	Spring	100.0a	93.5a	9.0a
Prodiamine	0.25	Spring	100.0a	88.9ab	9.0a
Prodiamine	0.38	Spring	100.0a	94.3a	9.0a
Prodiamine	0.5	Spring	100.0a	95.0a	8.7ab
Prodiamine	0.75	Spring	100.0a	98.7a	8.3b
Prodiamine	2.0	Spring	100.0a	100.0a	7.3c
Check	---	Spring			9.0a
Dacthal	5.25	Fall	63.5c	31.9d	9.0a
Dacthal	10.5	Fall	66.6c	24.8d	9.0a
Dacthal	21.0	Fall	77.2bc	31.3d	9.0a
Prodiamine	0.25	Fall	87.7ab	64.4c	9.0a
Prodiamine	0.38	Fall	95.2a	72.0bc	9.0a
Prodiamine	0.5	Fall	100.0a	81.2a-c	9.0a
Prodiamine	0.75	Fall	100.0a	90.6ab	8.3b
Prodiamine	2.0	Fall	100.0a	100.0a	5.7d
Check	---	Fall			9.0a
$LSD_{0.05}$			16.3	20.3	0.5

[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]Percent crabgrass control represents percent control of the crabgrass plant in the plot when compared with untreated check.

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

[4]Fall applications were made 6 November 1984, 3 October 1985 and 24 October 1986. Spring applications were made 20 April 1985 and 18 April 1986.

Table 2. The evaluation of prodiamine and other preemergence herbicides for control of crabgrass in a Kentucky bluegrass turf from applications made on 18 April 1986[1].

Herbicide	Rate[2] lb ai/A	% Crabgras Control[3] 7/02	7/21
Balan 2.5G	2.0 + 3.0*	96.2a	78.8bc
Betasan 4E	7.5	100.0a	88.0ab
Dacthal 75WP	10.5	91.5b	69.9c
Ronstar 2G	4.0	98.9a	92.5a
Pre M 60WDG	3.0	100.0a	94.1a
Prodiamine 65WDG	0.38	98.4a	88.9ab
Prodiamine 65WDG	0.50	97.2a	87.4ab
Prodiamine 65WDG	0.75	100.0a	94.1a
Prodiamine 65WDG	1.0	100.0a	95.7a
Prodiamine 65WDG	0.5 + 0.25*	100.0a	92.4a
Prodiamine 65WDG	0.5 + 0.5*	99.6a	91.7a
Prodiamine 65WDG	0.75 + 0.25*	97.2a	92.5a
Prodiamine 65WDG	1.0 + 0.25*	100.0a	90.4ab
$LSD_{0.05}$		4.1	12.1

[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]When applied, second applications are made in the fall prior to germination of winter annuals.

[3]Percent crabgrass control represents percent control of the crabgrass plant in the plot when compared with the untreated check.

*The second application was made on 28 August 1986.

Table 3. The 1986 fall applied Prodiamine evaluation.

Material	Rate lb ai/A	
Prodiamine	0.75	
Prodiamine	1.00	
Prodiamine	1.25	
Prodiamine	1.50	
Prodiamine	1.75	
Prodiamine	0.75 + 0.75	applied in the spring
Prodiamine	1.00 + 0.75	applied in the spring
Prodiamine	1.25 + 0.50	applied in the spring
Prodiamine	1.50 + 0.25	applied in the spring

EVALUATION OF ACCLAIM FOR PHYTOTOXICITY TO CREEPING BENTGRASS

D. J. Wehner and J. E. Haley

INTRODUCTION

The herbicide Acclaim (fenoxaprop, Hoechst Roussel Agri-Vet) has been shown to be an effective postemergence control of crabgrass. Information is needed to determine if there is phytotoxicity associated with the use of this herbicide on creeping bentgrass. The purpose of this study was to evaluate the phtotoxicity and weed control of Acclaim with and without a safener on creeping bentgrass.

MATERIALS AND METHODS

Acclaim, with and without safener, was applied at the rates indicated in Table 1 to a stand of Toronto creeping bentgrass on 7 July 1986 with repeat applications of selected treatments on 22 July and 4 August. The safener consisted of a combination of nitrogen and iron. The treatments were applied with a small plot sprayer that delivered 40 gallons of water per acre. Plots were observed for phytotoxicity and ratings were made several times after the application of the treatments. The percent of plot cover with crabgrass was rated on 20 August. The creeping bentgrass was mowed at 0.25 inches. Plot size was 3 x 10 feet with three replications.

RESULTS

All rates of Acclaim caused some discoloration of the turf during the course of this study as evidenced by ratings less than 9.0 (9.0 = no injury or discoloration, Table 1.). Note that ratings were made at approximately two-week intervals so that some of the treatments were not finished prior to the 28 July rating date. The discoloration lasted for different lengths of time depending on whether or not the treatments were reapplied. Ratings of less than 8.0 were considered objectionable. The use of the safener reduced the amount of discoloration due to Acclaim application. The percent crabgrass control in the treated plots was increased by applications of 0.12 lb ai/acre or more of Acclaim either as a single application or split into multiple applications. The best control of crabgrass was found where three applications of 0.04 lb ai/acre or applications of 0.12 + 0.06 lb ai/acre were made. Both of these treatments caused unacceptable phytotoxicity on the bentgrass.

Table 1. An evaluation of Acclaim applied to a creeping bentgrass putting green.[1]

Material	Rate lb ai/A	Phytotoxicity[2] 7/17	7/28	8/13	% Crabgrass[3] 8/20
Acclaim	0.06	8.7ab	8.7a	9.0a	22.2d
Acclaim	0.12	7.0d	9.0a	9.0a	65.6a-c
Acclaim	0.04 + 0.04 + 0.04	8.0bc	8.7a	6.7b	95.6a
Acclaim	0.06 + 0.06	8.3a-c	8.3a	9.0a	84.4ab
Acclaim	0.12 + 0.06	7.7cd	6.0b	9.0a	93.3a
Acclaim + safeners[4]	0.12	8.0bc	9.0a	9.0a	51.1cd
Acclaim + safeners	0.04 + 0.04 + 0.04	8.3a-c	8.7a	9.0a	76.7a-c
Acclaim + safeners	0.06 + 0.06	8.3a-c	8.7a	9.0a	61.1bc
check		9.0a	9.0a	9.0a	
$LSD0_{0.05}$		0.8	0.7	0.3	30.4

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

[3]Percent crabgrass control represents percent control of the crabgrass plant in the plot when compared with the untreated check

[4]Safeners applied are Sequestrene at the rate of 0.5 lb Fe/A and FLUF at the rate of 0.5 lb N/1000 sq ft.

EVALUATION OF HERBICIDES FOR BROADLEAF WEED CONTROL IN TURF

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

INTRODUCTION

The purpose of this research was to evaluate several herbicides for postemergence control of broadleaf plantain (Plantago major L.), buckhorn plantain (Plantago lanceolate L.) and white clover (Trifolium repens L.) in a mixed Kentucky bluegrass - tall fescue turfgrass stand.

Plantain and White Clover Control

MATERIALS AND METHODS

Herbicides were applied 13 June 1986 in 40 gallons of water per acre (Table 1). Plot size was 3 x 10 feet and each treatment was replicated 3 times. An untreated check was included within each replication. Weed control evaluations were made on a scale of 1-9, where 9 = a large, healthy weed population and 1 = no weeds present.

RESULTS

Excellent control of both plantain species was obtained with all materials at all rates with the exception of CGA 52463, EH 737and Turflon II Amine (Table 2). Excellent control of white clover was observed with all materials at all rates with the exception of CGA 52463, Weedar 64,and EH 737 Table 2).

Table 1. Herbicides evaluated for postemergence control of broadleaf and buckhorn plantain and white clover.

Herbicide	Active Ingredients	Manufacturer
Weedone DPC	2,4-D, 2,4-DP	Union Carbide
Weedone DPC Amine	2,4-D, 2,4-DP	Union Carbide
Banvel	dicamba	Velsicol
Turflon II Amine	2,4-D, triclopyr	Dow Chemical
Turflon	2,4-D, triclopyr	Dow Chemical
Starane	fluroxypyr	Dow Chemical
Weedar 64	2,4-D amine	Dow Chemical
Trimec 992	2,4-D, MCPP, dicamba	Dow Chemical
EH 680	2,4-D, MCPP, dicamba	PBI/Gordon Corporation
EH 737	2,4-D, MCPP, dicamba	PBI/Gordon Corporation
EH 791	2,4-D, MCPP, dicamba	PBI/Gordon Corporation
Riverdale ester	2,4-D, 2,4-DP, MCPP	Riverdale Chemical Company
Riverdale amine	2,4-D, 2,4-DP, MCPP	Riverdale Chemical Company
CGA 52463		Ciba Geigy

Table 2. Postemergence control of plantain and white clover 25 days following herbicide application on 13 June 1986.[1]

Herbicide	Rate pt cf/A	Weed Control[2] Plantain	White Clover
EH 680	3.0	1.0d	1.0c
EH 737	3.0	3.7b	3.7b
EH 791	3.0	1.3cd	1.0c
Weedone DPC	4.3	1.0d	1.0c
Weedone DPC plus dicamba	3.0 plus 0.1 lb ai/A	1.3cd	1.0c
Weedone DPC Amine	3.0	1.7b-d	1.7c
Weedone DPC Amine	4.0	1.3cd	1.0c
Weedone DPC Amine plus dicamba	3.0 plus 0.1 lb ai/A	1.0d	1.0c
Weedone DPC Amine plus dicamba	4.0 plus 0.125 lb ai/A	1.3cd	1.0c
Riverdale Amine	2.0	1.0d	1.0c
Riverdale Amine	3.0	1.0d	1.0c
Riverdale Ester	2.0	1.0d	1.3c
Riverdale Ester	3.0	1.0d	1.0c
Weedar 64	3.0	1.0d	4.0b
Turflon D	3.0	1.7b-d	1.0c
Turflon II Amine	3.0	3.3bc	1.0c
Starane	0.5	1.3cd	1.0c
CGA 52463	0.8	7.7a	8.7a
CGA 52463	1.0	8.3a	9.0a
check	---	9.0a	9.0a
$LSD_{0.05}$		2.1	1.8

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

BROADLEAF WEED CONTROL WITH TURFLON D AND TURFLON II

D. J. Wehner and J. E. Haley

INTRODUCTION

Turflon D and Turflon II are relatively new herbicides developed by Dow Chemical Company. Both herbicides contain 2,4-D and triclopyr; Turflon D is an ester formulation while Turflon II is an amine formulation. The purpose of this study was to determine the effect of application timing on the efficacy of these herbicides. This was done by applying the herbicides three times over the growing season to areas infested with white clover (Trifolium repens L.) and buckhorn and broadleaf plantains (Plantago lanceolata L. and Plantago major L.).

MATERIALS AND METHODS

The herbicides Turflon D, Turflon II, Starane (fluroxypyr, Dow Chemical Co.) and Trimec (PBI Gordon) were applied at the rates indicated in Table 1 on 3 June, 8 July, and 18 August 1986 to a mixed stand of Kentucky bluegrass and tall fescue located on the Agronomy South Farm at the University of Illinois. A new set of plots was used for each application date. The plots were mowed as needed to a height of 2" and did not receive supplimental irrigation. Treatments were applied with a small plot sprayer that delivered 40 gallons of spray per acre to 3 x 10 feet plots. There were three replications of each treatment and an untreated check.

Weed control ratings were given on a 1 to 9 scale with 9 = no control of the weed species and 1 = no weeds present.

RESULTS

Clover Control

Weed control ratings for the three dates of herbicide application to white clover are presented in Table 1. All herbicide treatments reduced the population of white clover compared to the check plot. The rating for the 3 June spray for Turflon II at the 3.5 pint rate should be disregarded as a mistake was made with this treatment on this date. In general, slightly better control was achieved earlier in the season and slightly better control of white clover was achieved with the ester formulation (Turflon D) than with the amine formulation (Turflon II). The rating for the check of 5.3 on the 4 September date indicated that the weeds were under drought stress and appeared wilted.

Plantain Control

Weed control ratings for the three dates of herbicide application to the plantains are presented in Table 1. Again, better control of the plantains occurred with the earlier spray date. Both formulations of triclopyr gave similar control ratings. The lower level of control found with the later spray dates was related to the fact that the weeds were under drought stress at the time of herbicide application.

Table 1. The evaluation of herbicides applied on three dates for the postemergence control of broadleaf weeds.[1]

		White Clover Control[2]			Plantain Control[2]		
		Application Date			Application Date		
	Rate	6/3	7/8	8/18	6/3	7/8	8/18
Material	pt cf/A*	35 DAT**	20 DAT	17 DAT	35 DAT	20 DAT	17 DAT
Turflon II	2.5	6.7b	4.7b	3.7b	1.7c	3.7b	3.0b
Turflon II	3.0	3.7c	4.3b	2.7bc	1.3c	2.7bc	2.7b
Turflon II	3.5	8.0ab	3.7bc	2.7bc	5.7b	2.0c	2.7b
Turflon D	3.0	3.0cd	3.7bc	2.3c	1.0c	3.3bc	2.7b
Turflon D	4.0	1.3de	2.0c	2.7bc	1.0c	3.0bc	3.0b
Trimec	3.0	2.0c-e	4.3b	3.0bc	1.0c	3.7b	3.0b
Starane	0.5 lb ai/A	1.0e	1.7c	2.7bc	5.3b	4.0b	3.7b
Check	---	9.0a	9.0a	5.3a	9.0a	9.0a	5.3a
$LSD_{0.05}$		1.7	2.2	1.1	2.9	1.5	1.2

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

*Rates are given as pints of comercial product (formulation) per acre.

**Refers to days after treatment.

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 Escort (metsulfuron methyl). 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 Escort are both resistant to degradation in the soil, the carry over of herbicide from one season to the next is of concern. This study was extended over three years to measure the long term effects of repeated applications.

A second experiment was initiated in 1986 to evaluate the phytotoxic effects of M6316 (Harmony), DPX-L5300 (Express), and DPX R9674 (Matrix), three experimental herbicides for cereal crops.

Experiment I

MATERIALS AND METHODS

The products tested were Telar at 0.19, 0.56 and 1.31 (dropped in 1986) oz ai/A and Escort at 0.24, 0.48 and 0.72 (dropped in 1986) oz ai/A. These were applied in a 0.25% v/v solution of the surfactant X77. Also included in the test was a treatment of 2,4-D (1.0 lb ai/A) plus Banvel (dicamba, at 0.25 lb ai/A) as an industry standard for broadleaf weed control. Treatments were replicated three times and an untreated check plot was included with each replication. All materials were applied 11 May 1984, 3 May 1985 and 7 May 1986 to 3 x 10 feet plots of tall fescue turf using a small plot sprayer at a spray volume of 40 gallons/A. Plots were not mowed following application until September.

RESULTS

In 1984, 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 Escort 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 2,4-D + Banvel combination but this was never significantly different than the control. All rates of Escort 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 2,4-D + Banvel combination.

In 1985 the same general trends were observed with the phytotoxicity ratings as in 1984 (Table 2). During 1985 no injury was observed with Banvel. Few seedheads appeared in any of the Telar or Escort treated plots . With most rates of Telar and Escort height was significantly lower than turf height in the untreated check plots up to 38 days following herbicide application (Table 3).

In 1986 phytotoxicity was observed in all plots treated with Telar or Escort as long as 34 days after application (Table 4). The lowest rate of Telar recovered the fastest. Turf treated with Escort exhibited the greatest phytotoxicity 50 days after appliction.

All rates of Telar and Escort significantly reduced turf height 34 days after application (Table 5). At 57 days after application no difference in height was observed among treated turf and the untreated check. All rates of Escort and Telar significantly reduced seedhead production when compared with the untreated check or the 2,4-D/dicamba treatment (Table 2).

Experiment II

MATERIALS AND METHODS

Treatments in the second experiment were Express at 0.5 and 1.0 oz ai/A, Harmony at 0.5 and 1.0 oz ai/A and Matrix at 0.25 and 0.5 oz ai/A. These materials were applied in a 0.25 % v/v solution of the surfactant X77. The herbicide 2,4-D at 1.0 lb ai/A was included as the industry standard for broadleaf weed control. Treatments were replicated 3 times and an untreated check plot was included with each replication. All materials were applied 7 May 1986 to 3 x 10 feet plots of tall fescue using a small plot sprayer at a spray volume of 40 gallons of water/A. Plots were not mowed following application until September.

RESULTS

Minor turf injury was observed up to 21 days after application with Express at both rates (Table 6). Minor turf injury was observed with both rates of Harmony at 34 days after application. No significant injury was found on tall fescue treated with 2,4-D or MATRIX.

Turf height was significantly reduced when compared to the check with all treatments except the 2,4-D treatment through 22 days after application (Table 7). By 50 days after treatment there was no difference among the treatments. All turf treated with herbicide had significantly fewer seedheads than found in the check plots (Table 4).

Table 1. The evaluation of phytotoxic effects of post emergence herbicides on tall fescue during 1984 [1].

			Phytotoxicity[2]					Percent
	Rate	All	2 WAT[3]	3 WAT	4 WAT	5 WAT	7 WAT	Seedheads
Material	oz ai/A	Dates[4]	5/24	5/31	6/06	6/13	6/29	6/05[5]
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
Escort	0.24	7.0c	9.0a	6.3b-d	5.0c	6.3b	8.3a	1.0d
Escort	0.48	5.7d	8.3b	5.7cd	4.0d	4.7c	6.0b	0.7d
Escort	0.72	4.6e	7.0c	5.0d	3.0e	3.7d	4.3c	0.0d
2,4D + dicamba	1.0 lb ai/A + 0.25 lb ai/A	8.7ab	9.0a	7.7ab	9.0a	9.0a	9.0a	100.0a
Check	---	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]Phytotoxicity evaluations are made on a 1-9 scale where 9 = no visible phytotoxic effects and 1 = complete necrosis.

[3]WAT refers to weeks after treatment.

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

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

Table 2. The evaluation of plant growth and seedhead development of tall fescue treated with postemergence herbicides during 1985.[1]

Material	Rate oz ai/A	Height[2] 25 DAT[3] 5/28	38 DAT 6/10	55 DAT 6/27	87 DAT 7/29	Percent Seedheads[4] 5/28
Telar	0.19	8.2b	9.4cd	12.0b	20.0	2.0b
Telar	0.56	7.9bc	9.7bc	11.3bc	19.4	1.0b
Telar	1.31	6.4c	7.5d	10.0c	17.0	0.3b
Escort	0.24	6.7bc	8.3cd	10.6bc	16.2	0.0b
Escort	0.48	7.6bc	9.0cd	10.6bc	19.9	0.3b
Escort	0.72	7.3bc	8.0cd	10.0c	17.8	0.0b
2,4-D + Banvel	1.0 lb ai/A + 0.25 lb ai/A	13.4a	12.1a	14.5a	21.4	25.0a
Check	--	11.8a	11.6ab	12.5b	19.0	25.0a
$LSD_{0.05}$		1.7	1.9	2.0	NS	4.2

[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 centimeters of the turfgrass plants.

[3]DAT refers to days after treatment.

[4]Percent seedheads represents the average percent of turfgrass plants in the treated plot, bearing seedheads.

Table 3. The evaluation of the phytotoxic effects of postemergence herbicides on tall fescue during 1985[1].

	Rate	Phytotoxicity[2]					
		2 WAT[3]	3 WAT	4 WAT	5 WAT	6 WAT	7 WAT
Material	oz ai/A	5/20	5/28	6/03	6/10	6/17	6/25
Telar	0.19	7.7b	7.7b	7.7b	7.0b	8.7a	8.3a
Telar	0.56	6.7bc	6.3c	5.7c	6.3b	6.3b	7.0b
Telar	1.31	6.7bc	5.3cd	4.7d	4.3d	5.3cd	6.3bc
Escort	0.24	6.0cd	6.0cd	5.7c	5.3c	5.7c	6.3bc
Escort	0.48	6.3c	5.3cd	4.7d	4.7cd	5.0d	6.3bc
Escort	0.72	5.0d	5.0d	4.0e	4.0d	5.0d	6.0c
2,4-D + dicamba	1.0 lb ai/A + 0.25 lb ai/A	9.0a	9.0a	9.0a	9.0a	9.0a	9.0a
Check	---	9.0a	9.0a	9.0a	9.0a	9.0a	9.0a
$LSD_{0.05}$		1.2	1.0	0.5	0.7	0.6	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]Phytotoxicity evaluations are made on a 1-9 scale where 9 = no visible phytotoxic effects and 1 = complete necrosis.

[3]WAT refers to weeks after treatment.

Table 4. The evaluation of the phytotoxic effects of Telar and Escort on a tall fescue turf treated on 7 May 1986.[1]

Material	Rate oz ai/A	Phytotoxicity[2] 6/4 28 DAT[3]	6/10 34 DAT	6/18 42 DAT	6/26 50 DAT
Escort	0.24	6.3b	4.7c	6.3b	6.3bc
Escort	0.48	5.0b	4.0d	5.0c	5.7c
Telar	0.19	8.7a	7.0b	9.0a	8.7a
Telar	0.56	6.3b	5.0c	6.7b	7.0b
2,4-D plus	1.0 lb ai/A				
dicamba	0.25 lb ai/A	9.0a	9.0a	9.0a	9.0a
check	---	9.0a	8.7a	9.0a	8.7a
$LSD_{0.05}$		1.8	0.5	1.0	1.2

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

[3]DAT refers to days after treatment.

Table 5. The evaluation of plant growth and seedhead development of tall fescue treated with Telar and Escort during 1986.[1]

		Height[2]				% Seedheads[3]
	Rate	5/16	5/28	6/11	7/3	6/18
Material	oz ai/A	9 DAT[4]	21 DAT	34 DAT	57 DAT	42 DAT
Escort	0.24	6.0b	6.8b	7.6d	11.5	0.7b
Escort	0.48	6.5b	6.5b	8.5cd	11.4	0.3b
Telar	0.19	5.9b	7.3b	8.9c	12.7	4.3b
Telar	0.56	6.0b	7.0b	8.4cd	12.1	1.0b
2,4-D plus dicamba	1.0 lb ai/a + 0.25 lb ai/A	7.7a	9.8a	12.5a	14.6	50.0a
check	---	7.9a	9.0a	11.1b	12.7	53.3a
$LSD_{0.05}$		0.7	1.5	1.2	NS	4.6

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

[3]Percent seedheads represents the average percentin the treated plot of turfgrass plants bearing seedheads.

[4]DAT refers to days after treatment.

Table 6. The evaluation of the phytotoxic effects of postemergence broadleaf herbicides on a tall fescue turf treated on 7 May 1986.[1]

Material	Rate oz ai/A	Phytotoxicity[2] 5/28 21 DAT[3]	6/4 28 DAT	6/10 34 DAT	6/18 43 DAT
Matrix	0.25	8.7a	9.0	9.0a	9.0
Matrix	0.50	9.0a	9.0	9.0a	9.0
Express	0.50	8.0b	8.7	9.0a	9.0
Express	1.0	7.3c	8.3	8.0c	8.7
Harmony	0.50	9.0a	9.0	8.3bc	8.7
Harmony	1.0	9.0a	9.0	8.7ab	8.7
2,4-D	1.0 lb ai/A	9.0a	9.0	9.0a	9.0
check	---	9.0a	9.0	9.0a	9.0
$LSD_{0.05}$		0.5	NS	0.5	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]Phytotoxicity evaluations are made on a 1-9 scale where 9 = no visible phytotoxic effects and 1 = complete necrosis.

[3]DAT refers to days after treatment.

Table 7. The effects of postemergence broadleaf weed control herbicides on plant height and seedhead production when applied to tall fescue during 1986.[1]

Material	Rate oz ai/A	Height[2] 5/16 9 DAT[4]	5/29 22 DAT	6/11 35 DAT	6/26 50 DAT	% Seedheads[3] 6/18 42 DAT
Matrix	0.25	7.7b	9.3bc	12.6c-e	14.8	35.0bc
Matrix	0.50	7.9b	9.9b	13.4a-c	16.2	13.3de
Express	0.50	7.2b	9.5bc	11.8de	16.6	15.0de
Express	1.0	7.0b	8.9c	11.6e	15.5	3.7e
Harmony	0.50	8.0b	9.6bc	13.2a-d	17.5	21.7cd
Harmony	1.0	7.6b	9.5bc	12.7b-e	16.0	10.0de
2,4-D	1.0 lb ai/A	9.5a	11.5a	14.6a	16.0	43.3b
check	---	9.4a	11.6a	14.1ab	16.0	58.3a
$LSD_{0.05}$		1.4	1.0	1.5	NS	14.7

[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 of the turfgrass plants in centimeters.

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

[4]DAT refers to days after treatment.

EVALUATION OF PLANT GROWTH RETARDANTS

J. E. Haley and T. W. Fermanian

INTRODUCTION

In recent years, many new chemical compounds have been evaluated for their ability to regulate turfgrass growth. The two components of growth most often affected are vegetative shoot growth and seedhead production. For many compounds the regulating effects on these two components have been inconsistent. An experiment was designed to evaluate several growth regulating compounds for their effect on a Kentucky bluegrass turf.

MATERIAL AND METHODS

Materials were applied on 1 May 1986 to a 7 month old stand of Kentucky bluegrass turf. Treatments included flurprimidol (Cutless 50WP) at 0.75, 1.0 and 1.5 lb ai/A; amidochlor (Limit 4F) at 2.5 lb ai/A; mefluidide (Embark 2S) at 0.25 and 0.38 lb ai/A and paclobutrazol (Clipper 50WP) at 0.75, 1.0 and 1.5 lb ai/A. Each treatment was replicated three times and an untreated check was included in each replication. Growth retardants were applied with a small plot sprayer at 40 gallons of water per acre. Plot size was 3 by 12 feet. Turfgrass height at growth retardant application was 4.5 cm. Following treatment application the turf was not mowed.

RESULTS

Turf quality was reduced when compared to the check with applications of Clipper, and Cutless at all rates as long as 69 days following application (Table 1). Turf quality was reduced when compared to the check with the 0.38 lb ai/A rate of Embark at 40 days after treatment. Some of the reduced quality may have been because the treatments were applied to a young turf that had not completely filled in.

All growth retardants at all rates reduced turf growth when compared with the check (Table 2). The greatest growth reduction was seen with Clipper and Cutless. Seedhead production was reduced with all plant growth retardants at all rates (Table 2). The greatest reduction was observed with Embark.

Table 1. The evaluation of Kentucky bluegrass turf quality when treated with plant growth retardants.[1]

		Phytotoxicity[2]				
	Rate	5/28	6/10	6/25	7/9	7/24
Material	lb ai/A	27 DAT*	40 DAT	55 DAT	69 DAT	84 DAT
Clipper	0.75	7.7	5.3cd	4.0c	4.3b	6.0ab
Clipper	1.0	7.3	4.7d	3.0d	3.3cd	4.7cd
Clipper	1.5	7.7	5.3cd	3.0d	3.0d	3.0e
Cutless	0.75	7.7	6.0c	4.3c	4.3b	4.7cd
Cutless	1.0	7.3	5.7c	4.0c	4.0bc	5.0bc
Cutless	1.5	7.3	4.7d	3.0d	3.0d	3.7de
Embark	0.25	7.0	8.0a	8.0b	7.3a	6.3a
Embark	0.38	6.0	7.0b	8.7ab	7.7a	6.3a
Limit	2.5	7.7	8.0a	8.3ab	7.7a	6.3a
check	---	7.0	8.7a	9.0a	7.3a	6.0ab
$LSD_{0.05}$		NS	0.8	0.9	0.8	1.2

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

*DAT refers to days after treatment.

Table 2. The evaluation of plant growth and seedhead development of Kentucky bluegrass treated with plant growth retardants.[1]

		Height[2]					Percent
	Rate	5/16	5/28	6/11	6/28	7/15	Seedheads[3]
Material	lb ai/A	15 DAT*	27 DAT	41 DAT	56 DAT	75 DAT	6/18
Clipper	0.75	5.8b	6.0b-e	6.3de	7.3c-e	8.8c-e	20.0bc
Clipper	1.0	5.6bc	5.9b-e	6.1de	6.1e	7.4ef	13.3cd
Clipper	1.5	5.6bc	5.6de	5.9e	6.5de	6.4f	11.7d
Cutless	0.75	6.0b	6.5bc	7.0cd	8.5c	9.4c	26.7b
Cutless	1.0	5.9b	6.6ab	6.7c-e	7.9cd	9.0cd	20.0bc
Cutless	1.5	5.5b-d	6.4b-d	6.5c-e	7.0c-e	7.8d-f	21.7b
Embark	0.25	5.1cd	5.7c-e	8.2b	11.3b	11.8b	1.0e
Embark	0.38	4.8d	5.2e	7.6bc	10.4b	12.5b	1.0e
Limit	2.5	5.2cd	5.9b-e	8.3b	10.9b	12.5b	10.0d
check	---	6.7a	7.3a	9.9a	13.5a	14.1a	71.7a
$LSD_{0.05}$		0.6	0.8	1.1	1.5	1.5	7.9

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

[3]Percent seedheads represents the average percent of turfgrass plants in the treated plot bearing seedheads.

*DAT refers to days after treatment.

EVALUATION OF CHELATED IRON AND NITROGEN SOURCES IN A FERTILIZATION PROGRAM

D. J. Wehner and J. E. Haley

INTRODUCTION

Iron is usually not defficient in the soils of Illinois. However, iron, when applied at a high enough rate, can enhance the color (make darker green) of turfgrass plants. The use of iron can reduce the amount of N needed to maintain acceptable color. With iron, the color remains acceptable but the growth of the plant is not as vigorous as would be found with a larger amount of nitrogen. The drawback in using iron is that the effect on the color is only temporary and can dissipate before another application can be made. Previous research at the University of Illinois has shown that fertilizing the turf with 0.5 pounds of nitrogen per 1000 square feet plus iron gave color equal to fertilizing with 1.0 pounds of nitrogen per 1000 square feet. The purpose of this research was to further evaluate the use of iron. In our previous research, the best results with iron were found where chelated iron was applied at the rate of 2.0 pounds of actual iron per acre in combination with a reduced rate of nitrogen. In the current study we are utilizing chelated iron with Formolene, Fluf, and urea in four applications through the growing season.

MATERIAL AND METHODS

Fertilizer treatments consist of nitrogen from either Formolene, Fluf, or urea with or without iron. The basic program consists of 4 applications of fertilizer providing 1 pound of actual N per 1000 square feet per application. Iron is substituted for 0.5 pounds of N per 1000 square feet in either round 1 and 2, round 2 and 3, or round 3 only (see Table 1.). Sequestrene 330 is the iron source and is applied at the rate of 2 pounds of iron per acre. The treatments were applied on 3 May, 2 July, 28 August, and 23 October 1985 and 21 May, 15 July, 28 August, and 8 October 1986 in a volume of 3.5 gallons of water per 1000 square feet. Color ratings were taken weekly throughout the season and clippings were returned to the plots.

RESULTS

1985

The results of this study for 1985 paralleled the results of our previous research with iron. That is, when the plant is growing slowly, the effect of iron is visible for 5 to 7 weeks but, when there is adequate rainfall, the effect of iron on color does not persist. During 1985, we had adequate rainfall for most of the summer. Dry weather occured at the begining of the growing season but was followed by frequent occurences of rainfall. The data indicate that the turf recieving N + iron compared favorably with the turf receiving only N during round 1 (applied 3 May) when the weather was dry but, during the later rounds, the effect of iron lasted only about 3 weeks.

1986

During 1986, the weather was dry during the late spring and early summer with adequate rainfall during mid-summer and dry weather in early fall. Fewer differences between treatments were found during 1986 (Table 1). On many rating dates, the treatments where iron was substituted for a portion of the nitrogen resulted in turf that rated equal or better (darker green) than turf where only N was used. The 1986 data would indicate that it is feasible to substitute iron for a portion of the total N on a routine basis. The exception to this observation seemed to occur with Fluf where slightly lower color ratings occurred with the use of iron in combination with N in comparison to the full rate of N.

This study will be continued for 1 more year so that we may adequately characterize the effect of these fertilization programs on turfgrass color.

Table 1. The evaluation of iron and nitrogen sources in a fertilization program.[1]

	lb N/1000 sq ft + oz Fe/1000 sq ft*				Color[2]					
Material	Rnd 1	Rnd 2	Rnd 3	Rnd 4	5/27	6/4	6/10	6/18	6/26	7/02
Formolene	1.0+0	1.0+0	1.0+0	1.0+0	7.0b-d	8.0bc	6.7e	7.3ab	7.0bc	6.7a-c
Formolene+Iron	0.5+0.7	0.5+0.7	1.0+0	1.0+0	7.7a-c	8.0bc	8.0a-c	7.3ab	6.7c	6.7a-c
Formolene+Iron	1.0+0	0.5+0.7	0.5+0.7	1.0+0	7.0b-d	7.7cd	7.3c-e	7.0bc	7.0bc	7.3a
Formolene+Iron	1.0+0	1.0+0	0.5+0.7	1.0+0	6.7cd	7.7cd	7.0de	7.0bc	7.0bc	7.3a
Fluf	1.0+0	1.0+0	1.0+0	1.0+0	6.7cd	6.7e	7.0de	7.0bc	7.0bc	7.3a
Fluf+Iron	0.5+0.7	0.5+0.7	1.0+0	1.0+0	7.3a-c	7.0de	7.7b-d	7.3ab	6.7c	6.0b-d
Fluf+Iron	1.0+0	0.5+0.7	0.5+0.7	1.0+0	6.0d	6.3e	6.7e	6.3c	5.3d	5.3d
Fluf+Iron	1.0+0	1.0+0	0.5+0.7	1.0+0	7.0b-d	6.7e	7.3c-e	6.7bc	6.3c	5.7cd
Urea	1.0+0	1.0+0	1.0+0	1.0+0	8.3a	8.7ab	8.0a-c	8.0a	7.7ab	7.3a
Urea+Iron	0.5+0.7	0.5+0.7	1.0+0	1.0+0	8.0ab	8.0bc	8.7a	7.3ab	7.0bc	6.3a-d
Urea+Iron	1.0+0	0.5+0.7	0.5+0.7	1.0+0	7.7a-c	9.0a	8.3ab	7.0bc	8.0a	6.7a-c
Urea+Iron	1.0+0	1.0+0	0.5+0.7	1.0+0	8.0ab	9.0a	8.0a-c	7.0bc	7.7ab	7.0ab
check	-	-	-	-	4.3e	4.3f	4.7f	4.3d	3.0e	3.3e
$LSD_{0.05}$					1.0	0.8	0.8	0.8	0.9	1.2

(continued)

[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.

*Round 1 treatments were applied 21 May, Round 2 treatments were applied 15 July, Round 3 treatments were applied 28 August and Round 4 treatments were applied 8 October.

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

Table 1. The evaluation of iron and nitrogen sources in a fertilization program (continued).[1]

Material	lb N/1000 sq ft + oz Fe/1000 sq ft*				Color[2]					
	Rnd 1	Rnd 2	Rnd 3	Rnd 4	7/09	7/18	7/24	7/30	8/06	8/13
Formolene	1.0+0	1.0+0	1.0+0	1.0+0	6.3ab	6.7b-d	7.0b	7.3cd	8.0ab	9.0a
Formolene+Iron	0.5+0.7	0.5+0.7	1.0+0	1.0+0	6.3ab	7.3ab	8.0a	8.0ab	8.3ab	9.0a
Formolene+Iron	1.0+0	0.5+0.7	0.5+0.7	1.0+0	6.7ab	7.3ab	8.0a	8.0ab	8.3ab	9.0a
Formolene+Iron	1.0+0	1.0+0	0.5+0.7	1.0+0	6.7ab	6.0d	7.0b	7.0de	8.0ab	9.0a
Fluf	1.0+0	1.0+0	1.0+0	1.0+0	7.3a	6.7b-d	7.0b	7.3cd	8.3ab	9.0a
Fluf+Iron	0.5+0.7	0.5+0.7	1.0+0	1.0+0	5.7b	6.7b-d	8.0a	8.0ab	8.3ab	9.0a
Fluf+Iron	1.0+0	0.5+0.7	0.5+0.7	1.0+0	5.7b	6.0d	8.3a	8.3a	8.7a	9.0a
Fluf+Iron	1.0+0	1.0+0	0.5+0.7	1.0+0	6.3ab	6.0d	7.3b	7.7bc	8.3ab	9.0a
Urea	1.0+0	1.0+0	1.0+0	1.0+0	7.3a	7.0bc	7.0b	7.0de	7.7bc	8.7a
Urea+Iron	0.5+0.7	0.5+0.7	1.0+0	1.0+0	7.3a	8.0a	8.0a	8.0ab	8.7a	9.0a
Urea+Iron	1.0+0	0.5+0.7	0.5+0.7	1.0+0	7.3a	8.0a	8.0a	8.0ab	8.0ab	9.0a
Urea+Iron	1.0+0	1.0+0	0.5+0.7	1.0+0	7.0a	6.3cd	7.0b	6.7e	7.0c	8.7a
check	-	-	-	-	4.0c	3.7e	3.3c	4.0f	5.7d	6.3b
$LSD_{0.05}$					1.0	1.0	0.5	0.6	0.7	0.5

(continued)

[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.

*Round 1 treatments were applied 21 May, Round 2 treatments were applied 15 July, Round 3 treatments were applied 28 August and Round 4 treatments were applied 8 October.

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

Table 1. The evaluation of iron and nitrogen sources in a fertilization program (continued).[1]

Material	lb N/1000 sq ft + oz Fe/1000 sq ft*				Color[2]				
	Rnd 1	Rnd 2	Rnd 3	Rnd 4	8/21	8/27	9/03	9/11	9/25
Formolene	1.0+0	1.0+0	1.0+0	1.0+0	8.3a-c	7.3ab	8.7a	9.0a	7.7a
Formolene+Iron	0.5+0.7	0.5+0.7	1.0+0	1.0+0	8.0bc	7.0bc	8.3a	8.7ab	7.3ab
Formolene+Iron	1.0+0	0.5+0.7	0.5+0.7	1.0+0	8.0bc	8.0a	8.7a	8.7ab	7.0b
Formolene+Iron	1.0+0	1.0+0	0.5+0.7	1.0+0	8.0bc	8.0a	9.0a	9.0a	7.0b
Fluf	1.0+0	1.0+0	1.0+0	1.0+0	8.0bc	7.3ab	8.7a	8.3ab	7.3ab
Fluf+Iron	0.5+0.7	0.5+0.7	1.0+0	1.0+0	7.0d	7.3ab	8.3a	8.0b	7.0b
Fluf+Iron	1.0+0	0.5+0.7	0.5+0.7	1.0+0	8.3a-c	8.0a	9.0a	9.0a	7.0b
Fluf+Iron	1.0+0	1.0+0	0.5+0.7	1.0+0	9.0a	7.7ab	9.0a	8.7ab	7.3ab
Urea	1.0+0	1.0+0	1.0+0	1.0+0	7.7cd	7.7ab	8.7a	8.7ab	7.3ab
Urea+Iron	0.5+0.7	0.5+0.7	1.0+0	1.0+0	8.0bc	7.3ab	9.0a	8.3ab	7.0b
Urea+Iron	1.0+0	0.5+0.7	0.5+0.7	1.0+0	8.3a-c	7.3ab	8.7a	8.7ab	7.0b
Urea+Iron	1.0+0	1.0+0	0.5+0.7	1.0+0	8.7ab	8.0a	8.7a	9.0a	7.0b
check	-	-	-	-	7.0d	6.3c	6.3b	6.3c	6.0c
$LSD_{0.05}$					0.8	0.7	0.8	0.9	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.

*Round 1 treatments were applied 21 May, Round 2 treatments were applied 15 July, Round 3 treatments were applied 28 August and Round 4 treatments were applied 8 October.

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

FOLIAR BURN FROM TURFGRASS FERTILIZATION

D. J. Wehner and J. E. Haley

INTRODUCTION

The lawn care industry is faced with the problem of treating a large number of lawns on a set time schedule. This results in fertilizer applications being made under varying weather conditions with the potential for fertilizer burn. Although the incidence of fertilizer burn is infrequent, when a lawn is damaged, customer disatisfaction can be a problem. The purpose of this research project is to study the incidence of fertilizer burn by understanding the nature of the fertilizer solution, the environmental conditions at the time of application, and the soil and plant water status.

MATERIALS AND METHODS

On six dates in 1986, eight fertilizer treatments were sprayed on Kentucky bluegrass turf. The treatments consisted of 0.5, 1.0, 1.5, and 2.0 lbs N/1000 sq ft from urea (46-0-0) and 0.25, 0.50, 0.75, and 1.0 lb N/1000 sq ft from ammonium nitrate (33.5-0-0). They were applied on 14 May, 17 June, 3 July, 4 August, 20 August, and 10 October using a small plot sprayer that delivered 1.5 gallons of water per 1000 sq ft. Plots were rated for burn two days after treatment application. The temperature, relative humidity, soil moisture, and plant water potential were recorded at the time of fertilizer application.

RESULTS AND DISCUSSION

This experiment was the first in a series of experiments planned to better understand foliar burn from turfgrass fertilization. As expected, as the amount of applied N increased, the severity of the fertilzer burn increased. In addition, the ammonium nitrate applications burned the turf more than the applications of urea. Preliminary conclusions from this study (data not shown) are that the severity of burn is most closely linked to the temperature. However, it also appears the relative humidity plays a role in determining if a solution will burn the turf. On hot days, when the humidity is low, there may be less injury than expected because the fertilizer droplet dries quickly. Once the droplet has dried, contact is lost with the leaf surface and there is less chance of burn. Also, it appears that salt index is not necessarily the best indicator for the burn potential of a fertilizer solution. The potential for a fertilizer to burn depends on both the concentration of the solution and other solution properties.

GRASSER: AN EXPERT SYSTEM FOR DESIGNING A TURF

Haibo Liu , T. W. Fermanian and J. Kelly

INTRODUCTION

GRASSER is a computer expert system to advise on developing a plan for turfgrass establishment. It presently contains 46 rules on the use of Kentucky bluegrass cultivars. Most of these rules are based on the cultivars past performance as reported in the national Kentucky bluegrass cultivar evaluation trials. A portion of the rules were inductivly learned from the cultivar evaluation data by utilizing the AQ algorithm (Michalski and Chilausky, 1980).

The establishment of turf is a complicated practice and expert advice is not available for every turf established. Computer agssistance is sesigned to be a substitute for true expert advice. GRASSER is a computer program that uses turf expert knowledge to attain a high level of performance on giving advice on turf establishment. Since it is a computer program GRASSER can include different experts options.

A field study was designed to evaluate the quality of turf establishment from plans using three different pathways for advice: 1) GRASSER recommendations; 2) a turfgrass expert's recommendation and 3) non-expert recommendation (survey of hardware stores and garden centers). The field experiment was designed to test each plan under two kinds of soil conditions.

MATERIAL AND METHODS

DEVELOPMENT OF GRASSER

Rules were designed to be used with AgAssistant, an expert system development tool (Fermanian et. al, 1985). All of the computer work was done on an IBM PC/AT.

The first set of the rules was built on paper after interviewing Dr. T. W. Fermanian on his approach to turf establishment . The rules were further refined by using a machine learning module in AgAssistant. Two different levels of rules were developed. The first set of rules concerned the establishment timing, soil texture, soil pH, soil fertility and mowing height suggestions in turfgrass establishment. The second set of rules was concerned with the selection of Kentucky bluegrass cultivars for various growing environments.

FIELD EVALUATION

In order to evaluate the performance of GRASSER, two field experiments were designed.

Each experiment consisted of a RCB arrangement of 6 x 10 feet plots for each establishment technique. There are six treatments for each experiment with three replications.

The evaluation of turf quality was based on a 1 to 9 scale. The percent of the plot covered with turf and the density of seedlings was also measured.

Two soil types were used. This was done to evaluate the range of soil conditions under which GRASSER performance was acceptable.

RESULTS

The field experiments were established on 24 September 1986. Initial data from the field experiments was collected last fall. Insufficient data was obtained for an accurate analysis. Additional data will be collected in 1987 and summarized in the 1987 research summary. Presently both AgAssistant and GRASSER are under further development. Further versions of GRASSER will have a expanded range of advice. Right now only preliminary results have been collected, but the following experiments will been evaluated for several years.

ACKNOWLEDGEMENTS

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Pithomyces chartarum: A MYCOTOXIN-PRODUCING FUNGUS ISOLATED FROM Poa pratensis SWARDS

H. T. Wilkinson

Pithomyces chartarum was isolated from bluegrass sod (Poa pratensis) in Illinois, Indiana and Wisconsin during July-August 1986. This is the first report of P. chartarum in the North Central United States and the first report of the fungus in bluegrass sod. The fungus appears to be a saprophyte on senescent bluegrass leaves.

In July-August, 1985-86 masses of dark spores were found during the mowing of Poa pratensis L. on several sod farms in Illinois, Indiana and Wisconsin. Operators and mowing equipment, as a result, were coated with large numbers of spores. The spore masses resembled smut spore (Ustilago and Entyloma spp.), also observable following the mowing of sod. However, leaf smuts are most prevalent in the North Central U.S.A. during the spring and autumn. In addition, the examined plants lacked leaf smut symptoms. The purpose of this research was to isolate and identify the spore forming fungus in bluegrass and to describe its ecological significance in bluegrass swards.

ASSOCIATION OF *Trechispora alnicola* WITH YELLOW RING DISEASE OF *Poa pratensis*

H. T. Wilkinson

Trechispora alnicola was associated with *Poa pratensis* roots and in the thatch layer of bluegrass sod. These plants had yellowed leaves. On thatch and culture medium, *T. alnicola* produced hyaline mycelium typical of *T. alnicola*. Conidia produced on thatch or on culture medium germinated by the production of a single germ tube. On thatch and in culture, basidia were arranged in an effused manner and produced echinulate basidiospores. On thatch and in culture *T. alnicola* produce a crystalline material. This is the first report of *T. alnicola* associated with a member of the Graminae.

YELLOW RING ON Poa pratensis CAUSED BY Trechispora alnicola

H. T. Wilkinson

Trechispora alnicola (Bourd. & Glaz) Liberta was identified as the causal agent of yellow ring disease of Poa pratensis. Mycelium and conidia were effective forms of inoculum when placed adjacent to the grass crowns or roots or drenched into sod. Kentucky bluegrass seedlings developed yellowed leaves, typical of yellow ring disease, 6-8 weeks after inoculation. Inoculated sod required 16 weeks to develop yellowed leaves. Disease severity was greatest at 20 and 25 C and no disease symptoms were observed at 30 C. The fungus was isolated from surface sterilized roots and crown tissues of naturally infected field sod. Bluegrass susceptibility was not affected by maturation: both 3-week-old and 2-year-old sod were susceptible. The fungus was capable of saprophytic colonization of naturally produced thatch. The fungus was readily recovered from inoculated grass roots after surface sterilization, but not crown tissue. In culture, the fungus grow most rapidly on thatch agar medium at 20-25 C and was capable of growth at 15 and 32 C.

RESISTANCE AND CONTROL OF YELLOW RING IN KENTUCKY BLUEGRASS SWARDS

H. T. Wilkinson

Trechispora alnicola (Bourd. & Galz) Liberta is the causal agent of yellow ring on Poa pratensis. In bluegrass swards, the fungus was incapable of infecting sod previously colonized by a different isolate of the same pathogen. In culture, isolates from the same diseased sod or from different swards, did not grow or produce conidia following the intersection of the two thalli. Transplantation of diseased sod or the inoculation of unifected field sod with plugs of diseased sod did not result in the development of yellow rings after three years. Twenty-one P. pratensis cultivars were susceptible to infection by T. alnicola, but ten of the cultivars appeared to be resistant to infection. In addition, 50 of 89 bluegrass selections and experimental crosses also displayed greater levels of resistance. Bluegrass mixtures consisting of 2 to 5 cultivars were infected by T. alnicola and developed severe yellow ring in the field. Agrostis palustris, Festuca rubra and Lolium perenne were not susceptible to infection by T. alnicola. The turf fungicide, Terraclor, prevented the effective dissemination of T. alnicola and limited the severity of yellow ring in sod, but did not eliminate disease symptoms. The fungicide Banner 1.1E reduced both the occurrence of new infections and disease severity, but was less effective than Terrachlor.

WEATHER DATA FOR URBANA STATION

DATE	TEMPERATURE		SOIL TEMPERATURE GRASS		SOIL TEMPERATURE SOIL		PRECIPITATION	RELATIVE HUMIDITY		DEW
	MAX	MIN	MAX	MIN	MAX	MIN	(INCHES)	MAX	MIN	
01MAR86	31	11	30	30	33	32	0	100	60	
02MAR86	40	31	35	32	34	31	0	100	40	
03MAR86	40	32	30	30	33	32	0	100	66	
04MAR86	39	33	32	30	34	32	0	100	65	
05MAR86	39	27	29	29	33	32	0	100	66	
06MAR86	48	27	29	29	33	32	0.05	100	68	
07MAR86	39	14	32	30	39	34	0.01	100	46	
08MAR86	25	19	33	32	33	32	0	100	45	
09MAR86	39	30	33	31	34	30	0	100	45	
10MAR86	68	50	38	30	43	32	0	96	44	
11MAR86	64	34	41	36	42	38	0.2	100	74	
12MAR86	47	34	39	37	44	37	0	100	76	
13MAR86	52	42	38	38	42	40	0.02	100	80	
14MAR86	64	33	44	38	51	41	0.2	100	59	
15MAR86	52	36	42	40	50	39	0	100	50	
16MAR86	42	35	41	38	42	39	0	74	.	
17MAR86	42	36	41	38	42	39	0	95	60	
18MAR86	54	41	43	37	49	38	0.03	94	56	
19MAR86	62	38	44	41	46	42	0.2	100	50	
20MAR86	42	17	44	35	45	35	0.01	94	64	
21MAR86	27	16	36	33	37	33	0	100	46	
22MAR86	39	25	37	33	39	33	0	94	32	
23MAR86	60	34	39	33	39	33	0	90	24	
24MAR86	63	30	42	37	48	39	0	100	20	
25MAR86	60	36	42	37	51	39	0	100	32	
26MAR86	74	50	45	40	55	43	0.15	100	20	
27MAR86	65	29	43	39	52	41	0	100	30	
28MAR86	54	41	48	41	56	42	0	86	32	
29MAR86	74	53	48	44	57	45	0	64	20	
30MAR86	82	58	55	48	65	52	0	75	30	
31MAR86	80	52	54	47	65	55	0	94	34	
TOTAL							0.87			
AVERAGE	51.8	33.7	39.6	35.9	44.1	37.5		95.4	47.8	

ACCUMULATIVE TOTAL 3.55

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
01APR86	84	55	55	50	60	52	0	90	30	
02APR86	66	36	52	47	59	49	0.18	100	62	HEAVY
03APR86	63	43	52	47	61	49	0.18	100	38	
04APR86	77	49	52	48	60	51	0	100	38	
05APR86	76	55	52	48	60	51	0.1	100	50	
06APR86	78	53	53	49	60	51	0	100	50	
07APR86	74	39	55	50	57	50	0	100	50	
08APR86	82	46	53	50	64	53	0.01	70	24	
09APR86	61	37	55	51	60	45	0	100	40	
10APR86	58	33	52	46	59	48	0	94	20	LIGHT
11APR86	63	34	52	46	59	48	0	80	20	
12APR86	69	39	58	50	64	44	0	95	50	
13APR86	70	40	57	50	62	49	0.01	100	45	
14APR86	70	49	54	50	65	55	0.03	100	30	
15APR86	60	31	51	45	55	45	0.25	100	50	
16APR86	42	34	46	43	45	43	0.03	100	60	
17APR86	48	36	45	43	46	43	0.01	100	64	
18APR86	62	43	50	43	58	44	0	100	48	
19APR86	70	48	57	47	65	48	0	92	34	
20APR86	69	49	53	50	61	54	0.11	100	28	
21APR86	56	43	50	48	55	50	0.08	100	64	
22APR86	50	29	49	43	51	41	0.02	100	48	MODERATE
23APR86	52	31	50	43	56	43	0	74	20	
24APR86	63	42	52	44	60	43	0	100	20	
25APR86	80	52	54	47	64	50	0	100	0	
26APR86	89	60	68	57	75	59	0	90	35	
27APR86	87	58	72	60	78	61	0	90	40	
28APR86	88	54	64	56	70	58	0.05	95	40	
29APR86	60	43	59	54	60	53	0.15	100	48	
30APR86	78	52	63	59	69	55	0.2	97	33	
TOTAL							1.41			
AVERAGE	68.2	43.8	54.5	48.8	60.6	49.5		95.6	39.3	

ACCUMULATIVE TOTAL 4.96

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
01MAY86	68	54	58	56	64	58	1.5	100	55	
02MAY86	66	44	60	53	64	52	0	92	32	NO DEW
03MAY86	58	38	56	51	62	51	0	100	26	LIGHT
04MAY86	69	42	60	52	70	53	0	84	36	NO DEW
05MAY86	75	51	58	54	70	59	0	68	25	
07MAY86	84	62	64	60	74	64	0.3	100	46	
08MAY86	83	54	69	61	75	61	0	100	54	
09MAY86	82	55	69	61	78	61	0	92	44	
10MAY86	77	51	67	60	78	63	0	100	38	
11MAY86	82	62	67	61	78	64	0	90	28	
12MAY86	72	61	64	61	68	66	0.02	100	68	
13MAY86	80	55	69	62	78	65	0	64	52	
14MAY86	82	56	66	61	76	64	0.1	100	46	
15MAY86	78	62	62	.	78	62	5	100	26	
16MAY86	74	57	64	61	68	63	0.34	100	60	
17MAY86	79	67	68	61	73	63	0.02	100	68	
18MAY86	81	49	68	62	74	62	0.27	100	50	
19MAY86	60	50	67	60	70	58	0.4	95	65	
20MAY86	59	40	59	54	59	50	0	100	58	
21MAY86	62	42	60	54	65	50	0	100	38	
22MAY86	64	44	61	55	72	53	0	100	42	
23MAY86	73	49	64	55	71	55	0	100	26	
24MAY86	75	53	65	57	75	58	0	100	36	
25MAY86	80	53	66	61	76	67	0	90	34	
26MAY86	74	60	68	64	74	63	0.1	100	55	
27MAY86	66	63	63	62	68	65	0.03	100	98	
28MAY86	76	62	.	.	73	65	0	.	.	
29MAY86	78	63	66	63	72	63	1.32	100	48	
30MAY86	78	63	70	61	75	66	0	100	54	
31MAY86	82	62	72	65	78	66	0	100	44	
TOTAL							9.4			
AVERAGE	73.9	54.1	64.5	58.9	71.9	60.3		95.7	46.6	
ACCUMULATIVE TOTAL							14.36			

WEATHER DATA FOR URBANA STATION

	TEMPERATURE		SOIL TEMPERATURE GRASS		SOIL TEMPERATURE SOIL		PRECIPITATION	RELATIVE HUMIDITY		DEW
DATE	MAX	MIN	MAX	MIN	MAX	MIN	(INCHES)	MAX	MIN	
01JUN86	86	68	74	65	80	66	0	100	50	
02JUN86	88	53	73	65	82	68	0	100	36	
03JUN86	71	48	70	62	78	65	0	82	32	
04JUN86	79	58	72	63	78	64	0	94	32	
05JUN86	86	62	71	66	79	68	0.04	100	50	
06JUN86	80	66	70	67	73	69	0.95	100	56	
07JUN86	82	69	76	64	75	68	0.56	100	66	
08JUN86	82	67	78	71	74	70	0.06	100	56	
09JUN86	86	63	76	70	80	68	0	90	46	
10JUN86	78	67	70	69	72	67	0.25	100	76	
11JUN86	86	71	70	69	72	67	0.25	100	66	
12JUN86	85	60	72	68	80	69	0.05	100	46	
13JUN86	66	52	69	63	70	63	0	100	78	
14JUN86	84	58	74	72	81	63	0	100	50	
15JUN86	83	65	72	69	80	71	0.17	100	56	
16JUN86	85	69	72	70	80	71	0	100	57	
17JUN86	88	58	75	69	81	70	0	100	38	
18JUN86	77	53	73	62	85	70	0	86	38	
19JUN86	81	62	73	66	83	69	0	100	54	
20JUN86	90	63	79	73	87	69	0	95	40	
21JUN86	95	68	77	71	85	72	0	100	32	
22JUN86	94	71	79	74	90	79	0	100	38	
23JUN86	90	60	80	75	85	75	0	95	60	
24JUN86	82	58	79	73	81	68	0	93	38	
25JUN86	77	46	77	67	84	69	0	94	48	
26JUN86	79	57	78	68	84	69	0	92	28	
27JUN86	90	69	76	69	84	71	0	100	46	
28JUN86	93	70	80	70	88	76	1.21	100	46	
29JUN86	87	69	79	75	83	76	0	100	56	HEAVY
30JUN86	83	60	80	75	83	76	0.4	100	47	
TOTAL							3.94			
AVERAGE	83.8	62	74.8	68.7	80.6	69.5		97.4	48.7	
ACCUMULATIVE TOTAL							18.3			

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
01JUL86	80	62	75	72	79	71	0.24	100	84	
02JUL86	74	62	72	70	73	69	0.76	100	100	
03JUL86	76	60	73	70	76	67	0	100	56	
04JUL86	79	61	75	70	85	67	0	100	40	
05JUL86	85	67	78	71	87	74	0	100	58	LIGHT
06JUL86	89	70	83	75	90	78	0	100	60	
07JUL86	90	65	85	75	90	75	0.04	100	55	
08JUL86	92	72	81	76	92	77	0	100	50	
09JUL86	91	71	81	76	92	80	0.04	100	46	
10JUL86	84	69	79	74	86	78	1.2	100	70	
11JUL86	86	70	78	73	84	75	1.14	100	74	
12JUL86	82	68	78	73	82	74	0.56	100	76	
13JUL86	83	63	78	74	82	73	0.1	100	70	
14JUL86	85	66	77	74	82	74	1.03	100	56	
15JUL86	85	69	81	77	83	74	0.1	98	68	
16JUL86	89	74	78	74	82	74	0	100	56	
17JUL86	92	68	81	77	91	87	0	100	54	
18JUL86	94	73	88	82	93	80	0	94	54	
19JUL86	93	76	82	78	92	80	0	100	46	
20JUL86	93	72	80	77	92	83	0	100	56	
21JUL86	86	64	85	74	90	78	0	100	50	
22JUL86	87	62	86	75	90	73	0	95	45	
23JUL86	87	67	78	74	88	74	0	100	44	
24JUL86	90	65	78	74	90	77	0	100	46	
25JUL86	89	72	78	74	89	78	0.06	100	56	
26JUL86	92	68	80	75	91	79	0	100	56	
27JUL86	86	66	79	75	90	80	0	100	54	
28JUL86	88	69	80	75	92	80	0.11	100	50	
29JUL86	90	68	80	75	94	80	0	100	52	
30JUL86	87	61	80	75	93	79	0	100	46	
31JUL86	87	60	85	80	88	76	0.92	100	65	
TOTAL							6.3			
AVERAGE	86.8	67.1	79.7	74.6	87.4	76.3		99.6	57.8	

ACCUMULATIVE TOTAL 24.6

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
01AUG86	84	57	78	72	86	75	0	98	80	
02AUG86	84	64	75	72	78	72	0	100	42	
03AUG86	80	53	82	70	86	70	0	100	40	
04AUG86	78	57	73	69	85	71	0	100	40	
05AUG86	82	62	82	69	86	68	0	100	45	
06AUG86	83	65	75	70	87	73	0.04	100	46	
07AUG86	77	61	72	70	78	71	0.12	100	76	
08AUG86	79	63	77	73	79	69	0	95	65	
09AUG86	86	59	77	74	86	71	0	100	45	
10AUG86	85	65	83	77	88	66	0.25	100	55	
11AUG86	82	59	73	69	79	67	0	100	54	
12AUG86	77	54	73	69	79	66	0	100	42	
13AUG86	78	56	75	67	87	65	0	100	34	
14AUG86	78	56	70	67	81	67	0	100	40	
15AUG86	87	64	70	67	81	67	0	100	40	
16AUG86	80	66	71	70	77	72	0.05	100	70	
17AUG86	83	60	74	70	82	73	0	100	64	MODERATE
18AUG86	88	65	74	71	87	75	0	100	36	
19AUG86	85	60	74	69	86	72	0	100	48	
20AUG86	84	58	80	75	83	71	0	97	48	
21AUG86	86	61	71	69	82	66	0	100	28	
22AUG86	85	60	72	69	84	68	0	100	38	
23AUG86	87	67	75	69	84	71	0	100	50	
24AUG86	81	52	73	68	82	69	0.02	10		MODERATE
25AUG86	80	58	73	68	82	69	0	95	40	
26AUG86	88	62	78	70	84	68	0.05	96	43	
27AUG86	88	60	76	72	82	67	0.4	100	38	
28AUG86	80	43	71	63	72	58	0	100	46	
29AUG86	67	44	65	60	74	58	0	100	28	
30AUG86	79	41	72	64	79	56	0	97	25	
31AUG86	82	45	73	64	80	62	0	94	26	
TOTAL							0.93			
AVERAGE	82	58	74.4	69.2	82.1	68.2		99.1	45.7	

ACCUMULATIVE TOTAL 25.53

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
01SEP86	81	54	72	64	82	65	0	100	24	
02SEP86	81	63	69	65	79	69	0	100	40	
03SEP86	83	62	72	66	80	70	0	95	55	
04SEP86	83	64	72	69	74	70	0.03	100	52	
05SEP86	86	58	74	69	78	70	0	82	36	
06SEP86	82	52	73	68	77	70	0	100	24	
07SEP86	73	41	71	66	74	64	0	97	47	
08SEP86	68	35	68	64	70	60	0	95	30	
09SEP86	74	44	70	63	73	64	0	100	32	
10SEP86	80	58	68	63	71	65	0	100	32	
11SEP86	88	66	72	65	75	65	0.25	100	60	
12SEP86	78	56	70	67	72	65	0.54	100	86	
13SEP86	74	45	68	63	68	60	0	100	48	
14SEP86	81	52	70	65	74	62	0	100	34	MODERATE
15SEP86	84	58	70	66	76	64	0	100	34	
16SEP86	83	52	70	66	76	67	0	100	36	
17SEP86	71	47	68	63	74	64	0	100	38	
18SEP86	78	54	66	64	69	65	0.53	100	52	
19SEP86	73	59	69	67	70	66	0.04	100	86	
20SEP86	73	64	68	67	68	66	2.26	100	100	
21SEP86	79	64	71	68	72	67	0.62	100	68	
22SEP86	91	65	73	69	77	67	0	100	46	
23SEP86	88	64	75	70	73	71	0.7	100	54	
24SEP86	73	64	73	71	72	70	0.31	100	100	
25SEP86	83	68	72	71	72	69	0.11	100	76	
26SEP86	88	70	73	71	74	69	0	100	66	
27SEP86	87	63	72	.	73	69	0.7	100	60	
28SEP86	85	64	73	72	75	70	0	100	66	MODERATE
29SEP86	90	72	74	73	75	71	0	100	46	
30SEP86	87	64	74	72	73	71	1.26	100	64	
TOTAL							7.35			
AVERAGE	80.8	58.1	71	67.1	73.9	66.8		99	53.1	

ACCUMULATIVE TOTAL 32.88

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
01OCT86	74	64	73	71	72	70	0.86	100	90	
02OCT86	74	61	72	71	71	69	0.02	100	90	HEAVY
03OCT86	74	71	.	.	71	.	0.23	.	.	
04OCT86	74	66	71	68	72	67	0.5	98	90	
05OCT86	73	46	72	69	73	67	0	98	60	
06OCT86	68	42	71	65	72	60	0	95	40	
07OCT86	60	36	65	60	63	53	0	96	36	
08OCT86	69	43	65	60	63	53	0	95	35	
09OCT86	76	52	65	62	67	58	0.1	96	46	
10OCT86	61	41	63	58	63	53	0	100	58	LIGHT
11OCT86	66	45	61	57	63	53	0	100	52	LIGHT
12OCT86	73	53	62	60	65	55	0.15	100	50	
13OCT86	57	44	63	59	63	57	0.08	100	88	LIGHT
14OCT86	46	33	60	57	55	49	0.08	100	92	HEAVY
15OCT86	50	31	58	55	56	53	0	100	46	
16OCT86	59	35	55	53	54	45	0	100	36	LIGHT
17OCT86	62	38	57	52	53	45	0	100	45	MODERATE
18OCT86	57	37	51	47	58	47	0	100	50	LIGHT
19OCT86	60	35	53	49	59	45	0	95	40	
20OCT86	68	45	57	53	61	50	0	100	32	LIGHT
21OCT86	72	46	58	55	63	53	0	100	50	LIGHT
22OCT86	75	46	60	57	66	54	0	100	42	NO DEW
23OCT86	72	50	59	57	62	56	0.01	100	62	
24OCT86	62	55	59	58	60	58	0.23	100	84	
25OCT86	58	53	58	57	59	58	0.8	100	100	
26OCT86	58	51	59	58	58	57	0.34	100	100	
27OCT86	54	48	59	58	58	54	0.19	100	100	
28OCT86	60	42	59	55	56	47	0.02	100	68	
29OCT86	67	49	57	55	56	49	0.01	100	56	
30OCT86	60	41	57	55	56	49	0	100	70	
31OCT86	60	38	56	54	57	48	0	100	50	
TOTAL							3.62			
AVERAGE	64.5	46.4	61.2	58.2	62.1	54.4		99.1	61.9	
ACCUMULATIVE TOTAL							36.5			