KSU

KANSAS STATE UNIVERSITY

1987

KANSAS STATE UNIVERSITY TURFGRASS RESEARCH

KANSAS TURFGRASS FOUNDATION

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Tall Fescue

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FOREWORD

First of all, on behalf of the Kansas State University turf team, I'd like to extend a hearty welcome to all you turfgrass colleagues attending this years Kansas State University/Kansas Turfgrass Foundation turfgrass field day. It is extremely gratifying to know that Kansas turfgrass managers take the special effort to keep abreast of our latest research findings, and we sincerely hope this information makes your job a little easier.

Some months ago I wrote a letter to the Heart of America GCSA and the Kansas GCSA outlining three main goals for the Kansas State University turfgrass program. These goals included: (1) expansion of the KSU turf program to more accurately reflect the strength of the Kansas turfgrass industry, (2) development of KSU as a national leader in environmental stress tolerance research, and (3) planning and installation of an underground automatic irrigation system to include all of the Rocky Ford Turfgrass Research plots. Please allow me to update you on the progress of these goals.

KSU Turfgrass Program

In order to attain real gains in any program, it is vital to have the best people you can get working on the team. Last fall, we initiated a search for a bona fide Rocky Ford superintendent. After screening over 90 applications from all over the country, we selected Paul Haupt from the University of Illinois. Paul is extremely knowledgeable (nine years at the Champagne Country Club), very hard-working, and is always willing to add the special effort it takes to make sure things are done right. We are indeed fortunate to have Paul on our team.

Secondly, we were in dire need of improved equipment to maintain the plots. Through the much-appreciated efforts of Rich Shumate and Eddie Robinson of Robinson's Lawn and Golf, Inc., and Al Alsbach and Gene Meyers of Champion Turf Equipment, we were able to meet some of those needs. Thanks, guys.

Thirdly, Dr. Ron Campbell has done a tremendous service for the Kansas turfgrass industry through his plant growth regulator and herbicide research during his long tenure at K-State. He will be retiring next summer. In the University system, when a position becomes vacant, it is not automatic that it will be refilled, nor that it will encompass the same responsibilities as before. Losing PGR and herbicide work on turfgrass would create a huge gap in our research effort. Kansas State University president Jon Wefald requested a detailed strategic plan that would outline specific university programs to be enhanced or phased-out in the light of current and future budgetary restraints. It is a credit to Dr. Paul Jennings, Horticulture Department Head, and Dr. Walt Woods, Dean of the Agriculture college, that the turfgrass program received high recommendation for program improvement. Although, the final decision has yet to be made, this recommendation put the KSU turf program in strong position to compete for the anticipated position vacancy to be created upon Dr. Campbell's retirement. Thank you, gentlemen.

Stress Tolerance Research

Although the ultimate proving ground in stress tolerance research is field response, physiological research needs to be performed in the growth chamber and laboratory setting. I am happy to report that we have completed a 10-month rebuilding project of a large walk-in growth chamber and constructed a temperature-controlled hydroponic system for turfgrass physiological research. In addition, during the past year,we have acquired thousands of dollars worth of sophisticated equipment to assess turfgrass water status and stress response.

Rocky Ford Irrigation System

The goal of acquiring an automated underground irrigation at the Rocky Ford Turfgrass Research Plots is an excellent example of where inter-departmental cooperation is vital. The Horticulture Department shares land use at the Rocky Ford site with the Department of Plant Pathology. Preliminary plans are being formulated through the efforts of Dr. Jennings and Plant Pathology Department Head, Dr. Fred Schwenk, for such an irrigation system after on-site consultation with an irrigation engineer earlier this summer. If such a cooperative propoosal is accepted by the Kansas State University Agriculture Experiment Station, installation of the pump, additional main line piping and valving may begin as early as this fail.

As you can see, we've got a lot of work to do, but I hope you agree that we're on the right track. Our immediate task is to keep the pedal to the floor.

Sincerely,

Jeff

Dr. Jeff Nus
Assistant Professor
Turfgrass Research and Teaching

PERSONNEL ASSOCIATED WITH THE TURFGRASS RESEARCH PROGRAM

Larry Leuthold - Professor Horticulture, Extension Turfgrass Specialist

Jeff Nus - Assistant Professor of Horticulture, Turfgrass Research and Teaching

Paul Haupt - Supertintendent, Rocky Ford Turfgrass Research Plots

Ron Campbell - Professor of Horticulture, Herbicide Physiology

John Pair - Professor of Horticulture and Superintendent of Horticulture Research Center, Wichita

Ned Tisserat - Assistant Professor of Plant Pathology, Research Horticulture Pathologist

Pam Borden - Turfgrass PhD candidate

Kala Mahadeva - Turfgrass PhD candidate

Brian Maggard - Turfgrass student employee

Nancy Wesley - Turfgrass student employee

Kelly Thelander - Turfgrass student employee

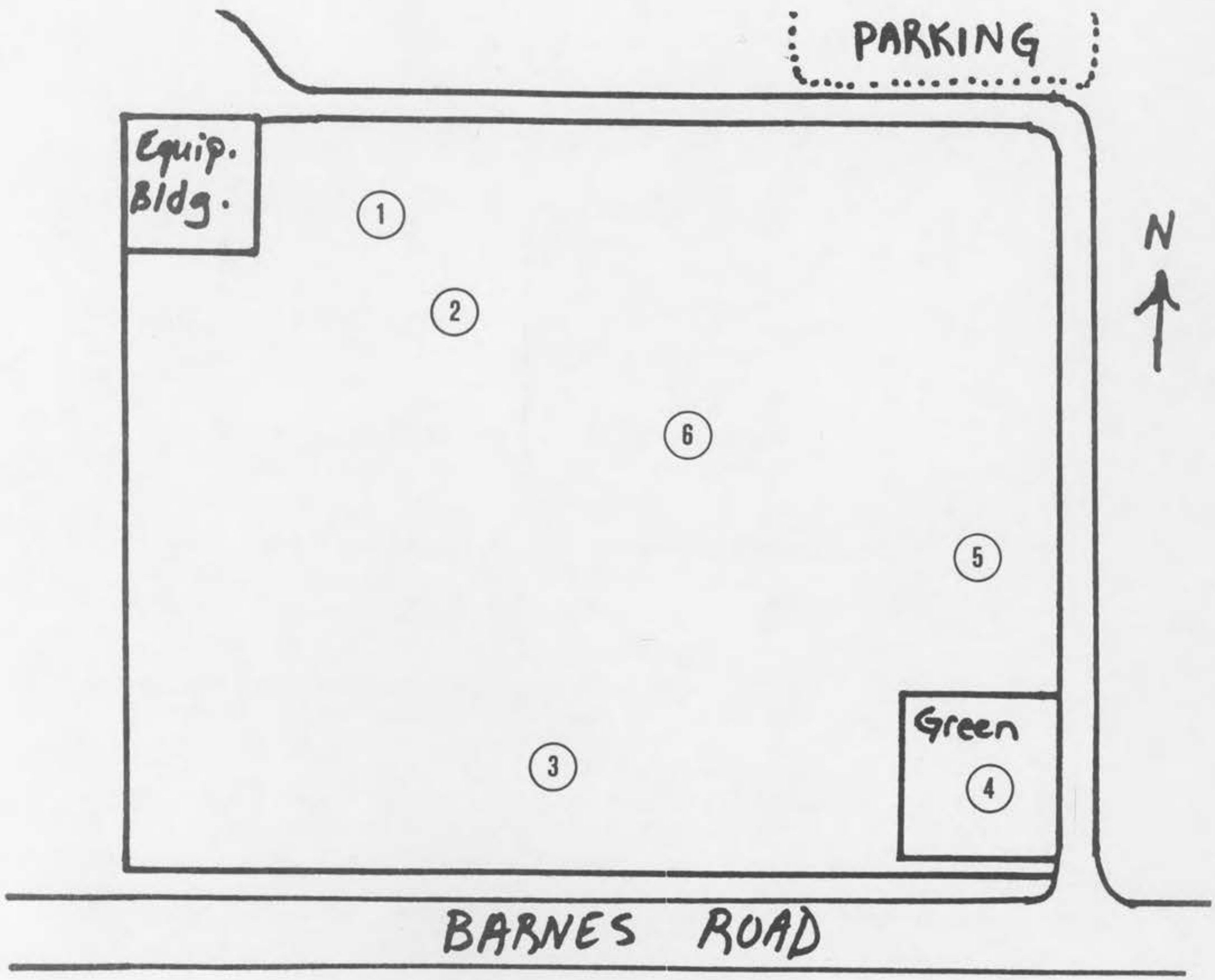
Rob Kenneson - Turfgrass student employee

Barry Harter - Turfgrass student employee

Joe McCleary - Turfgrass student employee

Wes Ory - Turfgrass student employee

Dan Walker - Turfgrass student employee



RESEARCH STOPS

1. National Bermudagrass Cultivar Trial and Winter Cover Study - Jeff Nus

2. Premergent Herbicide Study on Zoysia Establishment from Strip Sodding - Ron Campbell

3. National Perennial Ryegrass Cultivar Trial - John Pair

4. Bentgrass Studies - Paul Haupt

5. Plant Growth Retardant and Wetting Agent Effects on Water Use - Charlie Long

6. Zoysia Mowing Height and Nitrogen Study - Larry Leuthold

THANKS !!!

The following companies and organizations have contributed to the turfgrass research effort of Kansas State University and we express our sincere appreciation for their support. Without their generosity, the scope of the turfgrass research effort would be greatly curtailed.

Kansas Turfgrass Foundation

Heart of America Golf Course Superintendents Association

Kansas Golf Course Superintendents Association

Robinson's Lawn and Golf, Inc.

Cushman Manufacturing

Champion Turf Equipment

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Cranmer Nursery

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Elanco Corporation

American Hoechst

Chevron

Rhone-Poulenc

PBI Gordon

Stauffer Chemical Corporation

Dow Chemical

Diamond Shamrock

Scott's ProTurf Products

Sandoz Crop Protection

TITLE: Nitrogen Source Study

OBJECTIVE: To compare various nitrogen sources for maintaining turf quality of Kentucky bluegrass

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician

INTRODUCTION:

Depending on the release characteristics of the nitrogen source, the method of application, and irrigation practices, nitrogen use efficiency and its direct effect on turf quality can vary considerably. The choice of nitrogen fertilizers is one of the most important decisions turfgrass managers must make. To make wise decisions, information concerning nitrogen source effects on maintaining turf quality is needed.

MATERIALS AND METHODS:

This experiment was initiated in the Spring of 1987 to test various nitrogen sources for maintaining a Newport-Park-Delta Kentucky bluegrass blend. The area was planted in Fall of 1981 and received standard fertility practices. The experiment utilizes a Randomized Complete Block Design with six treatment which are replicated three times each. Nitrogen applications are applied 5 times per season at the rate of 1 lb N per 1000 sq. ft. Treatments include ureaform (Blue Chip, 38-0-0), sulfur coated urea (32-0-0), urea (45-0-0), urea plus micronutrients (Esmigran), Strengthen and Renew (AgroChem, 19-0-2), and Green Magic (AgroChem, 20-0-2). Quality parameters being recorded include monthly quality ratings, thatch accumulation at the end of the season, rooting depth, and verdure measurements.

TITLE: Influence of Growth Retardants on the Water Use Rate and Quality of of 'Sydsport' Kentucky Bluegrass

OBJECTIVE: To investigate if significant amounts of irrigation can be saved by the use of growth retardants and whether quality parameters may be affected

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician
Brian Kaiser, Turfgrass Student

INTRODUCTION:

Growth retardants for turfgrasses are materials that when applied in minute quantities greatly inhibit the vertical extension of grasses. Most of these materials are phytotoxic for a 2-4 week period following application. This phytotoxicity is characterized by a browning or "burning' of the leaves. In addition, sward density may be reduced.

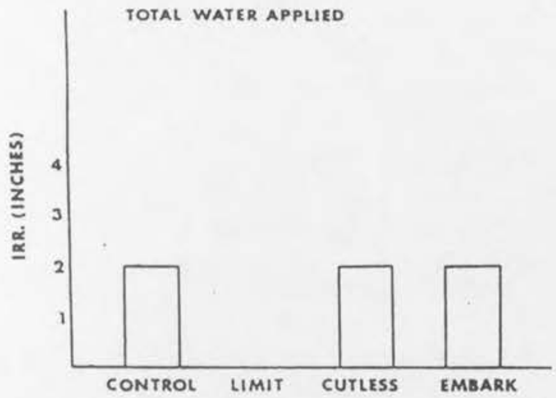
Because growth is a water demanding process, these materials by retarding the growth process represent a potential means by which significant amounts of irrigation might be saved. Reduced water use rates of turfgrasses would result in less soil water depletion during periods of prolonged water stress. This may lead to an increase in drought resistance of treated turfgrasses. This study was initiated to investigate if such savings of irrigation could be realized by the use of growth retardants and how these chemicals may affect quality and density of Kentucky bluegrass turf.

MATERIALS AND METHODS:

'Sydsport' Kentucky bluegrass was established in the fall of 1982 on Section B of the Toro Research Irrigation System at the Rocky Ford Turfgrass Research Plots. This section consists of twelve 15 X 15 ft plots. Each plot can be irrigated independently from the rest. Label rates of Limit, Embark, and Cutless were applied to three replications on May 18 and compared to non-treated control plots. Plots were retreated using the same randomization after an eight week period. Plots were irrigated when soil matric potentials indicated 60 centibars from Irrometer tensiometers placed at a 4 inch depth. Overall irrigation requirement, quality, sward density, and clipping yields were recorded for each treatment.

1986 RESULTS

1986 was a wet year for Kansas. Consequently, little supplemental irrigation was needed (Figure 1) although the Limit treated plots required the least. All PGR treatments significantly reduced clippings yield compared to the untreated control (Figure 2) throughout the 14-week clipping harvest period. Quality of the 'Sydsport' was reduced by each of the PGR treatments, however Limit decreased turf quality less than Cutless or Embark (Figure 3). Figure 4 shows although there was a general color enhancement by PGR treatments early in the treatment period, these color differences were lost as the treatment period progressed. Figures 5 and 6 shows the loss of turf density and increase in weed encroachment, repectively, of PGR-treated turfs. This is perhaps the major drawback of growth retardants, and should be a major consideration for turf managers who choose to use these chemicals.



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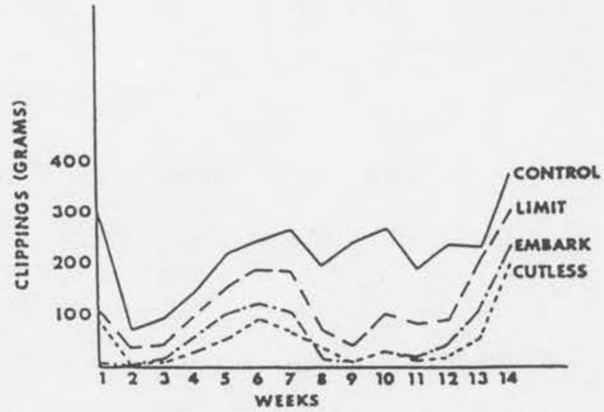

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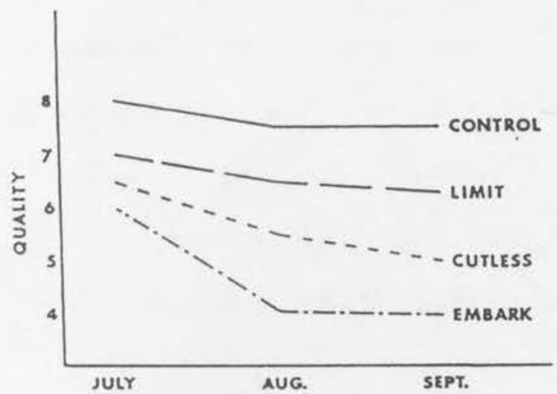

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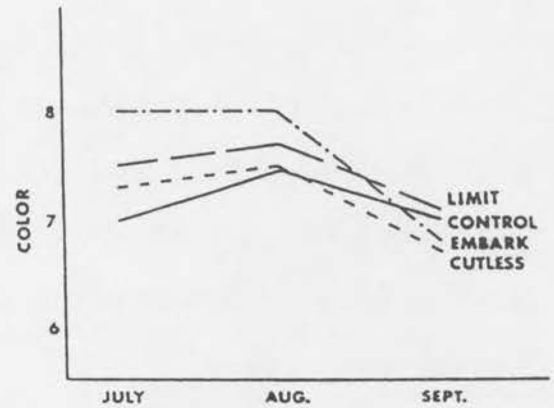

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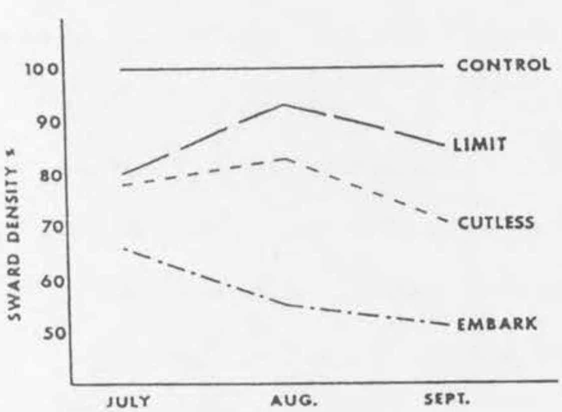

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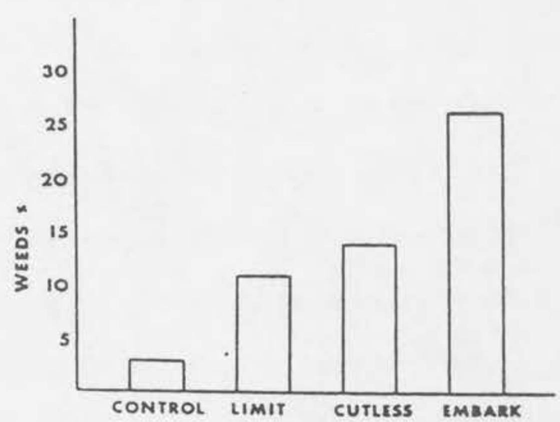


Figure 6.

TITLE: National Kentucky Bluegrass Cultivar Trial

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician
Kala Mahadeva, Turfgrass PhD Candidate

OBJECTIVE: To evaluate 72 Kentucky bluegrass commercial and experimental genotypes for their adaptability under Kansas conditions.

INTRODUCTION:

Kentucky bluegrass is one of the most widely used turfgrass species in the United States. It forms a dense, high quality sward of rich green color. Under Kansas conditions, however, it often does not perform well during mid-summer because it lacks a high degree of heat and drought tolerance. This trial was initiated to test 72 Kentucky bluegrass genotypes from the National Turfgrass Evaluation Program for their adaptability to Kansas conditions.

MATERIALS AND METHODS:

Seventy-two Kentucky bluegrass cultivars were planted in Section II of the Rocky Ford Turfgrass Research Plots during the first week of March, 1986. The planting utilized a completely randomized block design with 72 cultivars replicated three times each into individual 1 X 2 meter plots. A complete (20-20-20) fertilizer was applied immediately after seeding at 1 lb N per 1000 sq. ft. Plots received 4 lbs of nitrogen per 1000 square feet per season and irrigated to prevent severe water stress. Data collected included a subjective monthly quality rating (1-9).

TABLE 1. National Kentucky bluegrass cultivar trial quality ratings (1-9) at Rocky Ford Turfgrass Research Plots.

	Cultivar	July	August	September	October	November	Overall
1.	Classic	5.3	6.2	4.7	5.3	7.2	5.7
2.	Monopoly	5.2	6.7	4.0	4.8	6.0	5.3
3.	Barzan	4.5	6.0	3.8	4.2	4.2	4.5
4.	Gnome	4.3	5.8	4.0	3.0	5.2	4.5
5.	Tendos	6.0	6.2	5.2	5.2	6.0	5.7
6.	P-104	4.8	6.0	4.5	3.7	5.2	4.8
7.	Ram I	5.2	6.5	4.8	3.8	6.8	5.4
8.	Compact	5.7	6.8	5.8	6.2	7.0	6.3
9.	Joy	6.2	7.0	5.0	5.8	7.3	6.3
10.	Sydsport	5.0	5.7	4.3	4.5	6.0	5.1
11.	Haga	6.2	6.7	6.0	6.3	8.0	6.6
12.	Georgetown	5.5	6.7	5.7	7.0	8.2	6.6
13.	Somerset	4.5	5.7	5.3	6.0	5.5	5.4
14.	Mystic	6.5	6.8	4.5	4.5	5.7	5.6
15.	Baron	5.2	6.3	4.0	4.2	5.0	4.9
16.	Able I	5.8	6.0	5.2	6.3	6.8	6.0
17.	A-34	6.0	6.7	4.5	6.2	7.3	6.1
18.	Merit	4.0	5.7	3.2	2.5	4.7	4.0
19.	BAR VB 577	4.8	6.2	4.2	5.0	6.3	5.3
20.	Annika	5.3	5.8	3.8	4.3	5.8	5.0
21.	Conni	5.2	6.2	5.5	4.3	5.7	5.4
22.	Kenblue	6.7	7.2	4.3	6.7	6.7	6.3
23.	Bristol	5.0	6.5	3.8	4.7	5.8	5.2
24.	Victa	5.5	6.5	4.2	4.0	4.3	4.9
25.	Ba 70-139	5.5	6.3	2.8	2.8	4.7	4.4
26.	Ba 70-242	4.3	5.8	3.3	3.8	5.5	4.6
27.	Ba 72-441	4.7	6.3	2.7	2.8	5.0	4.3
28.	Ba 72-492	4.8	6.2	3.7	4.7	5.3	4.9
29.	Ba 72-500	4.5	5.8	3.8	3.5	5.3	4.6
30.	Ba 73-626	4.8	5.8	3.5	3.7	4.8	4.5
31.	BAR VB 534	5.8	6.5	5.3	6.0	6.8	6.1
32.	Cynthia	5.7	6.3	4.3	5.2	6.5	5.6
33.		--	--	--	--	--	--
34.	America	5.7	7.0	4.3	4.7	7.0	5.7
35.	Ba 69-82	5.0	5.8	3.2	2.8	5.0	4.4
36.	Ba 73-540	4.8	5.5	3.8	3.7	6.0	4.8
37.	Parade	5.3	6.5	4.8	4.3	7.7	5.7
38.	Asset	5.3	6.8	4.5	5.0	6.2	5.6
39.	HV 97	5.0	6.5	4.0	4.5	5.8	5.2
40.	Lofts 1757	5.7	6.8	4.5	4.8	6.2	5.6
41.	Cheri	4.7	6.2	3.0	3.3	5.2	4.5
42.	Eclipse	4.5	6.2	3.5	3.7	5.0	4.6
43.	Liberty	4.5	4.7	3.5	4.0	6.0	4.5
44.		--	--	--	--	--	--
45.	Dawn	4.5	6.3	4.2	4.8	5.7	5.1
46.	Merion	5.5	6.7	3.7	4.0	6.2	5.2
47.	Nassau	4.5	6.2	4.5	4.8	5.8	5.2

	Cultivar	July	August	September	October	November	Overall
48.	Amazon	4.7	7.0	4.5	4.3	5.8	5.3
49.	239	5.5	6.5	5.5	6.7	7.5	6.3
50.	Wabash	5.7	6.8	5.2	5.7	7.2	6.1
51.	Julia	5.5	6.2	3.8	4.3	6.2	5.2
52.	Ikone	5.8	6.3	4.5	4.0	5.2	5.2
53.	Glade	5.7	7.0	5.5	6.0	6.2	6.1
54.	Huntsville	5.2	7.0	6.2	6.8	5.5	6.1
55.		--	--	--	--	--	--
56.	Aguilla	5.5	6.5	4.8	6.3	6.8	6.0
57.	K1-152	5.6	6.2	4.5	4.3	6.7	5.5
58.	Harmony	5.5	6.5	3.7	4.2	5.7	5.1
59.	Welcome	6.8	6.7	4.2	4.0	6.0	5.5
60.	Aspen	5.3	6.3	3.8	5.2	6.7	5.5
61.	Rugby	5.8	6.8	4.3	5.0	6.2	5.6
62.	Trenton	5.5	6.3	4.8	5.3	7.0	5.8
63.	K3-178	5.3	6.2	4.3	5.7	7.0	5.7
64.	Midnight	6.0	7.2	4.8	3.8	5.0	5.4
65.	Challenger	4.3	5.7	3.2	3.0	5.5	4.3
66.	Blacksburg	5.8	6.8	4.8	4.5	6.0	5.6
67.	PST-CB1	5.7	6.3	5.5	6.0	7.5	6.2
68.	S.D. Cert.	5.7	6.7	5.5	6.8	7.7	6.5
69.	WW Ag 468	5.3	5.5	4.5	3.5	5.0	4.8
70.	WW Ag 491	5.7	6.2	5.0	6.5	6.0	5.9
71.	WW Ag 495	6.0	6.8	4.2	4.2	5.2	5.3
72.	WW Ag 496	5.3	6.0	3.2	3.7	4.8	4.6
		5.1	6.1	4.2	4.5	5.7	5.1

1986 RESULTS:

The 1986 growing season was a hard one for the Kentucky bluegrasses at Rocky Ford. They were Spring-planted so they were not well established before the hot weather set in. Somewhat surprising, some of the common types did better than expected.

It would not be accurate to say any of the Kentucky bluegrasses did well, but some cultivars that did not do as badly included Compact, Joy, Haga, Georgetown, BAR VB 534, 239, Glade, and even S.D. Certified. Poorer performing bluegrasses included BA 70-139, Liberty, BA 69-82, and Merit. It will be interesting to see if these results stand up as we go through the 1987 growing season.

TITLE: Effect of Various Rates of Potassium on Growth Response of Hydroponically-Grown 'Sydsport' Kentucky Bluegrass

OBJECTIVE: To establish growth responses of vegetatively-propagated 'Sydsport' Kentucky bluegrass at various rates of potassium in aerated nutrient solution in controlled environments

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician
Wally Backman, Turfgrass Student

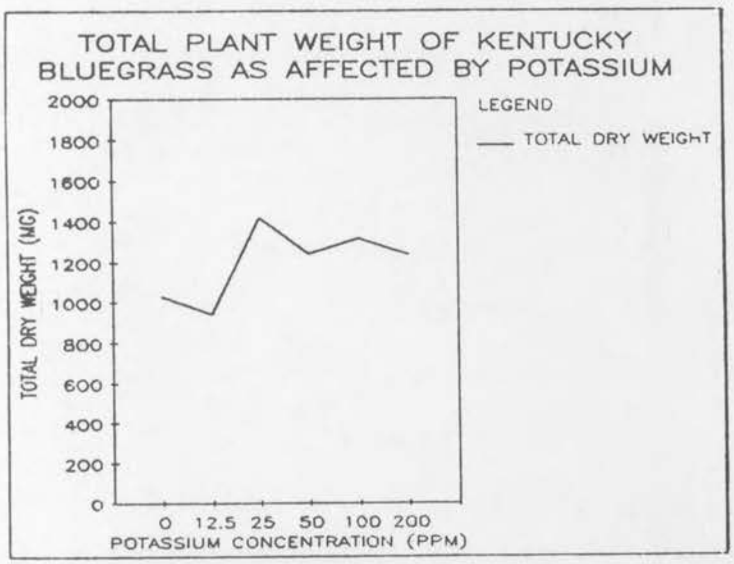
INTRODUCTION:

Many claims have been made concerning the use of potassium on turfgrass to enhance stress resistance. These claims include enhancement of wear, drought, disease, and freezing resistance. Data supporting these claims, however, has been based largely on field response where environmental conditions are not controlled. In an effort to substantiate these claims, it is necessary to explore turf response in a controlled environment. This experiment was designed to quantify growth responses to variable rates of potassium when genetically identical plants are grown in a temperature controlled, aerated hydroponic system.

RESULTS:

Vegetatively-propagated 'Sydsport' Kentucky bluegrass was grown hydroponically for 4 weeks in aerated nutrient solution containing 0, 3, 6, 12, 25, 50, 100, and 200 ppm potassium. Both root and shoot temperatures were controlled. Shoots were evaluated at 0, 1, 2, 3, and 4 weeks for leaf dry weight, root dry weight, total dry weight per shoot. Root-shoot ratios were calculated for each treatment.

Figure 1 shows that there was a generaly increase in total plant weight with increasing potassium concentration, but the effect is not dramatic. Similar observations were made for leaf growth (Figure 2). The effects of increasing potassium concentration on root growth is less clear (Figure 3). Major concern, however, should be focussed on Figure 4 where root-shoot ratios decreased with increasing potassium. If increased potassium rates do indeed increase drought resistance, the opposite effect should be expected. It should be emphasized that these results are prelimary and the experiment will be repeated at least two more times.



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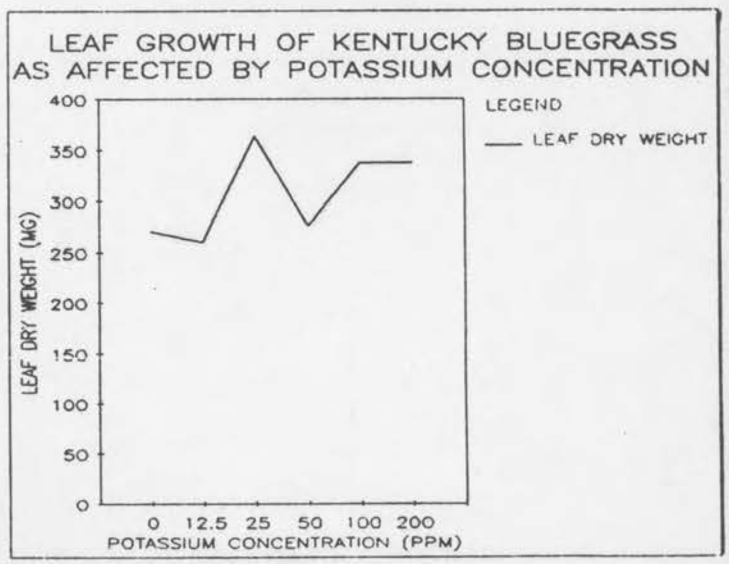

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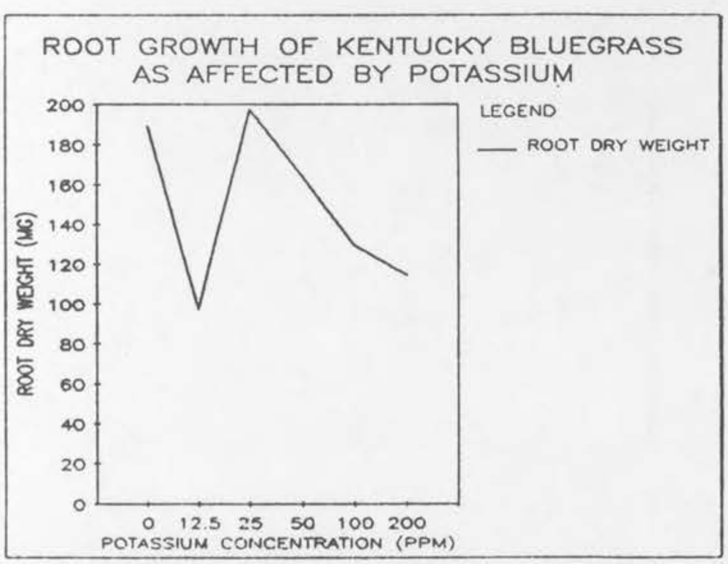

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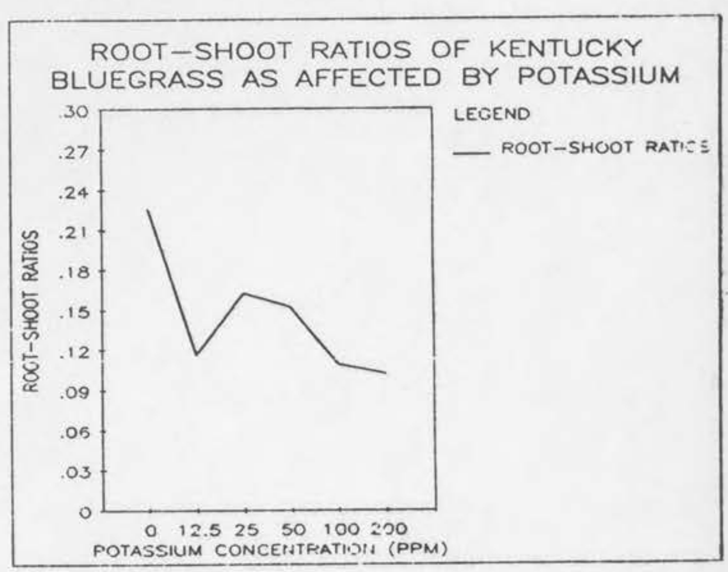


Figure 4.

TITLE: Bov-A-Mura Bluegrass Study

OBJECTIVE: To investigate the efficacy of Bov-A-Mura in promoting thatch decomposition and vegetative growth.

PERSONNEL: Ron Campbell, Turfgrass Research

FUNDING: PBI GORDON CORPORATION

INTRODUCTION:

Recently there has been increased attention to the use of chemical materials that activate microorganisms in turfgrass soils. Effects of special interest to turfgrass managers are thatch decomposition, increased tillering and promotion of deep-root development. This experiment was initiated to test whether the addition of Bov-A-Mura will enhance the quality of bluegrass plots maintained at the Rocky Ford Turfgrass plots and at the Wamego Country Club.

MATERIALS AND METHODS:

A compressed air plot sprayer equipped with a four-foot spray boom was used to treat 4 x 8 foot plots at rates of 0, 16, and 128 fluid oz. of Bov-A-Mura per 1000 square feet per application. Three applications per year were made, on April 3, July 17 and October 16. The plots reeceived 4 pounds N/1000/year. All plots were mowed at 2 inches through May 15, at 3 inches from May 16 to September 15 and at 2 inches for the remainder of the year. Clippings were not picked up.

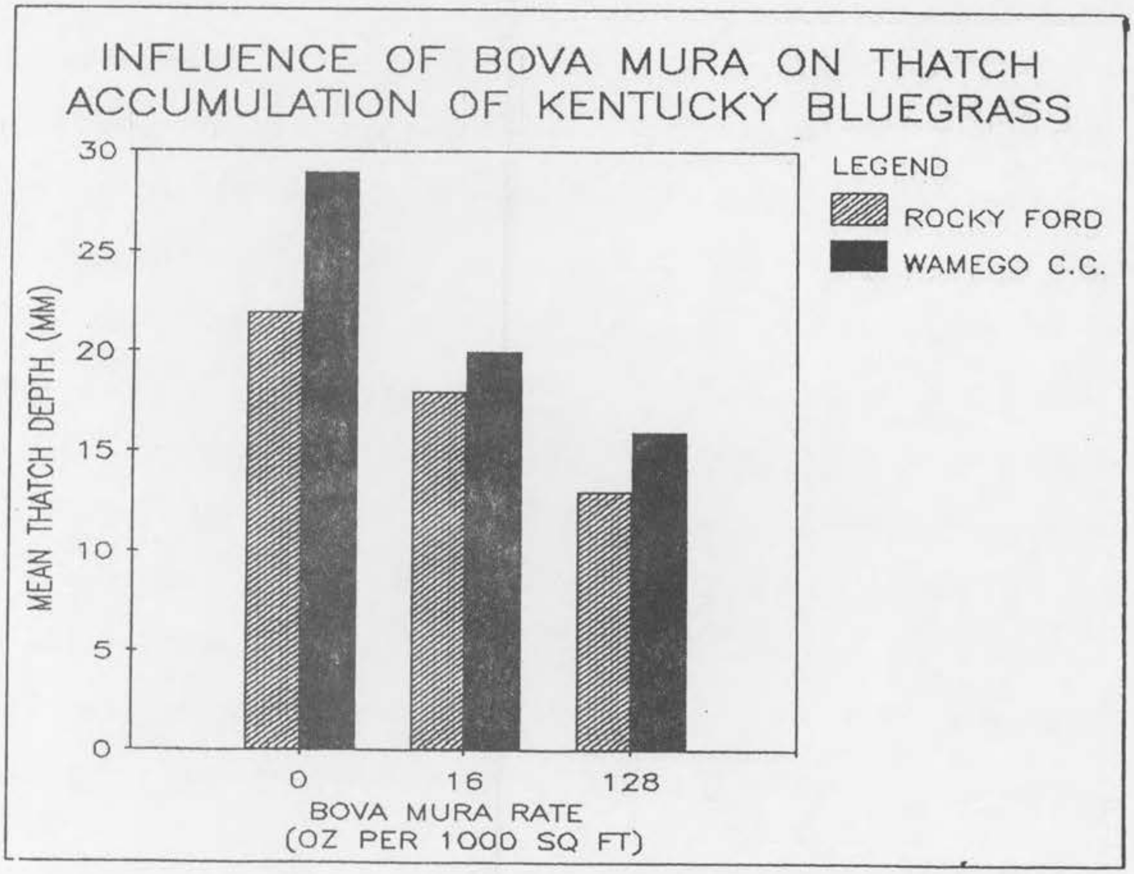
At the end of the growing season 4 soil cores were taken from each plot and visual observations were made on the depth of roots and thatch layer. The soil from the 4 soil core per plot were combined in a sterile water solution. A serial dilution of the solution was prepared as necessary and each dilution from each plot was ploted on two petri plates each with the proper agar media for fungi, bacteria and actinomycetes per plot. After incubation the colonies of either bacteria, fungi or actinomycetes per square centimeter were counted and averaged.

RESULTS AND DISCUSSION:

Bov-A-Mura treatments were effective in reducing the depth of thatch regardless of rate of application (Figure 1). The highest rate reduced thatch significantly compared to the lower rate. Also at both sites the Bov-A-Mura treatments also significantly increased the depth of root penetration. It is likely that in addition to promoting thatch composition and deep-rooted development that the treatments increased and water penetration and retention.

The microorganism counts were highly variable with no discernable pattern suggesting that proper soil dilutions were not used.

The study is being repeated in 1987 using the same treatments and plots. The microorganism determinations will be standarized and repeated.



TITLE: Comparison of Preemergence Control of Weeds From Fall and Spring Applications to Bluegrass

OBJECTIVE: Compare the efficacy of fall and spring applictions of selected new and experimental preemergence herbicides.

PERSONNEL: Ron Campbell, Turfgrass Research

FUNDING: Commercial Grants

INTRODUCTION:

Most weed species are prolific seed producers, especially the annuals. To be effective, preemergent herbicides must be applied to the soil surface before weed seeds germinate and emerge. Control is obtained either through root uptake or through absorption by the first leaf or shoot. In addition to proper timing success in preemergence weed control is also dependent upon uniformity of application. Preemergence herbicides may be equally effective applied either as sprayable or as granular formulations when uniformity applied at the proper rate and time. Labels of most commercial products suggest rainfall or overhead irrigation of one-half inch shortly after application to move the herbicide from the foliage to the soil surface. Although most preemergence herbicides are applied to turfgrass stands primarily to control annual grasses several annual broadleaf weeds such as spurges, pigweed, lambsquarter and henbit may be controlled also.

This experiment was initiated to compare the efficacy of preemergent labelled and experimental herbicides each applied in the fall of 1986 and the spring of 1987 in the control of annual weeds.

MATERIALS AND METHODS:

A compressed air field plot sprayer with a four-foot spray boom was used to treat 4x8 foot plots. Six herbicides were applied in the study (Table 1). Prodiamine was applied at 0.38, 0.5, 0.75, 1.0, 1.5 and 2.0 lbs/a.i. The granular form of Benefin was applied and all other herbicides were applied as sprayable formulations. Treatments were applied at two times. The fall treatments were applied November 6, 1986 and the spring treatments April 2, 1987. The tests for each chemical were established side-by-side to evaluate the spring vs. fall applications. Weed counts and phytotoxicity readings will be made at regular intervals through mid-summer.

Table 1. Preemergence Herbicides Applied To Compare Effectiveness of Fall and Spring Treatments.

Product name and formulation	Common name and formulation	Manufacturer
Balan 2.5 G	Benefin	Elanco
Betasan 4-E	Bensulide	Stauffer
Dacthal 75-W	DCPA	Diamond Shamrock
Weedgrass Control 60 WDG	Pendimethalin	O.M. Scott & Sons
- 65 WDG	Prodiamine	Sandoz Crop Protection
Ronstar 50 WP	Oxadiazon	Rhone-Poulenc

A major concern relative to the efficacy of preemergent herbicides is that of residual activity in the soil. A number of factors influence the disappearance or degradation in the soil. These include volatilization, degradation by ultraviolet light, microbial decomposition, and chemical decomposition. The relative importance of each of these factors is influenced by soil type, moisture content, temperature, light intensity, microflora, and method of application. In general, it is expected that the degradation processes describe would occur at a much lower rate than during the growing season. We are hoping to ascertain if fall preemergence herbicides is a viable option for Kansas turfgrass managers.

TITLE: Clearys Fungicide and Nitrogen Study

OBJECTIVE: To test various combinations of fungicides for their effectiveness to control dollar spot, brown pathch, and Pythium on creeping bentgrass and to test whether the addition of supplemental nitrogen nutrition during the disease susceptible summer months will affect the incidence and/or recovery compared to untreated turf.

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Brian Kaiser, Turfgrass Student

FUNDING: Clearys Corporation

INTRODUCTION:

A large portion of the golf course superintendent's supply budget is spent on fungicides for disease prevention on putting greens and tees. It is important to get broad spectrum disease control at a cost within budget. The most serious putting green diseases in Kansas are dollar spot, brown patch, and Pythium, and can be expected to occur annually during the hot summer months.

The amount of nitrogen fertilizer applied to putting greens is often slightly reduced during the summer months in an effort to instill greater drought and heat tolerance to creeping bentgrass. Putting greens with less nitrogen nutrition, however, are often slow to recover from disease damage. This study was initiated to test various fungicide combinations on the incidence of the three most common diseases on putting greens in Kansas and to see if the addition of a supplemental slow-release nitrogen fertilizer would affect the incidence and/or recovery rate of diseased turf.

MATERIALS AND METHODS

Several fungicide combinations were applied to 2 by 3 meter plots of 'Penncross' creeping bentgrass at 10-day intervals starting on June 1, 1986. In addition, flowable ureaform was added as a supplemental nitrogen source to the standard nitrogen fertility program utilizing urea to all but one of the treatments. The standard and supplemental nitrogen treatments, as well as the fungicide treatments are as follows:

Stardard N Fertility From Urea	Supplemental N Fertility From Flowable Ureaform
0.75 lb N April	0.4 lb N May
0.5 lb N May	0.4 lb N June
0.5 lb N June	0.4 lb N July
0.5 lb N July	0.4 lb N August
0.75 lb N August	
0.75 lb N September	
0.75 lb N October	

Treatments

1. Standard nitrogen fertility only. No supplemental nitrogen. No fungicides applied.
2. Standard nitrogen fertility plus supplemental nitrogen as FLUF (flowable ureaform). No fungicides applied.
3. Standard nitrogen fertility plus supplemental nitrogen as FLUF. Spotrete at 3.75 oz per 1000 square feet at 10-day intervals.
4. Standard nitrogen fertlity plus supplemental nitrogen as FLUF. Spotrete at 3.0 oz and 3336 at 1 oz per 1000 square feet at 10-day intervals.
5. Standard nitrogen fertlity plus supplemtnal nitrogen as FLUF. 3336 at 2 oz per 1000 square feet at 10-day intervals.

6. Standard nitrogen fertility plus supplemental nitrogen as FLUF. Caddy at 1 oz, Spotret e at 3 oz, and 3336 at 1 oz per 1000 square feet at 10-day intervals.

The experiment utilized a randomized complete block design with 6 treatments and 5 replications. Data to be collected include monthly quality ratings and disease ratings upon occurrence.

1986 RESULTS

QUALITY

1. Visual differences in putting green quality did not show up between treatments until mid-summer (Figure 1).

2. Substantial increases in putting green quality from the the application of supplemental nitrogen (flowable ureaform) were attained only if combined with fungicidal treatments (treatments 3, 4, 5, and 6 versus treatment 2, Figure 1).

3. The application of Spotrete at 3.75 oz per 1000 square feet applied at 10-day intervals substantially improved turf quality compared to standard plus supplemental nitrogen fertility treatments without fungicidal treatments (treatment 3 versus treatment 2, Figure 2). This fungicidal treatment was not as effective as the fungicide applications described in treatments 4, 5, and 6 (Figures 1 and 2), however.

4. The addition of supplemental nitrogen as flowable ureaform without applying fungicides did not improve turf quality compared to the standard nitrogen fertility treatment without fungicides (treatment 1 versus treatment 2, Figures 1 and 2).

5. Best quality bentgrass was attained with programs using supplemental nitrogen fertility as flowable ureaform in additional to standard nitrogen fertility supplied by urea with any of the following fungicidal programs:
   a. Spotrete at 3.0 oz and 3336 at 1 oz per 1000 square feet applied at 10-day intervals (treatment 4, Figures 1 and 2)
   b. 3336 at 2.0 oz per 1000 square feet applied at 10-day intervals (treatment 5, Figures 1 and 2).
   c. Spotrete at 3 oz, 3336 at 1 oz, and Caddy at 1 oz per 1000 square feet applied at 10-day intervals (treatment 6, Figures 1 and 2).

DOLLAR SPOT INCIDENCE

The first incidence of dollar spot on creeping bentgrass at the Rocky Ford Turfgrass Research Plots became evident in early July. Dollar spot incidence was evaluated on six dates during the 1986 growing season and a seasonal average of the percent plot area affected was calculated for each treatment. Dollar spot was larely confined to plots receiving no fungicidal control and affected areas increased rapidly during the latter part of the season (Table 1).

The addition of supplemental nitrogen as FLUF to the standard urea nitrogen treatment had little effect on the incidence of dollar spot observed (treatment 1 versus treatment 2, Figure 3). A fungicidal treatment of Spotrete at 3.75 oz per 1000 square feet applied at 10-day intervals greatly reduced dollar spot incidence, but was not as effective as the fungicide treatments described in treatments 4, 5, and 6. Fungicidal applications described in these treatments were all very effective in eliminating dollar spot during the 1986 northeast Kansas growing season (Table 1 and Figure 3).

Brown Patch Incidence

Very little brown patch occurred at the Rocky Ford Turfgrass Research Plots during 1986 (Table 2 and Figure 4). When it did occur, however, the addition of supplemental nitrogen from FLUF increased the area of the plots that was affected (treatment 1 versus treatement 2, Table 2 and Figure 4). All treatments receiving fungicides exhibited very little brown patch and were all judged to be effective programs for the control of brown patch on creeping bentgrass under conditions of the 1986 northeast Kansas growing season.

Pythium Incidence

No Pythium was observed on any of the plot area during the 1986 growing season.

Program Costs

Figure 5 shows the cost per fungicide application calculated from suggested retail prices. The use of Spotrete alone (treatment 3) exhibited good brown patch control, but lacked the degree of dollar spot control shown by the fungicide combinations in treatments 4, 5, and 6. The cost of program 3, however, is less than half the latter treatments. The turf manager must decide whether the additional dollar spot control (Figure 3) and better turf quality (Figures 1 and 2) are worth the extra cost of these programs.

Figure 1

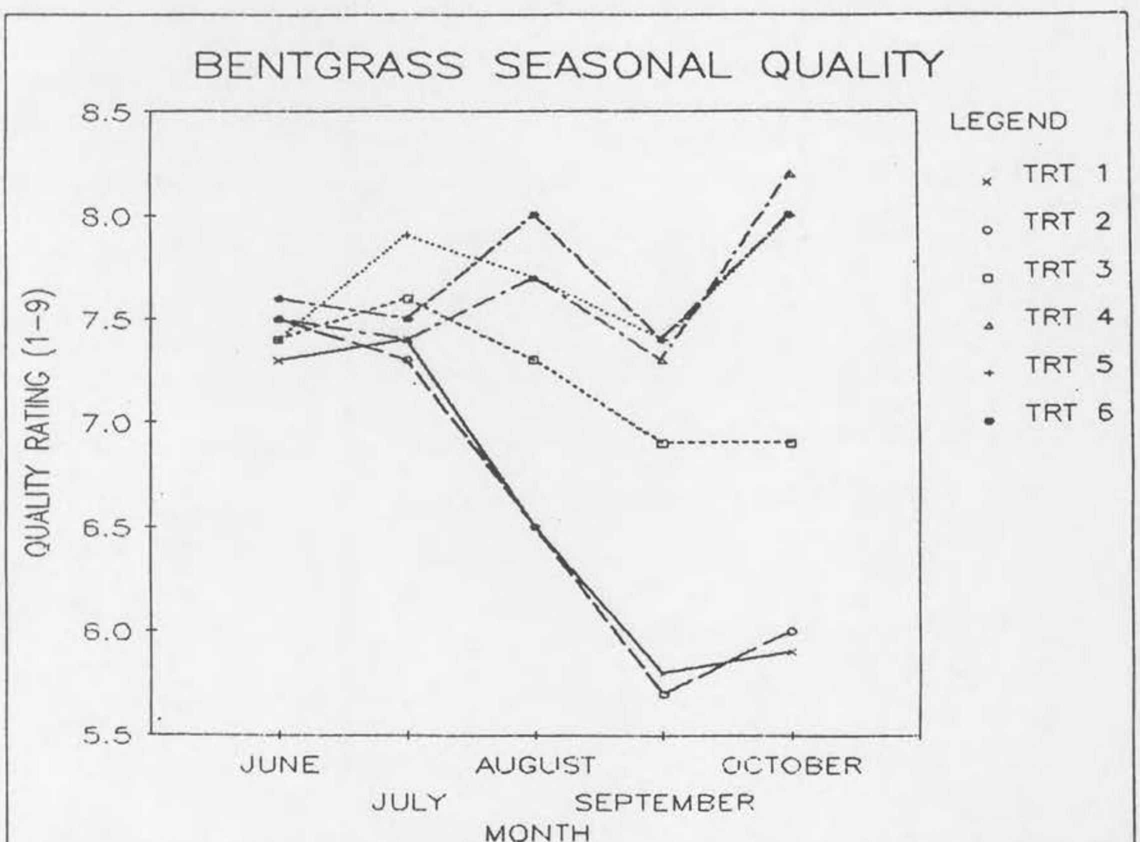


Figure 2

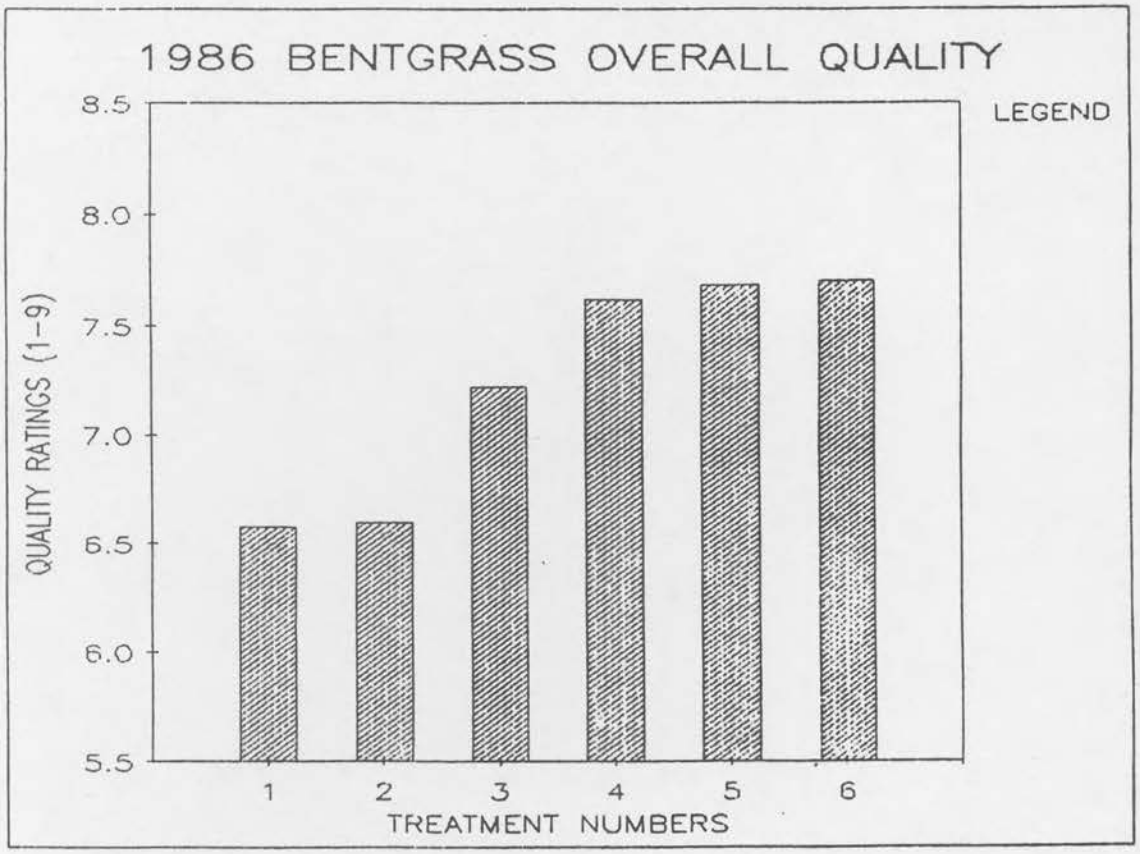


Figure 3

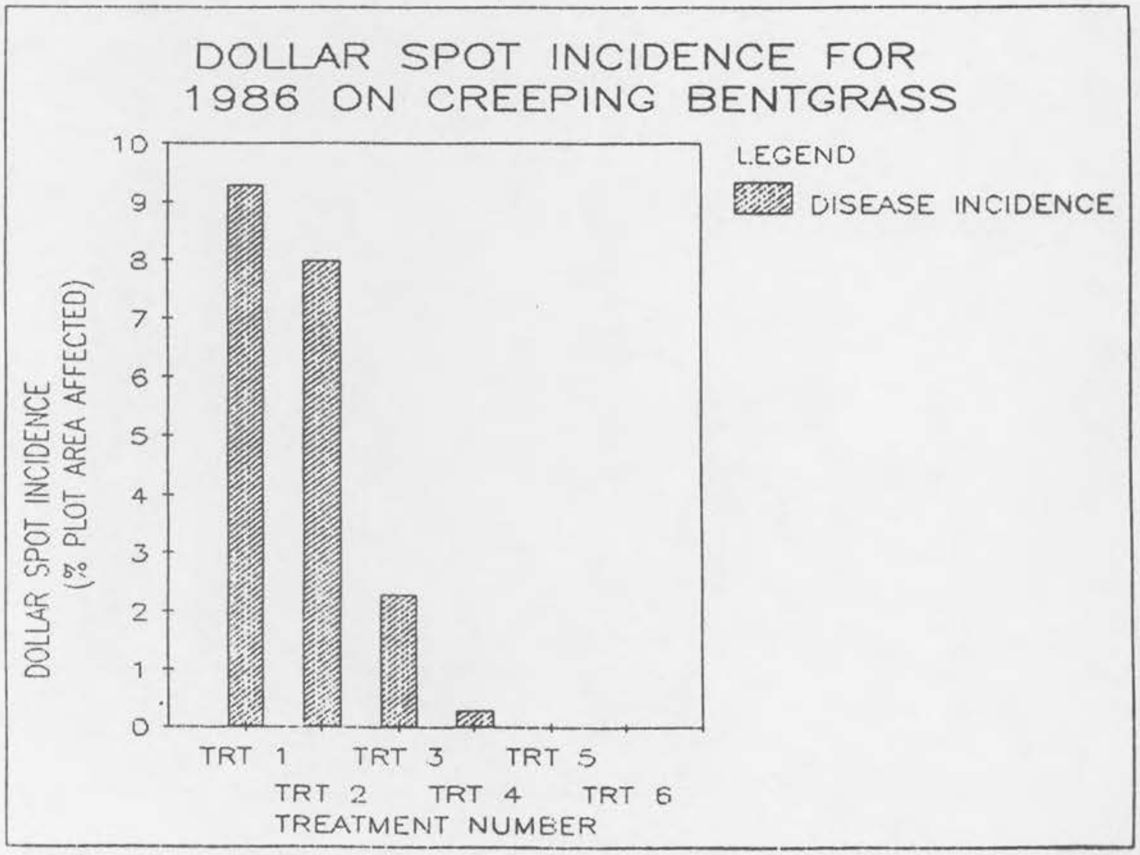


Figure 4

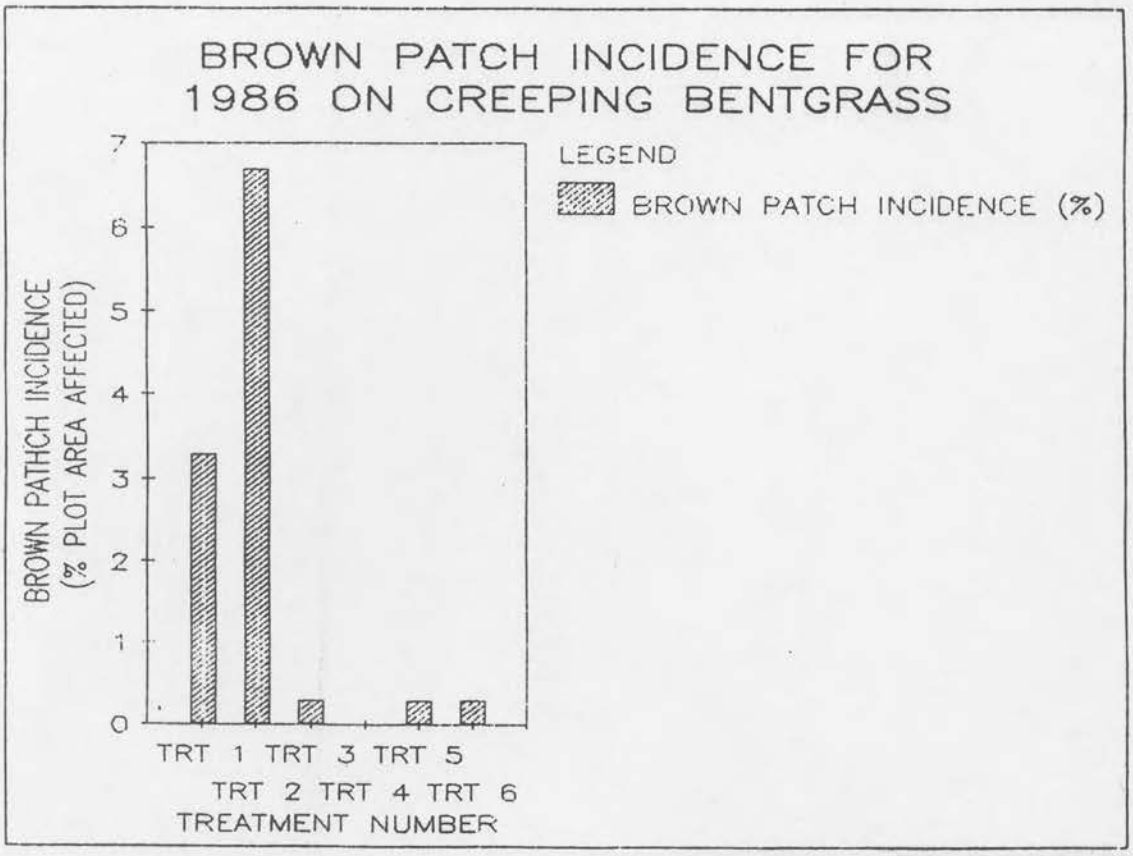
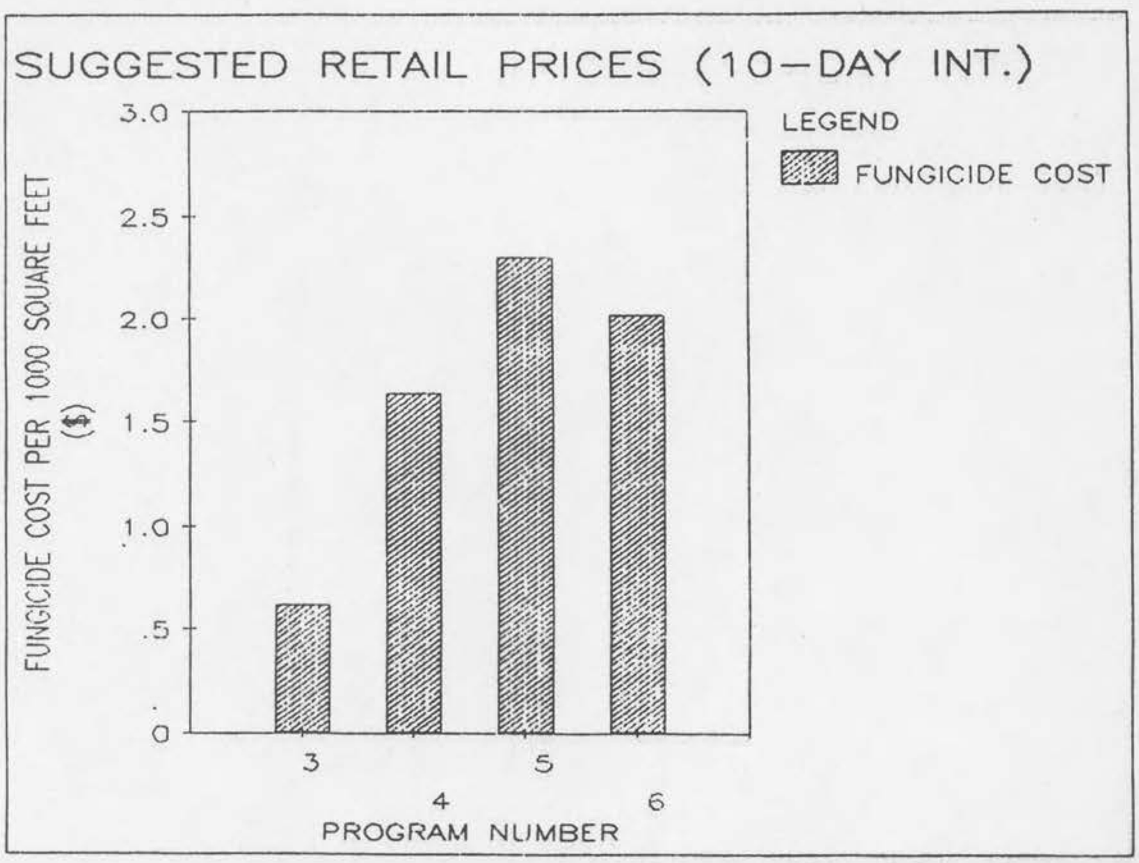


Figure 5



TITLE: Sulfur fertilization of 'Penncross' Creeping Bentgrass

OBJECTIVE: To test whether increasing rates of sulfur fertilization may enhance the quality of 'Penncross' creeping bengrass.

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician

FUNDING: Clearys Corporation, John Griffiths, Tech Rep

INTRODUCTION:

According to some researchers, serious sulfur deficiencies may occur in turf areas that are receiving high levels of nitrogen. Sulfur is important in many plant reactions including synthesis of certain vitamins, amino acids, and enzymes. Claimed benefits by the use of sulfur include better color, quality, reduced disease incidence, and annual bluegrass invasion. This experiment was designed to test whether the use of increasing rates of sulfur could effectively enhance the quality of 'Penncross' creeping bentgrass.

MATERIALS AND METHODS:

The experiment was initiated in the spring of 1986 on a three-year-old stand of 'Penncross' creeping bentgrass at the Rocky Ford Turfgrass Research Plots. No sulfur treatments were applied to this area before the experiment began. The experiment utilized a Randomized Complete Block Design with 5 treatments which were replicated 4 times each. Each plot was 1 X 2 meters. Flowable sulfur was applied at rates of 0.25, 0.5, 1.0, and 2.0 lbs of actual sulfur per 1000 square feet per application. Two applications are being applied per year in April and September with an R & D carbon dioxide backpack plot sprayer. Data being collected includes monthly quality ratings (1-9).

Table 1. 1986 'Penncross' creeping bentgrass quality as affected by application of sulfur.

Rate (per 1000 sq. ft.)	Average Quality Rating				
	July	Aug.	Sept.	Oct.	Overall
1. Control	7.8	7.1	7.5	7.6	7.5
2. 0.5 lb. per year	7.9	7.0	7.3	7.8	7.5
3. 1.0 lb. per year	8.0	7.1	7.4	7.8	7.6
4. 2.0 lbs. per year	8.0	7.1	7.5	7.9	7.6
5. 4.0 lbs. per year	8.0	7.4	7.3	7.9	7.6
	n.s.	n.s.	n.s.	n.s.	n.s.

1986 RESULTS:

Just as in the case of the iron study, the first year data from the sulfur study showed no significant differences in turf quality of 'Penncross' creeping bentgrass with the application of higher rates of sulfur. This study is being carried through 1987, however, and second year results will be looked at closely.

TITLE: Iron Fertilization of Bentgrass

OBJECTIVE: To investigate the efficacy of iron fertilization on 'Penncross' creeping bentgrass.

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician

INTRODUCTION:

In recent years, the use of iron to fertilize putting greens has received increased attention. Asd less nitrogen is used in an effort to deepen root systems and reduce the susceptibility of creeping bentgrass to certain diseases, a general loss of color is exhibited. The addition of iron has been shown to enhance color of turfgrasses in some instances, especially at very low nitrogen levels. This experiment was initiated to test whether the addition of chelated iron will enhance the quality of 'Penncross' creeping bentgrass.

MATERIALS AND METHODS:

An R & D carbon dioxide plot sprayer was used to treat 1 X 2 meter plots with a 10% iron chelate (Sequestrene 330) at rates of 0.5, 1, 2, 4, 6, and 8 oz of Sequestrene per 1000 square feet per application. A non-treated control was also included. Four application per year are being applied amounting to 0, 2, 4, 8, 16, 24, and 32 oz of Sequestrene per 1000 square feet per season. The experiment utilized a randomized complete block design with 7 treatments which were replicated 4 times each. Monthly quality ratings (1-9) are being recorded for each treatment.

Table 1. 1986 'Penncross' creeping bentgrass quality as affected by application of chelated iron (Sequestrene 330).

Rate (per 1000 sq. ft.)	Average Quality Rating				
	July	Aug.	Sept.	Oct.	Overall
1. Control	8.0	7.3	7.0	7.6	7.5
2. 2 oz. per year	7.9	7.4	7.3	7.6	7.5
3. 4 oz. per year	7.8	7.1	7.4	7.5	7.4
4. 8 oz. per year	7.9	7.4	7.4	7.8	7.6
5. 16 oz. per year	7.6	7.0	7.3	7.6	7.4
6. 24 oz. per year	7.8	7.3	7.3	7.8	7.5
7. 32 oz. per year	7.6	7.3	7.4	7.9	7.5
	n.s.	n.s.	n.s.	n.s.	n.s.

1986 RESULTS:

As shown in Table 1, there were no discernable differences in quality in any of the iron treatments during the 1986 season. Perhaps, differences will show up during the 1987 season, but prelimary results suggest the use of iron on bentgrass may have a limited effect on turf quality.

TITLE: Effect of Mowing Height and Potassium Fertilization on Quality Parameters of 'Penncross' Creeping Bentgrass

OBJECTIVE: To assess the quality of 'Penncross' creeping bentgrass at two mowing heights and increasing rates of potassium fertilization.

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician

INTRODUCTION:

Golf course superintendents are constantly under pressure to increase and maintain a high level of ball speed on putting greens. The most common method of improving speed is to lower mowing height on creeping bentgrass. Reducing mowing height, however, introduces additional turf management problems. Lower cut greens are less tolerant of environmental stresses than greens that are maintained at a higher cut. Of particular importance is high temperature stress. As the mowing height is reduced the potential of increased high temperature stress becomes obvious as green quality is often sacrificed.

The use of potassium as a "stress tolerance" nutrient has gained wide acceptance in recent years among turf managers. Claimed benefits include increased heat, drought, cold temperature, and disease resistance. This experiment was initiated in early summer of 1986 to test whether the general loss of green quality from the additional stress caused by lower mowing heights could be partially alleviated by the use of increased rates of potassium on 'Penncross' creeping bentgrass greens.

MATERIALS AND METHODS:

The experiment was initiated on a 4-year-old stand of 'Penncross' creeping bentgrass at the Rocky Ford Turfgrass

Research Plots. It utlizes a Randomized Complete Block Design with 10 treatment combinations. Each block is divided in half with one half being mowed at 0.18 inches and the other half cut at 0.09 inches. Each block is further divided into five potassium treatments: 0, 2, 4, 6, and 8 lbs of K per 1000 square feet per year applied in 4 applications (April, June, August, and October). Data to be collected include monthly quality, canopy temperature (taken with infrared thermometer), ball speed, and density ratings.

TITLE: Influence of Amendments in Sand on Bentgrass Establishment

OBJECTIVE: To test the effectiveness of various rates of sawdust, sphagnum peat, and clinoptillolitc zeolite on the rate of establishment of 'Penncross' creeping bentgrass

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician
Dr. Stan Brauen, Washington State University
Dr. Roy Goss, Washington State University

INTRODUCTION:

Quality turfgrass is most easily maintained on desirable root zones. Characateristics desired in a root zone include (1) minimum compaction tendency, (2) good soil water infiltration, (3) adequate aeration for deep rooting, (4) freedom from toxic chemicals, (5) an active microorganism population, (6) high cation exchange capacity, and (7) adequate water retention. Many times, however, turfgrass root zones contain much clay that does not allow for adequate aeration or water infiltration and percolation. On the other hand, root zones that are very sandy possess little capacity for retaining water and nutrients. Under either condition, root zone modification is necessary. Coarse textured materials are added to root zones high in clay to improve aeration and water infiltration and percolation. Fine textured materials (usually organic) are added to sandy root zones to improve water and nutrient retention capabilities.

Peat is the most commonly used amendment. Other amendments tht have been used include sawdust, shredded bark, calcined clay, vermiculite, perlite, and sewage sludge. Recent research has shown that another material, clinoptilolitic zeolite, may have promise for use as a soil amendment. Zeolites are crystalline, hydrated aluminosilicates. There are currently 40 types of zeolites known based on their chemcial composition, structure, and related physical properties. Clinoptilolitic zeolite possesses a high cation exchange capacity and selectively retains ammonium and potassium cations.

MATERIALS AND METHODS:

An experiment was initiated at Washington State University and completed here at Kansas State to test sphagnum peat, sawdust, and clinoptilitic zeolite at 5, 10, 20% (by volume) as amendments to sand for establishing 'Penncross' creeping bentgrass. Mixes were prepared off-site and placed into 1 X 2 meter plots arranged in a Randomized Complete Block designed with 10 treatments replicated 3 times each. Estalishment ratings were taken (1=no cover, 9=complete cover), cation exchange capacities were calculated, and moisture retension curves were established for each mix and the 100% sand control.

RESULTS

Figure 1 shows the average establishment ratings for each treatment. Figure 2 shows the effects of variable rates of each amendment on soil moisture levels at 0.1 bar soil matric potential. Figure 3 shows the effects of each amendment averaged over all rates for variable soil matric potentials. Figure 4 shows the calculated cation exchange capacities for each mix including the 100% sand control. All treatments receiving some amendment gave superior establishment to 100% sand, except sawdust at 10 and 20% rates. Clinoptilotic zeolite shows promise as an amendment primarily due to its cation exchange capacity enhancement (Figure 4) and not to its effect on soil moisture retention (Figures 2 and 3). Peat amended mixes proved to be superior in sand mix moisture retention (Figures 2 and 3) which contributed to the enhanced establishment ratings shown in Figure 1.

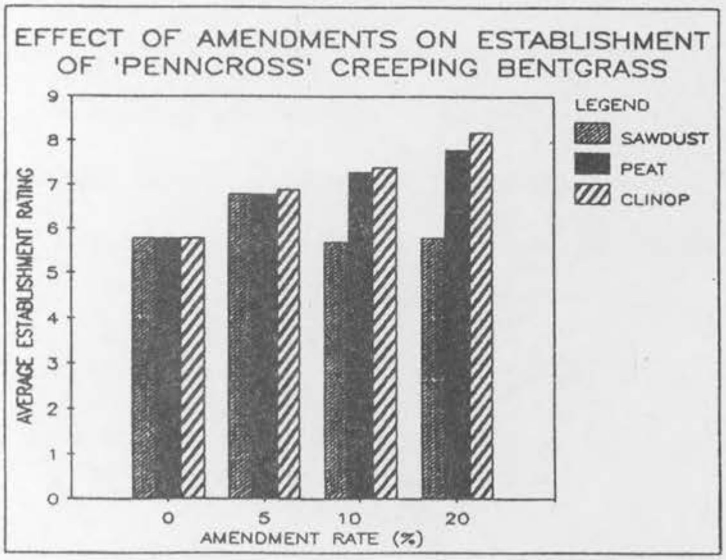


Figure 1.

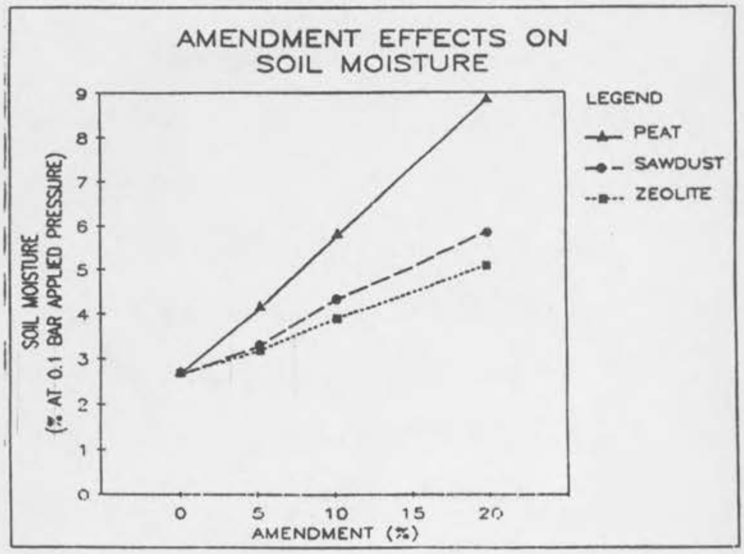


Figure 2.

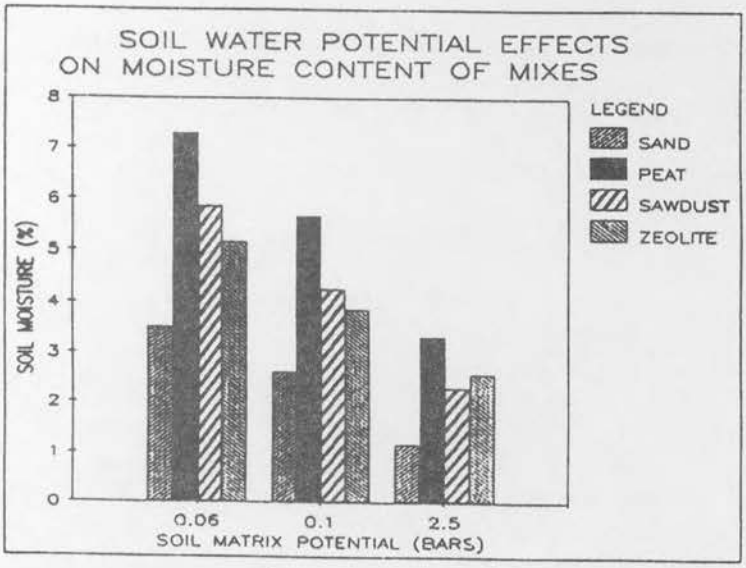


Figure 3.

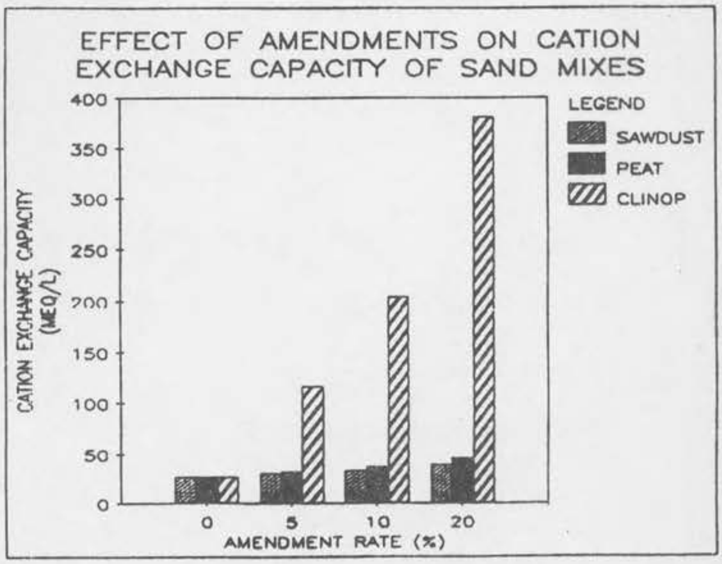


Figure 4.

TITLE: Annual Bluegrass Control Studies

OBJECTIVE: Determine efficacy of selected growth retardants and herbicides in controlling and retarding growth and establishment of annual bluegrass.

PERSONNEL: Ron Campbell, Turfgrass Research

FUNDING: Commercial Grants and Hatch 039

INTRODUCTION:

Annual bluegrass (Poa annua) is the most widespread turfgrass weed growing in each of the 50 states. It is an annual grassy weed germinating in the fall when the weather cools and establishes itself in the fall. It goes dormant during the cold of winter then greens up with the coming of warm weather in the spring and in Manhattan heads and produces seed during May and June. If the summer weather is hot and dry the plants die and if a heavy stand was present irregular brown spots appear in the turf. It is a special problem in golf course greens and fairways that are mowed short and are watered and fertilized regularly.

This study was designed to further study the effectiveness of selected growth retardants and herbicides in reducing Poa annua growth and establishment in a bluegrass fairway at the Manhattan Country Club.

MATERIALS AND METHODS:

A field type compressed air plot sprayer equipped with a four foot-boom was used to treat 4 x 8 foot plots of established Kentucky bluegrass with selected growth retardants and herbicides. Plots sprayed with growth retardants three times at two week intervals were treated in September of 1985 and 1986 and evaluated a year later for effect on crabgrass cover (Tables 1 & 2). Herbicides were applied 9-2-86 (Table 3). Normal cultural practices were followed. The fairway was irrigated as needed and mowed 0.7-1.0 height. A complete analysis (NPK) fertilizer was applied in spring and early fall each year. Supplemental nitrogen applications were made throughout the remainder of the growing season as needed. Fall overseeding of bluegrass and perennial ryegrass was accomplished.

RESULTS:

All five retardants applied in September 1985 significantly reduced the annual bluegrass cover when evaluated in the spring of 1986 (Table 1). There were no significant differences between retardants. The fungicide Rubigan was ineffective in reducing Poa annua populations.

Table 1. Annual Bluegrass Control with Growth Retardants, Spring 1986

Treatment*	Rate lbs ai/A	Percent weed cover 5-15-86
Rubigan	1.0	67.33 A[z]
Control	-	66.61 A
Paclobutrazol	0.20	9.33 B
XE 1019	0.025	7.67 B
Mefluidide	0.125	6.00 B
XE 1019	0.05	5.67 B
Flurprimidol	0.025	5.67 B
Paclobutrazol	0.034	4.67 B
Flurprimidol	0.50	3.33 B

[*] All chemicals were applied 9-24-85. Repeat applications of retardants and Rubigan were made each on 10-15 and 10-29-85, except for Mefluidide which was repeated only on 10-29-85.

[z] Means in columns with same letter are not significantly different by the Duncan's Multiple Range test at the 5 percent level.

Mefluidide and Rubigan were not included in the 1986 study. Four retardants were applied in 1986 at various rates. Again all growth retardants significantly reduced annual bluegrass populations when estimates were made June 1, 1987 (Table 2).

Considerable variation in control of annual bluegrass by herbicides was observed (Table 3). Nearly all herbicides significantly decreased the grassy weed population. Also there were significant differences observed among chemicals and rates of the herbicides. Prodiamine and bensulide were most effective of the materials tested. Herbicide applications were made September 2, normally annual bluegrass would not be germinated by this date. However the monthly mean temperatures for August were $4.2^{\circ}F$ lower than normal, and total precipitation for the month was 2.6 inches higher than normal. It is possible that some germination of annual bluegrass had occurred prior to the September 2 application date.

These results show that repeated early fall application of growth retardants were effective both years in reducing annual bluegrass populations. A further advantage is that the growth retardant treatments have not adversely affected late summer or fall overseeding of bluegrass fairways in our studies. Several preemergence herbicides have proven effective in reducing annual bluegrass fairways in our studies. Several preemergence herbicides have proven effective in reducing annual bluegrass stands but most can not be used in the fall because they interfere with fall overseeding practices. Except for golf courses it is possible that spring overseeding could be utilized in a Poa annua control program following late summer preemergence treatment.

Table 2. Annual Bluegrass Control With Growth Retardants, Spring 1987

Treatment*	Rate lbs/ai/A	Percent weed cover 6-1-87	
Control	-	35.00	A[z]
XE-1019	0.025	6.33	B
E1-500	0.50	4.33	B C
PP-333	0.41	2.67	C D
EL-500	1.00	2.67	C D
XE-1019	0.04	2.67	C D
EL-500	0.75	2.33	C D
PP-333	0.33	2.33	C D
XE-1019	0.06	2.00	C D
PP-333	0.50	1.67	C D
XE-1019	0.05	1.00	D

* All chemical treatments were applied 9-15-86 and repeated at the same rates on 9-29-86 and 10-13-86.

z Means in colums with same letter are not significantly different by the Duncan's Multiple Range test at the 5 percent level.

Table 3. Annual Bluegrass Control with Preemergence Herbicides, Manhattan Country Club, 1987.

Treatment*	Rate lbs ai/A	Percent weed cover
Control	---	35.5 A[z]
Pendimethalin	1.5	29.5 A B
Oxidiazon (WP)	1.5	27.0 B C
Oxidiazon (WP)	2.0	25.0 B C
Prodiamine	0.25	21.5 C D
Prodiamine	0.34	20.2 C D
Prodiamine	0.75	19.7 C D
Prodiamine	0.50	15.0 D E
Prodiamine	1.00	8.5 E
Bensulide 4E	12.50	8.3 E

* All herbicides were applied 9-2-87.

[z] Means in columns with same letters are not significantly different by the Duncan's Multiple Range test at the 5 percent level.

TITLE: Acclaim Bentgrass Study

OBJECTIVE: To evaluate Acclaim in the control of warm season annual grasses.

PERSONNEL: Ron Campbell, Turfgrass Research

FUNDING: Hoechst-Roussel Agri-Vet Company

INTRODUCTION:

The use of creeping bentgrass on Kansas golf courses is generally restricted to greens and tees. In spite of the extremely close mowing heights of a putting green the winter annual Poa annua (annual bluegrass) and the summer annual large crabgrass, (Digitaria sanquinaliis) are found on many putting greens. Bensulide is the only preemergence herbicide that can safely be used on most creeping bentgrass cultivars on close mowed greens. DCPA can be applied to creeping bentgrass except when growing at putting green height.

Acclaim has shown promise in controlling crabgrass seedlings when applied at the 1-3 leaf stage. Studies conducted here in 1986 were designed to establish threshold rates that would control crabgrass and not damage the creeping bentgrass.

This study was designed to further study the efficacy of removing crabgrass seedlings from 'Pencross' creeping bentgrass maintained at the Rocky Ford Turfgrass Research plots.

MATERIALS AND METHODS:

A field plot sprayer with a 4-foot boom will be used to treat 4x8 foot plots with Acclaim at rates of 0.04, 0.06, 0.08 and 0.12 lbs a.i./acre. The sprays will be applied when crabgrass seedlings reach the 1-2 leaf stage. Additional treatments at the same rates will be made as new seedlings reach the 1-2 leaf stage of growth. The study will consist of two blocks treated as described above. One block will be mowed at 1/8"-1/4", and the second one cut at 1/4-1/2" height. Regular quality ratings and weed control counts will be made.

EVALUATION OF NEMATICIDES FOR THE CONTROL OF PLANT-PARASITIC NEMATODES ON A BENTGRASS GREEN

T. C. Todd and Ned Tisserat
Department of Plant Pathology

Nematicides were evaluated on a bentgrass golf green at Clay Center, KS. Regular maintenance of the green was carried out by the superintendent. Rainfall amounts were above normal and temperatures were below normal for Jul and Aug. All chemicals were applied to the turf on 6 Jun. Granular formulations were mixed with a small quantity of sand for a more uniform application and applied by hand. Nemacur 3E was applied in 2 gal water/1000 sq ft as a foliar spray. One-half inch of water was applied immediately after application. All treatments were replicated four times in 3 ft x 3 ft plots arranged in a randomized complete block design. Turf quality was rated on a 0-10 scale on 29 Aug. Soil samples were assayed for nematodes using a modified Christie-Perry technique.

Nematicides did not significantly reduce lance or ring nematode populations at the 23 Jul or the 29 Aug sampling dates. Spiral nematode populations were significantly reduced on 29 Aug with both granular Nemacur treatments. The high Nemacur granular rate significantly improved turf quality when compared to the control. Turf quality in all plots was correlated with lance nematode populations sampled on 23 Jul ($r = 0.61$, $P<0.01$) and on 29 Aug ($r = 0.57$, $P<0.01$). No phytotoxicity was observed.

	Nematodes/100 cm^3 soil									
	Hoplolaimus galeatus			*Criconemella ornata*			*Helicotylenchus pseudorobustus*			Turf quality*
Treatment and rate/1000 sq ft	6 Jun	23 Jul	29 Aug	6 Jun	23 Jul	29 Aug	6 Jun	23 Jul	29 Aug	29 Aug
Control	63 a	134 a	60 a	322 a	546 a	437 a	40 a	46 a	111 ab	2.3 a
Oftanol 5G 0.9 lb	101 a	228 a	223 a	325 a	373 a	261 a	95 a	69 a	126 a	1.6 a
Nemacur 10G 2.3 lb.	75 a	94 a	96 a	285 a	265 a	228 a	37 a	2 a	3 c	1.2 a
Nemacur 10G 4.6 lb.	63 a	48 a	33 a	489 a	261 a	145 a	16 a	0 a	0 c	0.4 b
Nemacur 3E 12.8 oz.	146 a	116 a	75 a	457 a	342 a	221 a	60 a	3 a	7 bc	1.1 ab

Column means followed by the same letter are not significantly different (P=0.05) by FLSD test. All data were transformed by $\log_{10}(x+1)$ prior to analysis; actual nematode means are presented in the table.
*Turf quality rated on a 0-10 scale where 0 = no damage, 1 = 10% and 10 = 100% of plot area discolored.

TITLE: National Perennial Ryegrass Cultivar Trial

OBJECTIVES: To evaluate several perennial ryegrass genotypes for their adaptability to Kansas conditions.

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician
Kala Mahadeva, Turfgrass PhD Candidate

INTRODUCTION:

Perennial ryegrasses are used widely in most areas of the United States because they germinate very quickly and cover rapidly, possess good wear tolerance, and possess a rich deep green color. Efforts to improve perennial ryegrasses include selecting for better mowing quality, disease resistance, and environmental stress tolerance. It is important to supply the Kansas turfgrass manager with performance evaluation of commercial and experimental ryegrass genotypes, so he can make the best choice of ryegrasses for Kansas conditions.

MATERIALS AND METHODS:

Sixty-five commercial and experimental ryegrass genotypes were received from the National Turfgrass Evaluation Program and planted in Section II of the Rocky Ford Turfgrass Research Plots on March 16, 1987. Seeding rate was 6 lbs per 1000 square feet and a balanced (20-20-20) fertilizer was applied immediately after seeding at the rate of 1 lb N per 1000 square feet. Monthly quality ratings (1-9) are being recorded for each genotype which is replicated 3 times in a Randomized Complete Block Design. Plot size is 1 by 2 meters. They are mowed at 3-3.5 inches and fertilized 4 lb N, 1 lb of P2O5, and 1 lb of K2O per year.

Table 1. Average 1987 quality rating of perennial ryegrass cultivars at Rocky Ford Research Plots.

Cultivar	April	May	June	Overall
1. Barry	6.7	6.7	6.2	6.5
2. BAR LP 454	6.8	6.8	6.2	6.6
3. Tara	7.0	7.7	7.3	7.3
4. BAR LP 410	7.2	7.0	7.5	7.2
5. Cowboy	6.7	6.8	6.3	6.6
6. Yorktown II	7.0	6.8	6.8	6.9
7. Prelude	7.5	7.5	7.2	7.4
8. Palmer	7.2	7.7	6.8	7.2
9. Diplomat	7.3	7.2	6.8	7.1
10. Pavo	7.2	6.2	7.0	6.8
11. Ronja	7.3	6.8	7.0	7.1
12. Caliente	6.7	7.0	6.8	6.8
13. Aquarius	7.8	7.7	7.3	7.6
14. Delray	7.2	6.5	6.7	6.8
15. Goalie	7.0	7.0	7.0	7.0
16. Acrobat	7.2	6.8	6.8	6.9
17. Rival	6.3	6.7	6.5	6.5
18. Brenda	6.5	6.7	6.5	6.6
19. Derby	7.5	7.5	7.3	7.4
20. Regal	7.7	7.0	6.2	6.9
21. Gator	7.0	7.5	7.2	7.2
22. Patriot	7.2	7.3	7.0	7.2
23. Rodeo	7.2	7.5	7.5	7.4
24. Allaire	7.0	7.7	7.5	7.4
25. Pick 300	7.7	7.8	7.7	7.7
26. Pick 751	7.7	6.7	7.0	7.1
27. Ovation	6.8	6.8	6.5	6.7
28. SR 4000	7.0	7.3	7.0	7.1
29. SR 4031	7.5	6.7	6.7	6.9
30. SR 4100	7.5	7.0	6.7	7.1
31. Pick 233	7.7	7.0	7.0	7.2
32. Pick 647	7.8	7.7	7.7	7.7
33. Pick 600	7.0	8.0	7.3	7.4
34. Ranger	7.5	8.0	7.0	7.5
35. ISI-K2	6.8	7.5	7.0	7.1
36. Pennfine	6.8	6.7	6.8	6.8
37. PSU-222	7.3	7.3	7.0	7.2
38. PSU-333	6.7	6.7	6.7	6.7
39. MOM-LP-763	6.8	6.7	6.5	6.7
40. Sherriff	6.5	6.2	6.5	6.4
41. Birdie II	6.8	6.5	6.5	6.6
42. Citation II	7.2	7.3	7.3	7.3
43. Regency	6.5	6.7	6.7	6.6
44. Manhattan II	7.2	7.0	7.2	7.1

(cont.)

Table 1. (cont.)

Cultivar	April	May	June	Overall
45. PST-2PM	7.5	7.3	7.5	7.4
46. PST-2DD	8.2	8.0	7.2	7.8
47. PST-2H7	7.2	7.5	7.5	7.4
48. PST-250	7.0	7.7	7.2	7.3
49. Vintage-2DF	6.5	6.7	6.3	6.5
50. PST-259	6.5	7.2	7.5	7.1
51. PST-M2E	7.5	7.0	7.2	7.2
52. 246	6.3	6.5	6.8	6.6
53. Omega II	7.7	7.0	7.5	7.4
54. PST-2HH	7.3	7.7	6.3	7.1
55. ISI-851	7.0	7.5	7.3	7.3
56. NK 80389	7.2	7.5	7.7	7.4
57. Manhattan	6.7	7.2	5.8	6.6
58. Repell	7.3	7.3	7.2	7.3
59. DEL 946	7.0	7.2	7.3	7.2
60. Belle	7.5	7.2	7.3	7.3
61. Pennant	7.3	6.7	7.0	7.0
62. J 207	6.7	6.8	6.8	6.8
63. J 208	6.3	5.8	6.5	6.3
64. Linn	3.8	4.2	6.2	4.7
65. Runaway	7.3	7.0	6.8	7.1

1987 PRELIMINARY RESULTS:

From the limited data will have collected so far some of the better performing cultivars are Tara, Derby, Rodeo, Allaire, Citation II, PST-2DD, and Omega II. The poorer performers are Linn, and J 208. Care should be taken not to draw too many conclusion from this very small amount of quality data. Firm recommendations can only be made after 2-3 years of seasonal performance.

TITLE: Water Use and Quality of 'Manhattan' Perennial Ryegrass as Affected by Application of Increasing Rates of Wetting Agent

OBJECTIVES: To investigate whether water use rates and quality of 'Manhattan' perennial ryegrass can be significantly altered by the use of soil wetting agents.

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician
Brian Kaiser, Turfgrass Student

INTRODUCTION:

Wetting agents have long been used by turfgrass managers to relieve localized dry spots, provide more even coverage of pesticides, and to prevent dew formation on greens to help inhibit the incidence of certain turfgrass diseases. Some wetting agent manufacturers have claimed an increase in irrigation efficiency with the use of wetting agents.

The long-term future of irrigation agriculture depends on the efficient use of irrigation water. On many of the major aquifers of the United States, especially in the Great Plains, recharging of aquifers by natural means is not keeping pace with the demand placed on them by irrigation agriculture. Any means by which water could be saved and lower the demand from these aquifers warrants research attention. This study was initiated to test if increasing rates of a wetting agent would result in a lower water use rate or improvement in quality of 'Manhattan' perennial ryegrass.

MATERIALS AND METHODS:

Section A of the Toro Research Irrigation System was planted in the fall of 1983 with 'Manhattan' perennial ryegrass. This section consists of twelve 15 X 15 foot plots which can be irrigated independently. Irrometer tensiometers were buried at a

4-inch depth in each of these plots and irrigation is performed when soil tension reaches 60 centibars. Plots have been treated with 0, 2, 4, or 8 fluid ounces per 1000 square feet of Super Wet (Clearys) on May 23, 1986. Plots were retreated in exactly the same randomization 8 weeks later. Data collected includes summer monthly quality, clipping yield, and total supplemental irrigation for each treatment.

1986 RESULTS:

1986 was a wet year in Kansas and very little supplemental irrigation was required by any of the plots. Figure 1 shows that Super Wet at the 4 oz rate lower the water use over the other treatments, but this difference was not statistically significant. Figure 2 shows there was no effect of wetting agent treatments on clipping yield. Figure 3 shows that no significant differences in turf quality was obtained by the use of wetting agents on perennial ryegrass.

Although this experiment is being repeated in 1987, based on 1986 results, it appears very unlikely that the addition of wetting agents to fine textured soils will result in reduced water usage, any differences in growth (based on clipping yield), or turf quality.

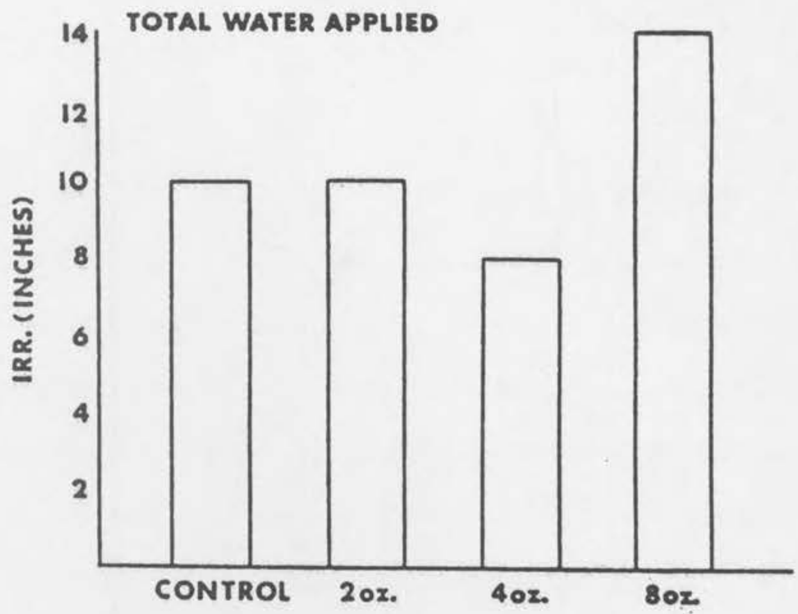


Figure 1.

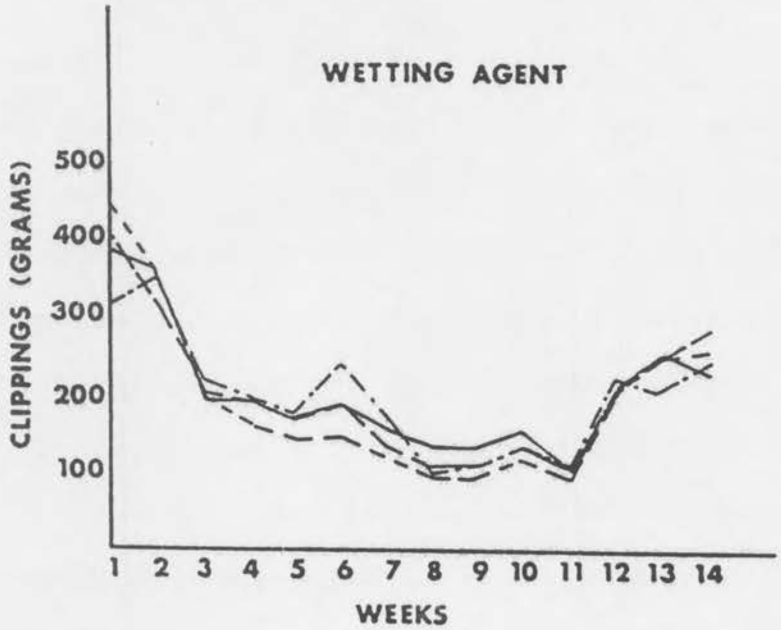


Figure 2.

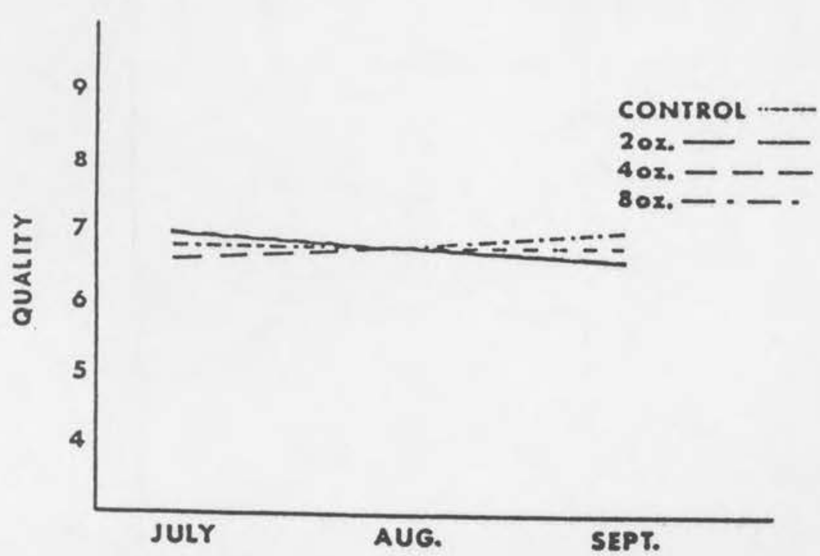


Figure 3.

TITLE: National Tall Fescue Cultivar Trial

OBJECTIVE: To evaluate commercial and experimental tall fescue genotypes under Kansas conditions

PERSONNEL: Jeff Nus, Turfgrass Reserach and Teaching
Paul Haupt, Turfgrass Technician
Kala Mahadeva, Turfgrass PhD Candidate

INTRODUCTION:

Tall fescue is the best adapted cool season turfgrass for use in the transition zone because of its greater drought and heat tolerance. Although toall fescue has few serious insect and disease problems, it possesses a coarse leaf texture and does not recover from injury because it lacks stolons and has only very short rhizomes. Efforts to select for improved tall fescue cultivars include selection for finer leaf blades, good mowing quality, a good rich green color, and improved sward density while maintaining good stress tolerance characteristics.

MATERIALS AND METHODS:

Thirty-three tall fescue cultivars are each planted in three 4 X 6 foot plots in Section II of the Rocky Ford Turfgrass Research Plots. These cultivars are receiving 3 lbs of N, 1 lb, of P2O5, and 1 lb of K2O per 1000 square feet per year. They are mowed at 3.5 inches and irrigated as needed to avoid severe stress.

1986 RESULTS:

Good performing tall fescues (Table 1.) include Rebel, Apache, 5GL (recently named FineLawn). Much of the difference in overall quality appears in the early and late season. Good fall

Table 1. National Tall Fescue Trial Quality Ratings at Rocky Ford Turfgrass Research Plots (1-9).

	Cultivar	April	May	July	Aug.	Sept.	Oct.	Nov.	Overall
1.	Johnstone	3.8	5.7	6.2	5.5	5.5	6.2	2.8	5.1
2.	Rebel	5.7	6.8	7.7	7.2	7.3	8.0	4.2	7.0
3.	Clemfine	4.8	6.5	7.5	6.7	6.3	6.8	4.3	6.1
4.	Williamette	6.2	6.8	7.3	6.7	7.2	7.3	4.3	6.5
5.	Mer Fq 83-1	4.7	5.5	6.8	5.8	5.7	6.5	3.8	5.5
6.	ISI C.J.	5.0	7.0	7.5	6.5	7.2	7.2	4.5	6.5
7.	Houndog	5.2	6.8	6.8	6.3	7.3	7.3	3.5	6.2
8.	Brookston	5.3	6.7	6.7	7.2	7.3	7.0	4.8	6.4
9.	Falcon	5.5	6.7	7.2	6.8	7.5	7.2	4.3	6.5
10.	Maverick	5.0	6.7	7.5	7.3	7.7	7.3	4.2	6.5
11.	Mustang	5.5	7.2	7.2	6.8	7.8	7.0	4.3	6.5
12.	Adventure	5.2	7.0	7.0	6.8	7.8	7.5	4.5	6.5
13.	TF 813	5.0	6.7	7.2	6.5	7.5	6.7	3.8	6.2
14.	Olympic	5.0	7.2	7.5	7.0	7.7	7.7	4.2	6.6
15.	Jaguar	5.8	7.0	7.5	7.0	7.7	7.2	4.3	6.6
16.	5GL	5.5	6.7	8.0	7.3	7.3	7.5	4.2	6.6
17.	Apache	5.3	7.2	8.0	7.5	8.0	7.5	4.8	6.9
18.	5LA	6.3	7.2	7.7	7.2	7.5	7.0	4.7	6.8
19.	Firelawn	5.7	6.7	7.0	6.5	7.2	6.8	3.5	6.2
20.	Kenhy	4.3	5.5	5.5	5.7	6.2	6.3	3.0	5.2
21.	KY-31	4.7	5.8	6.3	6.0	6.2	7.0	3.5	5.6
22.	SYN-GA-1	5.5	6.3	7.3	7.3	7.3	7.3	4.2	6.5
23.	KS-78-4	4.2	5.8	6.3	5.8	6.3	7.2	3.5	5.6
24.	Arid	5.3	7.2	7.5	7.3	7.5	7.2	4.3	6.6
25.	N.K. 81425	4.2	6.2	5.8	6.5	7.2	7.0	3.7	5.8
26.	N.K. 82508	4.3	6.5	6.8	6.8	6.7	6.7	3.8	6.0
27.	Tempo	4.8	6.3	7.5	7.0	6.7	7.2	4.0	6.2
28.	Barcel	4.5	5.2	6.7	6.5	6.5	6.7	3.8	5.7
29.	Festorina	3.8	5.3	6.0	6.0	6.8	6.8	3.7	5.5
30.	Unknown	5.5	6.8	6.8	6.5	7.7	7.3	4.5	6.5
31.	5D3	6.0	7.0	7.3	7.3	7.7	7.8	4.3	6.8
32.	562	5.5	6.7	7.7	7.2	6.7	7.2	4.0	6.4
33.	51W	6.2	6.7	7.2	7.2	7.2	7.3	4.7	6.6
		5.1	6.5	7.1	6.7	7.1	7.1	4.1	

color retention and early spring green-up are important considerations in evaluating quality. Poorer performers included Johnstone, Kenhy, and Festorina. This cultivar trial will be discontinued at the end of this season, as the National Turfgrass Evaluation Program will supply us with a new tall fescue seed set including approximately 60 genotypes.

TITLE: Tall Fescue Trial of New Preemergence Herbicides

OBJECTIVE: Determine the efficacy of new formulations of previously registered herbicides.

PERSONNEL: Ron Campbell, Turfgrass Research

FUNDING: Commercial Grants

INTRODUCTION:

Most summer annual grasses can be controlled with preemergence herbicides. Turfgrass herbicides must provide adequate control of target weeds without causing unacceptable injury to desirable turfgrasses within the plant community. Agricultural chemical companies spend considerable time and money on testing products before they can be labelled for public use. The information given on turfgrass tolerance is only a guide; a particular turfgrass species may vary in its response to a herbicide depending upon the intensity of culture, the physiological condition of plants, natural environmental conditions, and the specific cultivar or cultivars used. When a particular turfgrass is under severe stress, it may be injured by a herbicide to which it is normally tolerant. Due to the expense involved in synthesizing, testing and marketing of new herbicides chemical companies are now extensively testing new formulations of previously registered products. Several such herbicides are now being tested on turfgrass and other crops to determine their efficacy. This experiment was initiated to test the effectiveness of new formulations and combinations of preemergence herbicide applied to ´Rebel´ tall fescue for the control of annual weeds.

MATERIALS AND METHODS:

A compressed air field plot sprayer with a four-foot spray boom was used to apply sprayable herbicides, granules were applied by hand spreader to 4x8 foot plots (Table 1). New formulations of Team, Balan and Ronstar were applied at various rates on April 9. Monthly quality ratings and weed control estimates will be made.

Table 1. New Formulations of Previously Registered Products

Product name	Common name		Rate lbs a.i./A	Manufacturer
Team	Benefin + Trifluralin	2G	1.0,1.5,2.0,3.0	Elanco
Team	Benefin + Trifluralin	28S	1.0,1.5,2.0,3.0	Elanco
Balan	Benefin	60DF	3.0	Elanco
Balan	Benefin	2.5G	3.0	Elanco
Betasan	*Bensulide	4-E	9.0	Stauffer
Ronstar	*Oxadiazon	2G	3.0	Rhone-Poulenc
Ronstar	Oxadiazon	50WP	1.0,1.5,.75 + .75	Rhone-Poulenc

* Applied as standards for comparison.

TITLE: Acclaim Tall Fescue Study

OBJECTIVE: To evaluate Acclaim + pendimethalin on a timing schedule for the control of summer annual grassy weeds.

PERSONNEL: Ron Campbell, Turfgrass Research

FUNDING: Hoechst-Roussel Agri-Vet Company

INTRODUCTION:

Large crabgrass, (*Digitaria sanguinalis*) and smooth crabgrass, (*Digitaria ischaenum*) are summer annuals which persist well under most turf conditions. They are coarse-bladed and light or apple green in color. Crabgrasses are highly competitive in turf and their spreading growth habit tends to minimize recovery by turfgrass species. Crabgrasses can germinate throughout the entire growing season after soil temperatures have warmed in the spring. Germination occurs after each irrigation or rainy period, thus requiring persistent control.

It is more efficient to prevent growth of weeds than to eradicate them after growth starts, therefore preemergence herbicides are widely used to control summer annual grasses and selected broad-leaf weeds. Under certain climatic conditions the half-life of preemergence herbicides may be as short as 45 to 60 days. When this happens, it may be necessary to apply a second half-rate application. Since preemergent herbicides will not control weeds that have germinated, there usually is need for herbicides that can eradicate established grassy weeds.

Until recently there have been few effective postemergent herbicides available for use against grassy annual weeds. The best materials suitable for use have been the organic arsenicals such as AMA, CMA, DSMA, and MSMA. These materials require multiple applications and damage to turfgrass may be severe at temperatures above 90°F. Also, to avoid undue injury to the turfgrass, arsenicals should not be applied to dry turf.

The postemergence herbicide Acclaim (fenoxyprop-ethyl) has proven to be most effective in controlling annual grassy weeds in cool season turfgrasses. The chemical selectively controls grassy weeds in domestic turfgrasses regardless of the developmental growth stage - as effective against mature plants as those in the early seedling or intermediate stage. We have also controlled grassy weeds in buffalograss and bermudagrass stands with acceptable levels of phytotoxicity, but the product has not yet been labelled for use on these species. In 1986 we compared Acclaim applied singly, sequentially, and in combination as tank mixes with the residual grass herbicide, bensulide, dacthal, and pendimethalin when the grassy weeds were at the 1-3 leaf stage. These treatments were made to Midiron bermudagrass plots. In theory, the Acclaim sprays should control the early appearing grassy weeds and the preemergence herbicides should prevent germination and establishment.

This experiment was designed to evaluate Acclaim plus pendimethalin on a timing schedule for the control of summer grassy weeds in Kentucky bluegrass and tall fescue.

MATERIALS AND METHODS:

A field type compressed air plot sprayer equipped with a four foot boom was used to treat 4x8 foot plots of established 'Rebel' tall fescue with the Acclaim and Acclaim + pendimethalin sprays. Single applications of Acclaim and tank mixes with pendimethalin will be made. Acclaim rates used were 0.04, 0.06, 0.08, and 0.12 lbs a.i./A, and pendimethalin will be applied each time at 1.5 lbs a.i./A. Spray applications will be made at four dates over a six weeks period. Evaluations of crabgrass control and turf phytotoxicity will be taken at 2,4, and12 weeks after treatment.

TITLE: Control of Southern Masked Chafer Larvae in Tall Fescue Turf

OBJECTIVE: The following test was made to determine the efficacy of several commercially used granular insecticides for the control of first instar larvae of the southern masked chafer. A secondary objective was to test these materials for phytotoxicity.

PERSONNEL: Jim Nechols, Entomology Research and Teaching

INTRODUCTION:

Southern masked chafer represents a serious insect problem for Kansas turfgrasses. It has a one-year life cycle and the larvae (grubs) feed voraciously on several Kansas turfgrass species including tall fescue. As roots are eaten off, the turf initially exhibits drought symptoms followed by loss of turf ranging from small patches to virtual complete killed of the affected area. Information is needed by the Kansas turfgrass manager concerning chemical control of this serious pest.

MATERIALS AND METHODS:

The experiment ws conducted on an irrigated 4-year old stand of K-31 tall fescue located on the Rocky Ford Turfgrass Research Plots. Soil fertility was relatively hyigh with a pH of 7.4. Mowing height was maintained at 3.5 inches.

The experiment utilized a completely randomized block design with 5 replications of 5 treatments (including a non-treated control). Each replicate consisted of a turf core, cut and placed inside a 6-inch diamter PVC cylinder, and repositioned into the turf canopy. First instar souther masked chafers were collected from an adjacent tall fascue plot at the Rocky Ford plots. On July 24 and 25, 10 larvae were placed into each premoisted turf core. Granular applcations were made to each cylinder on July 29. All treatments were watered in with 0.5 inches of irrigation immediately after application. Observations were made at 3-day intervals during the first week following application. Larval mortality was evaluated on August 20 (21 days after treatment).

RESULTS:

Oftanl 5G, Mocap 5G, or Mocap 10G resulted in significantly fewer survivinging grubs three weeks post-treatment than the diazinon 5G treatment and the check (Figure 1). Larval mortality in the control group was relatively high. Stress related to digging and handling grubs may have been responsible for this mortality. Turf quality appeared to be high, however, so nutritional stress was probably not a limiting factor.

None of the turf cores exhibited phytotoxicity or insect damage by 6 weeks after treatment despite (a) use of one product (Mocap) at the 10G rate, and (b) densities of up to 6 third (last) instar southern masked chafer larvae per core. This may be related to the high level of turf maintenance at Rocky Ford or the cooler, wetter, summer conditions during 1986.

CONCLUSIONS:

1. Both rates of Mocap and Oftanol were highly effective in controlling first instar southern masked chafer larvae. The diazinon treatment was less effective.

2. Because of the high control mortality, the ratings should be interpreted on a relative scale, rather than on a quantitative scale. That is, it may not be accurate to state

that "Mocap 5G give 90% control, or that diazinon 5G gives only 65% control".

3. Phytotoxicity and insect damage ratings should be repeated under more stressful temperature/drought conditions that are typical of midsummer Kansas conditions.

4. The methods in this study should be continued for efficacy studies because white grubs are typically distributed irregularly in natural and managed turf environments. This procedure allows much grater precision in making comparative assessments of test chemicals.

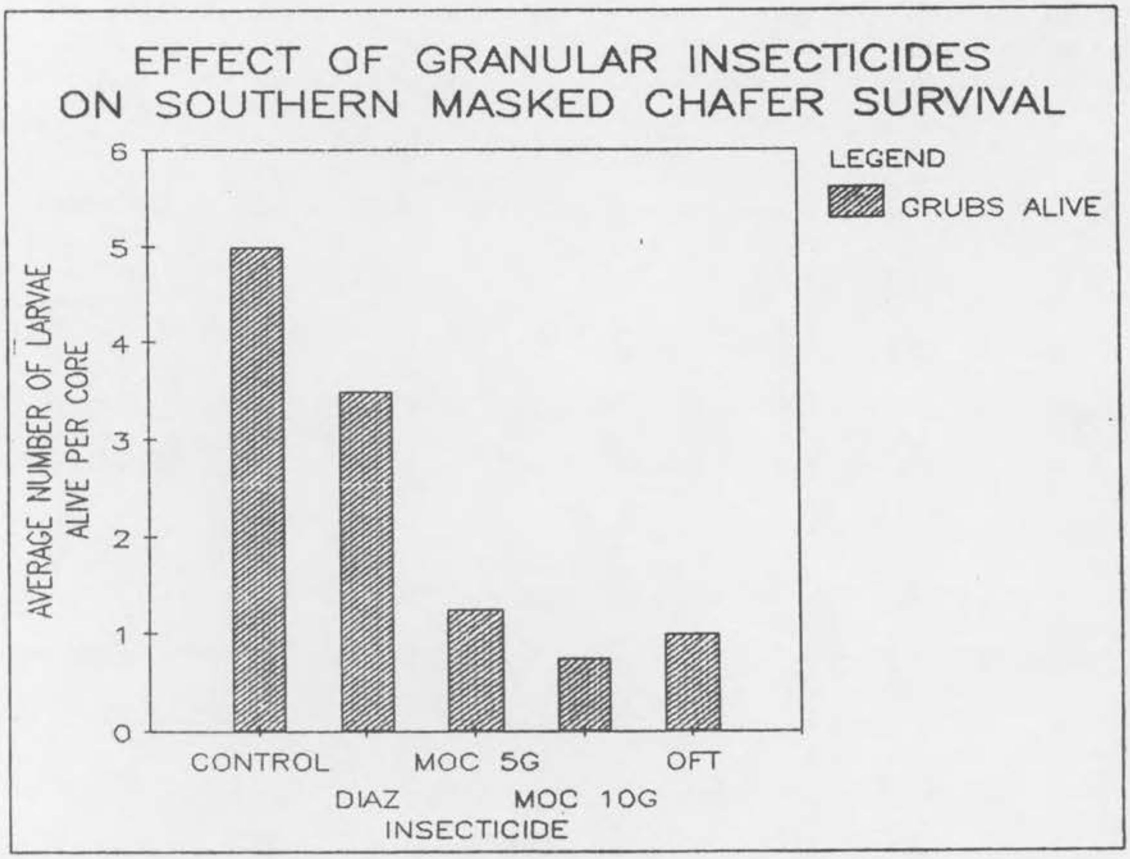


Figure 1.

TITLE: Buffalo Grass Management Study

OBJECTIVES: To test the quality response of 'Texoka' buffalo grass managed under increasing rates of nitrogen and different mowing heights.

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician

INTRODUCTION:

Buffalo grass is the only turfgrass species that is native to North America. Its natural range covers most of the Great Plains and extends eastward through mid-Iowa. It has been generally accepted that buffalo grass is a low maintenance species in that it requires very little (if any) nitrogen application and supplemental irrigation. The density of buffalo grass under these conditions is quite low, however, and its color is a dull green. It has also been stated that increased rates of nitrogen adds to weed encroachment, especially from more agressive perennial grasses. This experiment was initiated to test to what extent buffalo grass turf quality can be improved at increased rates of nitrogen and different mowing heights when strict weed control is practiced.

MATERIALS AND METHODS:

'Texoka' buffalo grass was established in Section II of the Rocky Ford Turfgrass Research Plots in 1984. This experiment utilizes 4 yearly rates of nitrogen: 1 lb of N per 1000 square feet applied in mid-May, 2 lbs of N per 1000 square feet applied in split applications in mid-May and mid-July, 3 lbs of N per 1000 square feet applied in split applications in mid-May, mid-June, and mid-July, and 4 lbs of N per 1000 square feet applied in split applications in mid-May, mid-June, mid-July, and mid-

August. Each fertility treatment is divided into two mowing heights: 1.75 inches and 3.5 inches. Strict weed control will be practiced using simazine glyphosate, benefin, and trimec. Insecticides will be applied as needed. Quality ratings (1-9) will be recorded for each treatment combination beginning in August, 1987.

TITLE: National Bermudagrass Cultivar Trial and Winter Cover Study

OBJECTIVES: To test several Bermudagrass genotypes for their adaptability and to test whether the use of protective winter covers and fall applied fungicides affect Bermudagrass quality and/or incidence of Spring Dead Spot.

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician
Kala Mahadeva, Turfgrass PhD Candidate

INTRODUCTION:

Much of Kansas is located in the transition zone for turfgrass adaptation. Cool season grasses are severely stressed by mid-summer high temperatures, and warm season grasses are often killed by winter low temperatures. Bermudagrass is susceptible to winter kill and efforts to breed for improved germplasm must evaluate for winter survival.

The use of winter covers to prevent winter damage by dessication and low temperatures has been used on bentgrass, but its use is largely uninvestigate with Bermudagrass. One drawback with the use of winter protective covers is enhancement of disease activity. This experiment was designed to investigate the efficacy of such protective covers alone and in combination with mid-fall application of fungicide with known activity against the suspected causal organism of Spring Dead Spot.

MATERIALS AND METHODS:

Sprigs were received from the National Turfgrass Evaluation Program in early 1986 and planted into flats in the greenhouse. Several flats of each genotype were vegetatively propagated from new stolons. A complete set was thus generated for the Horticulture Rersearch Center in Wichita.

Plugs were transplanted into the field in mid-May 1986 into 10 X 10 foot plots. The planting utilized a randomized complete block design with 28 trreatments and 3 replications. The plots were fertilized with 1 lb of N per 1000 square feet per growing month using ureaform. Each plot was divided in half during October 1986 and one half of each plot was treated with label rates of Rubigan. The plots were divided in half again in December where one half of each plot was covered with a spun-woven polyester winter cover.

Data that is being collected includes monthly quality, winter survival and greenup, incidence of Spring Dead Spot, daily winter maximum and minimum crown temperatures under the winter covers and in the exposed turf, texture ratings, color ratings, and percent cover. Addtional environmental data collection included daily air minimum and maximum temperatures, total daily solar radiation, daily soil temperatures at 2 and 4 inch depths, and mean daily wind speed. The following genotypes and their sponsors were used in this test.

CT 23 CAL-TURF CAMARILLO, CA
NM 43 NEW MEXICO STATE UNIV.
NM 72 NEW MEXICO STATE UNIV.
NM 375 NEW MEXICO STATE UNIV.
NM 471 NEW MEXICO STATE UNIV.
NM 507 NEW MEXICO STATE UNIV.
VAMONT VIRGINIA TECH.
E-29 KANSAS STATE UNIV.
A-29 KANSAS STATE UNIV.
RS-1 UNIV. OF KENTUCKY
MSB-10 MISSISSIPPI ST. UNIV.
MSB-20 MISSISSIPPI ST. UNIV.
MSB-30 MISSISSIPPI ST. UNIV.
A-22 KANSAS STATE UNIV.
TEXTURF TEXAS A&M UNIV.
MIDIRON KANSAS STATE UNIV.
TUFCOTE TEXAS A&M UNIV.
TIFGREEN TEXAS A&M UNIV.
TIFWAY TEXAS A&M UNIV.
TIFWAY II TEXAS A&M UNIV.
NMS 1 NEW MEXICO ST. UNIV.
NMS 2 NEW MEXICO ST. UNIV.
NMS 3 NEW MEXICO ST. UNIV.
NMS 4 NEW MEXICO ST. UNIV.
NMS 14 NEW MEXICO ST. UNIV.
ARIZONA COMMON NMS UNIV.
GUYMON ENID, OKLAHOMA
FB-119 UNIV. OF FLORIDA

Table 1. 1986 Quality ratings (1-9) of the National Bermudagrass Cultivar trials at the Rocky Ford Turfgrass Research Plots.

	Cultivar	July	Aug.	Sept.	Oct.	Overall
1.	CT-23	7.0	7.3	7.8	6.0	7.0
2.	NM-43	7.7	7.3	7.8	4.2	6.8
3.	NM-72	6.5	7.0	7.0	3.8	6.1
4.	NM-375	5.5	6.7	7.3	3.8	5.8
5.	NM-471	6.3	7.3	7.2	4.2	6.3
6.	NM-501	7.2	7.5	7.3	4.5	6.6
7.	Vamont	6.2	5.7	5.7	3.8	5.3
8.	E-29	7.2	6.5	6.5	4.0	6.0
9.	A-29	7.7	6.8	7.0	3.3	6.2
10.	RS-1	6.8	6.7	6.5	3.5	5.9
11.	MSB-10	7.3	7.8	8.7	5.0	7.2
12.	MSB-20	7.5	7.7	7.8	3.8	6.8
13.	MSB-30	7.8	7.5	7.8	3.8	6.8
14.	A-22	8.2	7.8	7.8	4.2	7.0
15.	Texturf	7.8	7.2	7.2	3.3	6.4
16.	Midiron	6.8	7.0	6.7	2.5	5.8
17.	Tufcote	7.8	6.8	7.3	3.5	6.4
18.	Tifgreen	8.0	8.0	7.8	3.3	6.8
19.	Tifway	7.8	8.0	8.8	5.2	7.5
20.	Tifway II	7.5	7.8	8.7	5.2	7.3
21.	NMS-1	7.5	7.0	6.5	3.7	6.2
22.	NMS-2	7.3	6.8	6.5	3.8	6.1
23.	NMS-3	7.3	7.5	7.2	3.7	6.4
24.	NMS-4	7.7	7.2	7.0	3.5	6.3
25.	NMS-14	7.2	6.7	6.3	3.7	6.0
26.	Az Common	6.8	5.8	5.7	2.8	5.3
27.	Guymon	5.5	5.8	5.8	2.7	5.0
28.	FB-119	7.5	7.2	7.2	4.7	6.6
		7.2	7.1	7.2	3.9	

1986 RESULTS:

Superior seasonal quality was exhibited by the cultivars CT-23, Tifway, Tifway II. As with the tall fescues, much of this difference is due to good fall color retention compared to other entries. 1987 data includes spring green-up, and it will be interesting to note how these cultivars perform with respect to that parameter. The poorer quality Bermudagrasses included most of the seeded types such as Guymon and Arizona common, as well as Vamont (Table 1).

Table 2. 1986 Color ratings (1-9) of the National Bermudagrass Cultivar Trials at the Rocky Ford Turfgrass Research Plots.

	Cultivar	August	September	October	Overall
1.	CT-23	6.7	7.0	5.2	6.3
2.	NM-43	7.0	7.2	3.0	5.7
3.	NM-72	7.3	8.0	3.8	6.4
4.	NM-375	7.5	8.2	4.3	6.7
5.	NM-471	7.2	7.8	3.5	6.2
6.	NM-507	7.7	8.0	4.3	6.7
7.	Vamont	6.7	6.3	3.7	5.6
8.	E-29	6.7	6.6	3.8	5.7
9.	A-29	5.8	6.5	3.0	5.1
10.	RS-1	7.3	7.0	3.3	5.9
11.	MSB-10	8.0	8.2	5.3	7.2
12.	MSB-20	7.0	7.2	2.8	5.7
13.	MSB-30	8.0	8.3	3.5	6.6
14.	A-22	7.8	7.5	3.8	6.4
15.	Texturf	8.0	7.3	3.7	6.3
16.	Midiron	6.5	6.7	2.0	5.1
17.	Tufcote	7.7	6.3	3.2	5.7
18.	Tifgreen	7.2	7.0	2.8	5.7
19.	Tifway	7.9	8.5	5.2	7.2
20.	Tifway II	7.7	8.3	5.7	7.2
21.	NMS-1	7.2	6.7	3.5	5.8
22.	NMS-2	8.2	7.2	3.8	6.4
23.	NMS-3	7.5	7.5	3.8	6.3
24.	NMS-4	7.7	7.5	3.7	6.3
25.	NMS-14	7.2	6.3	4.0	5.8
26.	AZ Common	7.0	6.5	3.2	5.6
27.	Guymon	6.7	6.3	2.5	5.2
28.	FB-119	7.5	7.3	4.7	6.5
		7.3	7.3	3.8	

Some of the components of quality are listed in Tables 2 and 3. Tifway and Tifway II retained good fall color relative to the other entries, whereas Midiron, Guymon, and MSB-20 were very quick to lose color in late season. Density ratings varied considerably between genotypes. Again Tifway, Tifway II, Tifgreen, and MSB-10 ranked very high exhibiting a close-knit turf. The seeded cultivars Guymon and Arizona common did not exhibit desired density (Table 3).

Table 3. 1986 Density Ratings (1-9), Texture Rating (1-9), and Seedhead Estimates (% of plot) of the National Bermudagrass Cultivar Trials at Rocky Ford Turfgrass Research Plots.

	Cultivar	Density	Texture	Seedheads
1.	CT-23	7.8	7.5	0
2.	NM-43	8.0	7.8	2
3.	NM-72	7.5	7.0	42
4.	NM-375	7.3	7.0	30
5.	NM-471	7.5	7.3	35
6.	NM-507	7.5	7.1	33
7.	Vamont	5.2	4.9	7
8.	E-29	6.5	5.9	0
9.	A-29	6.8	6.3	18
10.	RS-1	6.5	5.8	20
11.	MSB-10	8.7	8.3	2
12.	MSB-20	8.0	8.2	2
13.	MSB-30	8.2	7.3	2
14.	A-22	7.7	7.8	3
15.	Texturf	7.0	6.3	0
16.	Midiron	6.7	6.2	10
17.	Tufcote	7.3	7.3	3
18.	Tifgreen	8.0	8.1	3
19.	Tifway	8.5	8.2	2
20.	Tifway II	8.3	8.5	2
21.	NMS-1	6.7	6.5	3
22.	NMS-2	6.2	6.1	3
23.	NMS-3	7.5	7.3	18
24.	NMS-4	7.2	6.8	13
25.	NMS-14	6.3	5.9	8
26.	AZ(Common	5.5	4.9	0
27.	Guymon	5.2	4.8	0
28.	FB-119	7.3	7.0	22

Finest leaf texture was exhibited by Tifway II, Tifway, Tifgreen, MSB-10, AND MSB-20. Coarsest leaf texture was evident from Vamont, Guymon, and Arizona common. Production of seedheads is a distraction to turf quality. Cultivars producing the most seedheads included NM-72, NM-375, NM-471, and NM-507. Many cultivars produced little, if any, seedheads (Table 3).

Excellent results were obtained using the winter covers. The temperature data presented shows that a 10-15 degree (F) gain in daily soil surface temperature could be obtained by using these covers. Figures 1 and 2 show the first 10 days of February 1987 as an example. The covers have little effect on the mimimum daily soil surface temperature, however (Figure 2). The gain in daily soil surface temperature is closely related to the amount of incoming solar radiation, as shown in Figure 3. It appears that these covers would be useful in Kansas where many winter season days are bright, but in climates where the incoming solar radiation levels are poor, it seems doubtful that such clear differences could be realized.

The additional heat under the winter covers translated into much more growth of the protected turf (Figures 4 and 5), both in terms of spring coverage and biomass ratings. Late season fungicide treatments had little effect on spring coverage and spring biomass ratings (Figures 6 and 7).

TEMPERATURE DATA

Date	Air Temp Max (°F)	Air Temp Min (°F)	Total Solar Rad. (LY)	Soil Temp-2" Max (°F)	Soil Temp-2" Min (°F)	Mean Wind speed (mph)	Soil Surface Temp Uncovered Max	Soil Surface Temp Uncovered Min	Soil Surface Temp Covered Max	Soil Surface Temp Covered Min
JANUARY										
1	41	22	252.2	39	33	6.8	40	20	52	26
2	48	16	206.7	35	31	5.2	40	10	48	20
3	40	25	115.9	40	34	2.9	35	10	42	20
4	43	17	177.5	34	32	4.8	34	10	38	18
5	51	31	220.4	41	33	11.6	36	12	44	21
6	44	35	183.3	41	35	12.9	39	19	40	22
7	38	21	136.6	41	33	6	33	29	41	21
8	36	19	76.6	34	32	1.9	30	19	33	19
9	37	26	64.6	34	34	6.1	30	23	32	24
10	37	13	112.1	34	34	12.5	30	28	34	30
11	40	10	301.6	34	34	4.8	30	20	35	25
12	55	26	303.6	34	33	3.1	30	20	35	25
13	61	31	315.0	41	33	4.2	39	25	48	28
14	48	34	222.5	44	33	7.5	52	26	54	28
15	36	20	132.6	35	33	12.8	49	30	51	32
16	42	16	133.5	33	32	12	32	28	34	29
17	40	10	106.6	32	32	5.5	33	27	36	31
18	32	4	275.1	33	32	6.3	33	30	34	31
19	42	8	200.4	33	33	6	33	31	34	33
20	36	13	331.9	33	33	6.1	40	20	43	23
21	45	20	270.4	33	33	10.5	45	34	54	36
22	34	18	309.6	33	33	10	48	32	59	34
23	38	11	329.2	33	31	6.5	54	23	58	26
24	40	12	235.3	33	28	7	44	18	50	22
25	40	10	281.1	33	27	5.7	44	30	48	32
26	40	13	340.6	33	27	4.9	48	18	54	22
27	54	24	348.1	32	28	4.4	--	--	--	--
28	49	24	243.3	32	31	6.7	--	--	--	--
29	58	35	329.3	37	32	9.8	--	--	--	--
30	56	30	372.6	44	32	5.5	48	38	67	40
31	57	33	215.2	44	33	7.6	67	32	72	34
FEBRUARY										
1	64	38	343	55	37	3.1	55	29	76	32
2	64	38	314.8	51	36	6.7	52	34	68	36
3	51	27	340.1	48	34	5.4	54	30	64	32
4	45	33	71.8	40	34	8.6	44	32	50	34
5	36	33	30	37	35	6.5	36	34	39	35
6	52	30	268.9	51	35	5.8	54	32	67	34
7	66	28	406.5	52	33	4.4	58	32	78	30
8	48	24	410.1	47	33	11.7	54	26	69	30
9	50	18	370.4	42	31	7	54	26	70	28
10	61	28	389.3	52	33	3.4	62	30	80	32
11	69	29	418.7	55	34	4.2	64	32	80	34
12	66	28	421.6	58	34	3.2	68	34	84	36
13	63	34	230.7	54	38	4.8	64	41	68	42
14	50	39	89.4	47	41	7.6	44	35	48	36

(cont.)

Date	Air Temp Max (°F)	Air Temp Min (°F)	Total Solar Rad. (LY)	Soil Temp-2" Max (°F)	Soil Temp-2" Min (°F)	Mean wind speed (mph)	Soil Surface Temp. Uncovered Max	Soil Surface Temp. Uncovered Min	Soil Surface Temp. Covered Max	Soil Surface Temp. Covered Min
FEBRUARY										
15	42	29	24.2	44	55	12.7	36	32	39	34
16	36	25	188.5	39	34	10	39	30	44	32
17	39	23	338.1	39	33	9.3	44	28	54	30
18	41	17	323.2	40	31	2.7	56	34	66	32
19	46	19	409.3	45	32	3.5	58	34	68	36
20	48	27	271.1	46	34	3.8	60	32	70	34
21	54	26	453.1	50	33	4.9	--	--	--	--
22	40	23	471.2	48	33	6	--	--	--	--
23	57	23	465.7	50	33	8.3	--	--	--	--
24	56	35	281.1	50	38	7.1	--	--	--	--
25	52	40	109.9	46	41	7.2	--	--	--	--
26	56	41	184.3	49	42	10.2	--	--	--	--
27	44	40	64.8	45	42	9.9	--	--	--	--
28	42	35	31.5	43	38	15.9	--	--	--	--
MARCH										
1	51	32	490.2	51	35	9.4	--	--	--	--
2	66	29	517.7	58	35	4.4	--	--	--	--
3	68	34	510.8	60	36	6.3	--	--	--	--
4	72	39	478.8	58	38	7.3	79	28	80	33
5	73	41	537.7	67	40	4.3	78	36	98	38
6	79	40	543.8	70	42	4.8	79	32	78	35
7	72	45	549.9	65	44	6.1	78	29	94	32
8	69	35	355.4	59	41	8.4	79	30	96	36
9	36	29	132.6	44	38	14.6	43	30	45	32
10	43	25	528.5	56	35	7.2	75	26	79	30
11	53	19	573.7	60	34	3.2	74	19	80	22
12	63	30	564.3	63	36	4.6	76	26	85	28
13	68	41	553.1	63	41	10.3	76	28	85	32
14	71	46	478.0	67	47	10.1	78	41	86	42
15	48	40	122.5	52	46	8.7	54	40	56	42
16	47	39	51.3	46	44	11.7	44	40	46	41
17	54	47	56.5	51	45	12.5	51	45	54	47
18	50	42	72.9	50	45	4.6	52	33	54	31
19	67	34	528.3	62	41	7.7	79	30	85	32
20	75	52	559.9	66	49	12.2	86	32	97	34
21	64	37	609.7	62	43	4.8	79	32	89	34
22	74	36	391.1	62	41	9.2	83	30	89	32
23	61	42	63.8	54	47	9.3	51	41	54	43
24	47	35	145.9	51	43	6.7	53	35	56	37
25	44	35	146.1	47	41	8.6	50	36	44	38
26	49	36	398.7	55	40	5.7	74	35	63	40
27	64	31	585.9	63	37	5.6	85	30	76	35
28	46	24	43	49	37	17.3	40	30	42	36
29	30	20	440.2	37	34	20.8	52	30	54	32
30	37	17	677.2	47	33	6.8	67	20	76	22
31	55	19	643.5	54	34	4.6	57	35	68	37

(cont.)

	Air Temp		Total	Soil Temp-2"		Mean	Soil Surface Temp.			
							Uncovered		Covered	
	Max	Min	Solar Rad.	Max	Min	wind speed				
Date	(°F)	(°F)	(Ly)	(°F)	(°F)	(mph)	Max	Min	Max	Min
APRIL										
1	57	32	514.1	53	37	12.1	89	30	93	32
2	41	25	685.7	53	35	10.6	84	24	96	28
3	51	21	598.6	56	34	4.4	98	18	100	22
4	58	23	702	64	35	3.5	96	20	100	22
5	60	24	703	64	37	5.3	99	22	100	29
6	55	36	240	52	42	6.5	72	36	76	32
7	73	39	710	66	42	6.0	88	30	90	32
8	77	35	703	71	43	4.1	96	32	98	34
9	77	40	654.6	70	45	6.5	94	36	96	38
10	65	42	714	69	47	5.4	96	34	100	38
11	58	38	690.3	66	46	8.2	97	36	100	36
12	58	34	255	55	44	6.6	72	34	77	34
13	53	47	68.2	52	49	13.2	55	43	59	45
14	50	47	71.7	49	48	16.9	49	45	52	46
15	64	45	640	62	47	10.6	76	45	80	47
16	82	39	746	74	44	2.9	91	42	100	44
17	87	47	729	78	50	4.1	93	44	100	46
18	90	53	714	80	54	8.1	90	54	96	52
19	93	69	691	83	61	12.9	86	56	99	57
20	78	53	335.6	73	60	11.4	84	59	93	60
21	62	42	660.4	69	55	10.7	77	52	88	54
22	65	39	713	71	49	6.6	86	29	98	38
23	79	39	789	75	50	5.2	--	--	--	--
24	82	43	784	80	52	6.0	--	--	--	--
25	87	56	778	81	57	6.7	--	--	--	--
26	90	59	797	84	59	6.2	--	--	--	--
27	80	47	791	80	61	9.6	--	--	--	--
28	81	41	785	81	54	4.8	--	--	--	--
29	90	63	785	84	60	6.7	--	--	--	--
30	84	58	781	86	61	7.8	--	--	--	--

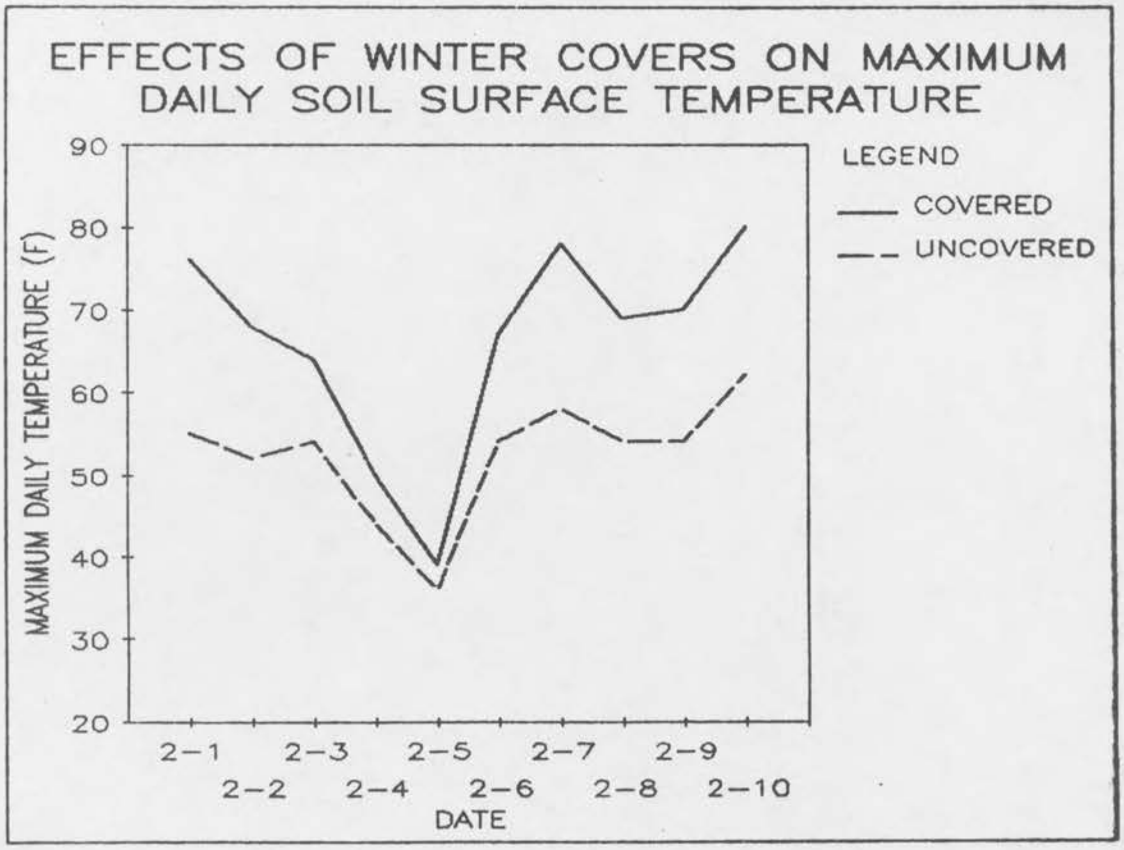


Figure 1

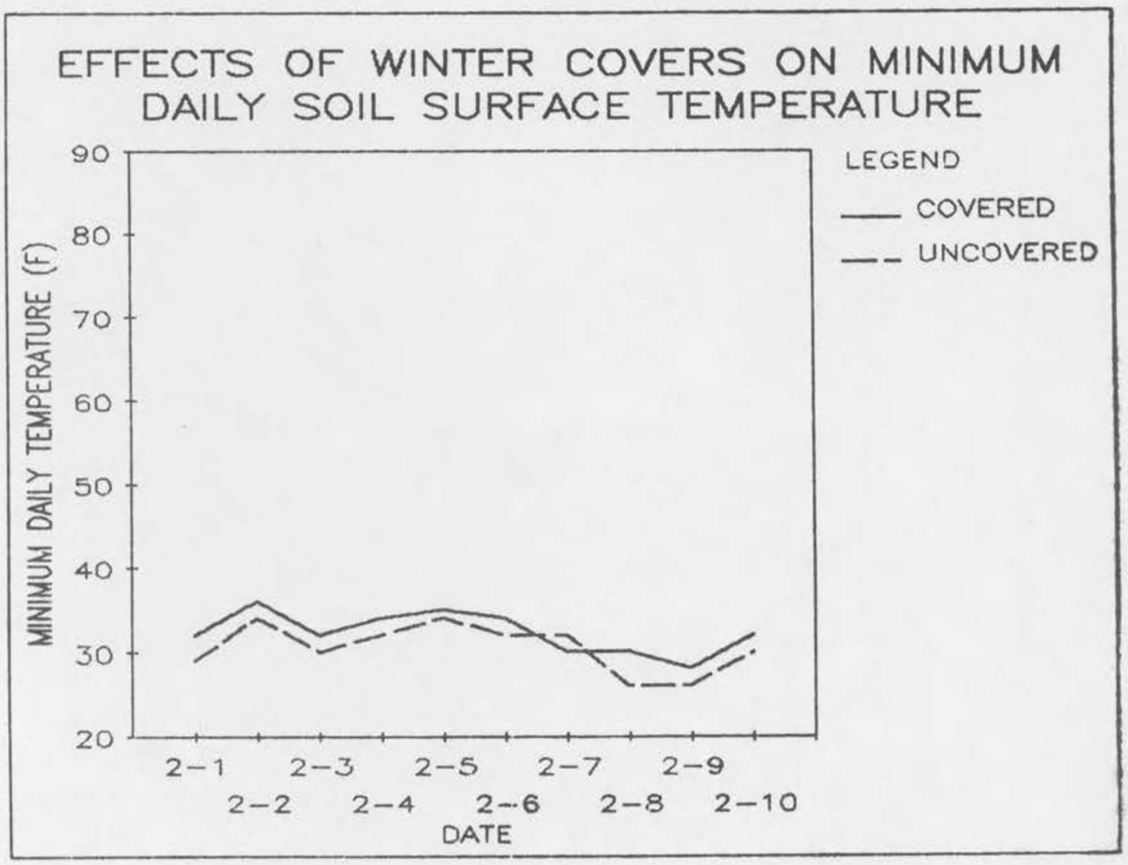


Figure 2

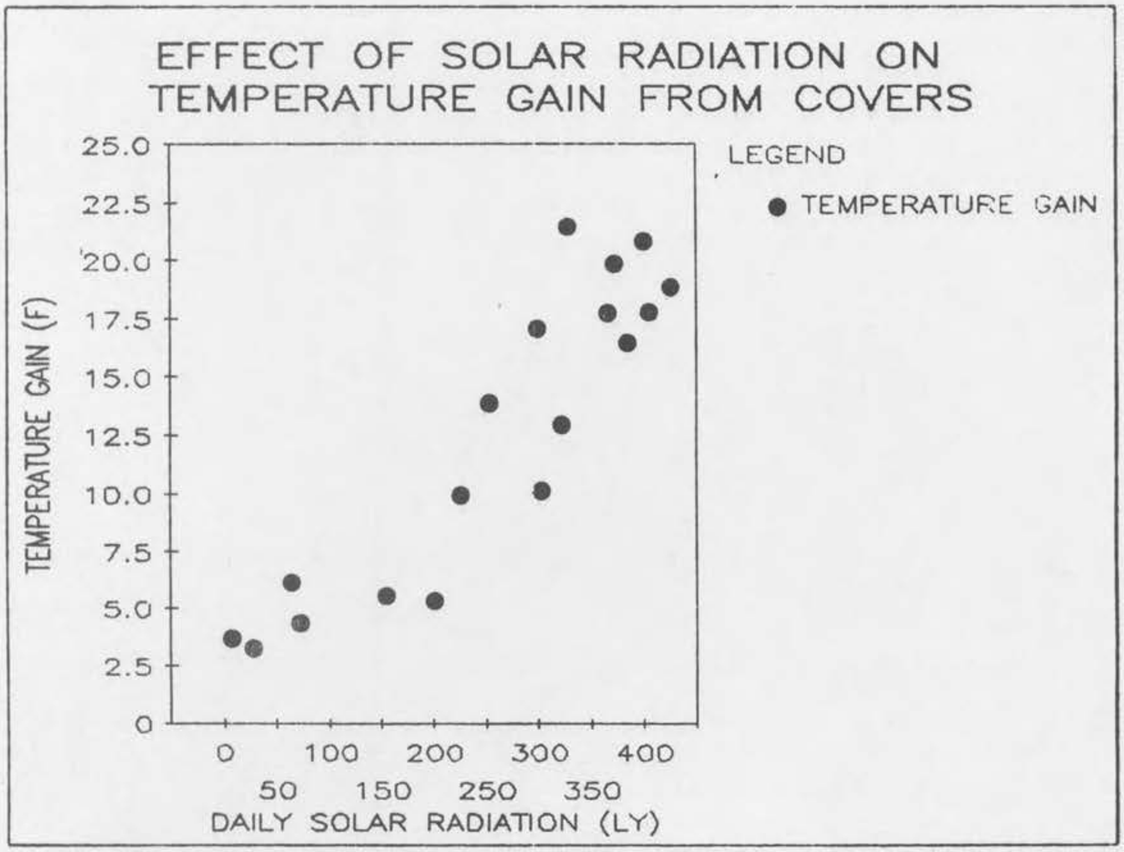

EFFECT OF SOLAR RADIATION ON
TEMPERATURE GAIN FROM COVERS
LEGEND
TEMPERATURE GAIN
TEMPERATURE GAIN (F)
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0
0
50
100
150
200
250
300
350
400
DAILY SOLAR RADIATION (LY)

Figure 3

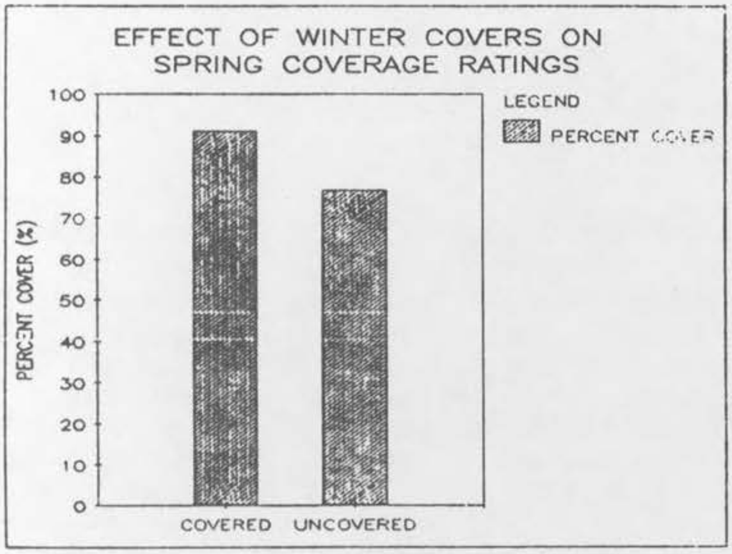


Figure 4

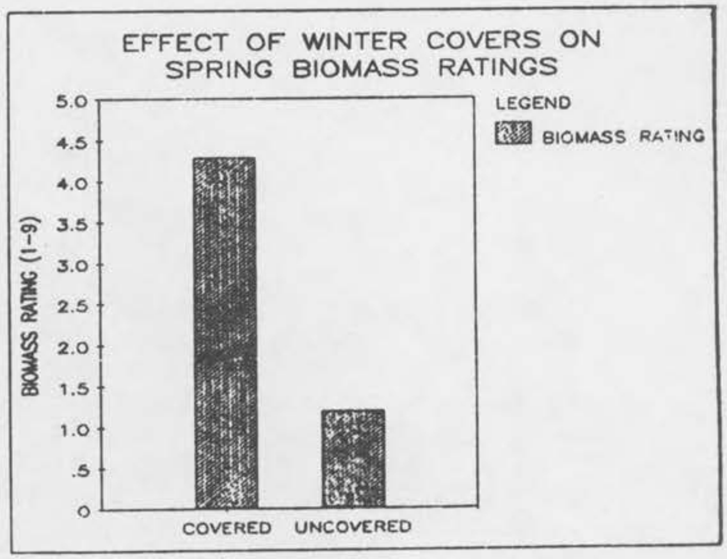


Figure 5

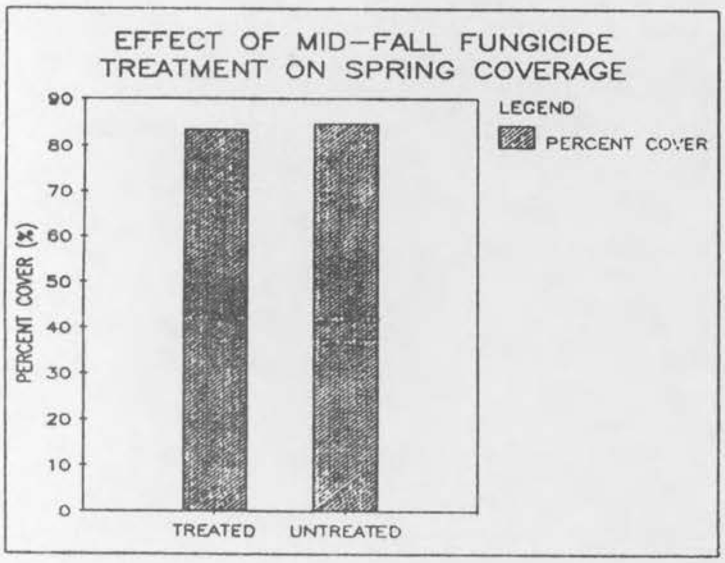


Figure 6

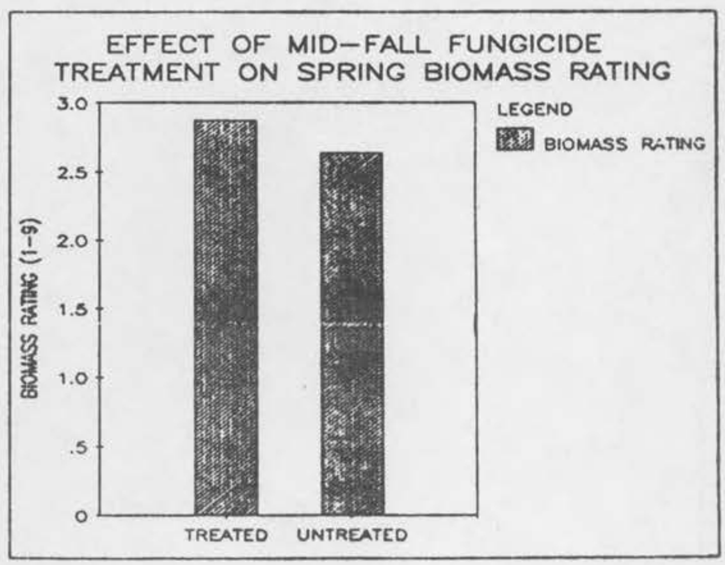


Figure 7

SPRING DEAD SPOT FUNGICIDE TRIALS 1986-1987

Ned A. Tisserat
Extension Specialist - Plant Pathology

Spring dead spot is one of the most serious diseases of Bermudagrass in Kansas. The disease results in the formation of roughly circular or arc-like patches of dead turf in the spring. Recent research at Kansas State University indicates that a _Leptosphaeria_-like fungus is responsible for the disease. Our research indicates that the fungus is active in the fall and that much of the turf damage occurs during this time period. Therefore, chemical control measures should be directed at stopping fungal colonization in autumn.

A fungicide plot was established in September 1986 in Wichita. A Bermudagrass lawn (Kansas Improved) was treated with eight fungicides in randomized complete block design with 4 replicates. Each plot was 10 x 10 ft. All fungicides were applied with a CO_2 backpack sprayer at 30 lb psi delivering the fungicide to each plot in 2 liters of water. All plots were irrigated immediately after application with approximately one-half inch of water. Ratings of the number of spots per plot and the percentage of each plot damaged by the disease were made in May 1987.

Disease pressure in all plots was considered to be high during the testing period. There was considerable variation in the number of spots even between replicates of the same treatment. None of the fungicides gave complete control of the disease. Plots treated with iprodione, fenarimol and propiconazol had fewer spots than control plots, although differences were not significant. Other fungicides tested did not appear to improve turf quality when compared to non-treated plots.

None of the fungicides tested in this study gave acceptable levels of control of spring dead spot. Further tests will be conducted in 1987 to determine whether additional fungicide applications will improve disease control.

TREATMENT**	RATE (oz.) 1000 sq. ft.	AVERAGE # SPOTS/PLOT	AVERAGE % AREA INFESTED
Iprodione (50WP)	4	4.1 ab*	4.0 a
Propiconazol (1.1E)	2	2.9 a	5.0 a
Fenarimol (50WP)	2	2.9 a	4.6 a
Triadimefon (25WP)	2	5.9 abc	9.4 ab
BAY HWG 1608 (25WP)	2	5.1 abc	11.7 ab
Control		6.5 abc	9.0 ab
Control		6.5 abc	11.1 ab
Thiophanate-ethyl (50F)	6	8.8 bcd	16.0 bc
Thiophanate-methyl (50WP)	6	10.3 cd	17.9 bc
Benomyl (50WP)	6	12.3 d	22.1 c

* Column means followed by same letter are not significantly different (P=0.05) by FLSD test

** Iprodione (Chipco 26019), Propiconazol (Banner), Fenarimol (Rubigan), Triadimefon (Bayleton), Thiophanate-ethyl (Cleary's 3336), Thiophanate-methyl (Fungo), Benomyl (Tersan 1991).

TITLE: Enhancement of Strip-Sodded Zoysia Establishment by Chemical Means

OBJECTIVES: To test various triazine herbicides and growth retardants for their effectiveness to enhance the rate of fill of strip-sodded Zoysia into established Kentucky bluegrass turf.

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician

INTRODUCTION:

In recent years the use of Zoysia for golf course fairways in the transition zone has gained popularity with golfers and turfgrass managers alike. Zoysia forms a very dense turf and has relatively few insect and disease problems. In addition, Zoysia does not require as much nitrogen fertility and irrigation as most other turfgrasses. With rising fertilizer and water costs, this is an important consideration for turfgrass managers.

Zoysia is established predominantly by vegetative means using sprigs, plugs, or strip sod. Zoysia sod is expensive, however, which prohibits full coverage sodding operations in most cases. Strip sodding has gained popular acceptance for Zoysia establishment because less sod is required to establish a given area. Fill of Zoysia is often slow requiring up to three years for complete coverage depending on the amount of sod used and its spacing, as well as cultural care after the sodding operation.

MATERIALS AND METHODS:

A modified sod cutter was used to remove 3-inch wide trenches on 15-inch centers of mature 'Park' Kentucky bluegrass on June 19, 1986 at the Rocky Ford Turfgrass Research Plots. Mature Zoysia was cut into 3-inch wide strips and transplanted into these trenches. On July 2, 2 X 2 meter plots were treated with various chemical treatments to retard the growth of the Kentucky bluegrass in hope to favor Zoysia competition and subsequent fill. These chemical treatments are listed below.

1. Control, no chemical treatment
2. Embark 2S at 1.5 pints per acre (label rate)
3. Embark 2S at 0.75 pints per acre (half label rate)
4. Embark 2S at 0.38 pints per acre (quarter label rate)
5. Cutless 50 WP at 3 lbs per acre (label rate)
6. Cutless 50 WP at 1.5 lbs per acre (half label rate)
7. Cutless 50 WP at 0.75 lbs per acre (quarter label rate)
8. Limit F at 2.5 quarts per acre (label rate)
9. Limit F at 1.75 quarts per acre (half label rate)
10. Limit F at 0.63 quarts per acre (quarter label rate)
11. Atrazine 80 WP at 1.25 lbs per acre
12. Atrazine 80 WP at 0.63 lbs per acre
13. Atrazine 80 WP at 0.32 lbs per acre
14. Simazine (Princep) 80 WP at 1.25 lbs per acre
15. Simazine (Princep) 80 WP at 0.63 lbs per acre
16. Simazine (Princep) 80 WP at 0.32 lbs per acre

RESULTS:

Treatments 11 and 14 (atrazine and simazine) resulted in a little faster Zoysia spread into established Kentucky bluegrass at the end of the first growing season (Figure 2). Although these treatments offered somewhat faster Zoysia spread, the quality of the Kentucky bluegrass was completely destroyed and the usefulness of those treatments for fairway conversion is not recommended. The other treatments with less devasting effects on the Kentucky bluegrass, however, did not effectively enhance the spread of Zoysia. Treatments 9, 10, and 13 (Limit at half and quarter label, and atrazine at the 0.32 lbs per acre rate) show promise mid-way through the 1987 season and they will be monitored closely.

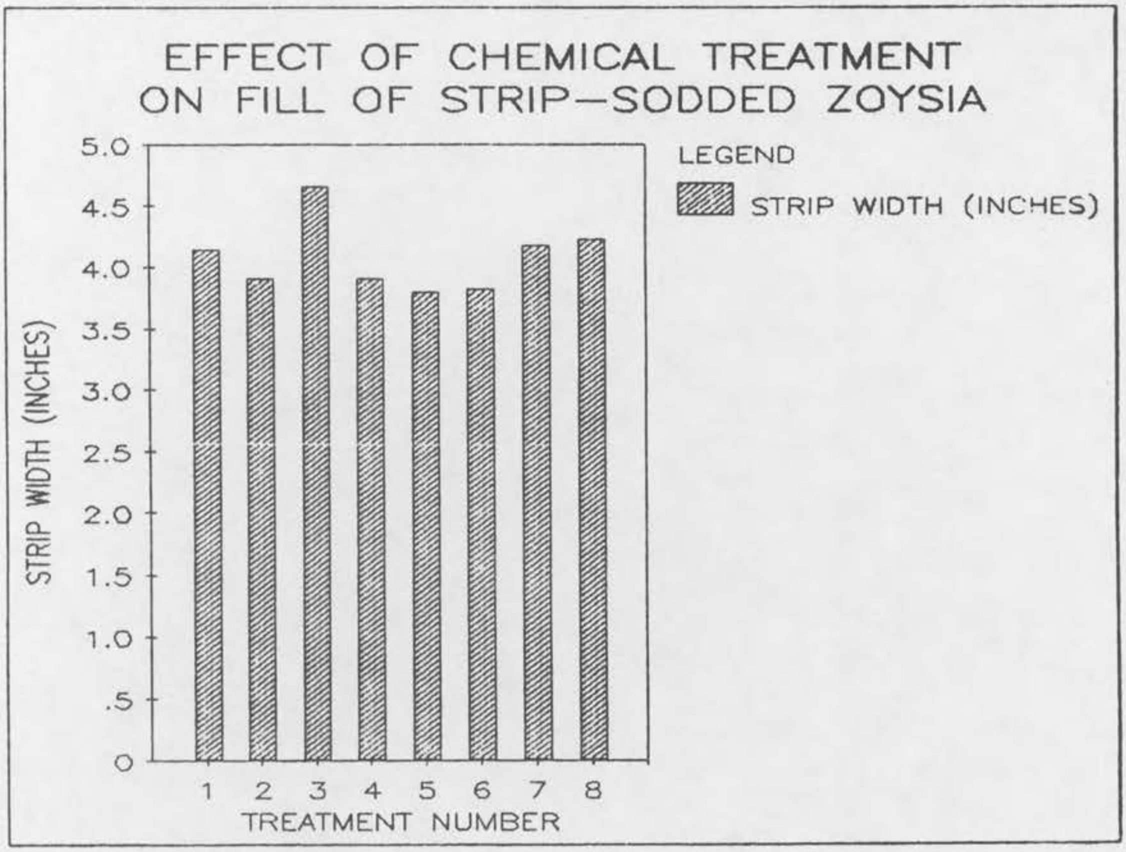


Figure 1 - End of season, 1986

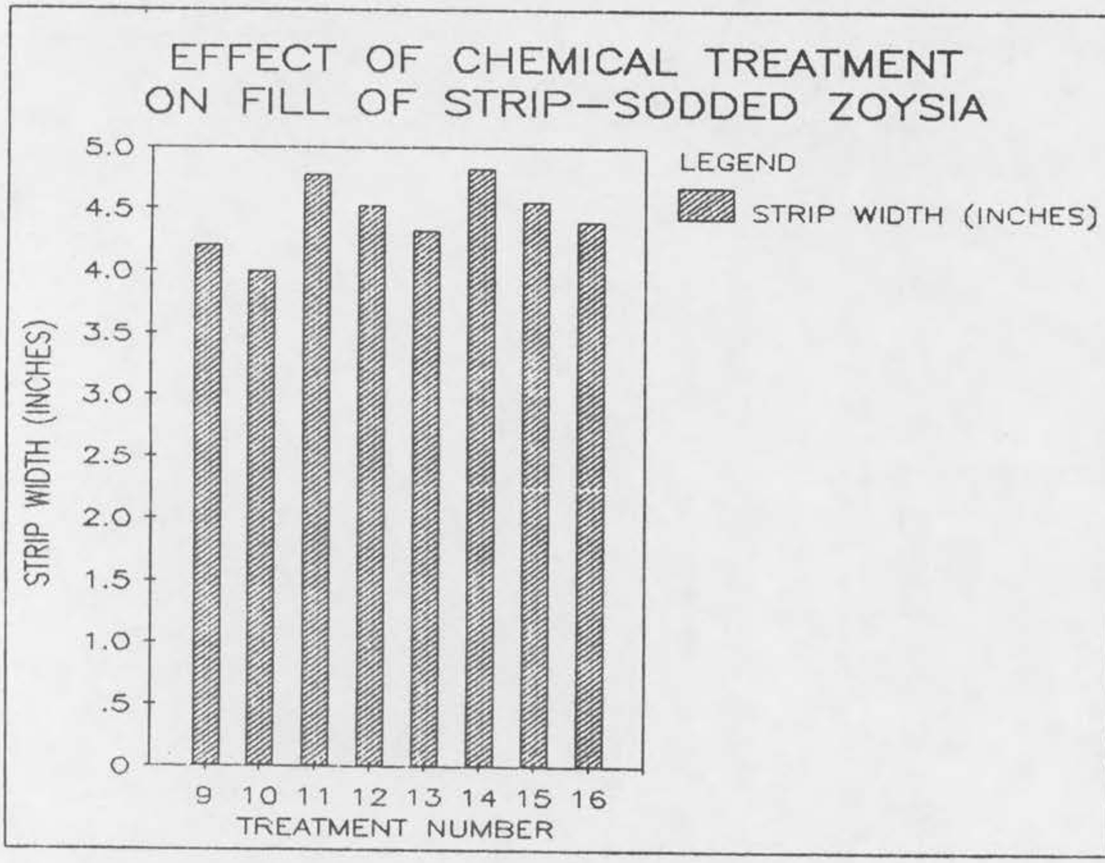


Figure 2 - End of season, 1986

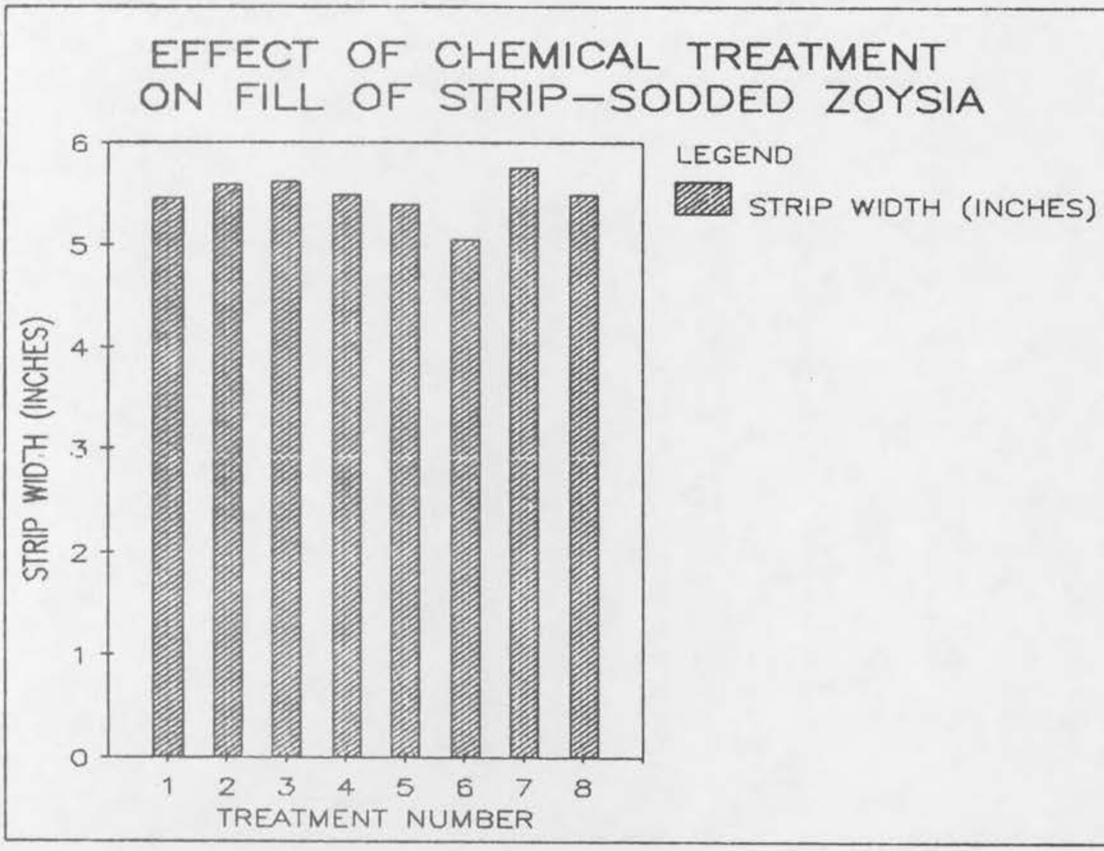


Figure 3 - July, 1987

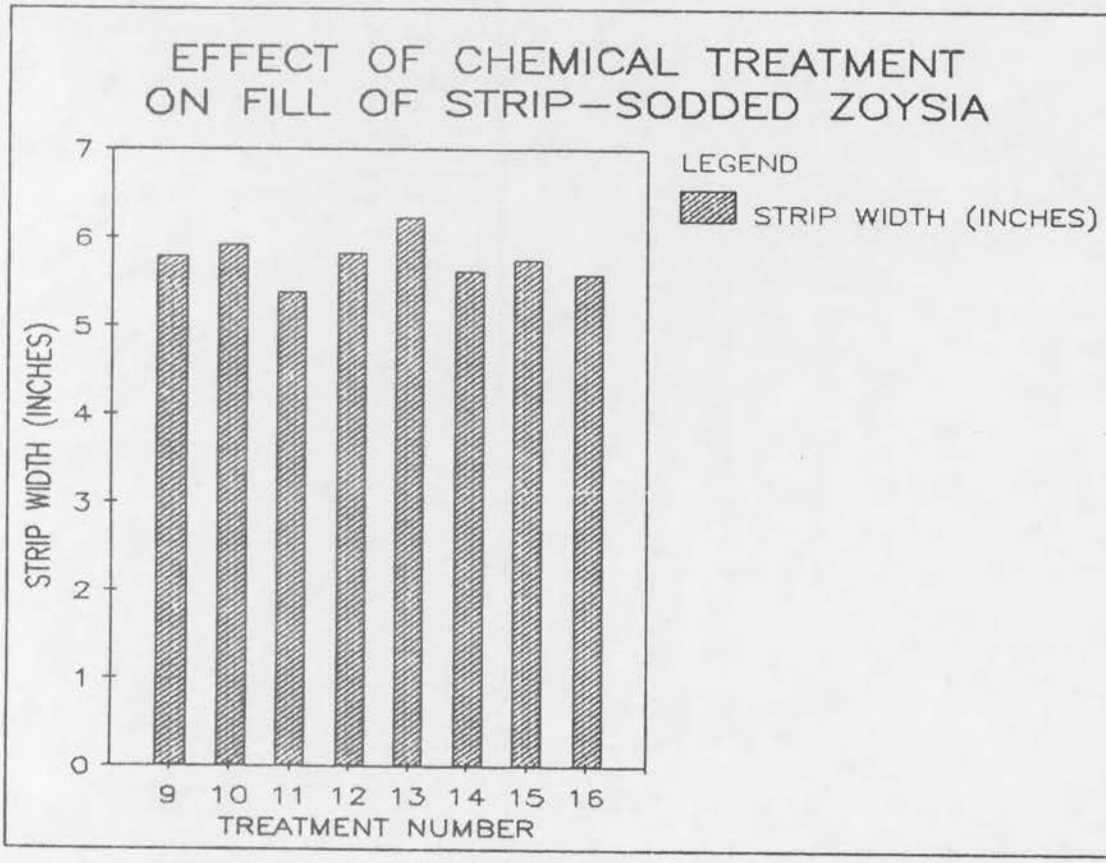


Figure 4 - July, 1987

TITLE: Enhancement of Strip-Sodded Zoysia Establishment by Placement of Nitrogen Fertilizer

OBJECTIVES: To test whether the spread of strip-sodded Zoysia into established Kentucky bluegrass can be enhanced by fertilization of Zoysia just prior to cutting or by variouis placement of urea or ureaform during the strip sodding operation.

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician

FUNDING: Kansas Turfgrass Foundation
Nor-Am Corporation, Bob Staib, Technical Representative

INTRODUCTION:

Zoysia has become a popular choice for golf course superintendents for use on fairways in the transition zone. Establishment of Zoysia is almost always accomplished by vegetative means which can result in up to three years from the establishment operation until 100% fill. Any means which could be utilized to speed up the rate of Zoysia establishment would be a great benefit for transition zone turf managers.

MATERIALS AND METHODS:

A modified sod cutter was used to remove 3-inch wide trenches on 15-inch centers of mature 'Park' Kentucky bluegrass on June 19, 1986 at the Rocky Ford Turfgrass Research Plots. mature Zoysia was cut into 3-inch wide strips and transplanted into these trenches. The following nitrogen fertilizer treatments were used in the experiment:

1. Control (no fertilizer)
2. Nitroform banded in trenches at 1 lb N per 1000 sq ft
3. Nitroform banded in trenches at 2 lb N per 1000 sq ft

4. Nitroform broadcast at 1 lb N per 1000 sq ft before sodding

5. Nitroform broadcast at 2 lb N per 1000 sq ft before sodding

6. Nitroform broadcast at 1 lb N per 1000 sq ft after sodding

7. Nitroform broadcast at 2 lb N per 1000 sq ft after sodding

8. Urea banded at 1 lb N per 1000 sq ft in trenches

9. Urea broadcast at 1 lb N per 1000 sq ft before sodding

10. Urea broadcast at 2 lb N per 1000 sq ft after sodding

11. Urea applied to Zoysia sod at 1 lb N per 1000 sq ft 7-10 days before cutting sod strips

12. Urea applied to Zoysia sod at 2 lb N per 1000 sq ft 7-10 days before cutting sod strips

RESULTS:

Data taken on the spread of Zoysia by measuring strip width is provided in Tables 1 and 2 for the end of the 1986 season and Table 3 and 4 for July of 1987. Unfortunately, no significant differences were found between treatments, although treatments involving Nitroform broadcast after transplanting either at the 1 or 2 lb of N rate, urea banded at 1 lb N in trenches, and urea broadcast at 1 lb N before sodding rated high.

The lack of significance may be due to the rates of N used. This information may imply that these rates were too low, particularly in the case of the slow releasing Nitroform. The management of mature Zoysia calls for relatively low rates of nitrogen (1-2 lbs N per 1000 square feet per year). However, when establishing Zoysia, this data suggests that higher rates are necessary to significantly enhance the spread of Zoysia from strip sodding.

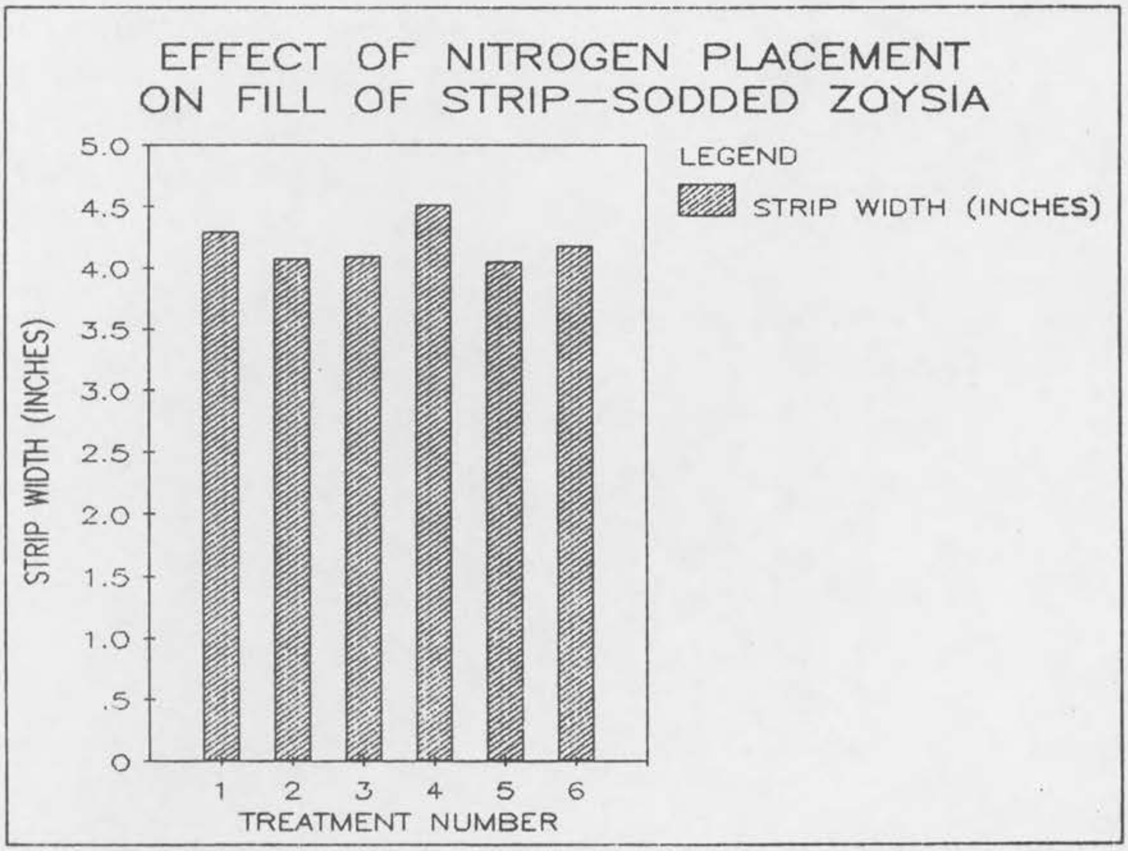


Figure 1. End of 1986 growing season data.

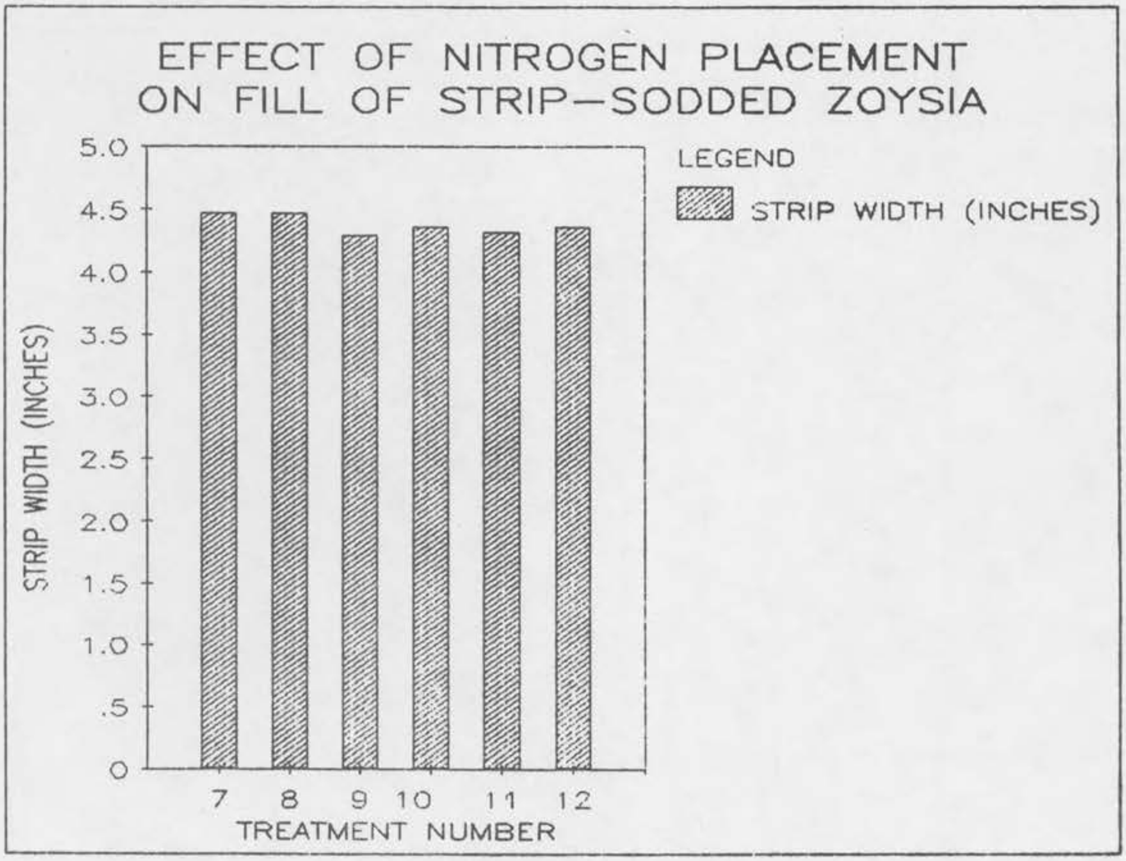


Figure 2. End of 1986 growing season data.

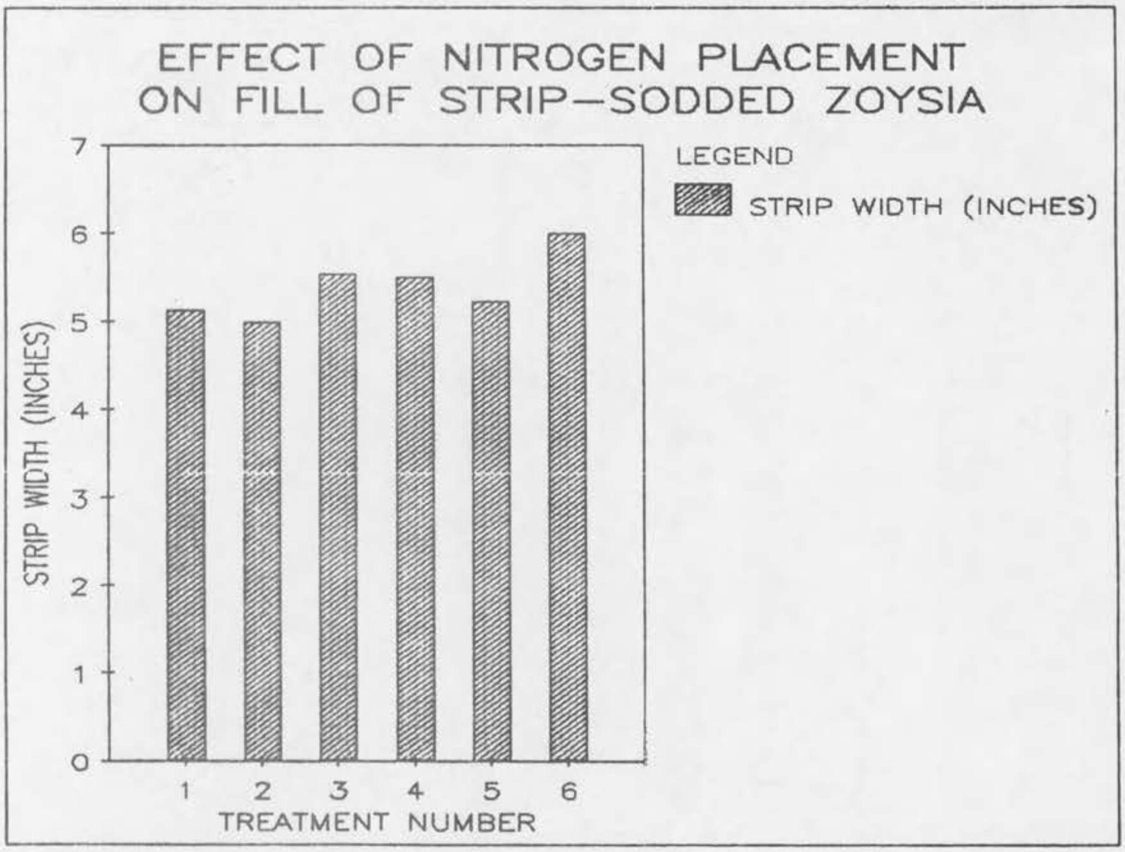


Figure 3 - July, 1987

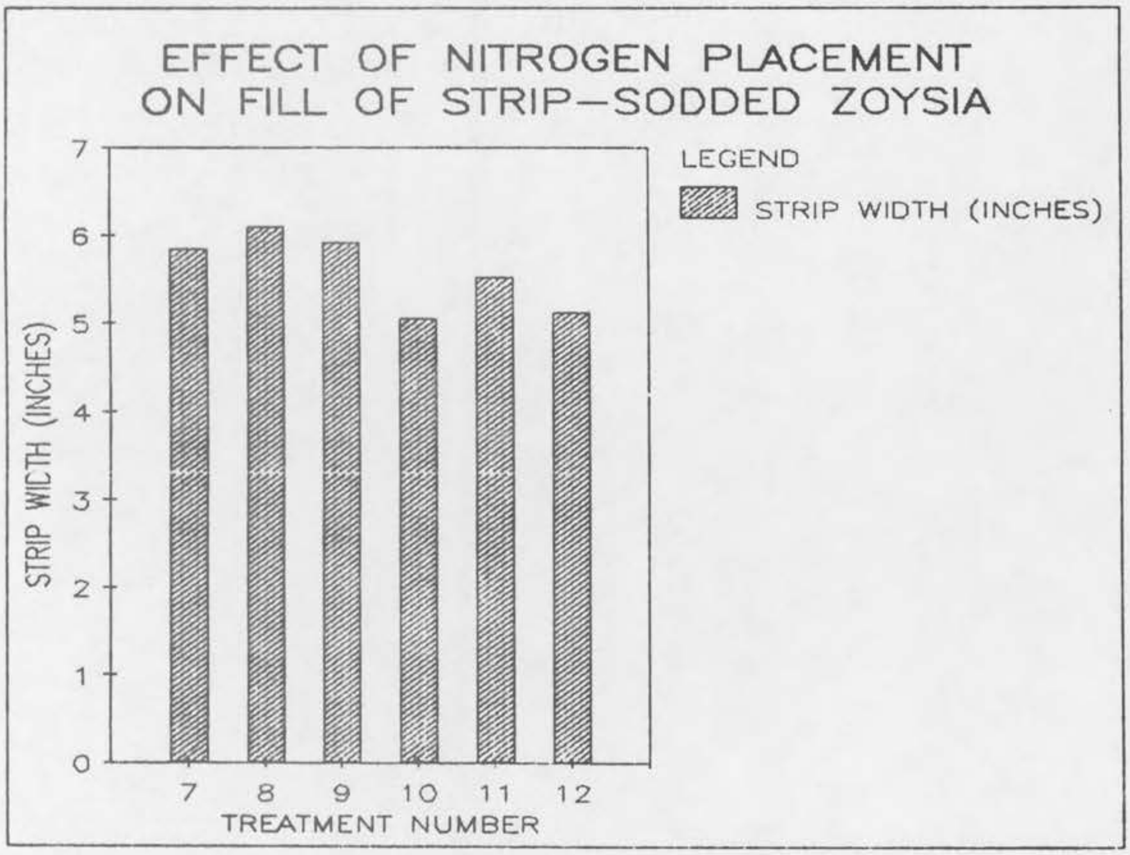


Figure 4 - July, 1987

TITLE: Effects of Various Premergent Herbicides on the Establishment of Strip-Sodded Zoysia

OBJECTIVES: To test various premergent herbicides for their potential inhibition of the lateral spread of Zoysia from strip sodding.

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician

FUNDING: Cranmer Nursery, Wichita

INTRODUCTION:

Weed control is necessary when establishing Zoysia from a strip sodding operation. It is important to establish what chemical control is least harmful to Zoysia, however, since the lateral spread of Zoysia is slow taking up to three years for complete coverage. Several chemicals are available to the turfgrass manager for annual weed control, but they exhibit a range of growth inhibition to non-target species. This experiment was designed to determine which premergent chemicals are least inhibitory to the lateral spread of Zoysia.

MATERIALS AND METHODS:

Mature 'Meyer' Zoysia was obtained from Cranmer Nursery (Wichita) and cut into 3-inch wide strips. These strips were transplanted into bare soil on 12-inch centers. Sixteen treatments were applied 1 week after transplating including half label and full label rates of Dacthal, Ronstar, bensulide, Balan, pendamethalin, Tupersan, simazine, and two non-treated controls. The experiment utilizes a Randomized Complete Block Design with 16 treatments each replicated 3 times. It is located in Section III of the Rocky Ford Turfgrass Research Plots. Rate of fill will be recorded during the 1986 and 1987 growing seasons.

TITLE: Growth and Water Use of Meyer Zoysiagrass As Influenced by Chemical Growth Regulators.

OBJECTIVE: To investigate whether growth regulators can increase water use efficiency while increasing lateral growth of zoysiagrass.

PERSONNEL: Pam Borden, Graduate Research Assistant
Ron Campbell, Turfgrass Research

FUNDING: Hatch 039

INTRODUCTION:

Turfgrasses are selected for planting based upon a variety of considerations. The anticipated persistance and quality of the turf and the rate of establishment are of primary importance. Rapid establishment is desired for soil stabilization, minimized post-planting care, and overall utility of the site. Zoysiagrass is typically established vegetatively, usually planted by plugs or sprigs. It is extremely slow to establish, thus requiring special attention to weed control requirements. There is considerable interest in growing zoysiagrass in portions of Kansas due to its tolerance to cold, heat and drouth. This experiment was initiated to determine if growth regulators could be used to significantly shorten the establishment time of asexually propagated zoysiagrass.

MATERIALS AND METHODS:

Growth regulators used in a greenhouse study included GA_3 and ethephon (Ethrel) chosen for their ability to increase zoysiagrass growth and pacloburazol (Cultar), flurprimidol (Cutless) and XE-1019 (Prunit) which have reduced water use in other turfgrasses.

Single stolons of 'Meyer' zoysiagrass were planted in 1 quart containers of 85:15 sand:soil and allowed to establish 3 weeks before treatment. The growth regulators were applied by foliar sprays (GA_3, ethephon) or mixed with water and poured onto the media as a drench treatment (flurprimidol, paclobutrazol, XE-1019). The zoysiagrass was clipped weekly at 1" and the amounts of water required, determined by pot weight, was recorded. Eight weeks after treatment the stolons and all of their outgrowth were harvested. The length of each new stolon was measured and root and shoot dry weights determined.

RESULTS AND DISCUSSION:

Drench applications of paclobutrazol at 0.09 lbs a.i./A and XE-1019 at 0.18 lbs a.i./A increased total stolon length (sum of all stolons) measured by 65% (Figure 1). Sprays of ethephon at 2.32 and 4.64 lbs a.i./A increased total stolon length 55% while flurprimidol drenches increased total stolon length 57% over stolons grown in untreated pots. The XE-1019 and flurprimidol drench treatments reduced water use 13% and 24%, respectively, Figure 2, and increased water use efficiency (the amount of plant dry weight produced per unit of water used by the plant) Figure 3, in addition to showing potential for increasing lateral growth. Although all the other chemical treatments significantly increased total stolon length they also increased total water use and decreased water use efficiency. If duplicated in field trials these results suggest that soil drench treatments of XE-1019 and flurprimidol may well decrease establishment time and water use of sprigged zoysiagrass.

Figure 1.

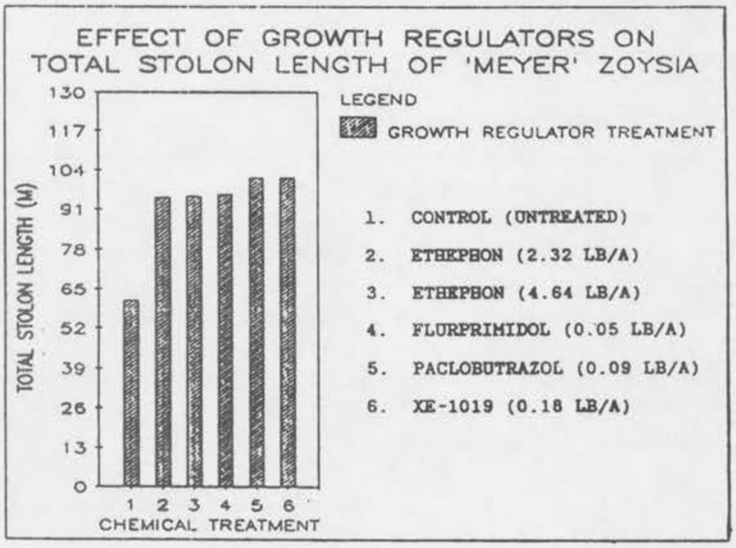


Figure 2.

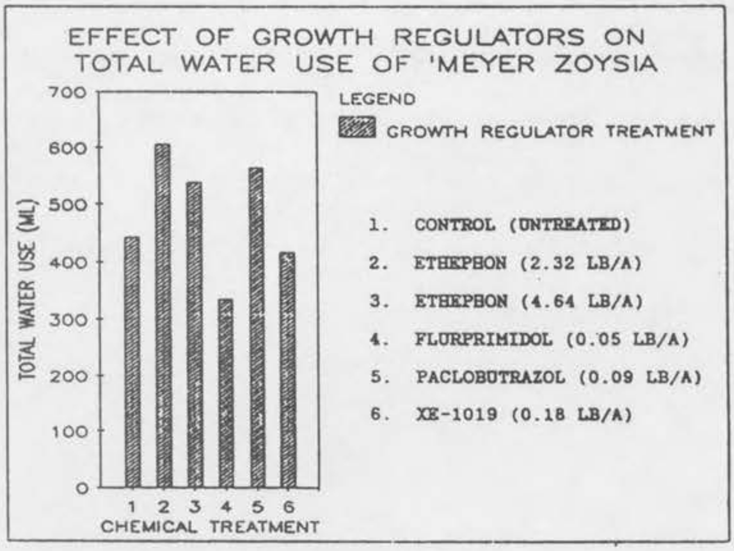
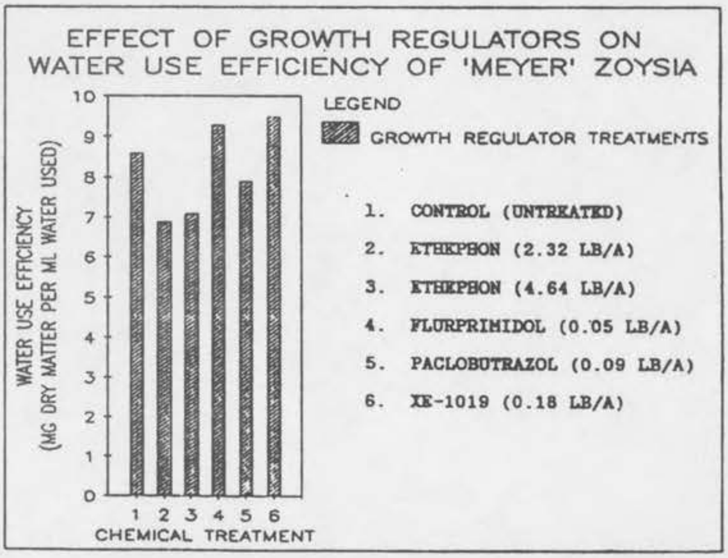


Figure 3.



TITLE: Postemergent Control of Broadleaf Weeds

OBJECTIVE: Test for effective herbicides to replace silvex as a general purpose broadleaf weed herbicide.

PERSONNEL: Ron Campbell, Turfgrass Research

FUNDING: Commercial Grants and Hatch 402

INTRODUCTION:

Various chlorophenoxy compounds both labelled and experimental, have been extensively tested in combination with other chemicals.

Postemergence herbicides are utilized to selectively control many broadleaf weeds in turf. These materials are systemic, absorbed through leaf and stem or root tissue, and transported throughout the plant to affect all parts; however good spray coverage is important. Bromoxynil, 2,4-D, Mecoprop (MCPP), and dicamba are frequently available in varying combinations. The chemical MCPA may be included in various combinations with the herbicides mentioned above. New promising broadleaf herbicides include Triclopyr and Starane 2. Triclopyr may be applied alone or in varying combinations with 2,4-D. Starane 2 has given good control of various hard-to-control weeds. The combinations listed above may also be tank mixed. When applied in combination, these materials exhibit a synergistic property, which may also cause injury to the turf. Optimum applications require moist, warm soil conditions for active weed growth. Postemergence herbicides must remain on leaf and stem surfaces for a period of time after application for thorough absorption. They should not, therefore, be applied prior to an anticipated rain. Also cool weather and/or dry conditions after application can minimize the effectiveness of postemergence herbicide applications. Most postemergence herbicides remain active long enough to prevent early reseeding or renovation of a turfgrass site. Very few postemergence herbicides have minimal soil activity and can be used in seedbeds to help control broadleaf weeds competing with turfgrass seedlings. Bromoxynil is an exception and may be used on seedling grasses such as Kentucky bluegrasses, perennial ryegrasses, most bentgrass cultivars and newly sprigged zoysiagrass to control several broadleaf species when applied in the early seedling stage.

Dicamba can cause injury to ornamental shrubs and trees and should not be applied near the root system of such species. Mecoprop and 2,4-D can injure flowers, vegetables, grapes, ornamental shrubs and fruit and ornamental trees through misapplication, as by wind-aided drift or volatile vapors.

This study was designed to determine the effectiveness of selected herbicides in controlling broadleaf weeds in a tall fescue and bluegrass stand at the Manhattan Country Club.

MATERIALS AND METHODS:

A field type compressed air sprayer equipped with a four foot boom was used to treat 4 x 8 foot plots of a mixed tall fescue and Kentucky bluegrass turf with 10 preemergence herbicides (Table 1). The plots were sprayed June 1 and were not irrigated but rainfall was adequate through May.

Table 1. Postemergent Herbicides Tested for Broadleaf Weed Control, 1987

Product Name	Common Name	Rate lbs a.i./A
1. EH 888* (Trimec 900)	MCPA/MCPP/Dicamba	1.2 + .55 + .125
2. Code 992 (Trimec Broadleaf)	2,4-D/MCPA/Dicamba	1.22 + .65 + .11
3. EH 883 (MCPA Tricec Ester)	MCPA/MCPP/Dicamba	0.76 + 0.76 + 0.20
4. EH 680 (Trimec Ester)	2,4-D/2,4-DP/Dicamba	0.75 + 0.75 + 0.195
5. EH 877 (MCPA Quadmec)	MSMA/MCPA/MCPP/Dicamba	3.06 + 0.82 + 0.82 + 0.20
6. EH 795 (Quadmec)	MSMA/2,4-D/MCPP/Dicamba	3.06 + 0.82 + 0.82 + 0.20
7. EH 869 (MCPA Trimec)	MCPA/MCPP/Dicamba	0.74 + 1.37 + 0.15
8. Code 896	MCPP/2,4-D/Dicamba	1.38 + .75 + .155
9. Turflon D	2,4-D/Triclopyr	1.0 + 0.5
10. Starane 2	Fluroxypyr	0.5

	Manufacturer
* Product 1-8	PBI/Gordon
" 9-10	Dow Chemical

RESULTS:

Results of the spray applications are presented in Table 2. Very good control was obtained with most of the herbicides. A wide range of broadleaf species were present. Included were Oxalis sp., broadleaf plantain Plantgp major, shepherds purse, Capsella Bursa-pastoris, black medic Medicago lupulina, dandelion Taraxacum officinale, common ragweed Ambrosia artemisiifolia, prostate spurge Euphorbia supina, daisy fleabane Erigeron annuus, horseweed Erigeron canadensis, wild carrot Daucus carota, and clover Trifolium repens.

Table 2. Broadleaf Weed Control, Manhattan Country Club, 1987

Treatment*	Rate lbs ai/A	Percent weed cover 6-17-87
Control	--	32 A[z]
Starane 2	0.50	1.5 B
EH 877	4.90	1.0 B
EH 883	1.72	0.75 B
Turflon D	1.50	0 B
EH 680	1.70	0 B
EH 795	4.90	0 B
Code 992	1.98	0 B
EH 888	1.87	0 B

*Plots sprayed 6-1-87

[z]Means in colums with the same letters are not significantly different by the Duncan's Multiple range test at the 5 percent level.

TITLE: Ornamental Grass Selections for Kansas

OBJECTIVE: To evaluate several ornamental grass species for their value and adaptability under Kansas conditions

PERSONNEL: Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician
John Pair, Horticulture Research Center, Wichita

INTRODUCTION:

Ornamental grasses have long been popular in Europe, but have been almost ignored for landscape use in the United States. This is difficult to understand since grasses have the ability to stand poor growing conditions and they flourish in many environments. In mid-May 1986, several ornamental grasses were transplanted from an area in Section II of the Rocky Ford Turfgrass Research Plots to an area close to the equipment storage building. These perennial grasses were in an early stage of seasonal growth and most transplanted well. Additional grasses were obtained from John Pair in Wichita and added to this collection in mid-June. Nitrogen at the rate of 1 lb per 1000 square feet was added as urea 3 weeks after transplanting for all grasses. General descriptions of these ornamental grass species is provided for some of the ornamental grasses planted at Rocky Ford.

Plume grass

Erianthus ravennae. Hardy USDA Zone 5, Clump fountain effect, up to 14 ft. Blooms late Sept-Oct. Full sun, fertilie soil. European import, light green. Tall silvery beige plumes, dries well, fine in arangements, does not scatter when dried.

Purple love grass

Eragrostis spectabalis. Hardy USDA Zone 5. 18-24 inches tall. Blooms July-August. Pleasing open form.

Spikelets are a fine shade of reddish purple - deeper shade in full fun. Likes sandy soil. Dries well, fine for winter arrangement, keeps very well. Excellent choice.

Maiden grass

Miscanthus sinensis 'Gracillinus'. Hardy USDA Zone 5. Clump form, dwarf form 3-5 ft. Non-dwarf 5-8 ft. Blooms early October, silvery white, reddish pink to red, persists in winter. Leaves long, narrow, light green, with white midrib texture fine. Form upright, arching, very graceful. Plumes excellent for drying, persist into spring in the field. Plant in full sun.

Striped Eulalia grass

Miscanthus sinensis 'Variegatus'. Hardy USDA Zone 6. Plant in protected site. Striped white and green longitudinally on leaves. Good plumes, nice choice.

Zebra grass

Miscanthus sinensis 'Zebrinus'. Hardy USDA Zone 5. Clump form, tall 6-8 ft. Full sun. Very tropical looking, yet hardy. Foliage striped horizontally or dashed with light cream on green leaves. Plumes large and show, pale yellow, light beige. Dries well, excellent for arrangement and can be dyed. Good screen or accent plant, very dramatic, tends to be overpowering. Full sun, takes damp soil, good creek-side choice.

Fountain grass

Pennisetum alopecuroides. Hardy USDA Zone 5. 2-4 feet tall, arching form. Plumes July to Oct. Does not dry well, tends to shatter. Use in summer arrangement with flowers. Plumes light reddish or coppery.

Ribbon grass

Phalaris arundinaceae 'Picta'. Hardy to USDA Zone 4. 2-4 feet tall. Blooms white, June-mid July. Foliage striped green and white, sometimes pinkish with upright open form.

Blue fescue

Ferstuca ovina 'glauca'. Hardy USDA Zone 4. 6-12 inches tall. Clum form, beautiful bluish bloom on leaves. Excellent in rock garden, border use. Full sun, well-drained soil. Avoid heavy wet soils.

TITLE: Evaluation of "dwarf" shrub cultivars

OBJECTIVE: Evaluate performance of several cultivars and species of low growing shrubs.

PERSONNEL: Robert Kenneson Jr., James Robbins, David Hensley and John Pair.

FUNDING: Donation of plant material by the following nurseries: Monrovia; Greenleaf; Lake County; Hines; Forrest Keeling; and Sunshine Farms.

INTRODUCTION:

Interest in new and different plants for use in commercial and residential landscapes is ever increasing. Nurserymen and designers are searching for improved plants to add new life to landscape designs and replace overused, standard selections.

Many low-growing or "dwarf" selections of deciduous and evergreen species have been introduced in recent years. These offer obvious advantages in terms of maintenance. The objectives of this planting were to become familiar with some of the newer material on the market and to determine their adaptability to our conditions. Companion plantings have also been established in Hays and Wichita.

The following are descriptions of the plants in this study:

1. Compact Oregon Holly (Mahonia aquifolium 'compacta')
   3' Tall upright and somewhat scraggly. Only one plant survived. Foliage ranged from green to yellow to red to brown.

2. Creeping Grapeholly (Mahonia repans)
   1.5' tall spreading stoloniferous plant with an erect branching habit. Spinet, holly-like foliage is dark glossy green turning red in late summer and persist into winter. Yellow flowers in spring followed by blue berries.

3. Dwarf Korean Lilac (<u>Syringa meyeri</u> 'Miss Kim')
Low growing lilac with very fragrant lavender blooms.

4. Dwarf Nandina or Heavenly Bamboo (<u>Nandina domestica</u> 'Harbor Dwarf') 3' x 3 1/2' very low, flat, spreading, dense habit. The medium to fine textured leaflets are glossy and green with a pink to bronze tinge in spring turning bright red to orange in the fall and winter.

5. Emerald Mound Honeysuckle (<u>Lonicera xylosteum</u> 'Emerald Mound') 3' x 4' coarse textured shrub with mounding habit. Dull, rich, green foliage emerges very early in the spring. Yellow-white flowers. Dark red berries in the fall.

6. Goldfinger Potentilla (<u>Potentilla fruticosa</u> 'Goldfinger') 4' x 4' nice small upright plant with an abundance of golden-yellow flowers 1 to 1 1/2 inches in diameter. Flowers are produced continuously from spring to fall.

7. Green-stem Forsythia (<u>Forsythia virdissima</u> 'Bronxensis') 1' x 3'. Very nice, dense, mounded habit. The heavily serrated, fine-textured foliage is yellowish turning green with maturity. Profuse, bright yellow blooms in early spring.

8. Inkberry (<u>Ilex glabra</u> 'Nordie') Only one plant survived. Up-right. Dark green foliage is similar to Boxwood but a bit larger. Not much shape due to winter injury, however new growth seems to be doing fine. It looks like it could be an attractive shrub with protection.

9. Ivory-Jade Euonymus (<u>Euonymus fortunei</u> 'Ivory-Jade') Dense, low-spreading form. Rich green foliage with ivory white margin. Can have a pinkish margin in cooler weather. All plants experienced much winter kill, but seemed to be coming back well.

10. Kobold Barberry (<u>Berberis thunbergii</u> 'Kobold') 2' x 2 1/2' this clean miniature plant forms a perfect mound without pruning small hard green foliage is characteristic of barberry foliage in summer turning yellowish or reddish in fall.

11. Little Princess Spirea (<u>Spiraea japonica</u> 'Little Princess') Very nice uniform mounding habit. Tiny serrated mint green foliage makes for a very fine textured plant. Rose-crimson blooms in summer cover the shrub offering a striking specimen. Even when flowers are spent. The stalks give a smokey-pink fringe to this very nice plant.

12. Lowboy Firethorn (<u>Pyracantha coccinea</u> 'Lowboy') Typical pyracantha "leggy" habit but more low growing. Rich, dark green foliage with bright orange berries in fall.

13. Minuet Weigela (Weigela florida 'Minuet')
Deciduous dark green foliage in spring with reddish purple tinge. Profuse deep pink flowers in early spring. All 3 plants had brown spots and holes on at least half of the foliage.

14. Monhub Spirea (Spiraea x Bumalda cv. Monhub)
Habit is much like S. japonica 'Little Princess'. Foliage is yellow green to yellow. Flowers are a pinkish purple.

15. Prostrate Broom (Genista pilosa 'Vancouver Gold')
Extremely low, mounding ground cover. Tiny dark green foliage. Looks like it could be a very nice plant but does not thrive well with competitive conditions. Yellow flowers in late spring.

16. Pyrenees Cotoneaster (Cotoneaster congestus)
Low mounded shrub with a tightly matted branching habit. Pink to white flowers. Fruit is bright red. Tiny dark green foliage, two out of three plants died completely, the other is 90% bare.

17. Scotch Broom (Cytisus x Praecox 'Allgold')
Very interesting plant. Tiny inconspicuous leaves grow on green slender stems. Bright yellow blooms grow along the stems in spring. During the rest of the year the shrub, appearing to be defoliated, is quite attractive.

18. Winter Gem Boxwood (Buxus microphylla 'Winter Gem')
Upright tidy boxwood that would make an excellent hedge. Soft green spring growth. The mature foliage is dark green and persistant through winter.

Mortality and condition of the shrubs are summarized in Table 1.

TABLE 1. Mortality during 1986 and 1987 and average quality evaluation during July 1987 for dwarf shrubs planted at Rocky Ford.

SPECIES	SURVIVAL 1986	SURVIVAL 1987	AVERAGE[z] QUALITY
Compact Oregon Grape Holly	1/3[y]	1/3	1.0
Creeping Grape Holly	3/3	2/3	1.6
Dwarf Korean Lilac	2/3	2/3	3.0
Dwarf Nandina (Heavenly Bamboo)	3/3	2/3	5.0
Emerald Mound Honeysuckle	2/3	2/3	4.0
Goldfinger Potentilla	2/3	2/3	4.0
Greenstem Forsythia	3/3	3/3	7.3
Inkberry	2/3	1/3	1.3
Ivory Jade Euonymus	3/3	3/3	2.0
Kobold Barberry	3/3	3/3	6.3
Little Princess Spirea	3/3	3/3	7.0
Lowboy firethorn	3/3	3/3	8.3
Minuet Weigela	3/3	3/3	3.6
Monhub Spirea	3/3	3/3	6.6
Prostrate Broom	3/3	3/3	1.3
Pyrenees Cotoneaster	3/3	1/3	0.3
Scotch Broom	3/3	3/3	7.0
Winter Gem Boxwood	3/3	2/3	4.0

[y]Denotes number remaining of the three replicates planted.

[z] Quality evaluation based on a scale of 0 to 9, with 0 = Dead and 9 = Excellent condition.

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