1992 Illinois Turfgrass Research Report

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This report was compiled and edited by Jean E. Haley, Senior Research Specialist, Department of Horticulture, University of Illinois.

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FOREWORD

The *1992 Illinois Turfgrass Research Report* presents the results of turfgrass research investigations conducted in Illinois during 1992. Contributors include scientists from the Departments of Horticulture at the University of Illinois and the Department of Crop and Soil Sciences at Southern Illinois University.

The 1992 growing season in East Central Illinois was excellent for growing turfgrass. Temperatures were below average and rainfall above average (Appendix C). Please keep in mind the weather conditions when evaluating research submitted in this report.

We hope the information presented here will aid turfgrass managers throughout Illinois when making management decisions. Nevertheless, information about products and procedures contained in this report are not intended as turfgrass management recommendations. All uses of pesticides must be registered by appropriate State and Federal agencies before they can be recommended. In addition, commercial companies are mentioned in this publication solely for the purpose of providing specific information. No endorsement of products is implied or intended.

Jean Haley, Editor

David Wehner, Associate Editor

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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 the 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 at the top of the column as a footnote marker then no significant difference was found among the means in this group of data.

TURFGRASS CULTIVAR RESEARCH AT THE UNIVERSITY OF ILLINOIS, URBANA, IL

Many years of research are needed to evaluate a turfgrass cultivar before it is placed on the market. For instance a cultivar that thrives in the Pacific northwest might die during a hot and dry midwest summer. With this in mind, studies were established to evaluate the performance of Kentucky bluegrass, perennial ryegrass, tall fescue, creeping bentgrass, buffalograss, and zoysiagrass cultivars under environmental conditions found in central Illinois.

NTEP (National Turfgrass Evaluation Program) Kentucky Bluegrass Cultivar Trial

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

Research Protocol:	**Kentucky Bluegrass Cultivar Evaluation**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Site Preparation:	existing vegetation killed with Roundup; area worked with Ryan dethatcher; fertilized at 1 lb N/M.
Seeding/ Establishment:	seeding date - September 17, 1990; seeding rate - 2 lbs seed/M; plot size - 5 ft x 6 ft; irrigation - to insure germination.
Plot Maintenance:	mowing height - 1.5 inches; irrigation - to prevent wilt;
1991	pesticides - postemergence broadleaf weed herbicide; fertilization - 1 lb N/M/yr;
1992	pesticides - postemergence broadleaf weed herbicide; fertilization - 3 b N/M/yr.
Experimental Design:	RCB; 3 replications.

Kentucky bluegrass (*Poa pratensis*) is the most widely used turfgrass in Illinois. Its medium to medium fine leaf texture, cold and drought tolerance, ability to form a dense sod, and ability to adapt to a wide range of cultural programs make it suitable for home lawns, parks, athletic fields, golf courses or any area where a medium to high quality turf is desired. The many cultivars of Kentucky bluegrass differ considerably in quality, color, texture, stress tolerance, and resistance to pests. The purpose of this evaluation is to evaluate the response of 126 Kentucky bluegrass cultivars to the environment found in central Illinois. This cultivar trial is part of a national program (NTEP) conducted at several sites nationwide.

The cultivars were established in the fall of 1990 and were allowed to mature during 1991. The turf was first evaluated for quality and disease performance in 1992. This information is listed in Table 1.

Most Kentucky bluegrass cultivar quality ratings for April were poor to fair. Turf quality improved in May and June and remained fair to good through July. August quality declined and turfgrass quality ratings were poor to fair for most cultivars. Poor performance was primarily the result of dollar spot (*Lanzia* spp. and *Moellerodiscus* spp.) infection in late summer. Turf quality improved following fertilization in September and remained good for the rest of the growing season. Cultivars that exhibited good to excellent dollar spot resistance were 'Livingston', 'Washington', 'Cultivar 1757', 'SR 2000', 'Princeton 104', and 'Eagleton'.

Table 1. The evaluation of Kentucky bluegrass cultivars during the 1992 growing season.[1]

Cultivar	Quality[2] 4/08	5/13	6/18	7/15	8/25	10/02	10/29	Dollar Spot[3] 8/24
A-34	4.7f-i	7.7j-l	7.0g-j	5.3a-e	4.0c-g	6.7f-i	6.3h-k	5.0d-i
Abbey	3.3b-e	5.3c-g	6.0d-g	6.0c-g	4.0c-g	4.7a-e	4.0a-e	5.7f-k
Able 1	3.0a-d	5.7d-h	6.3e-h	7.7h	4.3d-h	6.0d-i	5.7f-j	5.7f-k
Alpine	2.7a-c	5.3c-g	8.0j	7.3gh	4.0c-g	6.0d-i	6.0g-k	4.3b-g
Ampellia	3.3b-e	6.3f-j	6.3e-h	6.3d-h	4.0c-g	5.7c-h	6.3h-k	4.7c-h
Aspen	4.7f-i	5.7d-h	6.3e-h	5.7b-f	5.0f-i	5.7c-h	6.0g-k	5.7f-k
Ba 69-82	5.3h-j	7.7j-l	7.3h-j	7.3gh	4.3d-h	6.7f-i	6.7i-k	4.7c-h
Ba 70-131	4.0d-g	7.3i-l	7.0g-j	6.7e-h	4.0c-g	6.3e-i	6.7i-k	4.3b-g
Ba 73-366	3.0a-d	5.3c-g	6.7f-i	6.3d-h	4.0c-g	4.7a-e	3.7a-d	5.7f-k
Ba 73-381	3.3b-e	5.3c-g	6.3e-h	6.3d-h	5.0f-i	5.7c-h	4.0a-e	5.7f-k
Ba 73-382	3.0a-d	4.3a-d	5.7c-f	6.0c-g	4.0c-g	4.7a-e	3.7a-d	6.0g-l
Allure (Ba 73-540)	4.3e-h	8.0kl	7.3h-j	6.7e-h	4.0c-g	6.0d-i	6.0g-k	4.3b-g
Ba 74-114	3.3b-e	5.0b-f	5.0a-d	4.7a-c	3.7b-f	4.3a-d	4.3b-f	6.3h-l
Ba 76-305	3.7c-f	5.3c-g	5.7c-f	5.7b-f	4.3d-h	5.3b-g	5.0d-h	5.3e-j
Ba 77-279	3.3b-e	5.0b-f	5.7c-f	6.3d-h	4.0c-g	4.7a-e	5.3e-i	5.3e-j
Ba 77-292	4.0d-g	5.0b-f	5.7c-f	5.7b-f	4.0c-g	3.7ab	3.7a-d	4.3b-g
Ba 77-700	3.0a-d	5.0b-f	5.7c-f	6.0c-g	4.3d-h	5.0b-f	4.3b-f	6.0g-l
Ba 78-258	3.7c-f	6.0e-i	6.3e-h	7.0f-h	4.7e-i	5.3b-g	5.7f-j	6.0g-l
Banff	6.7kl	7.3i-l	5.7c-f	4.7a-c	4.3d-h	5.0b-f	5.3e-i	5.3e-j
BAR VB 1169	4.7f-i	8.3l	6.3e-h	6.0c-g	2.3ab	4.0a-c	4.3b-f	2.3a
BAR VB 1184	3.3b-e	5.7d-h	6.3e-h	5.3a-e	4.0c-g	5.7c-h	6.7i-k	4.3b-g
BAR VB 7037	4.0d-g	6.0e-i	6.0d-g	6.0c-g	3.7b-f	4.3a-d	4.3b-f	4.0a-f
BAR VB 895	5.7i-k	7.3i-l	6.0d-g	5.0a-d	4.0c-g	4.0a-c	5.0d-h	5.0d-i
Barblue	4.7f-i	7.7j-l	6.3e-h	4.3ab	4.0c-g	4.0a-c	4.7c-g	5.3e-j
Barmax	4.0d-g	8.0kl	7.0g-j	5.3a-e	4.0c-g	7.7i	6.7i-k	4.3b-g
Baron	3.3b-e	5.7d-h	6.7f-i	6.3d-h	4.0c-g	6.3e-i	4.7c-g	5.0d-i
Barsweet	3.0a-d	6.3f-j	7.7ij	4.3ab	2.7a-c	4.0a-c	4.3b-f	2.7ab
Bartitia	3.0a-d	6.7g-k	8.0j	6.7e-h	3.7b-f	4.7a-e	5.3e-i	4.0a-f
Barzan	2.3ab	4.0a-c	7.0g-j	6.7e-h	4.7e-i	4.3a-d	5.3e-i	5.3e-j
Blacksburg	3.3b-e	5.0b-f	7.3h-j	7.0f-h	4.7e-i	5.3b-g	4.7c-g	6.0g-l
Broadway	3.0a-d	6.3f-j	7.7ij	6.7e-h	4.0c-g	5.7c-h	5.7f-j	4.7c-h
Cardiff	4.0d-g	5.7d-h	6.3e-h	5.7b-f	3.7b-f	5.7c-h	5.7f-j	4.3b-g

(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 Protected 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]Dollar spot evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

Table 1. The evaluation of Kentucky bluegrass cultivars during the 1992 growing season.[1] (continued)

Cultivar	Quality[2] 4/08	5/13	6/18	7/15	8/25	10/02	10/29	Dollar Spot[3] 8/24
Challenger	4.3e-h	6.0e-i	6.3e-h	5.3a-e	4.0c-g	4.3a-d	4.7c-g	4.3b-g
Chelsea	2.0a	4.0a-c	5.0a-d	5.7b-f	3.3a-e	4.7a-e	3.3a-c	3.7a-e
Classic	7.0l	7.7j-l	7.3h-j	6.0c-g	4.7e-i	5.0b-f	5.7f-j	5.7f-k
Cobalt	4.0d-g	5.0b-f	5.3b-e	5.0a-d	4.7e-i	4.7a-e	5.3e-i	6.0g-l
Conni	3.0a-d	6.0e-i	7.7ij	6.0c-g	4.0c-g	6.7f-i	6.3h-k	4.3b-g
Coventry	5.0g-j	8.3l	7.0g-j	6.0c-g	3.3a-e	5.7c-h	6.3h-k	3.7a-e
Crest	3.3b-e	4.0a-c	4.7a-c	5.0a-d	4.0c-g	5.0b-f	4.0a-e	5.0d-i
Cultivar 1757	4.0d-g	6.3f-j	5.3b-e	5.3a-e	4.7e-i	5.3b-g	5.3e-i	6.7i-l
Cultivar 602	3.7c-f	6.3f-j	6.7f-i	5.7b-f	5.3g-j	5.7c-h	4.7c-g	5.3e-j
Cultivar 798	3.3b-e	5.7d-h	6.3e-h	5.3a-e	4.0c-g	4.3a-d	4.7c-g	5.7f-k
Cynthia	3.7c-f	5.0b-f	6.3e-h	4.3ab	3.3a-e	6.0d-i	6.0g-k	2.7ab
Dawn	5.3h-j	7.3i-l	6.0d-g	5.3a-e	4.3d-h	4.7a-e	5.0d-h	4.7c-h
Destiny	3.3b-e	5.7d-h	5.7c-f	5.3a-e	3.3a-e	4.7a-e	3.7a-d	5.0d-i
Donna	3.0a-d	5.0b-f	6.3e-h	4.7a-c	3.7b-f	5.3b-g	4.3b-f	3.3a-d
Eagleton	5.0g-j	6.3f-j	7.0g-j	6.7e-h	6.0ij	7.3hi	7.0jk	7.7l
Eclipse	3.7c-f	6.0e-i	7.3h-j	6.7e-h	5.0f-i	6.7f-i	5.7f-j	5.7f-k
Estate	5.3h-j	7.7j-l	7.0g-j	6.0c-g	3.7b-f	6.0d-i	5.7f-j	4.3b-g
EVB 13.703	4.7f-i	6.7g-k	6.3e-h	5.7b-f	3.7b-f	4.7a-e	5.3e-i	4.0a-f
EVB 13.863	3.0a-d	6.3f-j	5.7c-f	5.7b-f	3.3a-e	5.7c-h	4.7c-g	4.0a-f
Fortuna	3.0a-d	4.3a-d	5.7c-f	6.0c-g	4.3d-h	5.3b-g	4.7c-g	5.0d-i
Freedom	6.0j-l	7.7j-l	5.7c-f	5.3a-e	4.0c-g	4.7a-e	4.7c-g	4.7c-h
Gemar	5.0g-j	6.0e-i	4.7a-c	5.3a-e	3.3a-e	4.7a-e	4.3b-f	4.0a-f
Georgetown	5.3h-j	7.3i-l	5.7c-f	4.7a-c	3.7b-f	4.7a-e	5.0d-h	4.3b-g
Ginger	4.0d-g	4.0a-c	4.0a	4.0a	2.3ab	3.0a	2.7a	3.3a-d
Glade	4.0d-g	6.3f-j	7.0g-j	7.3gh	5.0f-i	5.0b-f	6.0g-k	6.0g-l
Gnome	3.3b-e	5.7d-h	5.7c-f	5.7b-f	3.7b-f	4.7a-e	4.0a-e	4.7c-h
Greenley	5.0g-j	4.7b-e	5.3b-e	4.7a-c	3.3a-e	4.0a-c	4.3b-f	4.3b-g
Shamrock (H86-712)	4.0d-g	6.7g-k	7.3h-j	6.3d-h	4.3d-h	5.3b-g	6.3h-k	5.3e-j
Haga	6.0j-l	7.3i-l	6.3e-h	5.0a-d	3.7b-f	5.0b-f	5.0d-h	3.7a-e
HV 125	3.0a-d	4.7b-e	5.0a-d	4.3ab	3.3a-e	4.0a-c	3.7a-d	4.0a-f
Indigo	3.0a-d	6.3f-j	6.3e-h	5.7b-f	4.3d-h	4.7a-e	5.0d-h	6.3h-l
J-229	4.3e-h	6.7g-k	6.3e-h	6.3d-h	4.0c-g	6.0d-i	5.7f-j	4.7c-h

(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 Protected 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] Dollar spot evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

Table 1. The evaluation of Kentucky bluegrass cultivars during the 1992 growing season.[1] (continued)

Cultivar	Quality[2] 4/08	5/13	6/18	7/15	8/25	10/02	10/29	Dollar Spot[3] 8/24
J-333	3.3b-e	7.3i-l	7.0g-j	6.0c-g	4.0c-g	5.0b-f	4.3b-f	4.3b-g
J-335	4.3e-h	7.3i-l	6.7f-i	6.7e-h	4.0c-g	5.3b-g	5.0d-h	4.3b-g
J-386	4.0d-g	6.0e-i	6.0d-g	6.0c-g	5.0f-i	7.0g-i	5.7f-j	4.7c-h
J11-94	5.7i-k	7.0h-l	6.7f-i	6.0c-g	4.0c-g	5.3b-g	5.7f-j	5.3e-j
J13-152	5.3h-j	7.3i-l	5.7c-f	4.7a-c	3.7b-f	6.0d-i	6.0g-k	4.3b-g
J34-99	5.3h-j	7.3i-l	6.7f-i	5.0a-d	4.7e-i	5.3b-g	5.7f-j	5.7f-k
Julia	4.7f-i	8.0kl	6.7f-i	6.0c-g	2.3ab	5.3b-g	6.0g-k	2.3a
Kelly	3.0a-d	5.3c-g	6.3e-h	6.7e-h	4.7e-i	5.0b-f	4.0a-e	5.0d-i
Kenblue	5.3h-j	4.7b-d	5.0a-d	6.0c-g	3.7b-f	4.7a-e	4.3b-f	4.0a-f
KWS Pp 13-2	2.0a	3.0a	4.7a-c	4.7a-c	3.7b-f	4.3a-d	4.7c-g	4.3b-g
Liberty	4.0d-g	6.3f-j	6.0d-g	5.7b-f	4.3d-h	5.7c-h	5.0d-h	5.0d-i
Limousine	4.0d-g	6.7g-k	7.7ij	6.7e-h	3.3a-e	4.3a-d	5.7f-j	3.0a-c
Livingston	3.7c-f	6.0e-i	6.3e-h	6.0c-g	5.0f-i	6.0d-i	5.3e-i	6.7i-l
Marquis	3.0a-d	4.3a-d	5.7c-f	5.7b-f	4.0c-g	5.0b-f	4.0a-e	5.0d-i
Melba	3.7c-f	6.7g-k	7.0g-j	5.3a-e	2.7a-c	4.7a-e	5.7f-j	2.3a
Merion	2.3ab	4.0a-c	5.0a-d	4.3ab	3.0a-d	4.7a-e	3.0ab	3.7a-e
Merit	3.0a-d	6.0e-i	5.7c-f	5.0a-d	4.0c-g	5.7c-h	4.3b-f	5.3e-j
Midnight	3.0a-d	5.0b-f	6.3e-h	5.7b-f	5.3g-j	4.7a-e	5.0d-h	6.0g-l
Minstrel	3.7c-f	6.0e-i	5.7c-f	5.3a-e	3.3a-e	4.0a-c	3.7a-d	3.0a-c
Miracle	3.3b-e	6.0e-i	6.3e-h	5.0a-d	3.7b-f	5.0b-f	4.3b-f	4.0a-f
Miranda	2.0a	5.3c-g	6.0d-g	7.0f-h	5.7h-j	6.0d-i	5.3e-i	6.3h-l
Monopoly	4.3e-h	7.3i-l	7.3h-j	6.7e-h	4.7e-i	6.0d-i	6.0g-k	5.0d-i
Nassau	3.7c-f	4.0a-c	5.0a-d	4.7a-c	3.7b-f	4.3a-d	4.3b-f	6.3h-l
NE 80-47	4.3e-h	6.7g-k	6.0d-g	5.3a-e	3.3a-e	5.3b-g	5.3e-i	4.0a-f
Noblesse	3.3b-e	5.0b-f	5.7c-f	4.3ab	3.7b-f	5.3b-g	5.3e-i	5.0d-i
NuStar	2.7a-c	5.7d-h	6.7f-i	6.0c-g	4.7e-i	6.0d-i	5.0d-h	5.0d-i
Opal	2.7a-c	5.3c-g	6.0d-g	5.0a-d	3.0a-d	4.0a-c	3.7a-d	3.0a-c
Platini	3.7c-f	8.0kl	7.0g-j	6.0c-g	3.0a-d	4.0a-c	4.7c-g	3.0a-c
PR-1	3.0a-d	6.0e-i	7.0g-j	6.0c-g	4.3d-h	6.0d-i	5.3e-i	5.7f-k
Princeton 104	4.0d-g	6.3f-j	7.3h-j	7.0f-h	6.7j	7.0g-i	7.3k	7.3kl
PST-0514	3.0a-d	6.0e-i	7.0g-j	6.7e-h	4.0c-g	5.3b-g	5.7f-j	4.3b-g

(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 Protected 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]Dollar spot evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

Table 1. The evaluation of Kentucky bluegrass cultivars during the 1992 growing season.[1] (continued)

Cultivar	Quality[2] 4/08	5/13	6/18	7/15	8/25	10/02	10/29	Dollar Spot[3] 8/24
PST-1DW	3.0a-d	5.3c-g	6.7f-i	7.3gh	4.0c-g	3.0a	4.7c-g	5.0d-i
PST-A7-1877	4.3e-h	6.7g-k	6.7f-i	6.7e-h	4.0c-g	6.3e-i	6.3h-k	5.0d-i
PST-A7-341	3.0a-d	5.0b-f	5.7c-f	5.7b-f	3.7b-f	4.3a-d	4.0a-e	4.7c-h
PST-A84-405	4.0d-g	6.0e-i	6.0d-g	5.3a-e	3.7b-f	4.3a-d	5.0d-h	4.7c-h
PST-A84-803	4.0d-g	6.3f-j	5.3b-e	5.3a-e	3.7b-f	4.7a-e	4.7c-g	6.3h-l
PST-A84-928	3.0a-d	4.0a-c	5.7c-f	5.0a-d	4.0c-g	4.7a-e	4.0a-e	5.3e-j
PST-B8-106	4.0d-g	7.0h-l	7.0g-j	5.3a-e	4.3d-h	5.7c-h	6.0g-k	4.7c-h
PST-B8-13	3.0a-d	3.7ab	5.3b-e	4.3ab	3.3a-e	3.7ab	3.7a-d	4.7c-h
PST-C-224	5.0g-j	8.0kl	7.3h-j	6.7e-h	3.3a-e	5.7c-h	5.7f-j	3.7a-e
PST-C-76	4.3e-h	5.0b-f	6.0d-g	5.3a-e	4.7e-i	5.3b-g	5.3e-i	5.0d-i
PST-HV-116	3.7c-f	6.3f-j	5.7c-f	5.3a-e	3.7b-f	4.3a-d	5.0d-h	3.7a-e
PST-R-740	3.0a-d	4.7b-e	5.7c-f	5.3a-e	3.7b-f	4.3a-d	4.0a-e	4.7c-h
PST-RE-88	3.7c-f	6.3f-j	7.0g-j	6.0c-g	4.3d-h	4.7a-e	4.3b-f	5.0d-i
PST-UD-10	4.7f-i	5.7d-h	7.0g-j	6.7e-h	5.3g-j	5.7c-h	5.3e-i	6.3h-l
PST-UD-12	5.3h-j	6.7g-k	5.7c-f	4.7a-c	3.7b-f	4.7a-e	4.7c-g	3.7a-e
PSU-151	5.3h-j	7.0h-l	6.0d-g	6.3d-h	5.3g-j	6.3e-i	6.0g-k	5.3e-j
R751A	3.0a-d	5.3c-g	6.3e-h	5.0a-d	3.7b-f	4.3a-d	4.3b-f	4.0a-f
Ram-1	4.0d-g	7.0h-l	6.7f-i	5.7b-f	2.7a-c	4.3a-d	5.0d-h	3.3a-d
Ronde	4.3e-h	6.0e-i	6.0d-g	5.0a-d	3.7b-f	5.3b-g	5.3e-i	3.3a-d
Silvia	4.7f-i	7.7j-l	6.3e-h	4.3ab	2.3ab	5.7c-h	5.3e-i	2.7ab
South Dakota	5.3h-j	5.3c-g	4.3ab	4.0a	2.7a-c	4.3a-d	3.7a-d	3.0a-c
SR 2000	3.3b-e	6.0e-i	6.3e-h	6.3d-h	5.7h-j	5.7c-h	5.7f-j	7.0j-l
SR 2100	3.3b-e	7.0h-l	6.7f-i	6.7e-h	5.3g-j	5.0b-f	5.7f-j	6.3h-l
Suffolk	5.3h-j	6.7g-k	5.7c-f	5.3a-e	3.3a-e	5.3b-g	5.3e-i	4.0a-f
Summit	2.3ab	5.0b-f	7.7ij	7.3gh	4.3d-h	5.7c-h	6.3h-k	4.7c-h
Touchdown	4.0d-g	6.7g-k	6.7f-i	6.0c-g	5.3g-j	5.7c-h	5.0d-h	6.3h-l
Trampas	2.7a-c	5.7d-h	6.7f-i	5.0a-d	4.0c-g	5.3b-g	5.0d-h	4.3b-g
Trenton	6.0j-l	7.7j-l	6.3e-h	5.7b-f	3.7b-f	5.7c-h	5.7f-j	4.0a-f
Washington	5.3h-j	7.3i-l	7.0g-j	6.7e-h	5.0f-i	6.3e-i	6.0g-k	6.7i-l
WW Ag 505	3.7c-f	6.3f-j	7.0g-j	6.0c-g	3.7b-f	5.3b-g	5.7f-j	3.7a-e
WW Ag 508	3.3b-e	5.3c-g	7.7ij	6.0c-g	2.0a	4.3a-d	4.3b-f	2.3a

[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 Protected 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] Dollar spot evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

Kentucky Bluegrass Maintained at a 0.75 Inch Mowing Height

J.E. Haley

Research Protocol:	**Kentucky Bluegrass Maintained at a 0.75 Inch Mowing Height**
Location:	Ornamental Horticulture Research Center Urbana, IL.
Site Preparation:	existing vegetation killed with Roundup; area rototilled; fertilized at 1 lb N/M.
Seeding/ Establishment:	seeding date - September 13, 1988; seeding rate - 2 lbs seed/M; plot size - 5 ft x 6 ft; irrigation - to insure germination.
Plot Maintenance:	irrigation - to prevent wilt;
1989	mowing height - 2 inches; fertilization - 3 lbs N/M/yr; pesticides - pre & postemergence crab-grass herbicide, Prograss at 0.75 lb ai/A (10/10/89 and 11/13/89).
1990	mowing height - 2 inches; fertilization - 3 lbs N/M/yr; pesticides - preemergence crabgrass herbicide.
1991	mowing height - 2 inches; fertilization - 1 lb N/M/yr; pesticides - pre & postemergence crab grass herbicide.
1992	mowing height - 0.75 inches; fertilization - 3 lbs N/M/yr; pesticides - postemergence broadleaf weed herbicide.
Experimental Design:	RCB; 3 replications.

Kentucky bluegrass (*P. pratensis*) is often mowed at heights as low as 0.75 for use on golf course fairways. Cultivars that perform well at a 2 or 3 inch mowing height may not perform as well when maintained at 1 inch or lower. This trial was established to evaluate Kentucky bluegrass cultivar quality when maintained at a 0.75 inch height of cut.

During the spring of 1992, fifty four mature Kentucky bluegrass cultivars that had been previously maintained at 2 inches were gradually lowered in mowing height to 0.75 inch. Turf quality was fair to poor for most of the growing season due to heavy incidence of dollar spot (*Lanzia* spp. and *Moellerodiscus* spp.) and necrotic ring spot (*Leptosphaeria korrae*) (Table 2).

Table 2. The evaluation of Kentucky bluegrass cultivars mowed at 0.75 inch in height during the 1992 growing season.[1]

Cultivar	Quality[2] 6/9	7/8	8/14	9/10	10/7	Dollar Spot[3] 8/14	Necrotic Ring Spot[4] 9/10
Abbey	5.3e-h	5.3e-i	5.0gh	3.0b-d	3.7b-e	5.3c-h	9.0b
Abel 1	6.0g-i	6.3hi	4.3e-g	3.3c-e	3.7b-e	3.0a-c	9.0b
Adelphi	4.7c-f	4.3b-g	4.0d-g	3.7d-e	3.0a-c	5.3c-h	9.0b
Alpine	7.0i	6.7i	3.0a-d	3.0b-d	3.3a-d	3.7a-e	9.0b
Amazon	3.3ab	2.7ab	2.7a-c	2.0a	2.7ab	2.7ab	9.0b
America	4.7c-f	5.3e-i	5.0gh	3.7d-e	4.3d-f	6.3f-h	6.0ab
Aspen	4.7c-f	5.0d-i	5.0gh	4.7g	4.3d-f	7.3h	9.0b
Ba 70-242	6.3hi	5.7f-i	4.3e-g	2.7a-c	3.0a-c	5.0b-h	9.0b
Baron	5.0d-g	4.3b-g	3.0a-d	3.0b-d	3.0a-c	2.0a	9.0b
Bel 21	4.0a-d	3.3a-d	3.0a-d	2.7a-c	2.3a	4.3a-f	6.0ab
Blacksburg	4.3b-e	2.7ab	2.3ab	2.7a-c	3.0a-c	3.0a-c	3.0a
Bristol	4.7c-f	4.7c-h	4.0d-g	3.3c-e	3.7b-e	4.7b-g	9.0b
Bronco	5.3e-h	6.3hi	5.7hi	4.3fg	4.3d-f	4.3a-f	9.0b
CB1	5.0d-g	5.0d-i	3.7c-f	3.0b-d	3.7b-e	3.7a-e	6.0ab
Challenger	4.7c-f	5.3e-i	4.3e-g	3.3c-e	3.3a-d	5.3c-h	9.0b
Chateau	4.0a-d	3.7a-e	3.3b-e	2.3ab	3.0a-c	3.0a-c	9.0b
Cheri	4.7c-f	4.3b-g	3.7c-f	2.7a-c	3.3a-d	3.7a-e	9.0b
Classic	4.7c-f	3.7a-e	3.0a-d	2.7a-c	3.0a-c	4.7b-g	9.0b
Compact	4.7c-f	4.0a-f	3.3b-e	3.0b-d	3.3a-d	3.3a-d	9.0b
Coventry	4.7c-f	4.3b-g	4.3e-g	3.0b-d	3.3a-d	4.0a-f	9.0b
Cultivar 229	4.7c-f	4.3b-g	4.0d-g	3.0b-d	3.0a-c	4.3a-f	9.0b
Cultivar 84-403	4.7c-f	4.7c-h	4.0d-g	3.3c-e	3.3a-d	5.0b-h	9.0b
Dawn	4.7c-f	4.0a-f	3.3b-e	3.0b-d	3.0a-c	4.0a-f	9.0b
Destiny	4.7c-f	4.7c-h	4.7f-h	3.7d-e	3.7b-e	4.3a-f	9.0b
Eclipse	5.7f-h	6.0g-i	4.3e-g	3.3c-e	3.3a-d	2.7ab	9.0b
Estate	5.0d-g	4.0a-f	3.3b-e	2.3ab	3.3a-d	3.7a-e	9.0b
Freedom	4.7c-f	4.0a-f	4.3e-g	3.0b-d	4.0c-f	5.3c-h	9.0b

(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 Protected 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] Dollar spot evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

[4] Necrotic ring spot evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

Table 2. The evaluation of Kentucky bluegrass cultivars mowed at 0.75 inch in height during the 1992 growing season.[1] (continued)

	Quality[2]					Dollar Spot[3]	Necrotic Ring Spot[4]
Cultivar	6/9	7/8	8/14	9/10	10/7	8/14	9/10
Fylking	4.3b-e	3.0a-c	2.3ab	2.0a	2.3a	3.0a-c	3.0a
Georgetown	4.3b-e	4.0a-f	3.7c-f	3.0b-d	3.3a-d	4.0a-f	9.0b
Glade	5.3e-h	5.3e-i	4.3e-g	3.7d-f	3.7b-e	4.0a-f	9.0b
Gnome	5.3e-h	4.7c-h	4.0d-g	2.3ab	3.3a-d	4.3a-f	9.0b
Banjo (H76-1034)	3.3ab	4.0a-f	3.3b-e	3.3c-e	3.7b-e	6.0e-h	9.0b
Haga	4.7c-f	4.7c-h	3.7c-f	3.3c-e	4.0c-f	5.7d-h	9.0b
Huntsville	3.0a	3.3a-d	3.3b-e	3.0b-d	3.0a-c	4.7b-g	9.0b
Ikone	4.0a-d	2.3a	2.7a-c	2.3ab	2.3a	3.0a-c	9.0b
Julia	3.3ab	2.7ab	2.3ab	2.0a	2.3a	2.0a	9.0b
Liberty	5.0d-g	4.3b-g	4.0d-g	3.0b-d	3.7b-e	4.3a-f	9.0b
Loft's 1757	4.3b-e	5.0d-i	4.0d-g	4.0e-g	3.7b-e	3.7a-e	3.0a
Merit	6.0gh	5.7f-i	4.0d-g	3.3c-e	3.0a-c	6.0e-h	9.0b
Midnight	5.7f-h	6.3hi	6.7i	5.7h	5.7g	7.0gh	9.0b
Monopoly	5.0d-g	5.7f-i	3.7c-f	3.0b-d	3.3a-d	4.3a-f	9.0b
Mystic	5.7f-h	6.0g-i	4.0d-g	2.3ab	4.0c-f	3.3a-d	9.0b
Nassau	4.0a-d	4.0a-f	3.7c-f	3.0b-d	3.0a-c	5.3c-h	9.0b
Nutop	4.7c-f	4.7c-h	2.7a-c	3.0b-d	3.3a-d	3.3a-d	9.0b
Opal	3.7a-c	3.3a-d	2.7a-c	2.0a	2.3a	2.7ab	9.0b
Ram I	4.7c-f	3.7a-e	2.0a	2.3ab	2.7ab	2.0a	3.0a
S-21	4.3b-e	5.0d-i	3.3b-e	3.3c-e	3.0a-c	5.0b-h	9.0b
Somerset	4.7c-f	4.3b-g	5.0gh	4.0e-g	5.0fg	6.3f-h	9.0b
Suffolk	4.7c-f	4.0a-f	4.0d-g	3.3c-e	3.3a-d	4.3a-f	9.0b
Sydsport	4.7c-f	3.3a-d	4.0d-g	2.3ab	3.7b-e	4.3a-f	9.0b
Tendos	5.0d-g	5.3e-i	4.3e-g	4.0e-g	4.7e-g	6.0e-h	9.0b
Trenton	4.3b-e	3.7a-e	3.3b-e	3.7d-f	3.3a-d	2.0a	9.0b
Victa	5.0d-g	4.3b-g	3.7c-f	3.0b-d	3.7b-e	4.0a-f	6.0ab
Wabash	6.0gh	6.3hi	3.7c-f	2.3ab	4.0c-f	3.7a-e	9.0b

[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 Protected 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] Dollar spot evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

[4] Necrotic ring spot evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

NTEP Perennial Ryegrass Cultivar Trial

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

Research Protocol:	**Perennial Ryegrass Cultivar Evaluation**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Site Preparation:	existing vegetation killed with Roundup; area worked with Ryan dethatcher; fertilized at 1 lb N/M.
Seeding/ Establishment:	seeding date - September 13, 1990; seeding rate - 4 lbs seed/M; plot size - 5 ft x 6 ft; irrigation - to insure germination.
Plot Maintenance:	mowing height - 1.5 inches; irrigation - to prevent wilt;
1991	pesticides - postemergence broadleaf weed herbicide; fertilization - 1 lb N/M/yr.
1992	pesticides - postemergence broadleaf weed herbicide; fertilization - 3 lb N/M/yr.
Experimental Design:	RCB; 3 replications.

In the past, perennial ryegrass (*Lolium perenne*) has been included in seed mixtures as a temporary lawn or nursegrass. In Illinois, deterioration of turf during summer months has prevented perennial ryegrass from becoming an important permanent turfgrass. Improved cultivars 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 NTEP perennial ryegrass trial. This nationwide test evaluates the performance of perennial ryegrass cultivars under a broad range of climate and cultural programs.

During 1992, early spring quality ranged from fair to good for most of these perennial ryegrass cultivars (Table 3). Red thread disease (*Laetisaria fuciformis*) became a problem during the spring and reduced turf quality throughout the summer months. Red thread can be a problem in turf during cooler damp weather and in turf where nitrogen levels in the soil are low. Although unusual for east central Illinois, this type of environment prevailed through mid summer and caused much disease infection that resulted in serious perennial ryegrass decline. It was not until the cultivars were fertilized in September that quality improved. Recovery was then rapid and perennial ryegrass quality was rated fair to excellent for the final evaluation dates of the growing season.

Table 3. The evaluation of perennial ryegrass during the 1992 growing season.[1]

Cultivar	Quality[2] 4/24	6/3	7/13ns	8/21	10/1	10/27	Red Thread[3] 6/3ns
Riviera	6.3b-f	5.0a-d	3.7	4.3b-g	6.3a-e	6.3a-f	7.3
Calypso	7.0d-g	5.0a-d	3.3	4.0a-f	7.0b-f	6.7b-g	5.3
Seville	7.0d-g	6.3d-f	4.3	5.7f-i	7.0b-f	7.7e-g	7.0
Caliente	6.7c-g	4.0a	3.0	4.7c-h	7.0b-f	6.3a-f	6.3
ZW 42-176	5.3a-c	5.7b-f	3.3	3.0a-c	6.3a-e	6.0a-e	7.0
BAR Lp 852	6.3b-f	4.3ab	4.0	4.0a-f	6.0a-d	6.3a-f	5.3
Barrage++	6.7c-g	6.0c-f	4.3	3.7a-e	7.3c-f	6.3a-f	7.0
Commander	7.0d-g	5.3a-e	4.0	3.7a-e	5.7a-c	5.3a-c	6.3
Assure	6.3b-f	5.7b-f	3.0	4.7c-h	6.3a-e	5.7a-d	6.0
Accolade	7.0d-g	4.3ab	2.7	3.7a-e	6.0a-d	5.0ab	6.3
Danilo	6.0a-e	5.7b-f	3.7	3.3a-d	7.0b-f	6.3a-f	7.3
EEG 358	5.3a-c	5.3a-e	2.7	5.0d-i	6.3a-e	6.0a-e	6.0
Meteor	5.3a-c	6.0c-f	2.7	3.0a-c	6.0a-d	6.0a-e	6.7
SR 4200	6.3b-f	5.7b-f	2.7	4.7c-h	7.7d-f	8.0g	6.0
Cartel	6.3b-f	4.0a	2.3	2.7ab	6.3a-e	5.7a-d	5.0
Saturn	7.0d-g	5.0a-d	3.0	4.3b-g	8.0ef	7.7e-g	6.0
PST-2OG	6.7c-g	5.7b-f	3.0	5.0d-i	7.7d-f	7.7e-g	5.3
PST-2FQR	6.7c-g	5.0a-d	3.0	5.0d-i	7.3c-f	7.0c-g	4.7
OFI-F7	6.7c-g	5.7b-f	3.0	6.0g-i	7.3c-f	6.0a-e	5.7
Poly-SH	6.7c-g	4.7a-c	3.0	3.3a-d	5.3ab	5.3a-c	4.7
Advent	5.7a-d	5.7b-f	2.3	6.3hi	7.7d-f	6.0a-e	5.0
OFI-D4	6.3b-f	6.0c-f	4.3	4.0a-f	6.7a-f	6.0a-e	6.3
PR 9121	6.0a-e	4.7a-c	3.0	3.3a-d	6.0a-d	5.7a-d	4.3
Allegro	7.0d-g	6.0c-f	3.0	2.7ab	5.0a	5.7a-d	6.0
Syn-P	7.0d-g	5.0a-d	2.7	3.3a-d	5.3ab	4.7a	5.7
Legacy	5.7a-d	5.7b-f	3.0	4.7c-h	6.0a-d	6.0a-e	6.0
Dandy	7.0d-g	5.7b-f	4.3	5.0d-i	7.3c-f	7.0c-g	7.0
Danaro	4.7a	4.7a-c	3.7	3.7a-e	6.7a-f	6.3a-f	7.7
Mom Lp 3147	7.0d-g	5.3a-e	3.3	4.3b-g	7.0b-f	7.0c-g	6.0
Mom Lp 3184	6.7c-g	4.7a-c	4.3	5.0d-i	6.7a-fa-f	6.0a-e	7.0
WVPB-88-PR-C-23	7.0d-g	5.3a-e	2.7	2.3a	7.0b-f	6.3a-f	5.7
Taya	6.3b-f	5.7b-f	2.3	3.3a-d	6.3a-e	5.3a-c	6.0
Equal	5.7a-d	5.0a-d	3.3	4.7c-h	6.7a-f	6.3a-f	5.7

(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 Protected 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]Red thread evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

ns No significant difference was found among the means in this group of data.

Table 3. The evaluation of perennial ryegrass during the 1992 growing season.[1] (continued)

	Quality[2]						Red Thread[3]
Cultivar	4/24	6/3	7/13[ns]	8/21	10/1	10/27	6/3[ns]
Charger	7.0d-g	4.7a-c	2.7	3.3a-d	6.7a-f	7.0c-g	5.0
PST-2B3	6.7c-g	4.0a	3.3	5.3e-i	7.7d-f	7.3d-g	5.7
Mom Lp 3111	6.0a-e	4.7a-c	3.3	4.3b-g	6.3a-e	6.7b-g	5.3
Target	5.7a-d	5.3a-e	2.7	6.3hi	7.3c-f	7.0c-g	5.0
Surprise	6.3b-f	4.3ab	3.0	3.3a-d	5.3ab	5.7a-d	6.7
PST-GH-89	5.0ab	5.3a-e	2.3	3.7a-e	7.3c-f	7.7e-g	5.0
Express	7.0d-g	4.7a-c	3.0	4.0a-f	7.0b-f	6.7b-g	4.7
PST-290	8.0g	5.3a-e	3.0	4.3b-g	7.0b-f	7.0c-g	5.0
Koos 90-1	6.7c-g	6.7ef	3.0	4.7c-h	7.3c-f	6.7b-g	6.0
Entrar	7.3e-g	5.3a-e	2.7	3.3a-d	7.3c-f	7.0c-g	4.7
Ovation	7.0d-g	5.3a-e	3.3	3.3a-d	5.7a-c	6.0a-e	7.0
WVPB 89-92	6.3b-f	7.0f	4.0	5.0d-i	7.0b-f	7.0c-g	6.7
Koos 90-2	6.7c-g	5.3a-e	3.0	3.7a-e	7.0b-f	7.0c-g	6.0
Pleasure	7.7fg	5.3a-e	4.0	4.3b-g	7.3c-f	7.0c-g	6.0
4DD-Delaware Dwarf	7.3e-g	6.3d-f	4.0	5.3e-i	7.3c-f	7.0c-g	6.0
BAR Lp 086FL	6.3b-f	5.3a-e	3.0	3.3a-d	7.7d-f	7.3d-g	5.7
WVPB-89-PR-A-3	7.7fg	5.7b-f	3.3	4.3b-g	7.0b-f	6.3a-f	5.7
Pick 9100	7.0d-g	5.0a-d	2.7	4.7c-h	7.3c-f	7.7e-g	5.0
Cutless	7.0d-g	5.3a-e	3.0	3.0a-c	6.7a-f	7.0c-g	5.7
Pick 1800	7.7fg	4.7a-c	3.3	4.7c-h	7.7d-f	7.7e-g	6.0
CLP 144	6.7c-g	4.7a-c	2.7	3.0a-c	6.7a-f	5.3a-c	5.0
PST-2DPR	6.7c-g	6.0c-f	3.3	3.7a-e	7.0b-f	7.7e-g	5.7
P89	5.7a-d	5.0a-d	3.0	5.7f-i	7.0b-f	7.0c-g	5.0
Pick DKM	6.7c-g	5.0a-d	3.0	3.7a-e	6.3a-e	7.0c-g	5.3
NK 89001	5.7a-d	4.7a-c	3.7	5.7f-i	7.3c-f	6.7b-g	6.0
Envy	7.7fg	5.0a-d	3.7	6.0g-i	8.3f	7.3d-g	5.7
Troubadour	6.0a-e	5.7b-f	4.0	4.0a-f	6.3a-e	6.7b-g	6.7
ZPS-28D	7.0d-g	5.7b-f	3.0	4.3b-g	7.3c-f	7.0c-g	6.0
GEN-90	7.7fg	6.3d-f	3.3	5.0d-i	8.0ef	7.3d-g	6.0
Sherwood	6.7c-g	5.3a-e	3.7	4.3b-g	6.3a-e	6.0a-e	6.7
Gettysburg	7.0d-g	5.0a-d	3.0	5.3e-i	7.7d-f	7.0c-g	5.7
Pebble Beach	6.3b-f	5.3a-e	3.0	3.0a-c	6.0a-d	6.0a-e	6.3
WVPB-89-87A	7.0d-g	5.7b-f	4.0	4.0a-f	6.7a-f	7.0c-g	7.0

(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 Protected 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] Red thread evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

[ns] No significant difference was found among the means in this group of data.

Table 3. The evaluation of perennial ryegrass during the 1992 growing season.[1] (continued)

Cultivar	Quality[2] 4/24	6/3	7/13[ns]	8/21	10/1	10/27	Red Thread[3] 6/3[ns]
Fiesta II	7.3e-g	5.0a-d	2.3	3.3a-d	6.3a-e	6.0a-e	6.0
Pick 89-4	7.3e-g	7.0f	4.7	5.3e-i	7.7d-f	7.7e-g	7.0
MVF 89-88	7.0d-g	4.3ab	3.3	3.7a-e	6.3a-e	6.3a-f	6.0
PR 9118	5.7a-d	5.0a-d	3.7	5.0d-i	7.3c-f	8.0fg	5.3
APM	5.3a-c	5.3a-e	2.7	6.0g-i	7.7d-f	7.3d-g	5.3
Toronto	5.3a-c	4.3ab	4.0	4.7c-h	6.7a-f	6.7b-g	6.0
PR 9109	7.0d-g	4.3ab	3.0	5.0d-i	7.0b-f	7.3d-g	4.7
Patriot II	7.7fg	5.3a-e	3.0	4.3b-g	7.3c-f	6.7b-g	5.0
MVF 89-90	6.0a-e	5.3a-e	3.7	5.0d-i	7.7d-f	7.0c-g	5.3
Pinnacle	7.7fg	7.0f	4.3	4.7c-h	7.7d-f	7.3d-g	7.3
Duet	6.0a-e	5.0a-d	3.7	4.3b-g	6.3a-e	6.7b-g	6.0
Competitor	7.0d-g	5.7b-f	3.0	3.7a-e	7.7d-f	7.7e-g	5.7
PR 8820	6.7c-g	5.0a-d	3.7	4.3b-g	6.7a-f	7.0c-g	4.7
Derby Supreme	7.3e-g	4.7a-c	3.3	4.0a-f	6.3a-e	6.0a-e	5.3
Lindsay	7.3e-g	4.3ab	3.0	4.0a-f	6.0a-d	5.3a-c	4.7
C-21	6.7c-g	5.3a-e	3.7	3.7a-e	7.3c-f	7.0c-g	6.0
PS-105	7.3e-g	6.0c-f	4.0	6.0g-i	8.0ef	7.0c-g	5.3
Dimension (2H7)	7.0d-g	4.7a-c	3.3	4.7c-h	8.0ef	7.0c-g	4.7
Repel II (LDRD)	6.7c-g	4.3ab	2.7	6.7i	7.7d-f	7.0c-g	4.7
PST-28M	8.0g	6.7ef	4.0	5.7f-i	7.7d-f	8.3g	7.0
Pick EEC	6.3b-f	5.7b-f	2.7	4.0a-f	7.7d-f	7.3d-g	5.7
2P2-90	6.7c-g	6.0c-f	3.7	5.0d-i	8.0ef	7.7e-g	5.0
Nomad	6.3b-f	6.0c-f	3.0	4.0a-f	7.0b-f	7.0c-g	5.7
Rodeo II	6.7c-g	5.7b-f	3.3	5.3e-i	7.7d-f	7.3d-g	6.0
Repell	7.0d-g	5.7b-f	3.7	5.7f-i	7.7d-f	7.3d-g	5.3
Cultivar 856	6.3b-f	4.3ab	3.3	4.0a-f	7.0b-f	6.7b-g	6.0
N-33	7.0d-g	5.0a-d	4.0	4.7c-h	8.0ef	7.3d-g	6.3
ZPS-2EZ	7.0d-g	5.0a-d	3.0	4.7c-h	8.0ef	7.0c-g	5.3
WM-II	5.7a-d	5.3a-e	3.7	4.0a-f	7.0b-f	6.0a-e	6.0
89-666	7.0d-g	6.3d-f	4.0	6.0g-i	8.0ef	7.3d-g	6.3
Yorktown III (LDRF)	6.7c-g	6.0c-f	4.3	5.7f-i	8.3f	8.0fg	5.7
HE 311	7.0d-g	7.0f	4.3	3.7a-e	6.3a-e	7.0c-g	6.7
Mom Lp 3182	5.7a-d	4.3ab	4.0	5.0d-i	7.3c-f	7.0c-g	5.7

[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 Protected 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] Red thread evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

[ns] No significant difference was found among the means in this group of data.

NTEP Tall Fescue Cultivar Trial

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

Research Protocol:	**NTEP Tall Fescue Cultivar Evaluation**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Site Preparation:	existing vegetation killed with Roundup; area worked with Ryan dethatcher; fertilized at 1 lb N/M.
Seeding/ Establishment:	seeding date - September 4, 1992; seeding rate - 4 lbs seed/M; plot size - 5 ft x 6 ft; irrigation - to insure germination.
Plot Maintenance:	mowing height - 1.5 inches; irrigation - to prevent wilt;
1992	pesticides - none; fertilization - 1.5 lbs N/M/yr.
Experimental Design:	RCB; 3 replications.

The introduction of improved "turf type" tall fescue (*Festuca arundinacea* Schreb.) cultivars has led to increased tall fescue use where a higher quality turf is desired. These cultivars appear to have a finer texture, increased density and better tolerance to low mowing than the pasture-type tall fescues. Some research indicates that the improved cultivars have retained the good drought, heat and wear tolerance needed in a low maintenance turf. In order to investigate the response of these cultivars to conditions found in east central Illinois a trial was established to evaluate 104 tall fescue cultivars. Ninety two of these cultivars are part of the NTEP tall fescue trial. These cultivars will be evaluated at 39 different locations across the United States.

The tall fescue cultivars were seeded on September 4, 1992. Seedling vigor data was collected about a month following planting (Table 4). This evaluation presents an indication of individual cultivar establishment potential. Percent plot cover ratings made 29 October also provide information about cultivar establishment rates. During the next few years the cultivars will be evaluated for overall quality performance, disease resistance, and cold and drought tolerance.

Table 4. The evaluation of tall fescue cultivars following seeding on September 4, 1992.[1]

Cultivar	Seedling Vigor[2] 10/1	Percent Cover[3] 10/29	Cultivar	Seedling Vigor[2] 10/1	Percent Cover[3] 10/29
Avanti	6.3e-h	56.7f-n	Bonsai	5.3b-e	36.7a-e
Lexus	5.0a-d	43.3a-i	Bonsai Plus	5.7c-f	43.3a-i
Vegas	5.7c-f	63.3j-p	SR 8300	6.0d-g	63.3h-o
Austin	6.7f-h	60.0h-o	Ky-31 no endo	8.3i	80.0p
BAR Fa 214	5.0a-d	40.0a-g	PSTF-401	6.3e-h	68.3l-p
BAR Fa 2AB	4.7a-c	51.7d-l	Finelawn Petite	5.7c-f	50.0c-l
BAR Fa 0855	5.3b-e	48.3b-k	Pick 90-10	4.3ab	51.7d-l
GEN-91	5.7c-f	43.3a-i	MB-23-92	4.7a-c	36.7a-e
PST-5VC	5.0a-d	46.7a-k	Astro 2000	5.7c-f	58.3g-n
J-1048	4.7a-c	45.0a-j	Lancer	6.3e-h	61.7i-p
Anthem	7.0gh	68.3l-p	Silverado	5.0a-d	41.7a-h
5PVC	5.0a-d	40.0a-g	Pick 90-12	5.0a-d	40.0a-g
Bonanza	5.3b-e	56.7f-n	Pixie	5.7c-f	50.0c-l
Guardian	6.0d-g	65.0k-p	Pick 90-6	4.0a	28.3a
ZPS-VL	5.0a-d	46.7a-k	PRO-9178	5.0a-d	51.7d-l
PST-5PM	5.0a-d	45.0a-j	Twilight	5.7c-f	51.7d-l
Montank	5.0a-d	48.3b-k	KWS-DSL	5.7c-f	65.0k-p
PST-5STB	4.7a-c	40.0a-g	Micro DD	5.7c-f	60.0h-o
Rebel Jr	7.0gh	65.0k-p	Finelawn 88	5.3b-e	43.3a-i
PST-59D	5.0a-d	41.7a-h	Kittyhawk	4.7a-c	45.0a-j
SR 8010	6.7f-h	73.3n-p	Aztec	5.3b-e	65.0k-p
ATF-006	5.3b-e	58.3g-n	Bonanza II	5.3b-e	48.3b-k
ATF-007	4.7a-c	35.0a-d	SR 8400	5.7c-f	61.7i-p
FA-19	5.0a-d	35.0a-d	MED 10-7-2	5.3b-e	60.0h-o
FA-22	5.3b-e	41.7a-h	Duke	5.0a-d	46.7a-k
Rebel-3D	5.7c-f	50.0c-l	J1047	4.3ab	30.0ab

(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 Protected Least Significant Difference test.

[2]Seedling vigor evaluations are made on a 1-9 scale where 9 = good germination and a fast growing, strong seedling and 1 = poor seed germination and a week seedling.

[3]Percent cover refers to the percent of the plot area covered with turf. It reflects seedling vigor and establishment rate.

Table 4. The evaluation of tall fescue cultivars following seeding on September 4, 1992.[1] (continued)

Cultivar	Seedling Vigor[2] 10/1	Percent Cover[3] 10/29	Cultivar	Seedling Vigor[2] 10/1	Percent Cover[3] 10/29
MED 10-6-8F	5.0a-d	61.7i-p	WSI-208-2	5.3b-e	43.3a-i
PST-5LX	4.7a-c	35.0a-d	5EX	5.3b-e	51.7d-l
Phoenix	4.7a-c	56.7f-m	CAS-LA20	4.0a	46.7a-k
PSTF-LF	5.3b-e	55.0e-m	Cultivar 403	6.7f-h	58.3g-m
SFL	6.7f-h	55.0e-m	ZPS-J3	6.0d-g	50.0c-l
Pick CII	6.0d-g	61.7i-p	ZPS-ML	5.0a-d	31.7a-c
M-2	6.3e-h	56.7f-m	Shenandoah	5.7c-f	51.7d-l
ZPS-E2	5.3b-e	48.3b-k	MED 2-7-11	4.7a-c	40.0a-g
Eldorado	5.7c-f	48.3b-k	Virtue	5.0a-d	45.0a-j
MB-22-92	4.0a	38.3a-f	ITR-90-2	4.7a-c	48.3b-k
CAS-MA21	4.7a-c	50.0c-l	OFI-TF-601	6.3e-h	53.3d-m
ISI-CRC	5.7c-f	50.0c-l	MED 2-3-19	5.3b-e	43.3a-i
5MX	5.3b-e	45.0a-j	Leprechaun	5.3b-e	50.0c-l
Cochise	5.3b-e	50.0c-l	ISI-AFA	5.3b-e	56.7f-m
MB-21-92	6.0d-g	48.3b-k	ISI-AFE	5.0a-d	46.7a-k
MB-24-92	4.3ab	43.3a-i	ISI-ATK	5.3b-e	51.7d-l
Safari	5.7c-f	55.0e-m	SIU-1	6.0d-g	50.0c-l
Olympic II	7.3hi	78.3op	PSTF-200	6.3e-h	65.0k-p
PST-RDG	5.3b-e	45.0a-j	Trailblazer II	5.7c-f	56.7f-m
PST-5DX w/endo	4.7a-c	46.7a-k	SR 8200	5.0a-d	45.0a-j
Tomahawk	4.7a-c	46.7a-k	Falcon	5.3b-e	50.0c-l
Monarch	4.7a-c	48.3b-k	MB-25-92	5.7c-f	61.7i-p
Ky-31 w/endo	7.3hi	71.7m-p	MED 2-9-3	6.3e-h	61.7i-p
MED 2-3-10	6.0d-g	60.0h-o	SR 8210	5.3b-e	50.0c-l
Cafa 101	5.7c-f	56.7f-m	Arid	7.3hi	73.3n-p
MED 10-1-1	5.7c-f	58.3g-m	5DC	4.7a-c	43.3a-i

[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 Protected Least Significant Difference test.

[2]Seedling vigor evaluations are made on a 1-9 scale where 9 = good germination and a fast growing, strong seedling and 1 = poor seed germination and a week seedling.

[3]Percent cover refers to the percent of the plot area covered with turf. It reflects seedling vigor and establishment rate.

NTEP National Bentgrass Trial

D.J. Wehner and J.E. Haley

Over the last few years, two factors have resulted in an increased interest in creeping bentgrass (*Agrostis palustris*). These factors are the use of creeping bentgrass for golf course fairways and increased construction of golf courses. Commercial and public breeders responded to the increased interest in creeping bentgrass by developing new cultivars. There is some interest in other species of bentgrass such as dryland bentgrass (*Agrostis castellana*), browntop bentgrass (*Agrostis capillaris*), and colonial bentgrass (*Agrostis tenuis*) for golf course applications. The purpose of this study is to evaluatenew cultivars of bentgrass for use as fairway and putting green turfs. Two sets of plots were established in the fall of 1990, one set is being mowed at putting green height while the other is being mowed at fairway height.

Research Protocol:	**Bentgrass Cultivar Evaluation**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Site Preparation:	existing vegetation killed with Roundup; area surfaced tilled; fertilized at 1 lb N/M.
Seeding/ Establishment:	seeding date - August 30, 1990; seeding rate - 2 lbs seed/M; plot size - 10 ft x 6 ft; irrigation - to insure germination.
Plot Maintenance:	mowing height - greens, 0.25 inches, fairway, 0.5 inches;
1991	pesticides - Lescosan in April; irrigation - to prevent wilt; fertilization - 1.17s lb N/M, 48 g Fe/M/yr; fungicides - throughout the season to control and prevent disease;
1992	pesticides - none; irrigation - to prevent stress; fertilization - 5 lbs N/M, 33.4 g Fe/M/yr; fungicides - throughout the season to control and prevent disease.
Experimental Design:	RCB; 3 replications.

Results of putting green height of cut. The second year of data was collected from this study in 1992 (Table 5). The overall quality of the plots increased during the year, but as the ratings indicate, they still would not be considered acceptable in many situations. Part of this was due to the generally cool and wet weather during the growing season. These plots are still developing. The cultivars receiving the highest quality ratings at the putting green height of cut were 'Putter', 'Providence', 'SR 1020', 'Pennlinks', 'Forbes 89-12', and 'Lopez'. None of these varieties were affected by the brown patch disease (*Rhizoctonia solani*) that occurred on the plots late in the year. The plots are on a preventative fungicide program, however, spray applications were less frequent during the later stages of the growing season.

Table 5. The evaluation of bentgrass cultivars mowed at the putting green height of cut during the 1992 growing season.[1]

Cultivar	Quality[2] 4/21	5/19	6/18	7/16	8/11	9/10	10/8	Brown Patch[3] 9/8
88.CBE	4.0b-d	3.7a-c	4.7c-e	3.0a	4.3b-d	4.0a-c	4.0cd	9.0c
88.CBL	4.0b-d	4.3bc	5.0c-e	4.0a-c	4.3b-d	4.7c-e	4.3de	9.0c
Allure[4]	3.0ab	3.0a	3.3ab	3.3ab	3.7ab	3.3a	2.3a	8.0b
Bardot[5]	3.3a-c	4.7c	4.7c-e	5.3de	4.0a-c	4.0a-c	3.0ab	6.0a
BR 1518[6]	2.7a	3.0a	3.0a	3.0a	3.0a	3.7ab	2.7ab	8.0b
Carmen	3.3a-c	3.3ab	4.3b-d	4.3b-d	4.7b-e	5.3e-g	4.3de	9.0c
Cobra	3.7a-c	3.3ab	4.7c-e	4.0a-c	4.3b-d	4.7c-e	4.0cd	9.0c
Egmont[7]	3.3a-c	4.7c	4.0a-c	5.3de	5.3d-f	4.7c-e	3.3bc	7.3b
Emerald	4.0b-d	4.0a-c	4.7c-e	4.7c-e	5.3d-f	6.0g	5.7g	9.0c
Forbes 89-12	5.0d	4.0a-c	5.7e	5.0c-e	5.0c-f	5.3e-g	5.3fg	9.0c
Lopez (WVPB 89-D15)	5.0d	4.7c	5.3de	5.0c-e	6.0f	5.7fg	5.3fg	9.0c
National	3.7a-c	4.0a-c	4.0a-c	4.0a-c	4.3b-d	4.3b-d	4.0cd	9.0c
Normarc 101	4.3cd	3.3ab	5.0c-e	5.0c-e	5.3d-f	5.7fg	5.0e-g	9.0c
Penncross	4.0b-d	3.3ab	4.0a-c	4.3b-d	5.3d-f	5.0d-f	5.3fg	9.0c
Penneagle	4.0b-d	4.0a-c	4.3b-d	4.7c-e	5.0c-f	5.3e-g	5.0e-g	9.0c
Pennlinks	3.7a-c	4.3bc	5.3de	5.7e	5.3d-f	5.0d-f	5.7g	9.0c
Providence	4.3cd	4.7c	5.3de	5.7e	5.7ef	5.7fg	4.7d-f	9.0c
Putter	4.0b-d	4.3bc	5.3de	5.3de	5.7ef	5.3e-g	5.3fg	9.0c
SR 1020	4.3cd	4.3bc	5.7e	5.3de	5.7ef	5.3e-g	5.0e-g	9.0c
Tracenta[8]	3.0ab	3.7a-c	4.0a-c	4.3b-d	4.3b-d	4.3b-d	3.0ab	8.0b

Results of the fairway height of cut. The overall quality of the plots mowed at the fairway height of cut was higher than the plots mowed at the putting green height of cut (Table 6). The cultivars 'Carmen', 'Penneagle', 'Putter', 'Normarc 101', and

[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 Protected Least Significant Difference test.

[2] Quality evaluations are made on a1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

[3] Brown patch evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

[4] Allure is a cultivar of colonial bentgrass.

[5] Bardot is a cultivar of colonial bentgrass.

[6] BR 1518 is a cultivar of dryland bentgrass.

[7] Egmont is a cultivar of browntop bentgrass.

[8] Tracenta is a cultivar of colonial bentgrass.

'Providence' received the highest quality ratings during the season. As with the putting green height of cut, these cultivars were not affected by the brown patch that occurred in September.

Table 6. The evaluation of bentgrass cultivars mowed at the fairway height of cut during the 1992 growing season.[1]

Cultivar	Quality[2]							Brown Patch[3]
	4/21	5/19	6/18	7/15	8/11	9/10	10/8	9/8
Allure[4]	4.0b	4.3bc	5.0b-d	5.3b-d	4.7ab	4.0ab	3.0a	7.3bc
Bardot[5]	4.3bc	5.3c-e	5.3cd	6.3e	5.0a-c	3.3a	3.0a	4.7a
BR 1518[6]	2.7a	3.0a	3.7a	3.3a	4.0a	3.3a	3.0a	7.3bc
Carmen	4.7bc	5.3c-e	5.7d	6.0de	6.7e-g	7.0f	6.7d-f	9.0c
Cobra	4.7bc	5.3c-e	5.7d	5.3b-d	6.3d-g	7.0f	7.3f	9.0c
Egmont[7]	4.0b	5.3c-e	5.3cd	6.0de	5.3b-d	4.7bc	4.0ab	5.7ab
Emerald	4.0b	3.0a	4.0ab	4.7b	6.0c-f	5.7c-e	6.3d-f	9.0c
Forbes 89-12	5.3c	6.3e	5.7d	5.3b-d	6.3d-g	6.0d-f	6.0c-e	9.0c
National	4.0b	3.0a	4.3a-c	5.0bc	5.3b-d	4.7bc	5.0bc	9.0c
Normarc 101	4.7bc	5.7de	6.0d	6.0de	7.3g	6.7ef	7.0ef	9.0c
Penncross	5.3c	4.7b-d	5.7d	5.3b-d	6.0c-f	5.0b-d	5.0bc	9.0c
Penneagle	5.3c	5.0b-d	5.7d	6.0de	7.0fg	7.0f	6.3d-f	9.0c
Providence	5.3c	6.3e	5.3cd	5.0bc	6.7e-g	6.7ef	6.7d-f	9.0c
Putter	5.0bc	5.7de	5.7d	6.3e	7.0fg	6.3ef	6.3d-f	9.0c
SR 1020	4.3bc	4.7b-d	5.7d	5.7c-e	6.3d-g	6.7ef	7.0ef	9.0c
TAMU 88-1	4.3bc	4.3bc	5.0b-d	5.7c-e	6.7e-g	5.7c-e	5.7cd	9.0c
Tracenta[8]	4.3bc	5.3c-e	5.7d	6.3e	5.7b-e	4.3ab	3.0a	7.0bc
Lopez (WVPB 89-D15)	4.7bc	4.0ab	5.0b-d	4.7b	5.3b-d	5.0b-d	5.0bc	8.7c

[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 Protected Least Significant Difference test.

[2]Quality evaluations are made on a1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

[3]Brown patch evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

[4]Allure is a cultivar of colonial bentgrass.

[5]Bardot is a cultivar of colonial bentgrass.

[6]BR 1518 is a cultivar of dryland bentgrass.

[7]Egmont is a cultivar of browntop bentgrass.

[8]Tracenta is a cultivar of colonial bentgrass.

1991 NTEP Buffalograss and Zoysiagrass Cultivar Trials

T.B. Voigt, J.E. Haley and L. Perkins

The severe growing seasons of 1988 and 1991 have increased interest in drought- and heat-tolerant grasses for Illinois. Among cool-season grasses tall fescue and the fine-leaf fescues tend to be most tolerant of ardent and droughty conditions. Warm-season grasses, in general, have exhibited even greater ability to tolerate, and even thrive in, very hot and dry conditions. Of the warm-season grasses , buffalograss (*Buchloe dactyloides*) and zoysiagrass (*Zoysia* spp.), may be the most promising for use in Illinois.

Research Protocol:	**1991 NTEP Buffalograss & Zoysiagrass Cultivar Trials**
Location:	Joliet Junior College, Joliet, IL; Ornamental Horticulture Research Center, Urbana, IL.
Site Preparation:	existing vegetation killed with Roundup (Joliet); area rotary tilled; fertilized at 1 lb N/M.
Seeding/ Establishment:	seeding date - June 27, 1991 (Joliet), June 28, 1991 (Urbana); plugging rate - 6 to 24 plugs/plot; plot size - 7 ft x 7 ft; irrigation - to insure establishment; pesticides - preemergence application of Simazine.
Plot Maintenance: 1991	mowing height - 2.0 inches; pesticides - broad spectrum postemergence broadleaf herbicide (Urbana); irrigation - none after establishment; fertilization - none after establishment.
1992	pesticides - broad spectrum postemergence broadleaf herbicide (Urbana); irrigation - none; fertilization - none.
Experimental Design:	RCB; 3 replications.

During the summer of 1991, Buffalograss and Zoysiagrass NTEP studies were initiated in Urbana. In addition, a second Buffalograss NTEP study was planted on the grounds of Joliet Junior College, Joliet, Illinois. The twenty-two buffalograss and twenty-four zoysiagrass cultivars in the studies are listed in Tables 7 and 8.

The purpose of these trials is to evaluate different buffalograss and zoysiagrass selections for their suitability for utility turf or lawn uses in Illinois, with primary interest in overall turf quality. Data collection began in 1992. Buffalograss and zoysiagrass cultivar recommendations will be made following the conclusion of this study in 1996. Until recommendations, based on multiple years of data collection, can be confidently be given, 'Texoka' and 'Sharp's Improved' seeded buffalograss can be used.

Buffalograss at Urbana. There were significant differences in overall buffalograss turf quality at each of the six monthly evaluations (Table 7). There were few, however, season-long consistencies in cultivar quality following one and one-half growing seasons. 'Highlight 4', 'Highlight 15', 'Highlight 25', and 'Bufflawn' produced poor quality turf throughout the season. No selections produced consistently high quality turf throughout the growing season.

On September 16 buffalograss color was evaluated. There were no significant differences among selections. Note that none of selections had minimally acceptable turf color. When compared to other, more commonly planted turfgrasses, all buffalograss selections were markedly gray-green.

Also on September 16 buffalograss cover was evaluated. There were significant differences in cover among the selections. 'BAM 101', 'NTDG-1', 'NTDG-3', 'NTDG-4', 'NTDG-5', 'Prairie', and 'Sharp's Improved' covered the greatest portion of the 7' by 7' plots by the evaluation date. These selections covered 70 to 90 percent, on average, in one and one-half growing seasons.

Zoysiagrass at Urbana. There were significant differences in overall zoysiagrass quality at each of the six monthly evaluations (Table 8). There were few, however, season-long consistencies in cultivar quality following one and one-half growing seasons. 'DALZ8501', 'DALZ8502', 'DALZ8516', and 'DALZ8701' producded poor quality turf throughout the season. None of the selections produced consistently high quality turf throughout the entire growing season, but 'GT2047' and 'El Toro' performed in the top group of these selections May through September.

On September 16 zoysiagrass color was evaluated. There were significant differences among selections. 'Belair', 'CD259-13', 'DALZ8501', 'DALZ8507', 'DALZ8512'. 'DALZ8514', 'DALZ9006', 'El Toro', 'Emerald', 'GT2004', and 'Meyer' were darker green at this evaluation than the other selections.

Also on September 16 zoysiagrass cover was evaluated. There were significant differences in cover among the selections. 'CD259-13', 'DALZ8512', 'El Toro', 'GT2047', and 'Korean Common' covered the greatest portion of the 7' by 7' plots by the evaluation date. These selections covered 60 to 80 percent, on average, in one and one-half growing seasons.

Buffalograss at Joliet. There were significant differences in overall buffalograss turf quality during each of the three monthly evaluations (Table 9). There were several season-long consistencies in cultivar quality following one and one-half growing seasons. 'Highlight 15' and 'Highlight 25' produced poor quality turf throughout the season. The turf quality of 'NE 84-315', 'NE 84-378', 'NE 84-45-3', 'NE 84-436', 'NTDG-1', 'NTDG-2', and 'Texoka' was rated in the top group at each of the three evaluations.

There were also significant color differences among selections on August 25. At that evaluation, the color of 'Highlight 4' and 'Highlight 15', 'Highlight 25' and 'Rutgers' was rated significantly lower than the other selections.

Also on August 25 buffalograss cover was evaluated. There were significant differences in cover among the selections. 'NE 84-378' produced significantly less plot cover than all selections except "Highlight 15', 'Highlight 25', and 'Prairie'. 'AZ143' covered significantly more of the plot than 'NE 84-378' and 'Highlight 25'.

Table 7. The evaluation of buffalograss cultivars during the 1992 growing season in Urbana[1].

	Quality[2]						Color[3ns]	Cover[4]
Cultivar	5/29	6/30	7/20	8/25	9/16	10/21	9/16	9/16
AZ143	3.7ef	5.0f-h	3.7c-e	5.7cd	5.3e-h	3.0b-d	4.0	5.7ef
BAM 101	3.7ef	5.0f-h	4.0d-f	6.0c-e	6.0gf	3.0b-d	4.0	6.7f-h
BAM202	2.7b-d	3.7d-f	3.7c-e	5.3c	5.0d-h	3.0b-d	4.0	6.0fg
Bison	2.3bc	3.7d-f	3.0bc	3.3b	4.7d-g	3.3cd	4.3	5.3d-f
Bufflawn	1.3a	1.7ab	2.0a	2.3a	3.7b-d	2.3ab	3.3	3.7b-d
Highlight 15	2.0ab	2.0a-c	2.0a	2.0a	2.3ab	2.0a	4.7	2.0ab
Highlight 25	1.3a	1.3a	2.0a	2.0a	2.0a	2.0a	3.3	2.0ab
Highlight 4	1.3a	1.3a	2.0a	1.7a	2.0a	2.0a	2.3	1.7a
NE 84-315	4.3f	5.0f-h	4.7f	6.7e	6.0gf	3.0b-d	4.0	6.0fg
NE 84-436	2.3bc	4.0d-g	3.7c-e	5.7cd	5.3e-h	3.0b-d	3.7	5.3d-f
NE 84-45-3	2.3bc	3.7d-f	3.0bc	3.7b	2.7a-c	2.3ab	3.7	4.0c-e
NE 84-609	2.7b-d	4.0d-g	3.7c-e	6.3de	5.7f-h	4.3e	5.0	5.7ef
NE 85-378	2.7b-d	4.0d-g	3.7c-e	6.0c-e	6.0gf	3.0b-d	4.7	6.0fg
NTDG-1	3.3de	5.3gh	4.3ef	6.7e	6.3h	3.0b-d	4.3	7.7gh
NTDG-2	3.3de	4.7e-h	4.0d-f	6.3de	5.3e-h	3.0b-d	4.0	6.0fg
NTDG-3	3.3de	5.0f-h	4.3ef	6.0c-e	6.0gf	3.0b-d	4.0	6.3f-h
NTDG-4	3.3de	5.0f-h	3.7c-e	5.7cd	6.0gf	3.0b-d	4.0	6.7f-h
NTDG-5	4.3f	6.0h	4.7f	6.7e	6.0gf	3.0b-d	4.0	6.3f-h
Prairie	2.0ab	3.3c-e	3.7c-e	4.0b	6.0gf	3.7cd	4.7	6.3f-h
Rutgers	2.0ab	2.7a-d	2.3ab	3.3b	4.3d-f	3.0b-d	5.0	3.3a-c
Sharps Improved	3.0c-e	4.7e-h	3.3cd	6.0c-e	5.3e-h	3.0b-d	4.0	8.0h
Texoka	2.3bc	3.0b-d	3.3cd	4.0b	4.0c-e	2.7a-c	4.0	4.0c-e

[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 Protected Least Significant Difference test.

[2]Turf quality is based on a 1-9 scale where 1=tan turf, bare soil, lowest quality, 6=minimal turfgrass quality, and 9=darkest green, very dense, highest quality.

[3]Turf color is based on a 1-9 scale where 1=tan turf, 6=minimal acceptable turfgrass color, and 9=darkest green.

[ns]No significant difference was found among the means in this group of data.

[4]Turf cover is based on a 1-9 scale where 1=0% plot cover or dead turf, 2=20% plot cover, 3=40% plot cover, 4=50% plot cover, 6=70% plot cover, 7=80% plot cover, 8=90% plot cover, and 9=99% plot cover.

Table 8. The evaluation of zoysiagrass cultivars during the 1992 growing season in Urbana[1].

Cultivar	Quality[2] 5/29	6/30	7/20	8/25	9/16	10/21	Color[3] 9/16	Cover[4] 9/16
Belair	4.3ef	3.7c-e	4.7c-f	4.0b	4.3c-d	3.3e-g	6.7d-f	4.7cd
CD2013	3.0b-d	3.7c-e	5.0c-g	4.3bc	5.3e-g	4.0gg	5.7de	4.3b-d
CD259-13	4.3ef	5.3f	6.3g	6.7ef	5.7e-g	3.0d-f	6.0d-f	6.0de
DALZ8501	2.0ab	2.0ab	2.3ab	2.3a	2.7a-c	2.0bc	6.0d-f	2.7ab
DALZ8502	1.0a	1.3a	1.3a	1.0a	1.0a	1.0a	1.0a	2.0a
DALZ8507	2.7bc	4.0c-f	5.0c-g	5.0b-d	5.3e-g	3.0d-f	6.7d-f	4.7cd
DALZ8508	2.7bc	4.3c-f	4.3c-e	4.3bc	5.3e-g	2.7c-e	5.7de	4.0bc
DALZ8512	3.7c-e	4.7d-f	6.3g	7.0f	6.3fg	3.3e-g	7.0ef	7.3e
DALZ8514	3.3c-e	3.3b-d	5.0c-g	6.0d-f	6.3fg	2.7c-e	7.3f	6.0de
DALZ8516	2.7bc	3.0bc	3.7bc	2.3a	3.0b-d	1.7ab	6.7d-f	2.7ab
DALZ8701	1.3a	1.3a	1.7a	1.3a	1.3ab	1.0a	3.0b	1.3a
DALZ9006	2.7bc	4.3c-f	4.3c-e	5.0b-d	4.7d-f	2.3b-d	6.3d-f	4.0bc
El Toro	4.0d-f	4.7d-f	5.7e-g	6.3d-f	6.7g	3.0d-f	7.0ef	7.0e
Emerald	3.7c-e	4.7d-f	5.0c-g	5.0b-d	5.3e-g	3.7fg	6.3d-f	4.0bc
GT2004	3.7c-e	3.7c-e	4.3c-e	4.3bc	5.3e-g	4.0g	6.0d-f	4.3b-d
GT2047	4.3ef	4.7d-f	5.3d-g	5.7c-f	6.0e-g	2.0bc	5.7de	5.7c-e
JZ-1 lot A89-1	3.0b-d	3.3b-d	4.0cd	4.3bc	4.7d-f	3.0d-f	5.7de	5.0cd
Korean Common Seed	3.3c-e	4.0c-f	4.3c-e	5.0b-d	5.0e-g	2.7c-e	5.3cd	5.7c-e
Meyer	3.3c-e	3.7c-e	5.0c-g	4.0b	4.7d-f	3.0d-f	6.7d-f	4.3b-d
Sunburst	5.0f	5.0ef	6.0fg	6.3d-f	4.7d-f	2.7c-e	4.0bc	4.3b-d
TC2033	3.7c-e	4.0c-f	4.3c-e	6.0d-f	6.0e-g	3.3e-g	6.7d-f	4.3b-d
TC5018	4.3ef	4.7d-f	5.3d-g	6.0d-f	5.3e-g	3.0d-f	5.7de	6.0de
TGS-B10	3.7c-e	4.3c-f	4.7c-f	5.3b-d	5.7e-g	2.7c-e	6.0d-f	4.3b-d
TGS-W10	4.0d-f	3.7c-e	4.7c-f	5.0b-d	4.7d-f	3.0d-f	6.0d-f	5.0cd

[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 Protected Least Significant Difference test.

[2]Turf quality is based on a 1-9 scale where 1=tan turf, bare soil, lowest quality, 6=minimal turfgrass quality, and 9=darkest green, very dense, highest quality.

[3]Turf color is based on a 1-9 scale where 1=tan turf, 6=minimal acceptable turfgrass color, and 9=darkest green.

[4]Turf cover is based on a 1-9 scale where 1=0% plot cover or dead turf, 2=20% plot cover, 3=40% plot cover, 4=50% plot cover, 6=70% plot cover, 7=80% plot cover, 8=90% plot cover, and 9=99% plot cover.

Table 9. The evaluation of buffalograss cultivars during the 1992 growing season in Joliet[1].

Cultivar	Quality[2] 5/9	Quality[2] 6/12	Quality[2] 8/25	Color[3] 8/25	Cover[4] 8/'25
NE 84-609	4.0b-d	4.3b-e	7.7d-f	5.0b-e	88.3bc
NE 84-315	7.7g	6.7g	8.0ef	5.7de	91.0bc
NE 84-378	6.3fg	5.7e-g	6.3c-f	6.0e	53.3a
NE 84-45-3	6.3fg	5.7e-g	6.7c-f	5.3c-e	88.0bc
NE 84-436	7.0fg	5.3d-g	7.0c-f	5.3c-e	92.7bc
Bufflawn	4.0b-d	4.0b-d	6.0b-e	4.3bc	85.7bc
AZ143	5.3c-f	6.3fg	8.3f	6.0e	97.3c
Highlight 4	3.3ab	4.3b-e	5.3bc	4.0ab	93.3bc
Highlight 15	1.7a	1.3a	2.0a	3.0a	68.3a-c
Highlight 25	3.0ab	3.7bc	4.0ab	4.0ab	67.7ab
Prairie	3.3ab	3.7bc	5.7b-d	5.0b-e	71.7a-c
Rutgers	3.7bc	3.3b	5.3bc	4.7b-d	86.7bc
Sharp's Improved	5.7d-f	5.3d-g	7.7d-f	5.0b-e	93.3bc
NTDG-1	6.3fg	5.7e-g	7.7d-f	5.7de	94.3bc
NTDG-2	6.7fg	6.0fg	7.0c-f	6.0e	93.3bc
NTDG-3	5.7d-f	5.3	6.7c-f	5.7de	93.3bc
NTDG-4	6.3fg	5.0g-f	7.0c-f	6.0e	94.7bc
NTDG-5	6.0e-g	5.0c-f	7.0c-f	5.7de	93.3bc
Bison	5.7d-f	5.3d-g	6.7c-f	5.7de	92.7bc
BAM 101	4.3b-e	3.3b	6.0b-e	5.3c-e	85.0bc
BAM 202	5.3c-f	5.3d-g	7.7d-f	5.7de	93.3bc
Texoka	6.0e-g	5.3d-g	6.3c-f	5.3c-e	88.3bc

1991 NCR-10 Regional Alternative Turfgrass Species Evaluation

T.B. Voigt and J.E. Haley

Turfgrasses planted in low-management areas such as roadsides, industrial sites, and airports reduce noise, dust, and air pollution and must control soil erosion with limited maintenance inputs. In addition, many residential areas and parks normally accustomed to higher-quality turf now require tough turfgrasses due to recent hot and dry weather conditions, watering restrictions, environmental concerns, and management constraints.

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[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 Protected Least Significant Difference test.

[2] Quality evaluations are made on a1-9 scale where 9 = excellent turfgrass quality and 1 = very poor turfgrass quality.

[3] Color is evaulated on a scale of 1-9 where 1 = tan turf, 6 == minimal acceptable turf color and 9 = darkest green.

[4] Cover is based on the percent area of the plot covered with turfgrass.

A USDA-sponsored group of turf researchers from eleven Midwestern universities, the NCR-10 research committee, has evaluated sixteen little-used, low-maintenance turfgrasses at nine sites under very low-maintenance conditions. In this study, the grasses are grown without pesticides, irrigation, or fertilizers. In addition, they are maintained at three heights in an attempt to define appropriate mowing regimes.

Research Protocol:	**NCR-10 Regional Alternative Turfgrass Species Evaluation**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Site Preparation:	existing vegetation killed with Roundup; area rotary tilled; fertilized at 1 lb N/M.
Seeding/ Establishment:	seeding date - September 7, 1988; seeding/plugging rate - see Table 1; plot size - 3 ft x 10 ft; irrigation - to insure establishment; pesticides - preemergence application of Simazine.
Plot Maintenance: 1989	mowing height - 2, 4 inches, & unmowed; pesticides - none, weeded by hand 8/89; irrigation - none; fertilization - none .
1990	mowing height - 2, 4 inches, & unmowed, unmowed plots mowed to 4 inches 10/90; pesticides - broad spectrum postemergence broadleaf herbicide 10/90.
1991	mowing height - 2, 4 inches, & unmowed; pesticides - none; irrigation - none; fertilization - none.
1992	mowing height - 2, 4 inches, & unmowed; pesticides - none; irrigation - none; fertilization - none.
Experimental Design:	Strip Plot 3 replications.

1992 mowing heights. There were significant differences among the three turfgrass mowing heights on the April, July, August, September, and October, 1992 evaluations (Table 10). During these months when significant differences in mowing height occurred, the alternate species produced the highest quality turf when maintained at two or four inches. During the August, 1992 evaluation, alternate species maintained at four inches produced significantly higher quality than alternative species maintained at two inches or when left unmowed.

1992 replications. There were significant differences among the three replications throughout the 1992 evaluations (Table 11). Based on seven ratings made during 1992, the alternative turfgrasses generally produced the highest quality turf in the first and second replicates. Because all replications were grown with similar management and weather inputs, it is possible that ratings dissimilarities are the result of differences in the soil moisture-holding ability at the individual replication sites.

1992 species. Ruff crested wheatgrass did not germinate and received quality ratings of 1 throughout the 1992 evaluation period. Both buffalograss selections were planted using plugs which resulted in low ratings (2-4) due to limited plot coverage, lack of growth during cooler portions of the year, and inability to compete well with cool-season weeds. There were significant quality differences among species at each monthly evaluation (Table 12). Generally, quality ratings collected July through September reflect the cool, wet weather of the period. Monthly mean ratings of the highly rated Exeter colonial bentgrass, sheep fescue, and Alta tall fescue are shown in Figure 1. Note that none of these species provided season-long, high-quality turf.

Observations and recommendations. 1992 marks the final year of this study. Several observations and recommendations can be made after evaluating these grasses for the past four years.

1. Throughout the four year study, when there were significant differences in quality ratings among mowing heights, the mowed plots generally received higher ratings than did the unmowed plots.

2. None of the four wheatgrasses (*Agrppyron* spp.) performed well after the first year of the study. In general, these grasses lack the heat tolerance necessary to produce acceptable quality turf throughout most Central Illinois summers.

3. Neither of the two buffalograsses (*Buchloe dactyloides*) produced adequate quality turf over the duration of the study. This can be attributed to a lack of uniform plot coverage and to the seasonal growth pattern of these warm season grasses. The two buffalograsses were the only grasses in the study to be established vegetatively (plugs). The spread of these grasses was hindered by weed competition These grasses may produce an acceptable low-maintenance turf provided uniform coverage is achieved. Currently, a study in Urbana is evaluating these, and twenty other, buffalograsses to determine their potential turf uses in Illinois.

4. Reton red top (*Agrostis alba* 'Reton'), Covar sheep fescue (*Festuca ovina* 'Covar'), alpine bluegrass (*Poa alpina*), bulbous bluegrass (*Poa bulbosa*), and Reubens Canada bluegrass (*Poa compressa* 'Reubens') performed variably over the evaluation period. All of these cool-season grasses tended to perform better early in the growing season and decline as temperatures increased. Both alpine and bulbous bluegrasses declined severely following the 1989 growing season. Of this group of five species, Reton red top performed best, but none of these can be unconditionally recommended for any turf application.

5. Over the duration of the study, Exeter colonial bentgrass (*Agrostis tenuis* 'Exeter'), Alta tall fescue (*Festuca arundinacea* 'Alta'), Durar hard fescue (*Festuca ovina* var. *duriuscula* 'Durar'), sheep fescue (*Festuca ovina*), and Colt rough-stalked bluegrass (*Poa trivialis* 'Colt') generally performed at the top of the entire group (Figure1). Colt rough-stalked bluegrass performed relatively well during 1989 and 1990, but performed poorly in the heat and drought of 1991 and continued to perform poorly during 1992. Durar hard fescue also performed relatively well during 1989 and 1990, and declined during the last two years in the study. Exeter colonial bentgrass performed relatively well in 1989 and 1990, declined during 1991, but recovered to perform acceptably in 1992. Alta tall fescue and sheep fescue could be considered the overall top performers due to their relatively uniform performance throughout the evaluation. Both performed adequately in 1989 and 1990, and showed top performance through the heat and drought of 1991. Their performance in 1992 was also at he top of the group.

Based on this evaluation. Alta tall fescue and sheep fescue can be recommended for minimal maintenance sites as erosion controls. It appeared that these both of these grasses produced higher quality turf when mowed at four inches, however this cannot be universally supported statistically. It is important to remember that NONE of the grasses evaluated in this study, including Alta tall fescue and sheep fescue, produced turf that meets minimal standards for acceptable lawn grass quality.

Table 10. Alternative turfgrass quality at three mowing heights during 1992 growing season[1]

Mowing Heights	Months[2]						
	April	May	June	July	August	Sept.	Oct.
Two Inches	3.6b	3.5a	3.2a	3.3ab	3.3b	3.2a	3.3ab
Four Inches	3. 7b	3.6a	3.6a	3.6b	3.8c	3.6b	3.5b
Unmowed	3.1a	3.1a	3.0a	3.0a	3.0a	3.0a	3.0a

Table 11. Alternative turfgrass quality of three replications[1]

Replicates	Months[2]						
	April	May	June	July	August	Sept.	Oct.
Replicate One	3.6b	3.6b	3.5b	3.4b	3.4ab	3.4b	3.4b
Replicate Two	3.7b	3.6b	3.4b	3.4b	3.5b	3.4b	3.4b
Replicate Three	3.0a	3.0a	2.9a	3.1a	3.2a	3.0a	3.0a

[1]Turf quality data is based on a 1-9 scale where 1=tan turf, bare soil, lowest quality, 6=minimal turfgrass quality, and 9=darkest green, very dense, highest quality.

[2]Mean quality rating is the mean of forty-eight observations made of each height each month. 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.

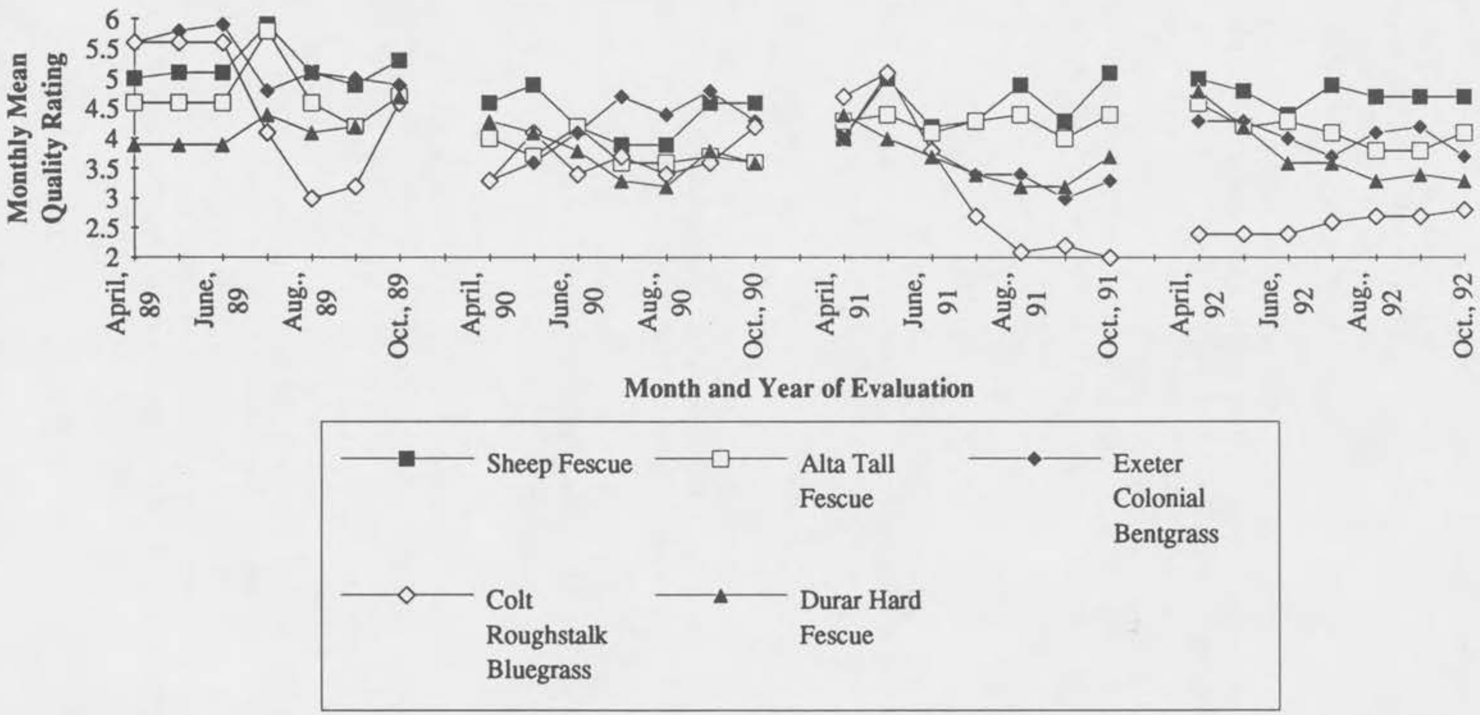
Table 12. The alternative turfgrasses, planting rates, and mean quality ratings for May, July and September, 1992.[1]

Species	Planting Rate lbs seed/M	Mean Quality Ratings[2] 5/92	7/92	9/92
Fairway Crested Wheatgrass *Agropyron cristatum*	4.3	3.1b-d	2.9bc	2.9bc
Emphraim Crested Wheatgrass *Agropyron desertorum* 'Emphraim'	4.2	2.8b	2.9bc	2.9bc
Ruff Crested Wheatgrass *Agropyron desertorum* 'Ruff'	6.2	1.0a	1.0a	1.0a
Sodar Streambank Wheatgrass *Agropyron riparium* 'Sodar'	4.2	3.8de	3.7ef	3.8de
Reton Red Top *Agrostis alba* 'Reton'	4.0	3.7c-e	3.7ef	3.7de
Exeter Colonial Bentgrass *Agrostis tenuis* 'Exeter'	3.8	4.3ef	3.7ef	4.2ef
NE 84-315 Buffalograss *Buchloe dactyloides* 'NE 84-315'	278 plugs/M	3.1b-d	3.4c-e	3.4cd
Texoka Buffalograss *Buchloe dactyloides* 'Texoka'	278 plugs/M	3.0bc	3.6d-f	3.2b-d
Alta Tall Fescue *Festuca arundinacea* 'Alta'	4.5	4.2ef	4.1f	3.8de
Durar Hard Fescue *Festuca ovina* var. *duriuscula* 'Durar'	4.2	4.2ef	3.6d-f	3.4cd
Sheep Fescue *Festuca ovina*	4.2	4.8f	4.9g	4.7f
Covar Sheep Fescue *Festuca ovina* 'Covar'	4.5	4.1ef	3.6d-f	3.7de
Alpine Bluegrass *Poa alpina*	4.0	3.0bc	3.0b-d	2.8bc
Bulbous Bluegrass *Poa bulbosa*	4.2	2.9b	3.1b-e	3.2b-d
Reubens Canada Bluegrass *Poa compressa* 'Reubens'	4.3	4.2ef	3.2c-e	3.2b-d
Colt Rough-stalked Bluegrass *Poa trivialis* 'Colt'	4.0	2.4b	2.6b	2.7b

[1]Turf quality is based on a 1-9 scale where 1=tan turf, bare soil, lowest quality, 6=minimal turfgrass quality, and 9=darkest green, very dense, highest quality.

[2]Mean quality rating is the mean of three replications (all mowing heights combined). 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.

Figure 1. 1989, 1990, 1991, and 1992 Quality Ratings for Five Alternative Turfgrasses



Evaluation of Perennial Ryegrass and Tall Fescue Cultivars for Adaptation to the Midwest

T.W. Fermanian and J.E. Haley

There has been a growing interest in using both perennial ryegrass (*L. perenne* L.) and tall fescue (*F.arundinaceae* L.) for medium to fine turfs throughout the Midwestern United States. Much of this interest has been generated because of a desire for a turfgrass species that is easy to establish, has strong seedling vigor, and provides a dense, fine-bladed, dark green turf. Improvements in both species has provided these characteristics and other strengths making these species ideal for use as turfgrasses.

Twenty-five years ago, very few cultivars of either species were available for turf use. Presently, over 75 cultivars of each species have been registered. Information on their relative turf performance and resistance to pest or environmental problems is incomplete.

A multiple experiment project was established in the fall of 1990 to examine various performance characteristics of a selected group of perennial ryegrass and tall fescue cultivars. The overall objectives of the project were:

1. To characterize their rooting system for both length and density,
2. To measure the establishment rate of the cultivars in ideal conditions.
3. To assess the general turfgrass quality characteristics under a medium level of maintenance.
4. To determine the relative ability of the selected cultivars to thrive in limited light,

Four separate experiments were established to meet these objectives. The results of the last two of these experiments will be reported. Experiments measuring the cultivars establishment rate to characterizing their rooting systems were reported in the *1991 Illinois Turfgrass Research Report.*

General performance evaluation. While many performance factors are of interest to Midwestern turf managers who must select a blend of turfgrass cultivars, the overall performance of the cultivars, as a turf, is often the deciding factor. Both perennial ryegrass and tall fescue cultivars establish quickly providing good-to-excellent turfs in a minimal amount of time. Since both species have a bunch-type growth habit, consistency of their turf quality varies greatly over time. An experiment was developed as part of this overall evaluation project to evaluate performance consistency of the selected cultivars.

An evaluation of the general performance of the cultivars (Table 13) was continued in the third growing season. Ratings were taken on 4/9/92, 5/7/92, 6/9/92, 7/8/92, 8/5/92, 9/8/92 and 10/7/92. These second year evaluations showed better performance of all of the tall fescue cultivars and Premium Kentucky bluegrass Sod Blend in comparison to the remaining cultivars. The 8/5/92 evaluation showed much lower overall performance of all cultivars with the perennial ryegrass and fine fescue cultivars

Research Protocol:	**Perennial Ryegrass and Tall Fescue Cultivar Evaluation: General Performance Test**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Site Preparation:	existing vegetation killed with Roundup; area rototilled, leveled and raked; fertilized at 1 lb N/M; mulched with straw following seeding.
Seeding/ Establishment:	seeding date - September 9, 1990; seeding rate - 4 lbs/M of perennial ryegrass and fine fescue, 6 lbs/M of tall fescue, 2 lbs/M of Kentucky bluegrass; plot size - 5 ft x 6 ft; irrigation - to insure germination.
Plot Maintenance: 1991	mowing height - 1.5 inches; irrigation - to prevent wilt; pesticides - none; fertilization - 1 lb N/M/yr.
1992	pesticides - postemergence broadleaf weed herbicide; fertilization - 3 lb N/M/yr.
Experimental Design:	RCB; 3 replications.

exhibiting the poorest general quality. Highly significant differences were found among all of the cultivars. There was a high degree of confounding with little general trends within a species. Performance increased by October but no significant differences among cultivars were found.

The disease Red Thread (*Laetisaria fuciformis*) was observed developing on many of the plots. An evaluation of the disease's effect on turf quality is shown in the last column in Table 13. All of the tall fescue and Kentucky bluegrass cultivars had minimal or no infection. The perennial ryegrass cultivars and fine fescue were variably infected; only 'Citation II', 'Manhattan II', and 'Pennfine' displayed resistance.

The general growth trends of each species over both years can be seen in Figures 1 & 2. Figure 1 shows the quality ratings for the tall fescue cultivars and 'Midnight' Kentucky bluegrass. The 'Midnight' Kentucky bluegrass response is shown with a thick, bold line for comparison to the tall fescue cultivars. Most of the tall fescue cultivars were rated with higher quality than the bluegrass over both seasons, however, not always significantly.

Figure 2 shows the quality ratings for the perennial ryegrass cultivars and 'Midnight' Kentucky bluegrass. Unlike the response of the tall fescue cultivars, most of the perennial ryegrass cultivars showed lower quality in late summer compared to 'Midnight' Kentucky bluegrass.

Table 13. The evaluation of 10 tall fescue cultivars, 10 perennial ryegrass cultivars, 1 fine fescue cultivars, 1 Kentucky bluegrass cultivar and 1 Kentucky bluegrass blend during the 1992 growing season.[1]

	Quality[2]							Red Thread[3]
Cultivars	4/9	5/7	6/9	7/8	8/5	9/8[ns]	10/7[ns]	7/8
Tall Fescue								
Arid	5.3c-e	7.7b-d	7.0d-g	5.3c-f	5.7e-g	5.0	7.0	9.0g
Galway	4.7a-c	7.0bc	7.3e-g	5.3c-f	5.7e-g	5.7	7.7	9.0g
Hounddog	5.3c-e	6.7b	7.3e-g	7.0fg	5.0c-g	4.7	7.0	9.0g
Mojave	4.7a-c	7.0bc	7.0d-g	5.3c-f	5.0c-g	4.7	6.3	8.3fg
Pacer	5.3c-e	7.0bc	7.7fg	6.0d-g	5.0c-g	4.0	6.0	9.0g
Rebel	6.0e	7.0bc	8.0g	6.7e-g	6.3g	3.3	5.7	9.0g
WVPB-88-TF-89-201	4.3ab	7.3b-d	8.3g	7.0fg	6.3g	3.3	6.3	9.0g
WVPB-88-TF-B-21	4.3ab	6.7b	7.0d-g	5.3c-f	4.7b-g	4.7	6.3	9.0g
WVPB-88-TF-C-10	5.7de	7.7b-d	8.0g	7.3g	6.0fg	3.3	6.7	9.0g
WVPB-88-TF-F-16	5.0b-d	7.3b-d	7.3e-g	6.0d-g	5.3d-g	4.3	6.3	8.3fg
Perennial Ryegrass								
Citation II	5.7de	8.3d	6.3c-f	4.7b-d	3.3a-c	4.7	6.0	6.0de
Delray	5.0b-d	7.7b-d	5.7b-d	3.7a-c	4.0a-e	3.3	6.7	4.3a-d
Manhattan II	5.7de	8.0cd	6.0b-e	4.7b-d	3.7a-d	3.3	6.3	5.0c-e
Patriot	5.3c-e	7.7b-d	5.3bc	3.0ab	3.7a-d	3.0	7.3	3.0ab
Pennfine	5.7de	7.3b-d	5.3bc	4.0a-c	4.3b-f	4.0	7.7	5.0c-e
Rodeo	5.0b-d	7.3b-d	4.7ab	3.0ab	3.0ab	3.7	6.7	3.3a-c
Stallion	5.7de	8.0cd	5.0a-c	3.0ab	3.3a-c	3.0	7.3	3.3a-c
WVPB-88-PR-89-57	5.0b-d	7.7b-d	5.3bc	3.0ab	4.7b-g	3.0	7.0	3.3a-c
WVPB-88-PR-D-10	5.7de	7.7b-d	6.0g-e	3.7a-c	3.7a-d	3.0	6.3	3.3a-c
WVPB-88-PR-D-12	5.7de	7.7b-d	5.7b-d	2.7a	3.7a-d	3.7	6.7	2.7a
Fine Fescue								
Pennlawn	5.3c-e	4.3a	3.7a	3.7a-c	2.3a	3.7	6.0	4.7b-d
Kentucky Bluegrass								
Midnight	4.0a	5.0a	5.7b-d	5.0c-e	5.0c-g	3.0	5.3	6.7ef
Premium Sod Blend	5.7de	6.7b	7.0d-g	4.3a-d	3.7a-d	2.7	5.3	8.3fg

[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 Protected 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]Red thread evaluations are made on a scale of 1-9 where 9 = no disease visible and 1 = turf necrosis as a result of disease infection.

[ns]No significant difference was found among the means in this group of data.

Figure 1. General quality of tall fescue cultivars grown in full sun for two years

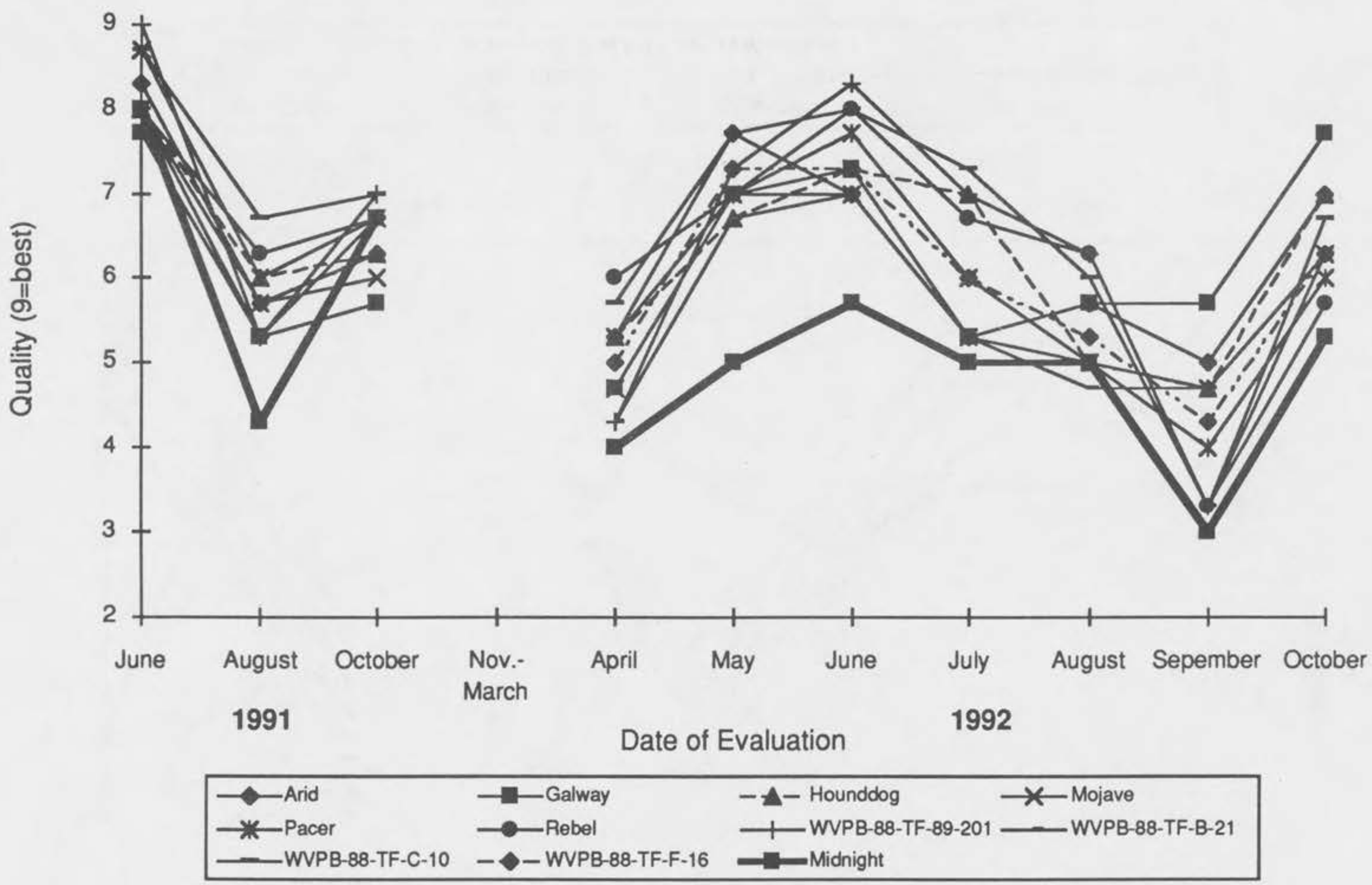
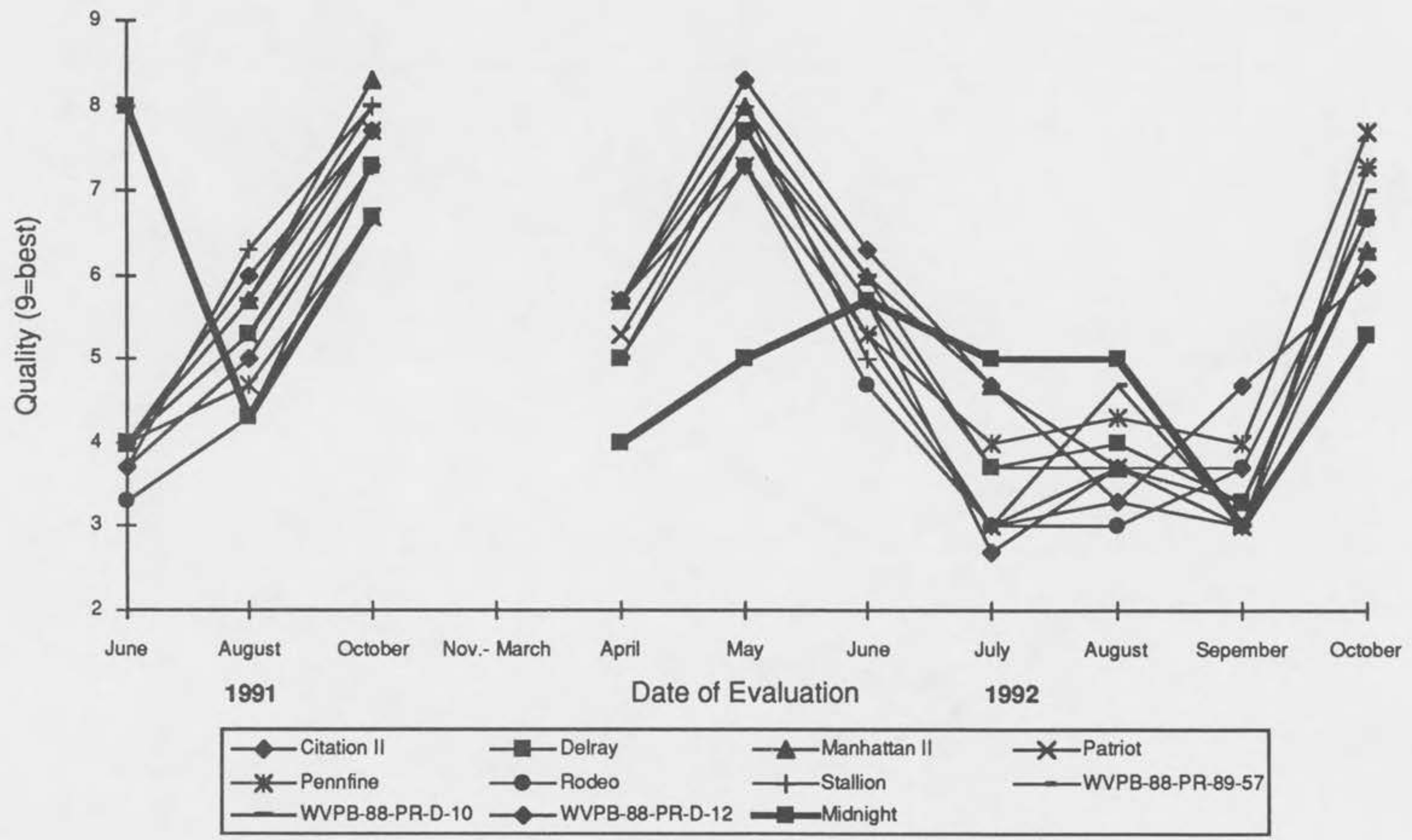


Figure 2. General quality of perennial ryegrass cultivars grown in full sun for two years



Shade adaptation of selected perennial ryegrass and tall fescue cultivars. Many turfed areas are in environments of low or limited light. In general, the performance of most cool season turfgrasses declines in shaded areas. Considerable varietal differences have been observed under these conditions. In an overall evaluation of turfgrass performance, it is quite useful to characterize the degree of vigor a cultivar displays in a shaded situation.

Research Protocol:	**Perennial Ryegrass and Tall Fescue Cultivar Evaluation : Under Shade**
Location:	Ornamental Horticulture Research Center, Urbana, IL; under canopy of mature (4-6" diameter) green ash trees.
Site Preparation:	existing vegetation killed with Roundup, (glyphosate, 2 applications); area mowed at 0.5 inches and vertically mowed with Ryan dethatcher; fertilized at 1 lb N/M; mulched with straw following seeding.
Seeding/ Establishment:	seeding date - August 28, 1990; seeding rate - 4 lbs/M of perennial ryegrass and fine fescue, 6 lbs/M of tall fescue, 2 lbs/M of Kentucky bluegrass; plot size - 5 ft x 6 ft; irrigation - to insure germination.
Plot Maintenance: 1991	mowing height - 1.5 inches; pesticides - none; irrigation - none; fertilization - 1 lb N/M/yr.
1992	pesticides - postemergence broadleaf weed herbicide; fertilization - 3 lb N/M/yr.
Experimental Design:	blocked in discontinuous groups; 3 replications.

Shade studies have been conducted, using various mechanisms, to induce lower light levels. Typically, studies are conducted with plastic, woven covers that reduce the light intensity reaching the turfgrass canopy. These covers can dramatically reduce air movement across the canopy, unfortunately. Ideally, shade studies should be conducted under natural tree cover to simulate both the reduced light and increased root competition found in most shaded turfs.

All evaluations of turfgrass quality were subjective evaluations (1-9) scale with 9 indicating optimal quality) of the uniformity of color, texture and density. They were taken on 4/8/92, 5/7/92, 6/9/92, 7/7/92, 8/5/92, 9/2/92 and 10/5/92. Means of analysis of variance for 6/9/92 and 9/2/92 were found to be significant as shown in Table 14.

In general the tall fescue varieties performed better than any of the other species. There were little differences observed within a species throughout the second growing season. Long-term performance will only be characterized after several additional years of evaluation.

Table 14. The evaluation of 10 tall fescue cultivars, 10 perennial ryegrass cultivars, 1 fine fescue cultivars, and 1 Kentucky bluegrass cultivar grown in the shade during the 1992 growing season.[1]

	Quality[2]						
Cultivars	4/8/92[ns]	5/7/92	6/9/92[ns]	7/7/92[ns]	8/5/92[ns]	9/2/92	10/5/92[ns]
Tall Fescue							
Arid	3.7	6.3cd	6.0	6.0	6.3	5.3d	4.7
Galway	2.3	4.7a-d	5.7	5.3	5.0	4.3a-d	4.0
Hounddog	2.3	4.0ab	4.7	4.7	4.7	3.3a-c	4.0
Mojave	2.7	5.0b-d	5.0	4.7	5.3	4.0a-d	4.3
Pacer	2.3	5.0b-d	6.0	5.3	5.0	4.3a-d	4.3
Rebel	3.0	6.7d	5.3	5.0	5.0	5.0cd	5.3
WVPB-88-TF-89-201	3.3	6.3cd	6.3	5.7	6.0	5.3d	5.7
WVPB-88-TF-B-21	3.0	5.3b-d	6.3	6.0	6.0	4.7b-d	5.7
WVPB-88-TF-C-10	3.3	6.7d	5.7	4.7	5.3	5.3d	6.3
WVPB-88-TF-F-16	3.0	6.3cd	5.3	4.3	4.3	4.3a-d	4.7
Perennial Ryegrass							
Citation II	2.7	4.3a-c	6.0	4.3	4.7	3.7a-d	3.7
Delray	2.3	4.0ab	4.7	4.0	4.0	3.0ab	3.7
Manhatten II	2.0	2.7a	5.3	4.0	4.0	2.7a	2.7
Patriot	2.3	5.0b-d	5.3	3.7	4.0	3.3a-c	4.3
Pennfine	2.7	4.0ab	5.0	4.0	4.3	3.7a-d	3.7
Rodeo	3.0	5.3b-d	6.7	4.7	5.0	5.0cd	5.0
Stallion	2.0	3.7ab	5.7	4.3	5.3	3.0ab	2.7
WVPB-88-PR-89-57	2.7	4.7a-d	6.7	5.0	5.7	4.3a-d	4.7
WVPB-88-PR-D-10	2.7	4.3a-c	5.7	4.7	5.3	4.3a-d	4.3
WVPB-88-PR-D-12	2.3	4.3a-c	6.7	4.7	5.3	3.7a-d	4.0
Fine Fescue							
Pennlawn	2.3	4.0ab	3.3	2.7	2.7	3.0ab	3.7
Kentucky Bluegrass							
Midnight	3.3	5.3b-d	4.0	4.0	4.7	2.7a	2.7

[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 Protected 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.

[ns] No significant difference was found among the means in this group of data.

Figures 3 and 4 present a summary of the observed quality trends in shade over the first two growing seasons. Figure 3 shows the quality ratings for the tall fescue cultivars, 'Pennlawn' red fescue and 'Midnight' Kentucky bluegrass. The 'Pennlawn' red fescue and 'Midnight' Kentucky bluegrass responses are shown with a thick, bold line for comparison to the tall fescue cultivars. Most of the tall fescue cultivars were rated with higher quality than the red fescue over both seasons, however, not always significantly.

Figure 4 shows the quality ratings for the perennial ryegrass cultivars and 'Pennlawn' red fescue and 'Midnight' Kentucky bluegrass. Unlike the response of the tall fescue cultivars, most of the perennial ryegrass cultivars showed similar quality in early spring as compared to red fescue and Kentucky bluegrass.

Figure 3. General quality of tall fescue cultivars grown in partial shade for two years

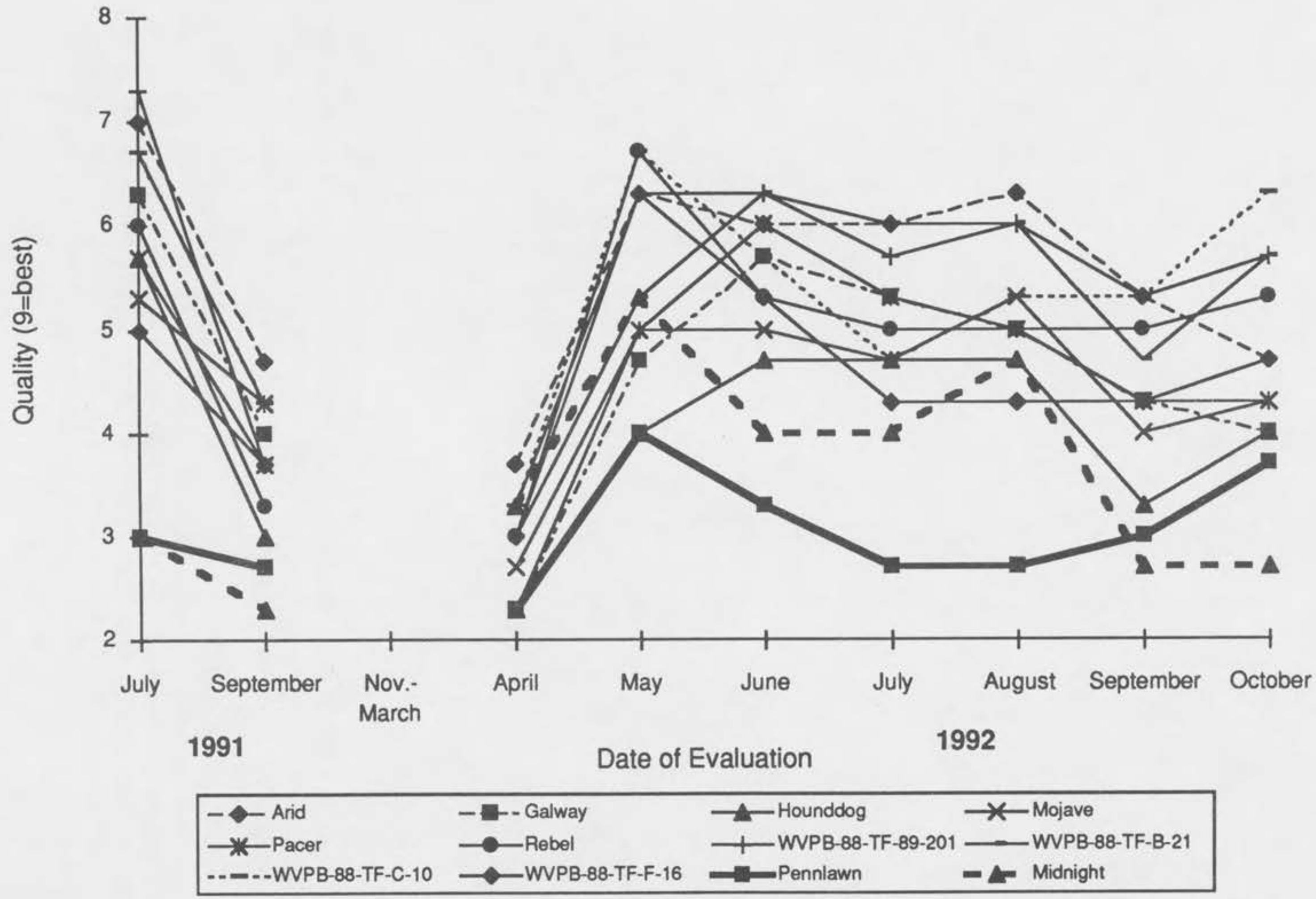
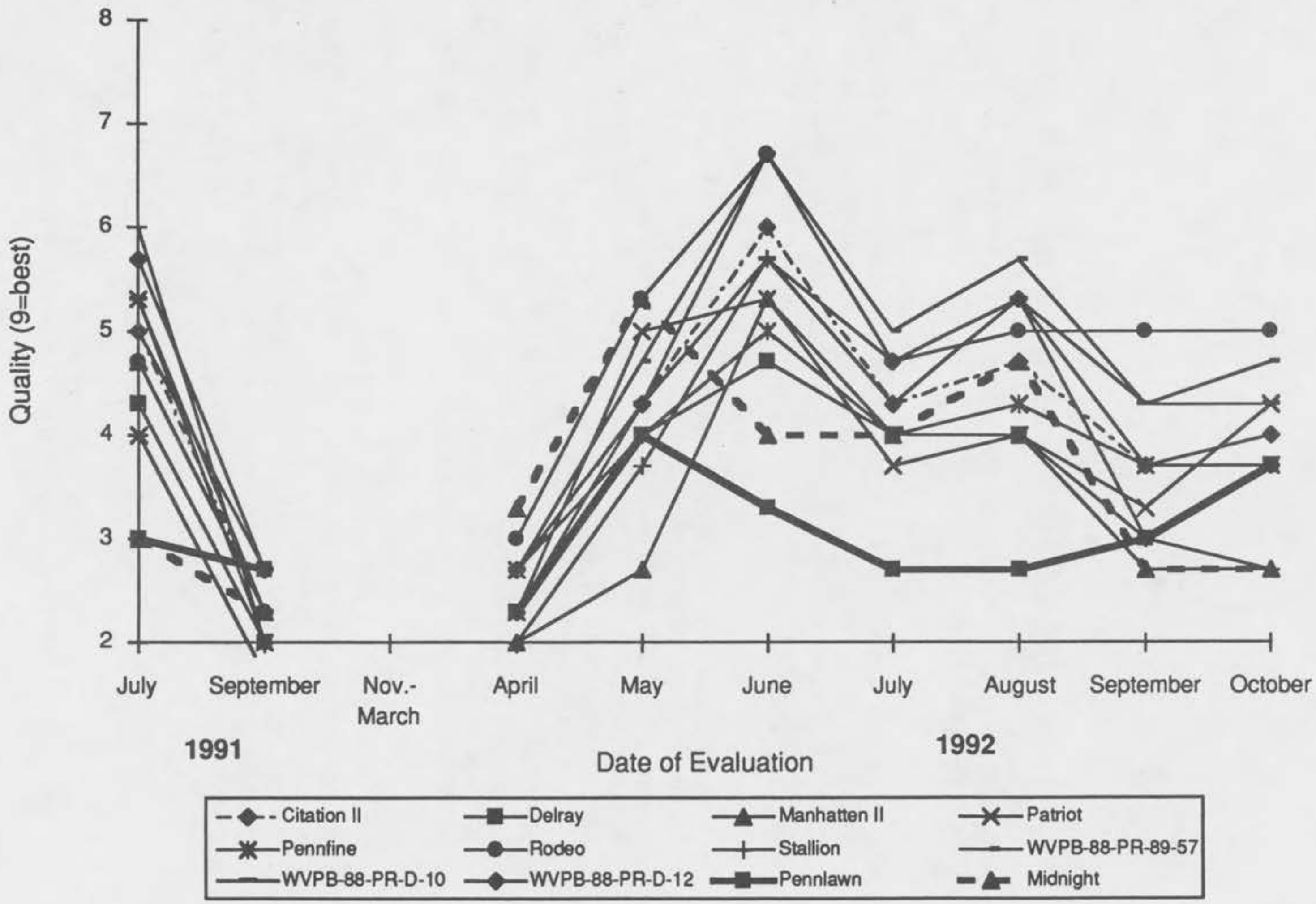


Figure 4. General quality of perennial ryegrass cultivars grown in partial shade for two years



Screening Kentucky Bluegrass Cultivars for Nitrogen Efficiency

A.F. Bertauski and D.J. Wehner

Kentucky bluegrass is the most widely accepted and utilized turfgrass found throughout cool season climates of the world. It is also found growing in transitional zones as well as arid and semi-arid conditions when irrigated (Beard, 1973). The vigorous spreading rhizome system is ideal in conditions where increased recuperative ability and density of turfgrass is in demand. Today approximately 70 cultivars are available for use. Among these, great variation has been noted in leaf texture, shoot density, color, growth habit, and disease resistance (Regional Turfgrass Evaluations).

Nitrogen is thought to be the mineral nutrient required in largest amount by plants. It can only be acquired by the plant through the root system from the soil solution. Most often the nitrogen in soil solution does not meet the requirements of plant growth, therefore fertilizer-nitrogen is commonly applied to the soil. In general, an appreciable increase in turfgrass color and density is observed when nitrogen is heavily applied. However, this is not a linear interaction. When nitrogen fertilizer applications reach excessive levels, carbohydrates are consumed almost exclusively in shoot production resulting in severe reduction in root growth, ultimately leading to poor plant health and even death. In addition to this, excessive nitrogen applications have an increased potential to move away from the actively absorbing root zone through leaching or runoff and can pollute viable water resources.

Many researchers have found variation of nutrient use among plants within a species (O'Sullivan et al., 1974; Maranville et al., 1980; Chevalier and Schrader, 1977), including Kentucky bluegrass cultivars (Mehall et al., 1983). This has been defined by Gerloff (1976) as mg dry weight/mg of nutrient in plant tissue and more recently by Siddiqi and Glass (1981) as biomass/nutrient concentration.

The purpose of this research is to screen Kentucky bluegrass cultivars under low nitrogen conditions and identify those that utilize less nitrogen to maintain acceptable qualities. By locating cultivars that use nitrogen more efficiently, fertilizer resources can be conserved without sacrificing quality, while the potential for NO_3 pollution from fertilizer will be reduced.

Research Protocol:	**Evaluating Kentucky Bluegrass Cultivars for Nitrogen Use Efficiency**
Location:	Plant Science Laboratory Greenhouse, Urbana, IL.
Experimental Conditions:	Static hydroponics system; 1.6 L pots supporting 3 plants each; nutrient solution approximately equivalent to quarter strength Hoagland's solution, with the exception of NO_3 concentration; High Intensity Discharge lights used as additional light source.
Fertility Treatments	Cultivars grown in nutrient solution for approximately 24 days, beginning 15 days after seeding; Nutrient solution is a low nitrogen solution, containing 280 uM NO_3 (4 ppm).
Experimental Design:	RCB; 7 reps; 14 cultivars per replication.

At present, results suggest significant differences among several cultivars in gram of total dry weight produced within the growing period and gram of shoot weight produced per gram of NO_3. There also appears to be significant differences in nutrient use in shoot and root production between species, that of tall fescue (*F. arundinacea*) and perennial ryegrass (*L.perenne*) and Kentucky bluegrass cultivars. Further evaluation is needed.

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Callus Level and Whole Plant Microculture Selection for More Salt Tolerant Creeping Bentgrass

Yu-Jen Kuo, M.A.L. Smith, L.A. Spomer

Creeping bentgrass (*Agrostis palustris* Huds.) is an outstanding cool season species used for golf greens, and bowling greens maintained at 0.2 to 0.3 inches cutting height. It is one of the most saline-tolerant of the cool season turfgrasses. 'Seaside' is a creeping bentgrass cultivar widely planted near the seashore, but it can not survive on soil which contains 120 meq L^{-1} of $CaCl_2$ and NaCl (260 meq L^{-1} total salts in seawater). However, callus induction in creeping bentgrass has been achieved from mature embryos by incubating in MS media with 2,4-D as a hormone source, and regenerated plants have been obtained on hormone free MS media. However, there are no reports of successful salt tolerant whole-plant selection via cell culture of this species. In vitro selection for salt-tolerant cell lines has been conducted for tomato, wheat , barley, tobacco and Kentucky bluegrass. Single step exposure of induced callus to the selective agent has been used to select a desirable genotype. A whole plant microculture (WPMC) system has recently been developed which permits intact root growth observation through the culture medium and vessel. In this report, in order to efficiently screen for potential cell-level salt tolerance, a single-step selective method from callus culture was used to isolate putative salt tolerant lines. Plantlets were regenerated and re-screened in a WPMC system to determine if cell-level selection resulted in plants with whole plant level tolerance. The morphology of callus and plant regeneration was studied using scanning electron microscopy.

Salt screening at the callus level. Yellow callus was induced from the axes of embryos in 2,4-D treated media in 1 wk. The explants on 1 mg L^{-1} 2,4-D medium showed significantly faster growth (63.1 mm^2) than those on 5 mg L^{-1} (34.6 mm^2) and on 10 mg L^{-1} (24.8 mm^2) after 4 wk. The seeds on 2,4-D free medium only germinated and did not produce callus. At the initial stage, only watery calli were observed; compact callus was enhanced after subculture for 1 or 2 passages. This type of compact callus demonstrated a high frequency of somatic embryogenesis on plant regeneration medium. Plantlets were regenerated from both the Na_2SO_4 free (153 plants) and stress (91 plants from 0.5%, 136 plants from 1.0%, 25 plants from 1.5%) regeneration medium within 5 months. The agar solidified Na_2SO_4 stress medium supplied a simple approach to select Na_2SO_4 tolerant plants in our experiment. Our selective method could avoid the cell suspension cultural problems of lost regenerative competence in the selected cell lines.

WPMC screening test. Microculture plants could be generated on WPMC medium and the growth of roots and shoots were viewed through gelrite solidified medium. The mean root number, root area and shoot area of WPMC plants derived from seedlings, or plants regenerated from callus grown on 0, 0.5%, 1.0% or 1.5% Na_2SO_4 stress media were exhibited in Table 15. The root number of seedling plants and non-selected plants grown on Na_2SO_4 free WPMC medium were significantly greater than selected plants. However, the number of roots was not related to root area and shoot area. The root area of seedling plants was markedly lower than selected plants; similarly, the shoot area of seedling plants was markedly lower than the 1.0% Na_2SO_4 selected plants when grown on Na_2SO_4 free WPMC medium. The non-selected plants showed significantly greater root area and shoot area than 0.5% Na_2SO_4 selected plants when grown on 0.5% Na_2SO_4 stress WPMC medium, but there were not significant differences

Materials and Methods

Salt screening at the callus level: Before dehusking, seeds of Seaside creeping bentgrass were surface sterilized. Twenty dehusked caryopses were cultured on 30 ml MS medium with 30 g L^{-1} sucrose, 8 g L^{-1} agar, and 0, 1, 5, or 10 mg L^{-1} 2,4-D. There were 80 replications per treatment, and the experiment was repeated 1 time. All cultures were incubated in the dark at 24 ± 1°C for 4 wk in a growth chamber. Callus area was then determined at this stage using video image analysis. Mean separation was analyzed by LSD (Student's t) at the 5% level of significance. Since the measurement was non-intrusive, the callus was subsequently separated from the initial explant and subcultured for use in maintenance and in regeneration experiments. After 4 wk, callus was transferred to 30 ml fresh MS medium with 1 mg L^{-1} 2,4-D in 15 x 100 mm disposable petri dishes, and incubated under 24-h cool-white fluorescent lighting (36 μmol m^{-2} s^{-1}) at 26 ± 2°C. After 4 wk, green tissue was generated on the surface of the callus, 0.5 ±0.1 g of this callus was exposed to 20 ml media with 0.1 mg L^{-1} 6-(r,r-dimethylallylamine) purine (2iP) and 0, 0.5%, 1.0%, or 1.5% Na_2SO_4 in a pyrex text tube, and incubated in the same environmental conditions as for subculture. After an additional 4 wk, regenerated plantlets were transplanted into soil:peat:vermiculite (1:1:1 v:v:v) mix in 170 cm^3 plastic pots, then acclimated in a high-humidity growth chamber. After 7-d, the transplants were transferred to a glasshouse under mist (5 sec at 10 min intervals) for 1 week, then to a greenhouse bench for further growth (salt free) for 9 wks (25°C/20°C day/night). The morphological changes of callus was observed by scanning electron microscopy (SEM).

WPMC screening test: The same developmental stage of nodal stolon segments (2.5-3.0 cm) from seedlings, non-selected plants (regenerated from callus grown on Na_2SO_4-free medium), and selected plants (regenerated from callus grown on Na_2SO_4-containing saline stress medium) was harvested from the plants in the greenhouse. Nodal explants were sterilized, and each explant was placed in a pyrex test tube containing 20 ml of media with 30 g L^{-1} sucrose, 1 mg L^{-1} indole acetic acid (IAA), 2.5 g L^{-1} gelrite, and either 0, 0.5%, 1.0%, or 1.5% of Na_2SO_4. Nodes from seedling plants were explanted only on salt free or 1.0% Na_2SO_4 medium. Nodes from selected plants from each putative salt tolerant plant were explanted on both salt free medium, and on medium with the same Na_2SO_4 concentration used during callus regeneration. Non-selected plants were explanted on all media formulations for comparison. Cultures were incubated for 4 wk under the same environmental conditions as used during plant regeneration. Evaluations of root number, root area (mm^2), and shoot area (mm^2) of each WPMC were made using video image analysis.

in root area between the two treatments. The root number of seedling plants grown on 1.0% Na_2SO_4 stress WPMC medium was significantly greater than the non-selected and 1.0% Na_2SO_4 selected plants, but the root area of seedling plants was markedly lower than for non-selected plants and 1.0% Na_2SO_4 selected plants; the shoot area of 1.0% Na_2SO_4 selected plants was significantly greater than seedling plants. The seedling plants generated only short root systems and terminated extension growth on 1.0% Na_2SO_4 stress medium after 10 to 14 days. The growth of non-selected plants and 1.5% Na_2SO_4 selected plants showed no marked differences when grown on 1.5% Na_2SO_4 stress WPMC medium. The root number of non-selected plants grown on Na_2SO_4 free WPMC medium was significantly greater than for plants grown on Na_2SO_4 stress WPMC medium. However, no marked differences in root area and shoot area were noted when plants were grown on Na_2SO_4 free and Na_2SO_4 stress WPMC medium. The Na_2SO_4 stress selected plants grown on both Na_2SO_4 free and Na_2SO_4 stress WPMC medium showed no marked differences on root number, root area, and shoot area, respectively. The putative salt tolerant regenerated plants from callus showed instability when vegetative characteristics were screened on WPMC prescreening system. The selected plants exhibited probably only salt adaptation at the callus level.

In conclusion, callus induction and plant regeneration via somatic embryogenesis was achieved from seed explants of 'Seaside' creeping bentgrass. The putative salt-tolerant plants selected from callus were unstable with regard to salt tolerance, but improved the ability of plants recovered from stress medium to grow under salt stressful conditions as revealed in the subsequent WPMC screen after compared to seedling plants. However, the root number may not be a valid criterion to verify salt tolerance stability compared to measuring the root area and shoot area in our WPMC screen system. The tolerance mechanisms of salt-tolerant regenerates requires further study over a number of seed generations.

Table 15. Mean root number, root area and shoot area of whole plant microculture plants of creeping bentgrass Seaside derived from seedlings (seed), or plants regenerated from callus on 0, 0.5%, 1.0%, or 1.5% Na_2SO_4 stress media. Plants were grown at various concentrations of Na_2SO_4 for 4 wk in the whole plant microculture screen system. Data were collected by video image analysis.

Treatment of microcultured plants [Na_2SO_4(%)]	Source of explants for WPMC	Root Number	Root Area (mm^2)	Shoot area (mm^2)
0	0*	8.7bcC**	214.1bcA	1160a-eA
	0.5	5.2a	249.7c-e	1176b-e
	1.0	5.3a	268.4de	1222de
	1.5	5.0a	247.3c-e	1158a-e
0.5	0	5.3aAB	272.7eA	1246deA
	0.5	5.0a	218.2bc	1025ab
1.0	Seed	9.2c	134.5a	1021a
	0	4.5aA	222.2b-dA	1154a-eA
	1.0	5.3a	257.4cde	1328e
1.5	0	5.4aB	262.2deA	1182c-eA
	1.5	4.8a	223.0b-d	1121a-d

*Numbers indicate that plants regenerated from callus were the source of explantsfor WPMC and each munber is the percentage of Na_2SO_4 in the medium.

**Means followed by the same lowercase (source of explants and treatment differences) and (treatment differences) letters are not significantly different at the 0.05 probability level by Student's t test.

TURFGRASS MANAGEMENT EVALUATIONS AT THE UNIVERSITY OF ILLINOIS

The Evaluation of a Tall Fescue Blend at 4 Fertility Levels and 3 Mowing Heights

J.E. Haley and T.B. Voigt

Research Protocol:	**Tall Fescue Management Evaluation**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Seeding/ Establishment:	establishment date - spring,1989; turf - mature Triathalawn tall fescue (Bonanza, Olympia, and Apache blend); plot size - 3 ft x 10 ft; pesticides - none.
Fertility Treatments:	0 lb N/M; 2 lbs N/M/y rapplied 1 lb in May & Sept; 4 lbs N/M/yr applied 0.5 lb in June, July & 1 lb in May, Aug., Oct.; 6 lbs N/M/yr applied 0.5 lb Apr, July & 1 lb in May, June, Aug., Sept.,Oct.; fertilizers were broadcast by hand.
Mowing Treatments:	1 inch, 2 inches, 3 inches mowing height; A rotary mower was used and clippings were removed and discarded.
Plot Maintenance:	mowing height - 1, 2 & 3 inches; pesticides - none, weeded by hand 8/89; irrigation - none;
1989	fertilization - treatments applied on May 10, June 1, June 22, July 14, Aug. 11 Sept. 12, Oct. 11.
1990	fertilization - treatments applied on Apr. 17, May 18, June 21, July 11, Sept. 13 & Oct. 19.
1991	fertilization - treatments applied on Apr. 26, May 28, June 20, Aug. 5, Aug. 28, Sept. 26, Oct. 21.
1992	fertilization - treatments applied on Apr. 23 May 19, June 16, July 15, Aug. 21, Sept. 22, Oct. 15.
Experimental Design:	strip plot (fertilization, randomized in block, mowing height stripped); 3 replications.

Research indicates that the improved tall fescue cultivars have retained all the good drought, heat and wear tolerance needed in a low maintenance turf. However, it is not yet known how management practices effect the overall quality of these improved cultivars. The purpose of this study is to evaluate the effects of nitrogen fertilization and mowing height on the quality of turf-type tall fescue. Quality and weed population evaluations are reported in Table 16.

Tall fescue quality was highest where the turf was fertilized with 4 or 6 lbs of nitrogen annually and when mowed at 2 or 3 inches in height. Weed populations (both annual grasses and broadleaf weeds) were greatest in the unfertilized plots or plots fertilized with 2 lbs N annually. Turf maintained at the 1 inch mowing height had the largest weed populations. Based on these preliminary results, it appears that improved tall fescue cultivars benefit from nitrogen fertilization. They should be mowed at a minimum of 2 inches in height.

Table 16. The evaluation of 4 fertility levels and 3 mowing heights when applied to a tall fescue turf blend during the 1992 growing season.[1]

Fertility Level[4]	Quality[2] 4/21	5/18	6/16	7/9	8/6	9/8	10/7	Weed Cover[3] 9/8
0 lb	5.1a	5.2a	4.7a	4.2a	4.6a	4.7a	4.1a	25.1a
2 lbs	6.6b	6.3b	7.2b	6.4b	5.7b	5.4ab	5.8b	15.9a
4 lbs	6.7b	6.9bc	7.7bc	7.4c	6.7c	6.8c	6.6b	10.3b
6 lbs	7.4c	7.4c	8.3c	8.7d	6.7c	7.0c	7.6c	9.3c
Mowing Height								
1 inch	6.2a	5.2a	6.0a	5.8a	5.1a	5.3a	4.5a	34.8c
2 inches	7.1b	7.2b	7.4b	7.1b	5.9b	6.4b	6.6b	8.1b
3 inches	6.1a	7.0b	7.5b	7.2b	6.7c	6.2b	6.9b	2.7a

[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 Protected 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] Weed cover is evaluated as % cover of the plot with weeds, both broadleaf and crabgrass.

[4] Fertility refers to the total amount of nitrogen in pounds per 1000 square feet applied annually.

CULTIVAR EVALUATIONS AT SOUTHERN ILLINOIS UNIVERSITY, CARBONDALE, IL

NTEP Kentucky Bluegrass Cultivar Trial

K.L. Diesburg and A. Griffin

Kentucky bluegrass (*Poa pratensis*) is the mainstay of turf throughout central to northern Illinois as well the rest of the upper midwest. In southern Illinois, it persists to a limited extent and is usually dominated by tall fescue, zoysiagrass, or bermudagrass, whichever happens to be present. In this region it has a tough time surviving in low-management situations so southern Illinois is an excellent place to test the heat, drought, or poor soil tolerance of Kentucky bluegrass. Kentucky bluegrass will persist and actually thrive, however, in this transition zone if it receives adequate supplemental nutrition, and timely irrigation. For this reason the new national trial, established during fall 1990, was organized by the USDA into two separate experiments, high and low management. The lineup of entries is different between the two trials because there are many cultivars adapted specifically to heat and drought stress, whereas other cultivars will do well only under high management, low stress conditions.

Research Protocol:	**NTEP Kentucky Bluegrass Cultivar Trial**
Location:	Southern Illinois University, Carbondale, IL.
Site:	soil - Hosmer silt clay loam.
Seeding/ Establishment:	seeding date - September 20, 1990; seeding rate - 3 lbs seed/M; plot size - 5 ft x 5 ft;
Plot Maintenance:	mowing height - 1.5 inches, high maintenance and 2.25 inches, low maintenance; irrigation - to prevent stress, high maintenance and none, low maintence; pesticides - Ronstar in April, Dacthal in June, Turflon D in April and Nov.; fertilization - 6 lbs N/M/yr (SCU & UF), high maintenance and 1 lb N/M/yr, low maintenance.
Experimental Design:	RCB; 3 replications.

During this second year after establishment the cultivars are approaching the turf quality you could expect of newly mature Kentucky bluegrass turf. The slower growing cultivars have recently caught up to the fast-establishing cultivars. Their advantage in color, slow growth, and lower canopy under high management is starting to become apparent. As long as sufficient moisture and nutrients are provided the cultivars best adapted to high management at a lower clipping height will rank in the upper half of Table 1. Under low management cultivar adaptation is entirely different (Table 2). Even at a higher mowing height, prolonged heat and lack of moisture take its toll on cultivars lacking physiologic and morphogenic mechanisms to withstand summer stress. In general, the slow-growing cultivars that excel under high management, often lack these mechanisms. A few of the top-ranking cultivars under low management have an aggressive spreading growth habit to the point of encroachment upon adjacent plots of less persistent cultivars. As this trend continues over the next few years, data will be presented identifying the cultivars superior in this regard.

Table 1. Performance of Kentucky bluegrass cultivars under high management.[1]

	Quality[2]							
Cultivar	April	May	June	July	August	Sept.	Oct.	Average
Georgetown	8.0	7.0	7.0	7.3	7.7	8.0	9.0	7.7
Midnight	7.0	7.7	7.0	7.3	8.0	8.7	8.0	7.7
Aspen	7.3	7.3	6.7	7.0	8.0	7.7	8.3	7.5
Cynthia	7.0	7.3	7.7	7.7	7.3	7.3	8.0	7.5
Blacksburg	7.0	7.0	6.7	7.7	8.0	8.0	7.7	7.4
Glade	6.3	7.0	7.0	8.0	8.0	8.3	7.0	7.4
Ba 76-305	7.0	7.0	7.7	7.3	7.3	7.7	7.7	7.4
BAR VB 895	7.3	6.7	6.7	6.7	7.7	8.3	8.3	7.4
PST-1DW	6.7	6.7	7.0	7.7	8.0	7.7	8.0	7.4
PSU-151	7.3	7.3	6.3	7.7	7.3	7.7	7.7	7.3
Conni	6.3	7.3	7.3	7.7	7.3	8.0	7.3	7.3
J11-94	8.0	7.3	6.7	6.0	7.0	7.3	8.3	7.2
602	7.0	7.0	6.7	6.7	7.3	8.3	7.7	7.2
Trampass	7.0	6.7	7.3	7.0	7.7	7.7	7.3	7.2
J-335	7.0	7.3	6.7	6.3	7.3	8.3	7.7	7.2
NuStar	6.7	7.0	7.0	7.0	7.7	8.0	7.0	7.2
PST-B8-13	6.3	6.7	7.0	7.0	7.7	8.3	7.3	7.2
Dawn	7.0	6.7	6.3	7.3	7.0	7.3	8.0	7.1
Classic	7.7	6.0	6.7	6.7	7.0	7.3	8.3	7.1
Ram-1	7.0	7.0	6.7	7.0	7.0	7.3	7.7	7.1
Julia	6.3	7.0	7.0	6.0	7.3	8.0	7.7	7.0
A-34	6.7	6.3	7.0	6.3	7.7	7.7	7.7	7.0
PST-B8-106	7.0	6.7	6.7	6.7	7.0	7.7	7.7	7.0
Touchdown	6.3	7.0	7.3	6.7	7.3	7.3	7.3	7.0
PST-A7-1877	6.7	7.7	6.7	6.3	7.0	7.3	7.3	7.0
1757	7.3	6.0	6.7	6.3	6.7	7.7	8.3	7.0
J-386	7.3	7.0	6.3	6.3	6.7	7.3	8.0	7.0
Merit	7.0	7.0	6.7	6.3	6.7	7.0	8.3	7.0
EVB 13.703	7.3	6.3	6.7	7.0	7.3	6.7	7.7	7.0
BAR VB 7037	7.3	5.3	6.3	7.3	7.3	8.0	7.3	7.0
J-333	7.3	6.7	6.3	6.3	7.0	7.7	7.7	7.0
Kenblue	7.7	6.7	6.3	6.0	7.0	6.7	8.3	7.0

(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 Protected 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.

Table 1. Performance of Kentucky bluegrass cultivars under high management.[1] (continued)

Cultivar	Quality[2]							
	April	May	June	July	August	Sept.	Oct.	Average
EVB 13.863	6.3	6.7	6.7	6.3	7.7	7.7	7.3	7.0
798	5.7	7.0	7.3	7.7	7.3	7.7	6.0	7.0
Barmax	8.3	6.0	5.7	6.0	7.0	7.0	8.7	7.0
PST-R-740	7.0	7.3	6.3	6.0	7.0	7.3	7.7	7.0
Ba 73-381	6.0	7.0	6.7	6.0	8.0	8.0	7.0	7.0
Cardiff	7.0	7.3	6.7	6.3	7.0	7.3	7.0	7.0
PST-A84-928	6.3	6.7	6.7	7.3	7.3	7.3	7.0	7.0
J13-152	6.7	7.0	6.7	6.3	7.0	7.7	7.0	6.9
KWS Pp 13-2	7.0	6.7	6.7	6.3	6.7	7.3	7.7	6.9
H86-712	6.7	6.7	7.0	6.3	6.7	7.7	7.3	6.9
SR 2000	6.0	7.0	7.3	7.0	7.0	7.0	7.0	6.9
Washington	7.0	6.7	6.3	6.7	7.0	7.0	7.7	6.9
Trenton	7.3	6.7	6.7	6.3	7.0	7.0	7.3	6.9
Eagleton	6.3	6.0	6.7	6.7	7.7	8.0	7.0	6.9
Ampellia	6.7	6.3	7.0	7.0	7.0	7.0	7.3	6.9
Opal	7.0	6.7	6.7	6.7	6.7	7.3	7.3	6.9
J-229	6.3	7.0	6.7	6.7	7.0	7.3	7.3	6.9
NE 80-47	7.0	7.0	6.0	6.3	7.0	6.7	8.0	6.9
Barsweet	6.7	6.0	6.7	7.7	7.7	6.9	6.8	6.9
Ba 69-82	6.0	7.0	7.0	6.3	7.0	7.7	7.0	6.9
Platini	7.0	6.0	6.0	6.0	7.0	7.7	8.3	6.9
PST-0514	6.0	7.3	7.0	6.7	7.3	7.3	6.3	6.9
Minstrel	6.0	6.7	6.7	7.0	7.3	7.3	7.0	6.9
Gnome	6.7	7.0	6.0	6.7	6.3	7.7	7.7	6.9
SR 2100	5.7	7.0	7.0	7.0	7.0	7.7	6.7	6.9
Able I	6.3	6.7	7.3	6.3	7.0	7.7	6.7	6.9
Crest	6.0	7.0	6.7	6.3	7.3	7.3	7.0	6.8
Destiny	6.3	6.3	6.7	7.0	7.3	7.3	6.7	6.8
Greenley	7.0	5.7	6.7	6.0	7.0	7.3	8.0	6.8
PST-A7-341	7.3	6.0	5.7	6.7	7.0	7.0	8.0	6.8
Ba 77-700	6.0	7.3	6.7	6.7	7.3	6.7	7.0	6.8
Banff	6.3	6.7	7.0	7.0	6.7	7.0	7.0	6.8

(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 Protected 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.

Table 1. Performance of Kentucky bluegrass cultivars under high management.[1] (continued)

Cultivar	Quality[2]							
	April	May	June	July	August	Sept.	Oct.	Average
Ba 73-540	6.3	6.7	6.7	7.0	7.0	7.0	7.0	6.8
Coventry	7.0	6.3	6.0	6.7	7.0	7.0	7.7	6.8
PST-A84-405	5.3	6.3	7.0	7.0	7.3	8.0	6.3	6.8
Haga	7.3	6.7	6.0	6.7	6.7	6.3	7.7	6.8
Ba 77-292	6.3	7.0	6.3	6.3	6.7	7.3	7.3	6.8
Ba 73-382	6.3	7.0	7.0	6.7	6.7	7.0	6.7	6.8
Cobalt	6.7	6.7	6.7	6.3	7.0	7.0	7.0	6.8
Liberty	6.7	6.7	6.0	6.3	7.0	7.0	7.7	6.8
Abbey	6.3	6.7	6.0	7.0	6.3	7.3	7.7	6.8
Ba 77-279	6.0	7.0	7.3	6.7	6.7	7.3	6.3	6.8
Ba 78-258	6.0	7.0	6.3	6.3	7.0	7.7	6.7	6.7
Livingston	6.7	6.7	6.0	6.3	6.3	7.7	7.3	6.7
Challenger	6.0	6.7	7.0	6.0	7.3	7.3	6.7	6.7
Nassau	5.7	7.3	7.0	6.3	6.7	7.3	6.7	6.7
Freedom	6.0	7.0	6.7	6.3	7.3	7.0	6.7	6.7
Silvia	6.3	6.7	6.7	6.3	7.0	7.7	6.3	6.7
Monopoly	7.0	6.0	6.3	6.7	6.7	6.7	7.3	6.7
Marquis	6.0	6.7	5.7	6.7	7.0	8.0	6.7	6.7
Barblue	6.3	6.0	6.0	7.0	7.0	7.3	7.0	6.7
Melba	5.7	6.7	6.7	6.3	7.0	7.3	6.7	6.6
J34-99	6.0	6.0	6.3	6.7	7.0	7.7	6.7	6.6
Barzan	6.0	6.3	6.7	6.7	7.0	6.7	7.0	6.6
PST-HV-116	6.0	5.0	6.0	7.3	7.0	7.7	7.3	6.6
PST-UD-12	6.3	6.3	7.0	6.0	7.0	6.7	7.0	6.6
PR-1	6.3	6.7	6.0	6.0	7.0	7.0	7.3	6.6
Bartitia	5.7	5.7	6.0	7.0	7.3	8.0	6.7	6.6
Miracle	6.3	5.7	5.7	6.3	7.3	7.7	7.3	6.6
Chelsea	6.7	6.3	5.7	6.7	6.7	7.0	7.0	6.6
Limousine	6.7	5.3	6.3	6.7	6.7	6.7	7.3	6.5
HV 125	6.3	6.3	6.3	6.3	6.0	7.0	7.3	6.5
PST-RE-88	6.7	5.7	6.0	6.3	6.7	7.3	7.0	6.5
Ba 70-131	6.3	6.0	6.3	6.0	6.3	7.3	7.3	6.5

(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 Protected 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.

Table 1. Performance of Kentucky bluegrass cultivars under high management.[1] (continued)

	Quality[2]							
Cultivar	April	May	June	July	August	Sept.	Oct.	Average
Eclipse	5.7	7.0	6.0	6.3	6.7	7.3	6.7	6.5
WW Ag 505	6.3	5.7	6.3	5.7	6.7	7.7	7.3	6.5
Fortuna	5.3	7.0	6.7	6.7	7.0	7.0	6.0	6.5
Princeton 104	5.7	6.0	6.0	6.7	7.0	7.3	6.7	6.5
Broadway	5.7	7.0	6.3	6.3	6.7	7.0	6.3	6.5
Indigo	6.0	6.3	6.7	6.7	6.3	6.7	6.7	6.5
Noblesse	5.7	6.3	6.3	6.7	7.3	7.0	6.0	6.5
BAR VB 1184	5.3	6.7	6.3	7.0	6.7	7.3	5.7	6.4
Donna	5.3	5.7	6.3	6.7	7.3	7.7	6.0	6.4
PST-UD-10	5.7	6.7	6.3	6.3	7.0	7.0	6.0	6.4
Ba 73-336	6.0	6.3	5.7	6.3	6.7	7.0	6.7	6.4
PST-A84-803	6.0	6.7	5.3	5.7	6.3	7.3	7.0	6.3
Ginger	5.7	6.0	6.7	6.3	6.3	7.0	6.3	6.3
South Dakota Common	6.3	5.7	6.0	6.0	6.3	7.0	7.0	6.3
PST-C-76	5.3	5.7	6.0	6.3	7.0	8.0	6.0	6.3
Merion	6.0	6.0	5.7	6.3	6.7	7.0	6.7	6.3
Estate	6.3	5.3	5.7	6.7	6.7	7.0	6.3	6.3
Ronde	6.0	6.3	5.3	6.3	6.7	7.0	6.3	6.3
Summit	5.3	6.3	6.3	6.0	6.3	7.0	6.3	6.2
Baron	5.3	5.3	6.0	6.0	7.0	7.7	6.3	6.2
PST-C-224	7.0	6.3	5.0	5.0	6.0	6.7	7.7	6.2
Miranda	5.3	6.0	6.3	6.3	6.7	7.0	6.0	6.2
BAR VB 1169	6.3	5.0	5.3	6.0	6.7	7.0	7.3	6.2
Suffolk	5.3	5.7	6.3	6.3	6.3	7.3	6.0	6.2
Ba 74-114	5.3	6.0	6.0	6.3	6.7	7.0	6.0	6.2
Alpine	5.7	6.0	5.7	5.7	6.7	6.7	6.7	6.1
R751a	5.7	6.0	5.3	6.7	6.0	6.7	6.3	6.1
Kelly	6.0	6.0	5.3	5.3	5.7	6.7	6.7	6.0
WW Ag 508	5.0	4.3	6.0	6.0	6.7	7.0	6.0	5.9
$LSD_{0.05}$	1.5	1.8	1.4	1.3	1.2	1.3	1.6	0.8

[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 Protected 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.

Table 2. Performance of Kentucky bluegrass cultivars under low management.[1]

Cultivar	Quality[2]							
	April	May	June	July	August	Sept.	Oct.	Average
Alene	5.7	8.3	8.0	7.3	8.3	8.3	9.0	7.9
ISI-21	6.3	7.7	7.3	7.3	7.0	8.3	9.0	7.6
GEN-RSP	6.3	7.3	7.0	7.0	7.0	7.3	5.7	6.8
Cobalt	6.3	6.0	7.0	5.7	6.0	7.0	8.0	6.6
PST-A7-111	6.0	6.0	6.3	6.3	6.0	7.0	8.0	6.5
Merion	6.3	6.0	5.7	6.0	6.0	7.7	7.3	6.4
Baron	4.7	6.3	6.7	6.3	6.3	6.7	6.7	6.2
Suffolk	6.3	5.3	5.7	5.7	6.3	6.3	7.3	6.1
PST-C-76	5.3	6.7	6.7	6.7	6.0	6.7	5.0	6.1
KWS Pp 13-2	5.0	6.3	6.3	5.7	6.3	6.7	6.0	6.0
ZPS-84-749	5.3	5.7	6.3	5.3	5.3	6.3	7.7	6.0
Washington	5.3	5.7	5.7	5.7	5.0	6.3	7.0	5.8
South Dakota Common	4.7	5.3	6.0	5.7	6.0	5.7	7.3	5.8
Opal	5.3	5.3	6.0	5.0	5.3	6.0	7.3	5.8
J-229	5.0	5.3	5.7	5.7	5.7	6.0	6.3	5.7
Kenblue	5.0	5.3	5.7	5.3	5.7	5.7	6.3	5.6
J-335	5.3	5.0	5.0	5.3	5.3	5.7	7.0	5.5
798	5.7	5.0	5.3	4.7	5.0	6.0	6.3	5.4
Freedom	4.7	4.7	5.0	5.3	5.3	5.7	6.7	5.3
BAR VB 895	4.7	5.3	5.3	5.3	5.0	6.0	5.3	5.3
Barmax	5.3	4.3	4.7	5.0	5.0	5.3	6.3	5.1
H76-1034	4.7	4.7	5.3	4.7	4.3	5.7	6.7	5.1
Midnight	4.3	4.3	4.7	4.7	4.0	5.7	7.0	5.0
Monopoly	4.0	5.0	5.0	5.3	5.0	5.3	4.7	4.9
Ba 78-376	5.0	4.0	5.0	4.3	4.0	5.0	6.3	4.8
NE 80-47	4.0	4.7	5.3	4.7	4.7	5.0	5.3	4.8
Liberty	3.7	4.7	5.7	4.7	4.7	5.0	5.3	4.8
NJIC	4.0	4.7	5.0	4.3	4.7	5.3	5.3	4.8
NuStar	5.3	4.0	5.0	4.0	4.0	4.7	6.0	4.7
Chelsea	5.3	4.0	4.7	3.7	4.7	5.0	5.7	4.7
Gnome	4.7	4.3	5.3	5.3	4.0	5.0	3.7	4.6
Livingston	5.0	4.0	4.0	4.0	5.0	5.0	5.0	4.6

(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 Protected 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.

Table 2. Performance of Kentucky bluegrass cultivars under low management.[1] (continued)

Cultivar	Quality[2]							
	April	May	June	July	August	Sept.	Oct.	Average
Merit	3.3	4.0	5.0	4.3	5.0	5.0	5.3	4.6
Voyager	5.0	3.7	4.0	4.0	4.7	5.0	5.3	4.5
Crest	5.3	4.0	4.7	4.3	4.0	4.3	5.0	4.5
Barsweet	5.3	3.3	4.0	4.0	3.7	4.3	6.3	4.4
Park	5.0	3.7	4.3	4.0	4.3	5.0	4.3	4.4
J-386	5.3	3.7	4.0	4.0	4.3	4.3	5.0	4.4
Ba 74-017	5.0	3.0	4.0	4.0	4.3	4.0	6.3	4.4
Bronco	3.3	3.7	4.0	4.0	4.7	4.7	6.3	4.4
MN 2405	5.0	3.7	4.7	3.3	4.7	4.0	5.0	4.3
PST-C-303	3.3	3.7	4.3	4.0	4.3	4.7	6.0	4.3
Haga	4.3	3.3	3.7	3.7	4.3	4.3	5.0	4.1
Unknown	4.0	3.3	3.3	3.7	3.3	4.3	6.7	4.1
BAR VB 7037	3.0	4.0	4.0	4.3	4.0	4.0	4.1	4.1
Miracle	3.3	3.3	4.3	3.7	3.7	4.3	5.0	4.0
Amazon	3.0	3.3	3.3	3.7	4.3	5.7	3.9	4.0
Barzan	4.3	3.3	3.3	4.0	4.0	4.3	4.0	3.9
BAR VB 1169	3.3	3.3	3.3	3.7	3.7	4.3	5.0	3.8
EVB 13.703	4.3	3.0	4.0	2.3	3.7	4.0	5.0	3.8
PST-C-391	6.7	2.3	2.0	3.0	2.7	3.7	5.3	3.7
Ram-1	3.7	3.0	3.7	3.3	3.3	3.7	4.3	3.6
Kyosti	4.0	3.0	3.3	2.3	3.7	3.7	4.7	3.5
PST-YQ	4.3	3.3	3.3	3.3	2.3	3.3	4.3	3.5
Fortuna	5.3	2.7	3.0	2.3	3.0	3.0	3.7	3.3
SR 2000	4.3	3.0	2.7	2.7	3.0	3.3	4.0	3.3
Sophia	5.0	2.3	2.7	2.3	2.7	3.0	4.3	3.2
Destiny	4.0	2.3	2.7	1.7	2.7	3.0	4.0	2.9
Bartitia	3.7	2.0	2.3	2.7	2.7	3.3	3.7	2.9
BAR VB 1184	4.0	1.7	2.3	2.0	2.7	2.3	3.0	2.6
EVB 13.863	3.7	1.7	2.3	1.3	2.3	2.0	2.7	2.3
Cynthia	3.3	1.3	1.3	1.7	2.0	2.3	3.7	2.2
$LSD_{0.05}$	2.7	3.2	3.3	3.1	3.2	3.2	3.2	1.9

[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 Protected 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.

NTEP Perennial Ryegrass Cultivar Trial

K.L. Diesburg and A. Griffin

Research Protocol:	**NTEP Perennial Ryegrass Cultivar Trial**
Location:	Southern Illinois University, Carbondale, IL.
Site:	soil - Hosmer silt clay loam.
Seeding/ Establishment:	seeding date - September 20, 1990; seeding rate - 6 lbs seed/M; plot size - 4 ft x 5 ft.
Plot Maintenance:	mowing height - 1.5 inches; irrigation - to prevent stress, pesticides - Ronstar in April, Dacthal in June, Turflon D in April and Nov.; fertilization - 4 lbs N/M/yr (SCU & UF);
Experimental Design:	RCB; 3 replications.

Perennial ryegrass (*Lolium perenne*) has come a long way since 1961 when NK-100 was released as the first cultivar specifically for turf. The USDA initiated a national turfgrass evaluation program of 47 entries in 1982. During the ensuing four years, there were enough releases of new cultivars to warrant the testing of a second trial containing 65 entries in 1986. In 1990, an even larger trial with 123 entries was organized and distributed for national testing. Perennial ryegrass does not persist well in the transition zone, but it is used extensively in species mixes as a nurse species for the slower establishing tall fescue and zoysia. It is also used in pure stand as a specialty grass in golf course tees and collars, or in any higher management situation where a high-quality cover is needed quickly.

The differences among perennial ryegrass cultivars are subtle when moisture, temperature, and nutrients are optimum and no pests are present. Differences occur in shade of green, texture, and density. There was little environmental stress in 1992 as long as irrigation was supplied. Temperatures were moderate. As a result, differences among cultivars (Table 3) are not dramatic. This demonstrates that any cultivar ranking in the top 7/12 of the list would provide very good quality turf if stress was avoided. Stress from moisture and disease have separated cultivars more significantly in the past (see *1991 Illinois Turfgrass Research Report*).

Table 3. Performance of perennial ryegrass cultivars under moderate management.[1]

Cultivar	Quality[2]							
	April	May	June	July	August	Sept.	Oct.	Average
GEN-90	8.7	8.0	7.7	7.3	7.3	7.3	7.3	7.7
SR 4200	7.7	7.0	7.7	8.0	7.3	8.0	7.3	7.6
Mom Lp 3184	7.3	7.3	7.3	7.0	7.7	8.0	8.0	7.5
2H7	7.7	6.3	7.3	7.3	8.3	8.0	7.7	7.5
Assure	9.0	6.7	6.7	6.7	7.3	8.0	7.7	7.4
4DD-Delaware Dwar	9.0	6.7	6.7	7.0	7.7	7.3	7.7	7.4
Pleasure	7.3	6.7	7.3	7.0	7.7	7.3	8.7	7.4
PST-2FF	8.0	6.7	7.0	7.0	7.3	7.7	8.0	7.4
PST-23c	8.7	6.7	6.7	6.7	7.0	7.7	8.0	7.3
PST-GH-89	7.7	7.0	7.0	7.0	7.3	7.0	8.3	7.3
PR 9108	6.0	6.7	7.0	7.7	7.3	8.0	8.7	7.3
WVPB 89-92	7.0	6.7	7.0	7.0	7.7	8.0	8.0	7.3
Koos 90-2	7.0	6.7	6.7	7.3	7.7	7.7	8.0	7.3
PST-2DPR	7.7	7.0	6.7	7.3	7.0	7.0	7.7	7.2
Dandy	7.7	6.0	6.7	7.3	7.3	7.3	8.0	7.2
WVPB-89-PR-A-3	8.3	6.7	7.0	7.0	7.0	7.0	7.0	7.1
OFI-F7	7.3	6.7	7.0	7.0	6.7	7.3	8.0	7.1
Mom Lp 3147	8.0	6.7	6.7	6.3	6.7	7.3	8.3	7.1
Mom Lp 3185	5.7	6.7	7.3	7.3	7.0	7.7	8.3	7.1
LDRD	7.7	6.7	6.3	6.7	7.0	7.0	8.7	7.1
P89	8.3	6.7	7.0	7.0	7.0	6.7	7.0	7.1
CLP 144	5.7	6.0	7.0	7.3	7.0	8.0	8.7	7.1
MVF 89-90	6.0	6.3	7.0	6.7	7.3	8.0	8.3	7.1
Sherwood	8.0	7.3	7.3	6.7	6.3	6.7	7.3	7.1
C-21	5.7	6.7	7.0	7.0	7.0	8.0	8.3	7.1
Pick 89-4	8.3	6.0	6.7	6.3	6.7	7.0	8.7	7.1
Riviera	7.0	6.7	6.3	6.7	7.3	7.3	8.0	7.0
Express	7.7	6.3	6.0	6.0	7.0	7.7	8.7	7.0
Pennant	6.0	6.7	6.7	6.7	7.0	7.7	8.7	7.0
Seville	7.7	6.3	6.0	6.3	7.3	7.3	8.3	7.0
Pick EEC	7.7	6.3	6.3	6.3	6.7	7.7	8.3	7.0

(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 Protected 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.

Table 3. Performance of perennial ryegrass cultivars under moderate management.[1] (continued)

Cultivar	Quality[2]							
	April	May	June	July	August	Sept.	Oct.	Average
ZPS-28D	8.7	6.0	6.7	6.3	6.7	7.3	7.7	7.0
Charger	7.0	6.7	6.7	6.3	7.0	7.3	8.3	7.0
Barrage	7.0	6.3	6.7	6.7	7.3	7.3	8.0	7.0
Essence	7.3	6.3	6.3	7.0	7.0	7.3	7.7	7.0
Pinnacle	8.0	6.0	6.7	7.0	7.0	7.0	7.3	7.0
Duet	6.3	6.0	7.0	6.7	7.3	7.3	8.3	7.0
Envy	7.3	6.0	6.7	6.0	6.7	8.0	8.0	7.0
Fiesta II	6.3	6.7	6.7	7.0	7.3	7.3	7.3	7.0
Competitor	7.0	5.7	6.3	7.0	6.7	8.0	8.0	7.0
89-666	8.0	6.0	6.0	7.0	7.0	7.0	7.7	7.0
Koos 90-1	8.0	6.0	6.3	6.3	6.7	7.7	7.7	7.0
N-33	6.7	6.0	5.7	6.3	7.0	8.3	8.3	6.9
Gettysburg	7.0	5.7	6.3	6.3	7.0	7.7	8.3	6.9
Pick 9100	7.7	6.3	6.7	7.3	6.3	6.7	7.3	6.9
Syn-p	8.0	6.3	6.0	6.0	6.7	7.0	8.3	6.9
Accolade	5.0	6.7	6.7	7.0	7.0	7.0	8.7	6.9
PST-2ROR	8.3	6.0	6.3	6.3	6.7	7.0	7.3	6.9
PST-20G	7.3	6.0	6.3	6.0	6.7	7.3	8.3	6.9
PST-28M	8.3	6.0	6.3	6.3	7.0	6.7	7.3	6.9
Pick 1800	8.3	6.7	6.0	6.7	6.3	7.0	7.0	6.9
PS-105	6.7	6.7	6.0	6.0	7.3	7.3	7.7	6.8
PR 9109	6.7	6.0	6.3	6.3	6.7	7.3	8.3	6.8
NK 89001	4.7	6.3	7.0	6.7	7.7	7.0	8.3	6.8
WM-II	7.0	6.0	6.0	6.3	7.0	7.3	8.0	6.8
PST-2FQR	7.0	5.3	6.0	6.3	7.3	7.7	7.7	6.8
856	5.3	6.3	6.7	6.7	6.7	7.7	8.0	6.8
APM	8.0	5.7	6.3	6.3	6.3	7.0	7.7	6.8
Citation II	8.0	5.7	5.7	6.0	6.7	7.7	7.7	6.8
Gator	6.7	6.3	6.0	6.7	6.7	7.7	7.3	6.8
Danilo	6.0	6.0	6.7	6.7	7.0	6.7	8.3	6.8
Advent	7.0	6.0	6.7	6.3	6.7	7.0	7.7	6.8

(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 Protected 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.

Table 3. Performance of perennial ryegrass cultivars under moderate management.[1] (continued)

Cultivar	Quality[2]							
	April	May	June	July	August	Sept.	Oct.	Average
Pebble Beach	7.0	5.3	6.0	6.7	7.0	7.3	7.7	6.7
PST-290	7.3	5.7	6.7	7.0	6.7	6.3	7.3	6.7
Danaro	4.3	5.7	6.3	7.0	7.0	7.7	9.0	6.7
WVPB-88-PR-C-23	4.3	7.0	7.0	6.7	7.0	7.0	8.0	6.7
MVF 89-88	5.7	6.0	6.3	7.3	6.7	7.0	8.0	6.7
Barrage ++	6.3	6.0	6.7	6.3	6.3	7.3	8.0	6.7
PR 9118	6.3	6.7	6.7	6.3	6.7	6.7	7.3	6.7
Regal	6.0	6.0	6.0	6.7	7.0	7.3	7.7	6.7
Manhattan	6.7	6.0	6.3	6.7	6.3	7.0	7.7	6.7
2p2-90	8.3	6.3	6.0	6.0	6.3	6.7	7.0	6.7
EEG 358	5.7	4.7	5.7	7.0	7.0	7.7	8.7	6.6
Pick DKM	7.7	6.0	6.0	6.0	7.3	6.7	6.7	6.6
PR 9119	6.3	6.0	6.3	6.3	6.7	7.0	7.7	6.6
PST-2B3	6.7	6.0	6.0	6.3	6.7	6.7	8.0	6.6
Taya	6.3	6.7	7.0	6.3	6.3	6.7	7.0	6.6
Repell	6.7	5.3	5.7	6.3	6.7	7.3	8.0	6.6
Saturn	6.0	6.0	6.3	6.3	6.3	7.3	7.7	6.6
CLP 39	5.3	6.3	6.3	6.0	6.3	7.3	8.3	6.6
Entrar	6.0	5.7	6.0	6.3	6.3	7.7	7.7	6.5
Legacy	6.7	5.7	6.3	6.0	6.7	7.0	7.3	6.5
WVPB-89-87A	7.0	6.0	6.0	6.0	6.7	6.7	7.3	6.5
Pick 89LLG	6.7	6.0	6.7	6.0	6.3	7.0	7.0	6.5
Cutless	6.0	6.3	5.7	6.7	7.0	6.7	7.3	6.5
Caliente	5.3	6.0	6.0	6.7	7.3	7.0	7.3	6.5
Lindsay	7.3	6.0	6.0	6.0	6.3	6.7	7.3	6.5
ZPS-2EZ	4.0	6.3	6.0	6.3	7.0	7.3	8.3	6.5
WVPB-88-PR-D-10	5.7	6.0	6.3	6.0	6.3	7.0	8.0	6.5
Derby Supreme	6.3	5.7	6.0	6.0	6.7	7.0	7.7	6.5
HE 311	6.0	5.3	6.0	6.3	7.0	7.7	7.0	6.5
Rodeo II	4.0	6.0	6.0	6.7	7.0	7.3	8.0	6.4
Allegro	6.0	5.7	6.3	6.7	6.7	6.3	7.3	6.4

(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 Protected 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.

Table 3. Performance of perennial ryegrass cultivars under moderate management.[1] (continued)

Cultivar	Quality[2]							
	April	May	June	July	August	Sept.	Oct.	Average
Stallion	5.0	5.7	6.0	7.0	6.7	7.0	7.7	6.4
Ovation	4.3	6.0	6.3	7.0	7.0	6.7	7.7	6.4
Commander	5.3	6.0	7.0	6.0	6.0	6.7	8.0	6.4
Premier	6.0	6.0	6.7	6.0	6.3	6.7	7.0	6.4
Target	6.7	5.0	5.3	5.7	6.7	7.3	8.0	6.4
Calypso	6.0	5.7	6.0	6.0	6.7	6.3	7.7	6.3
Cartel	4.7	6.0	6.7	6.0	6.7	7.0	7.3	6.3
Loretta	6.0	6.0	5.3	5.3	6.3	7.0	8.3	6.3
WVPB-88-PR-D-12	6.7	5.7	6.0	6.3	6.3	6.3	7.0	6.3
Equal	6.0	4.7	5.7	6.3	6.7	7.0	8.0	6.3
Meteor	5.3	6.0	6.3	6.7	6.7	6.3	7.0	6.3
PR 9121	7.3	6.0	5.7	5.7	6.0	6.3	7.0	6.3
OFI-D4	5.3	5.3	5.7	6.3	6.3	7.0	8.0	6.3
LDRF	6.7	5.7	6.0	6.0	6.3	6.3	7.0	6.3
Nomad	6.3	5.0	6.0	5.7	6.3	6.7	8.0	6.3
Bar Lp O86FL	4.7	5.7	5.3	6.3	7.3	6.7	7.7	6.2
Patriot II	5.7	5.3	5.3	6.0	6.7	7.0	7.3	6.2
Bar Lp 852	4.3	6.0	6.0	6.3	6.3	6.7	7.0	6.1
Mom Lp 3179	5.0	5.7	6.0	6.0	6.3	6.7	6.7	6.0
ZW 42-176	3.0	5.7	7.0	6.3	6.0	6.7	7.3	6.0
Toronto	4.3	5.7	5.7	6.0	6.3	6.7	7.3	6.0
Troubadour	4.0	5.3	5.7	6.7	6.0	6.7	7.3	6.0
Poly-SH	5.3	5.0	5.3	5.7	6.0	7.0	7.3	6.0
Unknown	5.0	5.7	5.3	5.3	6.0	6.3	7.7	5.9
Pennfine	3.7	5.7	5.7	6.0	6.3	6.7	7.0	5.9
Mom Lp 3182	6.3	4.7	5.0	5.7	5.7	6.0	7.3	5.8
Surprise	3.0	5.0	5.7	6.0	7.0	7.0	7.0	5.8
Goalie	3.7	5.0	5.3	6.0	6.3	6.3	7.3	5.7
Mom Lp 3111	4.7	4.3	5.7	5.7	6.0	6.0	6.7	5.6
Linn	2.0	4.0	4.0	4.3	5.0	5.7	6.3	4.5
$LSD_{0.05}$	1.9	1.4	1.5	1.3	1.5	1.5	1.3	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 Protected 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.

NTEP Tall Fescue Trial

K.L. Diesburg and A.M. Telle

Research Protocol:	**NTEP Tall Fescue Cultivar Trial**
Location:	Southern Illinois University, Carbondale, IL.
Site:	soil - Hosmer silt clay loam.
Seeding/ Establishment:	seeding date - September 14, 1992; seeding rate - 7 lbs seed/M; fertilization - 0.5 lb N/M (1-4-2) and 20 lb lime/M; plot size - 5 ft x 5 ft.
Plot Maintenance:	mowing height - 2.25 inches; irrigation - to insure germination; pesticides - siduron, preemergence; fertilization - 1 lb N/M, six weeks after germination.
Experimental Design:	RCB; 3 replications.

Tall fescue (*Festuca arundinacea*) is the dominant turfgrass species in southern Illinois. The combination of prolonged hot summers, poor soil, and periodic drought make the environment too harsh for Kentucky bluegrass in non-irrigated areas. In areas where a cool season turf is desired tall fescue is generally chosen. Many new tall fescue cultivars have become available that have the characteristics desired in a high quality turf. This year, a new national trial was planted at selected sites across the country. Many dwarf and semi-dwarf tall fescue types are included. The seedling vigor data in Table 4 indicates the speed at which each entry could be expected to reach a mature sod.

Considering the large LSD, there is a great deal of similarity among cultivars that have shorter plant heights. Greater differences among cultivars are evident at higher plant heights.

Table 4. Seedling vigor of entries in the National Tall Fescue Cultivar Trial, 31 days after seeding.[1]

Entry	Plant Height (cm)	Entry	Plant Height (cm)
Arid	10.7	FA-22	6.0
Anthem	9.3	PST-5STB	6.0
SR 8010	9.0	PRO-9178	5.8
SR 8200	8.8	FE-19	5.8
PSTF-LF	8.5	BAR Fa 2AB	5.8
Austin	8.2	Avanti	5.8

(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 Protected Least Significant Difference test.

Table 4. Seedling vigor of entries in the National Tall Fescue Cultivar Trial, 31 days after seeding (continued).[1]

Entry	Plant Height (cm)	Entry	Plant Height (cm)
SR 8300	8.2	Trailblazer II	5.7
Falcon	8.2	M-2	5.7
Guardian	8.0	Shenandoah	5.7
KWS-DSL	8.0	SIU-1	5.5
ATF-006	7.8	MB-21-92	5.5
ZPS-ML	7.8	Bonsai Plus	5.3
BAR Fa 0855	7.5	Monarch	5.3
Ky-31 w/endo	7.5	ZPS-E2	5.3
ZPS-J3	7.3	PST-RDG	5.3
Finelawn 88	7.3	Duke	5.3
Lancer	7.2	ISI-ATK	5.3
Phoenix	7.2	Vegas	5.3
PSTF-401	7.2	Excalibur	5.3
SR 8400	7.2	Pick 90-12	5.3
ISI-CRC	6.8	Pick CII	5.3
Minx	6.8	Finelawn Petite	5.3
WXI-208-2	6.8	ISI-AFA	5.2
Bonanza II	6.8	Tomahawk	5.2
CAS-MA21	6.7	MB-22-92	5.0
PST-5DX w/endo	6.7	Micro DD	5.0
Ky-31 no endo	6.7	ATF-007	5.0
Eldorado	6.7	Lexus	5.0
SFL	6.5	Rebel, Jr.	5.0
Astro 2000	6.5	Pixie	5.0
MB-25-92	6.5	PST-5PM	5.0
Twilight	6.5	PSTF-200	4.8
Cambridge	6.5	OFI-TF-60	4.8
Rebel-3D	6.5	Olympic II	4.8
BAR Fa 214	6.5	SR 8210	4.7
403	6.5	Pick 90-10	4.7
CAS-LA20	6.3	Pick 90-6	4.7
Virtue	6.3	PST-5LX	4.7
ZPS-VL	6.3	ISI-AFE	4.7
Safari	6.3	ITR-90-2	4.7
Cochise	6.2	MB-23-92	4.7
PST-5VC	6.2	QS-ST2	4.5
Montank	6.0	Leprechaun	4.3
GEN-91	6.0	Bonanza	4.3
Kittyhawk	6.0	MB-24-92	4.0
Cafa101	6.0	Silverado	4.0
J-1048	6.0	QS-RH2	3.7
PST-59D	6.0	Bonsai	3.5
$LSD_{0.05}$	2.6		2.6

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

Performance of Tall Fescue Cultivars at Belleville

K.L. Diesburg and A.O. Siegel

Research Protocol:	**Performance of Tall Fescue Cultivars at Belleville, IL**
Location:	Cardinal Creek Golf Course, Belleville, IL.
Site:	golf course rough.
Seeding/ Establishment:	seeding date - September 10, 1989; seeding rate - 6 lbs seed/M; plot size - 4 ft x 5 ft.
Plot Maintenance:	mowing height - 2.0 inches; irrigation - none,; pesticides - Scott's Goosegrass and Crabgrass Control; fertilization - 1.5 lbs N/M/yr (SCU & UF).
Experimental Design:	RCB; 3 replications.

Tall fescue is a species that has potential for use in a variety of situations. It has a high degree of heat and drought tolerance. When drought occurs, tall fescue goes into dormancy approximately three weeks later than Kentucky bluegrass. With higher management, the newer cultivars produce a beautiful lawn. There are many new tall fescue cultivars to choose from, some which are geneticaly similar. Most of them perform well during favorable weather conditions. However, it is important to determine which cultivars will perform well during periods of stress. The data presented here was taken from a tall fescue trial established on a golf course rough (Table 5). In most cases, a golf course rough will undergo a higher degree of stress than most home lawns. A rough is generally managed at the same level of fertility as a home lawn but with no irrigation. To allow faster play, a rough is usually mowed shorter than a home lawn. The cultivars in this trial are in the third growing season and the more persistent cultivars are becoming apparent.

Since 1991, the quality of Crossfire, PSTF-1, Kentucky 31, and Gala has dropped, while the quality of Thunderbird and Era has improved. Winchester, Cimarron, Arid and Bonzai have ranked among the highest in performance during 1991 and 1992.

Table 5. Tall fescue cultivar quality established on a rough at Cardinal Creek golf course.[1]

Entry	Quality[2]	Entry	Quality[2]
Winchester	7.3	Pacer	5.7
Rebel II	7.0	Jaguar	5.7
PSTF-S	6.5	Maverick II	5.7
Rebel Jr.	6.3	Galway	5.7
Era	6.3	Amigo	5.7
Cimarron	6.3	PSTF-1	5.3
Bonzai	6.3	Carefree	5.3
Arid	6.3	Willamette	5.3
Olympic	6.0	Gala	5.3
Mustang	6.0	Arriba	5.3
Thunderbird	6.0	8953	5.3
Apache	6.0	Taurus	5.3
Bonanza	6.0	Adventure	5.0
Trailblazer	6.0	Houndog	5.0
Wrangler	6.0	Crossfire	5.0
Elderado	6.0	Silverado	4.7
Falcon	5.7	Murietta	4.7
Monarch	5.7	Richmond	4.3
Mirage	5.7	Kentucky 31	3.8
$LSD_{0.05}$	1.6		1.6

[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 Protected 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.

Establishment and First Year Performance of the NTEP Zoysiagrass Cultivar Trial

K.L. Diesburg and A. Griffin

Research Protocol:	**Establishment and First Year Performance of the NTEP Zoysiagrass Trial**
Location:	Southern Illinois University, Carbondale, IL.
Site Preparation:	soil - Hosmer silt clay loam; pretreatment - Roundup; area rototilled and harrowed.
Seeding/ Establishment:	date plugged - June 10, 1991; plug spacing - 1 ft x 1 ft centers; plot size - 5 ft x 5 ft; fertilization - 0.5 lb N/M (1-4-2).
Plot Maintenance:	mowing height - 1.5 inches; irrigation - to insure germination; pesticides - Ronstar as preemergence, Princep as pre- and postemerrgence, Trimec Plus as postemergence; fertilization - 3 lbs N/M/yr (SCU).
Experimental Design:	RCB; 3 replications.

This is the first zoysiagrass (*Zoysia japonica*) cultivar trial in the NTEP program. Tests were established at 34 locations nationwide in 1991.

This trial, at SIU, has provided an excellent evaluation of establishment through stressful conditions found in southern Illinois (Table 6). After initial establishment was insured with irrigation, irrigation was withheld and the cultivars were subjected to drought stress that occurred late in 1991 and from mid-June through early September in 1992. Additionally, the pre- and postemergent herbicides did not control fall panicum. The trial was uniformly covered with this weed through most of the 1992 growing season. One entry died and a few are barely surviving. These types are usually very fine-textured and slow-growing. On the other hand the group including DALZ8512 to Sunburst are mostly filled in with stoloniferous growth.

Table 6. Establishment of zoysiagrass cultivars.[1]

Entry	Percent Cover[2]						
	April	May	June	July	August	Sept.	Oct.
DALZ8512	66	71	71	78	86	93	95
TC5018	63	71	70	80	86	88	93
DALZ8514	65	66	66	73	76	81	86
El Toro	70	76	73	80	85	81	83
QT2047	63	68	66	66	73	80	83
CD259-13	65	68	65	73	75	75	78
TC2033	61	73	65	70	73	76	78
Sunburst	51	58	50	60	63	70	75
CD2013	26	30	33	40	46	50	68
Meyer	25	26	30	40	48	51	56
JZ-1	20	31	26	36	45	48	55
DALZ9006	31	38	35	41	46	50	51
DALZ8507	26	30	28	33	38	41	45
Belair	15	15	23	28	36	38	43
Midwest	15	18	25	28	34	36	42
DALZ8508	16	23	18	21	30	36	38
Korean Common	20	18	21	25	26	31	36
TGS-W10	18	26	23	26	31	33	35
Emerald	13	23	16	20	26	30	35
QT2004	11	16	15	16	25	30	35
DALZ8501	11	13	11	21	26	30	33
DALZ8502	6	8	8	16	18	23	28
TGS-B10	1	6	8	11	13	18	24
Midcrest	1	8	10	14	18	21	23
FZ34-35A	1	3	5	6	6	10	11
DALZ8516	1	1	1	1	1	1	2
DALZ8701	0	0	0	0	0	0	0
$LSD_{0.05}$	16	19	19	22	23	24	23

[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 Protected Least Significant Difference test.

[2]Percent cover is a visual estimate of plot cover with zoysiagrass and is a reflection of the speed at which the cultivars establish a mature sod.

Persistence and Turf Quality of Zoysiagrass Germplasm

K.L. Diesburg and A. Griffin

Research Protocol:	**Persistence and Turf Quality of Zoysiagrass Germplasm**
Location:	Southern Illinois University, Carbondale, IL.
Site	soil - Hosmer silt clay loam.
Seeding/ Establishment:	date plugged - June 10, 1987; seeding rate - 6 lbs seed/M; plot size - 12 ft x 15 ft.
Plot Maintenance:	mowing height - 2.25 inches; irrigation - none; pesticides - Roundup on dormant turf, Trimec Plus and Princep; fertilization - 3 lbs N/M/yr .
Experimental Design:	RCB; 5 replications.

Most of the zoysiagrass germplasm collected in China, Japan, and Korea is not well adapted to southern Illinois. The purpose of this trial is to determine the persistence and quality of germplasm from several sources (Table 7).

This trial was going to be terminated, but some significant differences in spring recovery offered the opportunity to obtain more valuable data. The number of entries that had completely filled their plots did not increase from 1991 to 1992 (Table 8). Some increased while others decreased. Winter survival had a strong influence on the changes.

Table 7. Turf quality evaluations of zoysiagrass cultivars.[1]

Cultivar	Quality[2]							
	April	May	June	July	Aug.	Sept.	Oct.	Average
FZ34-35a	2.0	7.0	6.0	8.0	9.0	7.0	7.4	7.3
Z56-18	5.0	4.0	7.0	8.0	9.0	8.0	6.7	6.8
Z34-35b	6.0	6.0	6.0	7.0	7.0	6.0	6.2	6.3
Meyer	5.6	5.8	6.4	6.6	6.8	6.0	7.2	6.3
Emerald	5.6	5.0	6.0	6.6	7.4	6.0	7.2	6.3
FZ-32	7.0	6.0	7.0	6.0	6.0	6.0	6.4	6.3
8508	5.4	4.8	6.2	6.2	7.0	6.4	7.4	6.2
Belair	5.0	5.2	5.8	5.8	6.6	6.6	7.0	6.0
E2xM16	4.0	5.0	6.0	8.0	7.0	6.0	5.9	6.0
FZ102	4.6	4.6	5.2	5.4	6.4	8.0	7.2	5.9
8516	4.4	3.4	5.0	6.0	6.6	8.0	7.4	5.8
FZ-18	5.0	5.0	6.0	6.0	6.0	7.0	5.9	5.8

(continued)

[1] All values represent the mean of 5replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Protected 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.

Table 7. Turf quality evaluations of zoysiagrass cultivars.[1] (continued)

	Quality[2]							
Cultivar	April	May	June	July	Aug.	Sept.	Oct.	Average
Z-102	5.0	4.0	6.0	7.0	7.0	6.0	5.8	5.8
KC-7	5.0	5.0	6.0	7.0	6.0	5.0	5.6	5.7
Korean Common	4.0	5.0	6.0	6.0	6.0	6.0	5.5	5.5
R14-21(6)F	5.0	5.0	5.0	6.0	6.0	5.0	5.4	5.3
Midwest	3.2	3.4	4.4	5.4	6.6	6.4	7.2	5.2
USDA GT 1-1	5.0	4.0	6.0	5.0	6.0	5.0	5.3	5.2
F2-79	4.0	4.0	4.0	5.0	5.0	6.0	4.7	4.7
El Toro	3.0	4.0	5.0	5.0	5.0	5.0	4.5	4.5
$LSD_{0.05}$	1.4	1.7	1.2	1.2	1.0	1.6	1.1	0.9

Table 8. Percent cover of plot with zoysiagrass.[1]

	Percent Cover[3]						
Cultivar	April	May	June	July	Aug.	Sept.	Oct.
El Toro	82	91	92	97	97	99	100
Emerald	81	82	89	96	98	100	100
Meyer	94	95	98	100	99	96	99
Z34-35b	80	85	90	95	95	95	96
Belair	80	82	86	90	89	88	93
KC-7	75	80	80	85	85	90	93
Midwest	65	65	75	80	85	85	90
R14-21(6)F	75	75	75	75	80	80	85
USDA GT 1-1	80	80	80	80	80	80	80
FZ-18	40	50	55	60	65	70	75
Korean Common	40	50	55	60	65	70	74
F2-79	50	55	55	55	60	70	70
E2xM16	30	35	35	35	40	50	55
FZ-32	30	35	40	50	50	50	52
8508	33	35	38	44	46	46	49
Z56-18	25	30	30	35	40	45	46
Z34-35a	10	15	15	20	30	35	40
Z-102	10	10	10	10	15	25	30
FZ102	4	4	4	5	6	9	11
8516	1	1	2	2	2	4	5
$LSD_{0.05}$	20	21	22	21	22	20	22

[1] All values represent the mean of 5 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Protected 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 cover is a visual estimate of plot cover with zoysiagrass and is a reflection of the speed at which the cultivars establish a mature sod.

Establishment of the NTEP Bermudagrass Cultivar Trial

K.L. Diesburg

Research Protocol:	**Establishment of the NTEP Bermudagrass Trial**
Location:	Southern Illinois University, Carbondale, IL.
Site Preparation:	soil - Hosmer silt clay loam; pretreatment - Roundup; area rototilled and harrowed.
Seeding/ Establishment:	date plugged & seeded - June 29, 1992; plug spacing - 1 ft x 1 ft centers; seeding rate - 0.85 lbs seed/M; plot size - 6 ft x 6 ft; fertilization - 0.5 lb N/M (1-4-2).
Plot Maintenance:	mowing height - 1.5 inches; irrigation - to prevent stress; pesticides - Princep six weeks after seeding; fertilization - 3 lbs N/M/yr.
Experimental Design:	RCB; 3 replications.

This is the second NTEP bermudagrass (*Cynodon dactylon*) trial. Due to a severe winter, the first trial, established in 1989, did poorly at Carbondale. Only eight cultivars survived. Those seven are being maintained as winter-hardy germplasm for further investigation. The second trial will be evaluated over several growing seasons for quality, disease resistance and winter hardiness.

Establishment quality and percent stand data is a good indication of a cultivar's ability to recover from transplanting shock (if vegetative) or if seeded, germination rate and seedling vigor (Table 9). Several entries, Guymon, OKS 91-11, FHB-135, J-27, and J-912, had poor quality three weeks after establishment. This is an indication of poor seed quality. When this happens, rate of establishment cannot be estimated accurately. No preemergent herbicide could be applied to the trial, since bermudagrass is sensitve to siduron. As a result, a heavy infestation of goosegrass provided serious competition to the bermudagrass growth. In the absence of weed competition, all plots should normally have been filled in with bermudagrass by September 12 . The data shows how the goosegrass competition reduced bermudagrass growth. The goosegrass infestation was not uniform, so the entries were not judged for their ability to compete with goosegrass during turf maturation. Rather this serves as a record for reference during spring recovery.

Table 9. Establishment quality and percent stand of bermudagrass cultivars.[1]

Cultivar	Seeded[2] or Vegetative	Establishment Quality[3] July 22	Percent Stand[4] September 12
STF-1	v	7.0	74
Midlawn	v	7.3	69
Cheyenne	s	9.0	63
Sahara	s	9.0	61
Midfield	v	7.7	60
FMC 1-90	s	9.0	58
Tifgreen	v	7.3	58
Sundevil	s	6.3	46
Arizona Common	s	6.7	45
Texturf	v	6.3	45
TDS-BM1	v	9.0	42
Sonesta	s	8.7	41
Midiron	v	4.3	39
OKS 91-1	s	6.7	38
90173	s	6.7	37
FMC 5-91	s	7.7	35
FMC 6-91	s	7.0	34
FMC 3-91	s	8.0	31
Tifway	v	4.3	30
Arizona Common	v	8.7	28
FMC 2-90	s	8.3	23
J-912	s	5.0	16
J-27	s	2.7	7
FHB-135	v	2.3	6
OKS 91-11	s	3.7	2
Guymon	s	2.7	1
$LSD_{0.05}$		3.0	47

[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 Protected Least Significant Difference test.

[2]A "v" indicates that the cultivar was established from plugs planted on 1 ft by 1 ft centers and an "s" indicates the cultivar was established from seed at a rate of 0.85 lbs seed/M.

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

[4]Percent stand is a visual estimate of the plot covered with bermudagrass and is a reflection of the speed at which the cultivar establishes a mature sod.

Turf Quality of Winterhardy Bermudagrass Cultivars

K.L. Diesburg and A. Griffin

Research Protocol:	**Turf Quality of Winterhardy Bermudagrass Cultivars**
Location:	Southern Illinois University, Carbondale, IL.
Site Preparation:	soil - Hosmer silt clay loam; pretreatment - Roundup; area rototilled and harrowed.
Seeding/ Establishment:	date plugged - April 10, 1990; plot size - 12 ft x 12 ft.
Plot Maintenance:	mowing height - 2.25 inches, 1989 to1991 & 1.5 inches, 1992; irrigation - none; pesticides - Ronstar, preemergent & Princep, Trimec Plus, postemerrgent; fertilization - 4 lbs N/M/yr (nitroform and SCU).
Experimental Design:	RCB; 3 replications.

Of the 43 bermudagrass (*Cynodon dactylon*) cultivars tested at Carbondale during 1989 and 1990, only eight survived the winter of 1989-90. All of the eight went through the winters from 1990-92 with little damage. Turf quality was assessed for the first time in 1991. The mowing height was lowered in 1992 to 1.5 inches from the previous height of 2.25 inches. Additional evaluations will continue through the coming years. Data for 1992 is presented in Table 10.

Color and texture are the criteria that most strongly determined turf quality of bermudagrass when plot cover is complete as in this trial. Westwood has excellent color. NMCT and U-3 are more finely textured genotypes. The other five entries are more coarsely textured types. They have a more open canopy and can be used in mixtures with Kentucky bluegrass. This species combination often dominates old turf areas in the transition zone.

Table 10. Turf quality of winter-hardy bermudagrasses.[1]

	Quality[2]						
Cultivar	April	May	June	July	August	Sept.	Average
U-3	9.0	9.0	8.0	7.0	9.0	9.0	8.5
NMCT	6.0	8.0	7.0	8.0	9.0	9.0	7.8
Westwood	6.0	8.0	6.0	7.0	9.0	9.0	7.5
CD5.08	6.0	4.0	7.0	8.0	9.0	9.0	7.2
Vamont	7.0	6.0	7.0	7.0	7.0	7.0	6.8
C-53	5.0	7.0	7.0	7.0	7.0	8.0	6.8
NMPX5	6.0	5.0	7.0	6.0	6.0	7.0	6.2
CD-32	5.0	6.0	6.0	6.0	6.0	7.0	6.0

[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 Protected 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.

NTEP Buffalograss Trial

K.L. Diesburg and A. Griffin

This is the first buffalograss (*Buchloe dactyloides*) trial in the National Turfgrass Evaluation Program. This species is gaining in popularity. As our decreasing water supplies dicate that it will be increasingly difficult to use water for aesthetic purposes. It then becomes more important to have a turfgrass species that can persist at a reasonably good level of turf quality with little or no irrigation through the summer. Buffalograss, a species native to North America, is adapted well to long periods of drought that are frequent in the Great Plains. Seed production is difficult because the seeds are produced very close to the soil surface and, therefore, cannot be harvested with standard field machinery. The species is a vigorous stoloniferous spreader, so it is practical to establish it with vegetative plugs, as is done with Meyer zoysiagrass.

Research Protocol:	**NTEP Buffalograss Cultivarr Trial**
Location:	Southern Illinois University, Carbondale, IL.
Site Preparation:	soil - Hosmer silt clay loam; pretreatment - Roundup; area rototilled and harrowed.
Seeding/ Establishment:	date plugged - June 10, 1991; plug spacing- 1 ft x 1 ft centers; plot size - 5 ft x 5 ft, 2 ft between plots; fertilization - 0.5 lb N/M.
Plot Maintenance:	mowing height - 2.25 inches; irrigation - none; pesticides - Dacthal & Ronstar, preemergent; fertilization - 3 lbs N/M/yr (SCU, Nitroform, Nutralene).
Experimental Design:	RCB; 3 replications.

There are marked differences in turfgrass quality between the year of establishment (see the *1991 Illinois Turfgrass Research Report*) and this first year of full-season evaluation (Table 11). The growth habit among buffalograss genotypes is highly variable. Color, texture, and density were rated separately in order to more accurately characterize the entries. Some entries that rank highest in one category rank among the lowest in another, other entries rank similarly across all traits (Tables 12 and 13). It is obvious that the degree of satisfaction with buffalograss will depend heavily upon whether the cultivar being used has the kind of texture, color, and density the turfgrass manager expects. This match can be made only if the cultivar is observed before purchase.

Table 11. Performance of NTEP buffalograss cultivars.[1]

Cultivar	Quality[2]						
	April	May	June	July	August	Sept.	Average
Prairie	6.7	6.0	7.7	7.3	7.7	8.3	7.3
Highlight 15	6.0	7.7	6.7	7.0	8.0	8.3	7.3
Buffalawn	7.0	8.3	7.0	6.3	7.0	7.7	7.2
Highlight 25	6.3	8.3	6.3	6.7	7.3	8.0	7.2
Sharp's Improved	6.7	5.3	6.7	7.3	8.0	8.7	7.1
Rutgers	7.7	7.3	6.3	6.7	7.0	7.7	7.1
BAM 101	6.7	5.3	7.0	7.0	7.7	7.7	6.9
Highlight 4	6.0	7.7	6.7	6.3	7.0	7.7	6.9
NTDG-3	6.3	5.3	7.0	6.7	7.7	8.0	6.8
NE 84-436	7.0	5.3	6.7	7.0	7.3	7.7	6.8
NTDG-1	7.0	5.7	7.0	6.7	7.3	7.0	6.8
NTDG-2	6.0	5.7	7.0	7.0	7.3	7.7	6.8
Texoka	5.7	6.7	6.0	7.3	7.3	7.7	6.8
NE-84-45-3	5.7	5.3	7.3	7.3	7.0	7.7	6.7
Bison	6.7	5.3	7.0	6.3	7.0	7.7	6.7
BAM 202	6.0	4.7	7.7	6.7	7.0	7.3	6.6
NTDG-4	7.0	5.3	7.0	6.0	6.3	7.7	6.6
NE 85-378	4.7	5.3	6.7	7.0	7.7	8.0	6.6
NTDG-5	7.0	5.3	5.7	6.7	7.3	7.3	6.6
AZ143	6.3	4.3	6.7	7.0	7.0	7.3	6.4
NE 84-609	4.0	4.7	6.3	7.0	7.7	7.7	6.2
NE 84-315	6.7	4.0	6.0	6.7	5.7	6.0	5.8
$LSD_{0.05}$	0.95	2.14	1.74	1.39	1.55	1.64	1.15

[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 Protected 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.

Table 12. Blade texture/density of buffalograss cultivars found in the NTEP trial.[1]

	Texture[2]				
Cultivar	June	July	August	Sept.	Average
Buffalawn	7.7	8.0	9.0	9.0	8.4
Highlight 4	6.7	7.7	9.0	9.0	8.1
NE 84-315	7.3	7.7	8.3	8.7	8.0
NTDG-3	7.0	7.7	8.7	8.3	7.9
BAM 202	7.0	7.7	8.0	8.7	7.8
NTDG-5	7.0	7.7	8.0	8.0	7.7
NE 85-378	7.3	7.3	8.0	7.7	7.6
BAM 101	6.7	7.3	7.7	8.3	7.5
Highlight 15	6.7	6.7	7.7	8.3	7.3
NE 84-45-3	7.0	6.7	7.3	8.0	7.3
NTDG-4	6.7	7.0	7.7	7.7	7.3
Rutgers	7.3	6.7	7.0	7.7	7.2
NE 84-436	7.3	6.7	7.0	7.7	7.2
NTDG-1	6.0	7.0	7.3	8.3	7.2
Highlight 25	5.7	6.7	7.7	8.3	7.1
AZ143	6.0	7.0	7.3	8.0	7.1
Bison	6.7	6.7	7.3	7.7	7.1
NE 84-609	6.7	6.3	7.0	8.0	7.0
Texoca	7.0	6.3	7.3	7.3	7.0
NTDG-2	6.7	6.3	7.3	7.3	6.9
Sharp's Improved	6.7	6.0	7.0	8.0	6.9
Prairie	6.3	6.3	7.0	7.7	6.8
$LSD_{0.05}$	1.39	1.41	1.60	1.60	1.27

[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 Protected Least Significant Difference test.

[2]Texture evaluations are made on a 1-9 scale where 9 = more fine texture with high leaf density and 1 = more coarse texture with an open growth habit, giving low leaf density.

Table 13. Turf color of buffalograss cultivars found in the NTEP trial.[1]

Cultivar	Color[2]				
	June	July	August	Sept.	Average
NTDG-4	7.3	7.7	8.7	8.3	8.0
NE 84-45-3	7.3	7.3	8.3	8.7	7.9
Texoca	7.0	7.7	8.0	8.3	7.8
NE 85-378	7.3	7.0	8.0	8.3	7.7
Highlight 15	6.7	7.3	8.0	8.3	7.6
Buffalawn	7.0	7.3	7.7	8.0	7.5
NTDG-3	7.3	6.7	7.7	8.3	7.5
NTDG-5	7.0	6.7	7.7	8.0	7.3
Prairie	6.7	7.0	7.7	7.7	7.3
NE 84-315	6.0	6.7	7.7	8.7	7.3
NE 84-436	6.7	7.0	7.3	7.7	7.2
NTDG-1	8.0	6.3	7.0	7.3	7.2
Sharp's Improved	6.3	6.7	7.3	8.0	7.1
Highlight 4	7.3	6.7	7.0	7.3	7.1
BAM 202	6.7	7.0	7.3	7.3	7.1
AZ143	6.7	6.3	7.0	8.0	7.0
BAM 101	6.0	6.7	7.3	8.0	7.0
NTDG-2	6.0	7.0	7.0	7.7	6.9
Highlight 25	6.3	6.3	7.7	7.3	6.9
Bison	6.7	6.0	6.7	7.3	6.7
NE 84-609	6.3	6.0	6.7	7.0	6.5
Rutgers	6.3	6.3	6.7	6.7	6.5
$LSD_{0.05}$	1.21	1.50	1.37	1.47	1.51

[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 Protected Least Significant Difference test.

[2] Color evaluations are made on a 1-9 scale where 9 = very dark green, 5 = pale green, and 1 = straw color.

Low Input Sustainable Turf (LIST)

K.L. Diesburg

Research Protocol:	**Low Input Sustainable Turf (LIST)**
Location:	Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, Nebraska, and Kansas.
Seeding/ Establishment:	date seeded - cool season grass, fall 1992 or spring 1993 and warm season grasses, late spring 1992; plot size - 4 ft x 12 ft; irrigation - to insure germination; fertilization - 0.5 lb N/M (1-4-2).
Plot Maintenance:	mowing height - 3.5 inches; mowing frequency - alternate weeks, monthly, biannually; irrigation - none; pesticides - none; fertilization - 1 lb N/M/yr.
Experimental Design:	strip plot; 3 replications.

Turfgrass managers of the 1990s must make efficient use of resources, reduce environmental pollution and still maintain a desired level of turf quality. In low-management situations the desired turf quality is uniform, persistent cover with turfgrass color, texture, and density taking lower priority. The conclusion of the Alternative Species Project during 1991 identified five perennial grass species best suited to this purpose. The study was conducted in eleven states of the upper midwest United States, so we are confident that these species would be appropriate over a broad geographic area. A 3.5 inch mowing height provided best species performance.

With most low-management programs the manager prefers to mow as few times as possible. In the next phase of this program we will evaluate the same five species plus three others under three different schedules of mowing frequency. We will be observing how an infrequent mowing schedule effects turfgrass cover and persistence.

The trial was established this fall at Carbondale and several other locations. Some locations will establish it during spring, 1993. Species included in this trial are listed in Table 14. Initial data will be presented in the *1993 Illinois Turfgrass Research Report.*

Table 14. Species evaluated in the LIST evalution.

Common Name	Scientific Name
Sheep fescue	*Festuca ovina*
Tall fescue	*Festuca arundinacea*
Buffalograss	*Buchloe dactyloides*
Redtop	*Agrostis alba*
Colonial bentgrass	*Agrostis tenuis*
Kentucky bluegrass	*Poa pratensis*
Hard Fescue	*Festuca ovina* var *duriuscula*
Zoysiagrass	*Zoysia japonica*

COMPUTER RESEARCH AT THE UNIVERSITY OF ILLINOIS

Turfgrass Database Mining

T.B. Voigt, R.B. Rao, and T.W. Fermanian

Introduction. *Database mining* is a relatively new area of study that employs computers to glean electronic databases[1] for the previously unknown, but useful, information contained within them. Because of the magnitude of many databases, efficient and effective human analysis is impossible. However, to automate this activity, computer applications are now being developed and evaluated that can mine large databases for their useful contents. One example of database mining is the computerized analysis of the trillions of kilobytes of satellite-collected weather data for possible use in predicting future weather events. Additional databases have been created in business based on telephone calls or credit card transactions. It goes without saying that new databases will be created and new information will be extracted from them.

One method of extracting, analyzing, and using database information is *machine learning*. In machine learning, the database supplies information examples to a computer application, also called an learning algorithm. The learning algorithm then classifies this information and a model is developed. These models of classified information can then be used to predict the outcome of future situations.

The National Turfgrass Evaluation Program (NTEP[2]) was formed in 1980 to standardize the evaluation of turfgrasses produced in various breeding programs, and has, over the last 13 years, amassed a large volume of turfgrass species and cultivar[3] performance data at sites throughout the United States. The NTEP database contains cultivar performance information for Kentucky bluegrasses, perennial ryegrasses, tall fescues, fine-leaf fescues, creeping bentgrasses, as well as several warm season species. In addition to cultivar performance data, the NTEP database also contains growing environment and management information. In essence, the NTEP database is a storehouse of potentially useful information that can help determine how turfgrass cultivars may perform when established in various environments or grown under various management regimes.

It is with these points in mind that this research project was initiated. Employing the NTEP database as a source of information, we are currently attempting to identify relationships between turfgrass cultivar performance and different management and environmental conditions using machine learning applications. In the future, our goal is to use the relationships identified in machine learning in a computer expert system

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[1] A database is "a logically integrated collection of data maintained in one or more files and organized to facilitate the efficient storage, modification, and retrieval of related information." [Frawley, W.J., G. Piatetsky-Shapiro, and C. J. Matheus. 1991. Knowledge discovery in databases: an overview. p.. 1-27. *In* W.J. Frawley and G. Piatetsky-Shapiro (eds.) Knowledge discovery in databases. AAAI Press/The MIT Press, Menlo Park, CA.]

[2] NTEP is a non-profit, self-supporting program jointly sponsored by the National Turfgrass Federation, Inc. and the United States Department of Agriculture (USDA).

[3] cultivar - "an assemblage of cultivated plants distinguished by any characters which, when reproduced sexually or asexually, retain their distinguishing feature" [Turgeon, A.J. 1991 (third ed.). Turfgrass management. Prentice-Hall, Englewood Cliffs, NJ.].

such as TURFPLAN[1]. Using the learned cultivar/management/environment relationships, a computer expert system will assist turf managers optimize cultivar selection for a given set of environment and management conditions, as well as optimize management activities when given the cultivars being produced and the environment in which the cultivars are growing.

In this report, we present information about the machine learning algorithms used in our research. In addition, results of a preliminary study that compares the performance of the models with human experts is offered. To complete this study, we began by statistically processing the database to determine relative cultivar performance rankings. These relative cultivar performance rankings were then merged with management and environmental data for submission to machine learning and statistical applications to develop models.

Machine learning algorithms. In this research, we employed C4, CART (with two different Standard errors), and Bayesian tree-building algorithms. In addition, the AQ algorithm was also used. These learning algorithms all use inductive learning, that is, they learn by example; in this research the examples originate from the NTEP database. Also, in each of the machine learning algorithms, relationships in the data are sought. Strongly positive relationships among turfgrass cultivar performance, environmental conditions, and management activities result in the output as rules.

```
MH < 4.5:
| K < 4: T
| K >= 4:
| | N < 2.5: M
| | N >= 2.5:
| | | T < 2.5: T
| | | T >= 2.5:
| | | | I < 2.5: T
| | | | I >= 2.5: M
MH >= 4.5: T
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Figure 1. Example of tree-building decision rule

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[1] Fermanian, T.W. and H. Liu. 1989. An expert system for planning the establishment of turfs in Illinois. p.. 84-87. In J.E. Haley (ed.) 1988 Illinois turfgrass research summary. University of Illinois Department of Horticulture Series 51.

Tree-building machine learning algorithms produce rule output in a simple, diagnostic key-like form. Figure 1 presents an example of a tree-building type of rule for Haga Kentucky bluegrass as determined by C4 using 1983 data.

This decision tree, when translated into English, reads:

"If Haga Kentucky bluegrass is mowed at less than 2.1 inches and soil potassium is less than 240 pounds per acre, then performance is in the top category; **OR**
if Haga Kentucky bluegrass is mowed at less than 2.1 inches and the soil potassium is greater than or equal to 240 pounds per acre and nitrogen is less than 2.1 pounds of nitrogen per 1,000 square feet per year, then performance is in the medium group; **OR**
if Haga Kentucky bluegrass is mowed at less than 2.1 inches and the soil potassium is greater than or equal to 240 pounds per acre and nitrogen is greater than or equal to 2.1 pounds of nitrogen per 1,000 square feet per year and the average monthly temperature is less than 55° F, then performance is in the top group; **OR**
if Haga Kentucky bluegrass is mowed at less than 2.1 inches and the soil potassium is greater than or equal to 240 pounds per acre and nitrogen is greater than or equal to 2.1 pounds of nitrogen per 1,000 square feet per year and the average monthly temperature is greater than or equal to 55° F, and irrigation is supplied only during severe moisture stress and dormancy, then performance is in the top group; **OR**
if Haga Kentucky bluegrass is mowed at less than 2.1 inches and the soil potassium is greater than or equal to 240 pounds per acre and nitrogen is greater than or equal to 2.1 pounds of nitrogen per 1,000 square feet per year and the average monthly temperature is greater than or equal to 55° F , and irrigation is supplied prevent dormancy, then performance is in the medium group; **OR**
if Haga is mowed taller than 2.1 inches, then performance is in the top group."

As is obvious, the appearance of this tree is quite simple, but it supplies a great deal of information regarding Haga Kentucky bluegrass performance when grown under different management conditions and in different environments. In addition, it may certainly be useful for determining a cultural program for those turf managers growing Haga.

AQ15, on the other hand, develops rules that are in a more verbal, less graphical form. Figure 2 is an example of a single AQ15 rule, developed from 1983 NTEP data, for Sydsport Kentucky bluegrass when it performed in the top category.

[Tx = 4..6][PH = 4 v 5 v 7][P = 1 v 5 v 7 v 9]
[MH = 3 v 4 v 6][I = 1 v 3][T = 2..4 v 6v 8 v 9]
[D = 0 v 1 v 3 v 5 v 8 v 10 v 11][Pr = 3 v 5 v 7]

Figure 2. Example of AQ15 decision rule

When translated into English, this rule reads that:

> Sydsport Kentucky bluegrass performs in the top category when soil texture is loam or silt loam or silt or clay loam **AND** soil pH is 5.6 to 6.0 or 6.1 to 6.5 or 7.1 to 7.5 **AND** soil phosphorus levels are 0 to 60 or 151 to 270 or 271 to 450 or 451 or pound to the acre **AND** the mowing height is 1.1 to 1.5 inches or 1.6 to 2.0 inches or 2.6 to 3.0 inches **AND** the irrigation level is unirrigated or irrigated only during severe moisture stress **AND** dormancy **AND** the average monthly temperature is 45 to 49.9 or 50 to 54.9 or 55 to 59.9 or 65 to 69.9 or 75 to 79.9 or 80 to 84.9°F **AND** the degree days are 0 or 1 to 50 or 101 to 150 or 201 to 250 or 351 to 400 or 451 to 500 or 501 to 550 **AND** the monthly precipitation is.2.51 to 3.50 inches or 4.51 to 5.50 inches or 6.51 to 7.50 inches.

This rule is more detailed, somewhat more difficult to understand, and includes many more management and environmental conditions. It should be noted that this is only the first of ten rules that AQ15 generated for Sydsport when it performed in the top category.

In addition machine learning algorithms, we also attempted to produce a model that would correlate cultivar performance, environmental conditions, and management activities using traditional statistics. Logistic regression was used in place of standard regression because there were only three performance category assignments (top, medium, bottom) as opposed to a continuous string of assignments.

Processing the raw NTEP data for machine learning. This research focuses on a single turfgrass species, Kentucky bluegrass (*Poa pratensis* L.) using data from the initial NTEP evaluation of 1981 - 1985. This NTEP data contains readings for 84 cultivars at 45 sites in the United States and includes monthly quality (performance) ratings for each cultivar (which has been replicated three times at each site). This NTEP data also contains recordings of the management regime (i.e., irrigation level, quantity/type of fertilizer etc.) and the soil conditions for each evaluation site. The quality rating is made by an evaluator who visually inspects the cultivar plot and assigns an integer value between 1 (worst) and 9 (best). This rating is based on factors such as the turf color, uniformity, texture, and density.

As a first step, raw NTEP data was first separated into blocks of data from a single testing site and single months' quality ratings. The mean quality ratings were then statistically analyzed using a standard mean separation test, Fishers LSD. Based on its mean separation position in each block, the cultivars were then assigned to one of three performance categories, "top", "medium", or "bottom" as shown in Figure l. For example, if there were three distinct mean levels, a, b, and c, each mean group was assigned to one category. In situations where there were more than three LSD assignments, the total number of assignments was divided by 3 and assigned a performance category. In cases where the total number of LSD letter assignments was not evenly divisible by 3, the remnant letter assignments were placed in the lower performance categories. Upon completion of this step, each of the 84 Kentucky bluegrass cultivars was assigned a performance category (top, medium, or bottom) for each month and site in which they were evaluated by NTEP investigators.

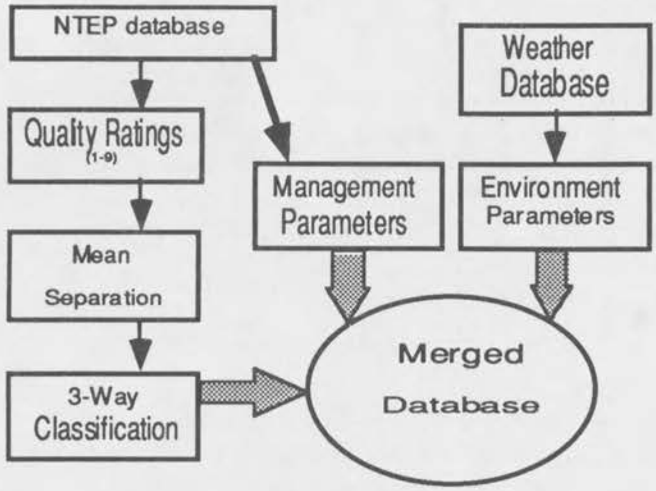

Figure 3. Developing the example database from NTEP data

The cultivar performance data was then merged with site management information obtained from the raw NTEP data. Finally, this merged data file was combined with monthly precipitation, average temperature, and degree day (base 65°F) data obtained from National Oceanic and Atmospheric Administration publications. The final data set was then separated by cultivar into examples consisting of a string of 12 integers corresponding to performance category, soil texture, pH, phosphorus, potassium, nitrogen fertilization level, light quantity, mowing height, irrigation practices, monthly precipitation, average monthly temperature, and monthly degree days. Figure 3 presents a graphical presentation of the steps involved in processing the data for learning.

Predicting cultivar performance. The goal of this initial study was to evaluate the effectiveness of different model building techniques for mining the database. The performance of the two human experts served as a benchmark. It was decided that if the learned models were comparable in accuracy to the human experts, their performance would be deemed satisfactory. For this initial study, we used 1983 data from the transformed database and 4 Kentucky bluegrass cultivars ('Haga', 'South Dakota Common', 'Midnight', and 'Sydsport'). For each of the four cultivars, 201 examples were available for testing. Of the data, 90% was used as a training set to learn the model, and 10% as a test set. The human experts were provided with the training and test sets, with the actual quality measurements removed from the test set. They were required to classify the test examples as top, middle, or bottom performers based on the training set and their intimate knowledge of the cultivars. The predictive accuracy was determined by tracking the number of times the expert predicted the actual performance.

We also learned models from the training set using some well-known decision tree building algorithms: C4, CART (with two different Standard errors), and a Bayesian tree building algorithm. In addition, the AQ algorithm was also used. Logistic regression was used in place of standard regression. The learned models were used to predict the quality of the

Table 1. Comparative performance of human and machine learning strategies.			
Learning strategy	**Percent predictive accuracy (10-way)**	**Model complexity**	**Model formation time efficiency**
C4	59.4	low	high
Cart (SE=1)	59.3	low	high
Bayes	60.1	low	high
Cart (SE=0)	58.6	low	high
AQ15	62.7	med	med
Regression	59.2	high	med
Human	43.1	high	low

events in the test set. The predictive accuracies for a 10-way cross-validation[1] are displayed in Table 1 (averaged over all 4 cultivars). While the accuracies of the machine learning algorithms are not especially high, they represent a significant increase in accuracy compared to the human experts. The relatively low accuracies (around 60%) are not surprising, given that the database still has a large subjective component in spite of the statistical pre-processing. In general, the decision tree algorithms were the fastest at building models (taking between a few seconds and 2 minutes on a SUN4 to learn a model for a single cultivar), followed by logistic regression and AQ which took about 15-20 minutes for model formation.

As we plan to eventually use the learned models in a turfgrass expert system it is essential for human experts to evaluate and validate the data. Therefore, the comprehensibility of the models is crucial. The algorithms are ranked in Table 1 in increasing order of complexity. The logistic regression models were hard to interpret and AQ produced a very large number of very specialized rules. The decision tree algorithms were the most readable and produced models of roughly similar accuracy. As C4 consistently produced the most compact trees compared with the other algorithms (using number of nodes as a complexity criterion), it was the algorithm of choice for the detailed study described in the next section.

Despite both experts being very familiar with the 4 cultivars their predictive accuracy was very low. Part of the problem was undoubtedly due to the database still having a large subjective component even after the statistical processing. Also, humans are typically not very good at these kinds of classification tasks involving a large number of numerical variables. Finally, it could be argued that this was an artificial task for the human experts, whose expertise was geared towards improving rather than predicting cultivar performance.

Conclusions. This research has several useful outcomes. The methodology presented in this paper provides a way to acquire domain expertise by using machine learning for database mining applications on the NTEP database. The results of this study also bear out our contention that even highly qualified human turfgrass experts do not possess the detailed level of information necessary to match cultivar performance with a wide-ranging set of environmental situations. In the past, the small number of

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[1] In a 10-way cross validation the data is split into 10 distinct subsets. Learning occurs on 9 subsets and testing occurs on the tenth. This process is repeated 10 times with each of the subsets being tested against the remaining 9.

available turfgrass cultivars made knowledge of specific cultivar attributes unnecessary. However, experts have been unable to keep up with the recent influx of several new and different cultivars. With increased pressure from the public to maintain turfs at lower cost with less pesticides, this cultivar-selection expertise will become vital in the near future.

This research also supplies information that can improve our knowledge about turfgrass cultivars. Many of the newly discovered relationships between the cultivar performance and the environment/management parameters have never been investigated in field experiments. These discovered relationships provide turfgrass researchers with testable hypotheses for future studies.

In addition to applying this methodology to the other species in the NTEP database, we hope that it will be applicable to several other agricultural domains. There are large amounts of unprocessed vegetable, fruit, and dairy data that can be profitably mined using these procedures;

Finally, based on our studies, we are able to make recommendations to NTEP about modifying the data collection procedures to facilitate database mining activities. To better evaluate future cultivar performance, we are recommending that NTEP select more varied test sites, impose different management regimes at the various sites, and collect more complete environmental data. Modification in the format of collected data is also recommended to reduce some of the subjective differences which have existed in the past.

ANNUAL AND PERENNIAL GRASS CONTROL RESEARCH AT THE UNIVERSITY OF ILLINOIS

Crabgrass (*Digitaria* spp.) is a common weed and continual problem in Illinois turf. It germinates in late spring and throughout summer on sunny, moist sites. Once established, crabgrass, often crowds out desirable turf. This is especially a problem in spring plantings or areas where the turf is weakened by stress or poor maintenance. Preemergence or postemergence herbicides are available to control crabgrass.

Preemergence Crabgrass Control

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

Research Protocol:	**Preemergence Crabgrass Control Evaluation**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Turf:	Kentucky bluegrass.
Application of Treatments:	date applied - April 28, 1992, all treatments except Pendimethalin w/ fertilizer and Lesco PreM; April 29, 1992, Pendimethalin w/ fertilizer; April 30, 1992, all Lesco PreM treatments; June 26, 1992, 2nd applications of Balan , Team G & Pendimethalin w/ fertilizer; liquid herbicides - applied with a CO_2 backpack sprayer; spray volume - 40 gpa; granular herbicides - broadcast by hand.
Turf Maintenance:	mowing height - 0.5 inches in May, 2 inches June through August; pesticides - no additional pesticides; irrigation - little irrigation was necessary due to heavy rainfall in July; fertilization - none .
Experimental Design:	RCB; 3 replications.

Most turfgrass managers prefer to control crabgrass with preemergence herbicides. These herbicides are applied prior to weed germination in the spring. In central Illinois germination begins mid-April to mid-May. Sometimes a second application of preemergence herbicide is needed to insure season long control. There are a number of preemergence herbicides for control of crabgrass on the market today. Periodically, new herbicides or new turf formulations of field crop herbicides are developed. These herbicides need to be evaluated for efficacy and compared to the existing materials. The purpose of this research was to evaluate Dimension 1EC and MON 25134 0.1G (dithiopyr, Monsanto Agricultural Co.), Team 2G (benefin + trifluralin, DowElanco), FN9064 (undisclosed, DowElanco), Ronstar, and EXP30742C 2.3G (oxadiazon, Rhone-Poulenc). Also included in this evaluation were PreM 60 DG (pendimethalin, LESCO, Inc.), Barricade 65WG (prodiamine, Sandoz Crop Protection), and Balan 2.5G (benefin, DowElanco). Herbicide rates are included in Table 1. An untreated plot was included with each replication.

It should be noted that temperatures throughout the growing season were cooler than average and rainfall greater than normal in July. Several times, the crabgrass research plots were flooded following heavy rainfalls. Crabgrass germination was not uniform or prolific throughout the study site. On July 24 untreated check plots in rep. 1 had 4% cover with crabgrass, 7.5% cover with crabgrass in rep. 2 and 5% in rep. 3. On August 10 the untreated plots had 17.5% crabgrass cover in reps. 1 and 2 and 15% cover in rep. 3. On September 8 rep. 1 was covered with 15% crabgrass, rep. 2 with 20% crabgrass and rep. 3 with 10% crabgrass. All plots treated with herbicide had significantly less crabgrass than the untreated check (not shown). Among herbicide treatments crabgrass control was significantly different on July 24 (Table 1) but no differences were statistically calculated among herbicide treatments on August 10 or September8.

Table 1. The evaluation of herbicides applied 28 April 1992 for preemergence control of crabgrass in a common Kentucky bluegrass turf.[1]

		% Crabgrass Control[2]		
	Rate	7/24	8/10[ns]	9/8[ns]
Herbicide	lb ai/A	87 DAT	104 DAT	133 DAT
Barricade 65WG	0.65	100.0c	98.0	100.0
Barricade 65WG	0.75	100.0c	100.0	100.0
Balan 2.5G / Balan 2.5G	1.5 / 1.5	100.0c	98.0	97.8
Team 2G	2.0	100.0c	100.0	100.0
Team 2G	3.0	100.0c	100.0	97.8
Team 2G /Team 2G	1.5 / 1.5	100.0c	100.0	100.0
FN9064 1.09G	250 lb cf/A	93.9b	96.0	97.8
FN9064 1.09G	375 lb cf/A	100.0c	100.0	100.0
Pendimethalin with fertilizer /		100.0c	98.0	97.8
Pendimethalin with fertilizer	1.5 / 1.5			
Betasan 8.5G	7.5	100.0c	96.0	88.9
Dimension 1EC	0.5	100.0c	100.0	100.0
MON 25134 0.1G	0.5	100.0c	100.0	100.0
MON 25134 0.1G	0.38	100.0c	100.0	97.8
PreM 60DG	1.5	87.9a	86.0	93.3
PreM 60DG	3.0	100.0c	90.0	100.0
Ronstar 2G	3.0	100.0c	100.0	97.8
Ronstar 2G	4.0	100.0c	100.0	100.0
EXP30742C 2.3G	5.0	100.0c	100.0	100.0
EXP 30742C 2.3G	6.0	100.0c	96.0	97.8

[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 Protected Least Significant Difference test.

[2]Percent crabgrass control is determined by making a visual estimate of crabgrass cover in each treated plot and comparing this with the visual estimate found in the untreated plot. Crabgrass averaged 5.5% cover in the untreated plot on 7/24, 16.7% cover on 8/10 and 15% cover on 9/8.

[ns] Ns indicates that no significant difference was found among the means in this group of data at the 0.05 level as determined by Fisher's Protected Least Significant Difference test.

Postemergence Crabgrass Control

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

If preemergence herbicides are not applied, fail to control crabgrass throughout the season, or are applied after some weed germination has occurred, then postemergence herbicides may be needed. In the past, organic arsenicals were the primary herbicides used for postemergence crabgrass control. In recent years fenoxaprop (Acclaim, Hoechst Roussel Agri-Vet), has been used on fine quality turf. Acclaim is generally thought to be less phytotoxic and more efficacious with a single application than the organic arsenicals. New herbicides have been developed that have both pre and post emergence control qualities. The purpose of this trial was to evaluate the newly labeled herbicide Dimension (dithiopyr, Monsanto), and to evaluate a recently developed herbicide, Drive (quinclorac, BASF). Also evaluated were new formulations of fenoxaprop, HOE-360 28g/L EW and HOE-360 69g/L EW (Hoechst Roussel Agri-Vet) in order to compare them with available postemergence crabgrass control herbicides.

Research Protocol:	**Postemergence Crabgrass Control Evaluation**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Turf:	Kentucky bluegrass.
Application of Treatments:	date applied - June 29, 1992, treatments applied at the 1-4 leaf stage of weed growth; July 20, 1992, all treatments applied at the 4 leaf-2 tiller stage of weed growth; June 24, 1992, Daconate 6 and Drive, 2nd applications; liquid herbicides - applied with a CO_2 backpack sprayer; spray volume - 40 gpa.
Plot Maintenance:	mowing height - 0.5 inches in June, 2.5 inches June through August; pesticides - no additional pesticides; irrigation - little irrigation needed due to heavy rainfall in July; fertilization - none; overseeded with large crabgrass, dandelion and white clover in late winter and early spring.
Experimental Design:	RCB; 3 replications.

Herbicides included in the trial were Acclaim 1EC, Drive 75DF, HOE-360 28g/L EW, HOE-360 69g/L EW, Dimension 1EC, Barricade 65DG (prodiamine, Sandoz Crop Protection), Lesco's PreM 60DG (pendimethalin, LESCO), and Daconate 6 (MSMA, Fermenta Plant Protection). Rates and formulations are listed in Table 2.

Cooler than average temperatures during the spring and summer kept crabgrass germination to a minimum. Data collected on July 24 showed only 5% plot cover with crabgrass in the untreated check plots in rep. 1, 7% in rep. 2 and 7% in rep. 3. Evaluations on August 6 revealed rep. 1 had 10% crabgrass cover, rep. 2 15% crabgrass cover, and rep. 3 had 20% crabgrass cover. September 6 evaluations showed no increase in crabgrass growth in the untreated plots. Good weed control was observed with most early and late treatments. Drive at a single application rate of 0.5 lb ai/A, Dimension at 0.5 lb ai/A and Acclaim at 0.18 lb ai/A applied at the 1-4 leaf stage and Drive applied at the 1-2 tiller stage of weed growth showed only fair crabgrass control at 69 DAT (1-4 leaf stage) and 47 DAT (1-2 tiller stage). Good postemergence control of white clover was observed with applications of Drive.

Table 2. The evaluation of herbicides for postemergence control of crabgrass applied to a Kentucky bluegrass blend during the 1992 growing season.[1]

Herbicide	Rate lb ai/A	Injury[2] 8/6 37 DAT	% Crabgrass Control[3] 7/24 25 DAT	8/10 41 DAT	9/6 69 DAT
Applied at the 1-4 Leaf Stage					
Dimension 1EC	0.5	9.0f	94.7d	95.6b	70.2a
Dimension 1EC + Acclaim 1EC	0.38 + 0.12	9.0f	100.0d	100.0b	100.0c
Dimension 1EC + Daconate 6	0.38 + 1.0	8.3f	100.0d	100.0b	100.0c
Drive 75DF	0.5	9.0f	100.0d	84.4a	70.2a
Drive 75DF / Drive 75DF	0.5 / 0.5	8.3f	84.1b-d	100.0b	100.0c
Drive 75DF + Barricade	0.5 + 0.5	9.0f	94.7d	97.8b	91.9bc
Drive 75DF + Barricade	0.75 + 0.5	8.3f	94.7d	95.6b	100.0c
Drive 75DF + Pendimethalin	0.5 + 1.5	9.0f	100.0d	100.0b	100.0c
Daconate 6 / Daconate 6	2.0 / 2.0	9.0f	84.1b-d	100.0b	97.3c
Acclaim 1EC	0.18	9.0f	100.0d	97.8b	67.5a

Applied at the 1-2 Tiller Stage	Rate lb ai/A	Injury[2] 8/6 17 DAT	% Crabgrass Control[3] 7/24 4 DAT	8/10 21 DAT	9/6 47 DAT
Drive 75DF + Acclaim 1EC	0.5 + 0.18	6.3b-d	89.4cd	100.0b	100.0c
HOE 360 28g/L EW	0.09	5.3a-c	24.3a	100.0b	100.0c
HOE 360 69g/L EW	0.06	7.7d-f	31.2a	100.0b	97.3c
HOE 360 69g/L EW	0.09	5.0ab	41.8ab	100.0b	100.0c
HOE 360 69g/L EW	0.12	5.0ab	45.5ab	100.0b	100.0c
HOE 360 69g/L EW	0.18	4.7a	50.8ab	100.0b	97.3c
Acclaim 1EC	0.12	6.3b-d	89.4cd	100.0b	100.0c
Acclaim 1EC	0.18	6.7c-e	34.9a	100.0b	94.6bc
Acclaim 1EC	0.25	5.7a-c	34.9a	100.0b	97.3c
Drive 75DF	0.75	8.0ef	31.2a	97.8b	75.6ab
untreated	-	9.0f			

[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 Protected Least Significant Difference test.

[2] Injury evaluations are made on a scale of 1-9 where 9 = no visible injury to the plant and 1 = plant necrosis.

[3] Percent crabgrass control is determined by making a visual estimate of crabgrass cover in each treated plot and comparing this with the visual estimate found in the untreated plot.

Tall Fescue Control with Illoxan

J.E. Haley and D.J. Wehner

Research Protocol:	**Tall Fescue Control with Illoxan**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Turf:	Triathalawn tall fescue blend.
Application of Treatments:	date applied - September 29,1992, all treatments; October 22, 1992, Illoxan treatments reapplied; liquid herbicides - applied with a CO_2 backpack sprayer; spray volume - 40 gpa.
Plot Maintenance:	mowing height - 2.5 inches; pesticides - no additional pesticides; irrigation - none; fertilization - none;
Experimental Design:	RCB; 3 replications.

Tall fescue is an excellent turf species for low or medium maintenance sites. However, because of its bunch type growth habit and coarse leaf texture, tall fescue is viewed as a weed when found growing in a Kentucky bluegrass or perennial ryegrass sward. Tall fescue can be removed with spot application of nonselective herbicides like glyphosate. Selective control of tall fescue can also be made with spot treatments of LESCO TFC (chlorsulfuron, Lesco).

Illoxan (diclofop-methyl, Hoechst-Roussel Agri-Vet) currently is used as a postemergence control for annual grassy weeds in wheat, barley, and soybeans. Tall fescue has shown some sensitivity to this herbicide and this test was established to evaluate Illoxan use as a selective spot treatment control.

All Illoxan treatments produced tall fescue injury 9 DAT (Table 3). At higher rates of Illoxan, injury 23 DAT was similar to the injury produced by LESCO TFC. Following a second application of Illoxan, turf injury from Illoxan at 1.5%, surpassed injury from LESCO TFC. The LESCO TFC treatment was not reapplied a second time. Tall fescue injury will be further evaluated in the spring.

Table 3. Injury to tall fescue from Illoxan.[1]

Herbicide	Rate v/v[3]	Injury[2] 10/8 9 DAT	10/22 23 DAT	10/27 5 DAT[4]	11/09 18 DAT
untreated	-	9.0c	9.0c	9.0c	9.0c
Illoxan	0.75%	8.0b	4.3ab	4.3b	3.0ab
Illoxan	1.0%	8.3bc	5.0b	4.0b	3.3b
Illoxan	1.25%	7.7b	4.0ab	3.3a	3.0ab
Illoxan	1.5%	7.7b	4.0ab	3.0a	2.3a
Lesco TFC	2.55 g cf/M	6.7a	3.3a	3.0a	3.7b

Injury to Quackgrass from Primo Application

J.E. Haley and T.W. Fermanian

Research Protocol:	**Injury to Quackgrass from Primo Application**
Location:	University of Illinois, grounds, Urbana, IL.
Turf:	Kentucky bluegrass.
Application of Treatments:	date applied - May 19,1992, all treatments; liquid herbicides - applied with a CO_2 backpack sprayer; spray volume = 40 gpa;
Plot Maintenance:	site maintained by U. of I. grounds department; maintenance variable;
Experimental Design:	RCB; 3 replications.

Primo (cimectacarb, Ciba Geigy), a growth regulator, has been approved by the EPA for use under the Experimental Use Permit (EUP) Program. Typically, this product would be applied to highly managed turf to reduce mowing frequency and clipping yield, especially in hard to mow sites. In some areas of the country, quackgrass (*Elytrigia repens* L. Nevski) competition is a serious problem in turfgrass. There was a concern in these areas that turfgrass growth would be reduced with applications of Primo but that quackgrass growth would not, giving the quackgrass the competitive edge. The purpose of this trial was to evaluate the effect of Primo applied to a Kentucky bluegrass/quackgrass turf.

[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 Protected Least Significant Difference test.

[2] Turf injury is evaluated on a scale of 1-9 where 9 = no visible turfgrass injury and 1 = dead turf.

[3] Rate is percent herbicide in volume/volume solution, unless otherwise stated.

[4] Data was taken 5 days after the second application of Illoxan.

All formulations and rates caused significant injury to the quackgrass when compared to the untreated plot (Table 4). This injury appeared as chlorosis. There was a general decrease in the population of quackgrass that did not appear to be Primo related. This data would suggest that quackgrass is at least as sensitive to Primo as Kentucky bluegrass. In a mixed Kentucky bluegrass / quackgrass stand it would not appear that the quackgrass would have the competative edge as a result of Primo applications.

Table 4. Injury to and control of quackgrass in a Kentucky bluegrass turf.[1]

Herbicide	Rate lb ai/A	Injury[2] 6/23	Percent Decrease[ns] from 5/19 to 9/2
check	-	8.7c	60.3
Primo 1EC	0.25	7.7b	51.0
Primo 1EC	0.5	5.3a	58.7
Primo 25WP	0.25	7.3b	58.2
Primo 25WP	0.5	5.3a	59.6

Intraspecies Root Development in Tall Fescue (*Festuca arundinacea* Schreb.) Treated with Prodiamine

S. Han and T.W. Fermanian

During the last decade many new tall fescue cultivars have been produced through breeding programs. Most of these new cultivars are considered turf-type tall fescues that have finer leaf blades than earlier cultivars. Recent releases of turf-type cultivars of tall fescue increase its versatility.

The quest for weed-free turf has led to the development of many herbicides for both preemergence and postemergence applications. Turfgrass safety is a primary factor in herbicide selection. Although satisfactory weed control has been frequently obtained, occasionally many of the commonly used preemergence herbicides have detrimental effects on the growth and development of certain cool-season turfgrasses. Injury or growth reduction often occurs when applications are repeated for consistent weed control. The extent of this injury is not always predictable and may vary with turfgrass variety and from year to year.

Since herbicides are extensively used in turf, their residual activity and the response of the turfgrass may determine root development and distribution within the soil

[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 Protected Least Significant Difference test.

[2] Turf injury is evaluated on a scale of 1-9 where 9 = no visible turfgrass injury and 1 = dead turf.

[ns] NS indicates that no significant difference was found among the means in this group of data at the 0.05 level as determined by Fisher's Protected Least Significant Difference test.

profile. Herbicides applied for weed control may also adversely affect fall overseeding, spring green-up and the extent of turfgrass tolerance to unfavorable environmental stress. With the current interest in dinitroaniline herbicides and their widespread use in turf, questions have arisen concerning the effects of prodiamine (Barricade, Sandoz Crop Protection) on root development of cool-season turf species and their cultivars.

The objectives of this study were (1) to determine the effects of prodiamine on root growth among sixty-five tall fescue cultivars in a field study, (2) to compare the effects of prodiamine on root development of 'Midnight' Kentucky bluegrass (*Poa pratensis* L.) and 'Pennfine' perennial ryegrass (*Lolium perenne* L.), and fourteen tall fescue cultivars in a greenhouse study.

Research Protocol:	**Prodiamine Effects on Rooting of Tall Fescue - Field Trial**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Turf:	65 , 4-yr old tall fescue cultivars; plot size - 5 ft x 6 ft.
Prodiamine Treatments:	date applied - July 20, 1991; prodiamine rate - 0, 0.67 kg ai/ha (6 lb ai/A); liquid herbicides - applied with a CO_2 backpack sprayer; spray volume - 40 gpa.
Turf Maintenance:	mowing height - 2 inches; pesticides - no additional pesticides; irrigation - as needed to prevent drought stress; fertilization - 3 lbs N/M in 1989, 1 lb N/M in 1990.
Experimental Design:	strip plot; 3 replications.

Field evalution. In field study, the mean root weight of the sixty five treated tall fescue cultivars was significantly less than the mean root weight for the tall fescue cultivars in the control plots four weeks after treatment. The cultivar 'Murietta' (PST-5D7) had the highest reduction in root weight when compared to the untreated half of the plot (Table 5). However, there was no significant difference among most of the cultivars that displayed a reduction in root weight as a result of prodiamine treatment. Visual quality of the top growth was also reduced by prodiamine, but the turfgrass quality was still considered acceptable.

Table 5. Field grown tall fescue cultivars showing a root reduction of more than 15% when treated with prodiamine at 6.7 kg ai ha^{-1}.

Cultivars	Root reduction[1] (%)	Cultivars	Root reduction[1] (%)
Murietta (PST-5D7)	43	Monarch	20
Winchester (PST-5F2)	26	Taurus	20
Phoenix (Normarc 77)	26	Apache	18
Tip	25	Vegas (Normarc 99)	18
Olympic (PST-50L)	24	Falcon	17
Sundance	23	Bel 86-2	16
Amigo (PST-5HF)	22	Guardian (Pick 845PN)	16
Titan	22	Eldorado (PST-5D1)[2]	16
Willamette	22	PST-5AG	15
Shortstop (Pick DDF)	21		

Research Protocol:	**Prodiamine Effects on Rooting of Tall Fescue - Greenhouse Trial**
Location:	Plant Science Laboratory Greenhouse, Urbana, IL.
Turf:	14 cultivars of tall fescue, 'Midnight' Kentucky bluegrass,'Pennfine' perennial ryegrass.
Seeding/ Establishment:	date seeded - Nov 19, 1991; PVC tube size - 4 inches in diameter, 60 inches in length; rooting medium - Turface (fired clay).
Prodiamine Treatments:	prodiamine rates - 0, 0.84, 1.68 kg ai/ha; date applied - April 2, 1992 (135 days after seeding); root sampling - 4 weeks after treatment.
Turf Maintenance:	mowing height - 2 inches; pesticides - no additional pesticides; irrigation - 6 hour a day by drip irrigation; fertilization - 20 L of hoagland solution (half strength) a day.
Experimental Design:	strip plot; 6 replications.

Greenhouse evaluation. In the greenhouse study, prodiamine at 0.84 and 1.68 kg ai/ha caused 22% and 29% mean reductions in total root dry weight, respectively, when compared to the control four weeks after treatment. Rooting of 'Rebel', 'Sundance' and 'Amigo TF' was significantly reduced by prodiamine at 1.68 kg ai/ha, however, prodiamine did not inhibit the rooting of 'Tip' tall fescue at 0.84 and 1.68 kg ai/ha (Table 6). Prodiamine effects on rooting of all sixteen cultivars in the greenhouse study are shown in Figure 1. The mean total root length of the sixteen cultivars was slightly decreased as the herbicide rate increased but was not found to be significant. No visible phytotoxicity was observed at both prodiamine rates during the experimental period.

[1]Root samples were taken four weeks after herbicide application.

[2]Greenhouse response of 16 selected cultivars to prodiamine at 0.84 and 1.68 kg ai ha^{-1} on root development expressed in percent of the control.

Rooting of Kentucky bluegrass was inhibited more than tall fescue and perennial ryegrass with prodiamine treatment. An additional greenhouse study has been initiated to substantiate the differences of rooting among tall fescue cultivars.

Table 6. Greenhouse response of 16 selected cultivars to prodiamine at 0.84 and 1.68 kg ai ha^{-1} on root development expressed in percent of the control.

Cultivar[2]	Root Weight (%)[1] Prodiamine Rates (kg ai/ha)	
Tall Fescue	0.84	1.68
Tip	137.4a	159.2a
Aztec	132.2a	90.8b
Winchester (PST-5F2)	128.5a	88.2b
Taurus	115.9ab	93.0b
Shenandoah (PE-7E)	95.0ab	104.1ab
Olympic II (PST-50L)	97.1ab	91.4b
Amigo (PST-5HF)	97.9ab	77.3b
Phoenix (Normarc 77)	85.1ab	86.7b
Guardian (PICK 845PN)	84.3ab	85.5b
Olympic	91.9ab	76.2b
Murietta (PST-5D7)	88.4ab	67.6b
Sundance	81.1ab	74.5b
Rebel	94.5ab	58.9b
Titan	73.5ab	78.5b
Perennial Ryegrass		
Pennfine	96.2ab	89.0b
Kentucky Bluegrass		
Midnight	57.8b	64.9b
$LSD_{0.05}$*	65.8	63.8

Acknowledgements

The authors wish to acknowledge the Illinois Turfgrass Foundation for their support of this research.

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[1]Root weights (%) are an average of six replications.

[2]Cultivars listed in order of prodiamine tolerance from the overall mean of the two treatments (0.84 and 1.68 kg ai ha^{-1}).

*For comparison of cultivars within a herbicide treatment.

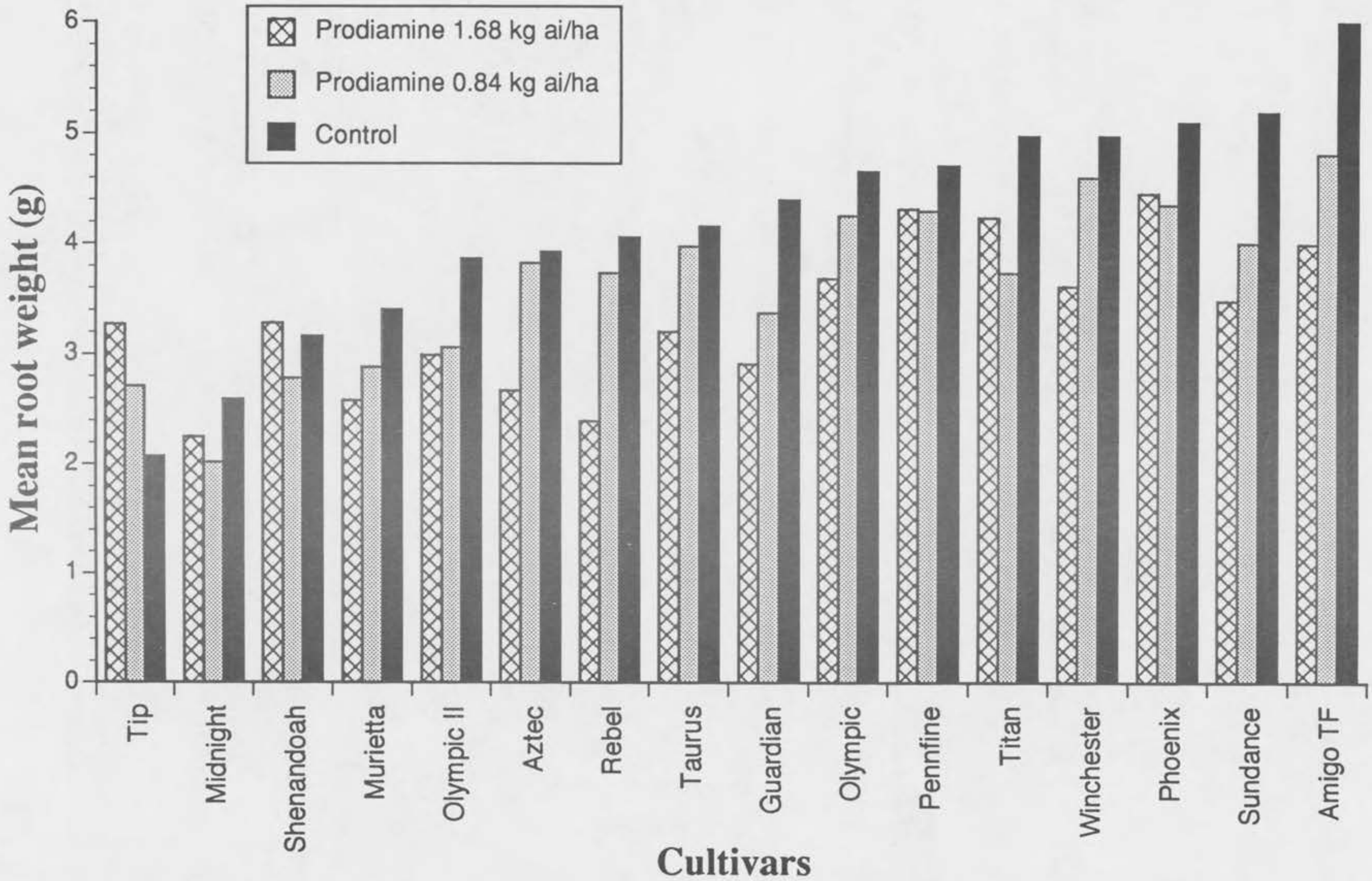

Figure 1. Mean total root weights of selected 16 cultivars when treated with prodiamine at 0.84 and 1.68 kg ai/ha.

HERBICIDE EVALUATIONS CONDUCTED ON CREEPING BENTGRASS TURF AT THE UNIVERSITY OF ILLINOIS

Dacthal Applied to a Creeping Bentgrass Turf Maintained at 3 Different Mowing Heights

J.E. Haley

Research Protocol:	**Dacthal Applied to a Creeping Bentgrass Turf Maintained at 3 Different Mowing Heights**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Turf:	Penncross creeping bentgrass.
Application of Treatments:	date applied - June 18,1992, all treatments; treatment - Dacthal @ 10.5 lbs ai/A applied with a CO_2 backpack sprayer; spray volume - 40 gpa.
Plot Maintenance:	mowing height - 0.25, 0.5 and 0.75 inches; pesticides - no additional pesticides; irrigation - to prevent stress; fertilization - 4 lbs N/M/yr.
Experimental Design:	strip plot; 4 replications.

Currently creeping bentgrass (*A. palustris*) is being more frequently used on golf course fairways. Many herbicides considered to be safe on Kentucky bluegrass fairways will result in turf injury when applied to creeping bentgrass mowed at 1 inch or less. In an effort to evaluate the potential phytotoxicity of Dacthal (DCPA, ISK Biotech) applied to a creeping bentgrass fairway, a trial was established on a creeping bentgrass turf maintained at 3 mowing heights, 0.25, 0.5 and 0.75 inches.

During this trial, no injury from Dacthal was observed on the bentgrass at any of the 3 mowing heights (Table 1). However, it should be noted that growing conditions were unusually favorable during this evalution. Temperatures were cool and rainfall plentiful. The turf was not exposed to wear stress, thus this effect could not be measured. To accurately determine Dacthal injury potential to creeping bentgrass, it would be necessary to repeat this evaluation during a more typical growing season.

Table 1. Dacthal injury on creeping bentgrass turf maintained at 3 mowing heights.[1]

Mowing Height Inches	Injury[ns] 7/9	Treatment	Injury[2ns] 7/9
0.25	8.6	Dacthal @ 10.5 lbs ai/A	8.5
0.50	8.6	Untreated	8.7
0.75	8.5		

Illoxan Applied to a Creeping Bentgrass Turf Mowed at 0.5 Inch

J.E. Haley, and D.J. Wehner

Research Protocol:	**Illoxan on Creeping Bentgrass Turf Mowed at 0.5 Inch**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Turf:	Penncross creeping bentgrass.
Application of Treatments:	date applied - June 29, 1992 ,early treatments; July 20, 1992, mid treatments; liquid herbicides - applied with a CO_2 backpack sprayer; spray volume - 40 gpa.
Plot Maintenance:	mowing height - 0.5 inch; pesticides - no additional pesticides; irrigation - to prevent stress; fertilization - 4 lbs N/M/yr; fungicides - as needed for disease prevention and control .
Experimental Design:	RCB; 3 replications.

Illoxan, also known as Hoelon 3EC, (diclofop-methyl, Hoechst-Roussel Agri-Vet) currently is used to control annual grassy weeds in wheat, barley, and soybeans. It is applied primarily as an early postemergence control on such sensitive and partially sensitive weeds as annual ryegrass (*Lolium miltiflorum*), crabgrass (*Digitaria* spp.) and giant foxtail (*Setaria faberii*).[3] There is some indication that creeping bentgrass may be tolerant to Illoxan. A preliminary study was designed to determine creeping bentgrass sensitivity to this herbicide.

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

[ns] NS indicates that no significant difference was found among the means in this group of data at the 0.05 level as determined by Fisher's Protected Least Significant Difference test.

[2] Injury evaluations are made on a scale of 1-9 where 9 = no visible injury to the plant and 1 = plant necrosis.

[3] For other sensitive weeds please consult the herbicide label.

Illoxan injury to creeping bentgrass was acceptable with early or mid season applications of 0.5 to 0.75 lbs ai/A (Table 2). Where injury occurred it was visible as chlorosis and appeared 4 to 7 days following application. By early August, none of the plots showed signs of injury. Since the evaluation area was free of crabgrass it is not known how efficacious this product applied at these rates would be.

Table 2. The evaluation of Illoxan applied to creeping bentgrass turf maintained at 0.5 inches.[1]

		Injury[2]				
	Rate	7/6	7/15	7/24	7/29	8/7[ns]
Treatment	lbs ai/A	7 DAT	16 DAT	25 DAT	30 DAT	39 DAT
Applied June 29						
Illoxan	0.5	8.3b	8.7bc	9.0c	9.0c	8.7
Illoxan	0.75	8.0b	9.0c	9.0c	9.0c	9.0
Illoxan	1.0	6.7a	8.3ab	8.7bc	9.0c	8.3
Acclaim	0.036	8.0b	8.0a	8.7bc	9.0c	8.7
Applied July 20				4 DAT	9 DAT	18 DAT
Illoxan	0.5			8.7bc	9.0c	8.7
Illoxan	0.75			8.0ab	8.3b	8.7
Illoxan	1.0			7.3a	7.3a	8.7
untreated	-	9.0b	9.0c	9.0c	9.0c	8.7

[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 Protected Least Significant Difference test.

[2]Injury evaluations are made on a scale of 1-9 where 9 = no visible injury to the plant and 1 = plant necrosis.

[ns]NS indicates that no significant difference was found among the means in this group of data at the 0.05 level as determined by Fisher's Protected Least Significant Difference test.

Dimension Applied to a Creeping Bentgrass Green Grown on Native Soil

J.E. Haley and T.W. Fermanian

Research Protocol:	**Dimension Applied to aCreeping Bentgrass Green Grown on Native Soil**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Turf:	Penncross creeping bentgrass green.
Application of Treatments:	date applied - June 18, 1992 all treatments; liquid herbicides - applied with a CO_2 backpack sprayer; spray volume - 40 gpa.
Turf Maintenance:	mowing height - 0.25 inches; pesticides - no additional pesticides; irrigation - to prevent stress; fertilization - 4 lbs N/M/yr.
Experimental Design:	RCB; 3 replications.

Dimension (dithiopyr, Monsanto) is a newly labeled pre and postemergence herbicide for control crabgrass. It has been found to be safe for use on creeping bentgrass fairways maintained at mowing heights of 0.5 to 1 inch. It appears to be safe when applied at recommended rates to creeping bentgrass greens grown on "amended" soils (soils with a high sand content). However, some injury has been observed when Dimension has been applied to "non-amended" creeping bentgrass greens or greens grown on soils with high clay content. In a study conducted at the University of Illinois, no injury was observed from applications of Dimension 1EC at 0.5 lb ai/A and Mon 25134 (an 0.1% granular formulation of dithiopyr) at 0.38 lb ai/A.

BROADLEAF WEED CONTROL RESEARCH AT THE UNIVERSITY OF ILLINOIS

Broadleaf weeds compete with turfgrass for water, light, space and nutrients. They reduce the aesthetic quality of the turf and are often symptomatic of an underlying problem (soil compaction, poor nutrition etc.).

Preemergence Broadleaf Weed Control

J.E. Haley and D.J. Wehner

Research Protocol:	**Preemergence Broadleaf Weed Control**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Turf:	Kentucky bluegrass
Application of Treatments:	date applied - April 26, 1991, Oct. 16, 1991, April 28, &Sept 29, 1992; liquid herbicides - applied with a CO_2 backpack sprayer; spray volume - 40 gpa.
Plot Maintenance:	mowing height - 2.5 inches; pesticides - no additional pesticides; irrigation - none; fertilization - none;
Experimental Design:	RCB; 3 replications.

Some herbicides that prevent crabgrass germination will also control select broadleaf weeds such as yellow woodsorrel (*Oxalis stricta*), prostrate spurge (*Euphorbia humistrata*), and chickweed (*Cerastium vulgatum* and *Stellaria media*). Gallery (isoxaben, DowElanco) is labeled to control, suppress, or partially control these weeds, and over 40 other broadleaf weed and annual grass species with preemergence applications to cool and warm season turfgrasses.

Gallery was evaluted in two trials at the University of Illinois. The first evaluation looked at selected rates and application timing of Gallery, Barricade (prodiamine, Sandoz Crop Protection) and Team (benefin + trifluralin, DowElanco) from the spring of 1991 through the fall of 1992. The second study is evaluating Gallery and Barricade from the spring of 1992 through the fall 1993.

During the first evaluation, differences in broadleaf weed populations among treatments were significant on only one date in 1992 (Table 1). The data indicates that for good control of spring germinating broadleaf weeds, a preemergence application of Gallery should be made in spring. Applications made the previous fall did not seem to provide enough control of the spring broadleaf weeds. Broadleaf weed species growing at this site were white clover (*Trifolium repens*), prostrate spurge, and dandelion (*Taraxacum officinale*).

Although Gallery is not sold as a preemergence crabgrass control herbicide, it is interesting to note, that 1992 spring applications of Gallery controlled crabgrass as well as applications of Team.

In the second, trial no significant differences among treatments have been observed at this time (Table 2). Although not statistically significant, crabgrass populations were slightly higher in plots not receiving a 1992 spring application of Barricade or Barricade + Gallery.

Table 1. The evaluation of Gallery applications made to a Kentucky bluegrass turf from spring 1991 to spring 1992.[1]

Herbicide	Time Applied	Rate lbs ai/A	Percent Broadleaf Weeds[2] 6/1/92	Percent Broadleaf Weeds[2] 7/24/92[ns]	Percent Broadleaf Weeds[2] 10/1/92[ns]	Percent crabgrass[3] 7/24/92
Barricade / Gallery	spring '91	0.65/0.75	1.0ab	9.0	41.7	9.0a-c
Barricade	spring '91	0.65	15.0cd	30.0	63.3	5.7ab
Gallery	fall '91	1.0	8.3a-d	32.7	41.0	8.3ab
Gallery	spring '91	1.0	2.7a-c	5.7	35.0	11.3bc
Gallery	spring '92	1.0	0.0a	1.7	3.0	0.7a
Gallery + Gallery	fall '91 + spring '92	0.75 + 0.75	3.3a-c	6.0	6.7	2.7ab
Gallery / Team w/ fertilizer + Team	fall '91 + spring '92	2.72 + 2.0	13.3b-d	35.7	39.0	0.7a
Trimec	spring '91 & '92, fall '91	3 pt cf/A	0.3a	1.0	3.7	18.3c
untreated	-	-	20.7d	40.0	66.7	10.7bc

Table 2. The evaluation of Gallery applications made to a Kentucky bluegrass turf from spring 1992 to spring 1993.[1]

Herbicide	Time Applied	Rate lbs ai/A	Percent Broadleaf Weeds[2] 7/24/92[ns]	Percent Broadleaf Weeds[2] 10/1/92[ns]	Percent crabgrass[3] 7/24/92[ns]
Barricade + Gallery	spring '92	0.49 + 0.75	3.0	5.3	0.0
Barricade	spring '92	0.65	6.7	17.7	0.0
Gallery	fall '92	1.0	6.0	14.0	4.3
Gallery / Gallery	fall '92/spring '93	0.75 / 0.75	7.7	10.7	4.3
Trimec	spring '92 & '93, fall '92	3.0 pt cf/A	5.0	8.3	4.3
untreated	-	-	5.0	10.7	6.7

[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 Protected Least Significant Difference test.

[2] Percent broadleaf weeds refers to the percent area of the plot covered with broadleaf weeds.

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

[ns] NS indicates that no significant difference was found among the means in this group of data at the 0.05 level as determined by Fisher's Protected Least Significant Difference test.

Postemergence Broadleaf Weed Control

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

Research Protocol:	**Postemergence Broadleaf Weed Control**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Turf:	Kentucky bluegrass.
Application of Treatments:	date applied - June 19,1992, all treatments; July 24, 1992, Drive 2nd applications; liquid herbicides - applied with a CO_2 backpack sprayer; spray volume - 40 gpa.
Plot Maintenance:	mowing height - 2.5 inches; pesticides - no additional pesticides; irrigation - none; fertilization - none;
Experimental Design:	RCB; 3 replications.

Many of the available postemergence herbicides will kill a variety of broadleaf weeds. These herbicides are often a combination of several active ingredients and are found in a variety of formulations. The purpose of this research was to evaluate several postemergence herbicides for weed control efficacy. Herbicide formulations can be found in Table 3 and herbicide rates and weed control results can be found in Tables 4 and 5.

When reviewing the data it should be noted that the trial site was flooded following heavy rainfall several times during the test period. All herbicide applications provided good white clover control 11 DAT when compared with the untreated plot (Table 4). Drive at 0.375 lb ai/A, Drive at 0.5 lb ai/A with a second application of Drive at 0.5 lb ai/A, and Drive + Pendimethalin were slower to respond than other treatments but at 24 DAT these all exhibited excellent control. AT 48 DAT, control with these treatments surpassed some of the labeled products.

Table 3. Herbicides evaluated for postemergence control of broadleaf weeds.

Trade Name	Active Ingredients or Common Name	Manufacturer
Dissolve	2,4-D; MCPP; 2,4-DP	Riverdale Chemical Co.
RD 50-25-05	2,4-D; MCPP; 2,4-DP	Riverdale Chemical Co.
RD 50-20-05	2,4-D; MCPP; 2,4-DP	Riverdale Chemical Co.
Tri-Power WS	MCPA; MCPP; and dicamba	Riverdale Chemical Co.
Trimec	2,4-D; MCPP; and dicamba	DowElanco
Tuflon II Amine	2, 4-D amine; triclopyr amine	DowElanco
Turflon ester	triclopyr	DowElanco
Confront	triclopyr; clopyralid	DowElanco
XRM 5202	2,4-D; triclopyr; and clopyralid	DowElanco
Drive	quinclorac	BASF
Duplosan (2,4DP-P)	dichlorprop	BASF

Table 4. The evaluation of herbicides for postemergence control of white clover.[1]

Herbicide	Rate lb ai/A	Clover Control[2] 6/30 11 DAT	7/13 24 DAT	8/6 48 DAT
Confront	3.0 pt cf/A	2.0a	1.0a	1.0a
Dissolve	1.8 lb cf/A	4.0e	2.7bc	3.3c
Dissolve	2.5 lb cf/A	3.3c-e	2.0a-c	3.0bc
Drive[3]	0.375	6.3g	1.0a	1.3a
Drive + 2,4DP-P	0.375 + 0.75	3.0b-d	1.3a	1.0a
Drive + Confront	0.375 + 1.3 pt cf/A	2.3ab	1.0a	1.0a
Drive + Pendimethalin	0.375 + 1.5	5.7fg	2.0a-c	2.3a-c
Drive + Turflon	0.375 + 3 pt cf/A	3.0b-d	1.0a	1.0a
Drive/Drive	0.5 / 0.5	5.0f	1.7ab	1.0a
RD 50-20-05	2.0 lb cf/A	3.0b-d	1.7ab	1.7ab
RD 50-20-05	2.8 lb cf/A	2.3ab	1.0a	1.7ab
RD 50-25-05	1.8 lb cf/A	2.7a-c	1.7ab	1.7ab
RD 50-25-05	2.5 lb cf/A	3.0b-d	1.7ab	2.3a-c
Trimec Classic	3.25 pt cf/A	4.0e	3.0c	2.3a-c
TriPower	2.5 pt cf/A	4.0e	1.7ab	2.0a-c
TriPower	3.5 pt cf/A	2.0a	1.3a	1.3a
Turflon Ester + Trimec Classic	1 pt cf/A + 3.25 pt cf/A	3.0b-d	1.3a	1.0a
Turflon II Amine	3 pt cf/A	2.7a-c	2.0a-c	3.3c
untreated	-	9.0h	9.0d	9.0d
XRM 5202	3 pt cf/A	3.7de	1.7a	2.3a-c

Dandelion control was fair to good with most of the herbicide treatments at 11DAT (Table 5). At 24 and 48 DAT all treatments provided good to excellent control when compared with the untreated plot.

[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 Protected Least Significant Difference test.

[2] All weed control evaluations are made on a scale of 1-9, where 9 = no control of the weed species indicated and 1 = no weeds present. A rating of 5 would indicate some injury to the weed or total control of some of the weeds but little control of others.

[3] All Drive applications were made in a solution with the surfactant BAS09002S at 1 qt surfactant/A.

Table 5. The evaluation of herbicides for postemergence control of dandelion.[1]

Herbicide	Rate lb ai/A	Dandelion Control[2] 6/30 11 DAT	7/13 24 DAT	8/6 48 DAT
Confront	3.0 pt cf/A	3.3ab	1.3ab	2.0a
Dissolve	1.8 lb cf/A	3.3ab	1.0a	1.0a
Dissolve	2.5 lb cf/A	3.0a	1.0a	2.0a
Drive[3]	0.375	7.0e	2.3bc	1.7a
Drive + 2,4DP-P	0.375 + 0.75	4.7cd	1.7a-c	1.3a
Drive + Confront	0.375 + 1.3 pt cf/A	3.3ab	1.0a	1.0a
Drive + Pendimethalin	0.375 + 1.5	5.3d	1.7a-c	1.0a
Drive + Turflon	0.375 + 3 pt cf/A	3.7a-c	1.0a	1.3a
Drive/Drive	0.5 / 0.5	5.3d	2.7a-c	1.0a
RD 50-20-05	2.0 lb cf/A	3.3ab	1.0a	1.7a
RD 50-20-05	2.8 lb cf/A	3.0a	1.7a-c	1.7a
RD 50-25-05	1.8 lb cf/A	3.3ab	1.0a	1.0a
RD 50-25-05	2.5 lb cf/A	3.0a	1.0a	1.0a
Trimec Classic	3.25 pt cf/A	4.3b-d	1.7a-c	1.7a
TriPower	2.5 pt cf/A	3.7a-c	1.3ab	1.0a
TriPower	3.5 pt cf/A	4.0a-c	2.0a-c	2.0a
Turflon Ester + Trimec Classic	1 pt cf/A + 3.25 pt cf/A	3.3ab	1.0a	1.3a
Turflon II Amine	3 pt cf/A	3.3ab	1.0a	1.3a
untreated	-	9.0f	9.0d	9.0b
XRM 5202	3 pt cf/A	4.3b-d	1.3ab	1.3a

[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 Protected Least Significant Difference test.

[2]All weed control evaluations are made on a scale of 1-9, where 9 = no control of the weed species indicated and 1 = no weeds present. A rating of 5 would indicate some injury to the weed or total control of some of the weeds but little control of others.

[3]All Drive applications were made in a solution with the surfactant BAS09002S at 1 qt surfactant/A.

Injury to Buffalograss from Postemergence Broadleaf Weed Herbicide

J.E. Haley and T.B. Voigt

Research Protocol:	**Injury on Buffalograss from Postemergence Broadleaf Weed Herbicide**
Location:	Ornamental Horticulture Research Center, Urbana, IL.
Turf:	Buffalograss.
Application of Treatments:	date applied - June 19,1992, all treatments; liquid herbicides - applied with a CO_2 backpack sprayer; spray volume - 40 gpa.
Plot Maintenance:	mowing height - 2.5 inches; pesticides - no additional pesticides; irrigation - none; fertilization - none.
Experimental Design:	RCB; 3 replications.

Buffalograss (*Buchloe dactyloides*), a grass native to the United States, is more frequently being selected as an alternative turf in low maintenance situation. Buffalograss is slow to establish and weeds can be a problem until a mature sod is formed. At this time, postemergence herbicides are probably the best way to deal with a broadleaf weed infestation in buffalograss. A study was established at the University of Illinois to determine the safety of some of the most common broadleaf weed control herbicides on this grass specie.

Table 6. Injury to Buffalograss from selected postemergence broadleaf weed herbicides.[1]

		Injury[2]		
Herbicide	Rate pt cf/A	6/24 5 DAT	6/30 11 DAT	7/14 25 DAT
Turflon II Amine	3.0	7.7b	6.0ab	8.0b
Confront	2.0	8.3bc	7.3bc	8.3bc
Trimec Classic	3.0	8.0bc	7.0bc	8.7bc
XRM 5202	3.0	7.7b	8.0cd	8.7bc
Drive[3]	0.5 lb ai/A	9.0c	9.0d	9.0c
Drive + 24D-DP	0.5 lb ai/A + 1.5	6.0a	5.3a	6.0a
untreated	-	8.7bc	9.0d	9.0c

[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 Protected Least Significant Difference test.

[2] Turf injury is evaluated on a scale of 1-9 where 9 = no visible turfgrass injury and 1 = dead turf.

[3] All Drive applications were made in a solution with the surfactant BAS09002S at 1 qt surfactant/A.

Significant turf injury was observed with several of the herbicides (Table 6). Most of the injury was not serious or long lasting. Drive + 24D-DP and Turflon II Amine were the most damaging at 11 DAT after treatment. At 25 DAT only Drive + 24D-DP treated turf had unacceptable injury. It should be noted that this site was temporarily flooded following heavy rainfall several times during the season. Water covered the plots for less than 24 hours each time, but it is not known what effect this may have had on the resulting data.

WEED CONTROL RESEARCH AT SOUTHERN ILLINOIS UNIVERSITY

Pre- and Postemergent Control of Turfgrass Weeds in Drought Stressed Kentucky Bluegrass Turf.

K.L. Diesburg and N.A. LaReau

The purpose of this evaluation was to compare the efficacy of some experimental and some unique combinations of herbicides on season-long preemergent and early postemergent control of crabgrass (*Digitaria* spp.) and preemergent control of selected broadleaf weeds. The herbicides evaluated in this trial include Acclaim 1EC (fenoxaprop, Hoechst Roussel Agri-Vet), Balan 2.5G (benefin, DowElanco), Barricade 65WG (prodiamine, Sandoz Crop Protection), Daconate 6 (MSMA, ISK Biotech), Dimension 1EC, and MON 25134 0.1G (dithiopyr, Monsanto Agricultural Co.), Drive 75DF (quinclorac, BASF), PreM 60DF (pendimethalin, O.M. Scott & Sons Co.), Ronstar 2G biodac, and Ronstar 2G clay (oxadiazon, Rhone-Poulenc Agricultural Co.). Herbicide rates and application dates can be found in Tables 1 - 5.

Research Protocol:	**Pre- and Postemergent Control of Turfgrass Weeds in Drought Stressed Kentucky Bluegrass Turf.**
Location:	Jackson Country Club, Murphysboro, IL.
Site:	turf - Kentucky bluegrass; plot size - 5 ft x 5 ft.
Application of Treatments:	date applied - April 11,1992, all preemergent treatments; June 10, 1992 most postemergent treatments; liquid herbicides - applied with a CO_2 backpack sprayer; spray volume - 150 gpa granular materials - "salt " shaker.
Turf Maintenance:	mowing height - 2.0 inches ; pesticides - no additional pesticides applied; irrigation - none; fertilization - 2 lbs N/M/yr..
Experimental Design:	RCB; 3 replications.

Preemergent herbicides were applied on April 11, 1992 when the soil temperature was 60.1°F. Unseasonably cool temperatures in late spring and early summer combined with little rainfall delayed crabgrass germination until early July, although limited germination was observed on June 3. Irrigation was unavailable so that crabgrass growth could not be induced. Crabgrass germination during the test period remained limited as evidenced in the untreated plots and surrounding areas. Early (three-leaf stage) postemergent crabgrass control applications were made on June 10, a final application of Drive was made on July 12, and a cleanup application of Acclaim was made on August 21.

Turf quality was not significantly reduced by any of the herbicide treatments when compared with the untreated plot (Table 1). It is important to note, that although not statistically significant, Barricade and Dimension treatments exhibited a frequent decrease in turfgrass quality. Barricade at 0.65 lb ai/A with a repeat application of 0.168 lb ai/A applied 60 days after the first treatment is of particular note.

Table 1. Changes in turf quality following herbicide applications.[1]

Herbicide*	Rate lbs ai/A	% Change in Turf Quality[2] 7/23/92	9/6/92
Ronstar 2G bio + MON 25134 0.1G	2.0 + 0.25	+6	-10
Drive[s3] / Drive[4]	0.5 / 0.5	0	-11
MON 25134 0.1G	0.19	+22	-11
Ronstar 2G clay	4.0	+6	-17
MON 25134 0.1G	0.25	+5	-21
MON 25134 0.1G	0.38	-7	-24
Pre-M	4.0	-9	-25
Untreated	-	-7	-26
Ronstar 2G bio	4.0	+5	-26
Dimension 1EC / Drive[s5]	0.5 / 0.375	+2	-28
Balan	3.0	-11	-34
Ronstar 2G bio	2.0	+6	-39
Barricade 65WG	0.75	-11	-40
Barricade 65WG / Barricade 65WG[6]	0.75 / 0.5	-7	-40
Dimension 1EC[3]	0.5	-43	-43
Dimension 1EC / Daconate 6[3]	0.38 / 1.0	-19	-43
Ronstar 2G bio + MON 25134 0.1G	1.0 + 0.25	-36	-48
Dimension 1EC / Acclaim 1EC[3]	0.38 / 0.12	-41	-50
Dimension 1EC	0.5	-41	-52
Ronstar 2G bio + MON 25134 0.1G	1.0 + 0.125	-48	-52
Ronstar 2G bio + MON 25134 0.1G	2.0 + 0.125	-31	-56
Barricade 65WG / Barricade 65WG[6]	0.65 / 0.168	-55	-66
$LSD_{0.05}$		69	50

[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 Protected Least Significant Difference test.

[2] Percent change in turf quality was determined through the formula: (final quality - starting quality)/starting quality x 100.

*Unless otherwise noted all applications were made April 11, 1992.

[s] All Drive applications were made in a tank mix with the surfactant Lutensol at a rate of 1 qt Lutensol/A.

[3] This treatment was applied as a postemergent control on June 10, 1992.

[4] The second application was made 32 days after the first.

[5] The second application was made on 8/21/92.

[6] The second application was made 60 days after the first.

When evaluated on July 23, the treatment of Barricade at 0.65 lb ai/A with a second application of 0.168 lb ai/A 60 days following the first was the only one shown to have a significant positive change in turfgrass cover compared to the untreated plot (Table 2). This seems incongruous in view of the turfgrass quality changes found in

Table 2. Changes in turf cover following herbicide applications.[1]

Herbicides*	Rate lbs ai/A	% Change in Turf Cover[2] 7/23
Barricade 65WG / Barricade 65WG[3]	0.65 / 0.168	133
MON 25134 0.1G	0.25	105
Ronstar 2G clay	4.0	105
Dimension 1 EC / Daconate 6[4]	0.38 / 1.0	87
Pre-M	4.0	68
Drive[s4] / Drive[5]	0.5 / 0.5	67
Dimension 1EC / Drive[6]	0.5 / 0.375	62
Barricade 65WG	0.75	61
Ronstar 2G bio + MON 25134 0.1G	2.0 + 0.25	60
MON 25134 0.1G	0.19	50
MON 25134 0.1G	0.38	48
Ronstar 2G bio	2.0	35
Dimension 1EC[4]	0.5	33
Barricade 65WG / Barricade 65WG[3]	0.75 / 0.5	28
Dimension 1EC / Acclaim 1EC[4]	0.38 / 0.12	28
Ronstar 2G bio + MON 25134 0.1G	1.0 + 0.25	27
Ronstar 2G bio	4.0	26
Dimension 1EC	0.5	23
Ronstar 2G bio + MON 25134 0.1G	1.0 + 0.125	22
Ronstar 2G bio + MON 25134 0.1G	2.0 + 0.125	16
Untreated	-	16
Balan	3.0	7
$LSD_{0.05}$		103

[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 Protected Least Significant Difference test.

[2]Percent change in turf cover was determined through the formula: (final cover - starting cover)/starting cover x 100.

*Unless otherwise noted all applications were made April 11, 1992.

[3]The second application was made 60 days after the first.

[4]This treatment was applied as a postemergent control on June 10, 1992.
[s]All Drive applications were made in a tank mix with the surfactant Lutensol at a rate of 1 qt Lutensol/A.

[5]The second application was made 32 days after the first.

[6]The second application was made on 8/21/92.

Table 3. Crabgrass and white clover cover in turf treated with pre and postemergent herbicides.[1]

Herbicide*	Rate lbs ai/A	% Crabgrass Cover[2] 7/23	% Crabgrass Cover[2] 9/6	% Clover Cover[3] 9/6
Ronstar 2G clay	4.0	0	0	0
Barricade 65WG / Barricade 65WG[4]	0.65 / 0.168	0	0	0
Ronstar 2G bio + MON 25134 0.1G	1.0 + 0.25	0	0	0
Balan	3.0	0	0	0
Ronstar 2G bio + MON 25134 0.1G	2.0 + 0.125	0	1.7	0
Dimension 1EC / Drive[s5]	0.5 / 0.375	0	0	0
Barricade 65WG / Barricade 65WG[4]	0.75 / 0.5	0	1.3	0
Dimension 1EC / Daconate 6[6]	0.38 / 1.0	0	0	0
Pre-M	4.0	0	0	0
Ronstar 2G bio + MON 25134 0.1G	2.0 + 0.25	0	0	0.3
Dimension 1EC[6]	0.5	0	0.3	0.3
MON 25134 0.1G	0.25	0	0	1
Dimension 1EC / Acclaim 1EC[6]	0.38 / 0.12	0	0	1.3
Drive[s6] / Drive[7]	0.5 / 0.5	0.3	0.3	0
Dimension 1EC	0.5	0.3	0	0
MON 25134 0.1G	0.38	0.3	0	0.3
Ronstar 2G bio	4.0	0.3	0	0.7
Ronstar 2G bio + MON 25134 0.1G	1.0 + 0.125	0.7	0.7	0
Barricade 65WG	0.75	0.7	0.3	0.7
MON 25134 0.1G	0.19	1.3	0.3	7.3
Untreated	-	4.3	5.0	1.7
Ronstar 2G bio	2.0	7.0	2.3	0
$LSD_{0.05}$		3.0	1.7	3.2

[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 Protected Least Significant Difference test.

[2] Percent crabgrass cover refers to a visual estimate of plot area covered with crabgrass.

[3] Percent clover cover refers to a visual estimate of plot area covered with clover .

*Unless otherwise noted all applications were made April 11, 1992.

[4] The second application was made 60 days after the first.

[s] All Drive applications were made in a tank mix with the surfactant Lutensol at a rate of 1 qt Lutensol/A.

[5] The second application was made on 8/21/92.

[6] This treatment was applied as a postemergent control on June 10, 1992.

[7] The second application was made 32 days after the first.

Table 1. This result could be misleading, considering the fact that the average initial turfgrass cover for this treatment was the lowest in the trial at 18%. Any increase in the turfgrass cover of those plots would therefore result in a greater percentage increase than a comparable increase in plots having more initial cover.

Although crabgrass pressure was good in the lower southeast corner of the trial, the season was too cool and dry for successful uniform establishment of crabgrass within the experiment. As a result of poor crabgrass germination no significant differences in crabgrass control were observed among treatments (Table 3). However, some herbicide performance should be noted. Plots that had crabgrass July 23 but where it was eliminated by Sept 6 were those treated with Dimension at 0.5 lb ai/A, MON 25134 at 0.38 lb ai/A, and Ronstar bio at 4.0 lb ai/A. Herbicides that provided partial control of crabgrass throughout the season included Ronstar bio at 2.0 lb ai/A, MON 25134 at 0.19 lb ai/A, Barricade at 0.75 lb ai/A, Ronstar bio 1.0 lb ai/A + Dimension at 0.125 lb ai/A, and Drive at 0.5 lb ai/A with a second application at 0.5 lb ai/A 32 days following the first.

White clover (*Trifolium repens*) occurred sporadically throughout the experimental area. Turf treated with Mon 25134 at 0.19 lb ai/A had more clover in it than the untreated plot (Table 3). Other herbicide treatments that did not control clover were Dimension at 0.38 lbs ai/A plus Acclaim at 0.12 lbs ai/A, MON 25134 at 0.25 and at 0.38 lbs ai/A, Barricade at 0.75 lbs ai/A, Ronstar bio at 4.0 lbs ai/A, Ronstar bio at 2.0 lbs ai/A plus Dimension at 0.25 lbs ai/A, and Dimension at 0.5 lbs ai/A.

Buckhorn plantain (*Plantago lanceolata)* occurred uniformly across the experiment. Dimension 1EC at 0.5 lbs ai/A, Barricade at 0.75 lbs ai/A with a repeat application of 0.5 lbs ai/A 60 days following the first, and Dimension at 0.5 lbs ai/A plus Drive at 0.375 lbs ai/A controlled the initial population and prevented reestablishment (Table 4). Barricade at 0.65 lbs ai/A plus a repeat application of 0.168 lbs ai/A 60 days later, Drive 0.5 lbs ai/A with a repeat application of 0.5 lbs ai/A 32 days later, and Pre-M significantly injured initial populations but allowed reestablishment of the original plants. Balan, and Ronstar clay at 4.0 lbs ai/A allowed final populations to be greater than that of the untreated plot.

Lespedeza (*Lespedeza striata*) populations were variable. Uneven distribution of this weed throughout the test site made it difficult to accurately asses population changes. Dimension at 0.5 lbs ai/A and MON 25134 at 0.25 lbs ai/A eliminated initial populations and prevented reestablishment through the entire season. Dimension at 0.5 lbs ai/A plus Drive at 0.373 lbs ai/A eliminated the initial population and prevented reestablishment through July 23. Other treatments that should be noted are Drive at 0.5 lbs ai/A with a repeat application of 0.5 lbs ai/A 32 days later, and Pre-M.

Table 4. Changes in buckhorn plantain cover following herbicide application.[1]

Herbicide*	Rate lbs ai/A	% Changes in Plantain[2] 7/23	 9/6
Dimension 1EC	0.5	-91	-93
Barricade 65WG / Barricade 65WG[3]	0.75 / 0.5	-74	-74
Dimension 1EC / Drive[s4]	0.5 / 0.375	-100	-62
Barricade 65WG / Barricade 65WG[3]	0.65 / 0.168	-60	-12
Drive[5] / Drive[6]	0.5 / 0.5	-71	+2
Ronstar 2G bio + MON 25134 0.1G	1.0 + 0.125	+15	+15
MON 25134 0.1G	0.38	+29	+16
Pre-M	4.0	-43	+25
Ronstar 2G bio + MON 25134 0.1G	1.0 + 0.25	+10	+26
Ronstar 2G bio	2.0	+69	+30
Dimension 1EC[5]	0.5	-8	+44
Dimension 1EC / Acclaim[5]	0.38 / 0.12	-6	+50
Ronstar 2G bio	4.0	+94	+72
Barricade 65WG	0.75	+43	+80
Untreated		+90	+85
Dimension 1EC / Daconate 6[5]	0.38 / 1.0	+43	+95
MON 25134 0.1G	0.19	+65	+110
MON 25134 0.1G	0.25	+108	+131
Ronstar 2G bio + MON 25134 0.1G	2.0 + 0.25	+52	+131
Ronstar 2G bio + MON 25134 0.1G	2.0 + 0.125	+31	+192
Balan	3.0	+179	+306
Ronstar 2G clay	4.0	+211	+396
$LSD_{0.05}$		132	156

[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 Protected Least Significant Difference test.

[2] Percent change in plantain was determined through the formula: (final plantain - starting plantain)/starting plantain x 100.

*Unless otherwise noted all applications were made April 11, 1992.

[3] The second application was made 60 days after the first.

[s] All Drive applications were made in a tank mix with the surfactant Lutensol at a rate of 1 qt Lutensol/A.

[4] The second application was made on 8/21/92.

[5] This treatment was applied as a postemergent control on June 10, 1992.

[6] The second application was made 32 days after the first.

Table 5. Changes in populations of lespedeza cover following herbicide application.[1]

Herbicide*	Rate lbs ai/A	% Change in Lespedeza[2] 7/23	 9/6
Dimension 1EC	0.5	-100	-100
MON 25134 0.1G	0.25	-100	-100
Dimension 1EC / Drive[s3]	0.5 / 0.375	-100	-71
Drive[4] / Drive[5]	0.5 / 0.5	-91	-91
Pre-M	4.0	-90	-80
Balan	3.0	-67	-17
Dimension 1EC / Daconate 6[4]	0.38 / 1.0	-84	-37
Barricade 65WG / Barricade 65WG[6]	0.75 / 0.5	0	+19
MON 25134 0.1G	0.38	+16	+49
Dimension 1EC / Acclaim[4]	0.38 / 0.12	+100	+716
Ronstar 2G bio + MON 25134 0.1G	2.0 + 0.25	-40	-80
Ronstar 2G clay	4.0	-47	-53
MON 25134 0.1G	0.19	+79900	+123200
Untreated	-	+1640	+2680
Barricade 65WG	0.75	+1680	+3710
Barricade 65WG / Barricade 65WG[6]	0.65 / 0.168	+129900	+179900
Ronstar 2G bio	4.0	+454	+432
Ronstar 2G bio + MON 25134 0.1G	1.0 + 0.25	+1590	+1390
Ronstar 2G bio + MON 25134 0.1G	1.0 + 0.125	+1880	+2150
Dimension 1EC[4]	0.5	+507	+305
Ronstar 2G bio	2.0	+2500	+2760
Ronstar 2G bio + MON 25134 0.1G	2.0 + 0.125	+507	+330
$LSD_{0.05}$		1932	2156

[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 Protected Least Significant Difference test.

[2] Percent change in lespedeza was determined through the formula: (starting lespedeza - final lespedeza)/starting lespedeza x 100.

*Unless otherwise noted all applications were made April 11, 1992.

[s] All Drive applications were made in a tank mix with the surfactant Lutensol at a rate of 1 qt Lutensol/A.

[3] The second application was made on 8/21/92.

[4] This treatment was applied as a postemergent control on June 10, 1992.

[5] The second application was made 32 days after the first.

[6] The second application was made 60 days after the first.

Tolerance of Zoysiagrass to DowElanco Herbicides

K.L. Diesburg

Research Protocol:	**Tolerance of Zoysiagrass to DowElanco Herbicides**
Location:	Southern Illinois University, Carbondale, IL.
Site:	soil - Hosmer silt clay loam; turf - Meyer zoysiagrass; plot size - 5 ft x 5 ft.
Application of Treatments:	date applied - June 5 ,1992, liquid herbicides - applied with a CO_2 backpack sprayer; spray volume -100 gpa.
Turf Maintenance:	mowing height - 1.5 inches ; pesticides - Princep @ 2 lbs ai/A, April 11; irrigation - none, turf dormant from late June to August; fertilization - 3 lbs N/M/yr, SCU and Nitroform.
Experimental Design:	RCB; 4 replications.

In the *1991 Illinois Turfgrass Research Report* our results show that the postemergence broadleaf weed control herbicides, clopyralid, fluroxypyr, and triclopyr did not reduce the turf quality of Meyer zoysiagrass (*Zoysia japonica* Steud. cv Meyer) turf. This year, an experimental compound, XRM 5202, was compared to Turflon (triclopyr, DowElanco) and Confront (triclopyr and clopyralid, DowElanco) and their effects upon Meyer zoysiagrass turf quality were evaluated.

Protocol requested that data be taken 2, 4, 8, and 16 weeks after treatment (WAT). The plots were inspected on all of these dates. Differences among plots could be noted at week 4, only (Table 6). At all other times there were no differences among plots. Turfgrass quality was decreased very slightly. A large difference in leaf angle was noted with Turflon Ester at 4 pt cf/A compared to the untreated plot. All treatments caused a noticeable increase in leaf angle from vertical. There is no apparent significance of this phenomenon to turfgrass quality, except to alter the texture slightly.

Differences in turfgrass quality were not noticeable by casual observation. At no time did turf quality drop to an unacceptable level. If an entire yard was to be treated without opportunity for comparison to an untreated area, phytotoxicity would probably not be noticed. If the applicator would happen to skip an area, the difference in turfgrass quality might be noticed, but it would not last for more than two weeks, and the difference noted would not be recognized as damage to the turf.

Table 6. Turfgrass quality and leaf angle of zoysiagrass in response to postemergent broadleaf herbicides at four weeks after treatment.[1]

Treatment	Rate pt cf/A	Quality[2] 4 WAT	Leaf Angle[3] 4 WAT
Turflon II Amine	6.0	7.4	6.5
Turflon Ester	4.0	7.6	3.7
Turflon II Amine	3.0	8.0	6.2
Confront	4.0	8.2	6.5
XRM-5202	3.0	8.4	6.5
Confront	2.0	8.7	6.2
Untreated		8.8	8.8
Turflon Ester	2.0	8.8	6.0
XRM-5202	6.0	8.9	7.5
$LSD_{0.05}$		1.1	2.1

Effects of MON 12051 50WP on Nutsedge in Immature Tall Fescue

K.L. Diesburg

Nutsedge (*Cyperus esculentus*) is one of the more difficult weeds to control in turf. Basagran (bentazon, BASF) is presently the pesticide of choice. Even with split applications there is a significant chance that it will not be totally effective. There is a need for a more reliable product that can be applied only once. The data presented here is a preliminary test of some experimental products MON 12051 (alachlor, Monsanto Agriculture Company) and Lentagran WP (pyridate, Agrolinz) compared to Basagran.

An experiment was first attempted on an unirrigated site where, as a result of frequent irrigation, there had been a dense nutsedge population during 1991. It was hoped that late spring rains in 1992 would encourage nutsedge growth. Unfortunately,June was a very dry month. The only nutsedge to appear was in open areas, intentionally made in the plots. Tall fescue and nutsedge growth was slow and treatment response was lacking.

A second experiment, reported here (Table 7), was placed in an area that was very wet from daily irrigation and had a dense stand of nutsedge. The nutsedge was growing at three times the rate of the tall fescue during the time of treatment. Nutsedge stands within plots ranged from 20-50% of the total stands. The nutsedge was succulent

[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 Protected 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] Leaf angle estimates are based on a scale of 1-9 where 9 = vertical and 1 = horizontal.

and responsive to the treatments and it died within two weeks after this data was recorded. The young turf was probably more sensitive to the treatments than a mature turf would be. There was some death of younger tall fescue plants in the turf treated with MON 12051, but the older plants showed little injury and filled in where the younger plants had been. Lower rates of MON 12051 and Pyridate should be attempted on juvenile turf with comparison plots of mature turf. Also, the lower turf quality ratings in the MON 12051 plots were due partially to the open spaces left by the dying nutsedge. No second application of Basagran was applied, which resulted in poor nutsedge control.

Research Protocol:	**Effects of MON 12051 50WP on Yellow Nutsedge in Immature Tall Fescue**
Location:	Southern Illinois University, Carbondale, IL.
Site:	soil - Hosmer silt clay loam; turf - juvenile 'Trailblazer II' tall fescue; plot size - 5 ft x 5 ft.
Application of Treatments:	date seeded - April 29,1992; date applied - June 10, 1992 ,all treatments; liquid herbicides - applied with a CO_2 backpack sprayer; spray volume -150 gpa.
Turf Maintenance:	mowing height - 2.25 inches ; pesticides - no additional pesticides; irrigation - daily to encourage nutsedge growth; fertilization - starter (1-4-2) @ 0.5 lb N/M/yr, 6 weeks after seeding, SCU @ 1 lb N/M/yr.
Experimental Design:	RCB; 3 replications.

Table 7. Effects of chemical treatments on quality of juvenile tall fescue turf and nutsedge.[1]

Herbicide	Rate lbs ai/A	Quality on June 30[2] Tall Fescue	Nutsedge
MON 12051 50WP	0.031[s]	5.7	2.0
MON 12051 50WP	0.047[s]	4.3	2.0
MON 12051 50WP	0.062[s]	4.3	2.3
Basagran	1.5	8.0	5.0
Untreated	-	9.0	7.0
Pyridate	3.3	1.7	1.3
$LSD_{0.05}$		1.6	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 Protected Least Significant Difference test.

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

[s] These materials were applied in a solution containing 0.5% v/v surfactant.

EFFECTS OF NUTRIENT SOURCES, BIOSTIMULANTS, AND SOIL MODIFIERS ON ZOYSIAGRASS (Zoysia japonica) TURF QUALITY

K.L. Diesburg and A. Griffin

The turf industry is being pressured by government agencies, as well as consumers to reduce environmental pollutants associated with its activities. To assist in this struggle some manufactures have introduced products that claim to make better use of resources by controlling nutrient release, improving turfgrass growth, or improving soil conditions. Included in this evaluation are materials that contain coated fertilizer particles (SCU, Once) or large N-containing molecules (Ringer, IBDU, Coron, Nitroform, Nutralene). It is hoped that these materials will control nutrient release and allow the turfgrass plant to more efficiently use the available nutrients and prevent fertilizer run-off. Products called biostimulants, mixtures of growth hormones and macro- and micronutrients, are thought to improve turfgrass root growth, crown density and/or vegetative color with minimal stimulation of leaf elongation. Products like Naiad and Turf-tech might temporarily improve cation exchange capacity of soil, allowing more efficient nutrient uptake by roots. All of these approaches imply less use of conventional fertilizers resulting in less nitrates and salts released into surface and ground water. The added economic advantage of potentially fewer mowings per season is viewed as meeting the demand and justifying the market development of these new products.

Research Protocol:	**Effects of Nutrient Sources, Biostimulants and Soil Modifiers on Zoysiagrass Turf Quality**
Location:	Southern Illinois University, Carbondale, IL.
Site:	turf - Korean Common zoysiagrass; soil - Hosmer silt clay loam; plot size - 5 ft x 5 ft.
Application of Treatments:	date applied - June 10 & July 10 ,1992 , all treatments, liquid herbicides - applied with a CO_2 backpack sprayer; spray volume - 150 gpa; granular materials - "salt " shaker; Terra-Sorb applied with a slit seeder at 0.5 inch depth.
Turf Maintenance:	mowing height - 1.5 inches ; pesticides - Dacthal in April, Trimec Plus in July; irrigation - none; fertilization - 2 lbs N/M/yr.
Experimental Design:	RCB; 4 replications.

The initial purpose for this experiment is to put many of these new products (Table 1) into the same management environment in order to determine their effects on turf quality. The long-term goal is to compare changes in soil properties after several years of treatment; such as cation exchange capacity, bulk density, and organic matter.

A mature 'Korean Common' zoysiagrass turf was not fertilized for two years. The slope of the experimental site is 3%, so drainage is enough to have allowed nutrient leaching from the top of the slope where the evaluation is taking place.

Table 1. Treatments applied to a mature Korean Common zoysiagrass.

Treatment	Manufacturer	Rate lbs material/M
Nutrient:		
Ammonium Nitrate (34-0-0)		1 lb N/M
Urea (46-0-0)		1 lb N/M
Sulphur Coated Urea (SCU 37-0-0)		1 lb N/M
Triple Super Phosphate (0-46-0)		1 lb P/M
Potassium Chloride (0-0-60)		1 lb K/M
Sulfur Coated Potassium (SCU 0-0-39)	Lesco	1 lb K/M
Sequestrine (10% iron chelate)	Ciba Geigy	0.2 lb Fe/M
Sulphur Coated Urea + Sequestrine		1 lb N/M + 0.2 lb Fe/M
Esmigran (micronutrients, 0.02% Fe)	Mallinkrodt	4 (0.2 lb Fe/M)
Sulphur Coated Urea + Esmigran		1 lb N/M
FeRROMEC AC (15-0-0, urea; 6% Fe)	PBI Gordon	1 lb N/M+ 0.1 lb Fe/M
(18-4-10)	Lebanon	1 lb N/M
(18-4-10) + Naiad	Lebanon	1 lb N/M+ 0.063
Ringers Turf 10-2-6 (animal by-product)	Ringer Corp.	1 lb N/M
IBDU (20-0-16)	Par-Ex	1 lb N/M
Once (24-0-0, resin-coated)	Grace-Sierra	3 lb N/M
Formolene (28-0-0)	Coron	1 lb N/M
Nitroform (38-0-0, long UF)	NorAm	1 lb N/M
Nutralene (40-0-0 short UF)	NorAm	1 lb N/M
Milorganite (6-2-0, processed sewage sludge)	Milwaukee Metropolitan Sewereage District	1 lb N/M
Biostimulant:		
Turf-tech II (cyanobacteria)	AgriTech	0.257
Turf-tech II + Nutralene		0.257+1 lb N/M
Bova Mura (5-0-0, cow manure base)	PBI Gordon	0.6 (0.03 lb N/M)
Sand-Aid (sea plant meal)	Emerald Isle	10
Sand-Aid + Milorganite		10 + 1 lb N/M
Per4max + Urea biostimulant	Floratine	0.19 + 1 lb N/M
Knife + Urea biostimulant	Floratine	0.19 + 1 lb N/M
Knife + Per4max + Urea		0.13 + 0.13 + 1 lb N/M
Knife + Per4max + Renaissance + Urea	Floratine	0.09 + 0.13 + 0.09 + 1lb N/M
Soil Modifier:		
Maxiplex + Urea humates	Floratine	0.75 + 1 lb N/M
CalpHlex + Urea Ca & cyclate	Floratine	0.37 + 1 lb N/M
Terra-Sorb (into core holes) polyacrylamide gel	ISI	3
Naiad surfactant	Lebanon	0.063

Dry, cool conditions dominated from December 1991 through August 1992 with an average of 0.7 inches of precipitation per month. Consequently, the treatment means of June 30 were low. At the time of first treatment, June 10, the turf was still actively growing, but by June 26 it was partially dormant. Complete dormancy had occurred by the end of July. A significant amount of precipitation on September 6 brought the zoysia out of dormancy and turf quality improved dramatically. In September there were 5.7 inches of rain. The data presented in Table 2 is unique in that it is a record of zoysiagrass response to treatments applied during a period of prolonged stress. Data from September 12 and 27 are a valuable indication of how well the materials could be expected to persist and have a positive effect upon turf quality once the period of stress ends.

Sequestrine was exceptionally effective improving turf quality during the stress of June, but could not compare to nitrogen-containing compounds during September. Once, IBDU, and later Milorganite resulted in the best looking plots during September. SCU + Sequestrine and Ammonium Nitrate were also superior treatments overall.

Table 2. Zoysiagrass turf quality and color in response to nutrient sources and soil amendments.[1]

	Quality[2]				Color[3]
Treatment	6/30	9/12	9/27	Average	9/12
Nutrient					
Once	4.6	8.6	8.6	7.3	9.1
IBDU	4.1	7.7	8.3	6.7	8.6
SCU + Sequestrine	5.8	7.3	7.1	6.7	6.9
Ammonium Nitrate	4.4	7.4	7.6	6.5	8.3
Milorganite	3.9	7.3	8.0	6.4	7.3
Urea	4.6	7.0	7.3	6.3	7.3
Ringer 10-2-6	4.4	7.1	7.2	6.2	7.9
SCU + Esmigran	4.5	6.9	7.0	6.1	7.8
SCU	4.2	6.6	7.3	6.0	7.3
Nitroform	4.0	6.5	7.4	6.0	6.6
18-4-10 + Naiad	4.1	6.6	7.0	5.9	7.2
FeRROMEC AC	3.6	6.9	7.3	5.9	6.9
Sequestrine	5.9	5.4	6.3	5.8	5.5
18-4-10	3.9	6.1	6.6	5.6	7.1
Nutralene	3.6	5.9	7.3	5.6	6.4
FormolenE	3.6	6.3	7.0	5.6	6.1
Potassium Chloride	3.9	5.5	6.3	5.2	6.0
Esmigran	4.0	5.3	6.4	5.1	4.5
TripleSuper Phosphate	3.4	5.3	6.4	5.0	4.9
SCK	3.8	4.4	6.0	4.7	4.0

(continued)

[1] All values represent the mean of 4 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Protected 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] Color evaluations are made on a scale of 1-9, where 9 = very dark green and 1 = straw color.

Table 2. Zoysiagrass turf quality and color in response to nutrient sources and soil amendments (continued).[1]

Treatment	Quality[2]				Color[3]
	6/30	9/12	9/27	Average	9/12
Biostimulant					
Knife + Per4max + Renaissance + Urea	4.7	8.0	8.4	7.0	8.9
Knife + Per4max + Urea	4.4	6.9	7.1	6.1	7.5
Per4max + Urea	4.5	6.2	7.2	6.0	7.6
Knife + Urea	4.8	5.7	6.1	5.5	5.6
Bova Mura	3.4	5.5	6.5	5.1	6.4
Soil Modifier					
CalpHlex + Urea	4.8	8.0	8.1	7.0	7.1
Maxiplex + Urea	4.3	7.2	7.1	6.2	7.2
Sand-Aid + Milorganite	4.0	6.1	6.8	5.6	5.5
Turf-tech II + Nutralene	4.2	6.0	6.6	5.6	5.1
Naiad	3.8	5.3	6.5	5.2	4.6
Sand-Aid	3.7	5.5	5.6	4.9	5.5
Terra-Sorb	3.6	5.1	5.8	4.8	4.9
Turf-tech II	3.4	4.5	5.5	4.5	4.3
Untreated	3.2	4.8	5.5	4.6	4.6
$LSD_{0.05}$	0.7	1.3	1.1	0.8	1.5

Products that were not superior but resulted in similar relative improvement in turf quality over the untreated control were: Urea, Ringer 10-2-6, SCU, Nitroform, Ferromec, Sequestrine, 18-4-10, Nutralene, and Coron. Ringer appeared to cause a greater degree of darker green color relative to its improvement of turf quality.

This experiment has not been designed to determine the degree of turfgrass quality improvement in a given year attributable to a soil modifier or specific components within the biostimulant mixtures. Rather, long term benefits to the soil and turfgrass rooting from these products will be determined in the future. All the biostimulants and soil modifiers with added nutrients caused improvements in turfgrass quality and were not different from the urea treatment. Among them, Knife + Per4max + Renaissance + urea and CalpHlex + urea were superior treatments in the trial.

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[1] All values represent the mean of 4 replications. Means in the same column with the same letter are not significantly different at the 0.05 level as determined by Fisher's Protected 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] Color evaluations are made on a scale of 1-9, where 9 = very dark green and 1 = straw color.

APPENDIX A ABBREVIATIONS

A	Acre.
ai	Active ingredients.
cf	Commercial formulation or formulated product.
cm	Centimeters.
CRD	Completely randomized design.
cv	Cultivar.
DAT	Days after treatment.
ft	Feet.
gpa	Gallons per acre.
K	Potassium.
lbs ai/A	Pounds of active ingredient per acre.
lbs cf/A	Pounds of formulated product per acre.
LSD	Least significant difference.
M	1000 square feet.
N	Nitrogen.
ns	Not significant.
NTEP	National Turfgrass Evaluation Program.
oz	Ounce(s).
P	Phosphorous.
pgr(s)	Plant growth retardant(s).
pt	Pint(s).
RCB	Randomized complete block.
RCU	Resin coated urea.
SCU	Sulfur coated urea.
UF	Urea formaldehyde.
WAT	Weeks after treatment.
yr	Year.

APPENDIX B
TURFGRASS PUBLICATIONS, ORDER FORMS

Illinois Turfgrass Research Report or Illinois Turfgrass Conference Proceedings

Available from: Jack Lagershausen
Executive Director
Illinois Turfgrass Foundation
Suite 200
111 E. Wacker Drive
Chicago, IL 60611

Make checks payable to the **Illinois Turfgrass Foundation.** All research reports and conference proceedings are $6.00 each.

number of copies		total amount
______	1980 Illinois Turfgrass Research Summary	______
______	1981 Illinois Turfgrass Research Summary	______
______	1982 Illinois Turfgrass Research Summary	______
______		______
______	1983 Illinois Turfgrass Research Report	______
______	1984 Illinois Turfgrass Research Report	______
______	1985 Illinois Turfgrass Research Report	______
______	1986 Illinois Turfgrass Research Report	______
______	1987 Illinois Turfgrass Research Report	______
______	1988 Illinois Turfgrass Research Report	______
______	1989 Illinois Turfgrass Research Report	______
______	1990 Illinois Turfgrass Research Report	______
______	1991 Illinois Turfgrass Research Report	______
	Proceedings from the	
______	16th Illinois Turfgrass Conference (1975)	______
______	17th Illinois Turfgrass Conference (1976)	______
______	18th Illinois Turfgrass Conference (1977)	______
______	19th Illinois Turfgrass Conference (1978)	______
______	20th Illinois Turfgrass Conference (1979)	______
______	21th Illinois Turfgrass Conference (1980)	______
sold out	22th Illinois Turfgrass Conference (1981)	sold out
______	23th Illinois Turfgrass Conference (1982)	______
______	24th Illinois Turfgrass Conference (1983)	______
______	25th Illinois Turfgrass Conference (1984)	______
______	26th Illinois Turfgrass Conference (1985)	______
______	27th Illinois Turfgrass Conference (1986)	______

total enclosed ______

Name: ______________________________
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TURFGRASS PUBLICATIONS AVAILABLE FROM THE UNIVERSITY OF ILLINOIS

Turfgrass Fact Sheets

Available from: Department of Horticulture
1105 Plant Sciences Laboratory
University of Illinois
201 S. Dorner Drive
Urbana, IL 61801

1 copy of 1 title - FREE. Multiple copies priced per copy. All orders must be prepaid. Make checks payable to the **University of Illinois.**

number of copies				total amount
______	TG-1-79	Selecting a Turfgrass for Illinois	$0.25	______
______	TG-2-79R	Fertilizer Recommendations for Turf	$0.25	______
______	TG-3-85	Publications and Organizations for Turfgrass Management	$0.25	______
______	TG-4-85	Establishment and Maintenance of Athletic Field Turf	$0.25	______
______	TG-5-86	Kentucky Bluegrass Turfs for Illinois	$0.25	______
______	TG-6-86	Tall Fescue Turfs in Illinois	$0.25	______
______	TG-7-86	Turfgrass Weed Control Methods	$0.25	______
______	TG-8-86	Turfgrass Improvement Programs	$0.25	______
______	TG-9-90	Turfgrass Management Strategies for Reducing Landscape Waste	$0.25	______
______	TG-10-90	Controlling Thatch in Turfgrass	$0.25	______
______	TG-11-91	Integrated Pest Management for Home Lawns	$0.25	______
______	TG-12-91	Cool Season Turfgrass Cultivar Recommendations	$0.25	______
______	TG-13-91	Cool Season Turfgrass Maintenance	$0.25	______

total enclosed______

Name: ______________________
Address: ______________________
City: ______________________ State/Zip: ______________________

Pesticide Applicator Training Guide

Available from: Office of Agricultural Entomology
163 Natural Resources Building
University of Illinois
607 E. Peabody
Champaign, IL 61820

Make checks payable to the **University of Illinois.**

number of copies				total amount
______	39-1	Illinois Pesticide Applicator Training Manual	$6.00	______

total enclosed______

Name: ______________________
Address: ______________________
City: ______________________ State/Zip: ______________________

Miscellaneous Turf Publications

Available from: Agricultural Publication Sales
54 Mumford Hall
University of Illinois
1301 W. Gregory Drive
Urbana, IL 61801

Make checks payable to the **University of Illinois.**

number of copies				total amount
______	Circular 1082	Illinois Lawn Care and Establishment	$3.00	______
______	NCRP No. 26	Lawn Weeds and Their Control	$2.00	______

total enclosed______

Name: ______
Address: ______
City: ______ State/Zip: ______

Vocational Agriculture Service

Available from: Vocational Agriculture Service
University of Illinois
1401 S. Maryland Dr.
Urbana, IL 61801
Phone: (217) 333-3871 FAX: (217) 333-0005

For postage and handling add $3 for orders under $25, 8% for orders $25 to $100, or 7% for orders over $100. Make checks payable to the **University of Illinois.**

number of copies				total amount
	Subject Matter Unit:			
______	U5008	Establishing a Lawn (8 pages)	$0.50	______
______	U5015	Turfgrass Diseases and Their Control (28 pages)	$1.80	______
______	U5016a	Identifying and Controlling Lawn Insects (20 pages)	$1.30	______
______	U5036	Maintaining a Weed Free Lawn (16 pages)	$1.05	______
	Slide Sets:			
______	S650a	Lawn Weeds - Identification and Control (76 frames)	$30.40	______
______	S651a	Steps to a Better Lawn (85 frames)	$35.50	______
______	S652	Identifying Illinois Turfgrasses (63 frames)	$26.70	______
______	S653	Seed Structure and Identification of Cool Season Turfgrasses (61 frames)	$25.90	______
______	MS650	All Four Slide Sets	$82.95	______

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Reports on Plant Disease

Available from: Extension Plant Pathology
N-533 Turner Hall
University of Illinois
1102 S. Goodwin
Urbana, IL 61801

Each RPD is $0.50 for orders of 1-4, which includes mailing charges. For orders of 5 or more each RPD is $0.25. Make checks payable to the **University of Illinois.**

number of copies			total amount
________	RPD 400	Recommendations for the Control of Diseases of Turfgrasses (7/83)	________
________	RPD 401	Slime Molds (4/86)	________
________	RPD 402	Turfgrass Disease Control (7/83)	________
________	RPD 403	Fairy Rings, Mushrooms, and Puffballs (9/87)	________
________	RPD 404	Snow Molds (6/87)	________
________	RPD 405	Helminthosporium Leaf, Crown, and Root Diseases of Lawn Grasses (4/86)	________
________	RPD 406	Powdery Mildew of Bluegrasses (4/86)	________
________	RPD 407	Dollar Spot of Turfgrasses (4/86)	________
________	RPD 408	Summer Patch and Necrotic Ring Spot (Fusarium Blight) of Lawns and Fine Turfgrasses (5/86)	________
________	RPD 409	Leaf Smuts of Turfgrasses (6/87)	________
________	RPD 410	Pythium Blight of Turfgrasses (10/91)	________
________	RPD 411	Rhizoctonia Brown Patch of Turfgrasses (5/86)	________
________	RPD 412	Rusts of Turfgrasses (6/87)	________
________	RPD 413	Corticum Red Thread of Turfgrasses (5/86)	________
________	RPD 414	Bacterial Wilt and Decline of Turfgrasses (10/87)	________
________	RPD 415	Yellow Tuft or Downy Mildew of Turfgrasses	________
________	RPD 416	Anthracnose of Turfgrasses	________
________	RPD 417	Minor Leaf Spot and Blight Diseases of Turfgrasses	________
________	RPD 1108	Nematode Parasites of Turfgrass (4/86)	________

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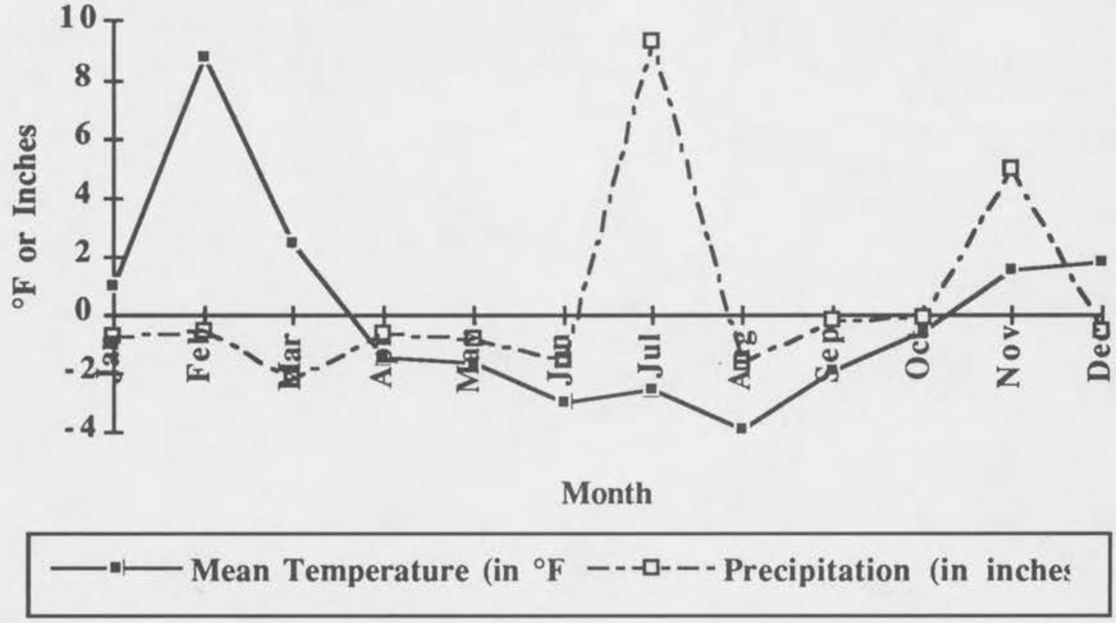
APPENDIX C
WEATHER INFORMATION FOR CHAMPAIGN, IL

1992 Champaign-Urbana Weather

T.B. Voigt

In 1992, cool season turfgrass in Champaign-Urbana generally benefited from above average winter and below average growing-season temperatures. Mean monthly temperatures were above average during January, February, March, November, and December, but were below average during the growing season, April through October (Figure 1). There were only three days during the year when temperatures either rose above 90°F or dropped below 0°F. Overall, the 1992 mean temperature was 0.3°F above normal.

Figure 1. 1992 deviations from mean monthly temperature and precipitation in Champaign-Urbana (0 = Monthly Mean)



Monthly precipitation was below normal in all months but July and November (Figure 1). July precipitation was above average by more than nine inches and November precipitation was above average by nearly five inches. In fact, July's 13.82 inches set an all-time record for precipitation in Champaign-Urbana. For the year, the total precipitation was 5.01 inches greater than normal.

During the early portion of the growing season, cool temperatures and below-average, but adequate, precipitation allowed cool season turfgrasses to perform well. July's abundant precipitation and the season's continued cool temperatures maintained turf well through the late-summer/early-autumn growing period. Above-average November precipitation most likely allowed turf to go into winter in a well-hydrated state. In Champaign-Urbana, and areas with similar weather patterns, unless turf suffers from a remnant, non-weather-related problem, it should begin the 1993 growing season in relatively good shape.

Champaign-Urbana turf problems in 1992. During 1992, general turf disease problems included dollar spot, red thread, and rust. These diseases were probably enhanced by the below average temperatures and abundant July moisture. These disease are often found to be a greater problem when nitrogen availability is inadequate. The cool, moist conditions allowed turf to grow rapidly, using more nitrogen than normal. In addition, the excessive rainfall during July probably leached additional nitrogen from the soil. Thus, dollar spot, red thread, and rust incidence were greater than normal due to weather conditions and the shortage of available nitrogen.

During the late-summer/early-autumn, white clover seemed to become a greater problem than normal. This is probably due to the cool, moist conditions that favor white clover growth and development.

Complaints of grub damage, in general were below normal in 1992. Where grubs were a problem, the damage seemed to occur in mid-to-late September which is later than normal.

Champaign, IL Water Survey Research Center				Local Climatological Data Illinois State Water Survey				January 1992 Summary				
	Temperature			Precip	Snow[1]		Weather	Wind		Sky	Degree Days[2]	
Date	Max.	Min.	Mean	Inches	Inches	Depth	Types[3]	Dir.	Speed	Cover[4]	Heat	Cool.
01/01/92	42	32	37	0	0			SE	3.3	CLDY	28	9
01/02/92	44	38	41	0.12	0		L-,R-	SE	3.5	CLDY	24	0
01/03/92	42	36	39	0	0			N	4.7	CLDY	26	0
01/04/92	38	32	35	0	0			N	3.9	CLDY	30	0
01/05/92	36	33	35	0	0			SE	2.9	CLDY	30	0
01/06/92	39	34	37	0	0				2.8	CLDY	28	0
01/07/92	39	36	38	0	0			SESE	4.1	CLDY	27	0
01/08/92	46	35	41	0.30	0		L-,R-	SE	9.3	CLDY	24	0
01/09/92	40	32	36	0	0			W	8.4	CLDY	29	0
01/10/92	33	27	30	0.01	0.1		S-	W	6.5	PC	35	0
01/11/92	48	28	38	0	0			SW	7.6	CLR	27	0
01/12/92	39	32	36	0.03	0		R,L	S	8.5	CLDY	29	0
01/13/92	42	30	36	0.23	1.8	2	R,L,S	N	6.6	CLDY	29	0
01/14/92	30	9	20	0.03	0.3	1	S-,BS	NW	7.9	PC	45	0
01/15/92	26	-3	12	0.15	1.5	3	S,BS	NW	8.8	PC	53	0
01/16/92	26	-6	10	0	0	2		SW	9.6	CLR	55	0
01/17/92	36	13	25	T	T	2	SW-	NW	8.8	CLR	40	0
01/18/92	13	0	7	0	0	2		NW	4.7	PC	58	0
01/19/92	31	-4	14	0	0	1		S	9.2	PC	51	0
01/20/92	32	27	30	0	0	1		SW	5.0	PC	35	0
01/21/92	47	29	38	0	0	T		SW	5.1	PC	27	0
01/22/92	42	32	37	0.07	0	T	R-	S	6.7	PC	28	0
01/23/92	39	23	31	T	T	T	S-	W	10.2	CLDY	34	0
01/24/92	29	15	22	0.04	0.4	T	S	NW	7.1	CLDY	43	0
01/25/92	36	26	31	0.05	0.6	T	S	SE	7.9	CLDY	34	0
01/26/92	36	17	27	0	0	T		S	5.7	CLR	38	0
01/27/92	45	28	37	0	0			N	6.6	PC	28	0
01/28/92	33	29	31	0	0			E	2.5	CLDY	34	0
01/29/92	36	31	33	0	0			SW	5.3	CLDY	32	0
01/30/92	47	31	39	0	0			N	5.0	PC	26	0
01/31/92	37	30	34	0	0			NW	6.0	CLDY	31	0
Total/ Average[5]	33.8	24.2	29.0	1.03		4.7		SE/NW	6.4		1060	
Departure from Average	+2.1	+8.2	-0.8	+1.0		-6.0		W	-1.9		-223	

[1] Snow depth at 7 AM LST.

[2] DEGREE DAYS: Heat and Cool base=65F; Heating/dd July-June. Cooling/dd Jan.-Dec.

[3] WEATHER TYPES: F=Fog; T=Thunderstorm; IP=Ice Pellets; A=Hail; R=Rain; S=Snow; Z=Freezing Precip; D=Dust; H=Haze; BS=BlowingSnow; RW=Rain Showers; SW=Snow Showers; L=Drizzle; INTENSITIES: +heavy; -light; absence of symbol indicates moderate, T = Trace.

[4] Sky 7 AM - 7PM LST. Other data midnight - midnight.

[5] Averages 1961-1990 data.

Champaign, IL Water Survey Research Center				Local Climatological Data Illinois State Water Survey				February 1992 Summary				
	Temperature			Precip	Snow[1]		Weather	Wind		Sky	Degree Days[2]	
Date	Max.	Min.	Mean	Inches	Inches	Depth	Types[3]	Dir.	Speed	Cover[4]	Heat	Cool.
02/01/92	37	26	32	0	0			NE	3.0	PC	33	0
02/02/92	50	25	38	0	0			S	5.1	CLR	27	0
02/03/92	63	31	47	0	0			SW	3.3	PC	18	0
02/04/92	49	31	40	0	0			N	7.2	CLDY	25	0
02/05/92	41	24	33	0	0			NE	3.7	CLR	32	0
02/06/92	45	22	34	0	0			NW	4.9	PC	31	0
02/07/92	35	24	30	0.01	0.1	T	S-	NW	6.9	CLDY	35	0
02/08/92	25	16	21	T	T	T	S-	NW	7.0	PC	44	0
02/09/92	30	13	22	0	0			SE	4.7	CLR	43	0
02/10/92	45	25	35	0	0			S	8.6	PC	30	0
02/11/92	38	22	30	0	0			NE	6.9	CLDY	35	0
02/12/92	28	21	25	0.2	2.1	2	S,ZL	E	5.0	CLDY	40	0
02/13/92	34	27	31	T	0	T	ZL--	W	4.1	CLDY	34	0
02/14/92	41	32	37	0.5	0		T,R	SE	4.8	CLDY	28	0
02/15/92	46	33	40	0.17	0		R	W	7.5	CLDY	25	0
02/16/92	43	34	39	0	0			SW	4.4	CLDY	26	0
02/17/92	54	32	43	0.24	0		R	E	4.4	PC	22	0
02/18/92	54	41	48	0.07	0		R-	W	8.5	CLDY	17	0
02/19/92	41	34	38	0.06	T		L-	W	8.7	CLDY	27	0
02/20/92	50	32	41	0	0			SW	9.2	PC	24	0
02/21/92	47	32	40	T	0		R--		5.0	PC	25	0
02/22/92	62	41	52	0	0			S	3.0	PC	13	0
02/23/92	62	39	51	0	0			NE	5.9	PC	14	0
02/24/92	48	34	41	0.1	0		R	E	3.6	PC	24	0
02/25/92	38	32	35	0	0			N	7.6	CLDY	30	0
02/26/92	45	30	38	0	0			W	7.1	PC	27	0
02/27/92	52	30	41	0	0			W	5.9	PC	24	0
02/28/92	59	33	46	T	0		L-	SW	9.5	PC	19	0
02/29/92	44	31	38	0	0			W	3.8	PC	27	0
Total/ Average[5]	45.0	29.2	37.1	1.35	2.2			VAR	5.8		799	0
Departure from Average	+8.7	+8.9	+8.8	-6.2	-4.8			S	-2.2		-243	

[1] Snow depth at 7 AM LST.

[2] DEGREE DAYS: Heat and Cool base=65F; Heating/dd July-June. Cooling/dd Jan.-Dec.

[3] WEATHER TYPES: F=Fog; T=Thunderstorm; IP=Ice Pellets; A=Hail; R=Rain; S=Snow; Z=Freezing Precip; D=Dust; H=Haze; BS=BlowingSnow; RW=Rain Showers; SW=Snow Showers; L=Drizzle; INTENSITIES: +heavy; -light; absence of symbol indicates moderate, T = Trace.

[4] Sky 7 AM - 7PM LST. Other data midnight - midnight.

[5] Averages 1961-1990 data.

Champaign, IL Water Survey Research Center				Local Climatological Data Illinois State Water Survey				March 1992 Summary				
Date	Temperature Max.	Min.	Mean	Precip Inches	Snow[1] Inches	Depth	Weather Types[3]	Wind Dir.	Speed	Sky Cover[4]	Degree Days[2] Heat	Cool.
03/01/92	70	34	52	0	0	0		SW	10.2	CLR	13	0
03/02/92	76	45	61	0	0	0		SW	6.5	CLR	4	0
03/03/92	77	43	60	0	0	0		NE	2.7	PC	5	0
03/04/92	71	44	58	0	0	0	F	S	4.6	PC	7	0
03/05/92	69	51	60	0.05	0	0	TRW-,F	SE	5.1	CLDY	5	0
03/06/92	66	48	57	0.05	0	0	R-,	SE	6.0	CLDY	8	0
03/07/92	56	48	52	T	0	0	L-	W	6.9	CLDY	13	0
03/08/92	69	50	60	0	0	0		S	4.4	CLR	5	0
03/09/92	62	34	48	0.09	0	0	R-	S	9.9	CLDY	17	0
03/10/92	34	20	27	0.08	0.6	T	S-,ZR-,BS	N	11.6	CLDY	38	0
03/11/92	29	16	23	0.04	0.5	1	S-	W	4.6	CLDY	42	0
03/12/92	30	22	26	0.02	0.2	T	S-	N	6.0	CLDY	39	0
03/13/92	36	19	28	0.03	0.3	T	S-	W	5.3	PC	37	0
03/14/92	36	30	33	0.02	0.2	T	S-	NNW	4.7	CLDY	32	0
03/15/92	38	24	31	0.01	0.1	T	S-	N	3.4	PC	34	0
03/16/92	49	21	35	0	0	0	T	S	9.3	CLR	30	0
03/17/92	57	35	46	0.02	0	0	R	NE	8.4	PC	19	0
03/18/92	38	30	34	0.81	0	0	R	NE	10.5	CLDY	31	0
03/19/92	44	30	37	0	0	0		NE	7.0	CLDY	28	0
03/20/92	51	30	41	0.02	0	0	R-	W	5.8	CLDY	24	0
03/21/92	51	35	43	0.27	0	0	R	SSE	7.4	CLDY	22	0
03/22/92	46	28	37	0.02	T	0	R-,SW-	N	8.2	CLDY	28	0
03/23/92	49	24	37	0	0	0		W	3.7	CLR	28	0
03/24/92	59	31	45	0	0	0		SW	6.8	CLR	20	0
03/25/92	51	36	44	0.15	0	0	R-,L	SW	5.8	CLDY	21	0
03/26/92	53	32	43	0.11	0	0	F	NW	7.3	CLDY	22	0
03/27/92	46	27	37	0	0	0		N	6.3	CLR	28	0
03/28/92	49	28	39	0	0	0		SE	4.1	CLDY	26	0
03/29/92	45	40	43	0.12	0	0	R-,L	SE	5.8	CLDY	22	0
03/30/92	44	33	39	0	0	0		N	7.6	CLDY	26	0
03/31/92	57	29	43	0.09	0	0	R,L,F	W	7.0	PC	22	0
Total/ Average[5]	51.9	32.8	42.4	2.0	1.9			W	6.6		696	
Departure from Average	+3.1	+1.7	+2.4	-1.3	-2.2			S	-2.0		-89	

[1] Snow depth at 7 AM LST.

[2] DEGREE DAYS: Heat and Cool base=65F; Heating/dd July-June. Cooling/dd Jan.-Dec.

[3] WEATHER TYPES: F=Fog; T=Thunderstorm; IP=Ice Pellets; A=Hail; R=Rain; S=Snow; Z=Freezing Precip; D=Dust; H=Haze; BS=BlowingSnow; RW=Rain Showers; SW=Snow Showers; L=Drizzle; INTENSITIES: +heavy; -light; absence of symbol indicates moderate, T = Trace.

[4] Sky 7 AM - 7PM LST. Other data midnight - midnight.

[5] Averages 1961-1990 data.

Champaign, IL Water Survey Research Center	Local Climatological Data Illinois State Water Survey	April 1992 Summary

Date	Temperature Max.	Min.	Mean	Precip Inches	Snow[1] Inches	Depth	Weather Types[3]	Wind Dir.	Speed	Sky Cover[4]	Degree Days[2] Heat	Cool.
04/01/92	41	29	35	*0.02	0.2	0	SW-	NW	6.4	CLDY	*30	*0
04/02/92	42	27	35	0	0	T		NW	4.8	CLR	*30	0
04/03/92	46	*26	36	0.11	0	0	R	SW	6.0	CLDY	29	0
04/04/92	48	34	41	0	0	0		N	7.0	PC	24	0
04/05/92	57	28	43	0	0	0		SE	3.4	CLR	22	0
04/06/92	61	33	47	0	0	0		S	5.5	CLR	18	0
04/07/92	67	42	55	T	0	0	RW-	W	6.0	PC	10	0
04/08/92	70	37	54	0.08	0	0	R,L,F	S	3.3	PC	11	0
04/09/92	69	44	57	0	0	0	F	N	4.2	CLDY	8	0
04/10/92	75	46	61	0.37	0	0	TRW,R,L,F	S	8.2	CLDY	4	0
04/11/92	74	44	59	0	0	0		N	8.5	CLDY	6	0
04/12/92	48	34	41	0	0	0		NE	9.1	CLR	24	0
04/13/92	55	32	44	T	0	0	L	E	4.7	CLDY	21	0
04/14/92	67	41	54	0.35	0	0	TRW+,R,RW,L	E	5.1	CLDY	11	0
04/15/92	78	48	63	*0.63	0	0	TRW+,TRW,R,L,F	SE	5.7	CLDY	2	0
04/16/92	75	46	61	0.44	0	0	TRW+,R,F	S	7.9	PC	4	0
04/17/92	53	43	48	0.35	0	0	R,L,F	NE	4.1	CLDY	17	0
04/18/92	77	50	64	0.19	0	0	R,L,F	SE	5.7	CLDY	1	0
04/19/92	68	60	64	0.13	0	0	R,L	S	9.0	CLDY	1	0
04/20/92	69	51	60	0.07	0	0	RW,L,F	SE	9.4	CLDY	5	0
04/21/92	57	40	49	0.03	0	0	L	SW	7.4	CLDY	16	0
04/22/92	56	37	47	0	0	0		W	6.4	PC	18	0
04/23/92	77	44	61	0.06	0	0	TRW	SW	7.3	CLDY	4	0
04/24/92	52	43	48	0.20	0	0	TRW,R,L,F	NW	5.9	CLDY	17	0
04/25/92	47	37	42	0.02	0	0	RW-	NW	4.8	CLDY	23	0
04/26/92	49	41	45	0.07	0	0	R,L	N	5.0	CLDY	20	0
04/27/92	51	36	44	0.07	0	0	R,L	N	6.0	CLDY	21	0
04/28/92	59	30	45	0	0	0		S	3.3	CLR	20	0
04/29/92	64	42	53	0.11	0	0	R,L	S	6.7	CLDY	12	0
04/30/92	*78	48	63	0	0	0	F	SE	3.7	PC	2	0
Total/ Average[5]	61.0	39.8	50.4	3.30	0.2			S	6.0		431	0
Departure from Average	-1.4	-1.6	-1.5	-0.64	-0.8			S	-2.5		+20	-10

[1] Snow depth at 7 AM LST.

[2] DEGREE DAYS: Heat and Cool base=65F; Heating/dd July-June. Cooling/dd Jan.-Dec.

[3] WEATHER TYPES: F=Fog; T=Thunderstorm; IP=Ice Pellets; A=Hail; R=Rain; S=Snow; Z=Freezing Precip; D=Dust; H=Haze; BS=BlowingSnow; RW=Rain Showers; SW=Snow Showers; L=Drizzle; INTENSITIES: +heavy; -light; absence of symbol indicates moderate, T = Trace.

[4] Sky 7 AM - 7PM LST. Other data midnight - midnight.

[5] Averages 1961-1990 data.

Champaign, IL Water Survey Research Center				Local Climatological Data Illinois State Water Survey				May 1992 Summary				
Date	Temperature Max.	Min.	Mean	Precip Inches	Snow[1] Inches	Depth	Weather Types[3]	Wind Dir.	Speed	Sky Cover[4]	Degree Days[2] Heat	Cool.
05/01/92	84	55	70	0	0	0		SW	10.3	CLR	0	5
05/02/92	80	52	66	0	0	0		NW	7.5	CLR	0	1
05/03/92	66	44	55	0	0	0		NW	6.8	CLR	10	0
05/04/92	64	41	53	0.14	0	0	RW	NW	3.8	CLR	12	0
05/05/92	55	38	47	T	0	0	RW-	NE	7.2	CLR	*18	0
05/06/92	64	*34	49	0	0	0		NE	5.8	CLR	16	0
05/07/92	69	38	54	0	0	0		E	2.0	CLR	11	0
05/08/92	75	42	59	0	0	0		NE	4.1	CLR	6	0
05/09/92	81	51	66	0	0	0		NW	4.2	CLR	0	1
05/10/92	85	51	68	0	0	0	F	S	5.0	CLR	0	3
05/11/92	83	54	69	0	0	0		S	7.3	PC	0	4
05/12/92	69	60	65	0.47	0	0	R,RW,L	S	2.8	CLDY	0	0
05/13/92	75	53	64	0	0	0		N	6.8	CLR	1	0
05/14/92	61	48	55	0.26	0	0	R,L	NE	3.0	CLDY	10	0
05/15/92	78	47	63	0	0	0	F	NE	1.9	CLR	2	0
05/16/92	*86	57	72	0	0	0	T	S	6.0	CLDY	0	7
05/17/92	82	66	74	T	0	0	RW-	SW	5.9	CLDY	0	*9
05/18/92	79	56	68	T	0	0	L	NE	4.5	PC	0	3
05/19/92	82	58	70	0	0	0	F	E	2.3	PC	0	5
05/20/92	85	59	72	0	0	0	F	SE	2.6	CLR	0	7
05/21/92	*86	60	73	*1.49	0	0	TRW+,F	SE	3.1	PC	0	8
05/22/92	75	64	70	0.54	0	0	TRW,TRW-,F	SW	3.2	CLDY	0	5
05/23/92	76	45	61	0.03	0	0	R-,H	N	6.7	PC	4	0
05/24/92	58	40	49	0	0	0		N	8.8	PC	16	0
05/25/92	58	39	49	0.01	0	0	L	N3	3.1	CLDY	16	0
05/26/92	56	42	49	0.02	0	0	L	NE	3.5	CLDY	16	0
05/27/92	65	37	51	0	0	0		NE	3.3	PC	14	0
05/28/92	70	43	57	0	0	0		E	3.1	CLR	8	0
05/29/92	72	49	61	0.05	0	0	R-	NE	5.8	PC	4	0
05/30/92	66	48	57	0.08	0	0	R-	N	6.0	CLDY	8	0
05/31/92	77	48	63	0	0	0		NE	3.9	CLR	2	0
Total/ Average[5]	73.0	49.0	61.0	3.09	0			NE	4.8		174	58
Departure from Average	-0.7	-2.7	-1.7	-0.88				S	-2.0		+24	-13

[1] Snow depth at 7 AM LST.

[2] DEGREE DAYS: Heat and Cool base=65F; Heating/dd July-June. Cooling/dd Jan.-Dec.

[3] WEATHER TYPES: F=Fog; T=Thunderstorm; IP=Ice Pellets; A=Hail; R=Rain; S=Snow; Z=Freezing Precip; D=Dust; H=Haze; BS=BlowingSnow; RW=Rain Showers; SW=Snow Showers; L=Drizzle; INTENSITIES: +heavy; -light; absence of symbol indicates moderate, T = Trace.

[4] Sky 7 AM - 7PM LST. Other data midnight - midnight.

[5] Averages 1961-1990 data.

Champaign, IL Water Survey Research Center					Local Climatological Data Illinois State Water Survey					June 1991 Summary		
	Temperature			Precip	Snow[1]		Weather	Wind		Sky	Degree Days[2]	
Date	Max.	Min.	Mean	Inches	Inches	Depth	Types[3]	Dir.	Speed	Cover[4]	Heat	Cool.
06/01/92	79	54	67	0	0	0		NE	2.0	PC	0	2
06/02/92	81	56	69	0	0	0		SE	2.4	PC	0	4
06/03/92	81	58	70	0.26	0	0	R,RW-,L	ESE	4.5	CLDY	0	5
06/04/92	79	64	72	0	0	0	F	N	2.7	CLDY	0	7
06/05/92	81	63	72	0	0	0	F	NW	3.4	PC	0	7
06/06/92	83	58	71	*1.44	0	0	TRW+,R,R-F,H	S	3.4	PC	0	6
06/07/92	78	58	68	0.06	0	0	R,R-	N	4.5	PC	0	3
06/08/92	76	54	65	0	0	0		NE	3.3	CLR	0	0
06/09/92	81	58	70	0	0	0		NE	4.7	PC	0	5
06/10/92	78	59	69	0	0	0		NE	3.2	PC	0	4
06/11/92	82	57	70	0	0	0		NE	3.4	CLDY	0	5
06/12/92	85	58	72	0	0	0		NE	1.9	CLR	0	7
06/13/92	82	60	71	0	0	0	T	S	3.1	PC	0	6
06/14/92	86	60	73	0	0	0		SE	2.6	PC	0	8
06/15/92	82	64	73	0	0	0	F	E	2.8	PC	0	8
06/16/92	88	64	76	0	0	0		SE	5.7	CLDY	0	11
06/17/92	*95	70	83	0.60	0	0	TRW+,TRW	SW	10.6	CLDY	0	*18
06/18/92	83	66	75	0	0	0		W	6.2	CLR	0	10
06/19/92	77	56	67	0	0	0		N	4.2	CLR	0	2
06/20/92	65	47	56	0	0	0		NE	5.6	CLDY	*9	0
06/21/92	67	44	56	0	0	0		N	4.6	PC	*9	0
06/22/92	70	*43	57	T	0	0	L	SW	2.4	CLDY	8	0
06/23/92	82	56	69	0.11	0	0	TRW,L	W	5.4	PC	0	4
06/24/92	80	59	70	0	0	0		W	4.0	PC	0	5
06/25/92	84	57	71	0	0	0	F	W	3.0	PC	0	6
06/26/92	79	59	69	0	0	0		N	4.8	CLR	0	4
06/27/92	77	54	66	0	0	0		NE	3.5	CLR	0	1
06/28/92	82	50	66	0	0	0		SE	1.9	CLR	0	1
06/29/92	86	56	71	0	0	0		SWSW	2.2	PC	0	6
06/30/92	87	58	73	0	0	0		E	2.0	PC	0	8
Total/ Average[5]	80.5	57.3	68.9	2.47	0			NE	3.8		26	153
Departure from Average	-2.4	-3.5	-3.0	-1.6				SW	-2.2		+10	-61

[1] Snow depth at 7 AM LST.

[2] DEGREE DAYS: Heat and Cool base=65F; Heating/dd July-June. Cooling/dd Jan.-Dec.

[3] WEATHER TYPES: F=Fog; T=Thunderstorm; IP=Ice Pellets; A=Hail; R=Rain; S=Snow; Z=Freezing Precip; D=Dust; H=Haze; BS=BlowingSnow; RW=Rain Showers; SW=Snow Showers; L=Drizzle; INTENSITIES: +heavy; -light; absence of symbol indicates moderate, T = Trace.

[4] Sky 7 AM - 7PM LST. Other data midnight - midnight.

*Highest or lowest value for the month.

[5] Averages 1961-1990 data.

Champaign, IL Water Survey Research Center				Local Climatological Data Illinois State Water Survey				July 1992 Summary				
	Temperature			Precip	Snow[1]		Weather	Wind		Sky	Degree Days[2]	
Date	Max.	Min.	Mean	Inches	Inches	Depth	Types[3]	Dir.	Speed	Cover[4]	Heat	Cool.
07/01/92	88	66	77		0.0	0	F	SE	2.4	PC	*0	12
07/02/92	*92	66	79	2.09	0.0	0	TRW+,R,L,F	SE	5.5	PC	0	14
07/03/92	74	60	67	.06	0.0	0	R,L	W	6.7	PC	0	2
07/04/92	83	*56	70		0.0	0		SW	3.8	PC	0	5
07/05/92	83	64	74		0.0	0	F	N	3.4	CLDY	0	9
07/06/92	79	61	70		0.0	0		SE	2.2	PC	0	5
07/07/92	71	59	65	3.11	0.0	0	TRW+,R,L	SE	4.8	CLDY	0	0
07/08/92	87	66	77	.20	0.0	0	TRW,F	SW	5.3	CLDY	0	12
07/09/92	85	68	77	.42	0.0	0	TRW+,R,L,F	W	2.1	CLDY	0	12
07/10/92	81	70	76		0.0	0		W	4.3	CLDY	0	11
07/11/92	84	69	77	.49	0.0	0	TRW+	SSE	2.0	CLDY	0	12
07/12/92	86	70	78	.37	0.0	0	TRW,R-,L	SW	4.2	CLDY	0	13
07/13/92	89	74	82		0.0	0		SW	5.5	CLDY	0	*17
07/14/92	84	66	75	.20	0.0	0	TRW,R,L	SW	4.7	CLDY	0	10
07/15/92	72	61	67	T	0.0	0	L,F	NW	3.4	CLDY	0	2
07/16/92	83	63	73	1.29	0.0	0	TRW+,F	W	3.4	CLDY	0	8
07/17/92	82	63	73	.10	0.0	0	R,L	W	4.7	PC	0	8
07/18/92	80	62	71		0.0	0		W	3.5	PC	0	6
07/19/92	84	60	72	.02	0.0	0	TRW,F,H	SSW	3.0	PC	0	7
07/20/92	79	66	73	.19	0.0	0	RW,L	SW	4.0	CLDY	0	8
07/21/92	77	61	69		0.0	0		NE	4.5	CLDY	0	4
07/22/92	78	62	70	.14	0.0	0	TRW,R	SE	3.2	CLDY	0	5
07/23/92	85	65	75	.78	0.0	0	TRW+,RW+ R,F	NE	3.4	CLDY	0	10
07/24/92	74	62	68		0.0	0	F	N	2.8	CLDY	0	3
07/25/92	76	65	71	.87	0.0	0	TRW+,RW, R,L,F	SE	3.0	CLDY	0	6
07/26/92	81	70	76	.31	0.0	0	R,L,F	W	3.6	CLDY	0	11
07/27/92	81	63	72		0.0	0		N	4.7[e]	PC	0	7
07/28/92	83	58	71		0.0	0		SW[e]	4.9[e]	CLR	0	6
07/29/92	82	64	73	.03	0.0	0	TRW,R	SW[e]	8.5[e]	PC	0	8
07/30/92	78	62	70	*3.15	0.0	0	TRW+,RW+ R,L	SE	4.2	CLDY	0	5
07/31/92	73	57	65	T	0.0	0	L	N	5.2	PC	0	0
Total/ Average[5]	81.1	63.8	72.5	13.82	0.0			W[e]	4.1[e]		0	238
Departure from Average	-4.2	-1.0	-2.6	+9.34				SW	-0.8		-2	-67

[1]Snow depth at 7 AM LST.

[2]DEGREE DAYS: Heat and Cool base=65F; Heating/dd July-June. Cooling/dd Jan.-Dec.

[3]WEATHER TYPES: F=Fog; T=Thunderstorm; IP=Ice Pellets; A=Hail; R=Rain; S=Snow; Z=Freezing Precip; D=Dust; H=Haze; BS=BlowingSnow; RW=Rain Showers; SW=Snow Showers; L=Drizzle; INTENSITIES: +heavy; -light; absence of symbol indicates moderate, T = Trace.

[4]Sky 7 AM - 7PM LST. Other data midnight - midnight.

*Highest or lowest value for the month.

[e]estimated

[5]Averages 1961-1990 data.

Champaign, IL Water Survey Research Center				Local Climatological Data Illinois State Water Survey				August 1992 Summary				
	Temperature			Precip	Snow[1]		Weather	Wind		Sky	Degree Days[2]	
Date	Max.	Min.	Mean	Inches	Inches	Depth	Types[3]	Dir.	Speed	Cover[4]	Heat	Cool.
08/01/92	78	53	66		0.0	0	F	SW	2.2	CLR	0	1
08/02/92	80	55	67	0.81	0.0	0	TRW+,R	SW	3.5	PC	0	3
08/03/92	79	60	70		0.0	0		NW	3.1	PC	0	5
08/04/92	75	58	67		0.0	0		NE	3.8	PC	0	2
08/05/92	77	56	67		0.0	0		NE	2.1	CLDY	0	2
08/06/92	79	58	69		0.0	0		SE	2.9	PC	0	4
08/07/92	80	59	70	0.02	0.0	0	RW-	S	5.2	PC	0	5
08/08/92	89	72	81		0.0	0	F	W	3.9	PC	0	*16
08/09/92	*91	66	79		0.0	0		SW	3.5	PC	0	14
08/10/92	88	70	79		0.0	0	F	W	5.0	PC	0	14
08/11/92	80	61	71		0.0	0		N	5.5	PC	0	6
08/12/92	80	55	68	0.21	0.0	0	R,RW,RW-	NE	3.0	PC	0	3
08/13/92	74	55	65	0.02	0.0	0	RW,F	N	5.0	PC	0	0
08/14/92	72	55	64		0.0	0		NE	6.1	CLR	1	0
08/15/92	72	51	62		0.0	0		NE	5.3	CLR	3	0
08/16/92	74	56	65		0.0	0		NE	4.0	PC	0	0
08/17/92	78	55	67		0.0	0		NE	1.7	CLR	0	2
08/18/92	81	53	67	0.14	0.0	0	RW,F	SW	4.1	PC	0	2
08/19/92	77	58	68		0.0	0	F	NE	5.1	CLR	0	3
08/20/92	77	53	65		0.0	0		NE	2.7	CLR	0	0
08/21/92	79	54	67		0.0	0		NE	1.7	CLR	0	2
08/22/92	82	60	71		0.0	0	H	E	2.5	CLR	0	6
08/23/92	83	64	74		0.0	0	F	SE	3.8	PC	0	9
08/24/92	85	65	75	0.02	0.0	0	RW,F	S	3.8	PC	0	10
08/25/92	89	66	78		0.0	0	F	S	5.1	PC	0	13
08/26/92	89	67	78	*1.02	0.0	0	TRW+,RW, R,F	S	4.2	PC	0	13
08/27/92	70	58	64	0.15	0.0	0	R,R-,L,F	NW	4.5	CLDY	1	0
08/28/92	70	51	61		0.0	0		NW	5.3	CLR	*4	0
08/29/92	79	*50	65		0.0	0		S	7.0	PC	0	0
08/30/92	76	56	66		0.0	0		W	6.5	CLDY	0	1
08/31/92	76	54	65		0.0	0		W	2.6	CLR	0	0
Total/ Average[5]	79.3	58.2	68.8	2.39	0.0			NE	4.0		9	136
Departure from Average	-3.7	-4.2	-3.9	-1.63				SW	-0.7		+2	-102

1 Snow depth at 7 AM LST.

2 DEGREE DAYS: Heat and Cool base=65F; Heating/dd July-June. Cooling/dd Jan.-Dec.

3 WEATHER TYPES: F=Fog; T=Thunderstorm; IP=Ice Pellets; A=Hail; R=Rain; S=Snow; Z=Freezing Precip; D=Dust; H=Haze; BS=BlowingSnow; RW=Rain Showers; SW=Snow Showers; L=Drizzle; INTENSITIES: +heavy; -light; absence of symbol indicates moderate, T = Trace.

4 Sky 7 AM - 7PM LST. Other data midnight - midnight.

* Highest or lowest value for the month.

5 Averages 1961-1990 data.

Champaign, IL Water Survey Research Center				Local Climatological Data Illinois State Water Survey				September 1992 Summary				
	Temperature			Precip	Snow[1]		Weather	Wind		Sky	Degree Days[2]	
Date	Max.	Min.	Mean	Inches	Inches	Depth	Types[3]	Dir.	Speed	Cover[4]	Heat	Cool.
09/01/92	79	54	67	0	0.0	0		SE	3.3	CLDY	0	2
09/02/92	74	64	69	0.08	0.0	0	T,R-,L,F	S	6.3	CLDY	0	4
09/03/92	82	58	70	0	0.0	0	F	W	4.0	PC	0	5
09/04/92	81	56	69	0	0.0	0		E	2.7	CLR	0	4
09/05/92	84	62	73	0	0.0	0	F	S	3.9	PC	0	8
09/06/92	84	63	74	0	0.0	0	F	SE	4.2	CLR	0	9
09/07/92	84	64	74	0.58	0.0	0	TRW+,F	S	5.3	PC	0	9
09/08/92	73	58	66	0.02	0.0	0	R	NW'	3.9	PC	0	1
09/09/92	87	60	74	0.66	0.0	0	TRW+,R,L	S'	8.3	CLDY	0	9
09/10/92	70	53	62	0	0.0	0		NW'	6.0	PC	3	0
09/11/92	72	50	61	0	0.0	0		NW"	2.5	CLR	4	0
09/12/92	75	48	62	0	0.0	0		SE	3.4	CLR	3	0
09/13/92	80	51	66	0	0.0	0		S	4.6	CLR	0	1
09/14/92	86	56	71	0	0.0	0		S	5.5	CLR	0	6
09/15/92	*89	64	77	0	0.0	0		S	5.6	PC	0	*12
09/16/92	86	64	75	0	0.0	0		S	10.6	PC	0	10
09/17/92	85	61	73	0	0.0	0		S	7.2	PC	0	8
09/18/92	76	52	64	0.13	0.0	0	TRW	NW	7.8	PC	1	0
09/19/92	70	46	58	0	0.0	0		N	2.7	CLR	7	0
09/20/92	66	48	57	0.26	0.0	0	R-,L	SE	5.2	CLDY	8	0
09/21/92	75	64	70	0.42	0.0	0	TRW+,RW-R,L,F	SW	6.7	CLDY	0	5
09/22/92	66	47	57	0	0.0	0		N	7.3	CLR	8	0
09/23/92	63	41	52	0	0.0	0		NE	4.5	CLR	*13	0
09/24/92	70	41	56	0	0.0	0		E	3.4	CLR	9	0
09/25/92	76	48	62	0	0.0	0		SE	4.2	CLDY	3	0
09/26/92	71	54	63	*0.99	0.0	0	R,RW,L,F	S	5.6	CLDY	2	0
09/27/92	72	48	60	0	0.0	0		W	4.1	CLR	5	0
09/28/92	65	44	55	0	0.0	0		N	5.3	CLR	10	0
09/29/92	66	40	53	0	0.0	0		N	2.6	CLR	12	0
09/30/92	71	*39	55	0	0.0	0		SE	1.5	CLR	10	0
Total/ Average[5]	75.9	53.3	64.6	3.14	0.0			S	4.9		98	93
Departure from Average	-1.8	-1.9	-1.9	+5.22				SW	-0.2		+17	-24

[1] Snow depth at 7 AM LST.

[2] DEGREE DAYS: Heat and Cool base=65F; Heating/dd July-June. Cooling/dd Jan.-Dec.

[3] WEATHER TYPES: F=Fog; T=Thunderstorm; IP=Ice Pellets; A=Hail; R=Rain; S=Snow; Z=Freezing Precip; D=Dust; H=Haze; BS=BlowingSnow; RW=Rain Showers; SW=Snow Showers; L=Drizzle;
INTENSITIES: +heavy; -light; absence of symbol indicates moderate, T = Trace.

[4] Sky 7 AM - 7PM LST. Other data midnight - midnight.

* Highest or lowest value for the month.

'direction from Bondville.

"direction from Bondville-Champaign.

[5] Averages 1961-1990 data.

Champaign, IL Water Survey Research Center				Local Climatological Data Illinois State Water Survey				October 1992 Summary				
	Temperature			Precip	Snow[1]		Weather	Wind		Sky	Degree Days[2]	
Date	Max.	Min.	Mean	Inches	Inches	Depth	Types[3]	Dir.	Speed	Cover[4]	Heat	Cool.
10/01/92	75	41	58	0	0	0	F	SW	3.3	CLR	7	0
10/02/92	79	43	61	0	0	0	F	SW	4.9	CLR	4	0
10/03/92	82	52	67	0	0	0		SW	4.4	CLR	0	2
10/04/92	77	51	64	0	0	0		E	2.9	PC	1	0
10/05/92	69	44	57	0	0	0		NE	3.5	CLR	8	0
10/06/92	72	39	56	0	0	0	F	SE	2.1	CLR	9	0
10/07/92	73	43	58	0	0	0		SE	5.2	CLDY	7	0
10/08/92	70	50	60	T	0	0	L	SW	12.5	CLDY	5	0
10/09/92	63	46	55	0	0	0		SW	9.2	PC	10	0
10/10/92	68	46	57	T	0	0	TRW-	W	4.8	CLR	8	0
10/11/92	64	38	51	0	0	0		W	5.3	CLR	14	0
10/12/92	69	38	54	0	0	0		NW	6.3	CLR	11	0
10/13/92	69	36	53	0	0	0		S	4.7	PC	12	0
10/14/92	*84	58	71	T	0	0	TRW-	SW	11.1	CLDY	0	*6
10/15/92	73	56	65	*1.38	0	0	TRW+,RW	S	5.5	CLDY	0	0
10/16/92	56	38	47	0	0	0		NW	8.0	PC	18	0
10/17/92	51	30	41	0	0	0		N	2.5	PC	24	0
10/18/92	48	32	40	0	0	0		NW	6.0	CLR	25	0
10/19/92	48	*26	37	0	0	0		S	3.8	PC	*28	0
10/20/92	61	34	48	0.15	0	0	R,L	SW	8.0	PC	17	0
10/21/92	65	41	53	0	0	0	F	E	2.7	CLR	12	0
10/22/92	79	44	62	0	0	0		S	3.4	CLR	3	0
10/23/92	79	51	65	0	0	0	F	SW	6.5	CLR	0	0
10/24/92	68	44	56	0	0	0		N	5.5	CLR	9	0
10/25/92	68	39	54	0	0	0		S	2.5	CLR	11	0
10/26/92	65	44	55	0	0	0		NE	5.3	PC	10	0
10/27/92	62	38	50	0	0	0		N	2.5	CLR	15	0
10/28/92	66	34	50	0.01	0	0	L	W	4.7	CLDY	15	0
10/29/92	52	44	48	0.06	0	0	R-,L	NE	5.5	CLDY	17	0
10/30/92	49	43	46	0.10	0	0	R-,L	NE	6.6	CLDY	19	0
10/31/92	52	43	48	0.38	0	0	R,L,F	E	4.2	CLDY	17	0
Total/ Average[5]	66.3	42.1	54.2	2.08	0.0			NE	5.3		336	8
Departure from Average	+1.2	-1.7	-0.3	-0.6	-0.1			S	-0.8		-13	-8

[1] Snow depth at 7 AM LST.

[2] DEGREE DAYS: Heat and Cool base=65F; Heating/dd July-June. Cooling/dd Jan.-Dec.

[3] WEATHER TYPES: F=Fog; T=Thunderstorm; IP=Ice Pellets; A=Hail; R=Rain; S=Snow; Z=Freezing Precip; D=Dust; H=Haze; BS=BlowingSnow; RW=Rain Showers; SW=Snow Showers; L=Drizzle; INTENSITIES: +heavy; -light; absence of symbol indicates moderate, T = Trace.

[4] Sky 7 AM - 7PM LST. Other data midnight - midnight.

*Highest or lowest value for the month.

[5] Averages 1961-1990 data.

Champaign, IL Water Survey Research Center				Local Climatological Data Illinois State Water Survey				November 1992 Summary				
	Temperature			Precip	Snow[1]		Weather	Wind		Sky	Degree Days[2]	
Date	Max.	Min.	Mean	Inches	Inches	Depth	Types[3]	Dir.	Speed	Cover[4]	Heat	Cool.
11/01/92	62	46	54	*3.53	0	0	TRW+,RW+ R,L	E	7.0	CLDY	11	*0
11/02/92	60	40	50	0.34	0	0	R,L	SW	13.5	CLDY	15	0
11/03/92	51	34	43	0.21	0	0	R,R-,L	S	6.5	PC	22	0
11/04/92	40	32	36	0	0	0		W	7.6	CLDY	29	0
11/05/92	35	32	34	0.02	*0.2	0	L,SW-	W	5.8	CLDY	31	0
11/06/92	39	30	35	T	T	0	S-	NNW	4.3	CLDY	30	0
11/07/92	38	28	33	0.02	0.1	T	S-,L	NE	2.9	CLDY	32	0
11/08/92	51	26	39	0	0	0		SE	7.4	CLDY	26	0
11/09/92	49	42	46	0.19	0	0	R,L	S	9.9	CLDY	19	0
11/10/92	51	46	49	0.76	0	0	R,RW,L	S	10.7	CLDY	16	0
11/11/92	54	49	52	0.58	0	0	R,L,RW,R-F	NE	4.4	CLDY	13	0
11/12/92	57	34	46	0.84	0	0	R,L,F	NW	10.5	CLDY	19	0
11/13/92	36	26	31	T	T	0	SW-	W	11.0	CLDY	34	0
11/14/92	33	24	29	T	T	0	SW-	NW	4.7	CLDY	36	0
11/15/92	33	*22	28	T	T	0	SW-	W	4.5	CLDY	*37	0
11/16/92	53	29	41	0	0	0		S	10.3	PC	24	0
11/17/92	55	40	48	0.03	0	0	RW-	SW	8.1	CLDY	17	0
11/18/92	44	39	42	0.11	0	0	R,L,F	NE	6.7	CLDY	23	0
11/19/92	48	41	45	0.01	0	0	L,F	E	4.5	CLDY	20	0
11/20/92	*64	46	55	0.14	0	0	R,L	SE	11.4	CLDY	10	0
11/21/91	57	44	51	0.02	0	0	L	W	9.2	CLDY	14	0
11/22/92	52	44	48	1.00	0	0	R,L	NE	10.6	CLDY	17	0
11/23/92	41	39	40	0.01	0	0	RW-	NW	5.1	CLDY	25	0
11/24/92	42	39	41	0.06	0	0	R,L	NE	5.1	CLDY	24	0
11/25/92	51	41	46	0.16	0	0	R,L	SW	9.9	CLDY	19	0
11/26/92	41	29	35	T	0	0	L-	W	10.8	CLDY	30	0
11/27/92	30	26	28	T	T	0	SW-	NW	3.6	CLDY	*37	0
11/28/92	35	27	31	0	0	0		SSW	4.9	CLDY	34	0
11/29/92	46	23	35	0	0	0		SW	7.7	CLR	30	0
11/30/92	39	30	35	T	T	0	SW	W	7.5	CLDY	30	0
Total/ Average[5]	46.2	34.9	40.6	8.03	0.3			W	7.5		724	
Departure from Average	+4.1	+1.1	-1.5	+4.93	-1.9			SW	0		+28	

[1] Snow depth at 7 AM LST.

[2] DEGREE DAYS: Heat and Cool base=65F; Heating/dd July-June. Cooling/dd Jan.-Dec.

[3] WEATHER TYPES: F=Fog; T=Thunderstorm; IP=Ice Pellets; A=Hail; R=Rain; S=Snow; Z=Freezing Precip; D=Dust; H=Haze; BS=BlowingSnow; RW=Rain Showers; SW=Snow Showers; L=Drizzle; INTENSITIES: +heavy; -light; absence of symbol indicates moderate, T = Trace.

[4] Sky 7 AM - 7PM LST. Other data midnight - midnight.

* Highest or lowest value for the month.

[5] Averages 1961-1990 data.

Champaign, IL Water Survey Research Center				Local Climatological Data Illinois State Water Survey				December 1992 Summary				
	Temperature			Precip	Snow[1]		Weather	Wind		Sky	Degree Days[2]	
Date	Max.	Min.	Mean	Inches	Inches	Depth	Types[3]	Dir.	Speed	Cover[4]	Heat	Cool.
12/01/92	39	28	34	0.03	0.1	T	SW,L	W	9.1	CLDY	31	0*
12/02/92	36	30	33	T	T	T	SW	WNW	12.2	CLDY	32	0
12/03/92	35	27	31	0	0	0		SE	6.7	CLDY	34	0
12/04/92	34	20	27	0	0	0		NW	8.8	PC	38	0
12/05/92	27	14	21	0	0	0		NW	5.8	PC	44	0
12/06/92	30	20	25	0.01	0.2	T	SW	S	7.4	CLDY	40	0
12/07/92	34	24	29	0	0	T		NW	4.7	PC	36	0
12/08/92	38	24	31	0	0	0		WNW	3.6	CLDY	34	0
12/09/92	32	20	26	0.39	*3.2	0	R,IP,ZR,SW	SE	7.4	CLDY	39	0
12/10/92	35	30	33	0.09	0.8	3	SW	NW	7.9	CLDY	32	0
12/11/92	38	28	33	0	0	2		NW	7.5	CLR	32	0
12/12/92	41	25	33	0	0	T		E	2.5	CLR	32	0
12/13/92	36	27	32	0	0	0	F	E	4.8	CLDY	33	0
12/14/92	39	31	35	0	0	0	F	SE	6.2	CLDY	30	0
12/15/92	55	37	46	0.55	0	0	R,L	SE	14.1	CLDY	19	0
12/16/92	42	36	39	0	0	0		W	6.9	CLDY	26	0
12/17/92	36	30	33	0.03	0.3	T	SW-	NW	4.8	CLDY	32	0
12/18/92	33	29	31	T	T	T	SW-	SSE	9.2	CLDY	34	0
12/19/92	43	27	35	0.22	0.5	T	F,R,L,ZR,IP, SW	SW	7.9	CLDY	30	0
12/20/92	27	15	21	0	0	T		NW	**5.9	CLR	44	0
12/21/92	38	16	27	0	0	T		SE**	**7.8	PC	38	0
12/22/92	44	24	34	0	0	0	F	S	6.9	PC	31	0
12/23/92	43	13	28	0	0	0	F	W	9.6	CLR	37	0
12/24/92	23	*5	14	0	0	0		S	10.6	CLR	*51	0
12/25/92	35	16	26	0	0	0		NW	11.7	CLR	39	0
12/26/92	28	9	19	0	0	0		SE	4.8	CLR	46	0
12/27/92	43	17	30	0	0	0		S	8.5	CLR	35	0
12/28/92	41	33	37	0	0	0	F	SE	5.5	CLDY	28	0
12/29/92	49	38	44	*0.66	0	0	R,L,F	SSE	8.4	CLDY	21	0
12/30/92	*58	44	51	0.47	0	0	R,L,F	SW	13.2	CLDY	14	0
12/31/92	44	12	28	T	T	0	SG-	NW	10.6	CLDY	37	0
Total/ Average[5]	37.9	24.2	31.1	2.45	5.1			NW			1,049	
Departure from Average	+1.4	+2.2	+1.8	-0.57	-0.9			S	-0.1		-68	

[1] Snow depth at 7 AM LST.

[2] DEGREE DAYS: Heat and Cool base=65F; Heating/dd July-June. Cooling/dd Jan.-Dec.

[3] WEATHER TYPES: F=Fog; T=Thunderstorm; IP=Ice Pellets; A=Hail; R=Rain; S=Snow; Z=Freezing Precip; D=Dust; H=Haze; BS=BlowingSnow; RW=Rain Showers; SW=Snow Showers; L=Drizzle;
INTENSITIES: +heavy; -light; absence of symbol indicates moderate, T = Trace.

[4] Sky 7 AM - 7PM LST. Other data midnight - midnight.

*Highest or lowest value for the month.

**Bondville and Champaign-Urbana data used, due to frozen anemometer.

[5] Averages 1961-1990 data.