# 1989 TURFGRASS RESEARCH

KANSAS TURFGRASS FOUNDATION

REPORT OF PROGRESS 574

**Agricultural Experiment Station • Kansas State University, Manhattan • Walter R. Woods, Director**

# FOREWORD

First of all, let me extend a hearty welcome to all you turfgrass colleagues from the Kansas State University turfgrass team. 1988 was a very difficult year to manage turf, with drought conditions dominating Kansas for the entire growing season. We can only hope that Mother Nature will provide us with a little less difficult 1989 growing season!

I think we may look back at 1989 and agree that it was the year that KSU Turfgrass Research "turned the corner" in our goal of becoming a much improved turf research facility. Dr. Walter Woods, Dean of the College of Agriculture, has approved a request for funds to build a new pumping system for the Rocky Ford Turfgrass Research Plots. We are awaiting bids at the time of this writing. The specifications call for a pumping capacity of 250 gpm, which will enable us to have sufficient water to start the next stage of improvement--construction of a completely automatic, underground irrigation system for the entire turf research facility. Currently, only about one fifth of the total plot area has underground irrigation. Obviously, this represents a quantum leap forward, and one that is long overdue.

Another very encouraging aspect of the turfgrass research program that has gained a lot of momentum this last year is the graduate program. We are fortunate to have some very high quality graduate students pursuing advanced degrees from Kansas State, and this Fall two more graduate students will join the team. With the constraint of available time that professors have to devote to individual projects, the scope and depth of turfgrass research is expanded greatly with a strong graduate program.

Our goal, as always, is to make the Kansas State University Turfgrass Research program the best it can be. Your efforts ranging from product donations, research grants, personal involvement in the research green construction, communicating research ideas, and involvement with one or more of the professional turfgrass organizations, are extremely appreciated. 1988 moved us closer to our goal. 1989 should turn the corner!

Sincerely,

Jeff



Dr. Jeff Nus
Assistant Professor
Turfgrass Science

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Brand names are used to identify products. No endorsements are intended nor is any criticism implied of similar products not mentioned.

Contribution No. 89-503-S from the Kansas Agricultural Experiment Station.

**Kansas Turfgrass Industry Builds New Green at Rocky Ford**

The Heart of America Golf Course Superintendents Association decided during its November, 1987 board meeting to launch a cooperative effort with members of Kansas State University, the Kansas Turfgrass Foundation, and the Kansas Golf Course Superintendents Association to add an additional 13,000 square feet of USGA spec research putting to the Rocky Ford Turfgrass Research Plots. The goal of the project was to build this green totally with donations of equipment, products, manpower, and expertise from the Kansas turfgrass industry. It proved to be quite an undertaking!

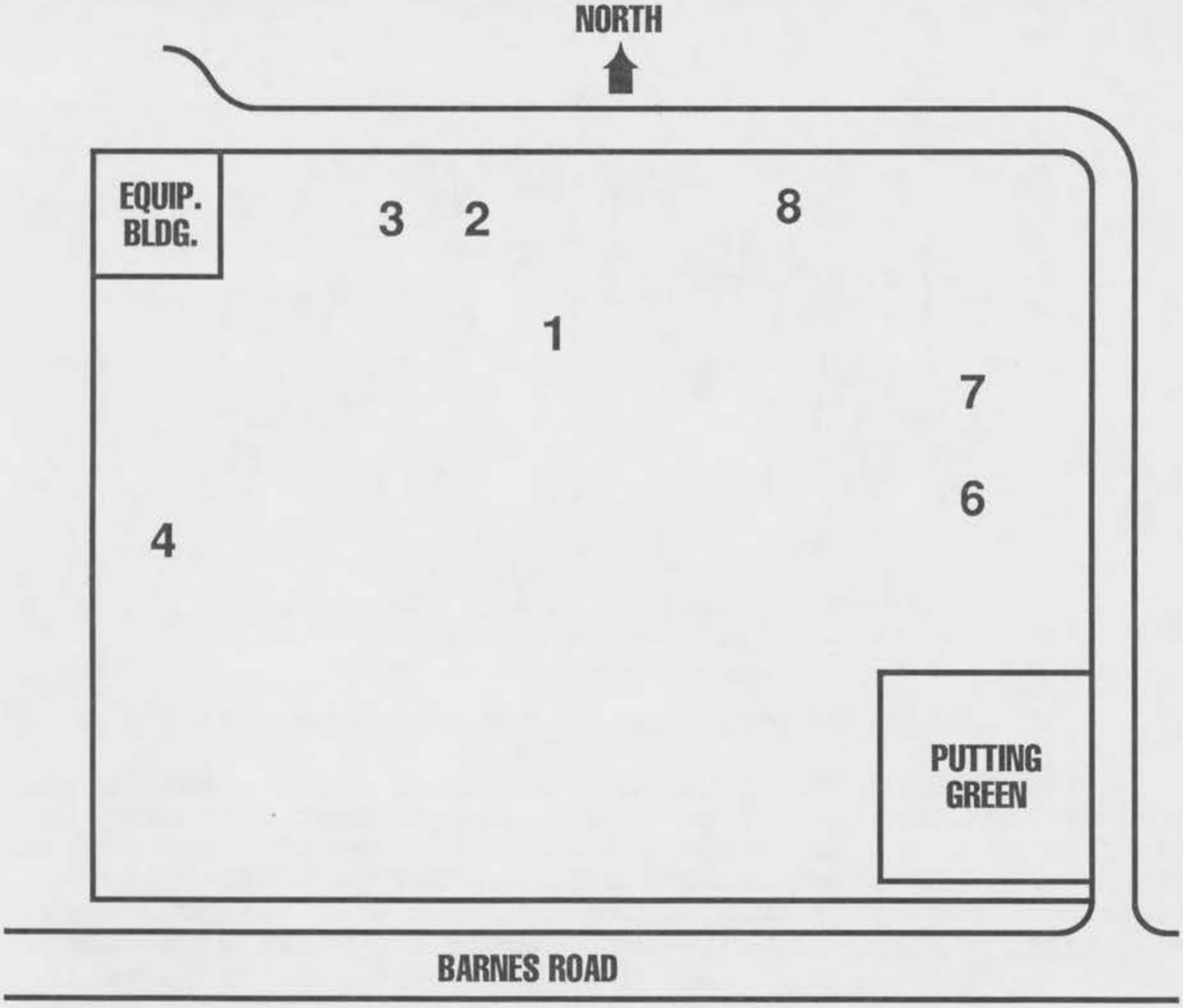
Groundbreaking began in February (Fig. 1) and construction continued at a rapid pace through the month, relying on volunteers from the industry and university to give up their weekends to add needed area for bentgrass research. The overall project was coordinated by Sandy Queen (CGCS, Overland Park Golf Course)_, but the magnitude of the project required the cooperation of many members of the Kansas turfgrass industry. Irrigation lines and heads were set in March (Fig. 2) and the area was ready for the subsurface layer of pea gravel (Fig. 3). This was no small order, since the Manhattan area does not have peat gravel of the size and shape that the USGA specifies. Over 330 tons of pea gravel were trucked from Kansas City to complete this phase of construction.

Once the pea gravel was finished to a final grade, a 2-inch layer of coarse sand was wheel barrowed onto the site by KSU turfgrass students. (I was able to successfully convince them of the importance of getting involved in this project, if they were expecting good Turf Science grades that semester! I called it "hands-on" experience"; my students called it "slave labor"!)

Once the coarse sand had a final grade, it was time for mixing the

mason sand with sphagnum peat. Unfortunately, it was one of the coldest days of the year when we mixed the 400 bales of peat with about 700 tones of sand, but spirits were up anyway (Fig. 4) and pre-mixing (Fig. 5) began. A soil shredder/pulverizer was used to final mix the premix and throw it out onto the green area (Fig. 6). As enough final mix accumulated, it was pushed into place and compacted (Figs. 7 and 8).

The list of donations of products, equipment, manpower, and knowhow was impressive indeed. Products and supplies alone totaled nearly $30,000. This project is proof of what can be accomplished if the will is there. We have finished two experiments on the established bentgrass already, and have plans for many, many more, including a national cultivar test involving about 15 bentgrass genotypes. This effort has greatly increased our capability for bentgrass research, and let me say on behalf of Kansas State University, thank you most sincerely for a job well done.




**Research Stops**

1. Weed Control Investigations in Kentucky Bluegrass (Roch Gaussoin)

2. Topsoil Replacement Study (Jeff Nus)

3. Spring Dead Spot Study (Ned Tisserat)

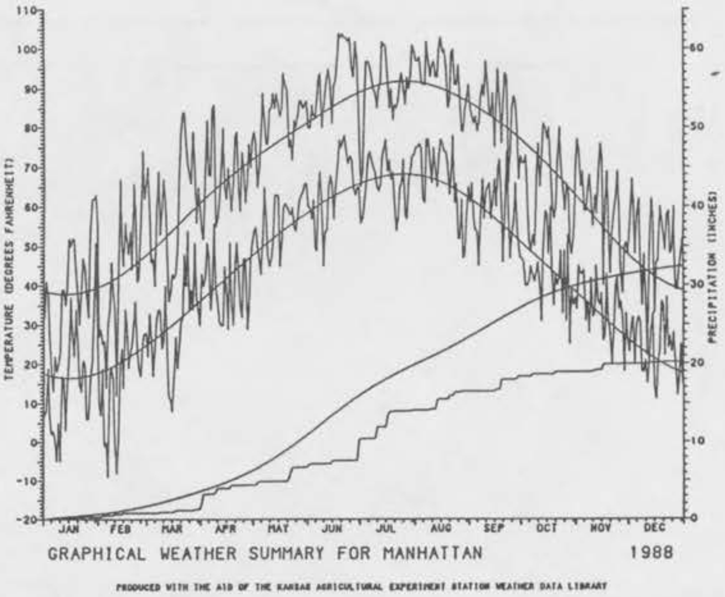
4. Alternative Turfgrass Species for Possible Future Use in Kansas (Bryan Unruh)

5. Influence of Potassium Rates and Mowing Height on Bentgrass Quality, Putting Speed, and Canopy and Rootzone Temperatures (Paul Haupt)

6. Use of Cross-Linked Polyacrylamide Gels to Extend Irrigation Intervals and Improve Safety Parameters of Sports Fields (Mike Boaz)

7. Potassium Influence on Drought Tolerance of Kentucky Blue-grass (Mike Sandburg)

8. NTEP Tall Fescue Cultivar Evaluations (John Pair and Larry Leuthold)




## Annual Weather Summary for Manhattan: 1988

This year was the seventh driest year since precipitation observations began in 1858. Surprising to most Manhattanites is that two of those drier years occurred as recently as 1963 and 1966. The annual mean temperature was not much above normal, but there were several months during the year with abnormal readings.

Precipitation: Every month during the year, except April, had below normal precipitation totals. Fortunately for this area, timely rains occurred during the growing season. This prevented the local crops from being as devastated as those in extreme northeast Kansas. Summer rains were extremely variable this summer - occurring on one side of town, and not on another. Two instances are recalled when the Manhattan airport reported over 2 inches of rain, while the station within the city recorded less than 0.1 inch. The most severe dry weather occurred in the last part of the year; very little rain fell after September 20. Since growing activity was slowed during this period, the effects of this dry period were not apparent. However, much of the soil moisture has been depleted, leaving little reserve to start the 1989 crop season.

Temperature: Although the mean temperature of the year was near normal, the average maximum (daytime) temperature exceeded normal by about 5 degrees in May, June, November, and December. In June temperatures of $100^{\circ}$F of greater were recorded on 8 days. This was unusually early in the year for such temperatures. In all, 18 days had temperatures of $100^{\circ}$F or greater. The highest temperature was $104^{\circ}$F on June 21. The lowest temperature for the year occurred on February 6 ($-9^{\circ}$F). The last $32^{\circ}$F freeze occurred on April 16 and the first one in the fall occurred on October 12. That gave a freeze-free period of 179 days, which is only one day short of the mean length.

Snowfall: Snowfall was less than normal again in 1988. Most of the snow fell in February and March. No major interruptions of travel or work occurred because of snow.

Storms: No significant storms occurred in our area during the year.

**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
Mike Sandburg, Turfgrass M.S. candidate

**INTRODUCTION:**

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 the fall of 1981 and has received standard fertility treatments. The experiment utilizes a randomized complete block design with 11 treatments, which are replicated three times each. Nitrogen applications are applied five times per season (early April, mid-May, late August, mid-October, and early December). Each nitrogen application is at the rate of 1 lb of actual nitrogen per 1000 sq ft. Nitrogen sources 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), Green Magic (AgroChem, 20-0-2), IBDU (fine, 31-0-0), IBDU (coarse, 31-0-0), Escote 100 (40-0-0), and Escote 200 (40-0-0); and an unfertilized check also was included. Quality parameters being recorded include monthly quality ratings, thatch accumulation at the end of the season, rooting depth, and verdure measurements.

**RESULTS:**

Figure 1 shows green-up ratings for different nitrogen fertilizers used in this study. Fine-graded IBDU and sulfur-coated urea resulted in superior spring green-up ratings compared to the other sources tested. LSD (0.05) equaled 0.65 for spring green-up.

Table 1 shows seasonal quality ratings by month for each nitrogen source. Overall means are also given. Again, fine-graded IBDU and SCU provided the best quality bluegrass in the study. All treatments were superior to the untreated check, but their performances were variable.

Figure 1.

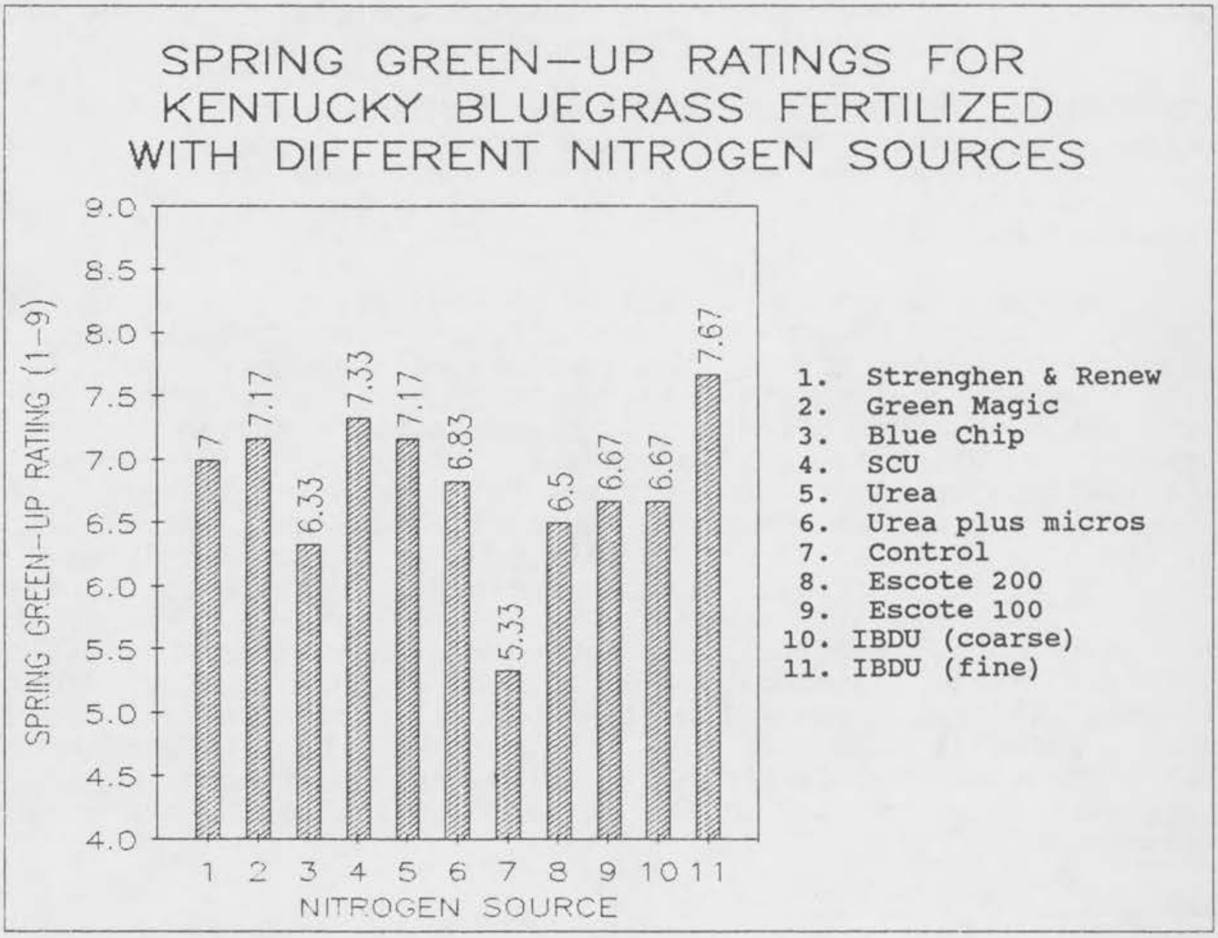



Table 1. Average monthly and seasonal quality ratings for a Newport-Park-Delta Kentucky bluegrass blend fertilized with different nitrogen sources.

| Nitrogen Source | Apr | May | Jun | Jul | Aug | Sept | Nov | Overall |
|---|---|---|---|---|---|---|---|---|
| Strength & Renew | 7.50 | 7.50 | 7.33 | 6.67 | 7.17 | 7.83 | 7.50 | 7.36 |
| Green Magic | 8.17 | 7.33 | 7.67 | 7.17 | 7.00 | 7.50 | 7.00 | 7.41 |
| Blue Chip | 7.33 | 7.17 | 7.67 | 7.00 | 7.50 | 7.17 | 7.67 | 7.36 |
| SCU | 8.83 | 8.33 | 8.50 | 7.33 | 8.33 | 7.50 | 8.33 | 8.16 |
| Urea | 9.00 | 8.17 | 7.50 | 7.33 | 7.33 | 7.50 | 8.00 | 7.83 |
| Urea + micros | 8.83 | 8.17 | 8.00 | 7.17 | 7.50 | 7.17 | 7.33 | 7.74 |
| Control | 6.00 | 5.50 | 6.67 | 6.00 | 6.50 | 6.50 | 5.67 | 6.12 |
| Escote 200 | 7.33 | 7.83 | 8.00 | 7.67 | 7.33 | 8.17 | 7.83 | 7.74 |
| Escote 100 | 7.50 | 7.83 | 8.50 | 7.83 | 7.67 | 8.17 | 7.50 | 7.86 |
| IBDU (coarse) | 7.50 | 7.50 | 8.00 | 7.50 | 8.00 | 7.83 | 7.17 | 7.64 |
| IBDU (fine) | 8.83 | 8.00 | 8.67 | 7.83 | 7.50 | 8.33 | 8.33 | 8.21 |
| LSD 0.05 | 0.59 | 0.73 | 0.60 | 0.88 | 0.97 | 0.76 | 0.70 | |

**TITLE:** National Kentucky Bluegrass Cultivar Trial

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

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

**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. Trails were initiated in both Manhattan and Wichita to test Kentucky bluegrass genotypes from the National Turfgrass Evaluation Program for their adaptability to Kansas conditions.

**MATERIALS AND METHODS:**

Manhattan

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 sq ft per season and were irrigated to prevent severe water stress. Data collected included a subjective monthly quality rating (1-9, 9 = best).

Wichita

A trial of 72 cultivars and experimental numbers was established on September 18, 1985. Plots were maintained at 4 lbs N/1000 sq ft per year, mowed at 2 1/2 in with clippings removed, and irrigated to prevent excessive stress. Team (Balan/Treflan) was applied in April and June to prevent crabgrass.

**RESULTS:**

Performance of Kentucky bluegrass cultivars at Manhattan and Wichita is shown in Tables 1 and 2, respectively. Best performing cultivars at Manhattan were Able I, Blacksburg, Challenger, Aspen, America, and Midnight (Table 1). Best Kentucky bluegrass quality in Wichita was obtained with the cultivars Blacksburg, Midnight, P-104, Victa, America, Challenger, Cheri, Destiny, Eclipse, Glade, Sydsport, Nassau, and Ba 73-626 (Table 2).

Table 1. Mean turfgrass quality ratings of Kentucky bluegrass cultivars in the 1985 National Kentucky bluegrass test at Manhattan, KS. 1988 data.

| Exp. No. or Cultivar | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | MEAN |
|---|---|---|---|---|---|---|---|---|---|---|
| ABLE I | 8.7 | 8.3 | 7.7 | 7.0 | 7.0 | 7.3 | 7.0 | 6.3 | 6.0 | 7.3 |
| BLACKSBURG | 8.0 | 8.0 | 6.7 | 7.3 | 7.7 | 7.7 | 6.7 | 6.7 | 6.7 | 7.3 |
| CHALLENGER | 7.7 | 7.7 | 7.7 | 7.0 | 7.3 | 7.0 | 7.0 | 7.0 | 7.0 | 7.3 |
| ASPEN | 7.3 | 7.3 | 8.3 | 7.3 | 7.7 | 7.3 | 6.7 | 6.0 | 6.7 | 7.2 |
| AMERICA | 8.0 | 7.7 | 7.3 | 6.7 | 6.7 | 7.0 | 7.0 | 7.3 | 6.0 | 7.1 |
| MIDNIGHT | 8.7 | 7.3 | 7.3 | 6.3 | 7.3 | 8.3 | 6.3 | 6.0 | 6.0 | 7.1 |
| ANNIKA | 7.3 | 7.0 | 8.0 | 6.7 | 6.7 | 7.0 | 7.0 | 7.0 | 6.3 | 7.0 |
| CYNTHIA | 7.0 | 8.0 | 8.3 | 6.7 | 8.0 | 6.3 | 6.7 | 6.3 | 6.0 | 7.0 |
| SYDSPORT | 7.3 | 8.0 | 7.3 | 6.7 | 7.3 | 7.7 | 6.3 | 6.7 | 6.0 | 7.0 |
| CLASSIC | 7.0 | 6.7 | 7.3 | 6.7 | 6.0 | 7.3 | 6.7 | 7.0 | 7.0 | 6.9 |
| ECLIPSE | 7.3 | 7.0 | 7.3 | 7.0 | 7.0 | 7.7 | 6.0 | 6.3 | 6.3 | 6.9 |
| HARMONY | 7.0 | 7.0 | 7.7 | 6.3 | 7.0 | 6.7 | 7.0 | 6.7 | 6.7 | 6.9 |
| RAM-1 | 7.7 | 7.7 | 7.7 | 5.0 | 6.3 | 8.0 | 6.3 | 6.7 | 6.7 | 6.9 |
| TENDOS | 6.7 | 7.3 | 7.7 | 6.3 | 7.0 | 7.0 | 6.7 | 6.7 | 6.7 | 6.9 |
| 239 (SUFFOLK) | 7.3 | 6.0 | 7.0 | 7.0 | 6.7 | 7.7 | 6.7 | 6.3 | 6.7 | 6.8 |
| GNOME | 7.7 | 6.7 | 6.7 | 6.3 | 7.7 | 7.0 | 6.3 | 6.7 | 6.3 | 6.8 |
| K1-152 | 6.7 | 6.3 | 7.3 | 7.0 | 7.3 | 7.0 | 7.0 | 6.3 | 6.0 | 6.8 |
| LOFTS 1757 | 7.3 | 6.7 | 6.7 | 6.7 | 7.3 | 6.7 | 6.7 | 6.7 | 6.3 | 6.8 |
| NASSAU | 7.3 | 7.0 | 7.0 | 5.0 | 6.3 | 7.3 | 7.7 | 7.0 | 6.3 | 6.8 |
| CHERI | 7.0 | 6.3 | 6.7 | 6.7 | 7.0 | 7.3 | 7.0 | 6.0 | 6.0 | 6.7 |
| GEORGETOWN | 6.7 | 6.0 | 6.7 | 6.7 | 6.7 | 7.0 | 6.7 | 7.0 | 7.0 | 6.7 |
| HAGA | 6.7 | 7.0 | 7.3 | 5.7 | 6.7 | 7.0 | 7.0 | 6.7 | 6.3 | 6.7 |
| PST-CB1 | 6.7 | 6.7 | 7.0 | 6.3 | 6.7 | 7.0 | 7.0 | 6.7 | 6.3 | 6.7 |
| RUGBY | 7.0 | 6.7 | 7.0 | 6.7 | 6.3 | 7.3 | 6.3 | 6.7 | 6.7 | 6.7 |
| TRENTON | 6.7 | 6.3 | 7.0 | 6.3 | 6.7 | 7.3 | 7.0 | 6.7 | 6.7 | 6.7 |
| WABASH | 7.0 | 7.3 | 7.3 | 6.3 | 6.7 | 6.7 | 6.7 | 6.7 | 6.0 | 6.7 |
| BA 69-82 | 6.3 | 7.3 | 7.3 | 6.0 | 7.0 | 6.0 | 6.7 | 6.3 | 6.3 | 6.6 |
| BA 70-139 (COVENTRY) | 7.0 | 6.7 | 6.3 | 6.3 | 7.3 | 7.0 | 6.3 | 6.0 | 6.0 | 6.6 |
| LIBERTY | 7.0 | 7.3 | 7.3 | 5.3 | 6.7 | 7.3 | 6.3 | 6.0 | 5.7 | 6.6 |
| MERION | 6.7 | 6.7 | 7.0 | 5.7 | 6.3 | 7.0 | 7.0 | 6.7 | 6.7 | 6.6 |
| MERIT | 7.3 | 6.7 | 7.3 | 6.3 | 7.3 | 6.7 | 6.0 | 5.7 | 5.7 | 6.6 |
| MYSTIC | 7.7 | 8.7 | 6.7 | 7.3 | 7.0 | 6.3 | 5.7 | 5.0 | 5.3 | 6.6 |
| PARADE | 6.7 | 7.0 | 7.3 | 6.3 | 6.0 | 7.0 | 6.3 | 6.3 | 6.0 | 6.6 |
| WELCOME | 7.0 | 6.7 | 6.7 | 6.3 | 6.3 | 6.3 | 7.0 | 6.3 | 6.3 | 6.6 |
| A-34 | 7.0 | 6.7 | 7.0 | 6.7 | 7.0 | 6.7 | 6.3 | 6.0 | 5.0 | 6.5 |
| ASSET | 5.7 | 7.0 | 7.3 | 5.7 | 7.0 | 7.0 | 6.3 | 6.0 | 6.3 | 6.5 |
| BA 72-492 (ESTATE) | 6.0 | 6.3 | 7.3 | 6.0 | 6.7 | 6.7 | 7.0 | 6.3 | 6.3 | 6.5 |
| BA 72-500 (CHATEAU) | 7.7 | 7.3 | 6.7 | 6.0 | 6.3 | 7.0 | 5.7 | 6.0 | 5.7 | 6.5 |
| BARON | 7.7 | 7.3 | 7.0 | 5.7 | 6.0 | 7.0 | 6.3 | 5.7 | 5.7 | 6.5 |
| BRISTOL | 6.7 | 7.0 | 6.7 | 5.7 | 6.3 | 7.0 | 6.7 | 6.3 | 6.0 | 6.5 |
| DAWN | 7.0 | 6.7 | 7.0 | 6.3 | 6.3 | 6.3 | 6.3 | 6.3 | 6.3 | 6.5 |
| HV 97 | 7.7 | 7.0 | 6.7 | 5.7 | 6.0 | 6.7 | 6.3 | 6.3 | 6.0 | 6.5 |
| IKONE | 6.7 | 6.7 | 7.0 | 6.0 | 6.3 | 7.3 | 6.3 | 6.3 | 6.0 | 6.5 |
| P-104 (PRINCETON 104) | 6.3 | 6.7 | 6.7 | 5.0 | 6.3 | 7.7 | 6.7 | 6.7 | 6.7 | 6.5 |
| VICTA | 6.7 | 7.0 | 7.3 | 5.0 | 6.3 | 7.3 | 6.3 | 6.0 | 6.3 | 6.5 |
| BA 70-242 | 6.0 | 6.3 | 6.7 | 6.3 | 6.7 | 7.0 | 6.7 | 6.3 | 5.7 | 6.4 |
| BA 72-441 (ABBEY) | 7.0 | 7.3 | 7.0 | 5.7 | 6.7 | 6.7 | 7.0 | 5.3 | 5.0 | 6.4 |
| CONNI | 7.0 | 7.3 | 6.7 | 4.0 | 5.3 | 7.7 | 7.0 | 6.7 | 5.7 | 6.4 |
| GLADE | 5.7 | 6.7 | 8.0 | 5.0 | 6.7 | 6.7 | 6.3 | 6.3 | 6.3 | 6.4 |
| COMPACT | 6.0 | 6.0 | 7.3 | 6.3 | 5.3 | 6.3 | 6.7 | 6.7 | 6.3 | 6.3 |
| JOY | 6.0 | 6.7 | 7.0 | 6.3 | 6.0 | 6.0 | 6.3 | 6.3 | 5.7 | 6.3 |
| K3-178 | 5.7 | 5.7 | 7.3 | 5.7 | 6.7 | 6.7 | 6.3 | 6.0 | 6.7 | 6.3 |
| SOMERSET | 7.0 | 7.0 | 7.0 | 5.7 | 6.7 | 7.3 | 5.3 | 5.0 | 6.0 | 6.3 |
| BA 73-540 | 6.0 | 6.0 | 6.3 | 5.0 | 6.0 | 6.7 | 6.7 | 6.3 | 5.7 | 6.1 |
| BA 73-626 | 7.0 | 6.7 | 6.7 | 5.3 | 6.0 | 6.3 | 6.0 | 5.7 | 5.3 | 6.1 |
| BARZAN | 5.7 | 5.3 | 7.3 | 5.7 | 5.7 | 6.7 | 6.7 | 6.0 | 6.0 | 6.1 |
| MONOPOLY | 6.7 | 5.7 | 7.0 | 6.3 | 6.3 | 6.3 | 5.7 | 6.0 | 5.3 | 6.1 |
| BAR VB 577 | 6.3 | 6.7 | 7.3 | 5.3 | 6.0 | 5.0 | 6.0 | 5.3 | 5.7 | 6.0 |
| KENBLUE | 6.0 | 7.0 | 7.0 | 6.3 | 6.3 | 5.3 | 6.0 | 5.3 | 4.7 | 6.0 |
| S.D. CERT. | 5.5 | 7.0 | 8.5 | 5.0 | 4.5 | 6.0 | 6.5 | 6.0 | 5.0 | 6.0 |

Quality ratings 1-9; 9 - ideal turf

Table 2. National Bluegrass cultivar evaluation at Wichita, KS. 1988.

| Exp. No. or Cultivar | Turf Quality (0-9 w/9 = best) 4-27 | 6-29 | 7-21 | 8-25 | Season Avg. |
|---|---|---|---|---|---|
| Blacksburg | 8.0 | 8.3 DG | 8.3 DG | 7.7 DG | 8.1 |
| P-104 | 7.7 | 7.8 | 8.5 DG | 8.0 DG | 8.0 |
| Midnight | 7.7 | 8.2 DG | 8.2 DG | 8.0 DG | 8.0 |
| Victa | 7.0 | 8.0 DG | 8.3 DG | 7.5 | 7.7 |
| America | 7.0 | 7.5 | 7.7 DG | 8.2 DG | 7.6 |
| Cheri | 7.2 | 8.0 | 8.0 DG | 7.2 | 7.6 |
| Glade | 7.2 | 7.8 | 7.8 DG | 7.7 | 7.6 |
| Sydsport | 7.7 | 8.3 DG | 7.2 $ | 7.0 $ | 7.5 |
| Ba 73-626 | 6.7 | 7.8 | 8.0 DG | 7.7 | 7.5 |
| Eclipse | 7.0 | 8.0 | 7.7 | 7.5 | 7.5 |
| Density | 6.8 | 8.2 DG | 7.8 DG | 7.3 | 7.5 |
| Nassau | 7.2 | 7.8 | 7.7 | 7.3 | 7.5 |
| Challenger | 7.5 | 7.5 | 7.7 | 7.5 DG | 7.5 |
| Tandos | 7.3 | 7.7 | 7.5 | 7.0 LG | 7.4 |
| Merit | 6.3 | 7.7 DG | 8.0 DG | 7.7 | 7.4 |
| Ba 69-82 | 7.5 | 7.8 | 7.3 $ | 7.0 $ | 7.4 |
| Merion | 6.5 | 7.5 | 8.3 DG | 7.3 | 7.4 |
| Baron | 6.2 | 7.8 | 7.7 DG | 7.5 | 7.3 |
| Ba 73-540 | 7.7 | 7.8 | 7.3 $ | 6.5 $ | 7.3 |
| Ba 72-492 | 7.7 | 7.7 | 7.2 $ | 6.5 $ | 7.3 |
| Ba 72-500 | 7.7 | 7.7 D | 7.2 $ | 6.7 $ | 7.3 |
| Lofts 1757 | 7.2 | 7.7 | 7.2 | 7.2 | 7.3 |
| Dawn | 7.0 | 7.7 | 7.5 | 7.0 | 7.3 |
| WW Ag 496 | 6.7 | 7.7 | 7.3 | 7.5 | 7.3 |
| Ikone | 7.0 | 8.0 | 7.2 | 7.0 | 7.3 |
| Gnome | 5.7 | 7.7 DG | 8.2 DG | 7.3 | 7.2 |
| Ba 70-139 | 7.3 | 7.8 DG | 7.0 $ | 6.8 $ | 7.2 |
| Ba 70-242 | 6.5 | 7.2 | 7.8 W | 7.2 | 7.2 |
| Welcome | 6.7 | 7.5 | 7.2 | 7.5 | 7.2 |
| WW Ag 468 | 6.7 | 7.5 | 7.2 | 7.3 | 7.2 |
| A-34 | 7.2 | 7.2 | 6.8 LG,$ | 7.5 LG | 7.2 |
| Conni | 7.5 | 7.2 | 7.0 $ | 7.0 | 7.2 |
| Bristol | 7.7 | 7.0 W | 7.0 | 7.3 | 7.2 |
| WW Ag 495 | 6.7 | 7.7 | 7.2 $ | 7.0 DG | 7.1 |
| Aspen | 6.3 | 7.5 | 7.5 | 7.0 | 7.1 |
| Ram-1 | 6.8 | 7.7 | 7.3 | 6.7 $ | 7.1 |
| Cynthia | 6.0 | 7.7 DG | 7.3 DG,$ | 7.5 DG | 7.1 |
| NE 80-88 | 7.0 | 7.2 W | 7.0 $ | 7.2 | 7.1 |
| Asset | 6.7 | 7.7 | 7.2 $ | 6.8 | 7.1 |
| HV 97 | 7.0 | 7.3 | 6.8 $ | 7.2 | 7.1 |
| Georgetown | 7.3 | 7.3 | 6.7 LG | 7.0 LG | 7.1 |
| PST-CB1 | 7.0 | 7.3 | 7.0 | 7.3 | 7.1 |
| Able I | 7.3 | 7.7 | 7.2 | 6.2 LG,Cg | 7.1 |
| Annika | 7.0 | 7.5 | 7.0 W | 6.8 | 7.1 |
| Liberty | 6.8 | 7.2 | 7.2 | 6.8 | 7.0 |
| Parade | 7.2 | 7.0 | 7.0 | 6.8 | 7.0 |
| Rugby | 7.2 | 7.0 | 7.0 | 7.0 | 7.0 |
| Amazon | 6.8 | 7.3 | 6.5 W | 7.5 | 7.0 |
| Ba 72-441 | 5.5 | 7.2 | 7.8 DG | 7.5 DG | 7.0 |
| Classic | 7.0 | 7.2 | 6.5 LG | 6.8 LG | 6.9 |
| Barzan | 6.3 | 7.0 | 7.3 | 7.0 | 6.9 |
| BAR VB534 | 6.0 | 7.5 | 7.3 DG,$ | 7.0 | 6.9 |
| Trenton | 7.2 | 7.0 | 6.7 LG | 6.7 | 6.9 |
| BAR VB577 | 6.8 | 7.5 | 6.7 $ | 6.7 | 6.9 |
| Julia | 6.8 | 7.7 | 6.7 $ | 6.3 | 6.9 |
| Harmony | 6.8 | 7.3 | 6.8 | 6.8 | 6.9 |
| Huntsville | 5.7 | 7.7 | 7.2 | 7.2 | 6.9 |
| F-1872 | 7.0 LG | 7.0 LG | 6.7 | 6.7 | 6.8 |
| Haga | 7.7 | 6.7 | 6.5 LG | 6.5 LG | 6.8 |
| Monopoly | 6.5 | 7.2 LG | 7.0 | 6.0 $ | 6.7 |
| Compact | 6.3 | 7.0 | 7.0 $ | 6.7 | 6.7 |
| Aquila | 6.7 | 7.2 | 6.5 $ | 6.5 | 6.7 |
| K3-178 | 6.8 | 7.2 | 6.2 LG | 6.7 LG | 6.7 |
| WW Ag 491 | 6.2 | 7.7 | 6.5 $ | 6.3 | 6.7 |
| K1-152 | 7.0 | 6.7 LG | 6.0 LG $ | 6.8 | 6.6 |
| Somerset | 6.2 LG | 7.2 | 6.8 LG | 6.2 | 6.6 |
| 239 | 6.3 | 6.8 | 6.5 W | 6.5 | 6.5 |
| Wabash | 6.0 LG | 6.3 LG | 6.0 LG $ | 7.0 LG | 6.3 |
| Joy | 5.3 LG | 6.7 | 7.2 | 6.2 $ | 6.3 |
| Mystic | 6.2 | 6.8 | 6.2 $ | 5.3 $ | 6.1 |
| SD Certified | 4.7 LG | 6.7 W | 6.0 W,$ | 5.7 $,W | 5.8 |
| Kenblue | 4.7 | 6.2 | 5.7 W,$ | 5.3 | 5.5 |

**TITLE:** Effects of Potassium on Drought Tolerance of "Ram 1" Kentucky Bluegrass

**OBJECTIVE:** To investigate the effects of various rates of potassium on drought-stressed turfgrass using parameters: overall quality, color, density, and top growth production

**PERSONNEL:** Michael A. Sandburg, Turfgrass M.S. Candidate
Jeff Nus, Turfgrass Research and Teaching

**INTRODUCTION:**

With the drought conditions during the past few years and the USGA's goal for reduced water use, all ways of reducing water need to be explored. One of the ways is by studying the effects of potassium fertilizer on turfgrasss. A plant's ability to retain moisture in stressed conditions is influenced, in part, by the amount of potassium it has available to absorb.

**METHODS:**

Twelve plots 15' by 15' are established at Kansas State University, Rocky Ford Turfgrass Research Plots with Kentucky bluegrass (Poa pratensis cv. Ram I). Each plot has an independent irrigation system that delivers 1.33 in of water per hr. The plots are divided into four treatments (control, 2 lbs, 4 lbs, and 6 lbs potassium/1000 sq ft/yr). These treatments include four applications per year (March, June, Sept., and Nov.).

Top Growth Production

The plots are mowed as needed at 3 in with a frequency sufficient to never remove more than a third of the leaf blade at any one time. Clippings from each plot are oven dried (60$^{o}$C, 48 hrs), and clipping yields (g) recorded for each potassium treatment.

Water Use

An Irams 5000 Time Domain Reflectometer (TDR) is used to record daily soil moisture to a depth of 5 inches in each plot. Irrigation cycles are initiated when soil moisture readings are 2% above wilting point. Soil dry down cycles also are plotted for each potassium treatment. Monthly and seasonal water use thus can be determined for each potassium treatment.

Qualitative Parameters

Quality ratings of the "Ram 1" Kentucky bluegrass plots are taken monthly. The ratings include color, density, and overall quality on a scale from 1-9 (9 = excellent). Means for each monthly quality parameter are recorded.

**RESULTS:**

The field portion of this study is at its mid-point, and the data have not been analyzed for statistical values.

As shown by the graph for overall quality (Fig. 1), there are slight differences between the treatments. The two highest rates (4 and 6 lbs K/1000) have produced a slightly better quality of turf. With increased potassium applications, the quality of turf at the 6 lb rate decreased. This may be caused by a toxic effect of potassium.

The effect of potassium on turf density (Fig. 2) is minimal for this study at this point.

The color of the turf was affected by the amount of potassium applied, with the high two treatments (6 and 4 lbs K) giving the best color (Fig. 3).

The yield of clipping yield was not affected by the amounts of potassium applied (Figs. 4 & 5).

Figure 1.

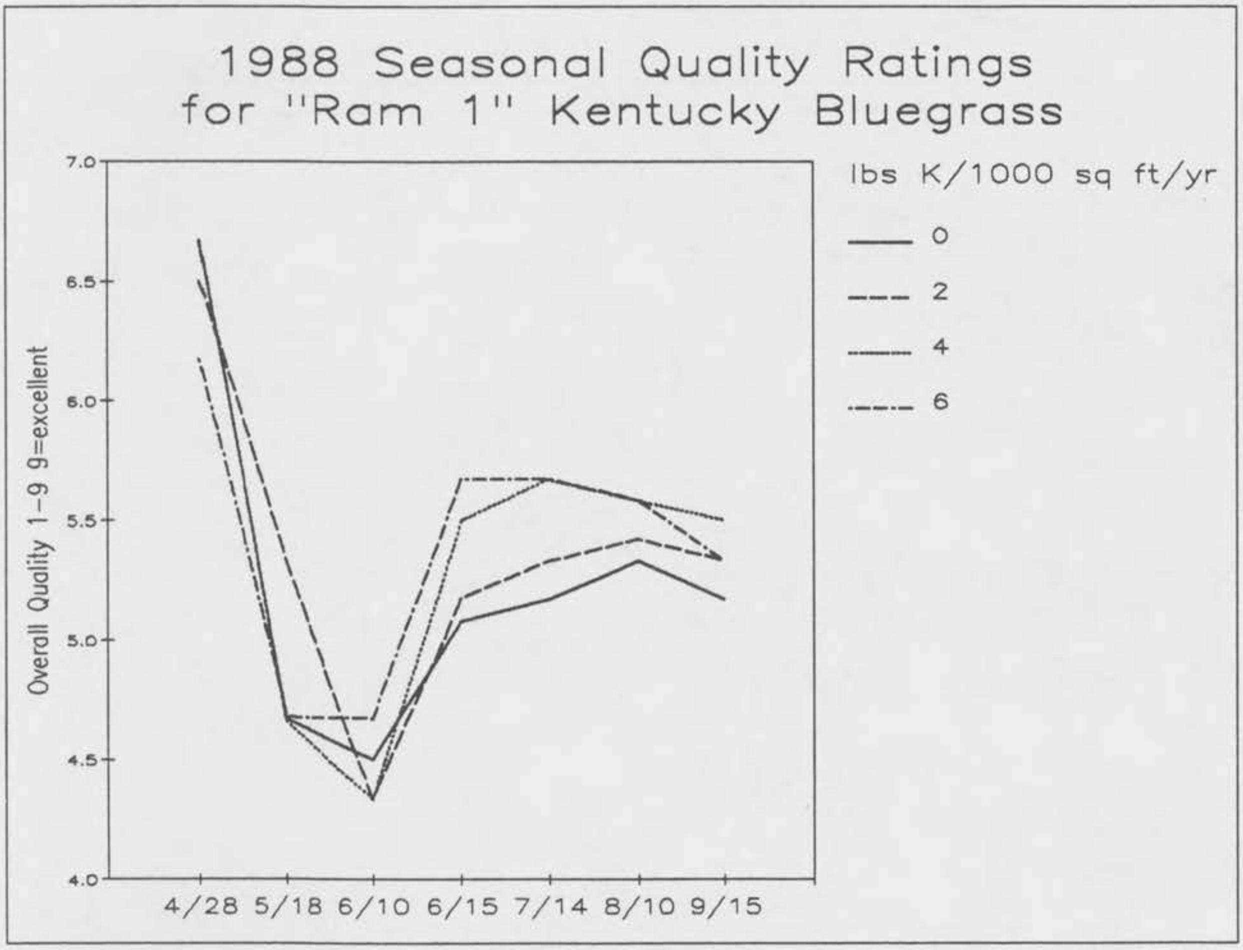


Figure 2.

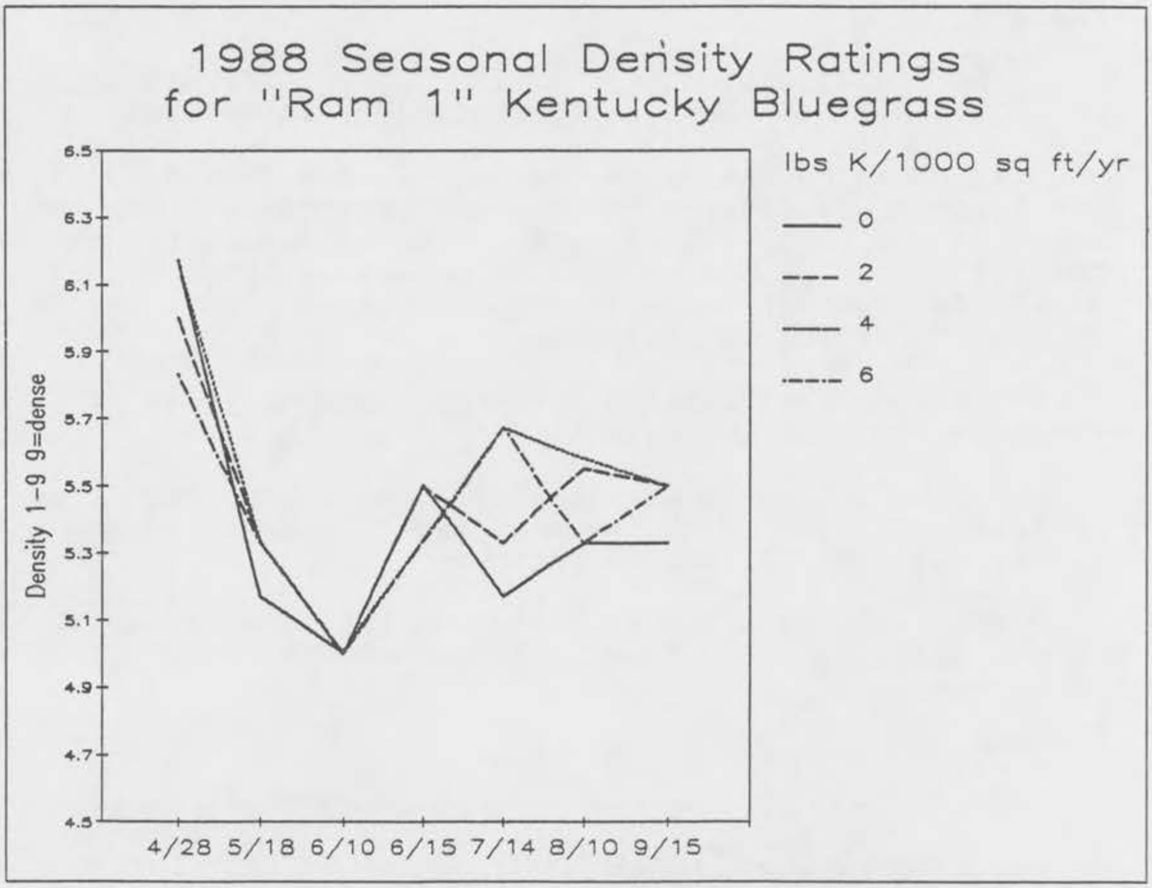
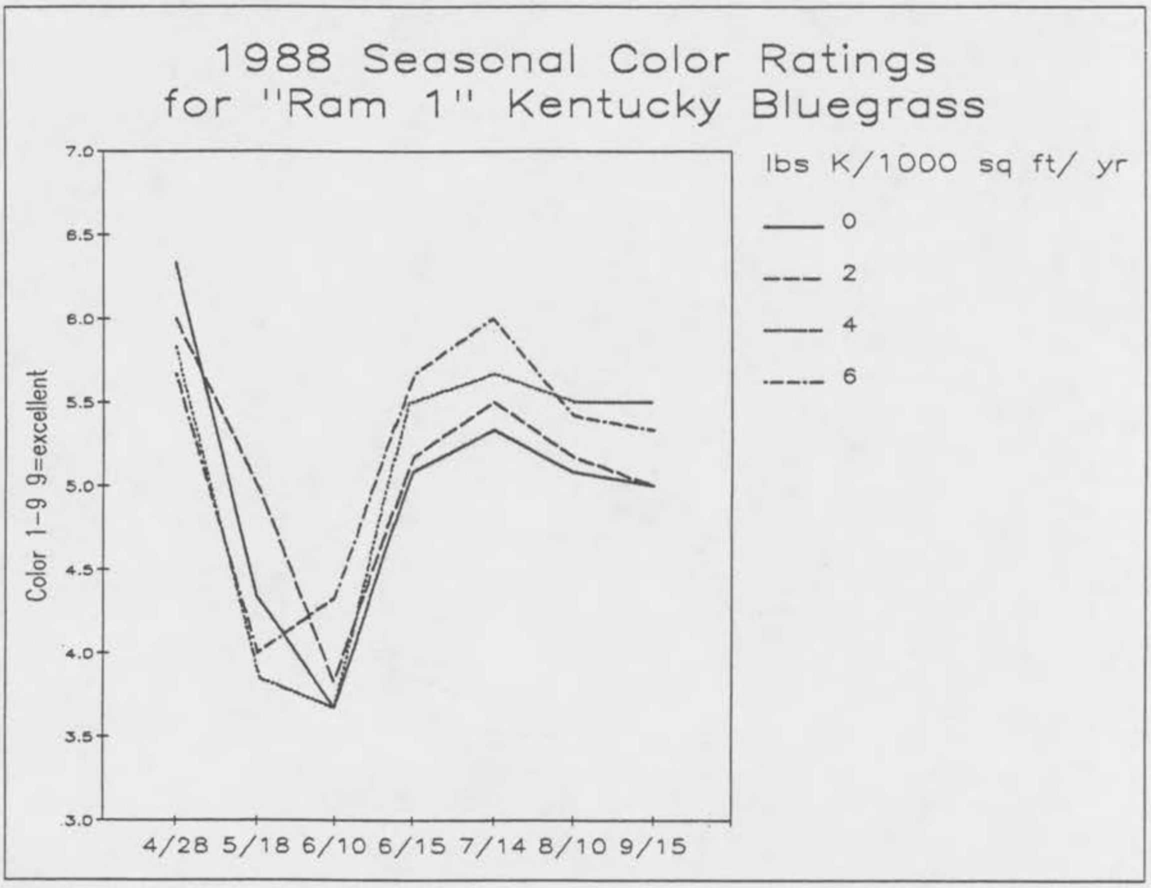
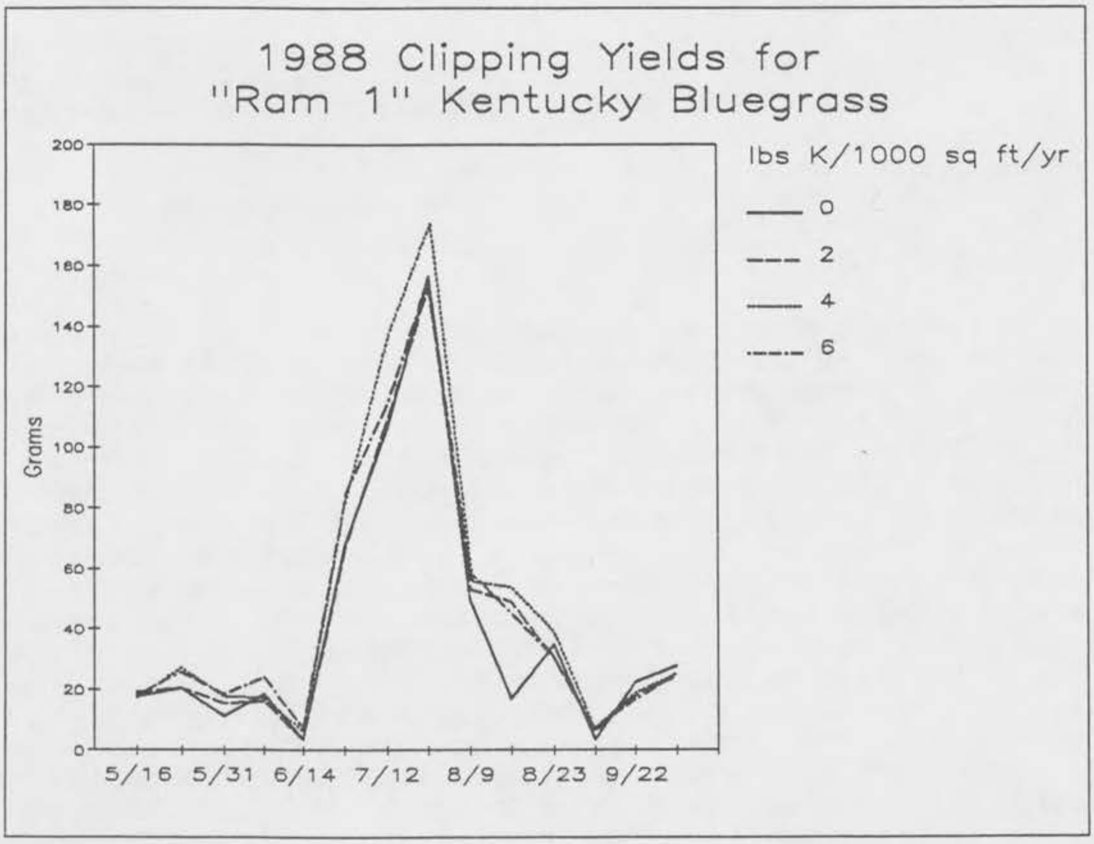
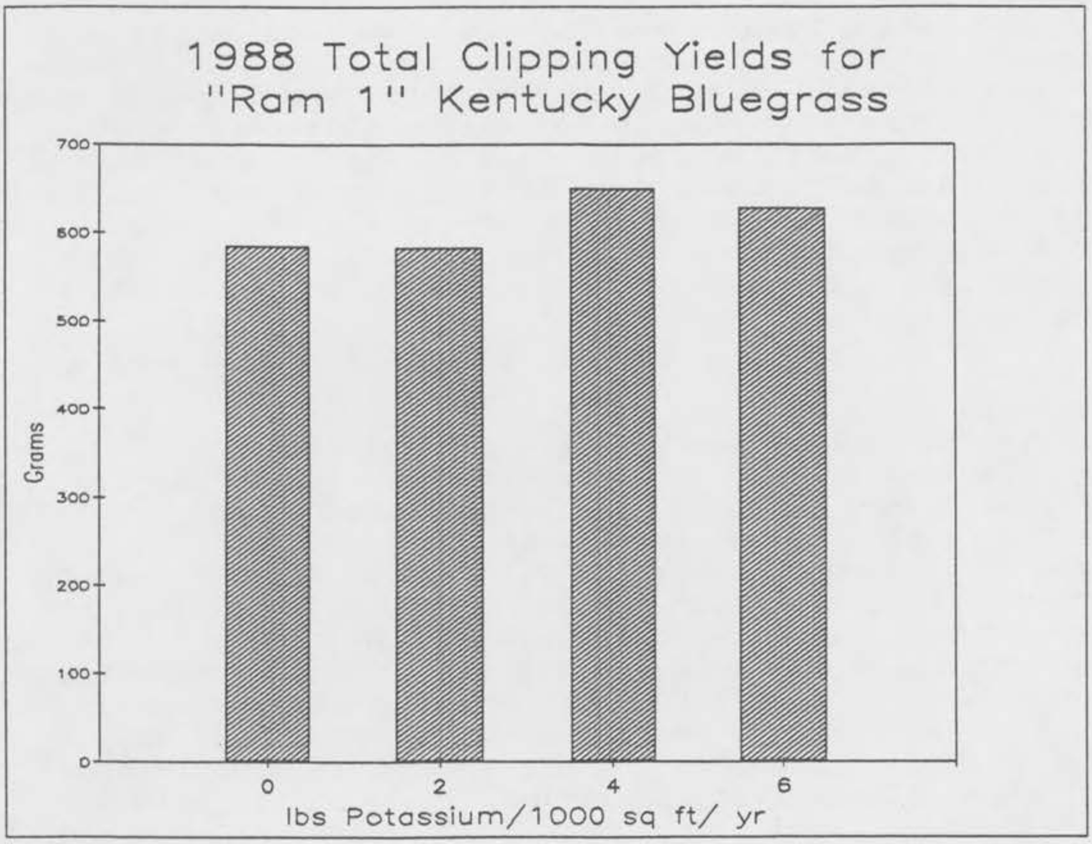



Figure 3.




1988 Clipping Yields for
"Ram 1" Kentucky Bluegrass
lbs K/1000 sq ft/yr
0
2
4
6
Grams
200
180
160
140
120
100
80
60
40
20
0
5/16 5/31 6/14 7/12 8/9 8/23 9/22


1988 Total Clipping Yields for
"Ram 1" Kentucky Bluegrass
Grams
700
600
500
400
300
200
100
0
0
2
4
6
lbs Potassium/1000 sq ft/ yr

**TITLE:** Kentucky Bluegrass Divot Study

**OBJECTIVE:** To identify cultivars of Kentucky Bluegrass that recover most rapidly from simulated divot damage

**PERSONNEL:** Paul Haupt, Turfgrass Technician
Roch Gaussoin, Turfgrass Teaching/Research

**INTRODUCTION:**

In situations where turfgrass quality declines from physical wear and damage, selection of an appropriate species and cultivar(s) is a management decision a turfgrass manager can make to enhance turf quality. For Kentucky bluegrasses, recovery primarily will be the result of new shoot production from old and new rhizomes. The rate of new shoot and leaf extension and production also will influence recovery. For Kentucky Bluegrass divot damage, there are two types. Type 1 involves the removal of roots, rhizomes, crowns, thatch, soil, stems, and leaves as a result of the club cutting deep into the surface. Factors listed above will influence recovery from the perimeter of the divot, with a portion also recovering from any leftover rhizomes inside the divot. Type 2 is not as destructive and is typically characterized by the removal of various amounts of the above-ground portion of the plant. Any recovery that occurs will be the result of new shoot initiation from rhizomes inside the divot, in addition to those factors listed for Type 1 recovery.

By simulating both types, it should be possible to gain information telling us what mechanisms are responsible for a cultivar's recovery. A good recovery from Type 1 damage suggests the ability to recover through aggressive rhizome production and/or a rapid prostrate growth habit by leaf elongation and tillering. A good recovery from Type 2 damage indicates the ability to recover through rapid shoot initiation. Recovery from Type 2 damage but not from Type 1 suggests that rapid shoot initiation from the leftover rhizome system is the mechanism responsible.

**METHODS:**

Beginning in September 1988, a mowing height of 3/4 inch was used to simulate fairway conditions on the site of the National Kentucky Bluegrass Cultivar Trial established during the Fall of 1987. Type 1 and Type 2 divots were simulated on Sept. 15 and 16. Type 1 divots were simulated by removing a 4.25" diameter plug from each cultivar and replacing it with soil minus the rhizomes. Type 2 divots were simulated by placing a divot-shaped template over each cultivar and using a string trimmer to remove the portion of the plants that lay above ground. Recovery was measured by estimating percent density 45 days and 7 mos. after divot simulation. Shoot counts per 4 $cm^2$ were also recorded for Type 2 2 wks. after divot simulation. One lb. N/1000 $ft^2$ was applied in March, April, May, Sept., Oct., 1988 as urea and the site was irrigated as needed to prevent wilt. Balan 2.5G a5 80 lbs./Acre and Trimec were applied for annual grassy weed and broadleaf weed control.

**RESULTS:**

Initial results suggest that significant differences in the ability to recover from divot damage exist for Kentucky Bluegrass cultivars. Type 1 varieties that performed well were PST-CBl 239, A-34 (Bensun), South Dakota Certified, Joy, Haga, and K3178. Type 2 varieties that ranked high were: Ba 69-82, South Dakota Cert., Haga, Nassau, Ba 73-540, PST-CBl, A-34 and Georgetown as of April 15, 1988. Table 1 shows how all 58 varieties compared. The National Perennial Ryegrass Trial established during the Fall of 1986 is currently being mowed at 3/4" and will be subjected to the same treatments and analyses as the bluegrass trials during 1989.

Table 1. Data for Kentucky bluegrass simulated divot recovery study. Manhattan, KS 1988-89

| Name | Fill-in[a] Type 1[b] | Type 2[c] |
|---|---|---|
| 239 | 7.33 | 8.33 |
| PST-CB1 | 7.33 | 8.67 |
| A-34 (Bensun) | 7.00 | 8.33 |
| South Dakota Cert. | 7.00 | 8.67 |
| Monopoly | 7.00 | 7.67 |
| Ba 72-500 | 7.00 | 7.67 |
| Haga | 7.00 | 8.00 |
| Ba 72-492 | 7.00 | 7.67 |
| K3-178 | 7.00 | 8.33 |
| Ba 70-139 | 6.67 | 7.67 |
| K1-152 | 6.67 | 8.33 |
| Dawn | 6.67 | 8.00 |
| Ba 69-82 | 6.67 | 7.67 |
| Ba 70-242 | 6.67 | 6.33 |
| Kenblue | 6.33 | 6.67 |
| Ikone | 6.33 | 7.33 |
| America | 6.33 | 6.00 |
| Lofts 1757 | 6.33 | 8.00 |
| Asset | 6.33 | 7.33 |
| Nassau | 6.33 | 7.33 |
| Parade | 6.33 | 8.00 |
| Joy | 6.33 | 8.33 |
| Harmony | 6.33 | 7.67 |
| Cheri | 6.00 | 7.00 |
| Liberty | 6.00 | 7.67 |
| Ram-1 | 6.00 | 8.00 |
| Challenger | 6.00 | 7.33 |
| Aspen | 6.00 | 6.67 |
| Wabash | 6.00 | 7.33 |
| Classic | 6.00 | 8.33 |
| Ba73-540 | 6.00 | 6.67 |
| Midnight | 6.00 | 7.33 |
| Georgetown | 6.00 | 7.67 |
| Somerset | 6.00 | 7.67 |
| Mystic | 6.00 | 6.67 |
| Trenton | 6.00 | 7.67 |
| P-104 | 5.67 | 7.67 |
| Compact | 5.67 | 7.33 |
| Glade | 5.67 | 7.00 |
| Gnome | 5.67 | 6.33 |
| BAR VB 577 | 5.67 | 7.67 |
| ABLE I | 5.67 | 6.67 |
| Victa | 5.67 | 7.33 |
| Baron | 5.67 | 7.33 |
| Merion | 5.67 | 7.33 |
| Sydsport | 5.67 | 7.00 |
| Merit | 5.67 | 6.33 |
| Rugby | 5.67 | 7.33 |
| Eclipse | 5.67 | 7.33 |
| Ba 72-441 | 5.67 | 6.67 |
| Cynthia | 5.67 | 7.33 |
| Bristol | 5.33 | 7.00 |
| Blacksburg | 5.33 | 6.33 |
| Tendos | 5.33 | 6.67 |
| Ba 73-626 | 5.00 | 6.00 |
| HV 97 | 5.00 | 6.33 |
| Barzan | 4.67 | 6.67 |
| Welcome | 4.00 | 6.00 |
| LSD (P = 0.05) | 1.38 | 1.20 |

[a]Based on a visual scale of 1-10 with a 10 indicating 100% fill-in.

[b]Simulated with a cup-cutter. [c]Simulated with a nylon string trimmer.

**TITLE:** Control of May Beetle Grubs with Various Insecticides and Predatory Nematodes (Hetero habitidus)

**OBJECTIVE:** To test alternative approaches for white grub control with commercially available insecticides

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

**INTRODUCTION:**

White grubs are the most serious insect pests for Kansas turfgrass managers (1985 Kansas Turfgrass Survey). In recent years, chemical control of white grubs (Southern Masked Chafer and May Beetles) has been quite variable. With rising public concern over the use of all pesticides on turf areas, it is necessary to explore alternative approaches for insect control, as well as to compare commercially available insecticides for their effectiveness in controlling these serious Kansas pests.

Commonly used insecticides for grub control include Oftanol, Turcam, and Diazinon. Recently, Triumph has been added to this list. Dyn-O-Mite is a contact insecticide made from the skeletal remains of a family of algae known as Bacillariophyceae. Ground particles from these algal deposits are razor sharp, and absorb over three times their weight in liquid. The theory behind effective grub control with this material is that these particles will enter the insect's body and cause a lethal level of dehydration.

Nematodes are microscopic worms that can infect both plants and animals. As turf managers, we are familiar with nematodes that can become parasitic on desirable turfs, such as creeping bentgrass. However, if enough insect-infecting nematodes are present in an area susceptible to grub damage, nematodes may offer a degree of biological control without the need for conventional insecticides that may represent some degree of ecological risk.

**MATERIALS AND METHODS:**

The White Grub Study utilizes an area of slightly more than 2000 sq ft composed of 'Baron' Kentucky bluegrass in Section I of the Rocky Ford Turfgrass Research plots. This study is set up as a randomized complete block experimental design with seven treatments and three replications. The treatments include Diazinon, Oftanol, Triumph, Turcam, Dyn-O-Mite, and nematodes (supplied through Bioscape, Wichita). Label rates are to be applied during the second week of July to the 3 by 3 m plots. Evidence for grub damage will be recorded as well as grub population sampling in August.

**RESULTS:**

Figure 1 shows the mean population of May beetle grubs sampled from various chemical and nonchemical treatments. Although there was quite a bit of variation in the experiment (LSD (0.05) = 37.7), results indicate a potential for using predatory nematodes for grub control. Nematode-treated plots exhibited equally low populations of May beetle grubs as the best chemical treatments - Turcam and Triumph.

Was it the attack by nematodes on May beetle grubs that was killing them or could it have been an artifact? To answer this question, discolored grubs were taken from the nematode-treated plots and analyzed for Hetero habitidus nematodes within their bodies. Results are shown in Table 1. No nematodes were found in healthy looking grubs taken from control or nematode-treated plots. Unhealthy looking (darkened, discolored) grubs, however, exhibited lethal populations of Hetero habitidus (Table 1). This experiment will be repeated in 1989 with a second species of predatory nematode. These preliminary results, however, indicate that biological control of white grubs may be a reasonable alternative to insecticidal control.

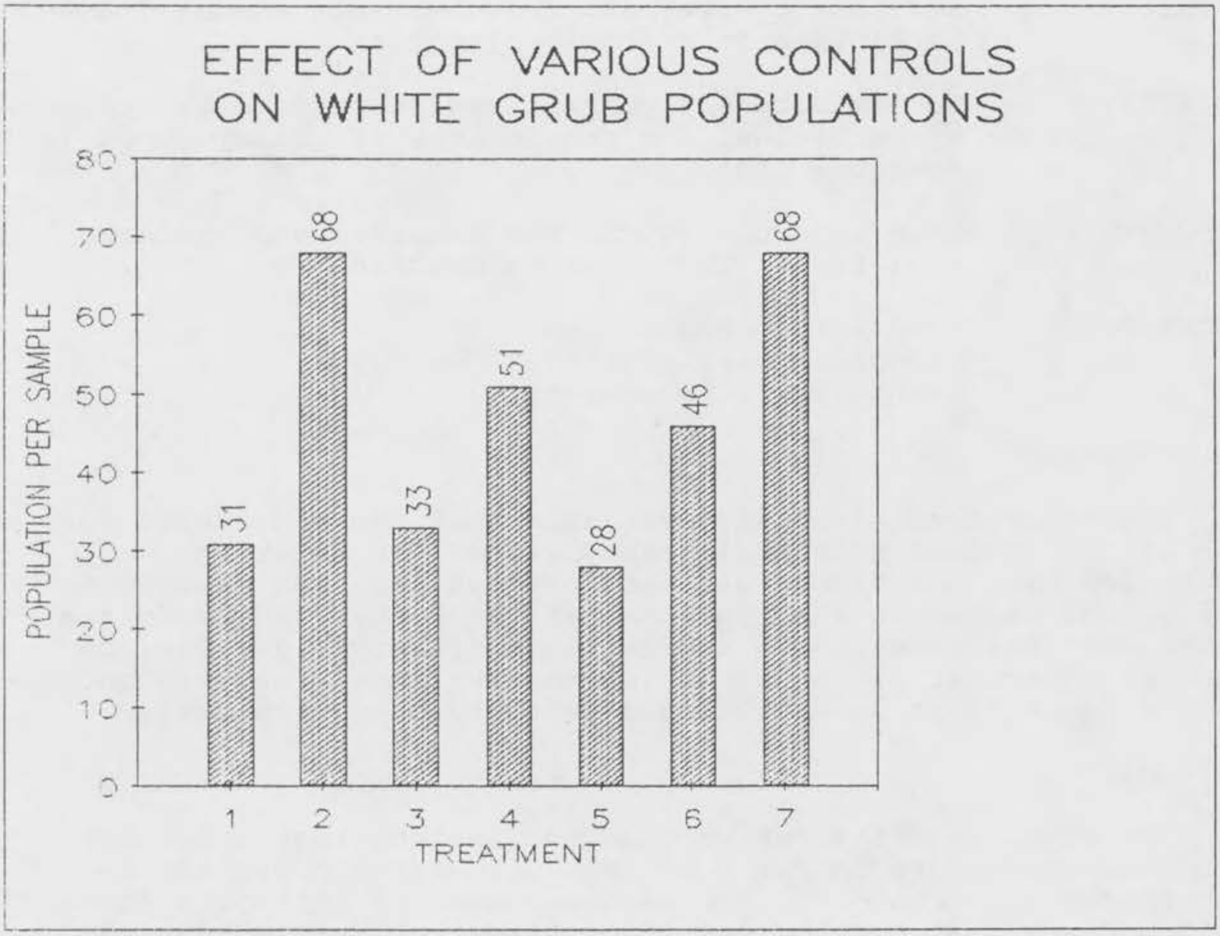



Table 1. <u>Hetero</u> <u>habitidus</u> nematode counts sampled from Phyllaphaga May beetle larvae (number per gram dry weight of grub tissue).

| Sample Group | Female | Male | Juveniles |
|---|---|---|---|
| Healthy looking grubs (9) taken from control plots | 0 | 0 | 0 |
| Healthy looking grubs (6) taken from nematode-treated plots | 0 | 0 | 0 |
| Unhealthy looking grubs (8) taken from nematode-treated plots | 429 | 25 | 3714 |

**TITLE:** Efficacy of Pre- and Postemergence Annual Grass Herbicides in Kentucky Bluegrass

**OBJECTIVE:** To evaluate efficacy of registered and experimental herbicides for the control of grassy weeds in Kentucky bluegrass

**PERSONNEL:** Roch Gaussoin, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician

**SPONSORS:** Sandoz Crop Protection
Hoechst-Roussel Agri-Vet Company
Elanco Products Company

**INTRODUCTION:**

Numerous herbicides are available that are registered for use in the control of annual grassy weeds. In addition, companies have new herbicides and formulations that need to be evaluated. Research was conducted at the Rocky Ford Turfgrass Research Plots to evaluate a wide range of herbicides for the control of annual grassy weeds (primarily large crabgrass and yellow foxtail) in an established Kentucky bluegrass turf.

**METHODS:**

To supplement the native weed population, the experimental area was overseeded in March of 1989 with large crabgrass and yellow foxtail. Large crabgrass was seeded at 1 lb/1000 $ft^2$ and yellow foxtail at 0.5 lb/1000 $ft^2$. Prior to overseeding, the area was mowed at 0.75" and verticut in two directions. All preemergence treatments were applied on April 5, 1989, except prodiamine, which was applied on March 25. All liquid formulations were applied with a compressed-air sprayer calibrated to deliver 35 GPA at 35 PSI. Granular formulations were applied using a shaker-can. Preemergence treatments are listed in Table 1.

Postemergence treatments will be applied based on crabgrass growth stage as outlined in Table 2. Application technique will be the same as for preemergence treatments.

Data will be collected on crabgrass and yellow foxtail control plus control of any additional resident weeds. The experimental design is a randomized complete block with three replications.

**RESULTS:**

To be reported at the Turfgrass Field Day at Manhattan, KS, June 29, 1989.

Table 1. Preemergence herbicides for annual grassy weed control applied at Manhattan, KS - 1989.

| Common Name | Trade Name | Company | Formulation | Rate |
|---|---|---|---|---|
| Prodiamine | -- | Sandoz | 65 WDG | 0.75 |
| Prodiamine | -- | Sandoz | 65 WDG | 1.0 |
| DCPA | Dacthal | Fermenta | 75 WP | 10.5 |
| Benefin | Balan | Elanco | 60 DF | 2.0 |
| Benefin | Balan | Elanco | 60 DF | 3.0 |
| Benefin/ Trifluralin | Team | Elanco | 2 G | 2.0 |
| Benefin/ Trifluralin | Team | Elanco | 2 G | 3.0 |
| Oxadiazon | Ronstar | Rhone-Poulenc | 50 WP | 1.5 |
| Oxadiazon | Ronstar | Rhone-Poulenc | 50 WP | 2.0 |
| Pendimethalin | Pre-M | Lesco | 60 WDG | 1.5 |
| Pendimethalin | Pre-M | Lesco | 60 WDG | 2.0 |
| Bensulide | Betasan | ICI Americas | 4 E | 12.0 |
| MON15175 | Dimension | Monsanto | 0.25 G | 0.5 |
| MON15151 | Dimension | Monsanto | 1 EC | 0.5 |
| MON15151 | Dimension | Monsanto | 1 EC | 0.75 |
| MON15104 | Dimension | Monsanto | 1 EC | 0.75 |
| Untreated control | | | | |

Table 2. Postemergence herbicidess for annual grassy weed control applied at Manhattan, KS - 1989.

| Treatment | Rate (lbs a.i./A) |
|---|---|
| Treatments applied at 1 to 3 leaf crabgrass | |
| Fenoxaprop[a] + pendimethalin | 0.08 + 2.0 |
| Fenoxaprop + pendimethalin | 0.12 + 2.0 |
| Fenoxaprop + (benefin/trifluralin)[b] | 0.08 + 3.0 |
| Fenoxaprop + (benefin/trifluralin) | 0.12 + 3.0 |
| MON15175 (0.25G) | 0.5 |
| MON15151 (1EC) | 0.38 |
| MON15151 (1EC) | 0.5 |
| MON15151 (1EC) | 0.75 |
| MSMA | 2.0 |
| MSMA | 3.0 |
| Treatments applied at 2 to 4 tiller crabgrass | |
| MON15151 (1EC) | 0.75 |
| MSMA | 3.0 |
| Miscellaneous treatment | |
| Pendimethalin (2.0 lbs at preemergence) followed by fenoxaprop (0.25 lbs) at 2 to 4 tiller crabgrass | |

[a]Acclaim

[b]DF formulation of Team

**TITLE:** Sulfur Fertilization of 'Penncross' Creeping Bentgrass

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

**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 from 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 3-yr-old stand of 'Penncross' creeping bentgrass at the Rocky Ford Turfgrass Research plots. No sulfur treatments had been applied to this area before the experiment began. The experiment utilized a randomized complete block design with four treatments that were replicated four times each. Each plot was 1 x 2 m. Flowable sulfur was applied at rates of 0.25, 0.5, 1.0, and 2.0 lbs of actual sulfur per 1000 sq ft per application. Two applications were applied per year in April and September with an R & D carbon dioxide backpack plot sprayer. Data collected included monthly quality ratings (1-9).

**RESULTS:**

Monthly quality of 'Penncross' creeping bentgrass as affected by sulfur fertilization is shown in Table 1. As in 1987, there were no differences in visual quality as a result of differential sulfur treatments. Thus, this study is being discontinued.

Table 1. Monthly quality of 'Penncross' creeping bentgrass as affected by sulfur fertilization.

| Lbs. of S per M $ft^2$ per year | | Monthly Quality April | May | June | July | Aug | Sept | Nov |
|---|---|---|---|---|---|---|---|---|
| (1) | 0 | 7.3 | 7.3 | 8.3 | 7.2 | 8.0 | 8.0 | 6.3 |
| (2) | 0.5 | 7.5 | 7.5 | 8.5 | 7.3 | 7.7 | 8.0 | 6.3 |
| (3) | 1 | 7.3 | 7.5 | 8.2 | 7.3 | 7.8 | 8.2 | 5.8 |
| (4) | 2 | 7.2 | 7.8 | 8.5 | 7.5 | 8.0 | 8.0 | 6.0 |
| (5) | 4 | 7.0 | 7.5 | 8.3 | 8.2 | 7.7 | 8.2 | 6.0 |
| | | N.S. | N.S. | N.S. | N.S. | N.S. | N.S. | N.S. |

**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. When 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 would enhance the quality of 'Penncross' creeping bentgrass.

**MATERIALS AND METHODS:**

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

**RESULTS:**

Monthly quality of 'Penncross' creeping bentgrass as affected by iron fertilization is shown in Table 1. Only during July and November did differential iron treatments significantly affect turf quality. The July ratings were taken only 2 days after the iron treatments were applied and are indicative of the very short-term color enhancement by iron. It should be noted, however, that the irrigation water that this green receives is very high in iron, and so the benefits of adding additional iron are minimized.

During the 1989 season, all nitrogen fertilization will be restricted from this study to see whether the plots treated with more iron will retain color to a greater extent at very low soil nitrogen levels.

Table 1. Monthly quality of 'Penncross' creeping bentgrass as affected by iron fertilization.

| Oz of Iron per 1000 $ft^2$ per year | Monthly Quality Apr | May | Jun | Jul | Aug | Sept | Nov |
|---|---|---|---|---|---|---|---|
| 0 | 7.1 | 7.4 | 8.1 | 6.8 | 7.9 | 8.0 | 6.0 |
| 2 | 7.0 | 7.3 | 8.3 | 7.5 | 8.0 | 8.5 | 6.5 |
| 4 | 7.3 | 7.5 | 8.3 | 7.0 | 8.0 | 8.1 | 6.0 |
| 8 | 7.4 | 7.1 | 8.0 | 7.4 | 7.8 | 8.3 | 6.1 |
| 16 | 7.5 | 7.6 | 8.5 | 7.9 | 8.0 | 8.5 | 6.4 |
| 32 | 7.6 | 7.3 | 8.5 | 8.4 | 7.9 | 8.4 | 6.3 |
| | N.S. | N.S. | N.S. | ** | N.S. | N.S. | * |
| P > F | .08 | .80 | .09 | .000 | .60 | .27 | .011 |

**TITLE:** Bentgrass Establishment Using Various Nitrogen Sources

**OBJECTIVE:** To test various nitrogen source fertilizers for their effectiveness in establishing 'Penncross' creeping bentgrass on high percentage sand greens

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

**INTRODUCTION:**

Establishing creeping bentgrass on high percentage sand greens is often because of the inherent low moisture and nutrient retention capacities of sand. Although various amendments, such as peat, rice hulls, sawdust, or sewage sludge, have been used to help alleviate these problems, the choice of starter fertilizer can have a major effect on the success of the establishment. This study was initiated to test various nitrogen sources for their effectiveness in enhancing rapid establishment of seeded bentgrass.

**MATERIALS AND METHODS:**

Area 2 of the newly constructed research green was used for this study. The experiment utilized a randomized complete block experimental design with seven treatments replicated three times each. Treatments included ureaform (Blue Chip, 38-0-0) at 10 lbs and 20 lbs per 1000 sq ft tilled into the surface 6-8 in; sulfur-coated urea at 12 and 14 lbs per 1000 sq ft tilled into the top 6-8 in; urea surface-applied at 1 lb of actual N per 1000 sq ft, followed by an additional 1 lb of N 3 wks later; a 13-25-12 starter fertilizer at 1 lb of N per 1000s sq ft surface-applied at seeding, followed by an additional 1 lb N application 3 wks later; and Milorganite at 100 lbs per 1000 sq ft tilled into the top 6-8 in just prior to seeding.

**RESULTS:**

Establishment ratings (1-9) were taken for each nitrogen source on 7/7, 8/3, and 9/3 as shown in Table 1. Excellent results were obtained with Blue Chip at the 7.6 lb N rate (tilled in). Although Blue Chip treatments did not exhibit the best establishment ratings during the July evaluation period, the warm temperature nitrogen release from Blue Chip became evident during the August and September evaluations (Table 1). The high rate of sulfur coated urea also performed very well (Treatment 6), as did milorganite at 100 lbs of material per 1000 sq ft.

Poor establishment was obtained with the urea treatment (Treatment 1). The surface-applied starter fertilizer (13-25-12) improved establishment over urea, but was inferior to treatments utilizing slow-release materials that were tilled into the seedbed prior to seeding (Table 1).

Table 1. Effect of various nitrogen sources and rates on establishment of seeded 'Penncross' creeping bentgrass (1-9, 9 = complete fill).

| N Source | N Rate (lb N per M sq ft$^2$) | Establishment Ratings 7/7 | 8/3 | 9/3 |
|---|---|---|---|---|
| 1. Urea | 1 lb of seeding plus 1 lb 3 weeks later | 3.2 | 3.3 | 3.8 |
| 2. 13-25-12 | 1 lb at seeding plus 1 lb 3 weeks later | 2.5 | 4.2 | 4.0 |
| 3. Blue Chip | 3.8 lb tilled in prior to seeding | 4.8 | 7.0 | 7.3 |
| 4. Blue Chip | 7.6 lb tilled in prior to seeding | 3.9 | 7.8 | 8.5 |
| 5. SCU | 3.8 lb tilled in prior to seeding | 4.2 | 6.2 | 6.7 |
| 6. SCU | 7.6 lb tilled in prior to seeding | 5.5 | 7.8 | 8.2 |
| 7. Milorganite | 6 lb (1000 lbs material) tilled in prior to seeding | 6.0 | 7.0 | 7.5 |
| LSD (0.05) | | 2.6 | 2.2 | 1.8 |

**TITLE:** Bentgrass Dormant Seeding Study

**OBJECTIVE:** Investigate the efficacy of various winter covers with timing of dormant seeding of creeping bentgrass

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

**INTRODUCTION:**

Late summer or early fall is considered the optimal time for seeding creeping bentgrass. Equipment problems, seed availability, and adverse weather conditions often delay seeding operations beyond the time considered best for establishment. Postponement of seeding late into the fall often results in low density, weak stands of creeping bentgrass in the following growing season. This stand loss is primarily due to lack of sufficient growth in the fall to survive winter conditions. Identification of management practices that would enhance the establishment of creeping bentgrass seeded very late in the fall would be beneficial to the golf course manager.

**MATERIALS AND METHODS:**

This study utilized approximately 2000 sq ft of the newly constructed USGA-spec research green at the Rocky Ford Turfgrass Research Plots. Four planting dates and two cover types were used. 'Penncross' creeping bentgrass was planted at 1 lb per 1000 sq ft on Oct 20, Nov 18, Feb 17, and Mar 17 on plots receiving no cover (control) or Trevera (a spun-woven polyester). Establishment ratings (1-9) were taken after cover removal for each plot. Each planting date x cover treatment was replicated three times in a randomized complete block design.

**RESULTS**

Effect of winter cover type and placement date on establishment of 'Penncross' creeping bentgrass is shown in Figure 1. LSD (0.05) equaled 2.18 for covers and 2.26 for dates. Bentgrass seeded in October or November had significantly higher establishment success compared to uncovered plots or covered plots seeded in February or March. Establishment ratings were higher under the Evergreen standed polyethylene compared to the spun-woven 'Trevia' when planted in October or November (Fig. 1). Establishment ratings were very poor in uncovered plots regardless of date of seeding (Fig. 1).

Figure 2 summarizes effect of seeding date averages across all cover treatments. It shows clearly that even though late October is really too late to plant bentgrass under usual conditions, covers may provide the additional protection needed for successful dormant seedling establishment.

Figure 1.

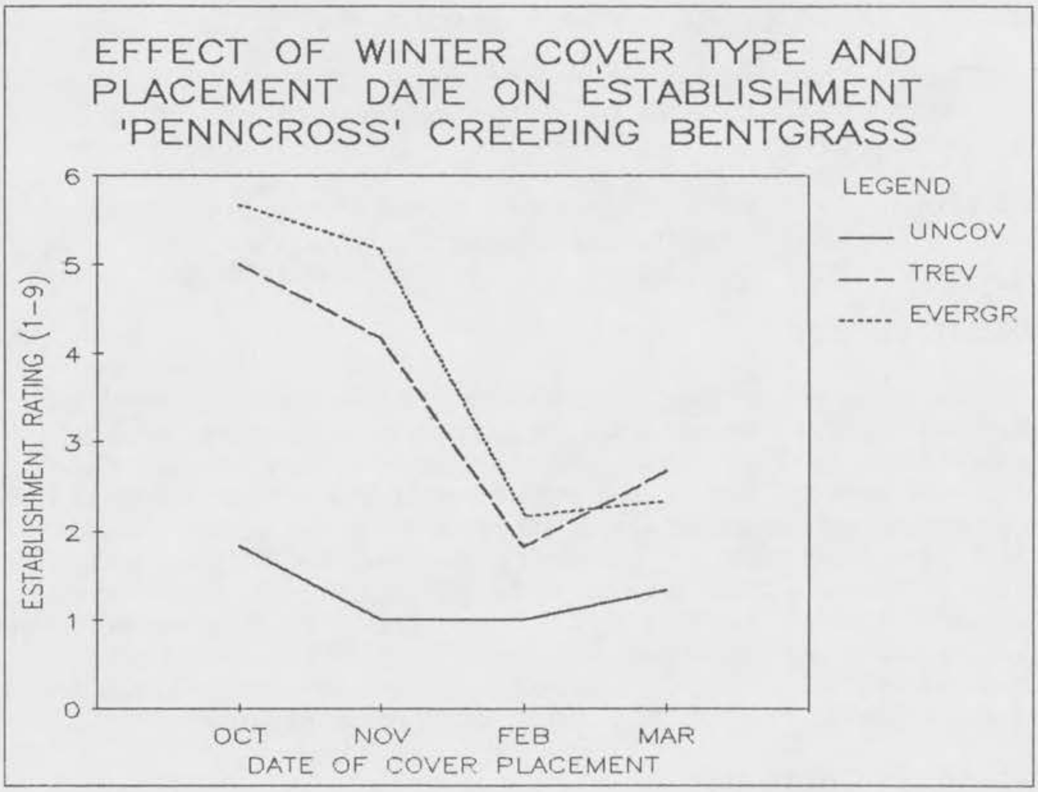
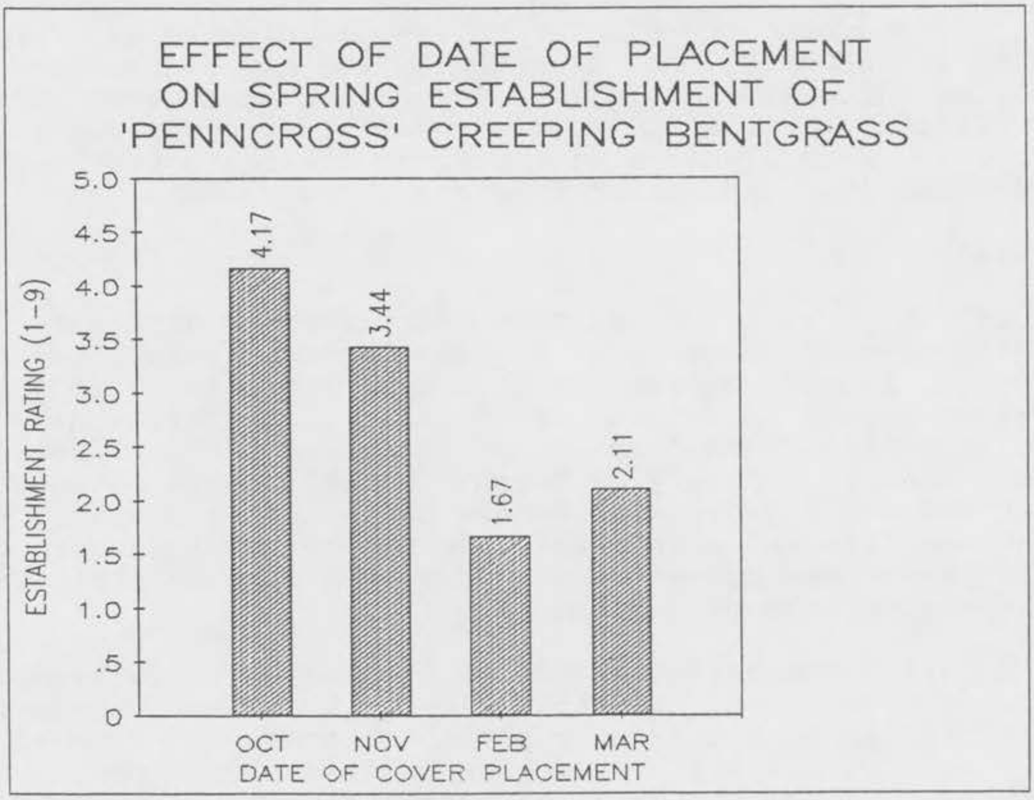



Figure 2.



**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 speeding on putting greens. The most common method of improving speeds 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 because 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 resistance to heat, drought, cold temperatures, and disease. 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 utilizes a complete block design with 10 treatment combinations. Each block is divided, with one half being mowed at 0.18 in and the other half cut at 0.09 in. Each block is further divided into five potassium treatments: 2, 4, 6, and 8 lbs of K per 1000 sq ft per yr. in four applications (April, June, August, and October). An untreated control is also included. Data being collected include monthly quality, rooting, rootzone, and canopy temperatures, and ball speed.

**RESULTS:**

Table 1 shows monthly quality of 'Penncross' creeping bentgrass as affected by potassium fertilization average across mowing heights. There was no statistically significant difference between plots treated with different rates of potassium from June through November. However, Table 2 shows that a reduction of mowing height from 3/16" to 3/32" significantly reduced quality during each month when the recordings were taken.

Table 3 shows that potassium did not affect ball speed at any rate of application during October or May evaluations. Table 4 shows the dramatic enhancement of ball speeds as mowing heights were decreased. It should be remembered, however, that additional ball speed is always accompanied by a loss of turf quality (Table 2).

The effect of potassium and mowing height on rooting are shown in Figures 1 and 2, respectively. Higher rates of potassium did not enhance rooting from samples taken in late May (Figure 1). In addition, significant reductions in rooting may occur if high rates of potassium are used with little regard to soil test information. Dramatic losses in rooting occurred in plots mowed to 3/32" height (Figure 2).

Table 1. Monthly quality of 'Penncross' creeping bentgarss as affected by potassium fertilization (averaged across mowing heights)

| | | | Monthly Quality | | |
|---|---|---|---|---|---|
| K level | June | July | August | September | November |
| 0 | 7.7 | 7.3 | 7.4 | 7.7 | 5.8 |
| 2 | 7.4 | 6.9 | 7.2 | 7.6 | 5.3 |
| 4 | 7.3 | 7.0 | 7.5 | 7.7 | 5.8 |
| 6 | 7.7 | 7.3 | 7.4 | 7.8 | 5.5 |
| 8 | 7.8 | 7.3 | 7.2 | 7.7 | 5.6 |
| | N.S. | N.S. | N.S. | N.S. | N.S. |

Table 2. Monthly quality of 'Penncross' creeping bentgrass as affected by mowing height (averaged across K rates)

| | | | Monthly Quality | | |
|---|---|---|---|---|---|
| Mowing Height | June | July | August | Sept | Nov |
| 3/32" | 6.9 | 6.7 | 7.0 | 7.2 | 4.6 |
| 3/16" | 8.2 | 7.7 | 7.7 | 8.2 | 6.5 |
| | ** | ** | ** | ** | ** |

Table 3. Effect of potassium fertilization on putting speed measured on 'Penncross' creeping bentgrass (averaged across mowing heights)

| K Rate (lb K per 1000 $ft^2$ per year) | Putting Speed (inches) 10/88 | 5/89 |
|---|---|---|
| 0 | 115 | 98 |
| 2 | 111 | 95 |
| 4 | 111 | 95 |
| 6 | 111 | 98 |
| 8 | 109 | 95 |
| | N.S. | N.S. |

Table 4. Effect of mowing height on putting speed measured on 'Penncross' creeping bentgrass (averaged across K rates)

| Mowing Height | Putting Speed (inches) 10/88 | 5/89 |
|---|---|---|
| 3/32" | 132 | 107 |
| 3/16" | 91 | 85 |
| | ** | ** |

Figure 1.

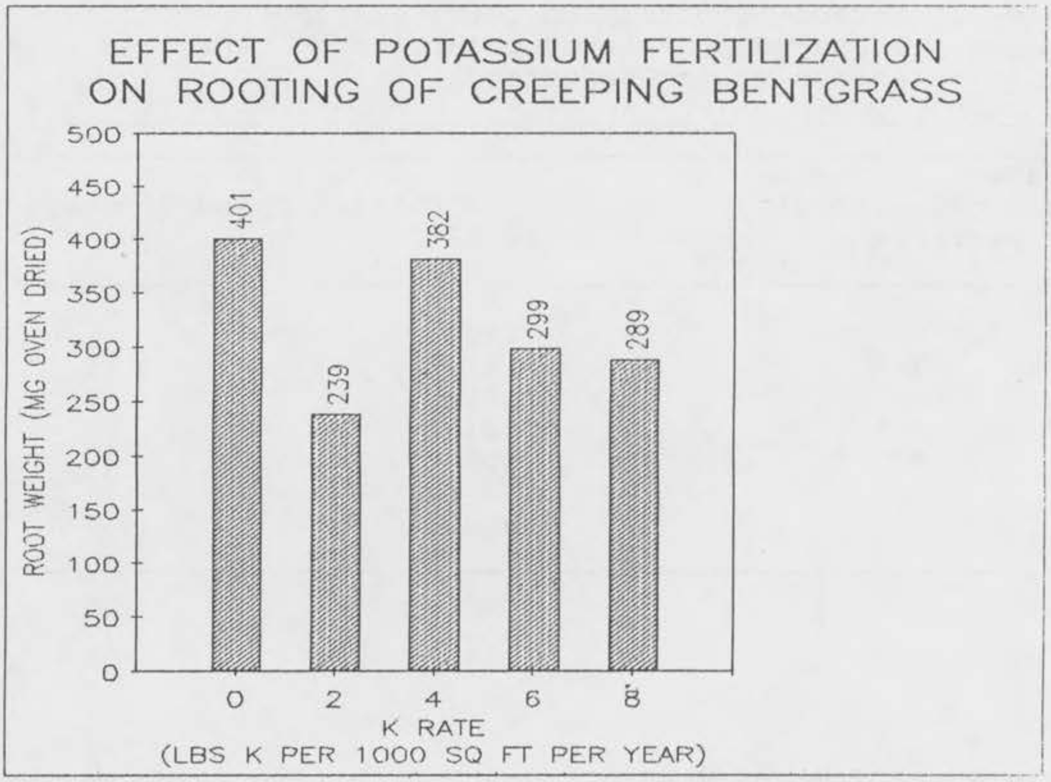
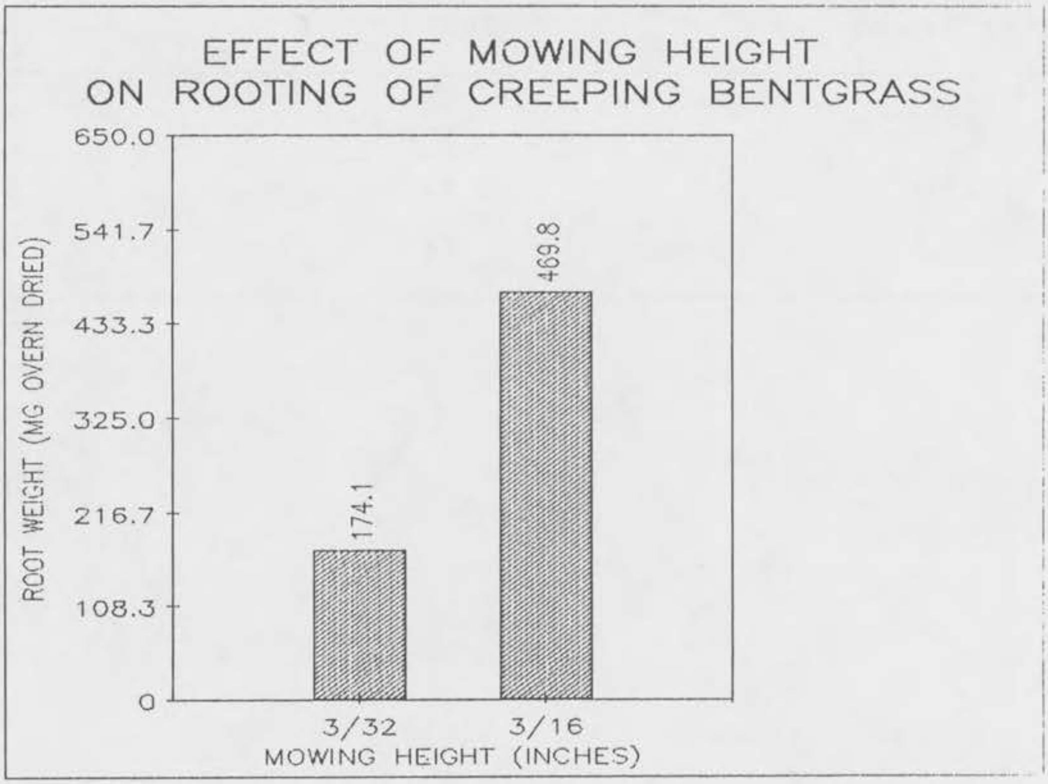



Figure 2.



**TITLE:** NTEP Perennial Ryegrass Cultivar Trial

**OBJECTIVE:** To evaluate several perennial ryegrass genotypes for their adaptability and performance under eastcentral Kansas conditions

**PERSONNEL:** Jeff Nus, Turfgrass Research and Teaching
John Pair, Turfgrass Research
Roch Gaussoin, Turfgrass Research and Teaching

**INTRODUCTION:**

Perennial ryegrasses are used widely in most areas of the United States because they germinate very quickly and cover rapidly and possess good wear tolerance and a rich deep 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 evaluations of commercial and experimental ryegrass genotypes, so he can make the best choice of ryegrasses for Kansas conditions.

**MATERIALS AND METHODS:**

Manhattan

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 sq ft, and a balanced (20-20-20) fertilizer was applied immediately after seeding at the rate of 1 lb N per 1000 sq ft. Monthly quality ratings (1-9, 9 = superb quality) are being recorded for each genotype, which is replicated three times in a randomized complete block experimental design. Plot size is 1 by 2 m. Plots are mowed at 3 in and fertilized with 4 lb N, 1 lb of P205, and 1 lb of K20 per year.

Wichita

A trial of 65 cultivars and experimental numbers was established on September 12, 1986. Maintenance was at 4 lbs N/1000 sq ft per year and a mowing height of 2 1/2 in with clippings removed. Balan/Treflan combination (Team) was applied in April and June for crabgrass prevention.

**RESULTS:**

Performance of the NTEP perennial ryegrass cultivar trials at Manhattan and Wichita are shown in Tables 1 and 2, respectively. Best perennial ryegrass performers in Manhattan were Blazer II, Saturn, PST-MZE, Citation II, Aquarius, Omego II, and Ranger. Best perennial ryegrass performers at Wichita were PST-2HH, Patriot, PST-2H7, Prelude, Pick 233, PST-250, Citation II, PST-2PM, Gator, and Pick 647. Also performing well were cultivars and experimental numbers Caliente, Derby, Birdie II, Manhattan II, Omega II, Pennant, BAR Lp 410, SR 4100, and PSU-333.

Table 1. Mean turfgrass quality of Perennial Ryegrass cultivars in the 1986 national Perennial Ryegrass test at Manhattan, KS. 1988 data.

| | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | MEAN |
|---|---|---|---|---|---|---|---|---|---|
| PICK 300 (BLAZER II) | 8.0 | 8.0 | 7.7 | 8.0 | 7.0 | 8.0 | 7.0 | 6.3 | 7.5 |
| PST-2PM (SATURN) | 7.7 | 7.0 | 7.7 | 8.0 | 7.7 | 7.7 | 7.7 | 6.7 | 7.5 |
| PST-M2E | 8.0 | 7.3 | 7.3 | 7.7 | 7.0 | 8.3 | 7.7 | 7.0 | 7.5 |
| CITATION II | 7.0 | 7.0 | 7.3 | 7.3 | 7.3 | 8.0 | 7.3 | 7.0 | 7.3 |
| KWS-AL-2 (AQUARIUS) | 7.7 | 8.7 | 7.3 | 7.7 | 6.3 | 7.3 | 7.3 | 6.3 | 7.3 |
| OMEGA II | 7.3 | 7.0 | 6.7 | 7.7 | 7.7 | 7.3 | 7.7 | 6.7 | 7.3 |
| RANGER | 7.0 | 7.3 | 7.7 | 7.7 | 6.3 | 7.7 | 7.3 | 7.0 | 7.3 |
| ALLAIRE | 7.7 | 8.0 | 7.0 | 7.3 | 6.7 | 7.7 | 7.0 | 6.3 | 7.2 |
| SR 4000 | 7.3 | 7.3 | 7.7 | 7.7 | 7.0 | 7.7 | 6.3 | 6.3 | 7.2 |
| TARA | 7.0 | 7.3 | 7.3 | 8.0 | 7.0 | 7.3 | 7.3 | 6.3 | 7.2 |
| PICK 647 | 7.3 | 7.7 | 7.0 | 7.3 | 6.7 | 7.7 | 7.0 | 6.0 | 7.1 |
| PICK 715 | 7.0 | 7.3 | 7.0 | 7.0 | 6.7 | 7.7 | 7.3 | 6.7 | 7.1 |
| PRELUDE | 7.3 | 7.0 | 7.3 | 7.3 | 7.0 | 7.7 | 7.0 | 6.3 | 7.1 |
| PST-2H7 | 7.0 | 7.3 | 7.7 | 7.7 | 6.3 | 7.7 | 6.7 | 6.7 | 7.1 |
| PST-2HH (CHARGER) | 7.3 | 7.7 | 7.0 | 7.0 | 7.0 | 7.3 | 7.0 | 6.3 | 7.1 |
| REPELL | 7.0 | 7.3 | 7.3 | 7.0 | 7.3 | 7.3 | 7.0 | 6.7 | 7.1 |
| SR 4100 | 7.7 | 6.7 | 7.3 | 7.0 | 7.3 | 7.3 | 7.3 | 6.3 | 7.1 |
| BARRY | 7.0 | 8.0 | 7.0 | 6.3 | 6.3 | 7.7 | 7.0 | 6.7 | 7.0 |
| BELLE | 7.7 | 6.7 | 7.0 | 6.7 | 7.3 | 7.0 | 7.0 | 6.3 | 7.0 |
| BIRDIE II | 6.7 | 6.3 | 7.3 | 7.0 | 7.0 | 7.7 | 7.0 | 7.0 | 7.0 |
| MANHATTAN II | 7.3 | 7.3 | 7.3 | 7.7 | 7.0 | 6.7 | 6.7 | 6.3 | 7.0 |
| PALMER | 7.0 | 6.7 | 7.3 | 7.7 | 7.3 | 7.7 | 6.3 | 6.3 | 7.0 |
| PATRIOT | 7.3 | 7.0 | 7.0 | 7.3 | 7.0 | 7.0 | 6.7 | 6.7 | 7.0 |
| PST-250 (COMPETITOR) | 7.0 | 7.7 | 7.0 | 7.3 | 6.3 | 7.0 | 7.0 | 6.3 | 7.0 |
| PST-259 (COMMANDER) | 7.0 | 7.0 | 7.3 | 7.7 | 6.7 | 7.3 | 7.0 | 6.3 | 7.0 |
| YORKTOWN II | 6.7 | 7.3 | 6.7 | 6.3 | 6.7 | 7.7 | 7.3 | 7.0 | 7.0 |
| DIPLOMAT | 6.7 | 6.7 | 7.0 | 6.7 | 6.7 | 7.3 | 7.3 | 6.7 | 6.9 |
| GATOR | 7.0 | 7.3 | 6.7 | 7.0 | 6.7 | 7.3 | 7.0 | 6.3 | 6.9 |
| ISI-851 (LINDSAY) | 7.0 | 7.3 | 7.3 | 7.7 | 6.0 | 7.3 | 6.3 | 6.3 | 6.9 |
| PICK 233 (DASHER II) | 7.0 | 7.0 | 7.0 | 7.3 | 6.7 | 7.0 | 6.7 | 6.7 | 6.9 |
| PST-2DD | 7.0 | 8.0 | 6.7 | 7.3 | 5.0 | 7.3 | 7.3 | 6.3 | 6.9 |
| PSU-222 | 6.7 | 6.7 | 7.0 | 7.3 | 6.7 | 7.3 | 7.0 | 6.7 | 6.9 |
| RODEO | 7.7 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 6.7 | 6.0 | 6.9 |
| BAR LP 410 | 6.7 | 6.7 | 7.3 | 7.0 | 6.7 | 7.3 | 6.3 | 6.7 | 6.8 |
| CALIENTE | 7.0 | 6.7 | 7.0 | 7.3 | 7.0 | 6.7 | 6.3 | 6.3 | 6.8 |
| GOALIE | 7.0 | 6.0 | 6.7 | 7.3 | 6.3 | 7.7 | 7.0 | 6.0 | 6.8 |
| ISI-K2 (DILLON) | 6.7 | 7.0 | 6.3 | 6.3 | 7.0 | 7.0 | 7.3 | 6.7 | 6.8 |
| PENNANT | 6.7 | 6.3 | 7.0 | 7.3 | 8.0 | 6.3 | 6.3 | 6.0 | 6.8 |
| PICK 600 (FIESTA II) | 7.7 | 7.0 | 6.7 | 7.0 | 6.0 | 7.3 | 6.7 | 6.3 | 6.8 |
| RONJA | 6.3 | 7.7 | 6.7 | 6.7 | 5.7 | 7.3 | 7.3 | 6.7 | 6.8 |
| RUNAWAY | 6.7 | 6.7 | 7.3 | 6.7 | 5.7 | 7.3 | 7.3 | 6.7 | 6.8 |
| SHERIFF | 6.7 | 6.7 | 7.0 | 7.0 | 6.7 | 7.0 | 7.0 | 6.3 | 6.8 |
| SR 4031 | 7.0 | 6.3 | 6.7 | 7.3 | 6.0 | 7.3 | 7.0 | 6.7 | 6.8 |
| 246 | 7.7 | 6.3 | 6.3 | 7.0 | 7.0 | 7.0 | 6.0 | 6.0 | 6.7 |
| ACROBAT | 6.7 | 7.0 | 6.3 | 7.0 | 7.0 | 6.7 | 6.7 | 6.0 | 6.7 |
| DERBY | 7.0 | 6.7 | 6.7 | 7.0 | 6.7 | 7.3 | 6.3 | 6.0 | 6.7 |
| NK 80389 | 6.7 | 7.0 | 6.7 | 6.7 | 5.7 | 7.3 | 7.0 | 6.3 | 6.7 |
| PSU-333 | 7.0 | 6.7 | 6.7 | 6.7 | 7.0 | 7.0 | 6.3 | 6.3 | 6.7 |
| REGENCY | 7.0 | 6.0 | 6.3 | 6.0 | 7.0 | 7.3 | 7.0 | 6.7 | 6.7 |
| COWBOY | 7.0 | 6.0 | 6.7 | 6.3 | 6.7 | 7.0 | 6.7 | 6.7 | 6.6 |
| DELRAY | 6.3 | 5.7 | 6.7 | 7.0 | 7.3 | 6.3 | 7.0 | 6.3 | 6.6 |
| BRENDA | 6.7 | 5.7 | 6.3 | 7.0 | 5.7 | 7.0 | 6.7 | 6.7 | 6.5 |
| DEL 946 | 6.3 | 6.0 | 6.3 | 6.7 | 7.3 | 6.7 | 6.7 | 6.3 | 6.5 |
| J207 | 6.7 | 7.0 | 6.3 | 6.7 | 6.0 | 6.7 | 6.7 | 6.0 | 6.5 |
| J208 | 6.3 | 6.7 | 7.0 | 6.0 | 5.7 | 7.0 | 7.0 | 6.7 | 6.5 |
| MANHATTAN | 5.7 | 6.3 | 6.7 | 6.7 | 6.7 | 6.7 | 6.3 | 6.7 | 6.5 |
| MOM LP 763 | 6.0 | 7.0 | 5.3 | 7.0 | 6.3 | 7.0 | 7.0 | 6.0 | 6.5 |
| OVATION | 6.3 | 6.3 | 6.0 | 6.7 | 7.0 | 6.7 | 7.0 | 6.0 | 6.5 |
| PENNFINE | 6.7 | 5.3 | 6.7 | 6.3 | 6.7 | 7.0 | 7.0 | 6.0 | 6.5 |
| REGAL | 7.0 | 5.7 | 6.3 | 6.7 | 6.7 | 7.0 | 6.7 | 6.0 | 6.5 |
| VINTAGE-2DF | 6.7 | 6.0 | 6.7 | 6.7 | 6.7 | 7.0 | 6.3 | 6.0 | 6.5 |
| BAR LP 454 | 6.7 | 7.0 | 6.7 | 6.7 | 6.7 | 6.3 | 5.7 | 5.7 | 6.4 |
| PAVO | 6.3 | 6.7 | 6.7 | 6.7 | 6.3 | 6.3 | 6.3 | 6.0 | 6.4 |
| RIVAL | 5.7 | 7.0 | 6.3 | 7.3 | 6.0 | 6.3 | 6.7 | 6.0 | 6.4 |
| LINN | 4.7 | 4.0 | 4.3 | 4.7 | 5.7 | 6.3 | 6.7 | 6.7 | 5.4 |

Quality ratings 1-9; 9 = best

Table 2. National Ryegrass cultivar evaluation at Wichita, KS. 1988.

| Exp. No. or Cultivar | Turf Quality (0-9 w/9=best) 5-24 | 7-15 | 8-31 | 10-21 | Season Avg. |
|---|---|---|---|---|---|
| PST-2HH | 7.3 | 6.8 | 7.5 DG | 7.5 | 7.3 |
| PST-2H7 | 7.3 DG | 6.2 DG,$ | 7.7 DG | 7.8 | 7.2 |
| Patriot | 7.8 | 6.5 $ | 7.2 | 7.2 | 7.2 |
| Pick 233 | 7.2 | 6.7 | 7.3 | 7.3 | 7.1 |
| Prelude | 7.5 | 6.7 $ | 7.2 DG | 7.2 | 7.1 |
| PST-250 | 8.0 DG | 6.3 $ | 7.2 | 7.0 | 7.1 |
| PST-M2E | 7.3 | 6.8 DG | 7.0 | 7.3 | 7.1 |
| Pick 647 | 7.8 | 5.8 | 7.2 | 7.3 | 7.0 |
| Citation II | 7.5 | 6.5 $ | 7.2 | 7.0 | 7.0 |
| PST-2PM | 7.3 | 6.3 $ | 7.0 | 7.3 | 7.0 |
| Gator | 7.5 | 6.0 Cg | 7.0 | 7.5 | 7.0 |
| PST-259 | 7.7 | 6.7 DG | 6.7 | 7.0 | 7.0 |
| Omega II | 6.8 | 6.7 | 7.0 Cg | 7.2 | 6.9 |
| SR 4000 | 7.3 | 6.5 | 6.7 | 7.3 | 6.9 |
| Caliente | 7.2 | 6.3 | 7.2 Cg | 6.8 | 6.9 |
| SR 4100 | 7.2 | 6.2 | 7.2 DG | 7.0 | 6.9 |
| Pennant | 7.0 | 6.3 $ | 7.3 | 7.2 | 6.9 |
| BAR Lp 410 | 7.5 | 6.5 | 6.3 | 7.2 | 6.9 |
| PSU-333 | 7.0 | 6.3 $ | 7.0 | 7.2 | 6.9 |
| Birdie II | 7.2 | 6.5 | 7.0 | 7.0 | 6.9 |
| Pennfine | 7.3 | 6.3 | 6.8 | 6.8 | 6.8 |
| Derby | 7.5 | 6.3 $ | 6.5 Cg | 6.8 | 6.8 |
| Manhattan II | 7.2 | 6.2 $ | 7.2 | 6.8 | 6.8 |
| Vintage-2DF | 7.2 | 6.2 | 6.8 | 7.0 | 6.8 |
| J207 | 7.3 | 6.3 $ | 6.7 Cg | 6.7 LG | 6.7 |
| Pick 600 | 7.2 | 6.0 $ | 6.8 | 6.7 | 6.7 |
| Runaway (HE 145) | 7.3 | 6.2 DG,$ | 6.7 | 6.8 | 6.7 |
| Ranger | 7.2 | 6.0 $ | 6.7 Cg | 7.0 | 6.7 |
| Mom Lp 763 | 7.2 LG | 5.7 $ | 7.0 LG | 6.8 | 6.7 |
| Palmer | 7.0 | 5.8 $ | 7.0 | 7.0 | 6.7 |
| Pick 715 | 7.3 | 6.2 S | 6.5 | 6.8 | 6.7 |
| Tara | 6.8 | 5.8 $ | 6.7 | 7.0 | 6.6 |
| ISI-851 | 6.8 | 6.8 $ | 6.2 | 6.8 | 6.6 |
| Belle | 7.3 | 6.0 $ | 6.8 | 6.5 | 6.6 |
| Goalie | 7.0 | 5.7 $ | 7.0 | 6.7 | 6.6 |
| Brenda | 7.3 | 6.2 $ | 6.3 Cg | 6.7 | 6.6 |
| Regency | 7.5 | 6.3 $ | 6.2 Cg | 6.5 | 6.6 |
| Sunrye (246) | 7.7 | 5.3 $ | 6.3 | 7.2 | 6.6 |
| Manhattan | 7.5 | 6.2 Cg,$ | 5.7 Cg | 6.5 | 6.5 |
| Repell | 7.3 | 6.2 $ | 6.3 | 6.3 | 6.5 |
| Cowboy | 6.7 | 6.2 | 6.3 Cg | 7.0 | 6.5 |
| Acrobat (HE 177) | 7.2 | 5.3 $ | 6.7 Cg | 7.0 | 6.5 |
| Yorktown II | 7.0 LG | 6.6 $ | 5.7 | 6.7 | 6.5 |
| Pick 300 | 7.5 | 5.3 Cg | 6.3 T | 6.8 | 6.5 |
| Pavo (WW E 14) | 7.2 | 6.3 $ | 6.3 | 6.2 | 6.5 |
| Ovation | 7.0 | 5.5 S | 6.3 LG,Cg | 6.8 | 6.4 |
| Delray | 6.7 LG | 5.8 | 6.8 DG | 6.5 | 6.4 |
| KWS-A1-2 | 6.6 LG,$ | 5.0 $ | 7.2 | 7.0 | 6.4 |
| SR 4031 | 7.5 | 6.0 | 5.8 | 6.5 | 6.4 |
| Sheriff | 7.2 | 5.8 $ | 6.2 Cg | 6.5 | 6.4 |
| PST-2DD | 7.7 DG | 5.5 CG | 5.2 Cg | 7.2 | 6.4 |
| Allaire | 7.8 T | 6.3 CG | 5.2 Cg | 6.5 | 6.4 |
| Ronja (WW E 31) | 7.3 W | 5.8 CG,W | 5.0 Cg | 7.0 | 6.3 |
| ISI-K2 | 7.3 | 6.5 $ | 5.8 | 5.8 | 6.3 |
| PSU-222 | 7.5 | 5.3 $ | 6.0 | 6.5 | 6.3 |
| BAR Lp 454 | 7.2 LG | 5.7 LG,S | 6.2 LG | 6.0 LG | 6.3 |
| Regal | 7.8 DG | 6.5 | 5.3 Cg | 5.8 | 6.3 |
| Barry | 7.2 DG | 6.2 | 5.3 Cg | 6.7 | 6.3 |
| Diplomat | 7.0 | 5.5 $ | 6.3 LG | 6.3 | 6.3 |
| DEL 946 | 7.0 | 5.5 $ | 6.2 | 6.3 | 6.2 |
| NK 80389 | 7.3 | 5.7 $ | 6.0 LG | 6.0 | 6.2 |
| Rival (HE 178) | 6.8 | 5.3 $ | 6.3 LG | 6.5 | 6.2 |
| J208 | 5.8 LG | 5.7 $ | 5.8 Cg | 6.8 | 6.0 |
| Rodeo | 7.0 | 5.7 $ | 4.8 | 6.3 | 5.9 |
| Linn | 5.0 T,C | 4.7 Cg,$ | 3.3 Cg | 5.0 | 4.5 |

Symbols: $ = Dollar Spot, C = Coarse, Cg = Crabgrass, DG = Dark Green, LG = Light Green, T = Thin stand

**TITLE:** Scalping Recovery of 65 Perennial Ryegrass Cultivars and Selections

**OBJECTIVE:** To identify selections of perennial ryegrass that recover best from simulated scalping injury

**PERSONNEL:** Paul Haupt, Turfgrass Technician
Roch Gaussoin, Turfgrass Teaching and Research

**INTRODUCTION:**

Irregular terrain and misadjusted mowers can cause severe scalping damage to establish turfgrass stands. Within a turfgrass species, the ability to recover from scalping injury, given equal management, depends on inherent genetic differences. Identification of perennial ryegrass cultivars that recover better from scalping injury can help turfgrass managers make appropriate choices for perennial ryegrass cultivars.

**METHODS:**

The National Perennial Ryegrass Trial established in 1986 was mowed at 3" in 1986-1988. On March 7, 1989, the mowing height on half of the trial was dropped to 3/4" in preparation for the Perennial Ryegrass Divot Recovery Study (see previous Kentucky Bluegrass Divot Study report).

On May 1, 1989, the area being mowed at 3/4" was verticut three times and core aerified once. The drop in mowing height plus the aerification treatments severely injured the perennial ryegrass. The ability for the ryegrass cultivars to recover from this treatment should be an estimate of scalping recovery of cultivars. On May 25, the cultivars were evaluated visually for recovery based on a scale of 1-10, with a 10 indicating best recovery.

**RESULTS:**

Ranking of perennial ryegrass selections based on recovery are shown in Table 1. Commercially available cultivars showing good to excellent recovery were Delray, Ovation, Rival, Pennfine, Pavo, and Regal, whereas poor recovery was exhibited by Tara, Yorktown II, Repell, and Diplomat. When making a cultivar choice, however, use scalping recovery combined with other desirable attributes.

Table 1. Recovery of 65 perennial ryegrass cultivars and selections after severe scalping injury. Manhattan, KS 1989

| Entry | Recovery[a] |
|---|---|
| Delray | 10.00 A |
| Ovation | 9.67 AB |
| Rival | 9.33 ABC |
| Pennfine | 9.33 ABC |
| Vintage-2DF | 9.33 ABC |
| Pavo | 9.33 ABC |
| Regal | 9.33 ABC |
| Derby | 9.00 ABCD |
| Acrobat | 9.00 ABCD |
| Belle | 9.00 ABCD |
| 246 | 9.00 ABCD |
| PSU-222 | 8.67 ABCDE |
| Goalie | 8.67 ABCDE |
| Pennant | 8.67 ABCDE |
| DEL 946 | 8.67 ABCDE |
| PST-259 | 8.67 ABCDE |
| PSU-333 | 8.67 ABCDE |
| J 207 | 8.67 ABCDE |
| Sherriff | 8.67 ABCDE |
| BAR LP 410 | 8.67 ABCDE |
| Pick 600 | 8.33 BCDEF |
| Prelude | 8.33 BCDEF |
| Aquarius | 8.33 BCDEF |
| Rodeo | 8.33 BCDEF |
| PST-2PM | 8.33 BCDEF |
| Brenda | 8.33 BCDEF |
| Regency | 8.33 BCDEF |
| Caliente | 8.33 BCDEF |
| SR 4031 | 8.33 BCDEF |
| J 208 | 8.33 BCDEF |
| MOM-LP-763 | 8.33 BCDEF |
| BAR LP 454 | 8.00 CDEFG |
| Patriot | 8.00 CDEFG |
| SR 4100 | 8.00 CDEFG |
| Birdie II | 8.00 CDEFG |
| Pick 647 | 8.00 CDEFG |
| Gator | 8.00 CDEFG |
| ISI-K2 | 8.00 CDEFG |
| Pick 233 | 8.00 CDEFG |
| Pick 751 | 7.67 DEFGH |
| Palmer | 7.67 DEFGH |
| Linn | 7.67 DEFGH |
| Pick 300 | 7.67 DEFGH |
| SR 4000 | 7.67 DEFGH |
| Barry | 7.67 DEFGH |
| Ronja | 7.67 DEFGH |
| Runaway | 7.67 DEFGH |
| ISI-851 | 7.67 DEFGH |
| Cowboy | 7.67 DEFGH |
| Citation II | 7.33 EFGHI |
| Allaire | 7.33 EFGHI |
| PST-2H7 | 7.33 EFGHI |
| Manhattan | 7.33 EFGHI |
| Omega II | 7.33 EFGHI |
| PST-2DD | 7.00 FGHI |
| Ranger | 7.00 FGHI |
| NK 80389 | 7.00 FGHI |
| Manhattan II | 7.00 FGHI |
| PST-250 | 7.00 FGHI |
| PST-M2E | 7.00 FGHI |
| Diplomat | 7.00 FGHI |
| PST-2HH | 6.67 GHI |
| Repell | 6.67 GHI |
| Yorktown II | 6.33 HI |
| Tara | 6.00 I |

Entries followed by different letters are significantly different based on the P=0.05 level of probabilty

[a] Based on a scale of 1 to 10 with a 10 indicating best recovery

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

**OBJECTIVE:** 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

**INTRODUCTION:**

Wetting agents have long been used by turfgrass managers to relieve localized dry spots, provide more even coverage of pesticides, and prevent dew formation on greens and 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 irrigated 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 by natural means is not keeping pace with the demand placed on them by irrigation. Any means by which water could be saved to lower the demand from those aquifers warrants research attention. This study was initiated to test if increasing rates of wetting agent would result in a lower water use rate or improvement in quality of 'Manhattan' perennial ryegrasses.

**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 12 15 x 15 plots that can be irrigated independently. Irrometer tensiometers were buried at a 4-in depth in each of these plots and irrigation is performed when soil tension reaches 60 centibars. Plots have been treated with 2, 4, or 8 fluid oz per 1000 sq ft of Super Wet (Clearys). An untreated control is included. Data collected include summer monthly quality.

**RESULTS:**

Table 1 shows the influence of various rates of wetting agent on summer quality of 'Manhattan' perennial ryegrass in 1988. Wetting agent applications up to 8 oz of material per 1000 sq ft did not significantly affect summer quality of 'Manhattan' perennial ryegrass.

Table 1. Influence of various rates of wetting agent on summer quality of 'Manhattan' perennial ryegrass in 1988.

| Wetting Agent rate (per application) | Monthly Quality May | June | July | August |
|---|---|---|---|---|
| 0 | 7.3 | 7.7 | 6.8 | 6.8 |
| 2 | 7.0 | 7.5 | 6.7 | 6.3 |
| 4 | 7.5 | 7.7 | 6.5 | 6.5 |
| 8 | 7.3 | 7.3 | 7.0 | 6.7 |
| | N.S. | N.S. | N.S. | N.S. |

**TITLE:** Effect of Cultivation Technique and Polyacrylamide Gels on Quality and Safety Factors of Sports Turf

**OBJECTIVES:**

1) To determine whether the addition of cross-linked polyacrylamide gels to sports turf root-zones may affect moisture retention, expansion properties, oxygen availability, and the water use requirement of the turf

2) To determine if power grooving alone or in combination with the use of polyacrylamide gels may reduce yield hardness and enhance turf quality compared to conventional hollow tine aerification

**PERSONNEL:** Jeff Nus, Turfgrass Research and Teaching
Roch Gaussoin, Turfgrass Research and Teaching
Mike Boaz, Graduate Assistant & Turfgrass student

**FUNDING:** Olathe Manufacturing Company

**OTHER SPONSORS:** Western Polyacrylamide, Pickseed West

**INTRODUCTION:**

Quality and safety characteristics are prime concerns of managers of sports turf. Quality sports turfs are difficult to maintain because of the high degree of wear damage and the soil compaction that occurs with moderate to heavy use. The cushioning effect of a quality turf, field hardness, and compaction and their relationships with soil water and irrigation management are of great concern to the field manager. Often, the manager is under rigid, incompatible schedules for field use and turf management.

Cross-linked polyacrylamide has been used as a soil conditioner in containerized plant production to greatly increase the amount of plant-available water. Methods for lengthening irrigation cycles while maintaining quality would be beneficial to sports turf management.

Recent research indicates that traditional coring techniques of aerification tend to create a deeper compaction zone just below the level of penetration. A machine that does not depend upon a downward motion may eliminate this problem.

**METHODS:**

<u>Frank Annenberg Sports Field</u>

The project will encompass a 'real life' testing on a soccer field at the Frank Annenberg Sports Complex, which is managed by the Manhattan Parks and Recreation Commission. The experiment will be initiated in the summer of 1989. Treatments will include a control (no aerification treatment), hollow tine coring, grooving along, and grooving in combination with the use of cross-linked polyacrylamide. Parameters to be monitored will be turf quality, field hardness, and rooting capacity.

T.R.I.S.

The Toro Research Irrigation System is a series of 88 15 x 15 ft. plots, each of which can be irrigated independently. Twenty-four of these plots are being used to investigate the effects of incorporating polyacrylamide into the rootzone on water use requirements and quality of Mustang turf-type tall fescue. The treatments will include a control and increments of additional available water held by the polymer based on the maximum evapotranspiration of the turf for 1, 2, 3, 4, and 5 days. Parameters to be collected include monthly quality, density, and rooting, plus seasonal water use.

Polyacrylamide Rate Study

As with any new material used in industry, limits need to be explored to set guidelines for its use. Rates of 1/2X, X, 2X, 3X, and 5X will be used (X - recommended rates as determined by the manufacturer). Parameters to be investigated include turf quality, rooting, and field hardness (or softness). At higher rates softness may determine mowability and also may reduce gas exchange.

**TITLE:** National Tall Fescue Cultivar Trial

**OBJECTIVE:** To evaluate commercial and experimental tall fescue genotypes under Kansas conditions and provide that data to the National Turfgrass Evaluation program

**PERSONNEL:** Jeff Nus, Turfgrass Research and Teaching
John Pair, Turfgrass Research

## INTRODUCTION:

Tall fescue is the best adapted, cool-season turfgrasses for use in the transition zone because of its greater drought and heat tolerance. Although tall 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 improve tall fescue cultivars include selection for finer leaf blades, good mowing quality, a good, rich green color, and better sward density, while maintaining good stress tolerance characteristics.

## MATERIALS AND METHODS:

### Manhattan

Sixty-five commercial and experimental tall fescue genotpyes were provided by the National Turfgrass Evaluation Program in the fall of 1987 (Table 1). They were planted in Section I of the Rocky Ford Turfgrass Research Plots during the first week of September. Each genotype was replicated three times in a randomized complete block experimental design. Seeding was done by hand at the rate of 8 lbs of seed per 1000 sq ft. Monthly quality ratings are being recorded for each genotype.

### Wichita

A new, national trial of 65 cultivars and experimental numbers was established on September 10, 1987. Plots were maintained at 4 lbs N/1000 sq ft per year, mowed at 2 1/2 in with clippings removed, and irrigated to alleviate stress. Team (Balan/Treflan) was applied in April and June for crabgrass prevention.

**RESULTS:**

Performance of the NTEP tall fescue cultivar trials at Manhattan and Wichita is shown in Tables 1 and 2, respectively. Best performing cultivars at Manhattan were KWS-BG-6, Pick DM, Pick 127, Aztec, Hubbard 87, Normarc 99, Shenandoah Shortstop, Pick GH6, Pick TF9, and PST-SMW. These cultivars have greatly improved color, fineness of texture, and sward density.

Best performing selections in Wichita were Hubbard 87, Monarch, Normarc 99, Pick DDF, Pick SLD, Pick TF9, KWS-BG-6, Tribute, Aztec, PE-7, PE-7E, Pick DM, Normarc 25, PST-50L, PST-5MW, Pick GH6, PST-5HF, PST-5DM, and Pick 127. Other close contenders were Pick 845 PN, Normarc 77, PST-5D7, Bonanza, Trailblazer, PST-5D1, Thoroughbred, Jaguar II, Apache, Carefree, Bel 86-1, Bel 86-2, PST-5EN, Finelawn 5GL, and Wrangler (Table 2). Other promising cultivars and experimental numbers include Legend, Sundance, Titan, Chieftan, Olympic, Cimmaron, Jaguar, Williamette, JB-2, BAR Fa 7851, KWS-DUR, PST-5AG, PST-5BL, PST-5AP, PST-DBC, and PST-5F2. Selections with notably darker genetic color are Pick DDF, Pick SLD, KWS-DUR, Pick GH6, PST-5MW, and Bel 86-1.

Table 1. Mean turfgrass quality ratings of Tall Fescue cultivars in the 1987 National Tall Fescue test at Manhattan, KS. 1988 data.

| Exp. No. or Cultivar | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | MEAN |
|---|---|---|---|---|---|---|---|---|---|
| KWS-BG-6 | 8.7 | 8.7 | 8.7 | 8.3 | 8.7 | 9.0 | 8.0 | 7.7 | 8.5 |
| PICK DM | 7.3 | 7.3 | 7.7 | 7.7 | 8.0 | 8.3 | 8.0 | 7.7 | 7.8 |
| PICK 127 | 8.0 | 8.0 | 7.7 | 8.0 | 7.7 | 7.7 | 7.3 | 7.0 | 7.7 |
| AZTEC | 7.3 | 7.3 | 7.7 | 7.7 | 8.0 | 7.7 | 7.3 | 7.3 | 7.5 |
| HUBBARD 87 | 8.0 | 7.3 | 8.0 | 7.3 | 7.7 | 7.3 | 7.3 | 7.3 | 7.5 |
| NORMARC 99 | 7.7 | 7.7 | 7.7 | 7.3 | 7.7 | 7.7 | 7.7 | 6.7 | 7.5 |
| PE-7E (SHENANDOAH) | 7.7 | 8.0 | 7.7 | 7.7 | 8.0 | 7.3 | 7.0 | 7.0 | 7.5 |
| PICK DDF (SHORTSTOP) | 8.3 | 8.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 6.7 | 7.5 |
| PICK GH6 | 7.3 | 8.0 | 8.0 | 7.3 | 7.7 | 7.7 | 7.3 | 7.0 | 7.5 |
| PICK TF9 | 7.7 | 7.3 | 7.0 | 7.3 | 7.3 | 8.0 | 7.7 | 7.3 | 7.5 |
| PST-5MW | 7.7 | 7.0 | 7.3 | 7.3 | 8.0 | 8.0 | 7.7 | 7.0 | 7.5 |
| PE-7 | 7.7 | 7.3 | 7.7 | 7.0 | 7.3 | 7.7 | 7.3 | 7.0 | 7.4 |
| PICK 845PN | 8.0 | 7.7 | 7.3 | 7.3 | 7.7 | 7.0 | 7.0 | 7.0 | 7.4 |
| PST-5D1 (ELDORADO) | 7.7 | 8.0 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 6.7 | 7.4 |
| TRAILBLAZER | 7.7 | 7.3 | 7.7 | 7.0 | 7.0 | 7.7 | 7.7 | 7.3 | 7.4 |
| PST-5BL (SILVERADO) | 7.3 | 8.0 | 7.0 | 7.0 | 7.0 | 7.7 | 7.7 | 7.0 | 7.3 |
| APACHE | 7.7 | 7.7 | 6.7 | 7.3 | 7.3 | 7.0 | 7.0 | 7.0 | 7.2 |
| KWS-DUR | 7.3 | 7.3 | 7.7 | 7.3 | 7.0 | 7.3 | 7.0 | 6.7 | 7.2 |
| MONARCH | 7.7 | 7.3 | 7.0 | 7.3 | 7.3 | 7.0 | 7.0 | 6.7 | 7.2 |
| PST-5HF (AMIGO) | 7.7 | 7.3 | 7.0 | 7.7 | 7.0 | 7.0 | 7.0 | 7.0 | 7.2 |
| CAREFREE | 7.3 | 7.0 | 7.3 | 6.7 | 7.0 | 7.3 | 7.3 | 6.7 | 7.1 |
| CHIEFTAIN | 7.0 | 7.0 | 7.0 | 7.0 | 7.3 | 7.3 | 7.3 | 7.0 | 7.1 |
| PICK SLD | 7.7 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.1 |
| PST-5D7 (MURIETTA) | 7.7 | 7.3 | 7.3 | 6.7 | 7.0 | 7.0 | 7.0 | 7.0 | 7.1 |
| PST-5DM | 7.0 | 7.7 | 7.0 | 7.3 | 7.3 | 7.0 | 7.0 | 6.7 | 7.1 |
| SUNDANCE | 7.0 | 7.0 | 7.3 | 7.0 | 7.0 | 7.3 | 7.0 | 7.3 | 7.1 |
| BAR FA 7851 (BARNONE) | 7.3 | 7.3 | 6.7 | 7.0 | 6.7 | 6.7 | 7.0 | 7.0 | 7.0 |
| LEGEND | 6.7 | 6.7 | 7.0 | 7.0 | 6.3 | 7.3 | 7.3 | 7.3 | 7.0 |
| NORMARC 25 | 7.7 | 6.7 | 7.0 | 7.0 | 7.3 | 7.0 | 7.0 | 6.7 | 7.0 |
| NORMARC 77 | 6.7 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| PST-5AP | 7.7 | 7.0 | 7.0 | 7.3 | 6.7 | 6.3 | 7.0 | 7.3 | 7.0 |
| PST-5EN | 7.0 | 6.7 | 7.0 | 7.3 | 6.7 | 7.0 | 7.0 | 7.0 | 7.0 |
| PST-5F2 (WINCHESTER) | 7.0 | 7.0 | 7.0 | 7.3 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| PST-5OL | 6.7 | 6.7 | 7.3 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| BEL 86-1 | 7.7 | 7.3 | 7.3 | 7.0 | 6.7 | 6.7 | 6.7 | 6.0 | 6.9 |
| BEL 86-2 | 7.3 | 7.3 | 6.7 | 6.7 | 6.7 | 7.0 | 7.0 | 6.7 | 6.9 |
| BONANZA | 7.7 | 7.0 | 6.7 | 6.7 | 7.0 | 7.3 | 6.3 | 6.3 | 6.9 |
| CIMMARON | 7.0 | 7.0 | 7.0 | 6.3 | 7.0 | 7.0 | 7.0 | 7.0 | 6.9 |
| JB-2 | 7.3 | 6.7 | 6.7 | 6.7 | 6.7 | 7.0 | 7.0 | 7.0 | 6.9 |
| OLYMPIC | 7.0 | 6.7 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 6.3 | 6.9 |
| PST-5AG | 7.3 | 6.3 | 7.3 | 6.3 | 7.0 | 7.0 | 7.0 | 6.7 | 6.9 |
| TAURUS | 7.3 | 7.0 | 7.0 | 7.0 | 6.7 | 6.7 | 6.7 | 7.0 | 6.9 |
| TRIBUTE | 6.7 | 7.0 | 7.3 | 7.0 | 6.7 | 7.0 | 7.0 | 6.7 | 6.9 |
| WRANGLER | 7.0 | 7.0 | 6.7 | 7.0 | 7.0 | 7.0 | 7.0 | 6.7 | 6.9 |
| ADVENTURE | 7.0 | 7.0 | 6.7 | 6.7 | 6.7 | 6.7 | 6.7 | 7.0 | 6.8 |
| JAGUAR | 7.0 | 7.0 | 6.3 | 7.0 | 6.3 | 7.0 | 6.7 | 6.7 | 6.8 |
| MESA | 7.3 | 6.7 | 7.0 | 6.7 | 7.3 | 7.0 | 6.3 | 5.7 | 6.8 |
| REBEL II | 6.3 | 6.7 | 6.7 | 6.7 | 6.7 | 7.3 | 7.3 | 7.0 | 6.8 |
| THOROUGHBRED | 7.0 | 6.7 | 6.7 | 6.7 | 7.0 | 7.0 | 6.7 | 6.7 | 6.8 |
| TRIDENT | 7.0 | 7.3 | 6.7 | 7.0 | 6.3 | 6.7 | 6.7 | 7.0 | 6.8 |
| JAGUAR II | 6.7 | 7.0 | 7.0 | 6.0 | 6.7 | 7.0 | 6.7 | 6.7 | 6.7 |
| PACER | 7.0 | 6.7 | 6.7 | 5.7 | 6.7 | 6.7 | 7.0 | 7.0 | 6.7 |
| PST-DBC | 7.0 | 7.3 | 6.7 | 6.7 | 6.7 | 6.7 | 6.3 | 6.3 | 6.7 |
| ARID | 6.0 | 6.3 | 7.0 | 6.7 | 6.7 | 6.3 | 7.0 | 7.0 | 6.6 |
| REBEL | 6.3 | 6.0 | 6.7 | 6.7 | 6.0 | 7.0 | 7.0 | 7.0 | 6.6 |
| FINELAWN 5GL | 6.7 | 6.7 | 7.0 | 6.7 | 6.3 | 6.3 | 6.3 | 6.0 | 6.5 |
| TITAN | 7.0 | 6.3 | 6.3 | 6.7 | 6.7 | 6.3 | 6.3 | 6.3 | 6.5 |
| FALCON | 6.7 | 6.3 | 6.7 | 6.0 | 6.3 | 6.7 | 6.3 | 6.0 | 6.4 |
| RICHMOND | 6.0 | 6.3 | 6.3 | 6.3 | 6.0 | 6.3 | 6.3 | 6.3 | 6.3 |
| TIP | 5.7 | 6.3 | 6.3 | 6.3 | 6.0 | 6.3 | 7.0 | 6.7 | 6.3 |
| FINELAWN I | 6.7 | 6.3 | 6.3 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.2 |
| WILLAMETTE | 6.3 | 5.7 | 6.0 | 6.0 | 6.3 | 6.3 | 6.7 | 6.3 | 6.2 |
| FATIMA | 6.3 | 6.3 | 6.0 | 6.3 | 5.3 | 6.0 | 6.3 | 6.3 | 6.1 |
| SYN GA | 6.0 | 6.0 | 6.3 | 6.0 | 6.0 | 6.0 | 6.0 | 6.3 | 6.1 |
| KY-31 | 6.0 | 5.0 | 5.3 | 5.0 | 5.0 | 5.0 | 5.0 | 5.3 | 5.2 |

Quality ratings 1-9; 9 = best

Table 2. National Tall Fescue cultivar evaluation at Wichita, KS. 1988.

| Exp. No. or Cultivar | Genetic Color | Turf Quality (0-9 w/9=best) 5-19 | 6-30 | 8-5 | 10-10 | Season Avg. |
|---|---|---|---|---|---|---|
| Hubbard 87 | 7.3 | 8.0 | 7.8 DG | 7.8 | 7.5 SF | 7.8 |
| Pick TF9 | 7.3 | 7.8 | 7.8 DG | 7.8 | 7.5 | 7.7 |
| KWS-BG-6 | 6.2 | 8.0 | 7.8 DG | 7.8 DG | 7.3 DG | 7.7 |
| Pick SLD | 7.7 | 7.8 | 8.0 D | 8.0 | 7.2 | 7.7 |
| Normarc 99 | 6.5 | 8.0 | 7.7 | 7.8 | 7.2 | 7.7 |
| Monarch | 6.8 | 7.8 | 7.5 | 7.8 | 7.7 | 7.7 |
| Pick DDF | 7.7 | 7.7 DG | 7.8 | 7.8 | 7.7 DG | 7.7 |
| PE-7E | 7.5 | 7.7 | 7.7 | 8.0 DG | 7.2 | 7.6 |
| PE-7 | 7.3 | 7.7 | 7.7 | 7.5 | 7.5 | 7.6 |
| Pick DM | 7.5 | 7.8 | 7.5 | 7.3 | 7.7 DG | 7.6 |
| Aztec | 7.3 | 7.8 | 7.8 | 7.7 | 7.2 | 7.6 |
| Tribute | 7.5 | 7.3 | 7.7 DG | 8.3 DG | 7.2 | 7.6 |
| Pick GH6 | 7.8 | 7.3 | 7.7 | 7.8 DG | 7.2 | 7.5 |
| PST-5DM | 7.3 | 7.7 | 7.8 | 7.7 | 7.0 | 7.5 |
| Normarc 25 | 7.2 | 7.5 | 7.8 | 7.5 | 7.2 | 7.5 |
| Pick 127 | 7.5 | 7.7 | 7.8 D | 7.7 | 7.0 | 7.5 |
| PST-5HF | 7.5 | 7.7 | 7.2 | 7.7 | 7.3 | 7.5 |
| PST-5MW | 7.7 | 8.0 | 7.5 | 7.7 | 7.0 | 7.5 |
| PST-50L | 7.5 | 7.5 | 7.5 | 7.8 | 7.2 | 7.5 |
| PST-5D7 | 6.2 | 7.3 | 7.5 | 7.7 | 7.2 | 7.4 |
| Pick 845PN | 7.3 | 7.8 DG | 7.2 | 7.5 | 7.3 | 7.4 |
| Normarc 77 | 7.5 | 7.2 | 7.5 | 7.7 | 7.2 | 7.4 |
| PST-5D1 | 7.3 | 7.5 | 7.3 | 7.7 | 7.3 | 7.4 |
| Trailblazer | 7.5 | 7.8 | 6.8 | 7.7 DG | 7.2 | 7.4 |
| Bonanza | 7.3 | 7.7 | 7.2 | 7.3 | 7.3 | 7.4 |
| Finelawn 5GL | 7.0 | 7.5 | 7.2 | 7.5 | 7.0 | 7.3 |
| PST-5EN | 7.0 | 7.3 | 7.5 | 7.5 | 7.0 | 7.3 |
| Bel 86-2 | 7.2 | 7.5 | 7.0 | 7.5 | 7.2 | 7.3 |
| Bel 86-1 | 7.7 | 7.5 | 7.2 | 7.2 | 7.2 | 7.3 |
| Wrangler | 7.3 | 7.2 | 7.3 | 7.5 | 7.2 | 7.3 |
| Thoroughbred | 7.0 | 7.5 | 7.5 | 7.3 | 6.8 | 7.3 |
| Carefree | 7.3 | 7.5 | 7.2 | 7.3 | 7.3 | 7.3 |
| Apache | 7.5 | 7.3 | 7.3 | 7.5 | 7.2 LG | 7.3 |
| Jaguar II | 7.3 | 7.3 | 7.2 | 7.5 | 7.3 | 7.3 |
| KWS-DUR | 7.8 | 7.0 | 7.2 | 7.8 | 6.8 | 7.2 |
| Sundance | 7.2 | 7.5 | 6.8 | 7.5 | 7.0 | 7.2 |
| PST-5AP | 7.2 | 7.3 | 7.3 | 7.0 | 7.2 | 7.2 |
| PST-5AG | 7.3 | 7.7 | 7.0 | 7.0 | 7.3 | 7.2 |
| Legend | 7.3 | 7.3 | 7.2 | 7.0 | 7.2 | 7.2 |
| Cimmaron | 7.3 | 7.7 | 6.8 | 7.5 | 6.8 | 7.2 |
| PST-5F2 | 7.5 | 7.2 | 7.3 | 7.3 | 7.0 | 7.2 |
| Willamette | 7.0 | 7.0 | 7.2 | 7.3 | 6.8 | 7.1 |
| Olympic | 7.0 | 7.5 | 7.0 | 7.2 | 6.8 | 7.1 |
| PST-DBC | 7.3 | 7.3 | 6.8 | 7.2 | 7.0 | 7.1 |
| PST-5BL | 6.5 | 7.5 | 6.7 | 7.0 | 7.3 | 7.1 |
| BAR Fa 7851 | 7.3 | 7.2 | 7.0 | 7.0 | 7.2 | 7.1 |
| Chieftan | 6.8 | 7.0 | 7.0 | 7.3 | 6.8 | 7.0 |
| JB-2 | 7.0 | 7.0 | 7.2 | 7.0 | 7.0 | 7.0 |
| Jaguar | 6.5 | 7.0 | 6.8 | 7.0 | 7.0 LG | 7.0 |
| Titan | 7.2 | 7.2 | 6.8 | 7.2 | 6.8 | 7.0 |
| Adventure | 7.2 | 7.2 | 6.7 | 6.8 | 7.0 | 6.9 |
| Taurus | 7.2 | 7.3 | 6.5 | 7.0 | 6.7 | 6.9 |
| Syn Ga | 6.8 | 7.0 | 7.0 | 7.0 | 6.7 | 6.9 |
| Trident | 7.2 | 6.8 | 6.8 | 7.2 | 7.0 | 6.9 |
| Arid | 6.7 | 6.8 | 6.5 | 7.2 | 7.0 | 6.9 |
| Rebel II | 7.0 | 7.0 | 6.3 LG | 6.8 | 7.3 | 6.8 |
| Finelawn I | 6.5 | 6.7 | 6.5 LG | 7.2 | 7.0 | 6.8 |
| Mesa | 7.3 | 7.0 | 6.5 | 6.7 | 7.2 | 6.8 |
| Rebel | 6.5 | 6.7 | 6.7 | 6.8 | 6.7 LG | 6.7 |
| Falcon | 6.8 | 6.7 | 7.0 | 7.0 | 6.3 | 6.7 |
| Richmond | 6.8 | 6.8 | 6.2 | 7.2 | 6.7 | 6.7 |
| Pacer | 7.2 | 7.0 | 6.3 | 7.2 | 6.3 | 6.7 |
| Fatima | 6.8 | 6.7 | 6.7 | 6.2 | 6.0 | 6.4 |
| Tip | 6.8 | 6.2 | 5.8 | 6.8 | 6.0 | 6.2 |
| Ky-31 | 6.2 | 6.5 | 6.0 LG | 6.0 LG | 6.0 LG | 6.1 |

Symbols: D = Dense, DG = Dark Green, and LG = Light Green.

**TITLE:** Creeping Red Fescue Potassium Study

**OBJECTIVE:** To test whether increasing rates of potassium will enhance quality of 'Ensylva' creeping red fescue during periods of extended high temperatures

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

**INTRODUCTION:**

Creeping red fescue (Festuca rubra) is often included in lawn mixtures because it is shade-adapted and forms an extremely fine-textured turf of high quality. The use of creeping red fescue in Kansas is limited, however, because it lacks heat tolerance and will lose sward density and quality during the hot summer months. Potassium is receiving considerable attention for its claimed value in enhancing stress tolerance. This study was initiated to test whether increasing rates of potassium applications could result in enhanced creeping red fescue quality, especially during the hot summer months in Kansas.

**MATERIALS AND METHODS**

A 2400 sq ft area of Section II of the Rocky Ford Turfgrass Research Plots was seeded with 'Ensylva' creeping red fescue at the rate of 6 lbs per 1000 sq ft in late August, 1986. In the spring of 1987, the area was divided into 22 7 X 14 ft plots. The experiment utilized a randomized complete block design with six treatments replicated four times each. The treatments included total seasonal potassium applications of 1, 2, 3, 4, and 5 lbs of actual K per 1000 sq ft applied as potassium sulfate, plus an untreated control. Four equal applications were made for each treatment in April, June, September, and November. Monthly quality ratings (1-9, 9 = the best) were recorded starting in July of 1987).

**RESULTS:**

Table 1 shows the effect of various rates of potassium fertilization on monthly quality of 'Ensylva' creeping red fescue. No statistically significant effect on turf quality was obtained with higher application rates of potassium.

Table 1. Effect of various rates of potassium fertilization on monthly quality of 'Ensylva' creeping red fescue.

| K Rate (lbs K per 1000 $ft^2$ per year) | Monthly Quality | | | | | |
|---|---|---|---|---|---|---|
| | May | June | July | Aug | Sept | Nov |
| 0 | 7.5 | 6.8 | 4.7 | 4.2 | 4.5 | 4.8 |
| 1 | 7.0 | 6.3 | 3.5 | 3.5 | 3.8 | 4.3 |
| 2 | 7.2 | 6.5 | 4.0 | 4.2 | 4.5 | 4.8 |
| 3 | 7.3 | 6.7 | 5.0 | 5.0 | 5.3 | 5.5 |
| 4 | 6.8 | 6.5 | 4.3 | 4.2 | 4.7 | 5.0 |
| 5 | 7.3 | 6.8 | 5.0 | 5.2 | 5.2 | 5.3 |
| | N.S. | N.S. | N.S. | N.S. | N.S. | N.S. |

**TITLE:** Management of Overseeded Guymon Bermudagrass on Athletic Field Turf

**OBJECTIVES:** To evaluate Guymon bermudagrass for potential use on high school athletic fields and compare effects of mowing heights and fertilizer programs on overseeding with tall fescue and perennial ryegrass to provide a combination warm-cool season turf for year around play

**PERSONNEL:** John C. Pair, Turfgrass Researcher

**SPONSOR:** Kansas Turfgrass Foundation

**INTRODUCTION:**

Although warm-season turf species, such as bermudagrass, offer excellent recuperative potential for repair of injury during sports activities, the season of play usually continues after frost stops top growth. Overseeding with a cool-season species offers additional seasonal color, protection for players, and possible benefit toward overwintering of the bermudagrass. Guymon bermuda, a recent hardy introduction, is rather open growing, which allows easy overseeding of cool-season species. However, management of the combination warm- and cool-season turf involves attention to the fertility and mowing height requirements of both species.

**METHODS:**

A 2,500 sq ft area was sown to Guymon bermudagrass on May 6, 1988 at the rate of 2 lbs seed per 1000 sq ft. The area was mowed at 1 1/2 in and fertilized with urea at 1 lb N per 1000 sq ft July 8 to encourage rapid establishment. On Sept. 16, three replications each of perennial rye and turf type fescue were overseeded by light power raking, and of 18-46-0 at 1/2 lb N per 1000 sq ft was applied. On Nov. 4, all plots were given 6-24-24 at 1/2 lb N per 1000 sq ft. In the meantime, uniform compaction was begun over the entire area by means of a studded roller applied four times weekly across from Oct. 13 through November to simulate a football season.

In the spring of 1989, mowing heights of 1, 1 1/2 and 2 1/2 in were imposed across fertilizer treatments consisting of 3, 3 1/2 and 4 lbs of N per 1000 sq ft per year in a factorial experiment. Frequency of mowing was every other day at 1 in, twice weekly at 1 1/2 in and weekly at 2 1/2 in.

**RESULTS:**

Guymon bermudagrass was well established by overseeding time in September. The low rate of nitrogen (1/2 lb N per 1000 sq ft) and light power raking when sowing fescue and ryegrass did not appear to induce any winter injury to the bermudagrass. The nitrogen level was not entirely adequate for the proper growth of fescue and ryegrass, so an additional 1/2 lb of N was applied after the Guymon went dormant in November to improve growth and color during compaction treatments.

Distribution of nitrogen in the three treatments is designed to obtain adequate growth but not over-stimulate ryegrass in summer, and mowing heights are designed to accommodate both species and the sport requirements. Collection of data on individual plot performance begins in summer, 1989.

**TITLE:** Effect of Three Levels of Soil Compaction on the Performance of Six Bermudagrass Cultivars

**OBJECTIVES:**
1. Screen various bermudagrasses under typical sports field conditions and,
2. To mesure physical effects of compaction as influenced by core aerification

**PERSONNEL:** John C. Pair and Jeff Nus

**SPONSOR:** Kansas Turfgrass Foundation

**INTRODUCTION:**

For most high school sports fields and municipal recreation areas, bermudagrass provides the most wear- resistant turf species available. However, damage from winter injury and the effects of compaction severely reduce survival and hinder recovery and repair of the playing surface in the following season. The following experiment offers a screening mechanism for comparing hardiness and resistance to compaction of various bermudagrass selections.

**METHODS:**

Sprigs of vegetative bermudagrass clones, Midiron, A-29, Westwood, and were compared with seeded types, Guymon and Common (hulled bermuda). All grasses were established on June 4, 1986 and compaction treatments, consisting of weekly applications of 4, 8, and 12 times across with a modified Kisgen aerator, began on September 24. Foot traffic was simulated by replacing aerator tines with steel "feet" on which were attached five football cleats to approximate actual and compaction equal to actual sports play.

Half of each plot was core aerated to alleviate the effects of foot traffic, and physical effects were measured by a penetrometer before and after compaction.

**RESULTS:**

After two seasons of simulated traffic, considerable differences were apparent at various treatment levels and especially among cultivars. The most wear-resistant, vegetative selections were A29, Midiron, and Westwood. Poorest survival occurred in plots of Common hulled bermuda (Table 1). Complete winter kill occurred in those seeded plots receiving the most traffic treatments (12 times across) and considerable injury occurred at the moderate rate (8 times across). Guymon bermudagrass, also seeded, sustained less winter injury and survived all levels of compaction.

Monthly core aerification, which continued until September 15, did not reduce injury from compaction and, in fact, appeared to only move the compaction layer down to a depth of 10 to 15 cm (Fig. 1). This study will continue for one more year.

Table 1. Injury to bermudagrass cultivars as influenced by compaction[1]

| | | Aerified | | | | Season | Non-aerified | | | | Season |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cultivar | Trt. | 9-16 | 9-26 | 10-20 | 10-27 | Avg. | 9-16 | 9-26 | 10-20 | 10-27 | Avg. |
| Midiron | 1 | 6.8 | 6.5 | 6.7 | 6.7 | 6.7 | 7.3 | 6.8 | 6.8 | 7.2 | 7.1 |
| | 2 | 5.7 | 5.2 | 5.7 | 5.8 | 5.6 | 6.3 | 6.0 | 6.3 | 6.2 | 6.2 |
| | 3 | 4.7 | 4.7 | 4.8 | 5.0 | 4.8 | 5.3 | 5.5 | 5.5 | 5.3 | 5.4 |
| | 4 | 8.2 | 8.2 | 8.2 | 8.2 | 8.2 | 8.3 | 8.5 | 8.2 | 8.2 | 8.3 |
| Common | 1 | 6.3 | 6.2 | 5.5 | 5.5 | 5.9 | 6.2 | 6.2 | 5.7 | 5.7 | 5.9 |
| | 2 | 5.3 | 5.5 | 4.3 | 4.8 | 5.0 | 5.2 | 5.0 | 4.8 | 5.0 | 5.0 |
| | 3 | 4.7 | 4.2 | 4.0 | 4.2 | 4.3 | 4.7 | 4.7 | 4.0 | 4.3 | 4.4 |
| | 4 | 6.7 | 6.8 | 6.0 | 6.5 | 6.5 | 7.0 | 7.0 | 6.5 | 6.7 | 6.8 |
| A-29 | 1 | 7.3 | 6.5 | 6.7 | 6.5 | 6.8 | 7.5 | 6.8 | 7.2 | 7.0 | 7.1 |
| | 2 | 6.7 | 5.8 | 5.7 | 5.8 | 6.0 | 7.3 | 6.0 | 6.2 | 6.5 | 6.5 |
| | 3 | 5.7 | 4.7 | 5.0 | 5.5 | 5.2 | 5.7 | 5.3 | 5.5 | 5.8 | 5.6 |
| | 4 | 8.5 | 8.2 | 7.8 | 8.2 | 8.2 | 8.2 | 8.3 | 8.2 | 8.3 | 8.2 |
| Westwood | 1 | 7.2 | 6.8 | 6.5 | 6.7 | 6.8 | 7.5 | 7.0 | 6.8 | 7.0 | 7.1 |
| | 2 | 6.7 | 5.5 | 5.7 | 6.0 | 6.0 | 6.8 | 5.8 | 6.2 | 6.3 | 6.3 |
| | 3 | 6.0 | 4.7 | 5.0 | 5.3 | 5.2 | 6.2 | 5.2 | 5.0 | 5.7 | 5.5 |
| | 4 | 8.3 | 7.8 | 7.2 | 7.7 | 7.8 | 8.2 | 7.5 | 7.5 | 7.8 | 7.7 |
| Arizona | 1 | 6.2 | 6.7 | 5.7 | 5.8 | 6.1 | 5.7 | 6.0 | 5.2 | 5.7 | 5.6 |
| Common | 2 | 4.8 | 4.8 | 4.2 | 4.3 | 4.5 | 4.7 | 4.3 | 4.2 | 4.5 | 4.4 |
| (seed) | 3 | 2.8 | 2.7 | 2.8 | 2.7 | 2.8 | 3.0 | 2.8 | 2.7 | 2.8 | 2.8 |
| | 4 | 6.8 | 7.3 | 5.7 | 6.3 | 6.5 | 6.8 | 7.0 | 6.3 | 6.3 | 6.6 |
| Guymon | 1 | 7.2 | 6.7 | 5.7 | 6.5 | 6.5 | 7.3 | 7.0 | 6.5 | 6.7 | 6.9 |
| (seed) | 2 | 6.3 | 6.0 | 4.7 | 5.2 | 5.6 | 6.5 | 6.5 | 5.5 | 5.7 | 6.1 |
| | 3 | 5.7 | 5.2 | 4.3 | 4.7 | 5.0 | 6.3 | 6.0 | 4.8 | 5.2 | 5.6 |
| | 4 | 8.3 | 7.8 | 7.0 | 7.5 | 7.7 | 8.2 | 8.0 | 7.3 | 7.7 | 7.8 |

1/ Injury rated on a scale of 0-9 with 0 = dead, 9 = no injury.

**TITLE:** NTEP National Bermudagrass Cultivar Trial

**OBJECTIVE:** To test several bermudagrass genotypes for their performance at Manhattan and Wichita

**PERSONNEL:** Jeff Nus, Turfgrass Research and Teaching
John Pair, Turfgrass Researcher
Kala Mahadeva, Turfgrass Ph.D. 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.

Winter covers to prevent damage by desiccation and low temperatures have been used on bentgrass, but their use is largely uninvestigated 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:**

Manhattan

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

Plugs were transplanted to the field in mid-May 1986 in 10 x 10 foot plots. The planting utilized a randomized complete block design with 28 treatments and three replications. The plots were fertilized with 1 lb of N per 1000 sq ft per growing month in a urea form.

Data that are being collected include monthly quality and greenup, texture ratings, color ratings, and percent cover.

Wichita

Twenty-eight accessions of bermudagrass were established in the spring of 1986. Several selections are seeded types but all were planted in the greenhouse either from seed or sprigs the previous fall, then transplanted to the field on May 20 to compare growth, hardiness, and turf qualities. Maintenance consisted of mowing at 1 inch with clippings removed, 4 pounds of nitrogen per 1000 sq ft per year, and irrigation to alleviate stress.

**RESULTS:**

Manhattan

Mean monthly quality ratings for NTEP bermudagrasses are shown in Table 1. Best performers were RS-1, A-29, E-29, Tufeote, and Tifgreen. Table 2 exhibits spring and summer density ratings as well as seedhead estimates for each entry of the NTEP bermudagrass trial.

Wichita

Relatively mild winters since establishment have allowed even the southern bermudagrass selections to overwinter successfully. However, obvious differences in hardiness were visible as indicated by green-up ratings (Table 3). Hardiest selections included Midiron, E-29, A-22, A-29, and RS-1. Guymon, established from seed, also survived well. Highest turf quality was exhibited by E-29, A-22, A-29, MSB-10, MSB-20, Tifway, Tifway II, and Midiron.

Several accessions, including CT-23, NM 43, NM 375, Vamont, MSB-10, MSB-20, MSB-30, A-22, Tifway, Tifway II, and NMS 14, developed spring dead spot from earlier inoculations by Extension Plant Pathologist, Ned Tisserat. Best spring green-up following a very dry winter with widely fluctuating temperatures was shown by Midiron, A-29, E-29, A-22, MSB-20, RS-1, Tifgreen, Tufcote, Guymon, and Vamont. .pa

Table 1. Mean turfgrass quality ratings of bermudagrass cultivars in the National Bermudagrass Cultivar Trials Manhattan, KS, 1988.

| | Cultivar | MAY | JUN | JUL | AUG | SEP | OCT | MEAN |
|---|---|---|---|---|---|---|---|---|
| 1. | CT-23 | 1.0 | 3.3 | 7.0 | 7.3 | 6.7 | 6.7 | 5.3 |
| 2. | NM-43 | 1.3 | 7.7 | 8.3 | 6.7 | 6.7 | 6.3 | 6.2 |
| 3. | NM-72 | 1.0 | 1.3 | 4.3 | 7.0 | 6.3 | 6.3 | 6.3 |
| 4. | NM-375 | 2.0 | 2.3 | 7.0 | 6.3 | 6.3 | 6.3 | 5.1 |
| 5. | NM-471 | 1.0 | 1.3 | 2.7 | 6.7 | 6.7 | 6.0 | 4.1 |
| 6. | NM-507 | 1.0 | 1.0 | 1.7 | 6.7 | 6.0 | 5.7 | 3.7 |
| 7. | Vamont | 6.7 | 8.0 | 7.3 | 5.7 | 6.7 | 6.0 | 6.7 |
| 8. | E-29 | 7.3 | 7.7 | 8.0 | 6.7 | 6.3 | 6.0 | 7.0 |
| 9. | A-29 | 7.0 | 7.7 | 8.3 | 7.0 | 7.0 | 6.7 | 7.3 |
| 10. | RS-1 | 7.0 | 8.3 | 8.7 | 6.7 | 7.0 | 7.0 | 7.4 |
| 11. | MSB-10 | 2.0 | 6.7 | 7.3 | 7.0 | 6.7 | 7.0 | 6.1 |
| 12. | MSB-20 | 5.3 | 7.3 | 8.0 | 7.7 | 6.7 | 6.3 | 6.9 |
| 13. | MSB-30 | 3.7 | 8.3 | 8.3 | 8.0 | 7.0 | 6.3 | 6.9 |
| 14. | A-22 | 6.3 | 7.7 | 8.7 | 7.3 | 6.7 | 6.3 | 7.2 |
| 15. | Texturf | 5.3 | 7.7 | 8.3 | 7.0 | 5.7 | 6.3 | 6.7 |
| 16. | Midiron | 7.3 | 7.3 | 7.3 | 7.3 | 6.3 | 6.0 | 6.9 |
| 17. | Tufcote | 8.0 | 7.3 | 7.3 | 6.7 | 6.7 | 6.3 | 7.1 |
| 18. | Tifgreen | 7.3 | 7.3 | 8.3 | 7.0 | 6.3 | 6.0 | 7.1 |
| 19. | Tifway | 1.3 | 4.3 | 7.3 | 7.7 | 6.7 | 6.3 | 5.6 |
| 20. | Tifway-II | 1.7 | 5.0 | 7.7 | 8.0 | 6.3 | 6.3 | 5.8 |
| 21. | NMS-1 | 1.0 | 3.7 | 6.3 | 6.0 | 6.7 | 6.3 | 5.0 |
| 22. | NMS-2 | 2.7 | 3.3 | 5.3 | 6.0 | 6.7 | 5.7 | 4.9 |
| 23. | NMS-3 | 1.3 | 1.7 | 3.0 | 7.3 | 6.7 | 6.0 | 4.3 |
| 24. | NMS-4 | 1.0 | 2.7 | 7.0 | 7.0 | 6.0 | 6.0 | 4.9 |
| 25. | NMS-14 | 1.0 | 4.3 | 5.7 | 7.0 | 6.0 | 6.7 | 5.1 |
| 26. | AZ-Common | 1.0 | 2.3 | 5.3 | 6.7 | 6.0 | 6.0 | 4.6 |
| 27. | Gymon | 4.3 | 7.0 | 5.7 | 5.0 | 6.3 | 6.0 | 5.7 |
| 28. | FB-119 | 1.0 | 6.3 | 3.3 | 7.0 | 6.0 | 5.3 | 4.8 |

Quality ratings 1-9; 9 = best

Table 2. 1988 Density ratings (1-9) and seedhead estimates (% of plot of the National Bermudagrass Cultivar Trials at Rocky Ford Turfgrass Research Plots.

| | Cultivar | Density | | Seedheads |
|---|---|---|---|---|
| | | Spring | Summer | |
| 1. | CT-23 | | 1.0 | 3.5 |
| 2. | NM-43 | 6.7 | 7.0 | 53.0 |
| 3. | NM-72 | 2.7 | 6.6 | 56.0 |
| 4. | NM-375 | 1.0 | 2.3 | 65.0 |
| 5. | NM-471 | | 1.3 | 58.0 |
| 6. | NM-507 | | 1.0 | 53.0 |
| 7. | Vamont | 6.7 | 7.0 | 6.1 |
| 8. | E-29 | 7.3 | 7.0 | 5.1 |
| 9. | A-29 | 7.0 | 6.6 | 3.3 |
| 10. | RS-1 | | 7.0 | 5.1 |
| 11. | MSB-10 | 6.6 | | 5.5 |
| 12. | MSB-20 | 7.3 | 6.6 | 4.0 |
| 13. | MSB-30 | 7.6 | 6.6 | 4.1 |
| 14. | A-22 | 6.6 | 6.3 | 4.6 |
| 15. | Texturf | 6.6 | 6.6 | 4.6 |
| 16. | Midiron | 6.3 | 6.6 | 5.3 |
| 17. | Tufcote | 6.3 | | 5.5 |
| 18. | Tifgreen | 6.6 | | 5.6 |
| 19. | Tifway | 5.6 | 6.6 | 4.3 |
| 20. | Tifway-II | 5.3 | 7.0 | 3.5 |
| 21. | NMS-1 | 6.0 | 7.3 | 73.0 |
| 22. | NMS-2 | 4.0 | 7.3 | 73.0 |
| 23. | NMS-3 | 2.6 | 7.0 | 56.0 |
| 24. | NMS-4 | | 7.3 | 75.0 |
| 25. | NMS-14 | 5.0 | 6.6 | 78.0 |
| 26. | AZ-Common | | 7.0 | 7.2 |
| 27. | Gymon | 5.3 | 6.6 | 58.0 |
| 28. | FB-119 | 1.0 | | 66.0 |

Table 3. Bermudagrass Cultivar Evaluation at Wichita, KS, 1988

| Exp. No. or Cultivar | Green-up 5-5 | Turf Quality (0-9 w/9=best) 6-1 | 7-6 | 8-31 | Season Avg. |
|---|---|---|---|---|---|
| E-29 | 7.3 | 8.3 DG,M | 8.0 MG | 8.5 DG | 8.3 |
| A-22 | 7.3 | 8.0 SDS,F | 8.5 DG,F | 8.0 DG | 8.2 |
| MSB-10 | 2.7 | 7.7 SDS,DG | 8.7 DG | 7.7 DG | 8.0 |
| A-29 | 7.0 | 8.0 DG | 7.8 MG | 8.2 DG | 8.0 |
| Tifway | 2.0 | 7.7 SDS,F | 8.3 DG | 7.8 DG | 7.9 |
| MSB-20 | 4.7 | 8.2 SDS,DG | 7.7 SH,F | 7.5 | 7.8 |
| Midiron | 8.3 | 7.7 | 7.7 SH | 7.8 | 7.7 |
| Turfcote | 6.7 | 8.0 DG | 7.8 | 7.0 | 7.6 |
| NM 43 | 5.0 | 7.7 SDS,DG | 7.8 SH,DG | 8.0 DG | 7.5 |
| NM 375 | 4.3 | 6.8 | 7.7 | 7.3 SH | 7.5 |
| Tifgreen | 6.0 | 7.7 DG,F | 7.5 F | 7.2 SH | 7.5 |
| Texture 10 | 4.3 | 6.8 | 7.7 | 7.3 SH | 7.3 |
| Guymon (seeded) | 8.3 | 6.7 C | 6.8 DG,C | 7.5 CG | 7.0 |
| CT-23 | 2.3 | 5.7 SDS | 7.5 MG | 7.7 | 7.0 |
| MSB-30 | 1.5 | 5.3 SDS | 7.2 DG | 8.3 DG | 6.9 |
| RS-1 | 7.0 | 5.8 LG | 6.8 SH,C | 6.7 SH | 6.4 |
| NM 507 | 1.3 | 3.7 WK | 7.2 WK,DG | 8.0 | 6.3 |
| NMS 14 | 3.0 | 5.7 SDS,C | 6.3 SH,C | 7.0 DG | 6.3 |
| NM 471 | 1.3 | 3.5 WK | 7.0 DG | 7.8 | 6.1 |
| Vamont | 5.6 | 6.3 SDS,C | 5.7 SH,C | 6.3 SH,LG | 6.1 |
| Common (seeded) | 4.3 | 6.0 LG,C | 6.2 SH,T | 7.0 | 5.8 |
| Guymon | 6.0 | 5.8 | 5.3 SH | 6.7 | 5.9 |
| FB-119 | 1.0 | 4.3 WK | 6.3 SH | 7.2 | 5.9 |
| Arizona Common | 4.0 | 4.3 LG,C | 6.2 SH,T | 7.0 | 5.8 |
| NMS 1 | 2.3 | 4.8 SDS.C | 6.2 SH,C | 6.3 W | 5.8 |
| NMS 2 | 2.3 | 4.7 C | 5.7 SH,C | 5.8 W | 5.4 |
| NMS 4 | 1.0 | 2.7 WK | 5.5 WK,SH,T | 7.3 SH | 5.2 |
| NM 72 | .7 | 3.0 WK | 5.0 WK,T,SH | 7.0 SH | 5.0 |
| NMS 3 | 1.0 | 3.0 WK | 4.8 DS,WK | 6.8 SH | 4.9 |

Symbols: SDS = Spring Dead Spot, DG = Dark Green, MG = Medium Green, T = Thin Stand, SH = Seed Heads, W = Weedy, LG = Light Green, WK = Winter Kill, F = Fine, M = Medium, and C = Coarse Texture.

**TITLE:** Bermudagrass Winter Cover Study

**OBJECTIVE:** To evaluate the efficacy of a spun-woven polyester covers for improving winter survival, degree-day accumulation, and spring green-up of bermudagrass.

**PERSONNEL:** Jeff Nus, Turfgrass Research and Teaching
Kala Mahadeva, Turfgrass Ph.D. candidate

**INTRODUCTION:**

Bermudagrass is often subject to severe winter kill in the transition zone because most cultivars possess sufficient winter hardiness. In addition, bermudagrass is slow to green-up in the spring, which is especially noticeable where both cool- and warm-season turfgrass species are grown. Management techniques that may reduce the danger of extensive winter kill and speed the green-up rate of bermudagrass may be useful in promoting Bermudagrass for use in the transition zone.

**MATERIALS AND METHODS:**

Half of each plot of the 28 entries of the NTEP bermudagrass cultivar trial was covered with Trevira (a spun-woven polyester) in mid-December or left uncovered. Type T thermocouples were used to measure the soil surface temperature in uncovered and covered plots at 2-hr intervals utilizing an Omega date recorder. Degree - day accumulation was calculated for both covered and uncovered plots.

Covers were removed from bermudagrass cultivars on April 27 and biomass ratings (1-9, 9 = full cover) and coverage estimates (%) were taken. Clippings were taken from both covered and uncovered plots, oven dried (60°C, 48 hrs.), and weighed.

**RESULTS:**

Temperature data for the bermudagrass winter cover study are given in Table 1. Maximum and minimum, soil-surface temperatures were increased up to 10 and 3 degrees, respectively, compared to those in uncovered plots

Figure 1 shows the effect of covers on degree-day accumulation for March and April. Using 50°F as the base temperature for bermudagrass growth, there was no net accumulation before March. The placement of covers resulted in an increase of approximately 35-40 and 9-100 degree-days in March and April, respectively.

Figures 2, 3, and 4 exhibit the effect that the spun-woven polyester covers had on biomass ratings, coverage estimates, and clipping yield, respectively. In this study, the presence of these covers allowed timely green-up of some bermudagrass cultivars, which otherwise would have suffered severe winter kill.

Table 1. 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 Speed (mph) | Soil Surface Temp Uncovered Max | Uncovered Min | Covered Max | Covered Min |
|---|---|---|---|---|---|---|---|---|---|---|
| FEBRUARY | | | | | | | | | | |
| 1 | 38 | 13 | 145.8 | 44 | 31 | 17.1 | 24.5 | 20.9 | 32.7 | 20.9 |
| 2 | 15 | -5 | 129.6 | 31 | 22 | 16.7 | 20.7 | 16.3 | 24.6 | 17.6 |
| 3 | 5 | -10 | 290 | 27 | 18 | 15.8 | 21.7 | 12.1 | 28.0 | 13.2 |
| 4 | -0 | -5 | 83.5 | 21 | 18 | 10.9 | 18.1 | 15.6 | 19.5 | 16.6 |
| 5 | 9 | -3 | 251.2 | 26 | 21 | 5.8 | 24.6 | 17.1 | 24.7 | 17.2 |
| 6 | 20 | 1 | 227. | 28 | 25 | 4.4 | 24.6 | 17.1 | 24.7 | 17.2 |
| 7 | 30 | -2 | 352.2 | 28 | 24 | 3.4 | 24.5 | 17.6 | 24.9 | 18.1 |
| 8 | 20 | -3 | 357.8 | 28 | 24 | 7.4 | 24.6 | 12.9 | 28.7 | 13.9 |
| 9 | 37 | -4 | 354.3 | 28 | 22 | 4.3 | 31.0 | 12.8 | 34.6 | 13.9 |
| 10 | 50 | 9 | 346.5 | 31 | 24 | 3.3 | 31.1 | 14.9 | 36.3 | 16.9 |
| 11 | 42 | 23 | 279.4 | 32 | 28 | 4.4 | 36.6 | 18.9 | 38.1 | 19.9 |
| 12 | 38 | 19 | 102.4 | 32 | 29 | 2.2 | 28.6 | 17.6 | 30.8 | 19.1 |
| 13 | 36 | 20 | 164.2 | 32 | 31 | 5.7 | 30.5 | 19.7 | 31.6 | 20.6 |
| 14 | 33 | 15 | 142.0 | 32 | 29 | 3.7 | 29.9 | 19.8 | 33.5 | 20.6 |
| 15 | 33 | 20 | 229.4 | 32 | 31 | 6.4 | 24.9 | 20.9 | 27.1 | 21.2 |
| 16 | 35 | 14 | 307.9 | 31 | 25 | 4.2 | 25.7 | 19.7 | 26.1 | 20.3 |
| 17 | 33 | 19 | 265.1 | 32 | 27 | 5.8 | 31.6 | 20.6 | 33.1 | 21.2 |
| 18 | 37 | 26 | 133.2 | 32 | 32 | 3.0 | 29.6 | 24.6 | 34.4 | 23.8 |
| 19 | 35 | 25 | 73.7 | 32 | 32 | 5.1 | 26.7 | 24.1 | 28.4 | 25.4 |
| 20 | 33 | 28 | 69.0 | 32 | 32 | 5.8 | 28.7 | 24.8 | 32.4 | 26.2 |
| 21 | 38 | 19 | 253.9 | 32 | 32 | 7.3 | 30.9 | 21.5 | 38.9 | 22.3 |
| 22 | 22 | 7 | 391.2 | 32 | 23 | 11.2 | 24.9 | 17.0 | 34.3 | 18.1 |
| 23 | 35 | 1 | 354.7 | 31 | 18 | 5.2 | 32.5 | 16.1 | 36.6 | 16.9 |
| 24 | 53 | 22 | 380.5 | 33 | 25 | 3.5 | 43.2 | 19.8 | 52.1 | 20.6 |
| 25 | 68 | 27 | 359.3 | 44 | 32 | 5.4 | 45.3 | 22.1 | 53.9 | 22.6 |
| 26 | 37 | 24 | 102.4 | 32 | 32 | 6.4 | 30.9 | 24.6 | 32.2 | 29.1 |
| 27 | 42 | 13 | 327.2 | 33 | 32 | 2.0 | 31.1 | 24.9 | 32.4 | 28.4 |
| 28 | 35 | 24 | 377.9 | 42 | 32 | 9.2 | 36.6 | 24.1 | 44.4 | 26.2 |
| MARCH | | | | | | | | | | |
| 1 | 27 | 23 | 70.4 | 33 | 32 | 6.3 | 25.8 | 23.6 | 27.1 | 24.9 |
| 2 | 46 | 27 | 109.8 | 32 | 32 | 6.8 | 30.7 | 24.2 | 34.3 | 24.9 |
| 3 | 57 | 15 | 128. | 48 | 32 | 9.0 | 29.3 | 17.9 | 39.2 | 19.3 |
| 4 | 21 | 11 | 337.2 | 34 | 28 | 17.0 | 29.3 | 17.9 | 39.2 | 19.3 |
| 5 | 28 | 9 | 420.2 | 31 | 24 | 18.5 | 30.7 | 17.3 | 40.7 | 18.9 |
| 6 | 41 | 10 | 453.9 | 32 | 22 | 8.9 | 41.6 | 17.6 | 48.4 | 18.9 |
| 7 | 52 | 16 | 438.4 | 36 | 28 | 5.2 | 50.0 | 19.3 | 56.7 | 19.8 |
| 8 | 63 | 27 | 427.9 | 43 | 32 | 5.8 | 51.5 | 22.1 | 59.2 | 24.1 |
| 9 | 74 | 32 | 424.7 | 52 | 32 | 6.0 | 59.9 | 22.8 | 61.6 | 26.6 |
| 10 | 85 | 42 | 439.6 | 62 | 37 | 4.1 | 68.1 | 25.8 | 74.2 | 29.3 |
| 11 | 81 | 37 | 429.6 | 65 | 40 | 4.5 | 69.7 | 29.3 | 75.1 | 32.1 |
| 12 | 62 | 40 | 266.6 | 57 | 46 | 9.0 | 67.4 | 35.4 | 69.6 | 37.2 |
| 13 | 54 | 31 | 238.7 | 55 | 41 | 5.3 | 57.3 | 29.6 | 61.5 | 32.7 |
| 14 | 62 | 25 | 320.3 | 52 | 38 | 11.3 | 51.0 | 24.5 | 53.6 | 28.7 |
| 15 | 52 | 20 | 472.7 | 56 | 34 | 4.7 | 63.8 | 23.5 | 67.7 | 26.7 |
| 16 | 71 | 36 | 446.4 | 60 | 38 | 7.0 | 64.9 | 26.7 | 67.6 | 31.4 |
| 17 | 39 | 22 | 198.8 | 46 | 38 | 11.0 | 46.5 | 25.9 | 49.3 | 29.1 |

MARCH (cont.)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 42 | 16 | 473.9 | 53 | 34 | 7.7 | 66.4 | 20.2 | 67.6 | 23.9 |
| 19 | 56 | 30 | 203.8 | 49 | 37 | 7.1 | 49.6 | 27.7 | 51.9 | 31.6 |
| 20 | 43 | 23 | 104.6 | 44 | 34 | 14.0 | 31.9 | 22.2 | 38.1 | 25.6 |
| 21 | 46 | 16 | 519.2 | 50 | 31 | 4.7 | 60.3 | 20.2 | 65.1 | 23.5 |
| 22 | 60 | 26 | 491.6 | 53 | 33 | 6.7 | 48.8 | 22.2 | 56.0 | 24.7 |
| 23 | 71 | 35 | 488.0 | 60 | 36 | 6.6 | 64.9 | 26.8 | 68.1 | 31.2 |
| 24 | 75 | 46 | 489.1 | 66 | 44 | 5.6 | 79.6 | 36.1 | 82.4 | 38.3 |
| 25 | 78 | 35 | 466.1 | 63 | 44 | 8.3 | 66.9 | 34.0 | 71.2 | 37.2 |
| 26 | 82 | 60 | 392.7 | 68 | 54 | 10.9 | 71.7 | 45.5 | 73.4 | 46.7 |
| 27 | 81 | 58 | 350.7 | 67 | 58 | 8.8 | 69.5 | 48.4 | 71.4 | 49.6 |
| 28 | 77 | 55 | 472.6 | 68 | 54 | 4.9 | 72.4 | 43.7 | 77.2 | 44.9 |
| 29 | 82 | 47 | 421.3 | 70 | 51 | 7.1 | 80.0 | 42.3 | 82.6 | 43.7 |
| 30 | 56 | 38 | 219.2 | 59 | 45 | 11.6 | 55.7 | 42.1 | 61.6 | 44.3 |
| 31 | 60 | 28 | 512.7 | 56 | 40 | 4.7 | 63.6 | 31.1 | 64.1 | 36.6 |
| APRIL | | | | | | | | | | |
| 1 | 64 | 44 | 306.4 | 54 | 43 | 7.1 | 56.7 | 38.1 | 58.1 | 40.9 |
| 2 | 65 | 51 | 243.3 | 61 | 51 | 4.6 | 67.4 | 44.1 | 65.5 | 45.6 |
| 3 | 64 | 47 | 333.9 | 60 | 47 | 6.2 | 63.1 | 39.1 | 69.6 | 41.4 |
| 4 | 58 | 41 | 463.4 | 56 | 43 | 10.3 | 62.6 | 37.7 | 66.7 | 39.4 |
| 5 | 62 | 33 | 489.8 | 60 | 41 | 5.6 | 60.6 | 34.4 | 66.3 | 37.6 |
| 6 | 56 | 37 | 344.6 | 61 | 47 | 5.6 | 65.9 | 41.2 | 61.4 | 43.8 |
| 7 | 70 | 35 | 416.4 | 63 | 43 | 6.2 | 69.4 | 35.3 | 65.8 | 38.4 |
| 8 | 53 | 35 | 491.1 | 60 | 47 | 13.7 | 62.5 | 40.5 | 66.9 | 42.6 |
| 9 | 48 | 26 | 395.1 | 54 | 42 | 8.1 | 55.6 | 27.3 | 57.9 | 32.3 |
| 10 | 48 | 22 | 592.5 | 58 | 37 | 5.2 | 69.1 | 26.1 | 62.6 | 30.8 |
| 11 | 63 | 24 | 552.0 | 62 | 37 | 5.6 | 68.9 | 26.2 | 74.4 | 30.9 |
| 12 | 66 | 32 | 593.7 | 68 | 44 | 3.9 | 82.3 | 36.2 | 86.5 | 39.6 |
| 13 | 70 | 38 | 483.7 | 64 | 45 | 5.7 | 85.6 | 36.5 | 92.6 | 39.8 |
| 14 | 77 | 39 | 528.8 | 70 | 48 | 6.5 | 82.6 | 35.7 | 86.6 | 39.1 |
| 15 | 73 | 35 | 601.8 | 71 | 47 | 4.4 | 76.2 | 41.8 | 79.3 | 45.4 |
| 16 | 78 | 55 | 396.9 | 69 | 56 | 7.0 | 75.5 | 41.7 | 76.1 | 44.9 |
| 17 | 63 | 47 | 540.7 | 69 | 54 | 10.1 | 82.3 | 35.3 | 90.7 | 39.6 |
| 18 | 66 | 39 | 462.8 | 67 | 54 | 7.8 | 94.1 | 44.8 | 96.3 | 47.8 |
| 19 | 74 | 28 | 618.4 | 72 | 46 | 2.8 | 87.2 | 51.4 | 89.7 | 53.8 |
| 20 | 83 | 49 | 511.9 | 68 | 55 | 6.6 | 89.9 | 59.4 | 91.4 | 62.1 |
| 21 | 94 | 49 | 603.6 | 79 | 56 | 4.4 | 82.6 | 55.3 | 84.7 | 59.1 |
| 23 | 96 | 67 | 415.9 | 80 | 66 | 6.8 | 93.1 | 60.3 | 98.6 | 61.5 |
| 24 | 94 | 65 | 443.5 | 79 | 65 | 7.0 | 93.5 | 59.4 | 98.3 | 66.4 |
| 25 | 92 | 71 | 496.2 | 84 | 69 | 5.8 | - | - | - | - |
| 26 | 98 | 60 | 603.0 | 87 | 66 | 5.3 | - | - | - | - |
| 28 | 75 | 48 | 653.4 | 78 | 62 | 8.4 | - | - | - | - |
| 29 | 67 | 42 | 649.6 | 76 | 58 | 7.7 | - | - | - | - |
| 30 | 72 | 38 | 366.7 | 73 | 56 | 5.4 | - | - | - | - |

Figure 1.

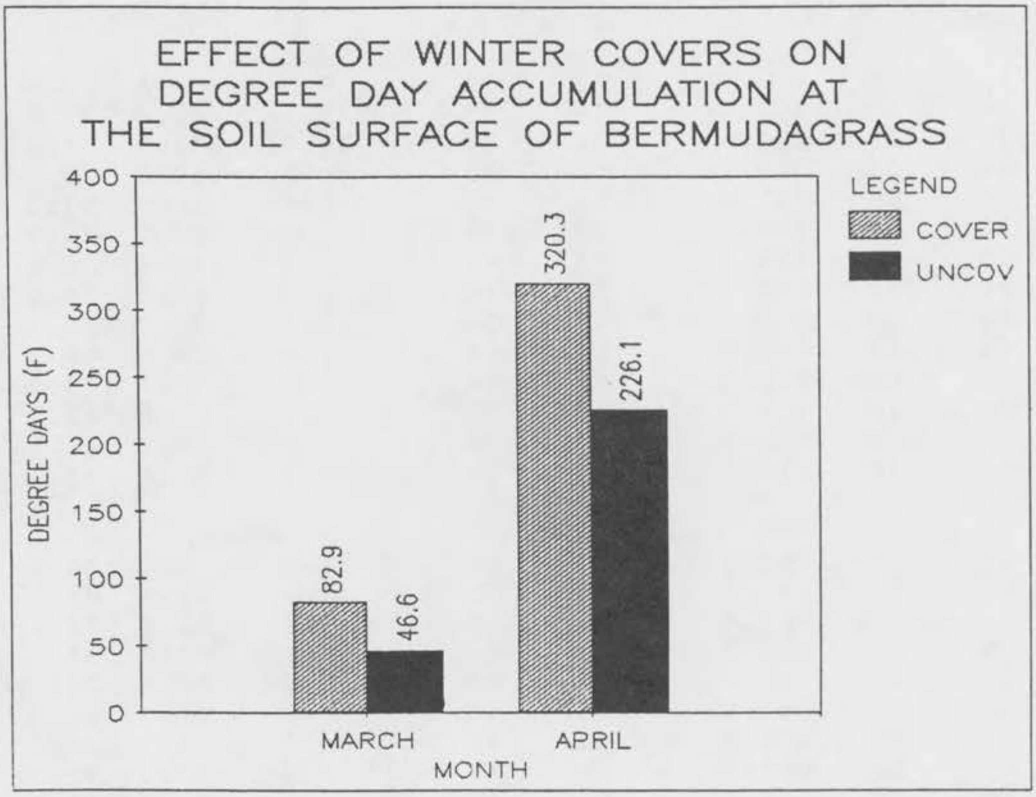



Figure 2.

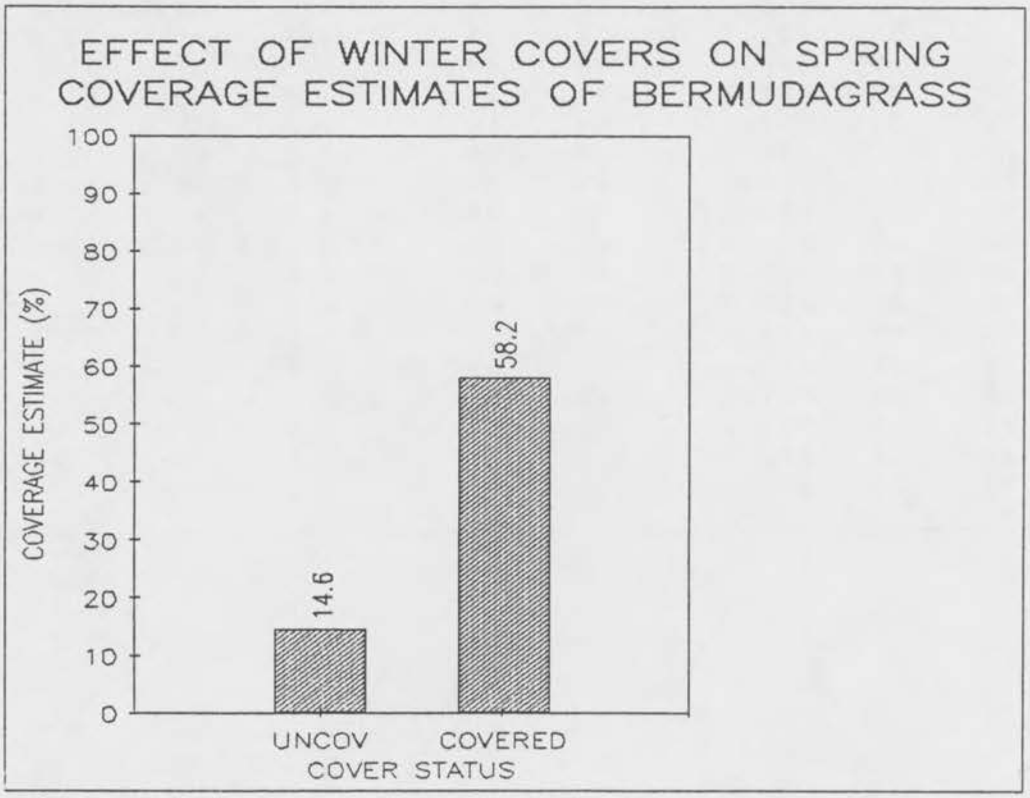


Figure 3.

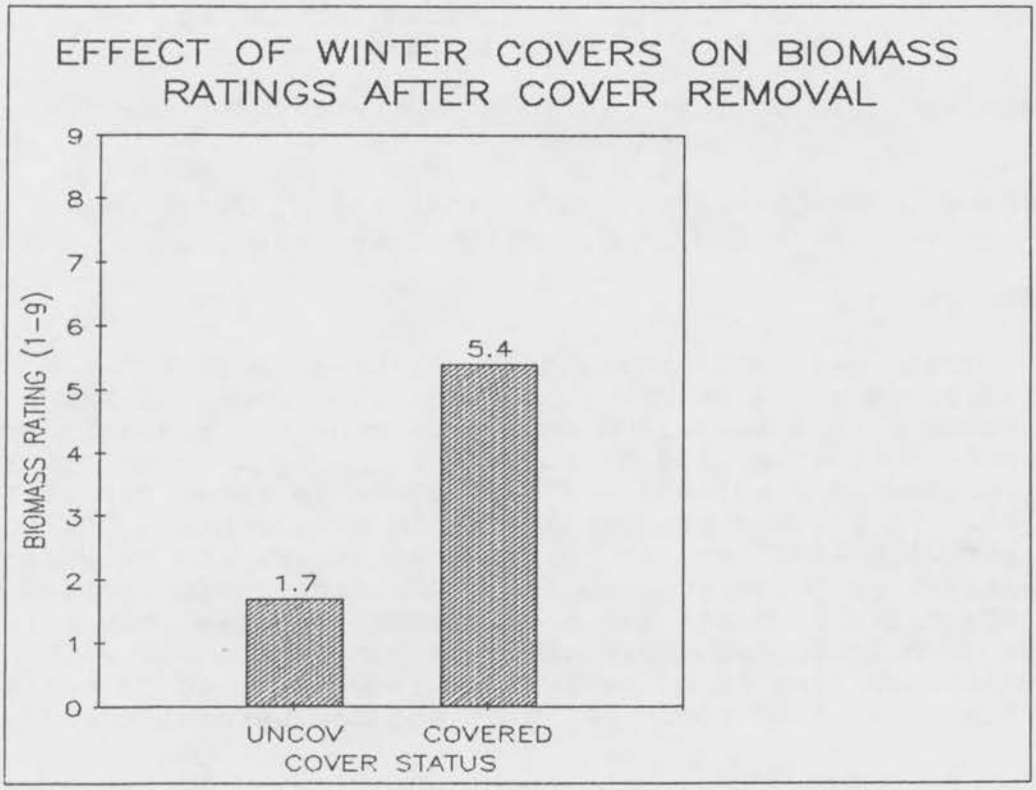
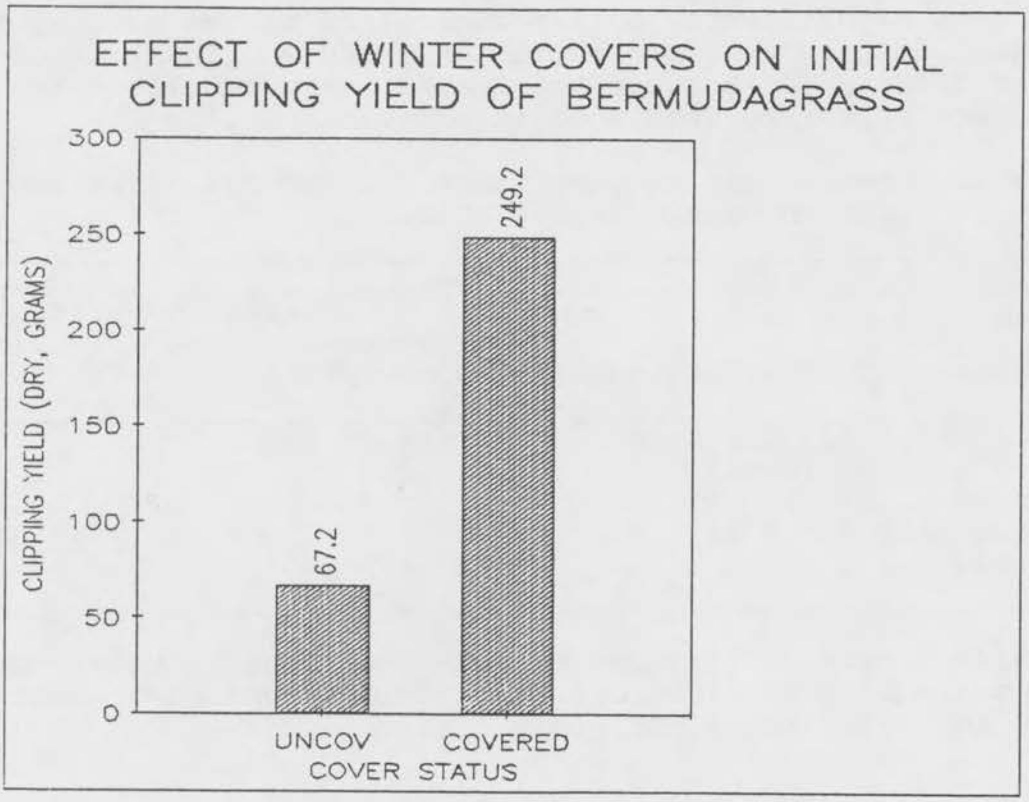



Figure 4.



**TITLE:** Evaluation of Fungicides for Control of Spring Dead Spot of Bermudagrass

**OBJECTIVE:** To evaluate various fungicides for control of spring dead spot

**PERSONNEL:** N. Tisserat, S. Nelson, and J. Pair, Dept. of Plant Pathology and Horticulture, KSU.

**INTRODUCTION:**

Fungicides were evaluated on 'Kansas Improved' and 'A-29' bermudagrass plots in Wichita. Each plot received high maintenance (> 4 lb N/1000 sq ft) through the summer. Fungicide treatments were applied to 10 X 10 ft plots in eight replications on 'Kansas Improved' and 4 X 5 ft plots in three replications on 'A-29'. Fungicides were applied with a hand-held, $CO_2$-powered sprayer with 8004 Tee Jet nozzles, at 30 psi and in water equivalent to 5 gal/1000 sq ft. Fungicides were applied at various times in September and October 1988 (see tables), and plots were irrigated immediately after application with approximately 1/4 in of water. Plots were rated in early May for the number of dead spots per plot and the percent disease area.

**RESULTS:**

None of the fungicides at any application period or at any rate gave significantly better control of spring dead spot compared to unsprayed plots (Tables 1 and 2). The lack of control and of differences between treatments was a result of the low incidence of spring dead spot in all plots.

Table 1. Evaluations of fungicides for control of spring dead spot on bermudagrass. Plot 1.

| | Disease Severity | |
|---|---|---|
| Treatment and Rate/1000 sq ft | Number spots/plot* | % Plot area diseased |
| Chipco 26019 (23 FL) 8 oz | 2.3 | 1.7 |
| Banner 1.12 EC (2 oz) | 4.3 | 3.0 |
| Bay 1608 1.2 EC (2 oz) | 4.4 | 2.5 |
| Rubigan 11.6 AS (8 oz) | 4.7 | 3.2 |
| Control | 4.7 | 2.6 |

*No significant differences between treatments. Values presented are means of 8 replications. Fungicides applied 12 September, 1988 and evaluated 8 May, 1989.

Table 2. Evaluations of fungicides for control of spring dead spot on bermudagrass. Plot 2.

| Treatment and Rate/1000 sq ft | Disease Severity* Number spots/plot | % plot area diseased |
|---|---|---|
| Control | 2.3 | 5.5 |
| Rubigan 11.6 AS (8 oz) Sept | 2.5 | 3.7 |
| Rubigan 11.6 AS 4 oz Sept + 4 oz Oct | 2.6 | 5.2 |
| Rubigan 11.6 AS 4 oz Oct | 1.5 | 8.1 |
| Rubigan 11.6 AS 8 oz Oct | 3.3 | 11.8 |
| Banner 1.2 EC 4 oz Sept | 1.8 | 4.3 |
| Banner 1.2 EC 2 oz Sept + 2 oz Oct | 1.2 | 1.6 |
| Banner 1.2 EC 2 oz Oct | 2.7 | 5.7 |
| Banner 1.2 EC 4 oz Oct | 3.3 | 12.7 |
| Control | 2.8 | 9.1 |

*No significant differences between treatments. Values presented are means of 3 replications. Fungicides applied 12 September 1988 and evaluated 8 May 1989.

**TITLE:** National Bermudagrass Trial: Screening Bermudagrass Clones for Resistance to Spring Dead Spot

**OBJECTIVE:** To evaluate bermudagrass genotypes for their resistance spring dead spot caused by Ophiosphaerella herpotricha

**PERSONNEL:** N. Tisserat, S. Nelson, and J. Pair, Dept. of Plant Pathology and Horticulture, KSU

**INTRODUCTION:**

The National Bermudagrass Trial was established in Wichita in 1986. In that year, each clone within the trial was inoculated with Ophiosphaerella herpotricha, the cause of spring dead spot of bermudagrass in Kansas. In May 1988, circular dead spots developed in most of the plots. In May 1989, each bermudagrass genotype was rated for severity of spring dead spot. The number of spots/plot and the percent area diseased in each plot were determined.

**RESULTS:**

There were significant differences ($P<0.05$) between clones in percent area diseased, but not the number of spots (Table 1). The cultivar Midiron did not exhibit any symptoms of spring dead spot. This confirms earlier observations that this cultivar is more resistant to the disease. Other Kansas selections, including E-29, A-22, and A-29, did develop spring dead spot, but were not as seriously damaged as other clones. Interestingly, CT-23 (California), Tufcote (Georgia), and RS-1 (Kentucky) also showed very little damage. Many of the clones in the national study suffered extensive winter damage and could not be rated.

Our results indicate there is variation in bermudagrass clones to damage caused by spring dead spot. Our preliminary findings confirm that the cultivar Midiron displays the highest resistance to spring dead spot. Further studies are being conducted in a greenhouse.

Table 1. Severity ratings of spring dead spot for National Bermudagrass Trial, Wichita, KS, May 1989.

| Clone | Source | Disease Severity* Number Spots/Plot | Disease Severity* % Plot Area Diseased |
|---|---|---|---|
| Midiron | Kansas | 0 | 0 |
| RS-1 | Kentucky | 0.4 | 0.43 |
| E-29 | Kansas | 4.0 | 0.59 |
| Tufcote | Maryland | 1.8 | 0.68 |
| A-22 | Kansas | 1.0 | 0.80 |
| A-29 | Kansas | 1.0 | 1.05 |
| CT-23 | California | 1.3 | 1.53 |
| MSB-30 | Mississippi | 3.0 | 1.77 |
| Texturf-10 | Texas | 2.7 | 2.24 |
| Tifway II | Georgia | 2.3 | 2.52 |
| NM 375 | New Mexico | 2.0 | 2.81 |
| MSB-20 | Mississippi | 4.0 | 3.29 |
| Tifgreen | Georgia | 2.8 | 3.47 |
| Tifway | Georgia | 3.3 | 3.54 |
| Vamont | Virginia | 4.0 | 4.13 |
| MSB-10 | Mississippi | 4.3 | 4.14 |
| | FSLD | NS | 2.07 |

*Values presented are means of three replications.

**TITLE:** Effects of Various Pre-emergent Herbicides on the Establishment of Strip-Sodded Zoysia

**OBJECTIVE:** To test various preemergent 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
Bryan Unruh, Turfgrass Student

**FUNDING:** Cranmer Nursery, Wichita, KS

**INTRODUCTION:**

Weed control is necessary when establishing Zoysia from a strip sodding operation. However, it is important to establish what chemical control is least harmful to zoysia since the lateral spread of zoysia is slow, taking up to 3 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 nontarget species. This experiment was designed to determine which preemergent chemicals are least inhibitory to the lateral spread of zoysia.

**MATERIALS AND METHODS:**

Mature 'Meter' 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 transplanting, including half and full label rates of Dacthal, Ronstar, bensulide, Balan, pendamethalin, Tupersan, amd simazine; two non-treated controls were included. The experiment utilizes a randomized complete block design with 16 treatments each replicated three times. It is located in Section III of the Rocky Ford Turfgrass Research Plots. Rate of fill was recorded during the 1987 and 1988 growing seasons, and rooting will be recorded through 1989.

**RESULTS:**

Table 1 shows the rooting of 'Meyer' zoysiagrass by depth as affected by various label and half label rates of preemergence herbicides. This experiment exhibited a lot of variation, which is evident by the quite large LSD (0.05) for each depth group; therefore, few conclusions can be made at this time. A range of rooting capacities was exhibited by the treatments, but rooting inhibition doesn't always follow rates. More root sampling will be done through 1989 and probably in 1990 to gain more stable information.

Effect of preemergence herbicides (averaged over rates) on estimated fill (%) and strip width (cm) 'Meyer' zoysiagrass after one season are shown in Figures 1 and 2, respectively. The LSD (0.05) for these analyses are 1.43 and 3.8, respectively. All preemergence weed control resulted in some increase of estimated fill (Fig. 1) and strip width (Fig. 2). In other words, annual weed control seems to be an important factor for enhancing the spread of strip-sodded zoysia.

Figures 3 and 4 show the combined effect (averaged over all preemergence chemicals) of rate on estimated fill (%0 and strip width (cm) after one season. LSD's (0.05) for Figures 3 and 4 are 5.6 and 1.5, respectively. In this study, all treatments were superior to untreated controls, but full rates were not overall more inhibitory to coverage estimates and strip width compared to half label rate (Fig. 3 and 4).

Table 1. Rooting (mg dry weight) at various depths of 'Meyer' zoysiagrass as affected by various preemergent herbicides at label and half label rates.

| Treatment | Rate (lbs a.i./$A^{-1}$ | Depth 0-6" | 6-12" | 12-18" | 18-24 |
|---|---|---|---|---|---|
| Dacthal | 10.5 | 123 | 26 | 7 | 6 |
| Dacthal | 5.3 | 134 | 20 | 7 | 8 |
| Ronstar | 3.0 | 134 | 36 | 13 | 3 |
| Ronstar | 1.5 | 100 | 20 | 8 | 3 |
| Bensulide | 10.0 | 136 | 36 | 10 | 3 |
| Bensulide | 5.0 | 95 | 23 | 15 | 8 |
| Balan | 1.0 | 158 | 26 | 11 | 3 |
| Balan | 0.5 | 119 | 26 | 18 | 13 |
| Pendamethalin | 0.75 | 103 | 26 | 8 | 6 |
| Pendamethalin | 0.38 | 109 | 37 | 23 | 8 |
| Control | -- | 114 | 31 | 15 | 11 |
| Control | -- | 146 | 24 | 8 | 5 |
| Tupersan | 18.0 | 146 | 50 | 20 | 10 |
| Tupersan | 9.0 | 149 | 31 | 10 | 4 |
| Simazine | 2.0 | 129 | 33 | 15 | 9 |
| Simazine | 1.0 | 150 | 45 | 23 | 6 |
| LSD (0.05) | | 46 | 27 | 12 | 7 |

Figure 1.

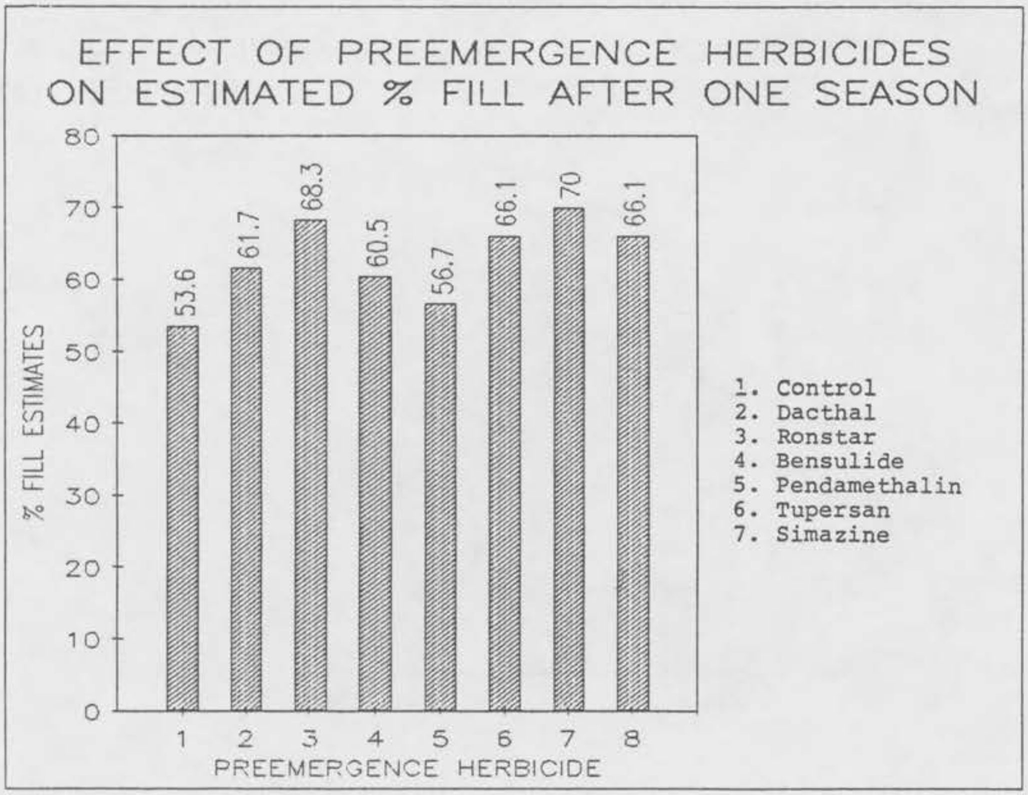



Figure 2.

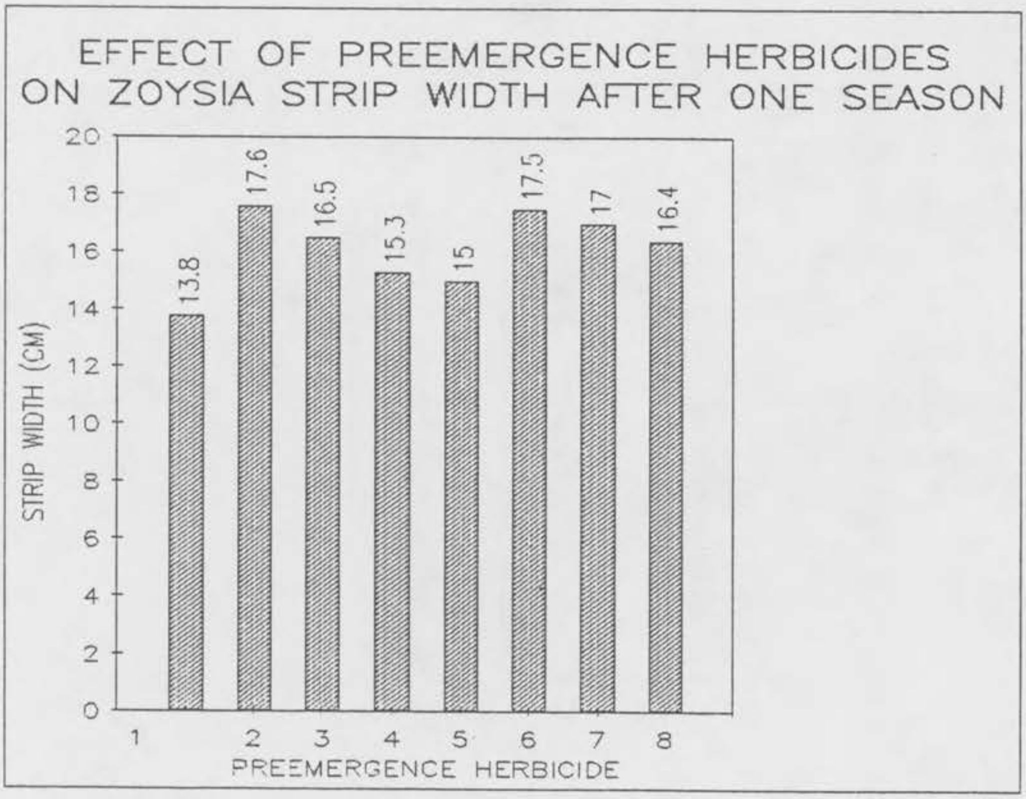


Figure 3.

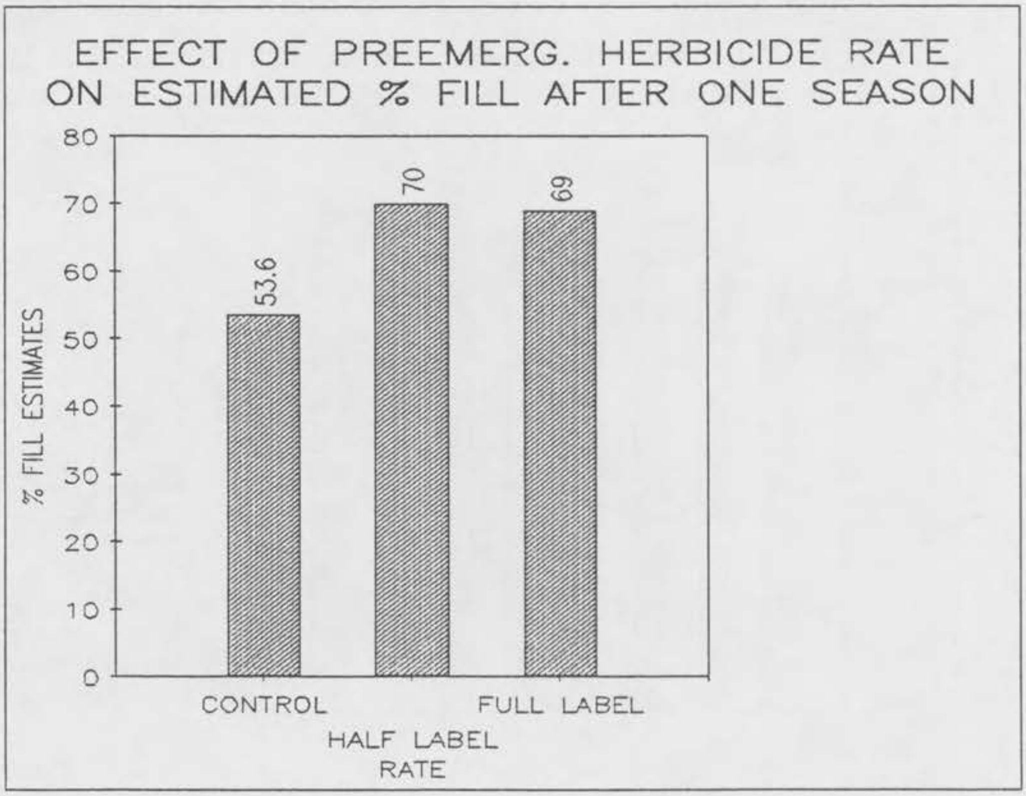
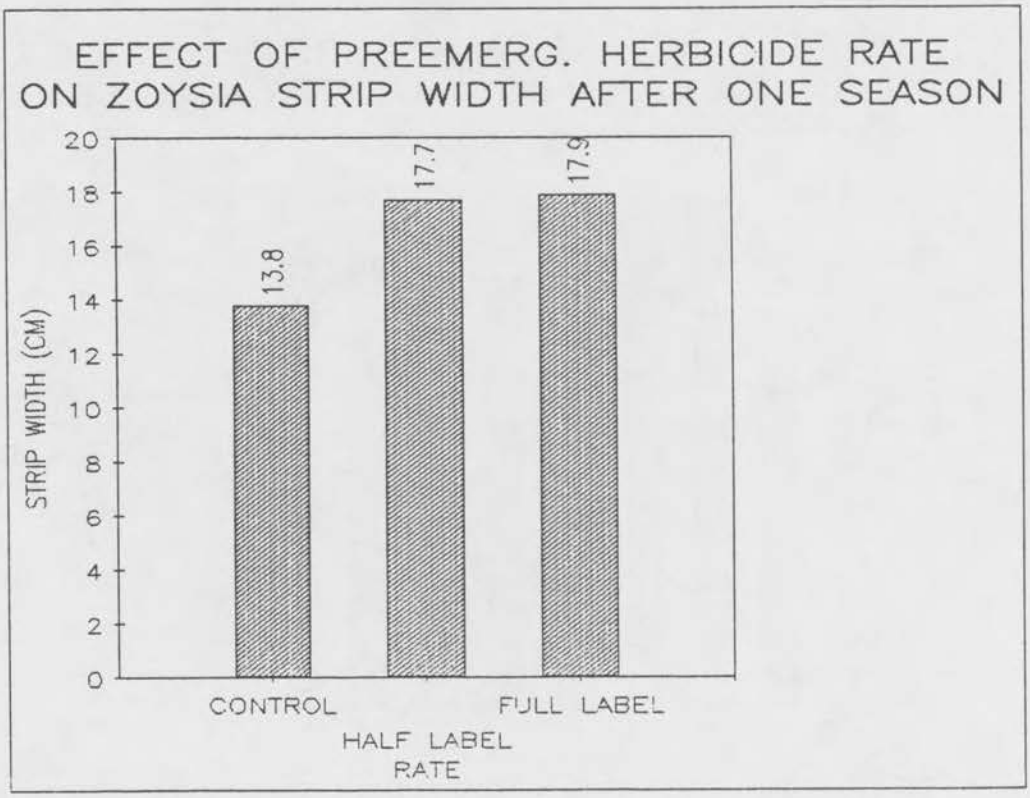



Figure 4.



**TITLE:** Zoysia Winter Cover Study

**OBJECTIVE:** To test the efficacy of polyester and polyethylene covers for winter protection and spring green-up enhancement of 'Meyer' zoysia

**PERSONNEL:** Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician
Kala Mahadeva, Turfgrass student

**INTRODUCTION:**

The use of zoysia in the transition zone is increasing because of its lower water use and fertility requirements compared to many cool-season turf species. It also forms a dense, high quality turf when closely mowed. Because zoysia is a warm-season turf species, it is slow to green-up in the spring and is often subject to extensive winter kill, especially if it is established on poorly drained sites. These experiments were initiated to test whether polyethylene or polyester winter covers are effective to safely enhance spring green-up of zoysia and, thus, extend the active growing period for this otherwise popular, transition zone species.

**MATERIALS AND METHODS:**

Two experiments were initiated using winter covers. The first experiment utilized a randomized complete block design with four treatments: uncovered control and Trevira (a spun-woven polyester), 4-mil solid polyethylene, or "Evergreen" (a stranded polyethylene) covers. Covers were applied during the first week of December and removed on April 27. Type T thermocouples were positioned at the soil surface of covered and uncovered plots and connected to an Omega data logger for continuous temperature monitoring. In addition, daily solar radiation data were obtained from the Agronomy Research Farm in an effort to relate strength of incoming solar radiation with heat-capturing capacities of the covers. Data taken included daily temperature and solar radiation data, spring green-up, and clipping yields at time of cover removal.

The next experiment utilized only two cover types versus the uncovered control. Trevira and 4-mil solid polyethylene were placed on plots during the first week of December, January, February, and March. Covers were removed on April 27. This experiment was designed to test whether cover type or date of cover placement had an effect on spring green-up, rating, and clipping yields of 'Meyer' zoysiagrass compared to uncovered controls.

**RESULTS:**

<u>Experiment 1</u>

Table 1 shows maximum and minimum daily temperatures at the soil surface of covered and uncovered zoysia as affected by cover type. Polyethylene covers resulted in maximum heat gain, followed by Trevira and Evergreen. As much as 70°F above ambient temperature was realized with soil polyethylene.

Figure 1 shows the effect of incoming solar radiation on temperature gain (uncovered minus covered soil surface temperature) of covered plots. Polyethylene was much too efficient at raising soil surface temperature. Trevira and Evergreen ranked second and third.

Additional information concerning each cover type's ability to retain heat can be seen Figure 2. Both solar radiation and temperature gain are plotted against the first 15 days of March. All covers were dependent on solar radiation, but polyethylene held on to acquired heat longer than the porous Trevira or Evergreen.

Figures 3 and 4 show the effects of winter covers on spring green-up rating and clipping yield on 'Meyer' zoysiagrass at cover removal. Although the additional heat acquired by polyethylene-covered zoysiagrass resulted in higher clipping yield, the green-up rating of polyethylene was inferior to both Trevira and Evergreen. Polyethylene-covered turf was much too far along and was frost damaged extensively. Trevira- and Evergreen-covered turf did not experience this frost damage.

Experiment 2

Figures 5 and 6 show the effect of placement date of Trevira and polyethylene (solid 4-mil) on spring green-up rating and clipping yield of 'Meyer' zoysiagrass. Month of cover placement had little effect on spring green up of polyethylene covered plots because of extensive frost damage (Fig. 5). Trevira-covered plots showed better green-up with earlier placement dates. Uncovered control plots averaged 1.45 spring green-up ratings. The LSD (0.05) for Fig. 5 is 0.9.

Polyethylene-covered plots yielded significantly greater clippings than Trevira-covered plots (Fig. 6), but this early growth was detrimental because of frost damage. Uncovered control plots averaged 35 g of oven dried clippings. The LSD (0.05) for Figure 6 is 50.7

Table 1. Maximum and minimum daily temperatures at the soil surface of covered and uncovered zoysia as affected by cover type.

| | Uncovered | | Polyethylene | | Evergreen | | Trevira | |
|---|---|---|---|---|---|---|---|---|
| | Max | Min | Max | Min | Max | Min | Max | Min |
| Feb. 89 | | | | | | | | |
| 1. | 30.2 | 26.1 | 45.1 | 27.5 | 34.4 | 29.1 | 35.3 | 26.5 |
| 2. | 25.0 | 19.5 | 39.7 | 22.6 | 29.8 | 24.4 | 30.3 | 17.9 |
| 3. | 24.4 | 20.9 | 37.6 | 19.4 | 25.3 | 23.5 | 28.7 | 18.7 |
| 4. | 22.5 | 22.1 | 23.9 | 22.5 | 24.1 | 23.2 | 21.3 | 19.8 |
| 5. | 24.5 | 23.8 | 28.2 | 22.6 | 25.0 | 24.5 | 24.8 | 21.7 |
| 6. | 25.2 | 20.2 | 27.6 | 21.1 | 25.3 | 23.9 | 25.1 | 19.5 |
| 7. | 24.8 | 21.2 | 29.4 | 20.6 | 25.4 | 23.9 | 31.1 | 19.1 |
| 8. | 22.4 | 18.1 | 36.4 | 18.9 | 25.8 | 22.1 | 31.1 | 19.4 |
| 9. | 23.3 | 21.5 | 42.7 | 21.4 | 28.5 | 24.7 | 36.3 | 20.5 |
| 10. | 26.9 | 25.7 | 62.1 | 26.3 | 31.3 | 25.7 | 41.1 | 20.4 |
| 11. | 27.1 | 25.2 | 52.8 | 27.7 | 32.0 | 25.2 | 38.6 | 19.9 |
| 12. | 25.7 | 25.6 | 47.9 | 24.2 | 32.0 | 25.2 | 38.6 | 19.9 |
| 13. | 26.0 | 25.7 | 32.5 | 23.8 | 33.4 | 25.3 | 32.3 | 18.8 |
| 14. | 26.2 | 24.7 | 55.2 | 29.6 | 33.5 | 28.1 | 34.5 | 25.4 |
| 15. | 26.1 | 25.7 | 32.0 | 23.5 | 29.7 | 25.3 | 28.0 | 20.5 |
| 16. | 26.8 | 24.7 | 41.4 | 24.8 | 30.5 | 25.5 | 31.1 | 20.5 |
| 17. | 26.2 | 24.3 | 69.9 | 28.6 | 38.5 | 25.6 | 38.6 | 25.1 |
| 18. | 26.2 | 26.1 | 66.1 | 28.7 | 37.1 | 28.3 | 39.0 | 26.7 |
| 19. | 26.1 | 26.1 | 37.6 | 30.2 | 32.2 | 29.2 | 31.6 | 27.9 |
| 20. | 26.1 | 25.7 | 45.6 | 28.2 | 32.4 | 26.2 | 33.7 | 26.7 |
| 21. | 26.3 | 25.9 | 70.8 | 26.5 | 38.9 | 26.1 | 41.3 | 21.6 |
| 22. | 25.7 | 20.9 | 72.1 | 21.7 | 34.3 | 24.5 | 37.9 | 16.3 |
| 23. | 26.1 | 25.6 | 85.0 | 30.1 | 36.8 | 27.1 | 43.2 | 24.9 |
| 24. | 27.1 | 26.5 | 90.0 | 34.0 | 52.7 | 23.6 | 56.0 | 23.3 |
| 25. | 28.3 | 26.5 | 94.6 | 34.6 | 46.9 | 26.6 | 49.1 | 29.7 |
| 26. | 26.1 | 25.7 | 42.1 | 26.3 | 31.9 | 30.7 | 32.9 | 28.8 |
| 27. | 26.1 | 26.0 | 40.2 | 28.2 | 32.8 | 29.9 | 30.2 | 25.3 |
| 28. | 26.3 | 25.9 | 95.8 | 31.7 | 44.9 | 31.2 | 44.1 | 25.9 |
| March 89 | | | | | | | | |
| 1. | 25.9 | 25.7 | 38.8 | 29.6 | 31.7 | 29.4 | 29.3 | 25.7 |
| 2. | 26.2 | 25.7 | 51.6 | 35.1 | 36.3 | 33.1 | 37.9 | 31.6 |
| 3. | 30.4 | 26.3 | 49.0 | 28.6 | 36.4 | 29.2 | 47.2 | 23.3 |
| 4. | 56.4 | 24.7 | 82.1 | 27.4 | 38.1 | 26.4 | 45.4 | 22.3 |
| 5. | 27.9 | 24.3 | 80.1 | 26.6 | 39.4 | 25.5 | 44.2 | 32.5 |
| 6. | 30.6 | 25.5 | 92.6 | 28.6 | 43.7 | 26.7 | 58.2 | 27.7 |
| 7. | 32.2 | 26.9 | 116.1 | 33.8 | 47.3 | 29.6 | 63.6 | 26.5 |
| 8. | 35.7 | 26.1 | 118.6 | 26.4 | 49.4 | 32.4 | 66.9 | 30.7 |
| 9. | 46.1 | 33.7 | 120.9 | 39.5 | 51.7 | 36.6 | 69.0 | 35.8 |
| 10. | 54.6 | 37.4 | 118.0 | 42.5 | 57.1 | 39.9 | 77.9 | 36.6 |
| 11. | 58.7 | 41.9 | 138.2 | 49.1 | 60.9 | 41.3 | 70.3 | 35.3 |
| 12. | 50.4 | 37.7 | 110.9 | 39.3 | 59.0 | 39.1 | 66.9 | 36.5 |
| 13. | 50.3 | 37.2 | 94.3 | 40.6 | 52.0 | 38.1 | 63.6 | 36.6 |
| 14. | 45.9 | 32.3 | 71.2 | 36.9 | 45.1 | 25.1 | 52.3 | 28.4 |
| 15. | 51.7 | 33.1 | 99.4 | 28.2 | 67.7 | 31.8 | 74.5 | 30.1 |
| 16. | 51.3 | 37.7 | 98.8 | 37.6 | 67.5 | 32.1 | 74.1 | 34.4 |
| 17. | 41.5 | 30.6 | 74.3 | 35.1 | 40.1 | 27.1 | 54.7 | 29.4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| March (cont.) | | | | | | | | |
| 18. | 52.7 | 32.6 | 100.5 | 38.5 | 75.6 | 60.8 | 74.3 | 28.2 |
| 19. | 43.7 | 36.7 | 74.1 | 35.5 | 57.6 | 31.3 | 57.9 | 30.7 |
| 20. | 34.5 | 28.4 | 40.1 | 28.9 | 40.4 | 38.1 | 46.1 | 39.2 |
| 21. | 52.2 | 30.6 | 92.8 | 33.1 | 60.8 | 27.6 | 74.4 | 24.6 |
| 22. | 49.3 | 33.3 | 89.4 | 40.5 | 78.6 | 29.6 | 65.7 | 32.1 |
| 23. | 52.3 | 30.6 | 92.8 | 33.1 | 60.8 | 27.2 | 74.4 | 22.9 |
| 24. | 49.3 | 33.3 | 89.2 | 39.1 | 63.6 | 29.8 | 75.3 | 40.8 |
| 25. | 53.5 | 37.8 | 96.3 | 46.9 | 68.1 | 37.4 | 76.1 | 28.1 |
| 26. | 54.3 | 41.2 | 112.3 | 42.8 | 79.6 | 40.8 | 89.5 | 38.6 |
| 27. | 59.3 | 47.7 | 101.6 | 48.7 | 71.2 | 46.6 | 81.0 | 36.6 |
| 28. | 60.5 | 52.7 | 92.3 | 55.6 | 79.9 | 51.4 | 76.9 | 46.9 |
| 29. | 62.4 | 50.4 | 98.1 | 55.4 | 80.4 | 50.1 | 81.0 | 66.8 |
| 30. | 50.7 | 48.7 | 107.1 | 57.6 | 77.2 | 47.3 | 81.3 | 42.5 |
| 31. | 69.7 | 51.8 | 112.9 | 59.9 | 86.9 | 49.2 | 88.9 | 42.7 |
| April 89 | | | | | | | | |
| 1. | 51.6 | 41.5 | 89.6 | 51.9 | 55.1 | 40.8 | 62.4 | 40.0 |
| 2. | 59.6 | 45.7 | 97.7 | 52.1 | 60.7 | 46.4 | 64.9 | 59.8 |
| 3. | 56.2 | 42.9 | 83.5 | 49.3 | 63.1 | 40.1 | 65.3 | 40.6 |
| 4. | 57.2 | 42.2 | 92.6 | 49.8 | 62.9 | 40.3 | 62.1 | 40.6 |
| 5. | 56.1 | 43.7 | 99.1 | 54.1 | 68.6 | 39.8 | 68.9 | 39.3 |
| 6. | 56.3 | 40.5 | 104.4 | 48.3 | 69.8 | 41.9 | 66.4 | 43.7 |
| 7. | 56.1 | 46.1 | 97.9 | 55.3 | 58.9 | 47.1 | 65.3 | 49.3 |
| 8. | 56.2 | 39.8 | 80.8 | 50.6 | 67.3 | 42.4 | 72.5 | 43.9 |
| 9. | 48.7 | 36.8 | 81.8 | 48.1 | 60.7 | 35.4 | 63.8 | 38.9 |
| 10. | 56.3 | 34.6 | 105.2 | 49.5 | 69.3 | 36.3 | 75.3 | 45.3 |
| 11. | 56.9 | 42.2 | 107.6 | 52.3 | 71.4 | 44.1 | 62.3 | 31.3 |
| 12. | 67.8 | 41.5 | 119.6 | 52.4 | 82.3 | 42.3 | 77.8 | 39.9 |
| 13. | 60.0 | 44.1 | 102.1 | 49.9 | 75.3 | 44.4 | 74.3 | 38.3 |
| 14. | 71.9 | 43.2 | 116.1 | 46.7 | 74.6 | 42.4 | 84.3 | 39.9 |
| 15. | 66.0 | 47.6 | 105.8 | 58.3 | 77.3 | 49.4 | 81.2 | 40.3 |
| 16. | 61.4 | 47.6 | 103.4 | 55.6 | 72.4 | 48.2 | 74.4 | 47.5 |
| 17. | 64.1 | 40.1 | 107.3 | 44.4 | 74.7 | 49.3 | 69.6 | 47.3 |
| 18. | 67.2 | 34.2 | 101.4 | 40.8 | 88.3 | 87.9 | 155.4 | 23.2 |
| 19. | 75.1 | 39.4 | 113.4 | 50.3 | 87.8 | 84.3 | 139.3 | 33.6 |
| 20. | 85.2 | 45.3 | 106.8 | 38.9 | 101.9 | 94.9 | 36.2 | 21.9 |
| 21. | 84.7 | 55.6 | 101.9 | 51.1 | 101.7 | 91.8 | 35.6 | 24.4 |
| 22. | 98.8 | 68.7 | 106.2 | 68.1 | 106.8 | 98.3 | 38.6 | 21.7 |
| 23. | 87.1 | 63.3 | 108.3 | 64.6 | 106.9 | 98.7 | 38.5 | 17.3 |
| 24. | 94.7 | 67.1 | 104.9 | 67.1 | 108.1 | 99.5 | 54.3 | 18.6 |
| 25. | 105.3 | 63.7 | 106.9 | 70.8 | 104.7 | 99.8 | 53.6 | 17.9 |
| 26. | 99.9 | 53.5 | 107.6 | 70.9 | 101.1 | 99.4 | 151.4 | 14.8 |

Figure 1.

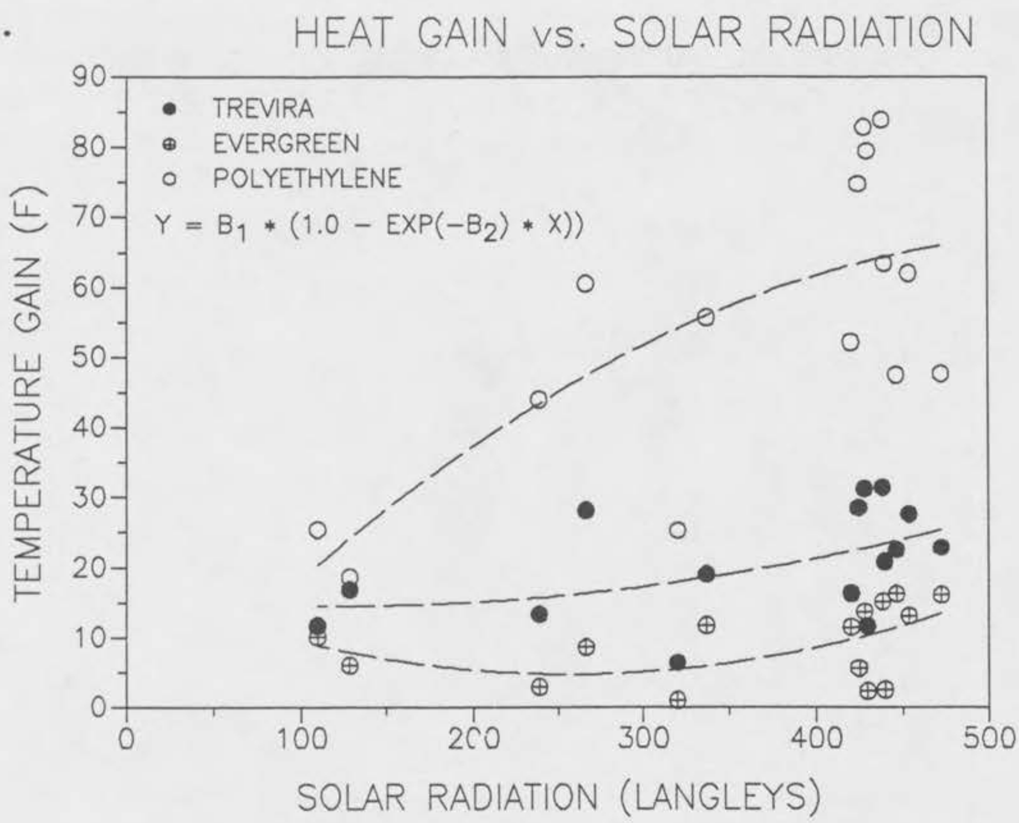
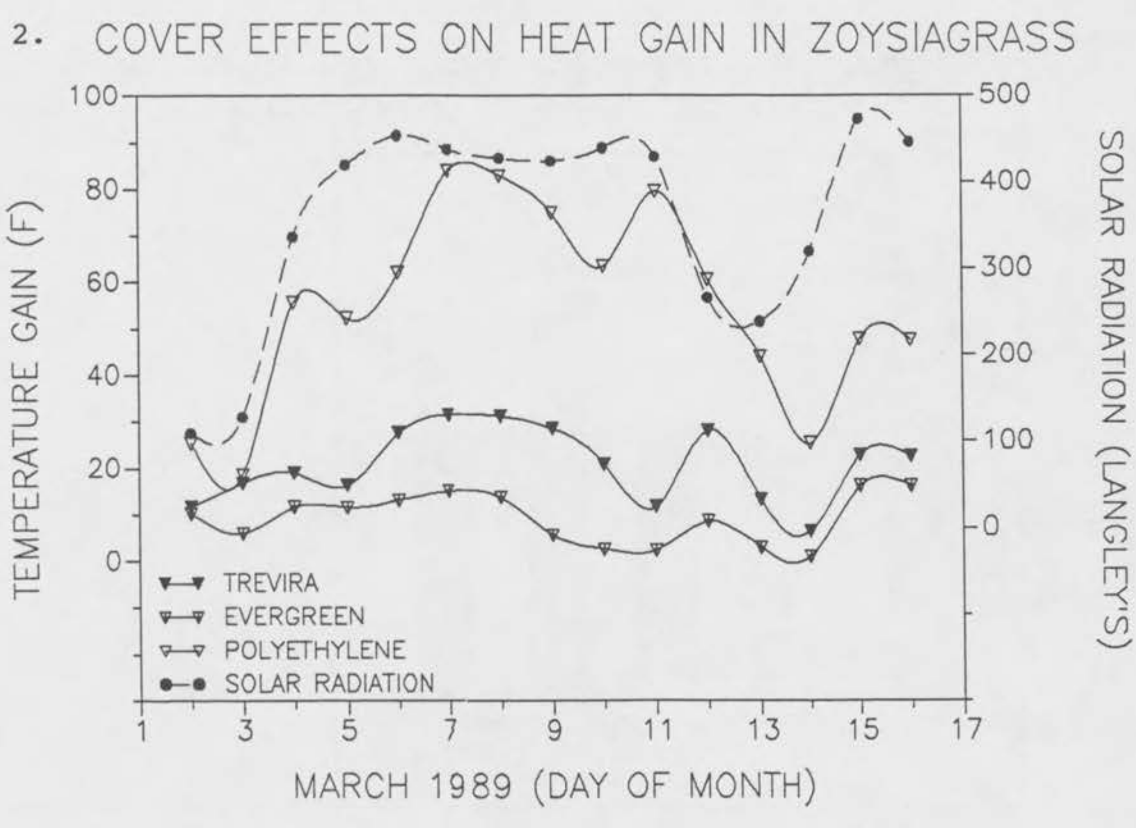



Figure 2.



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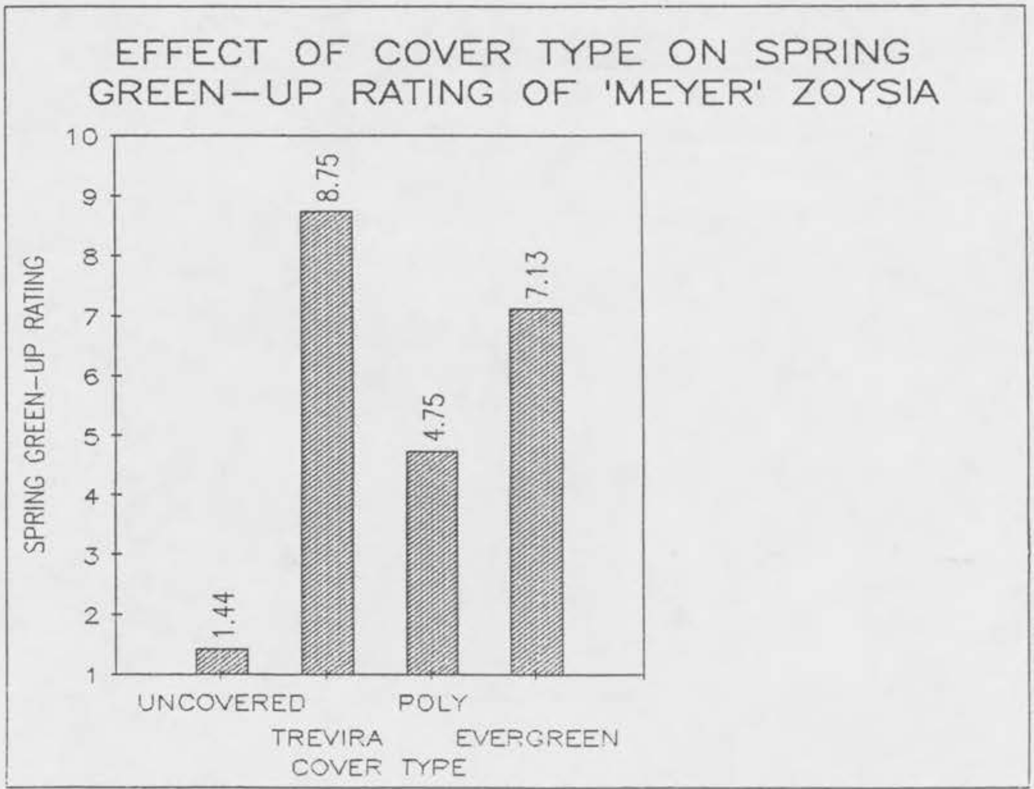


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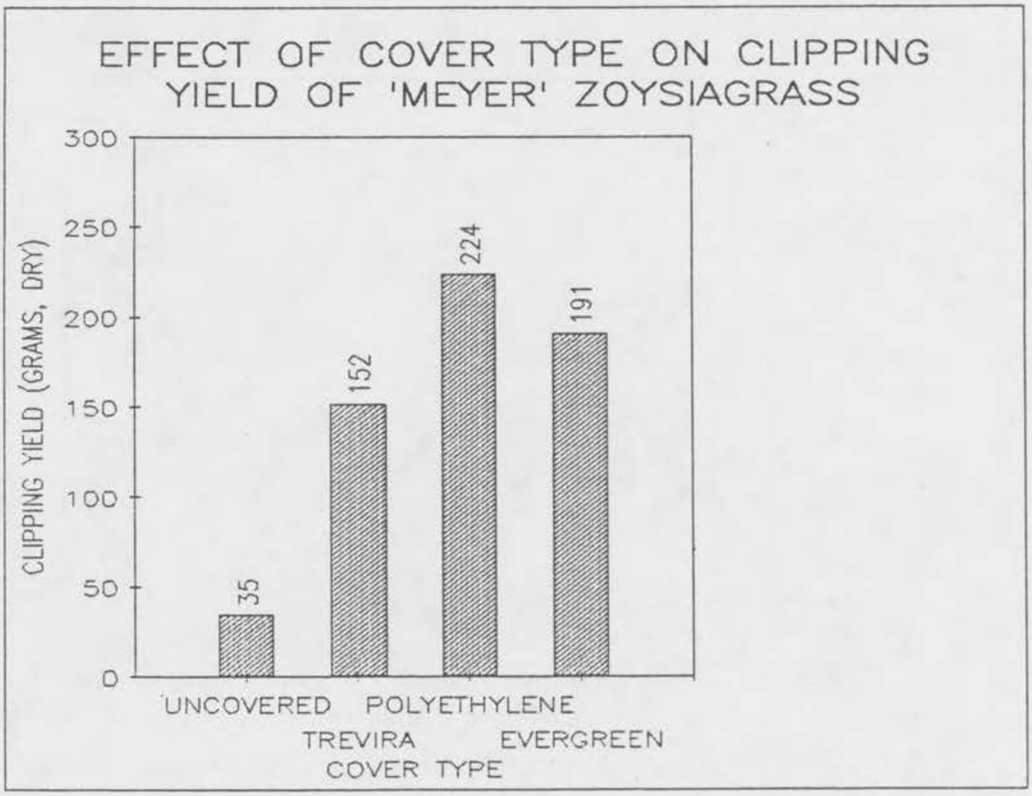


Figure 5.

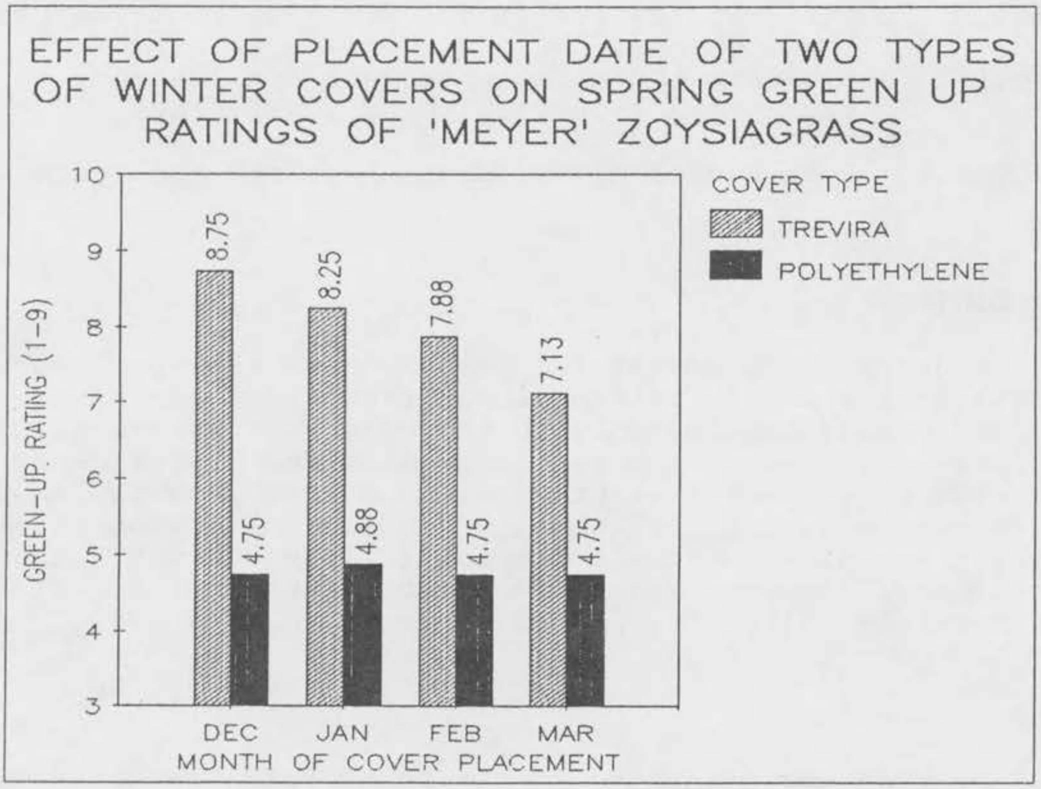
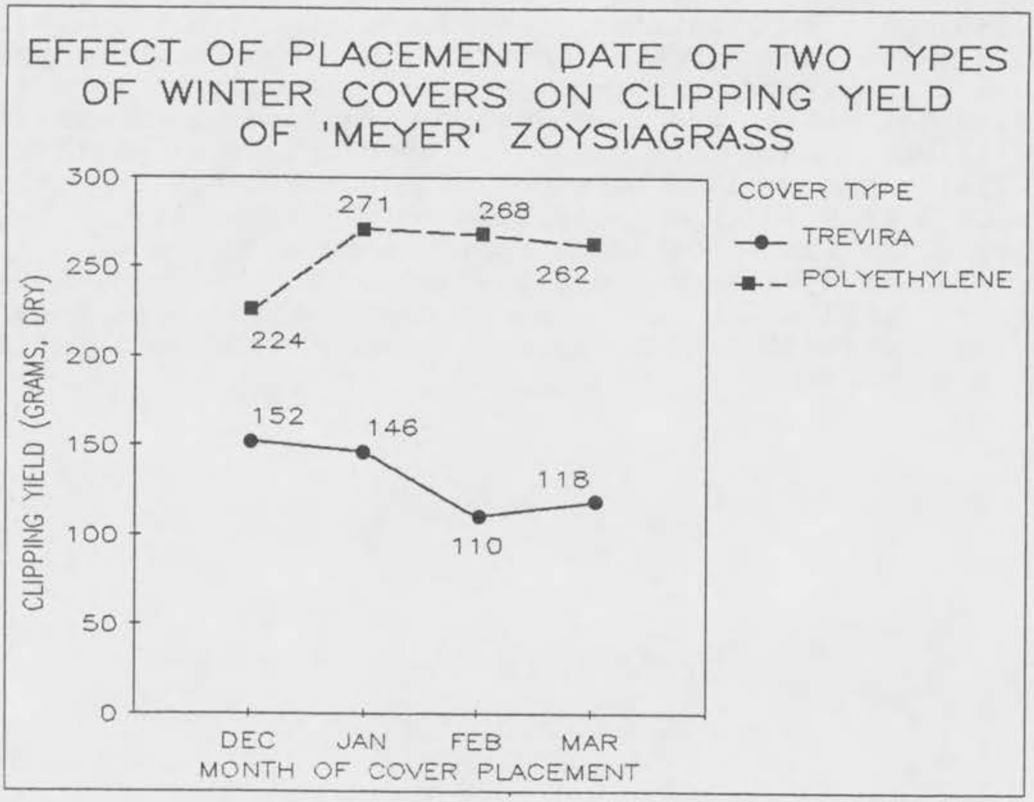



Figure 6.



**TITLE:** Fall Application of Ethofumesate to Zoysiagrass

**OBJECTIVE:** Evaluate the effects of fall applications of ethofumesate on quality of zoysiagrass

**PERSONNEL:** Roch Gaussoin, Turfgrass Research and Teaching

## INTRODUCTION:

Prograss (ethofumesate) is a selective herbicide currently registered for use in perennial ryegrass, Kentucky bluegrass, creeping bentgrass, and dormant bermudagrass overseeded with perennial ryegrass. Prograss is labeled for preemergence control of a wide range of annual broadleaf and grassy weeds, as well as postemergence control of annual bluegrass and common chickweed. In order to determine the potential for the use of Prograss in zoysiagrass, research was conducted to determine its effects on zoysiagrass quality.

## METHODS:

Research was conducted at the Rocky Ford Turfgrass Research Plots located near Manhattan, KS. The Zoysiagrass was maintained at a 0.5" height, and cultural practices included applications of pesticides and fertilizers as recommended for Kansas. Treatments included split applications of ethofumesate at 0.75, 1.0, and 1.5 lbs a.i./A and an untreated control. Treatments were applied using a $CO_2$ sprayer calibrated to deliver 30 GP at 35 PSI. The experimental design was a randomized complete block with three replications. Data were collected on symptoms of phytotoxicity and zoysiagrass quality based on of quality based on a visual scale of 1 to 9, with 9 indicating no phytotoxicity or best quality. The first herbicide application occurred on October 18, 1988 followed by a second application on November 18, 1988. On the first application date, the zoysiagrass was just beginning to show signs of winter dormancy and by the second application was totally dormant.

**RESULTS:**

Visual observation of the test area after the October application showed no adverse effects of herbicide application. In April of 1989, however, the treated plots did not green-up as well as the untreated control (Table 1). Treated plots were still discolored in May, indicating that the herbicide did not just delay green-up but, in fact, severely injured the zoysiagrass. Based on this evaluation, it appears that late fall applications of Prograss on zoysiagrass is unacceptable because of the damage inflicted. Further research is necessary to determine the applicability of Prograss use in zoysiagrass.

Table 1. Effects of fall ethofumesate applications on the quality of zoysiagrass

| Treatment (lbs a.i./A) | | | Visual Quality[a] | |
|---|---|---|---|---|
| 10/18/88 | | 11/18/88 | 4/24/89 | 5/12/89 |
| 1.5 | + | 1.5 | 1.3 | 1.7 |
| 1.0 | + | 1.0 | 3.3 | 4.7 |
| 0.75 | + | 0.75 | ~~8~~5.3 | ~~8~~6.7 |
| Untreated control | | | 8.3 | 8.7 |
| LSD (P = 0.05) | | | 1.0 | 1.15 |

[a]Scale of 1 to 9 with a 9 indicating best quality

**TITLE:** Chemical and Nonchemical Control of Brown Patch in Zoysiagrass

**OBJECTIVE:** To evaluate new and existing fungicides and non-chemical control measures for zoysiagrass infected with brown patch

**PERSONNEL:** Roch Gaussoin, Turfgrass Research & Teaching
Ned Tisserat, Extension Turfgrass Pathology

**SPONSORS:** Sandoz Crop Protection
NOR-AM Chemical Company
Sustane Corporation

**INTRODUCTION:**

Brown patch, caused by the pathogen Rhizoctonia solani, is the most widespread disease of turfgrass. Brown patch is can attack all known turfgrasses, including zoysiagrass. No resistant cultivars of zoysiagrass, or any other turfgrass species exist, so control depends on proper management and often requires chemical control measures. Because of the nature of the pathogen, preventative application of fungicides is much more successful than curative applications. Research will be conducted on several new and existing fungicides to determine their efficacy in the control of R. solani in zoysiagrass.

In addition to the aforementioned chemical treatments, a nonchemical control measure also will be investigated. This will involve applications of Sustane, a natural, organic fertilizer (5-2-4), which has been shown to be active on several pathogens in tests in Michigan.

**METHODS:**

Treatments include two experimental fungicides manufactured by Sandoz Crop Protection, one or two registered fungicides (Iprodione and/or propiconazole), Sustane, and an untreated control. All treatments will be applied on 14- and 21- day schedules, except Sustane, which will be applied only on the 21-day schedule. Treatments will be initiated in early June and terminated after peak brown patch season. In late June or early July, the experimental area will be inoculated with oat seed infected with R. solani to supplement disease infestation. Experimental design is a randomized complete block with three replications. Data will be collected on turfgrass quality and pathogen suppression.

**TITLE:** Etiology of a Spring Patch Disease of Zoysiagrass

**OBJECTIVE:** To determine the cause of spring patch disease in zoysia

**PERSONNEL:** N. Tisserat, S. Nelson, A. Nus and J. Pair, Dept. of Plant Pathology and Horticulture, KSU

**INTRODUCTION:**

For the past several years, a spring disease of zoysiagrass has been noted on golf tees and home lawns in northeastern Kansas. Symptoms of the disease are similar to those of spring dead spot of bermudagrass. Affected turf fails to break dormancy during the spring green-up period. This results in roughly circular areas of dead turf. In some cases, the turf is not completely killed, but is very slow to resume spring growth. Occasionally, symptoms of this decline are noted in the fall. Our objective was to determine the cause of this springtime patch disease of zoysiagrass.

**METHODS:**

Samples of diseased turf were collected from the Topeka Country Club and isolations were attempted from roots. A fungus, tentatively identified as Ophiosphaerella herpotricha, was consistently isolated from the roots. Pathogenicity of the fungus to zoysiagrass was tested in greenhouse trials. In the fall of 1988, zoysiagrass at the Horticulture Research Center in Wichita was inoculated with the fungus in an attempt to reproduce symptoms in the field.

**RESULTS:**

Ophiosphaerella herpotricha was consistently isolated from roots of zoysiagrass showing symptoms of the spring patch disease. This fungus has been identified previously as a cause of spring dead spot of zoysiagrass in Kansas. Greenhouse results indicated that the fungus caused extensive discoloration and weight loss of bermudagrass roots. These results are similar to tests conducted with bermudagrass. Field inoculations did not result in the formation of dead spots in the spring of 1989. However, this was not unexpected, since symptoms may take several years to develop. In conclusion, Ophiosphaerella herpotricha has been isolated from spring patches on zoysiagrass and is pathogenic to this species in greenhouse tests. Nevertheless, field trials must be completed to confirm that this fungus is responsible for the disease.

Table 1. Root discoloration and weight loss of zoysiagrass 3 months after inoculation with Ophiosphaerella herpotricha in greenhouse trials.

| Treatment | Root Discoloration* | Root weight (grams) |
|---|---|---|
| Ophiosphaerella herpotricha | 3.3 | 0.72 |
| Control | 0.3 | 1.06 |

*Root discoloration ratings on 0-5 scale, where 0 = no discoloration and 5 = roots totally discolored. Values for root discoloration and root weights are means of 10 replicates. Values in each column are significantly different ($P < .05$).

**TITLE:** Buffalograss Management Study

**OBJECTIVE:** To test quality response of 'Texoka' buffalograss managed under increasing rates of nitrogen and different mowing heights

**PERSONNEL:** Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician
Mike Sandburg, Turfgrass M.S. candidate

**INTRODUCTION:**

Buffalograss 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 buffalograss is a low maintenance species, in that it requires very little (if any) nitrogen application and supplemental irrigation. The density of buffalograss under these conditions is quite low, however, and its color is a dull green. It also has been stated that increased rates of nitrogen encourage weed encroachment, especially from more aggressive perennial grasses. This experiment was initiated to test to what extent buffalograss turf quality can be improved with increased rates of nitrogen and different mowing heights when strict weed control is practiced.

**MATERIALS AND METHODS:**

'Texoka' buffalograss was established in Section III of the Rocky Ford Turfgrass Research Plots in 1986. This experiment utilizes four yearly rates of nitrogen: 1 lb of N per 1000 sq ft applied in mid-May; 2 lbs of N per 1000 sq ft applied in split applications in mid-May and mid-July; 3 lbs of N per 1000 sq ft applied in split applications in mid-May, mid-June, and mid-July; and 4 lbs of N per 1000 sq ft 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 in and 3.5 in. Strict weed control is practiced using simazine glyphosate, benefin, and trimec. Insecticides are applied as needed. Quality ratings (1-9) have been recorded for each treatment combination beginning in August, 1987.

**RESULTS:**

Table 1 shows the effect of nitrogen level and mowing height on the June, July, and August quality of 'Texoka' buffalograss. Quality was improved slightly (mostly because of color) up to about 3 lbs of actual N per 1000 square feet. It should be noted, however, that using that high N rate on buffalograss necessitates strict weed control, especially from more aggressive cool-season grass invaders (i.e., use of glyphosate during off-season).

Mowing height should be rather high on buffalograss to maximize quality (Table 1). The 3.5 inch mowing height always had a significantly higher quality rating than the 1.75 inch 'Texoka' during each summer month. .pa

Table 1. Influence of nitrogen fertility and mowing height on quality of 'Texoka' buffalograss.

| Variable | June | July | August |
|---|---|---|---|
| Nitrogen level (lb N/1000 ft/year) | | | |
| 1 | 6.5 | 6.9 | 6.3 |
| 2 | 6.7 | 7.2 | 6.6 |
| 3 | 7.4 | 7.6 | 7.0 |
| 4 | 7.8 | 7.5 | 7.9 |
| LSD (0.05) | 0.61 | 0.15 | 0.35 |
| Mowing Height | | | |
| 1.75 | 6.5 | 6.7 | 6.4 |
| 3.50 | 7.7 | 7.8 | 7.5 |
| LSD (0.05) | 0.18 | 0.17 | 0.25 |

Quality ratings are means of 5 reps utilizing a 1-9 subjective scale where 9 = top quality and 1 = dead turf.

**TITLE:** Herbicide Phytotoxicity to Buffalograss under High Temperatures

**OBJECTIVES:** To determine the tolerance of buffalograss to summer applications of phenoxy herbicides

**PERSONNEL:** John C. Pair and Jerald Nickels

**INTRODUCTION:**

Buffalograss is the only native grass species used for turf purposes. Attempts to improve turf quality through fertilizing and watering usually result in increased numbers of weeds during summer. Control of the weeds by conventional phenoxy herbicides has often resulted in injury to the buffalograss. This experiment compares the phytotoxicity of several broadleaf weed killers applied at two temperatures (78$^{o}$ and 99$^{o}$F).

**METHODS:**

Well established, 2 year-old buffalograss was treated with three conventional herbicides at two rates and under two temperature regimes, representing moderate and high temperature applications. Application was by a $CO_2$ plot sprayer at 26 GPA and 20 PSI using the following herbicides: 2,4-D Amine (Formula 40), Banvel-D, and Trimec.

The first application was made at 3:00 p.m. on July 25 with an air temperature of 99$^{o}$F under bright, sunny conditions. A second application to adjoining plots was made at 2:45 p.m. on August 5 under somewhat overcast and cloudy conditions and a temperature of 78$^{o}$F. However, after application, temperatures reached 83$^{o}$ later in the day as the sun came out, and temperatures rose to 95$^{o}$ and 98$^{o}$ on August 6 and 7, respectively. Injury was evaluated 3 days, 1 wk and 2 wks after application.

**RESULTS:**

Injury was first noticed 48 hrs after application and was most severe on plots treated with 2,4-D at 4 lb AI/A (Table 1). Visual symptoms consisted of burning of leaf blade and necrosis of tissue on turf receiving direct exposure to the herbicide. Injury peaked at 1 wk following application, and with the exception of the 4 lb rate of 2,4-D, injury was within an acceptable level of damage. Three weeks later and after the first mowing, all treatments were within an acceptable range of visual quality.

Injury occurring under a more moderate temperature regime (78$^{o}$F) followed a very similar pattern (Table 2). Most injury occurred with use of 2,4-D at the 4 lb rate, followed by Trimec at 4 pints per acre. Lower rates of both products and both rates of Banvel-D provided an acceptable level of injury, and all injury was reduced to an acceptable level in 2.5 wks.

Table 1. Injury to buffalograss from herbicides applied at 99°F.[1]

| Treatment | Rate (AI/A) | Percent Injury 7-28 | 8-1 | 8-8 | 8-17 |
|---|---|---|---|---|---|
| Control | -- | 0 | 0 | 0 | 0 |
| 2,4-D | 2.0 lb. | 22.5 | 23.8 | 6.3 | 0 |
| 2,4-D | 4.0 lb. | 46.3 | 52.5 | 37.5 | 8.8 |
| Banvel-D | .25 lb. | 5.3 | 8.8 | 0 | 0 |
| Banvel-D | .50 lb. | 11.3 | 15.0 | 3.8 | 2.5 |
| Trimec | 2 pts. | 6.5 | 1.3 | 0 | 0 |
| Trimec | 4 pts. | 30.0 | 20.0 | 3.8 | 0 |

[1]Applied July 25, 1988. Injury rating based on 0-100% with 0=no injury, less than 20% acceptable, and greater than 20% unacceptable injury (average of 4 replications).

Table 2. Injury to buffalograss from herbicides applied at 78°F[1]

| Treatment | Rate (AI/A) | Percent Injury 8-8 | 8-17 | 8-22 |
|---|---|---|---|---|
| Control | | 0 | 0 | 0 |
| 2,4-D Amine | 2.0 lb. | 18.8 | 21.3 | 8.8 |
| 2,4-D Amine | 4.0 lb. | 50 | 47.5 | 20.0 |
| Banvel-D | 0.25 lb. | 0 | 0 | 0 |
| Banvel-D | 0.50 lb. | 6.3 | 10.0 | 0 |
| Trimec | 2 pts. | 1.3 | 2.5 | 0 |
| Trimec | 4 pts. | 22.5 | 22.5 | 5.0 |

[1]Applied August 5, 1988. Temperature was 78° when treatments started under overcast sky but as sun came out, temperature reached 83° at 4:30 in the afternoon (average of 4 replications).

**TITLE:** Topsoil Replacement Study

**OBJECTIVE:** To investigate the minimum topsoil replacement requirement for establishing and maintaining tall fescue or Kentucky bluegrass from seed or sod on disturbed sites

**PERSONNEL:** Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician
Mike Sandburg, Turfgrass M.S. candidate
Mike Boaz, Turfgrass M.S. candidate

**INTRODUCTION:**

Establishing and maintaining quality turfgrass on disturbed building sites is a difficult task. Traffic from excavation and construction equipment results in soil compaction, and often much (if not all) of the topsoil is removed before construction begins. Subsoil is generally a much poorer rooting medium for turfgrasses than topsoil because of reduced fertility, aeration, and drainage, as well as a greater compaction tendency. This study was initiated to investigate the minimum topsoil replacement requirements when all of the existing topsoil has been removed. This information is needed by turfgrass professionals whose task is to convince the developer of the need for replacement topsoil to establish and maintain property value-enhancing turfgrasses.

**MATERIALS AND METHODS:**

Excavation began in early July of 1988 to remove the topsoil from a 32 by 72 ft rectangle from Section II of the Rocky Ford Turfgrass Research Plots. After topsoil was removed, the resultant "dish" was back-filled with subsoil to grade, 2 in or 4 in below grade in a randomized complete block experimental design. Topsoil that was initially removed was replaced on the plots that are sub-soil back-filled to 2 and 4 in below grade. Plots that are sub-soil back-filled to grade received no topsoil replacement.

In early September, plots were seeded with K-31 tall fescue and 'Baron' Kentucky bluegrass. In addition, plots were sodded with the same cultivars of tall fescue and Kentucky bluegrass. Data are being taken on speed of establishment, quality, density, and penetrometer resistance by depth. Comparisons will be made for those plots being established on subsoil only, subsoil with 2 in of topsoil, and subsoil with 4 in of replacement topsoil, as well as species (tall fescue versus Kentucky bluegrass) and establishment method (seed versus sod).

**RESULTS:**

Table 1 shows monthly quality of tall fescue and Kentucky bluegrass as affected by establishment method and depth of replacement topsoil. Tall fescue had significantly better quality than Kentucky bluegrass up to May of this year. However, both tall fescue and Kentucky bluegrass exhibited superior quality if they were sodded rather than seeded. Adding 2 in of topsoil to the subsoil significantly enhanced both seeded and sodded, tall fescue and Kentucky bluegrass. Adding 4 in of topsoil, however, did not significantly increase quality over the 2-in replacement depth.

Figure 1 shows the effect of replacement topsoil depth on density (%) of both seeded and sodded, tall fescue and Kentucky bluegrass. Adding topsoil (at least 2 in) was much more important when grass was seeded than when sodded. Tall fescue seemed to be more adaptable to no topsoil conditions than Kentucky bluegrass, using either establishment method (Figure 1).

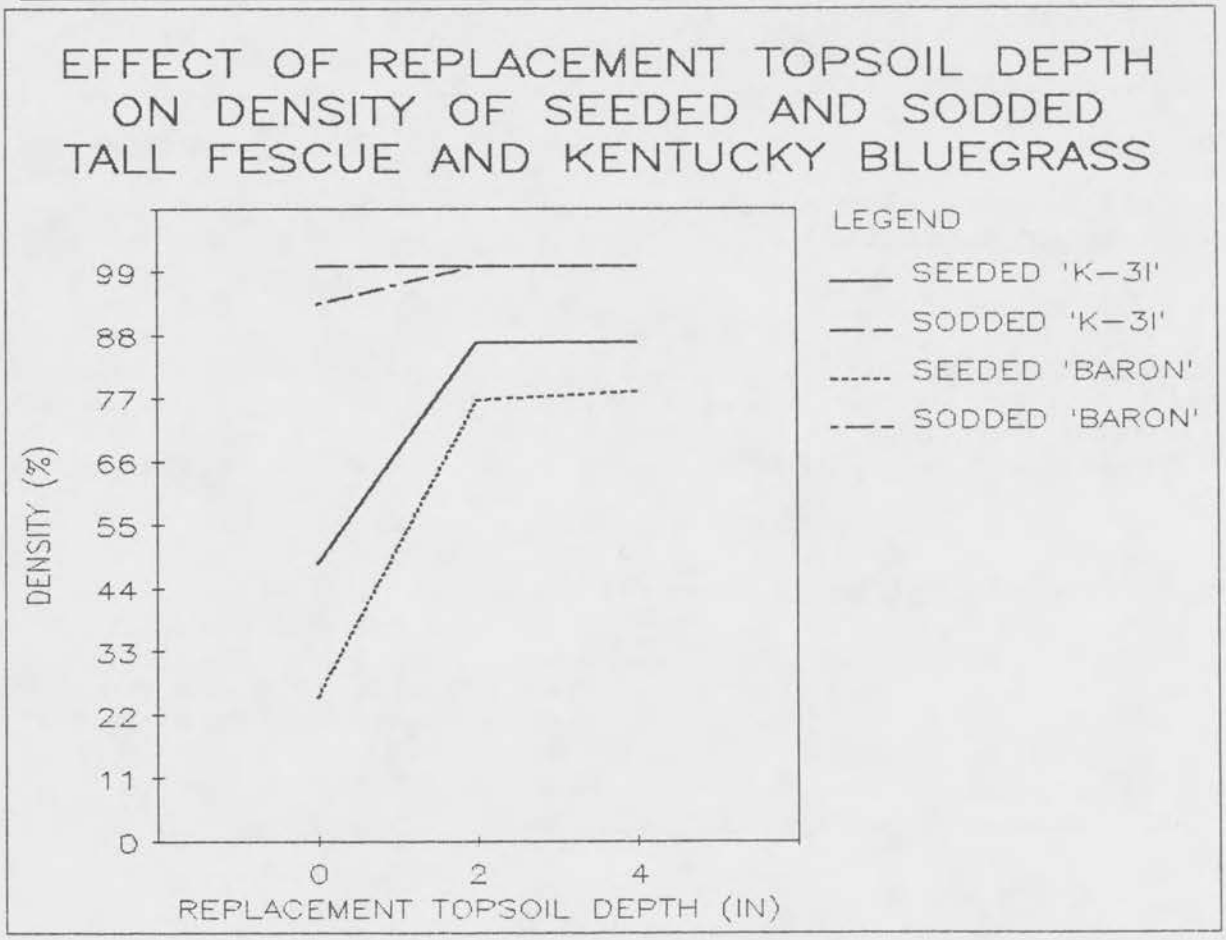
Table 2 provides data on penetrometer resistance by 5, 10, and 15 centimeter depths. No significant effects were found from species or method of establishment, but significant difference at all depths were found between replacement topsoil depths (Figure 2).

Table 1. Monthly quality of tall fescue and Kentucky bluegrass as affected by establishment method and depth of replacement topsoil.

| | Monthly Quality | | | |
|---|---|---|---|---|
| Variable | 10/88 | 11/88 | 4/89 | 5/89 |
| <u>Species</u> | | | | |
| Tall fescue | 6.7 | 7.3 | 5.0 | 5.8 |
| Kentucky bluegrass | 5.2 | 6.3 | 4.5 | 5.8 |
| | * | * | * | N.S. |
| <u>Establishment Method</u> | | | | |
| Sodded | 7.0 | 7.3 | 5.7 | 7.2 |
| Seeded | 4.8 | 6.3 | 3.8 | 4.4 |
| | ** | ** | ** | ** |
| <u>Replacement Topsil Depth</u> (inches) | | | | |
| 0 | 4.6 | 5.2 | 3.5 | 4.7 |
| 2 | 6.5 | 7.4 | 5.3 | 6.2 |
| 4 | 6.7 | 7.8 | 5.5 | 6.4 |
| LSD (0.05) | 0.4 | 0.6 | 0.7 | 0.4 |

Table 2. Effect of species, establishment method, and topsoil replacement depth on penetrometer resistance at 5, 10, and 15 cm.

| | Penetrometer Resistance ($N/cm^2$) 5 cm | 10 cm | 15 cm |
|---|---|---|---|
| Species | | | |
| Tall fescue | 211 | 217 | 240 |
| Kentucky bluegrass | 231 | 210 | 210 |
| | N.S. | N.S. | N.S. |
| Establishment Method | | | |
| Seeded | 207 | 221 | 232 |
| Sodded | 235 | 208 | 219 |
| | N.S. | N.S. | N.S. |
| Replacement Topsoil Depth (inches) | | | |
| 0 | 270 | 261 | 257 |
| 2 | 199 | 194 | 216 |
| 4 | 196 | 187 | 205 |
| LSD (0.05) | 43 | 43 | 37 |



**TITLE:** Alternative Turf Species Study

**OBJECTIVE:** To test various grass species for their adaptability for use as turfgrasses under Kansas conditions

**PERSONNEL:** Jeff Nus, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician
Mike Sandburg, M.S. Candidate

**INTRODUCTION:**

Many turf managers are surprised to learn that of all the species used as turfgrasses, only one (buffalograss) is native to this country. All of the others were imported from eastern Europe, Africa, or Asia, and gradually improved by selecting for superior turf-type characteristics. Most breeding programs, however, have developed improved cultivars for use in high maintenance conditions, where adequate moisture and fertility are available. In recent years, this approach has been challenged. Additional emphasis is now being placed on developing turfgrass cultivars specifically for low maintenance conditions. It is very rare that a cultivar selected under high maintenance conditions will perform well in low maintenance sites. It may prove beneficial to look at other species that have not been used extensively as turfgrass in an effort to identify those that might be adaptable to low maintenance conditions. This project is part of a regional effort to evaluate several species for use under such conditions.

**MATERIALS AND METHODS:**

Seed was received from Dr. Nick Christians, Iowa State University and plugs of buffalograss from Dr. Ed Kinbacher, Univ. of Nebraska, for this study. The experiment was arranged in randomized complete block with main plots (species) split into 2 in, 4 in, or unmowed mowing treatments. Sixteen species were used and are shown with their seeding rates in Table 1. Two pounds of $P_2O_5$ and 1.0 lb of N per 1000 $ft^2$ were applied at seeding. Irrigation was applied only for establishment. No subsequent irrigation was applied. Quality ratings (1-9) are being given to each mowing height x species combination. In addition, weed encroachment (1-10, 1 = 10% plot coverage) ratings were taken in May, 1989, and are presented in Table 2.

**RESULTS:**

Table 1 shows average quality ratings for the alternate species study for Nov., 1988 and April, 1989 (averaged across mowing heights). The very dry winter in Manhattan severely decreased quality ratings of all species and resulted in the death of bulbous bluegrass and Ruff crested wheatgrass. For both dates, Fairway crested wheatgrass, Reubens Canada bluegrass, and Reton red top show the most promise.

Table 2 shows that a large variation existed between species in the amount of weed encroachment. Species with high weed encroachment include Poa alpina, Poa trivialis, and 'Texoka' buffalograss.

Figures 1 and 2 show the effects of mowing treatments on quality and weed encroachment of these alternate turf species. Averaged across all species, there were no significant differences by mowing height (within month) (Figure 1), but weed encroachment increased as mowing height increased (Fig. 2). LSDs (0.05) for Fig. 1 are 1.7 and 1.3 for November and April, respectively. LSD (0.05) for Figure 2 is 0.8.

Table 1. Performance of NCR alternative turfgrass species at Manhattan, KS.

| | Species | Rate lb seed/1000 $ft^2$ | Quality Rating Nov. 1988 | Quality Rating Apr. 1989 |
|---|---|---|---|---|
| 1 | Fairway Crested Wheatgrass | 4.3 | 5.2 | 4.3 |
| 2 | Ephraim Crested Wheatgrass | 4.2 | 5.3 | 3.4 |
| 3 | Sodar Streambank Wheatgras | 4.2 | 5.3 | 3.8 |
| 4 | Ruff Crested Wheatgrass | 6.2 | 1.0 | 1.0 |
| 5 | Reubens Canada Bluegrass | 4.3 | 6.5 | 3.8 |
| 6 | Durar Hard Fescue | 4.2 | 2.3 | 2.1 |
| 7 | Covar Sheep Fescue | 4.5 | 4.3 | 3.4 |
| 8 | Alta Tall Fescue | 4.5 | 5.4 | 2.7 |
| 9 | Sheep Fescue | 4.2 | 2.6 | 2.5 |
| 10 | Bulbous Bluegrass | 4.2 | 4.7 | 1.1 |
| 11 | Poa alpina | 4.0 | 3.8 | 1.7 |
| 12 | Reton Red Top | 4.0 | 6.4 | 3.4 |
| 13 | Colt Poa trivialis | 4.0 | 6.7 | 1.7 |
| 14 | Exeter Colonial Bentgrass | 3.8 | 6.4 | 2.0 |
| 15 | Texoka Buffalograss | 1 plug tray | 1.0 | 1.0 |
| 16 | NE 84-315 Buffalograss | 1 plug tray | 1.0 | 1.3 |
| | LSD (0.05) | | 1.9 | 1.3 |

Table 2. Weed encroachment of the alternative species study at Manhattan, KS evaluated in May, 1989.

| | Species | Weed Encroachment (1 = 10% of plot covered) | |
|---|---|---|---|
| 1 | Fairway Crested Wheatgrass | 0.22 | (2.2%) |
| 2 | Ephraim Crested Wheatgrass | 0.89 | (8.9%) |
| 3 | Sodar Streambank Wheatgrass | 2.22 | (22.2%) |
| 4 | Ruff Crested Wheatgrass | dead | -- |
| 5 | Reubens Canada Bluegrass | 2.22 | (22.2%) |
| 6 | Durar Hard Fescue | 2.56 | (25.6%) |
| 7 | Cover Sheep Fescue | 2.22 | (22.2%) |
| 8 | Alta Tall Fescue | 1.44 | (14.4%) |
| 9 | Sheep Fescue | 1.78 | (17.8%) |
| 10 | Bulbous Bluegrass | dead | -- |
| 11 | _Poa alpina_ | 5.56 | (55.6%) |
| 12 | Reton Red Top | 1.67 | (16.7%) |
| 13 | Colt _Poa trivialis_ | 3.67 | (36.7%) |
| 14 | Exeter Colonial Bentgrass | 2.67 | (26.7%) |
| 15 | Texoka Buffalograss | 5.76 | (57.6%) |
| 16 | NE 84-315 Buffalograss | 2.00 | (20.0%) |
| | LSD (0.05) | 1.8 | (18%) |

Figure 1.

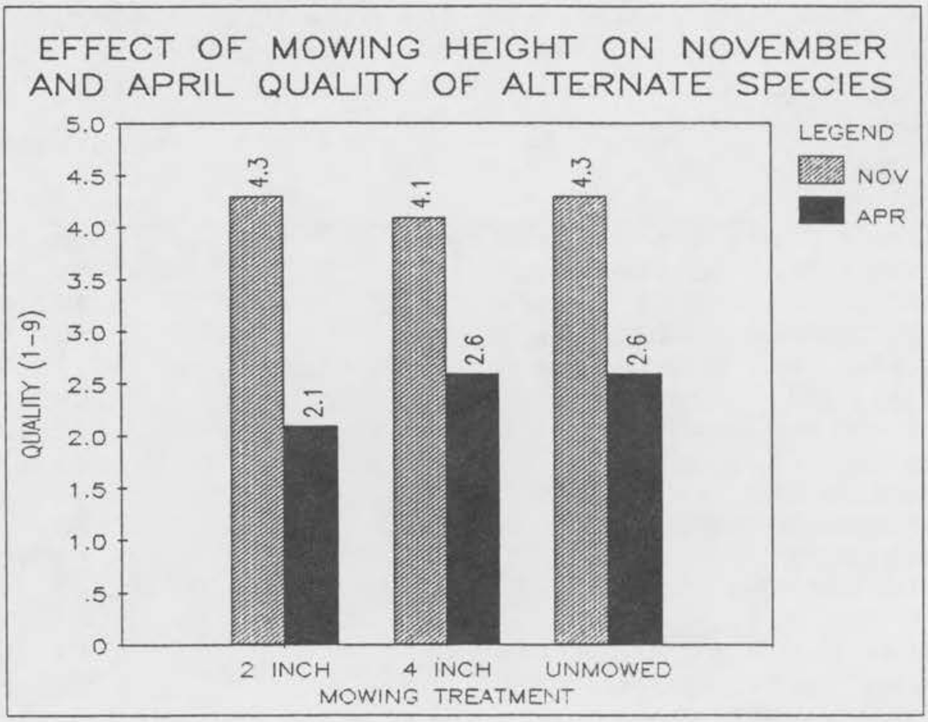
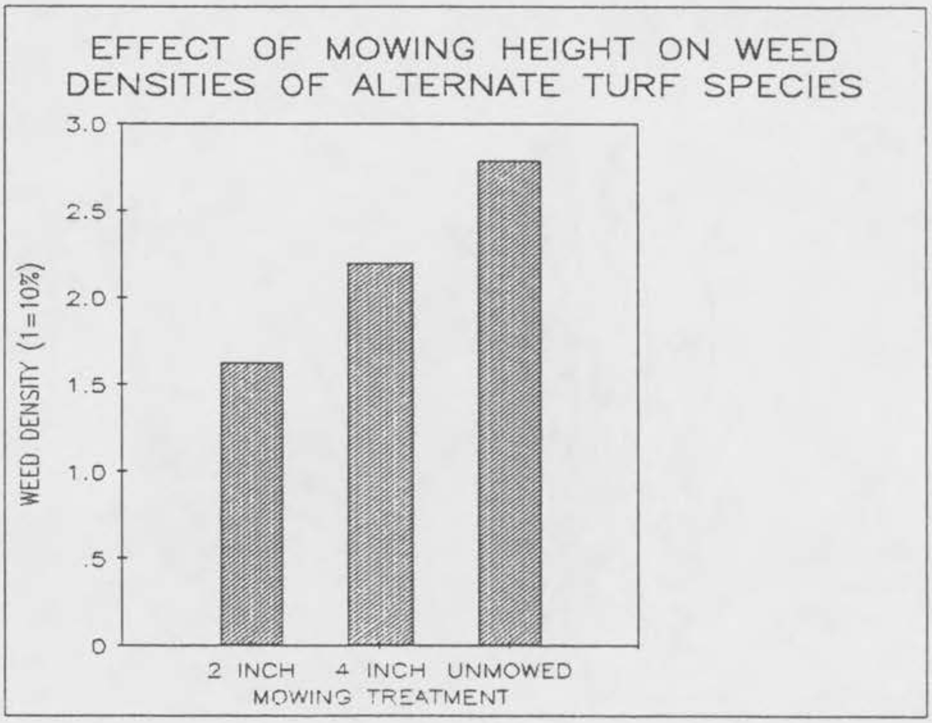



Figure 2.



**TITLE:** Compaction Study of Warm-Season Species

**OBJECTIVE:** To evaluate several warm season genotypes from Ray Keen's breeding program for their performance under different nitrogen and traffic conditions.

**PERSONNEL:** Bob Carrow, Turfgrass Research, Univ. of Georgia
Jeff Nus, Turfgrass Research and Teaching
Rock Gaussoin, Turfgrass Research and Teaching
Paul Haupt, Turfgrass Technician

**INTRODUCTION:**

Turfgrass breeding and selection programs have most often selected improved cultivars under high maintenance conditions. When germplasm is released, however, turf manners desire much information concerning the selection's performance under a variety of management conditions. This requires that genotype performance be evaluated, while certain cultural factors are manipulated. Two such factors are nitrogen fertility and traffic.

This study was designed to test the performance of seven bermudagrass and three zoysia selections from Dr. Ray Keen's breeding program and compare them to the performance of 'Midiron' bermudagrass and 'Meyer' zoysiagrass, respectively, under two levels of nitrogen fertility while receiving traffic.

**MATERIALS AND METHODS:**

Cultivars in the trial were:

| Cultivar | Species |
|---|---|
| Midiron | Bermuda |
| A-6 | Bermuda |
| Mid-Mo (S-16) | Bermuda |
| Kansas Common | Bermuda |
| A-29 | Bermuda |
| E-29 | Bermuda |
| A-22 | Bermuda |
| E7 | Bermuda |
| 56-8 | Zoysia |
| 58-6 | Zoysia |
| 21-15 (12) | Zoysia |
| Meyer | Zoysia |

Each cultivar was established in a 12 x 12 ft plot with three replications per cultivar. Each plot was subdivided into four subplots of 6 x 6 ft each for the nitrogen and traffic treatments. Cultivars were established in the spring of 1983.

Traffic treatments and N-treatments were initiated in 1984 and terminated in 1988.

<u>Nitrogen</u> <u>Treatments</u>:
Low N - 1.0 lb N/1000 $ft^2$ on May 1 (12-12-12)
0.6 lb N/1000 $ft^2$ on July 15 (45-0-0)

High N - 1.0 lb N/1000 $ft^2$ on May 1 (12-12-12)
0.75 lb N/1000 $ft^2$ on June 10 (45-0-0)
0.75 lb N/1000 $ft^2$ on May 1 (12-12-12)
0.75 lb N/1000 $ft^2$ on June 10 (45-0-0)
0.75 lb N/1000 $ft^2$ on July 15 (45-0-0)
0.75 lb N/1000 $ft^2$ on Aug 15 (45-0-0)

Traffic Treatments

No traffic - traffic from routine mowing only.

High traffic - routine plus six passes per area with a tractor drawn roller on:
Sept. 1, 15
Oct. 1, 15
Nov. 1, 15
March 15
April 1, 15
May 1

Data were collected on turfgrass quality in June, July and August of 1988 based on a scale of 1 to 9 with a 9 indicating best quality. Thatch measurements were obtained on January 24, 1989 by removing a cup-cutter plug from each plot and measuring thatch thickness in millimeters.

**RESULTS:**

Based on statistical analysis, cultivars were significantly different in quality on all evaluation dates (Table 1). Mid-Mo and A-22 bermudagrass had the best quality, where Kansas Common had the lowest quality in June. Similar trends were seen in the July and August data.

On all evaluation dates, the compacted plots averaged across cultivars exhibited lower quality than the noncompacted (Figure 1). Additionally, the higher nitrogen rate increased quality of all cultivars (Figure 2).

Cultivars differed in thatch depth, based on statistical analysis (Table 2). The bermudagrass selections had less thatch than the zoysia selections. Among the bermudagrasses, A-29 exhibited the greatest thatch accumulation, and among the zoysias, Meyer had less thatch than any of the selections.

Compacted plots, averaged across cultivars, had less thatch than noncompacted (Figure 3). The low nitrogen rates also decreased thatch accumulation (Figure 4).

Based on the results of this study, it is recommended that high rates of N fertility promote thatch accumulation and should be avoided, if at all possible. Most of the cultivars in this study are not commercially available, but the information gained from this investigation will help identify possible cultivars for release to the public. Prior to release, however, these cultivars must be evaluated for disease and stress tolerance and other important attributes.

Table 1. Quality of Dr. Ray Keen's bermudagrass and zoysia selections. Manhattan, KS. 1988.

| Cultivar | June | Quality Rating<br>July | August |
|---|---|---|---|
| Midiron (B) | 7.0 | 6.8 | 6.9 |
| A-6 (B) | 7.2 | 7.1 | 6.8 |
| Mid-Mo (S-16) (B) | 7.7 | 6.7 | 6.9 |
| Kansas Common (B) | 5.3 | 4.6 | 5.5 |
| A-29 (B) | 8.0 | 6.9 | 7.1 |
| E-29 (B) | 6.8 | 7.0 | 7.0 |
| A-22 (B) | 7.7 | 6.7 | 6.4 |
| E-7 (B) | 7.4 | 7.1 | 6.7 |
| 56-8 (Z) | 6.5 | 7.0 | 6.8 |
| 58-6 (Z) | 7.0 | 7.4 | 6.7 |
| 21-15 (Z) | 7.3 | 7.1 | 8.0 |
| Meyer (Z) | 6.6 | 6.9 | 7.0 |
| LSD (0.05) | 1.1 | 0.9 | 1.0 |

[a]Based on a scale of 1-9 with a 9 indicating best quality

Table 2. Thatch depth of Dr. Ray Keen's bermudagrass and zoysiagrass selections

| Cultivar | Thatch Depth, mm |
|---|---|
| Midiron (B) | 11.5 |
| A-6 (B) | 11.7 |
| Mid-Mo (S-16) (B) | 13.5 |
| Kansas Common (B) | 13.8 |
| A-29 (B) | 17.8 |
| E-29 (B) | 15.3 |
| A-22 (B) | 15.4 |
| E-7 (B) | 14.9 |
| 56-8 (Z) | 23.7 |
| 58-6 (Z) | 24.4 |
| 21-15 (Z) | 25.5 |
| Meyer (Z) | 19.7 |
| LSD (0.05) | 4.5 |

Figure 1.

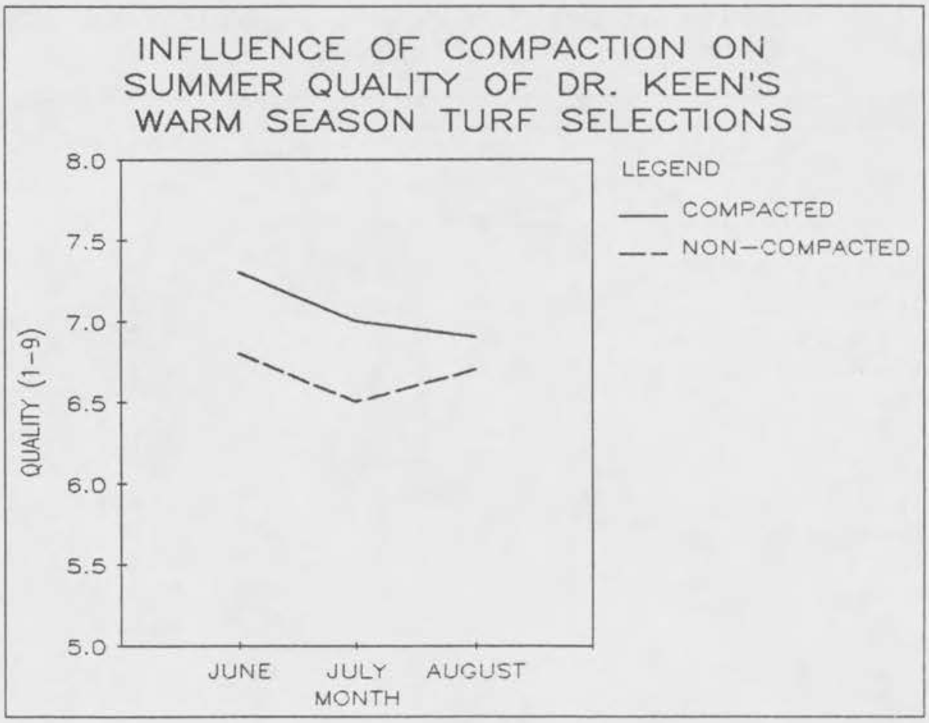



Figure 2.

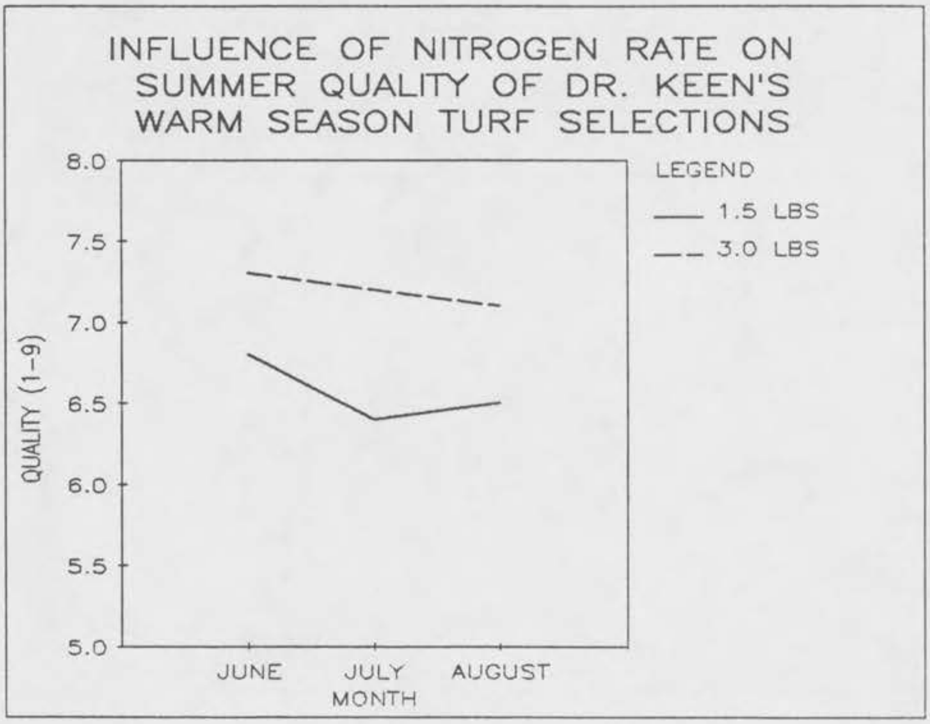


Figure 3.

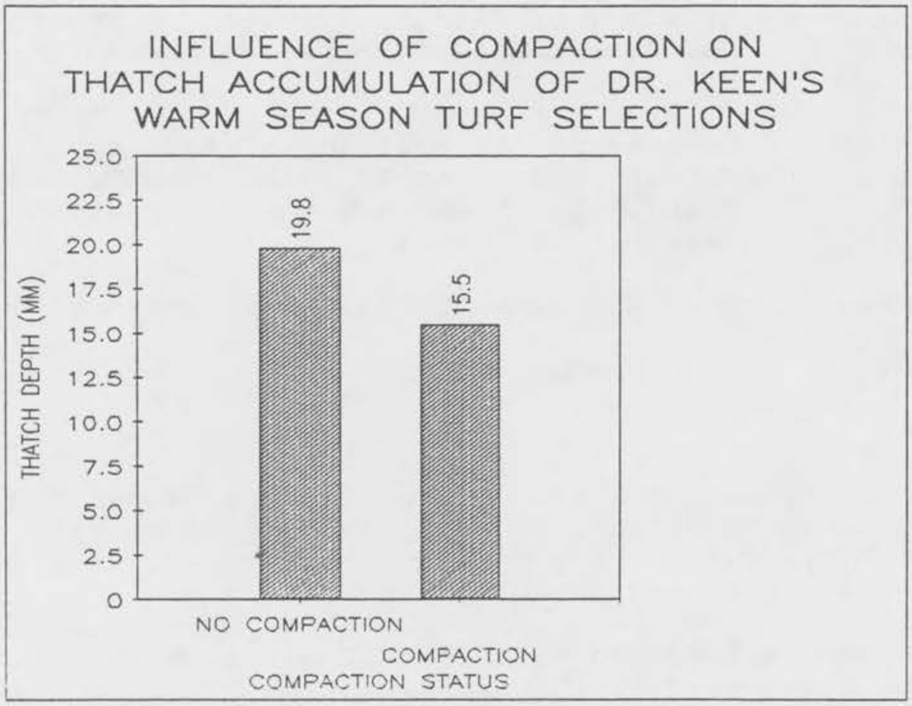
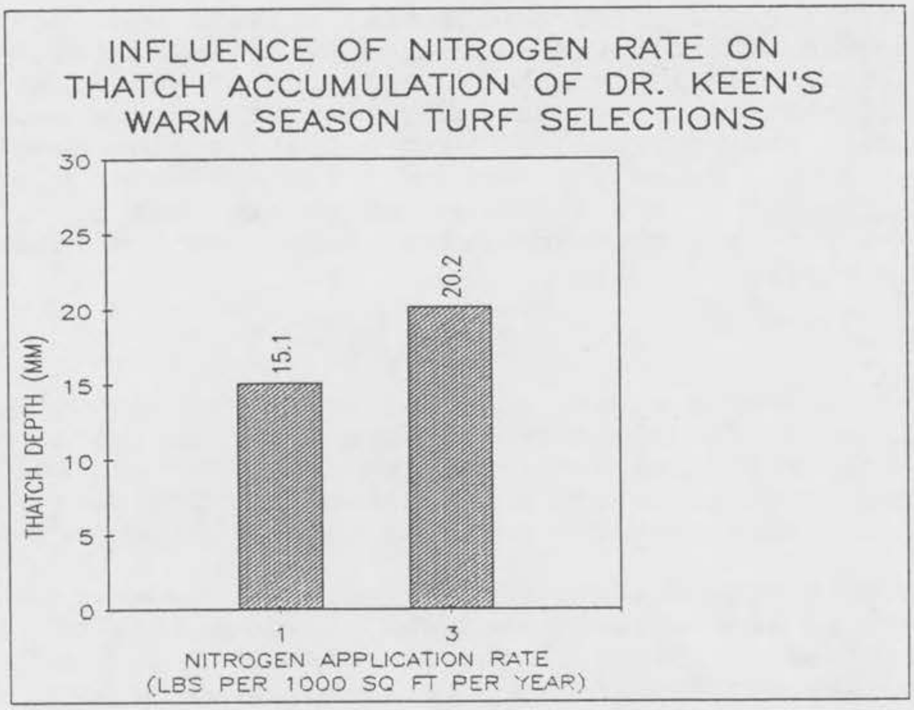



Figure 4.



**TITLE:** Efficacy of Fall Application of Herbicides for the Control of Broadleaf Weeds in Turf

**OBJECTIVE:** To compare the efficacy of fall application of Confront, Turflon II Amine, and Trimec in controlling broadleaf weeds infesting cool-season turfgrasses

**PERSONNEL:** Roch E. Gaussoin, Turfgrass Research & Teaching

**SPONSOR:** Dow Chemical U.S.A.

**METHODS:**

The study was conducted on the driving range at Manhattan Country Club, Manhattan, KS on a mixed-stand of tall fescue and perennial ryegrass. The test location was severely infested with white clover and dandelion.

Treatments included: Turflon II Amine at 2.0, 2.5, and 3.0 pt/A; Confront at 1.0, 1.5 and 2.0 pt/A; Trimec at 3.0 and 4.0 pt/A; and an untreated control. Treatments were applied with a back-pack $CO_2$ sprayer equipped with 8015 nozzles calibrated to deliver 118 gal/A (2.7 gal/1000 $ft^2$) at 30 PSI. Treatments were applied on November 17, 1988. Winds were < 2 mph and ambient temperature was 57-62$^{o}$F. Data were collected on initial weed pressure, phytotoxicity to turf species 2 and 3 wks after treatment, dandelion leaf curl 3 wks after treatment and percent weed control 8 wks after treatment. Initial weed pressure and percent weed control were evaluated by a visual estimate of weed populations. Final percent of weed control was normalized to the untreated control. Phytotoxicity to turf species was evaluated on a visual rating from 1-9, with a 9 indicating severe phytotoxicity. Dandelion leaf curl was evaluated with a visual rating from 1-9 with a 9 indicating severe leaf curl. Plot size was 3.5 x 7 ft and the experimental design was a randomized complete block.

**RESULTS:**

Initial white clover populations ranged from 5 to 20%, whereas populations of dandelion ranged from 5 to 30%. Evaluation of turfgrass 2 wks after treatment found neither the tall fescue or perennial ryegrass exhibiting visible phytotoxicity for any treatment. This response was also seen 3 wks.

However, the dandelions in treated plots were exhibiting leaf curling and necrosis at 3 wks so data were collected on this attribute (Table 1). The 3.0 pt/A rate of Turflon II Amine produced the most severe leaf curl, followed by both rates of Trimec and the three rates of Confront. Dandelions treated with 2.0 or 2.5 pt/A Turflon II Amine exhibited minimal leaf curl and necrosis.

Control information for white clover is shown in Table 2. The 4 pt/A rate of Trimec produced the best control (82%) followed by Confront at 2 pt/A (69%). Trimec at 3 pt/A and Turflon II Amine at 3.0 pt/A gave identical control (64%). Turflon II Amine at 2.0 or 2.5 pt/A gave some control but did not differ statistically from the untreated plots.

No data are tabulated for dandelion control because on the 8 wk evaluation date, no dandelions were present. This was true of both treated and untreated plots as well as the general turf area surrounding the test site. The test location received no irrigation, and precipitation in Manhattan was below normal. This lack of moisture plus the lack of insulating snow cover may have been sufficient to eradicate the existing dandelion population.

However, the dandelions in treated plots were exhibiting symptoms at 3 wks after treatment that indicated a treatment response. All treatments, except the two lowest rates of Turflon II Amine, were producing antagonistic effects in the dandelions.

None of the applied treatments caused visible phytotoxicity to tall fescue or perennial ryegrass indicating that all products, under the conditions evaluated, are safe for use on these two turfgrass species.

Table 1. Efficacy of fall application of herbicides for the control of dandelion in turf. Manhattan Country Club, Manhattan, KS, 1988-89.

| Treatment (pt/A) | | Leaf Curl* (1-9 = most curl) | Rank |
|---|---|---|---|
| Turflon II Amine | 2.0 | 2.0 | 7 |
| | 2.5 | 2.3 | 6 |
| | 3.0 | 7.3 | 1 |
| Confront | 1.0 | 4.3 | 5 |
| | 1.5 | 5.7 | 4 |
| | 2.0 | 5.7 | 4 |
| Trimec | 3.0 | 6.3 | 3 |
| | 4.0 | 7.0 | 2 |
| Control | 0.0 | 1.3 | 8 |
| LSD (P = 0.05) | | 1.5 | |

Table 2. Efficacy of fall application of herbicides for the control of white clover in turf. Manhattan Country Club, Manhattan, KS, 1988-89.

| Treatment (pt/A) | | % Control* | Rank |
|---|---|---|---|
| Turflon II Amine | 2.0 | 36 | 7 |
| | 2.5 | 40 | 6 |
| | 3.0 | 64 | 3 |
| Confront | 1.0 | 59 | 4 |
| | 1.5 | 55 | 5 |
| | 2.0 | 69 | 2 |
| Trimec | 3.0 | 64 | 3 |
| | 4.0 | 82 | 1 |
| Control | 0.0 | 0 | 8 |
| LSD (P = 0.05) | | 32 | |

*Rated 8 wks after treatment

**TITLE:** Postseeding Application of Isoxaben on Kentucky Bluegrass and Tall Fescue

**OBJECTIVE:** To determine efficacy and application timing of isoxaben following seeding of Kentucky bluegrass and tall fescue

**PERSONNEL:** Roch Gaussoin, Turfgrass Research & Teaching
Paul Haupt, Turfgrass Technician

**SPONSOR:** Elanco Products Company

**INTRODUCTION:**

Isoxaben (Gallery) is a herbicide that gives good to excellent preemergence control of a broad range of annual broadleaf weeds. Gallery is currently under label review by the Environmental Protection Agency but should be available in the not too distant future. Information on the postseeding time interval necessary for safe application of Gallery is not available. Research was conducted to determine the time interval necessary in new seedings of Kentucky bluegrass and tall fescue.

**METHODS:**

'Baron' Kentucky bluegrass and 'Rebel II' tall fescue were seeded on September 9, 1988. Prior to seeding 1 lb/N/1000 $ft^2$ as 10-18-22 was incorporated into the seed bed. Seeding rates for Kentucky bluegrass and tall fescue were 2 and 8 lbs/1000 $ft^2$, respectively. After seeding, the area was mulched with wheat straw at 1 bale/1000 $ft^2$. Gallery treatments were applied 2, 4 and 6 wks after seeding (WAS) at 0.5, 0.75 and 1.0 lbs a.i./A; an untreated control was included. Data were collected on henbit weed infestation and percent turfgrass cover 4 wks after treatment (WAT). Percent turfgrass cover was also evaluated in April of 1989. Both attributes were estimated with a visual scale of 1-10, with a 10 indicating 100% cover or infestation. The experimental design was a 4(rate) x 3(treatment date) factorial with three replications. Results for tall fescue and Kentucky bluegrass were analyzed separately.

**RESULTS:**

Kentucky Bluegrass

Growth stages for Kentucky bluegrass were 1 leaf at 2 WAS, 3 leaf at 4 WAS, and 2-3 tiller at 6 WAS.

Data for Kentucky bluegrass cover 4 WAT and in April of 1989 are shown in Table 1. At 4 WAT, plots ranged from 45 to 87% Kentucky bluegrass. Plots treated 2 WAS exhibited the least coverage, with the plots receiving the highest rate of Gallery having less than 50% cover. This response was also seen in the 4 WAS treatments, only less pronounced.

By April of 1989, the control plots had 97% or greater coverage of Kentucky bluegrass. The 2 WAS treatments had between 10 and 17% cover, indicating a severe reduction in stand relative to data collected 4 WAT. The 4 WAS treatment also showed a reduction in stand relative to the untreated plots but was still 90% or greater in stand cover. The 6 WAS treatment did not differ from the control plots. Based on growth stage at time of application, it appears that application of Gallery to newly seeded Kentucky bluegrass is relatively safe, as long as the grass is tillering.

Data for henbit control in Kentucky bluegrass 4 WAT are shown in Table 2. Results of statistical analysis showed no significant effect on henbit control, based on application timing. Therefore, only the rate means are shown. In Kentucky bluegrass, Gallery significantly reduced henbit infestations with all rates equally suppressing the henbit population (95% control).

<u>Tall Fescue</u>

Growth stages for tall fescue were 1-2 leaf at 2 WAS, 3 leaf to 1 tiller at 4 WAS, and 5-7 tiller at 6 WAS.

Data for tall fescue cover 4 WAT (rate mean), and in April of 1989 are shown in Table 3. No significant effect of application timing was exhibited in the tall fescue plots 4 WAT effect was significant in April 1989. Rates were a significant source of variability in data collected 4 WAT and in April of 1989. Tall fescue cover 4 WAT ranged from 88% for untreated plots to 70% for the highest rate of Gallery. All rates of Gallery significantly reduced tall fescue cover by 4 WAT. Based on the April 30, 1989 evaluation, however, treatment at 2 WAS with the 0.5 rate of Gallery did not differ from the control, and at 4 WAS, only the highest rate of Gallery decreased the tall fescue stand. Treatment at 6 WAS with Gallery at any rate did not affect the tall fescue cover. Based on growth stage at time of application, it appears that the use of Gallery at a rate of 0.5 lb a.i./A is safe on tall fescue in the 1-2 leaf stage, rates of 0.5 or 0.75 are acceptable on 3-leaf to 1-tiller tall fescue, and all three rates are acceptable to tall fescue at the 5-7-tiller stage.

Results for henbit cover in tall fescue are shown in Table 4. All Gallery treatments significantly reduced henbit populations relative to the controls. The best control was on tall fescue treated 2 WAS (100% control) but only the 0.5 rate can be utilized at this time, based on results of tall fescue cover discussed above. At 2 and 4 WAS, henbit suppression was equal with all rates.

Table 1. Kentucky bluegrass cover[a] postseeding[b], following treatment with Gallery.

| Rate (lb. a.i./A) | Treatment Timing (WAS[c]) | | | | | |
|---|---|---|---|---|---|---|
| | 2 | 4 | 6 | 2 | 4 | 6 |
| | 4 WAT[d] | | | April 30, 1989 | | |
| Control | 7.5 | 8.7 | 7.5 | 10.0 | 10.0 | 9.7 |
| 0.5 | 5.5 | 7.2 | 7.5 | 1.7 | 9.0 | 9.7 |
| 0.75 | 6.3 | 7.5 | 7.2 | 1.2 | 9.1 | 9.7 |
| 1.0 | 4.5 | 6.8 | 7.0 | 1.0 | 9.2 | 9.8 |
| LSD (P = 0.05) | | 1.13 | | | 0.33 | |

[a]Based on a visual scale of 1-10 with a 10 indicating 100% cover.

[b]Kentucky bluegrass seeded Sept. 24, 1988.

[c]Weeks after seeding.

[d]Weeks after treatment.

Table 2. Henbit cover in newly seeded Kentucky bluegrass 4 wks after treatment with Gallery.

| Rate (lb a.i./A) | Henbit Cover[a] |
|---|---|
| 0 | 2.90 |
| 0.5 | 0.22 |
| 0.75 | 0.17 |
| 1.0 | 0.06 |
| LSD (P = 0.05) | 0.66 |

[a]Based on a visual scale of 1-10 with a 10 indicating 100% cover.

Table 3. Tall fescue cover[a] postseeding[b], following treatment with Gallery.

| Rate (lb. a.i./A) | 4 WAT[d] | Treatment Timing (WAS[c]) 2 | 4 | 6 |
|---|---|---|---|---|
| | | | April 30, 1989 | |
| Control | 8.8 | 9.0 | 9.5 | 8.7 |
| 0.5 | 7.3 | 8.0 | 8.8 | 8.8 |
| 0.75 | 7.3 | 6.5 | 8.2 | 8.2 |
| 1.0 | 7.0 | 6.7 | 7.5 | 8.5 |
| LSD (P = 0.05) | 1.0 | | 1.5 | |

[a]Based on a visual scale of 1-10 with a 10 indicating 100% cover.

[b]Tall fescue seeded Sept. 24, 1989.

[c]Weeks after seeding.

[d]Weeks after treatment.

Table 4. Henbit cover in newly seeded tall fescue 4 wks after treatment with Gallery.

| Rate (lb. a.i./A) | Treatment Timing (WAS[a]) 2 | 4 | 6 |
|---|---|---|---|
| Control | 6.3 | 4.8 | 4.2 |
| 0.5 | 0.0 | 1.5 | 2.5 |
| 0.75 | 0.0 | 2.0 | 2.0 |
| 1.0 | 0.0 | 1.5 | 3.0 |
| LSD (P= 0.05) | | 1.7 | |

[a]Weeks after seeding.

**TITLE:** Investigation of Management Factors for the Conversion of Monostands of Kentucky Bluegrass to Monostands of Tall Fescue

**OBJECTIVE:** To develop a management program for the gradual conversion of Kentucky bluegrass to tall fescue through the use of plant growth regulators, overseeding methods, and tall fescue varieties.

**PERSONNEL:** J. Bryan Unruh, Turfgrass Graduate Student
Roch Gaussoin, Turfgrass Research & Teaching

**SPONSOR:** Kansas Turfgrass Foundation

**INTRODUCTION:**

In the past, the wide leaf blade and upright growth habit of tall fescue made it an unacceptable choice for highly maintained turfgrass installations. The recent genetic improvements, as well as questionable water availability, however, have spawned a strong interest in the use of tall fescue on highly maintained turfgrass areas. Many of these areas were originally planted to Kentucky bluegrass, and conversion to tall fescue can be troublesome. Complete renovation utilizing non-selective herbicides can be successful but requires the installation to be inaccessible for use for up to a year. Removal of the Kentucky bluegrass and resodding is possible, but may be cost prohibitive. However, the gradual conversion of Kentucky bluegrass stands to tall fescue does not limit utilization of the turfgrass during the transition process and may be economically acceptable.

**METHODS:**

This research will be conducted on a mature stand of of Kentucky bluegrass at Rocky Ford Turfgrass Research Station. Twenty-four treatments will be arranged such that all possible combinations will be applied. Treatments will include overseeding rate (6 or 12 lbs/1000 $ft^2$), cultivar (Rebel II or Mustang), seeding method (verticut/broadcast or slit seeded), and chemical treatment (Manage, Embark, or an untreated control). Overseeding will occur in mid to late August. Chemical treatments will be applied 2 wks prior to overseeding operations. Data will be collected on turf quality and conversion success starting in the spring of 1990. The experiment will be conducted for 2 yrs.

**TITLE:** Effect of Plant Growth Regulator Compounds on in Vitro Growth of Rhizoctonia solani and Leptosphaeria korrae, Two Fungal Pathogens of Turfgrass

**OBJECTIVE:** To test, in vitro, the activity of three plant growth regulators on the growth of the fungal pathogens that cause brown patch and necrotic ring spot

**PERSONNEL:** Roch Gaussoin, Turfgrass Research and Teaching
Ned Tisserat, Turfgrass Extension Plant Pathologist
Ann Nus, Pathology Technician

**INTRODUCTION:**

Plant growth regulator's (PGR's) are used on turfgrass to reduce the amount of foliage growth and, thus, reduce the frequency of mowing. These compounds may have other effects on the plant and the microflora associated with the leaves or roots of the turfgrass plant. For example, the chemical structure of the PGR paclobutrazol (the active ingredient in Scott's TGR) is similar to the sterol inhibitor fungicide, fenarimol (Rubigan), indicating the potential for fungicidal activity.

**METHODS:**

Potato dextrose agar was amended with the PGR chemicals paclobutrazol, flurprimidol, and melfluidide at 0, .1, 1, 10, 100, and 1000 ppm; an untreated control was included. Small disks of agar containing R. solani or L. korrae were placed in the center of each plate and incubated at 25°C for 4-10 days. Radial growth of each fungus was measured at regular intervals. Any effect of the PGR on fungal growth should result in increased or decreased radial growth.

**RESULTS:**

The PGR's, paclobutrazol and flurprimidol, inhibited growth of both R. solani and L. korrae at concentrations higher than 10 ppm. Both fungi were completely inhibited at concentrations higher than 100 ppm (Figures 1 and 2). The concentrations at which these PGR's inhibit fungal growth is similar to those of many fungicides, indicating that these compounds may have fungicidal or fungistatic properties. In contrast, the PGR mefluidide stimulated growth of R. solani at concentrations of 10 ppm or higher, but had little effect on growth of L. korrae.

These results suggest that both paclobutrazol and flurprimidal may affect pathogen growth. Further greenhouse and field studies are needed to determine whether PGR's influence disease development. We are currently setting up such greenhouse trials.

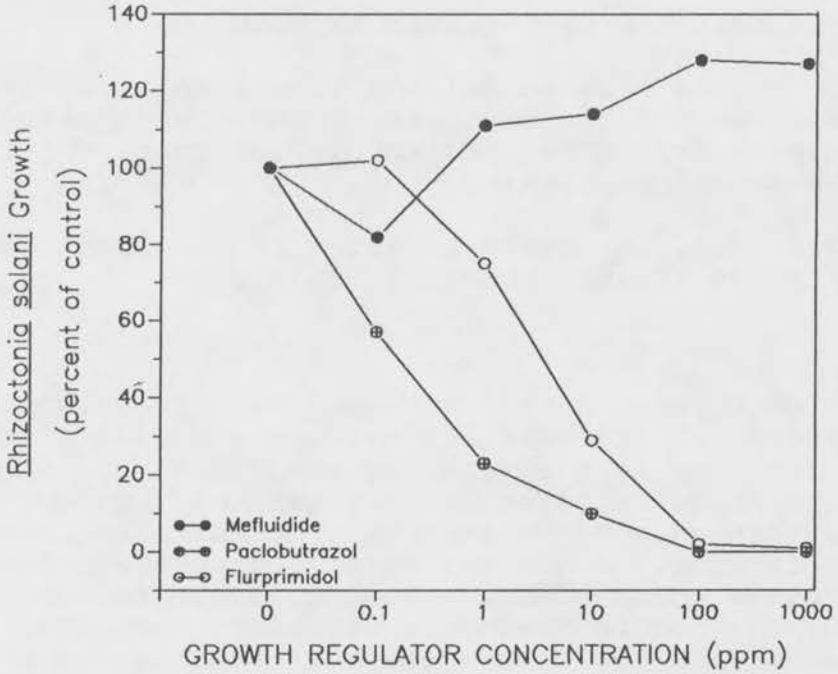



Figure 1. Growth per day of <u>Rhizoctonia</u> <u>solani</u> on potato dextrose agar amended with increasing concentrations of three plant growth regulators.

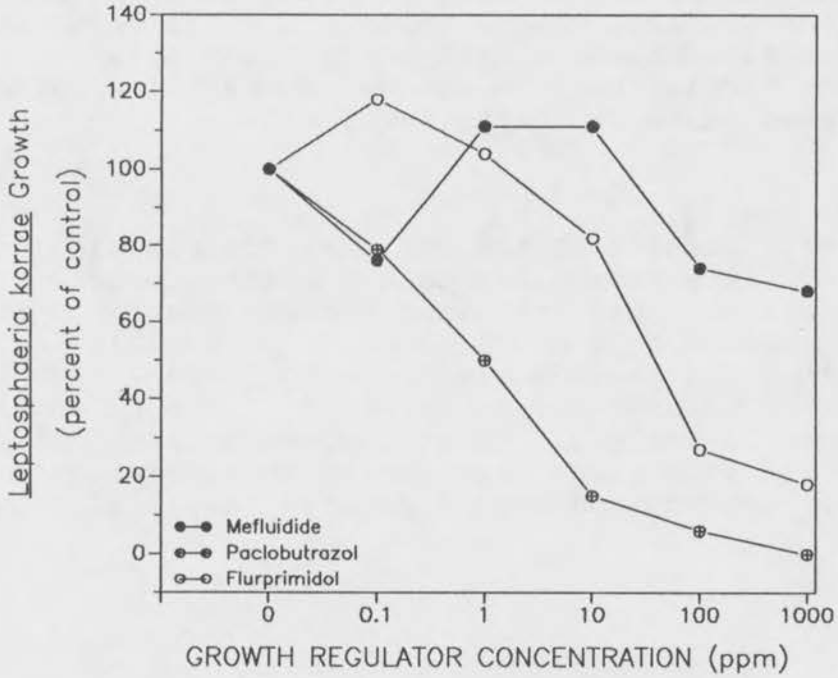



Figure 2. Growth per day of <u>Leptosphaeria</u> <u>korrae</u> on potato dextrose agar amended with increasing concentrations of three plant growth regulators.

**TITLE:** National Prairie Wildflower Test

**OBJECTIVE:** To evaluate 50 annual and 50 perennial wildflower species for the performance under eastcentral Kansas conditions and supply information for national compilation.

**PERSONNEL:** Jeff Nus, Turfgrass Research and Teaching
Ann Nus, Plant Pathology Technician

**INTRODUCTION:**

According to Crystal Rose-Fricker of Pure Seed Testing, Inc. of Hubbard, Oregon, wildflowers are gaining popularity across the United States for uses in parks, along roadsides, and in background areas of golf courses. Unfortunately, much information concerning species survival, performance, and maintenance is lacking. Since the federal government has initiated a program where roadside budgets must include wildflowers to help reduce mowing requirements and costs, it is necessary to establish basic survival, maintenance, and performance data for annual and perennial wildflower species that may be used in such settings.

**MATERIALS AND METHODS:**

Seeds of 50 annual and 50 perennial wildflower species were supplied to the Kansas State turfgrass program by Pure Seed Testing, Inc. of Hubbard, Oregon. Table 1 lists these species by common and scientific names. Both annuals and perennials were planted in late April. Data on emergence, blooming period, and most serious weed pests are being recorded.

**RESULTS:**

Preliminary results of the National Prairie Wildflower Test are given here. Since perennials take a season to get established, data for the first year include mostly annuals. 1989 should provide needed data on blooming of perennials. Emergence success and flowering periods are shown in Table 1, adaptability of annual prairie wildflowers to Kansas in Table 2, and blooming period in Kansas in Table 3. General comments are included at the end. Most serious weeds encountered include pigweed, puncture vine, ragweed, and annual grasses, especially crabgrass.

Table 1. Emergence success and flowering periods of wildflower species

| Common Name | Emergence Yes or No | Flowering Start | Flowering End |
|---|---|---|---|
| **Annuals** | | | |
| 1. African Daisy | Yes | July | Mid Aug. |
| 2. Baby's Breath | Yes | 6/10 | 8/10 |
| 3. Catchfly | Yes | 6/30 | Frost |
| 4. Corn Poppy | Yes | 6/23 | 8/1 |
| 5. Dwarf Cornflower | Yes | 6/20 | Frost |
| 6. Globe Gilia | Yes | 6/23 | Aug |
| 7. Mountain Garland | Yes | 6/13 | 6/30 |
| 8. Mountain Phlox | Yes | 7/1 | 8/15 |
| 9. Pimpernel | Yes | 7/10 | Sept |
| 10. Rocket Larkspur | Yes | 6/25 | Aug |
| 11. Scarlet Flax | Yes | 7/10 | Frost |
| 12. Spurred Snapdragon | Yes | 6/2 | Aug |
| 13. Sweet Alyssum | Yes | 8/15 | Frost |
| 14. Tall Plains Coreopsis | Yes | 6/23 | Aug |
| 15. Lemon Mint | Yes | 7/18 | Frost |
| 16. Cosmos | Yes | 6/15 | Sept |
| 17. Starflower | Yes | 7/14 | Frost |
| 18. California Poppy | Yes | 6/5 | Frost |
| 19. Baby Blue Eyes | Yes | -- | -- |
| 20. Garland Chrysanthemum | Yes | 6/25 | Frost |
| 21. Blue Bells | Yes | 6/2 | 7/30 |
| 22. Tidy Tips | Yes | -- | -- |
| 23. Annual Indian Blanket | Yes | 7/14 | Frost |
| 24. Birds Eyes | Yes | 6/13 | 7/30 |
| 25. Tall Godetia | Yes | 7/5 | 7/30 |
| **Perennials** | | | |
| 26. Black-Eyed Susan | Yes | Aug | |
| 27. Blue Flax | Yes | July | |
| 28. Dwarf Columbine | Yes | -- | |
| 29. Johnny Jump Up | Yes | Late June | |
| 30. Dwf. Lance-Lvd. Coreopsis | Yes | -- | |
| 31. Maiden Pinks | Yes | -- | |
| 32. Missouri Primrose | Yes | Aug (few) | |
| 33. Prairie Coneflower | Yes | Aug | |
| 34. Purple Coneflower | Yes | Aug | |
| 35. Siberian Wallflower | Yes | July | |
| 36. Sweet Williams | Yes | -- | |
| 37. Soapwort | Yes | -- | |
| 38. Snow in Summer | Yes | -- | |
| 39. White Yarrow | Yes | Aug | |
| 40. Dames Rocket | Yes | -- | |
| 41. Forget-Me-Not | Yes | -- | |
| 42. Creeping Zinnia | Yes | July | |
| 43. Tall Evening Primrose | Yes | Aug | |
| 44. Small Burnet | Yes | -- | |
| 45. Red Yarrow | Yes | Aug | |
| 46. Gilia | Yes | Sept | |
| 47. Wild Thyme | Yes | -- | |
| 48. Rocky Mountain Penstemon | Yes | -- | |
| 49. English Wallflower | No | -- | |
| 50. Roman Chamomile | Yes | July | |

Table 2. Good annuals for Kansas

| | |
|---|---|
| <u>Early Bloom</u> | <u>Late Bloom</u> |
| African Daisy | Sweet Alyssum |
| Babys Breath | Annual Indian Blanker |
| Catchfly | Lemon Mint |
| Mountain Garland | |
| Mountain Phlox | <u>All Season</u> |
| Pimpernel | California Poppy |
| Rocket Larkspur | Garland Chrysanthemum |
| Spurred Snapdragon | Cosmos |
| Tall Plains Coreopsis | |
| California Poppy | |
| Blue Bells | |
| <u>Not Adapted</u> | |
| Corn Poppy | These faded fast in July heat, but |
| Tidy Tips | would be acceptable for early blooms |
| Tall Godetia | followed by something else. |

Table 3. Blooming period for annual prairie flowers in Kansas

| Species | May Jun Jul Aug Sep Oct |
|---|---|
| African Daisy | XXXXXXXXXXXXXXXXX |
| Dwf Cornflower | XXXXXXXXXXXXXXXXXXXXXXXXXX |
| Globe Gilia | XXXXXXXXXXXXXXXXX |
| Mountain Garland | XXXXXXXX |
| Mt. Phlox | XXXXXXXXXX |
| Rocket Larkspur | XXXXXXXXXX |
| Pimpernel | XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| Scarlet Flax | XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| Spurred Snapdragon | XXXXXXXXXXXXXXXXX |
| Tall Plains Coreopsis | XXXXXXXXXXXXXXXXX |
| Lemon Mint | XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| Cosmos | XXXXXXXXXXXXXXXXX |
| Sweet Alyssum | XXXXXXXXXXXXXXXXXXXXXXX |
| Starflower | XXXXXXXXX |
| California Poppy | XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| Garland Chrysan | XXXXXXXXXXXXXXXXXXXXXXXXXX |
| Blue Bells | XXXXXXXXX |
| Birds Eyes | XXXXXXXXXXXXXXXXX |
| Annual Indian Blanket | XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |

## Comments on Wildflower Species

**African Daisy** - (Dimorphotheca aurantiaca) - Good, rapid (1 wk) germination and growth. Good drought tolerance and weed competition.

**Baby's Breath** - (Glpsophila) - Somewhat slow and spotty germination. Early bloom.

**Catchfly** - (Silene armeria) - Slow to germinate.

**Corn Poppy** - (Papaver rhoeas) - Fair germination and early growth - thin. Did not do well in hot, dry weather. Beautiful, showy flowers.

**Dwarf Cornflower** - (Centaurea) - Don't thin. Good germination and growth. Competes will with weeds and handles drought well.

**Globe Gilia** - (Gilia capitata) - Good germination and growth. Pale blue flowers. Thin 10" apart. Delicate, pretty, blue flowers.

**Mountain Garland** - (Clarkia unguiculata) - Excellent germination and growth. Heavy bloomer. Plants took a beating in drought. Bees love it. Short bloom period because of heat, which plants don't tolerate.

**Pimpernel** - (Anagallis arvensis) - Slow to germinate. Prefers cool climates.

**Rocket Larkspur** - (Delphinium ajacis) - Fair germ. and growth. Needs cool growing season. Pretty flowers and attractive foliage. Looks pretty good at end of June, in spite of very hot (100+) and dry weather.

**Scarlet Flax** - (Linum grandiflorum rubrum) - Excellent germination and growth.

**Spurred Snapdragon** - (Linaria moroccana) - Excellent germination and growth. Bloomed about 6 weeks after sowing. Bloomed well for 2-3 weeks, then pretty much stopped toward end of June.

**Sweet Alyssum** - (Lobularia maritima) - Poor germination. Not doing well. Came on strong late in season.

**Tall Plains Coreopsis** - (Coreopsis tinctoria) - Good germination and growth. Do not thin, self sows. Good bloomer. Bright yellows/oranges.

**Lemon Mint** - (Monarda citriodora) - Somewhat slow to germinate. Good growth after slow start.

**Cosmos** - (Cosmos bipinnatus) - Excellent germination and growth. Thin 18-20". Very aggressive, strong grower. Competes very well with weeds, also drought tolerant.

**Starflower** - (Scabiosa stellata) - Fair germination and growth.

**California Poppy** - (Eschscholzia californica) - Very good germination and growth. Another good, early June bloomer. Bloom slowed way down by end of June.

**Baby Blue Eyes** - (Phacelia campanularia) - Excellent germination and growth. Full bloom from sowing. Perennial. Started dying back about 3rd week of June.

**Garland Chrysanthemum** - (Chrysanthemum coronarium) - Excellent germination and growth. Another vigorous grower. Started blooming late June.

**Tidy Tips** - (Layia platyglossa) - Poor germination. Daisylike flowers. Thin to 9".

**Annual Indian Blanket** - (Gaillardia pulchella) - Poor germination. The few to germinate are growing well.

**Birds Eyes** - (Gilia tricolor) - Good germination and growth.

**Tall Godetia** - (Clarkia amoena) - Fair germination and growth.

**TITLE:** Evaluation of Weed Barrier Materials in Plant Establishment and Growth

**OBJECTIVE:** To determine the influence of weed barrier matierals on establishment and growth of ornamentals and weed control

**PERSONNEL:** David Hensley, Department of Horticulture

**INTRODUCTION:**

Weeds in new ornamental plantings are typically controlled mechanically with various mulches or with herbicides. Black plastic has been utilized sometimes under mulch as a physical barrier to weed growth. However, plant problems associated with reduced water penetration and soil oxygen levels have curtailed its general usage.

Several woven and spun polyethylene products have been introduced as weed mats or barriers during the past few years. These are porous to water and air but impervious to most weeds.

The purpose of this study was to examine the influence of two fabric weed barriers on plant growth and to compare them to mulch alone, mulch with herbicide, and mulch with black plastic.

**MATERIAL AND METHODS:**

An area that contained numerous annual and perennial weeds in the previous year was plowed, disked, and tilled thoroughly. Two lbs N per 1,000 sq ft were incorporated before planting. Plots were 5' x 5' and covered with Warren's Weed Arrest, Dewitt Weed Barrier, or black plastic (1.5 mil) before planting bareroot Bloodtwig Dogwood (*Cornus sanguinea*), 1-gallon container-grown Andorra Juniper (*Juniperus horizontalis* 'Plumosa'), and Manhattan Euonymus (*Euonymus kiautschovicus* 'Manhattan') on April 29, 1988.

All areas were mulched with 3" of sawdust material from the K-State bull barns on May 16. Controls consisted of mulch only and mulch with Ronstar applied after mulching. The mulch and herbicide applications were repeated in early spring, 1989.

Growth (height and diameter) was measured at planting, during midsummer, and in fall 1988, and weed population and soil moisture data were taken in fall 1988. Measurements will be repeated in 1989.

**RESULTS:**

The Warren's fabric was the most difficult to cut and work with. Loss of Andorra juniper was high because of the inability to adequately irrigate the area during the first growing season. The remaining junipers have been removed from the study. Survival of the other species was 100%.

There were no statistical effects on height or diameter growth of Euonymus during either evaluation (Table 1). Ronstar application resulted in the least height growth, however. Use of black plastic did not reduce growth.

The same trends were found with Cornus (Table 2). There were some, but inconsistent, statistical differences among plant widths during the second evaluation.

The mulched areas generally had a greater soil moisture content than unmulched areas at the 0 to 3 in depth, but there were no differences at the 3 to 6 in depth (Table 3).

All mulch barrier materials and the herbicide provided significant reduction in percent weed cover compared to that of the mulch-alone treatment (Table 4). Table 1. Growth of Euonymus in mulch treatments during 1988.

Table 1. Growth of Euonymus in mulch treatments during 1988.

| | Height (cm) | | Width (cm) | |
|---|---|---|---|---|
| Treatment | 7/29 | 8/19 | 7/29 | 8/19 |
| Mulch only | 32.0 | 47.4 | 35.7 | 55.9 |
| Dewitt | 23.2 | 46.5 | 37.0 | 54.2 |
| Warrens | 37.0 | 39.8 | 32.3 | 50.1 |
| Herbicide | 30.3 | 33.9 | 37.7 | 67.7 |
| Black plastic | 24.0 | 49.1 | 40.0 | 52.5 |
| PR>F | .09 | .25 | .61 | .46 |

Table 2. Growth of Cornus in various mulch treatments during 1988.

| | Height (cm) | | Width (cm) | |
|---|---|---|---|---|
| Treatment | 7/29 | 8/19 | 7/29 | 8/19 |
| Mulch only | 40.0 | 54.2 | 41.3 | 54.2 ab[z] |
| Dewitt | 33.0 | 39.8 | 31.3 | 44.0 ab |
| Warrens | 34.3 | 41.5 | 35.3 | 39.8 b |
| Herbicide | 33.0 | 42.3 | 42.0 | 61.8 ab |
| Black plastic | 45.7 | 61.8 | 48.3 | 73.7 a |
| PR>F | .21 | .07 | .11 | .04 |

[z] Mean separation by Newman/Keul's Range Test (.05).

Table 3. Soil moisture content (%) under mulch and mulch liners. Data were taken 8/14/88.

| Treatment | Depth (inches) 0-3 | 3-6 |
|---|---|---|
| Mulch only | 12.6 ab | 13.5 a |
| Dewitt | 11.6 ab | 13.0 a |
| Warrens | 11.2 ab | 12.7 a |
| Herbicide | 13.4 a | 13.8 a |
| Black plastic | 12.4 ab | 14.9 a |
| Non-mulched control | 9.4 b | 14.9 a |
| PR > F | .06 | .04 |

[z] Mean separation by Newman/Keul's Range Test (.05).

Table 4. Influence of various mulch treatments on weed control. Data were taken during the second evaluation (8/19/88).

| Treatment | % Weed Cover | No. of Grasses | No. of Broadleafs | Total Weed Numbers |
|---|---|---|---|---|
| Mulch alone | 51.7 a[z] | 4.7 | 1.7 | 6.3 |
| Dewitt | 6.7 b | 0.7 | 0.0 | 0.7 |
| Warrens | 13.3 b | 2.0 | 0.7 | 2.7 |
| Herbicide | 10.0 b | 1.0 | 0.3 | 1.3 |
| Black plastic | 10.0 b | 0.3 | 0.3 | 0.7 |
| PR>F | .02 | .21 | .09 | .10 |

[z] Means followed by the same letter are not significantly different (Newman/Keul's Range Test, .05).

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**THANKS!!!**

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Kansas Turfgrass Foundation

Heart of America Golf Course Superintendents Association

Kansas Golf Course Superintendents Association

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