5-1986

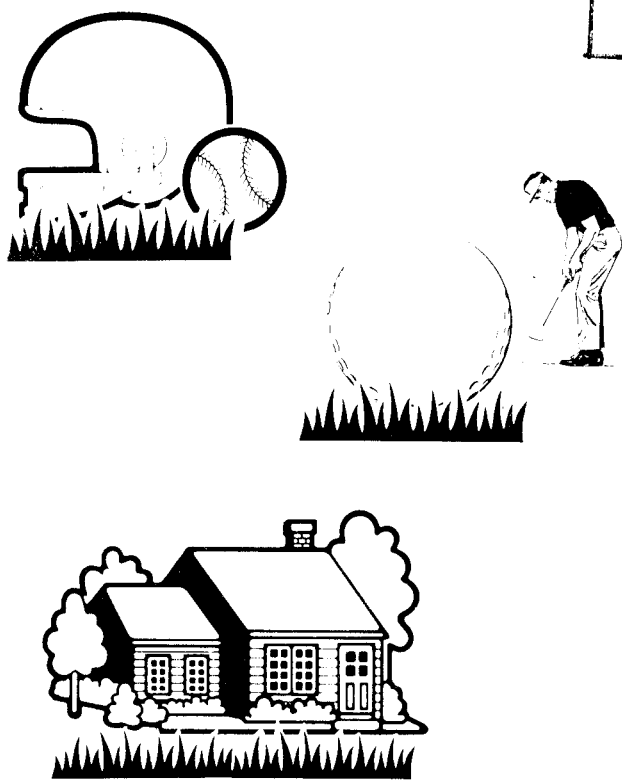
1985 Turfgrass Management Annual Research Summary Report

University of Tennessee Agricultural Experiment Station

Lloyd M. Callahan

The University of Tennessee
Agricultural Experiment Station

Research Report 86-10
May 1986



1985 Turfgrass Management Annual Research Summary Report

Lloyd M. Callahan

Department of Ornamental Horticulture
and Landscape Design

1985

TURFGRASS MANAGEMENT ANNUAL

RESEARCH SUMMARY REPORT

Department of Ornamental Horticulture and Landscape Design

The University of Tennessee

Knoxville, Tennessee

Prepared By:

Dr. Lloyd M. Callahan

Professor

Turfgrass Management

Published By:

The University of Tennessee

Agricultural Experiment Station

Knoxville, Tennessee

TABLE OF CONTENTS

Principal Turfgrass Management Personnel

Department of Ornamental Horticulture and Landscape Design

The University of Tennessee, Knoxville

Dr. Lloyd M. Callahan (Turf Research Project Leader)
Professor
Turfgrass Management Research and Teaching

Dr. Thomas J. Samples (Turf Extension)
Assistant Professor
Turfgrass Management Extension
(Joined Department December 1, 1985)

Mr. Dennis P. Shepard (Turf Research)
Research Associate
Turfgrass Management Research
(Joined Department October 15, 1985)

Miss Lori D. Lester (Turf Research)
Graduate Research Assistant
Turfgrass Management Research
(Graduated with M.S. degree August, 1985)

Miss Ellen R. McDonald (Turf Research)
Graduate Research Assistant
Turfgrass Management Research
(Graduated with M.S. degree December, 1984)

Mrs. Sandra B. Ractliffe (Turf Research)
Graduate Research Assistant
Turfgrass Management Research
(Started M.S. Program in Turf April 2, 1986)

Perennial Ryegrass Cultivar Evaluations for Lawn Adaptation in Tennessee

L. M. Callahan and L. D. Lester

Objectives of this study are to evaluate selected cultivars of perennial ryegrass (Lolium perenne L.) for adaptation under lawn conditions at Knoxville, Tennessee. Evaluations are part of a southern regional cooperative adaptation program following uniform management practices and data criteria.

Methods and Materials

Perennial ryegrass cultivars were seeded September 19, 1983, at 5 pounds per 1,000 sq. ft. Plots are 4 ft. by 6 ft. in size and replicated three times. Mowing is once per week at 2 1/2 inches cutting height with clippings dropped. Fertilization is four times per year totaling 4-1-2 pounds actual N-P_2O_5-K_2O per 1,000 sq. ft. Irrigation is applied as needed. No pesticides are applied.

Results and Discussion

Perennial ryegrass cultivars in this study have only been under evaluation for two years. Cultivar evaluation studies generally need to be conducted for at least three years before reliable recommendations can be made. The following discussions will deal only with the progress

of this study. It should be remembered also that perennial ryegrasses generally are short-lived perennials, as compared to Kentucky bluegrass which is a long-lived perennial.

Green stand density. Perennial ryegrasses develop stand density through an upright, bunch-type growth. They maintain density through prolific tillering and short rhizome growth. Stand density is a category reflecting grass response to practically all types of environmental stress and disease; thus, it is the most important category measuring performance.

Leading perennial ryegrass cultivars exhibiting high green stand densities from September 1983 to September 1984 were Fiesta, Gator, Pennant, Prelude, Premier and Palmer (Table 1). During the second year test period (1984 to 1985) Gator, Pennant and Premier repeated as leaders but were joined by Regal, Diplomat and the Rutgers Experimental M-382 (Table 1).

Quality appearance. This is a composite category combining green stand density; leaf blade color; texture (leaf blade width); and injury from parasitic diseases, insects, and high and low temperatures. Leading perennial ryegrass cultivars in 1983-84 were Fiesta, Prelude, Pennant, Gator, Palmer, Blazer, Yorktown II and Premier (Table 1). Gator, Pennant and Premier repeated among the leaders in quality appearance in 1984-85 (Table 1). Other leading quality performance cultivars were Regal, Rutgers M-382 and SWRC-1.

Rhizoctonia resistance. Rhizoctonia brown patch (Rhizoctonia solani Kuhn.) was prevalent during the first year of evaluations but not the following year; thus, results are shown only for 1983-84 (Table 1).

Table 1. Perennial ryegrass cultivar rankings during first two years of evaluations for adaptation.

1983-84 Results				1984-85 Results				
Cultivar	% Green Std Den	Qlty Appear[1/]	Rhizoc Resist[2/]	Cultivar	% Green Std Den	Qlty Appear	Helmin Resist[3/]	Webworm Resist[4/]
1. Fiesta	95	9.0	9.0	Regal	78	6.8	4.7	7.0
2. Gator	95	8.0	8.0	Gator	72	6.6	5.0	7.0
3. Pennant	94	8.5	7.3	Pennant	72	6.3	6.0	5.7
4. Prelude	93	9.0	9.0	Premier	72	6.7	5.0	7.0
5. Premier	92	7.3	7.5	Diplomat	71	6.1	3.0	4.7
6. Palmer	91	7.7	8.0	Rut. M-382	71	6.2	6.3	3.7
7. Yorktown II	90	7.5	7.5	SWRC-1	70	6.2	6.0	6.3
8. SWRC-1	88	6.7	6.7	Palmer	69	6.1	4.0	5.0
9. Rut. M-382	86	6.0	7.0	Prelude	69	6.1	7.0	7.3
10. Acclaim	86	6.0	6.5	Derby	67	5.8	2.3	6.0
11. Blazer	85	7.5	8.0	Acclaim	66	5.4	5.0	5.7
12. Derby	85	6.0	6.0	Blazer	66	5.5	4.7	4.0
13. Barry	85	6.0	6.0	Ranger	66	6.0	5.0	3.0
14. Pennfine	85	5.5	6.0	Barry	65	5.2	3.0	4.0
15. Regal	83	6.5	7.0	Fiesta	64	5.4	4.7	5.3
16. Omega	83	5.5	6.5	Omega	64	5.9	2.3	3.3
17. Ranger	82	5.5	6.5	Yorktown II	63	5.0	4.0	2.0
18. Diplomat	80	6.0	7.0	Pennfine	62	5.1	2.7	5.3
19. Citation	73	4.3	5.3	Citation	61	4.8	3.0	6.0
20. Common	35	1.7	1.7	Common	36	2.2	2.0	3.3

1/ General overall quality appearance: 1-9; 9 = Best.

2/ Rhizoctonia solani resistance: 1-9, 9 = Resistant.

3/ Helminthosporium Leaf Spot resistance: 1-9; 9 = Resistant.

4/ Sod webworm resistance: 1-9; 9 = Resistant.

Perennial ryegrass cultivars exhibiting high resistance during 1983-84 were Fiesta, Prelude, Blazer, Gator and Palmer.

Helminthosporium resistance. Helminthosporium blight (Helminthosporium species) occurred during the second year but not the first year. Results are shown only for the 1984-85 evaluation period (Table 1). Cultivars showing high resistance the second year of evaluations were Prelude, Rutgers M-382, Pennant and SWRC-1.

Sod webworm resistance. Sod webworm activity was only noted during the summer of the second year of evaluations, thus results are shown only for 1984-85 (Table 1). Sod webworm feeding activity was severe in a few cultivars with little damage in others. Damage was also consistant with each replicated plot of certain cultivars. Perennial ryegrass cultivars showing high resistance to sod webworms were Prelude, Gator, Premier, Regal and SWRC-1.

Herbicide Combination Effects

In a Bentgrass Green

L. M. Callahan

This study has completed the second year of a four year investigation period. The study is designed to determine the effectiveness of selected preemergence herbicides applied singularly and in combination (follow-up) treatments in controlling large crabgrass (Digitaria sanguinalis) and goosegrass (Eleusine indica) in a bentgrass (Agrostis palustris Huds. 'Penncross') green. In addition, herbicide phytotoxicity to the bentgrass and effectiveness of soil/herbicide residues in weed control is being evaluated.

Methods and Materials

Individual herbicide application dates are March 1, April 1, and April 15. Chemical formulations and rates applied are shown in Table 1.

Table 1. Individual herbicide common names, trade names, formulations and rates applied.

Common Name	Trade Name	Formulation	lbs ai/acre
Benefin	Balan	2.5 G	2 and 4
Bensulide	Betasan	7 G	5 and 10
Oxadiazon	Ronstar	2 G	2 and 4
Oxadiazon	Ronstar	50 W	2 and 4
Oxadiazon/ Benefin/UF*	Regalstar	1/0.5	2/1 and 4/2

(Regalstar = oxadiazon 1%/benefin 0.5%/Ureaform* 38%)

Combination herbicide application dates are March 1, for the first chemical treatment, followed by an April 1 or an April 15 treatment for the second herbicide. Treatment combinations are shown in Table 2.

Table 2. Combination herbicides, formulations, and rates applied.

March 1 Treatments			April 1 or April 15 Treatments)	
Herbicide/Form.	lbs ai/ acre		Herbicide/Form.	lbs ai/ acre
Benefin G	2	+	Oxadiazon G	2
Benefin G	4	+	Oxadiazon G	4
Benefin G	2	+	Regalstar G	2/1
Benefin G	4	+	Regalstar G	4/2
Bensulide G	5	+	Oxadiazon G	2
Bensulide G	10	+	Oxadiazon G	4
Oxadiazon G	2	+	Bensulide G	5
Oxadiazon G	4	+	Bensulide G	10
Benefin G	2	+	Bensulide G	5
Benefin G	4	+	Bensulide G	10

Results and Discussion

Crabgrass Control. Individual herbicide treatments giving 90 to 100% control of crabgrass with applications on March 1 and April 1 were Oxadiazon at 4 lb ai/A and Regalstar 4/2 lb ai/A (Table 3). Crabgrass control was 94 to 100% on April 15 with both the 2 and 4 lb ai/A rates of Oxadiazon and the 2/1 and 4/2 lb ai/A rates of Regalstar.

Table 3. Percent crabgrass control in a Penncross bentgrass green following individual preemergence herbicide treatments during Spring, 1985. 1/

Herbicide/Form.	lb. ai/ acre	Treatment Dates		
		March 1	April 1	April 15
Benefin 2.5 G	2	24%	41%	66%
	4	44	62	84
Bensulide 7 G	5	6	23	44
	10	28	41	78
Oxadiazon 2 G	2	76	82	94
	4	100	100	100
Oxadiazon 50 W	2	62	79	97
	4	90	94	100
Regalstar G	2/1	75	84	94
	4/2	100	100	100

1/ Crabgrass germinated April 19, 1985.

Crabgrass was 90 to 100% controlled with all herbicide combination treatments applied on March 1 + April 1 and March 1 + April 15, except the combination of Benefin at 2 lbs + Bensulide at 5 lbs ai/A (Table 4).

Table 4. Percent crabgrass control in a Penncross bentgrass green following combination preemergence herbicide treatments during Spring, 1985. 1/

Herbicide/Form.	lb ai/acre		Treatment Dates: March 1 + April 1	Treatment Dates: March 1 + April 15
Benefin G	2 + Oxadiazon G	2	100%	100%
	4 +	4	100	100
Benefin G	2 + Regalstar G	2/1	100	100
	4 +	4/2	100	100
Bensulide G	5 + Oxadiazon G	2	100	100
	10 +	4	100	100
Oxadiazon G	2 + Bensulide G	5	100	100
	4 +	10	100	100
Benefin G	2 + Bensulide G	5	79	86
	4 +	10	90	98

1/ Crabgrass germinated April 19, 1985.

Goosegrass control. Individual herbicide treatments giving 100% control of goosegrass were both rates of Oxadiazon 2 G on all three treatment dates, Oxadiazon 50 W at 4 lb ai/A on April 15, and Regalstar at 4/2 lb ai/A on all three dates (Table 5). Oxadiazon 50 W at 4 lb ai/A on April 1 and Regalstar 2/1 lb ai/A on April 15 gave 91% control of goosegrass.

Table 5. Percent goosegrass control in a Penncross bentgrass green following individual preemergence herbicide treatments during Spring, 1985.

Herbicide/Form.	lb ai/ acre	Treatment Dates		
		March 1	April 1	April 15
Benefin 2.5 G	2	0%	0%	0%
	4	13	22	26
Bensulide 7 G	5	4	0	0
	10	17	13	22
Oxadiazon 2 G	2	100	100	100
	4	100	100	100
Oxadiazon 50 W	2	74	70	78
	4	87	91	100
Regalstar G	2/1	83	87	91
	4/2	100	100	100

Goosegrass control was 100% following both treatment sequence dates with all herbicide combinations containing Oxadiazon (Table 4).

Table 6. Percent goosegrass control in a Penncross bentgrass green following combination preemergence herbicide treatments during Spring, 1985. 1/

Herbicide/Form., lb ai/acre				Treatment Dates: March 1 + April 1	Treatment Dates: March 1 + April 15
Benefin G	2	+ Oxadiazon G	2	100%	100%
	4	+	4	100	100
Benefin G	2	+ Regalstar G	2/1	100	100
	4	+	4/2	100	100
Bensulide G	5	+ Oxadiazon G	2	100	100
	10	+	4	100	100
Oxadiazon G	2	+ Bensulide G	5	100	100
	4	+	10	100	100
Benefin G	2	+ Bensulide G	5	37	49
	4	+	10	68	82

1/ Goosegrass germinated May 20, 1985.

Stand density. Stand density of the Penncross bentgrass is a measure of sod loss (phytotoxicity) following herbicide treatments. Bentgrass stand density was 99 to 100% following all individual herbicide applications on all three treatment dates (Table 7). However, foliage discoloration or chlorosis did persist for approximately 4 to 6 weeks following treatments with Oxadiazon 2G and 50W, and Regalstar at both rates for the dates shown in Table 7.

Table 7. Stand density of a Penncross bentgrass green following individual preemergence herbicide treatments during Spring, 1985.

Herbicide/Form.	lb ai/ acre	Treatment Dates		
		March 1	April 1	April 15
Check		100%	100%	100%
Benefin 2.5 G	2	100	100	100
	4	100	100	100
Bensulide 7 G	5	100	100	100
	10	100	100	100
Oxadiazon 2 G	2	100	*100	100
	4	100	*100	*99
Oxadiazon 50 W	2	100	*100	100
	4	100	*100	*99
Regalstar G	2/1	100	*100	100
	4/2	*100	*100	*100

* = Foliage discoloration.

Stand density of the bentgrass was 98 to 100% following all combination herbicide applications for both treatment sequence dates (Table 8). Again, bentgrass foliage discoloration was evident with herbicide treatments containing Oxadiazon.

Table 8. Stand density of a Penncross bentgrass green following combination preemergence herbicide treatments during Spring, 1985.

Herbicide/Form., lb ai/acre			Treatment Dates: March 1 + April 1	Treatment Dates: March 1 + April 15
Check			100%	100%
Benefin G	2 + Oxadiazon G	2	*100	*100
	4 +	4	*100	*100
Benefin G	2 + Regalstar G	2/1	*100	*100
	4 +	4/2	*99	*98
Bensulide G	5 + Oxadiazon G	2	*100	*100
	10 +	4	*99	*100
Oxadiazon G	2 + Bensulide G	5	100	100
	4 +	10	*100	*100
Benefin G	2 + Bensulide G	5	100	100
	4 +	10	100	100

* = Foliage discoloration.

Annual Bluegrass Control With Treatment Programs of Bensulide

L. M. Callahan and E. R. McDonald

Annual bluegrass (Poa annua L.) continues to be a serious weed in greens of bentgrass (Agrostis palustris Huds.). Many methods have been tried over the past three decades to eradicate this pest but to no avail. Annual bluegrass can tolerate the same close mowing pressure as bentgrass. Both are cool season grasses with similar climatic tolerances. Under the close mowing stress on golf greens bentgrass sometimes has only a slightly better tolerance to herbicides than does annual bluegrass, thus eradication has not worked and control is difficult at best. Herbicides and rates that would control annual bluegrass under high mowing heights sometimes kill the bentgrass under low mowing heights.

Methods and Materials

A Penncross bentgrass green was treated wtih eleven combinations of variable rates and dates throughout the year of Bensulide for annual bluegrass control. This study was conducted over a three year period ending in 1985. Cross plot seedings of annual bluegrass (Poa annua var. annua) and a cross plot sodding of the perennial-type of annual bluegrass Poa annua var. reptans) were made. The P. annua var. annua was seeded in December of each year. Treatment programs by dates, rates, and annual bluegrass control are shown in Table 1.

Table 1. Percent Control of Annual and Perennial-types of *Poa annua* with treatment Programs of Bensulide.

Prog. No.	Treatment Dates[1]	lb ai/A Per Date	lb ai/A Annual Totals	Percent Control[2] 1984 Annual[3] 6-15	1984 Annual[3] 10-10	1984 Perennial[4] 6-15	1984 Perennial[4] 10-10	1985 Annual 6-15	1985 Annual 10-10	1985 Perennial 6-15	1985 Perennial 10-10
				%							
1	8-15/2-15	10/10	20	6	0	0	0	6	6	6	6
2	8-15/2-15	15/15	30	6	21	0	0	21	9	14	0
3	8-15/2-15/3-20	10/10/10	30	1	36	0	0	32	21	28	2
4	2-15/3-20/8-15	10/5/5	20	18	26	0	0	1	1	5	0
5	8-15/2-15/3-20	10/5/5	20	2	4	0	0	9	1	8	0
6	8-15/2-15/ 3-20/4-20	10/10/ 5/5	30	5	40	0	0	19	0	13	0
7	2-15/3-20/4-20/ 5-20/6-20	10/5/5/ 5/5	30	18	64	0	0	0	0	0	0
8	8-15/9-15/2-15/ 3-20/4-20	10/5/10/ 5/5	35	6	32	0	0	2	2	5	0
9	8-15/9-15/10-15/ 2-15/3-20	10/5/5/ 10/5	35	11	4	0	0	6	2	8	0
10	1-15/2-15/3-20	10/5/5	20	75	81	0	0	78	61	35	8
11	8-15/1-15/3-20	10/10/10	30	3	21	0	0	26	7	6	0

1/ Treatment began in 1983 with the first date shown for each program.

2/ Results are shown for June and October of 1984 and 1985.

3/ Annual-type is *Poa annua* var. *annua* and is seeded into test plots in early December of each year beginning in 1982.

4/ Perennial-type is *Poa annua* var. *reptans* and was sodded in test plots on September 13, 1982.

Results and Discussion

In 1984, control of P. annua var. annua reached a high of 81% with Bensulide program 10, and 64% with program 7 (Table 1). None of the programs gave measurable control of the P. annua var. reptans. Bensulide program effectiveness in 1985 reached a high of 78% and only with program 10. This same program gave 35% control for P. annua var. reptans. Program 10 was composed of Bensulide treatments on January 15 at 10 lbs., February 15 at 5 lbs., and March 20 at 5 lbs. ai/A. Although this program totaled only 20 lbs. ai/A for the year, the treatment dates appeared to provide effective weed control. However, none of the treatment programs, including program 10, gave sufficient control of either species of Poa annua to warrant formal recommendation.

On a positive note, however, even though some programs totaled 35 lbs. ai/A of Bensulide for the year, with treatments actually made over a four year period, no sod loss or foliage discoloration of the bentgrass was observed.

Annual Weedy Grass Control

With Treatment Programs of Arsenic

L. M. Callahan

This is an ongoing study to determine the effectiveness of Arsenic in controlling annual bluegrass (Poa annua var. annua), large crabgrass (Digitaria sanguinalis), and goosegrass (Eleusine indica) in a bentgrass (Agrostis palustris Huds. 'Penncross') green. Determinations are also being made of Arsenic residues and persistence in the green rootzone. Determinations include phytotoxic effects of the Arsenic to the bentgrass following the variable rates and treatment dates of the different programs.

Methods and Materials

The intent with the variable Arsenic program treatments is to gradually remove the more difficult to control annual bluegrass with minimal injury to the bentgrass. The study is being conducted with Tricalcium Arsenate 26% flowable (Turf-Cal) in a bentgrass PURR-WICK Green. Arsenic treatments, as expressed in Table 1, are in Pints of Product/1,000 sq. ft.

Annual bluegrass is cross-seeded into the plots in February, April and September. Large crabgrass and goosegrass are cross-seeded into the plots in February and April. Weed control is shown in Table 1 and phytotoxicity to bentgrass in Table 2.

Results and Discussion

Crabgrass control. Control of crabgrass was 100% with Tricalcium Arsenate treatment programs 3, 4 and 6 (Table 1). These were the only program treatments made on the established bentgrass green during the spring of 1985. Crabgrass normally is an easy weed to control.

Program 3 has three treatment dates starting with 2 pints on March 15 followed by 1 pint each on April 15 and May 15 (Table 1). Program 4 receives 2 pints on each of the same treatment dates shown for program 3. Program 6 receives the same treatments as program 3, plus 2 pints on September 15 followed by 1 pint each on October 1 and November 15.

Goosegrass control. Goosegrass normally is more difficult to control than crabgrass because germination occurs throughout the spring and summer periods. Generally, a herbicide needs a long effective soil residue period to give good control of this weed. In this study, goosegrass control with Arsenic was 86% with program 3, and 100% with programs 4 and 6 during spring 1985 (Table 1).

Annual bluegrass control. Arsenic applications in March and April gave poor control of annual bluegrass as shown by 31 and 39% control with programs 3 and 4, respectively (Table 1). Additional Arsenic treatment programs were started in the fall of 1985.

Following September treatments, annual bluegrass control reached 60 to 61% with programs 1, 2, 6, 7 and 8. Following October treatments, annual bluegrass control increased to 65 to 70% with programs 1, 2, 6, 7 and 8.

Table 1. Percent control of annual weedy grasses with treatment programs of Arsenic in a Purr-Wick bentgrass green during 1985.

Prog. No.	Treatment Rates and Dates [1] (Pints/1,000 sq. ft.)	Percent Control[2]			
		Crabgrass [3]	Goosegrass [4]	Annual blue [5]	
		6-27	6-27	9-20	10-28
1.	2 pt 9-15/1 pt 10-15/1 pt 11-15	0 %	0 %	60 %	68 %
2.	2 pt 9-15/2 pt 10-15/2 pt 11-15	0	0	61	69
3.	2 pt 3-15/1 pt 4-15/1 pt 5-15	100	86	31	3
4.	2 pt 3-15/2 pt 4-15/2 pt 5-15	100	100	39	28
6.	2 pt 3-15/1 pt 4-15/1 pt 5-15/ + 2 pt 9-15/1 pt 10-15/1 pt 11-15	100	100	60	66
7.	2 pt 9-15/1 pt 10-15/1 pt 11-15/ + 2 pt 3-15/1 pt 4-15/1 pt 5-15	0	0	60	70
8.	2 pt 9-15/1 pt 10-15/1 pt 11-15/ + 2 pt 3-15/2 pt 4-15/2 pt 5-15	0	0	60	65
13.	1 pt 9-15/1 pt 10-15/1 pt 11-15/ + 1 pt 3-15/1 pt 9-15	0	0	31	28
14.	1 pt 9-15/1 pt 10-15/1 pt 11-15/ + 1 pt 3-15/1 pt 4-15/1 pt 9-15	0	0	24	22
15.	1 pt 9-15/1 pt 10-15/1 pt 11-15/ + 1 pt 3-15/1 pt 4-15/ + 1 pt 9-15/1 pt 10-15/1 pt 11-15	0	0	24	28

1/ Treatments began in 1985 with the first date shown for each program.

2/ Results are shown for June 27, September 20 and October 28, 1985.

3/ Large crabgrass (*Digitaria sanguinalis*) was seeded into plots February 7 and April 29, 1985.

4/ Goosegrass (*Eleusine indica*) was seeded into plots February 7 and April 29, 1985.

5/ Annual bluegrass (*Poa annua*) was seeded into plots February 7, April 29, and Sept. 6, 1985.

Table 2. Stand density of Penncross bentgrass following treatment programs of Arsenic in a Purr-wick green during 1985. 1/

Prog. No. 2/		Dates of Stand Density Determination					
		3-20	4-22	5-21	8-15	9-20	10-28
1		91%	94%	99%	100%	**100%	91
2		95	97	100	100	**100%	98
3		*91	*61	*91	97	97	97
4		*90	*50	*90	95	95	100
5	Check	90	93	100	100	100	98
6		*87	*63	*93	100	**100	99
7		92	95	100	100	**100	96
8		91	95	100	100	**100	97
9	Check	94	95	99	100	100	99
10	Check	90	93	100	100	100	100
11		+49	+69	+91	+96	+98	100
12		+67	+80	+96	+96	+99	100
13		94	96	100	100	**100	97
14		90	93	100	100	**100	98
15		88	96	100	100	**100	96
16	Check	85	89	97	97	99	99

1/ Purr-wick green seeded to Penncross bentgrass September 7, 1984.

2/ See Table 1 for Treatment rates and dates corresponding with treatment program numbers.

+ Bent seedlings treated with Arsenic October 1, 1984.

* Plots treated with Arsenic on 3-15, 4-15, and 5-15 and exhibited yellow/brown foliage mottling for approximately 2 weeks.

** Plots treated with Arsenic 9-13.

Bentgrass phytotoxicity. Penncross bentgrass germinated September 14, 1984. Arsenic treatment programs 11 and 12 were applied to the bentgrass seedlings on October 1, 1984. The two-week-old seedlings exhibited little tolerance to Arsenic and were severely injured (Table 2). Recovery was very slow exhibiting 49 and 67% stand density following treatments 11 and 12, respectively, by March 20, 1985. By May 21, 1985, recovery reached 91 and 96%, respectively.

Bentgrass was in the establishment stage going into spring, 1985. Micro-nutrient treatments were needed beginning in January 1985 to aid the completion of bentgrass establishment due to influence of the high porous nature of the 90% sand-10% peat moss rootzone mixture. Arsenic treatment programs 3, 4 and 6, applied March 15, 1985, resulted in bentgrass injury as observed on April 22, reducing sod density to 61, 50 and 63%, respectively (Table 2). Bentgrass exhibited good recovery throughout spring and fall.

Evaluation of Labeled Herbicides for Phytotoxicity in Selected Warm Season Turfgrass Cultivars

L. M. Callahan

Warm season turfgrasses that are commonly available in southern nurseries were established in large plots. These cultivars are available for use in determining safe use of selected labeled herbicides under environmental conditions at Knoxville, TN.

Methods and Materials

Warm season turfgrass cultivar plots 10 ft. x 20 ft. in size were established with 2-inch sod plugs set on 1-foot centers during July and August of 1981 and 1982. Cultivars established were Emerald, Matrella (Manilagrass), Meyer, and Midwest Zoysia, and Tifway, Midiron, Tifgreen and Sunturf bermudagrass.

Eight preemergence herbicides were applied at one rate each in a 2-foot strip across cultivars on April 2, 1985. Herbicides, corresponding product names, formulations, and rates in pounds active ingredient/acre (lb ai/A) were: Benefin (Balan) 2.5 G at 4 lb, Benefin 1.0 G plus Oryzalin 1.0 G (Elanco XL) at 1/1 lb, Benefin 0.5 G plus Oxadiazon 1.0 G (Regalstar) at 4/2 lb, (4 lb Oxadiazon + 2 lb Benefin), Bensulide 7 G (Pre-san) at 12 lb, DCPA 5 G (Dacthal) at 12 lb, Ethofumesate 4 F (Progress) at 1 lb, Oxadiazon 2 G (Ronstar) at 4 lb, and Prosulfalin 50 W (Sward) at 3 lb ai/A.

Results and Discussion

Zoysia phytotoxicity. At the time of herbicide treatments on April 2, 1985, all Zoysia plots were dormant. Following treatment with Progress, stand density of Emerald Zoysia was 5% and Matrella Zoysia was 0% by August 22, 1985 (Table 1). Meyer Zoysia density recovered only to 85% by August 22. Progress was very phytotoxic.

Other herbicides inhibiting recovery of Emerald Zoysia by August 22 as evidenced by reduced stand densities, were Balan, 35% stand density; Elanco XL, 40%; Pre-San, 40%; and Regalstar, 30% (Table 1). Herbicides inhibiting Matrella Zoysia recovery were Pre-San and Elanco XL. Meyer Zoysia recovery was inhibited by Pre-San and Progress. Stand density was 80% in untreated plots (Checks) of Emerald and Matrella Zoysia and 98% in Meyer Zoysia by August 22.

Bermudagrass phytotoxicity. Bermudagrass plots were dormant when herbicides were applied April 2, 1985. Stand density in all bermudagrass plots treated with herbicides was 90 to 100% by August 22 (Table 2). Stand density in Check plots was 98 to 99% by August 22. Several herbicides restricted stand recovery in Sunturf bermudagrass by May 30 but recovery was generally complete by August 22. Tifway showed less regrowth restriction by herbicides on May 30 than Midiron, Tifgreen and Sunturf bermudagrass.

In general, the bermudagrasses were much less susceptible to herbicide inhibition of stand regrowth following winter dormancy than were the Zoysias.

Table 1. Percent green stand density of three Zoysias following preemergence herbicide treatments on April 2, 1985. 1/

Herbicide, Form.	lb ai/ acre	Zoysias Emerald 5-30 2/	Emerald 8-22	Meyer 5-30	Meyer 8-22	Matrella 5-30	Matrella 8-22
		&		&		&	
Check		35	80	80	98	50	80
Balan 2.5 G	4	5	35	80	100	5	80
Dacthal 5 G	12	10	75	60	100	5	80
Elanco XL 2 G	1/1	5	40	80	100	15	70
Pre-San 7 G	12	0	40	30	80	5	35
Progress 4 F	1	0	5	20	85	0	0
Regalstar G	4/2	5	30	80	100	5	80
Ronstar 2 G	4	10	80	80	95	5	80
Sward 50 W	3	10	80	80	90	35	80

1/ All Zoysias were still dormant when herbicides were applied on April 2, 1985.

2/ Stand density means are reported for May 30 and August 22, 1985.

Table 2. Percent green stand density of four bermudagrasses following pre-emergence herbicide treatments on April 2, 1985. 1/

Herbicide, Form.	lb ai/ acre	Bermudagrass Cultivars							
		Tifway		Midiron		Tifgreen		Sunturf	
		5-30 2/	8-22	5-30	8-22	5-30	8-22	5-30	8-22
		&							
Check		95	99	85	98	95	98	90	98
Balan 2.5 G	4	95	100	85	98	95	98	40	95
Dacthal 5 G	12	95	98	85	96	83	96	40	98
Elanco XL	1/1	95	94	85	98	85	98	40	90
Pre-San 7 G	12	95	98	85	98	92	96	80	96
Progress 4 F	1	95	100	85	98	90	99	40	98
Regalstar G	4/2	95	100	85	98	95	99	40	96
Ronstar 2 G	4	95	100	85	98	95	98	90	98
Sward 50 W	3	95	92	85	92	90	96	85	94

1/ All bermudagrasses were still dormant when herbicides were applied on April 2, 1985.

2/ Stand density means are reported for May 30 and August 22, 1985.

Evaluation of the Experimental Herbicide MF-737 for Phytotoxicity in Selected Turfgrass Species

L. M. Callahan

A promising new experimental preemergence herbicide, MF-737, was evaluated for phytotoxicity on three turfgrass species.

Methods and Materials

MF-737 4E was applied at 0.5, 1.5 and 3.0 lb ai/A on Kentucky 31 tall fescue, Penncross creeping bentgrass, and Tifway bermudagrass. Treatments were made in plots 4 ft x 6 ft in size replicated three times on April 12, 1985. Applications were made with a gauged hand pump compression sprayer delivering at a rate of 22 gallons/A. The tall fescue was maintained at 3-inches cutting height and Tifway bermudagrass at 2-inches cutting height. Both were mowed once per week and clippings dropped. Penncross bentgrass was maintained under golf green conditions at 5/16 of an inch cutting height.

Results and Discussion

Tall fescue response. Tall fescue exhibited a mottled brown and green (BG) foliage color by April 29 (Table 1). Foliage browning at the 0.5 lb rate was 5%, the 1.5 lb rate was 20%, and the 3.0 lb rate was 40%. By May 15 all herbicide treatments and the Check exhibited medium green (MG) foliage, except for the 3.0 lb rate which was 10% brown.

Live stand density of tall fesuce following all MF-737 rates and the Check was 95% on both April 29 and May 15 (Table 1). Indications are that foliage discoloration was localized in the leaf blades and did not affect the entire plant.

Growth height reduction of tall fescue did occur, from 10 to 60% with low to high rates, respectively, on April 29 (Table 1). By May 15 only the 3.0 lb ai/A rate of MF-737 resulted in height reduction, which was 20%.

Penncross bentgrass response. Phytotoxicity of MF-737 was greater in Penncross bentgrass than in the tall fescue (Table 1). Foliage mottled browning ranged from 5 to 80% following the low to high rate of MF-737, respectively, by April 29. By May 15, the 1.5 lb rate resulted in 5% and the 3.0 lb ai/A rate caused 30% foliage browning.

Live stand density of bentgrass was reduced to 98% with 0.5 lb, 75% with 1.5 lb, and 35% with the 3.0 lb ai/A of MF-737 by April 29 (Table 1). Bentgrass recovered to 95% density with 1.5 lb and 70% density with the 3.0 lb ai/A rates by May 15. No height reduction determinations could be made since the bentgrass was being maintained under a 5/16 inch mowing height.

Tifway bermudagrass response. Foliage discoloration of the bermudagrass was brief and only 5% following the 3.0 lb ai/A rate of MF-737 (Table 1). No foliage discoloration was observed on May 15. The bermudagrass exhibited no loss of live stand density following treatment with MF-737 (Table 1). Height reductions of 5 and 20% for

rates of 1.5 and 3.0 lb ai/A, respectively, were observed April 29. However, full growth height recovery resulted by May 15.

Table 1. Phytotoxicity evaluations of the experimental preemergence herbicide MF-737 (4E) in selected turfgrasses. 1/

Turf Species and Cvs	Herbicide lb ai/A 3/	Turfgrass Responses 2/							
		Foliage Color 4/		Browned Foliage		Live Density		Height Reduction	
		4-29	5-15	4-29	5-15	4-29	5-15	4-29	5-15
				%					
Ky 31 tall fescue	Chk	DG	MG	0	0	95	95	0	0
	½	BG	MG	5	0	95	95	10	0
	1½	BG	MG	20	0	95	95	30	0
	3	BG	MG	40	10	95	95	60	20
Penncross bent	Chk	MG	MG	0	0	100	100		
	½	BG	MG	5	0	98	100		
	1½	BG	BG	35	5	75	95		
	3	BG	BG	80	30	38	70		
Tifway bermuda	Chk	DG	MG	0	0	100	100	0	0
	½	DG	MG	0	0	100	100	0	0
	1½	DG	MG	0	0	100	100	5	0
	3	BG	MG	5	0	100	100	20	0

1/ Experimental herbicide MF-737 was supplied by Mallincrodt, Inc.

2/ Turfgrass responses are reported for April 29 and May 15, 1985.

3/ Herbicide treatments were applied April 12, 1985.

4/ Color Codes: DG = Dark Green, MG = Medium Green, BG = Mottled Brown and Green.