# 1983 IOWA TURFGRASS FIELD DAY

AND

# EQUIPMENT SHOW


## Thursday
## June 30, 1983

IOWA STATE UNIVERSITY
HORTICULTURAL RESEARCH
STATION
AMES, IOWA

Many of the projects at the field research area have now been established for nearly 4 years. The first cultivar and management studies were seeded in August, 1979. The area was expanded in 1980 to 3.2 acres and in 1981, an additional 1 acre was seeded and studies were begun. Plans are presently under way to further expand the area by another 3 acres in 1984.

The first research report was printed for the 1981 field day, which was held on June 18 of that year. An expanded research report was compiled for the next field day which was held on July 29, 1982. The following report is the third to be printed. It includes 1982 data from the field research projects, as well as a number of other turfgrass investigations being conducted at Iowa State University.

The expansion which has taken place since 1979 was made possible through grants from the Iowa Turfgrass Institute, the Iowa Golf Course Superintendents Association, and through donations made by the companies listed at the end of this report. The profits from activities such as the field day, the Iowa Turfgrass Conference and the 1983 golf tournament are very important in making research projects of this type possible.

On behalf of the Iowa Turfgrass Institute and Iowa State University, I would like to thank you for attending this year's field day.

Nick Christians
June, 1983

Acknowledgements

I would like to acknowledge Mr. Jeffrey Nus for his work in helping to establish the turfgrass research area over the past 4 seasons. Appreciation is also expressed to David Brahm, Sally Johnson, and Thomas Robeson for their efforts in developing the area.

I would also like to acknowledge Dr. Charles V. Hall for his direction and help in establishing the turfgrass research program at Iowa State University, and to thank each of the past and present members of the board of directors of the Iowa Turfgrass Institute for their encouragement and support.

Nick Christians
June, 1983

PROGRAM

Thursday

June 30, 1983

9:30 a.m. to 3:00 p.m.

8:00 - 9:15 ...............Registration and Coffee with exhibitors

9:15 - 9:30 ...............Opening remarks and introductions

9:30 - 12:00...............Tour of Research Area

12:00 - 1:30...............Lunch

1:30 - 3:00 ...............Afternoon Educational Program

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In case of rain, an indoor morning program is planned at the research station.

## MORNING PROGRAM

There are 10 studies on the research area that we will be looking at this morning. Most of the areas in today's program are either new or are different from those which were viewed at last year's field days. There is a number on the back of your lunch ticket which corresponds to 1 of the 10 areas. At 9:30 you will be instructed to go to the study with the same number as that on your ticket (see map). There will be 15 minutes allowed for each stop. Each presentation will last from 7 to 8 minutes and there will be approximately 5 minutes for questions. At the end of 13 minutes a horn will blow and your group will have 2 minutes to move to the next stop. Each group will see all 10 research areas.

There are more than 10 studies on the research plots. Many of those investigations will have signs on them. Please feel free to visit any of these areas during lunch or after 3:00. The staff involved in presenting the morning program will be available for questions throughout the day.

The research areas that will be discussed this morning and the individuals who will be presenting the information are as follows:

| | | |
|---|---|---|
| 1. | Chemical Disposal Facility | Dr. Charles V. Hall, Head, Department of Horticulture, Iowa State University |
| 2. | Iron-Nitrogen Studies | Nick Christians, Dept. of Horticulture, Iowa State Univ. |
| 3. | Bentgrass Cultivars | Sally Johnson, Dept. of Horticulture, Iowa State Univ. |
| 4. | Tall Fescue Control Studies | Brian Maloy, Dept. of Horticulture, Iowa State Univ. |
| 5. | Perennial Ryegrass Cultivars | Tom Fermanian, Dept. of Horticulture, Univ. of Illinois |
| 6. | Fall Fertilization Study | Norm Hummel, Dept. of Horticulture, Iowa State Univ. |
| 7. | Prairie Grass and Wildflower Establishment | James Midcap, Dept. of Horticulture, Iowa State Univ. |
| 8. | Growth Retardant Studies | Ken Diesburg, Dept. of Horticulture, Iowa State Univ. |
| 9. | Turfgrass Cultivar Trials | David Brahm, Dept. of Horticulture, Iowa State Univ. |
| 10. | Kentucky Bluegrass Cultivar Evaluations | Robert Shearman, Dept. of Horticulture, Univ. of Nebraska |

## Afternoon Program

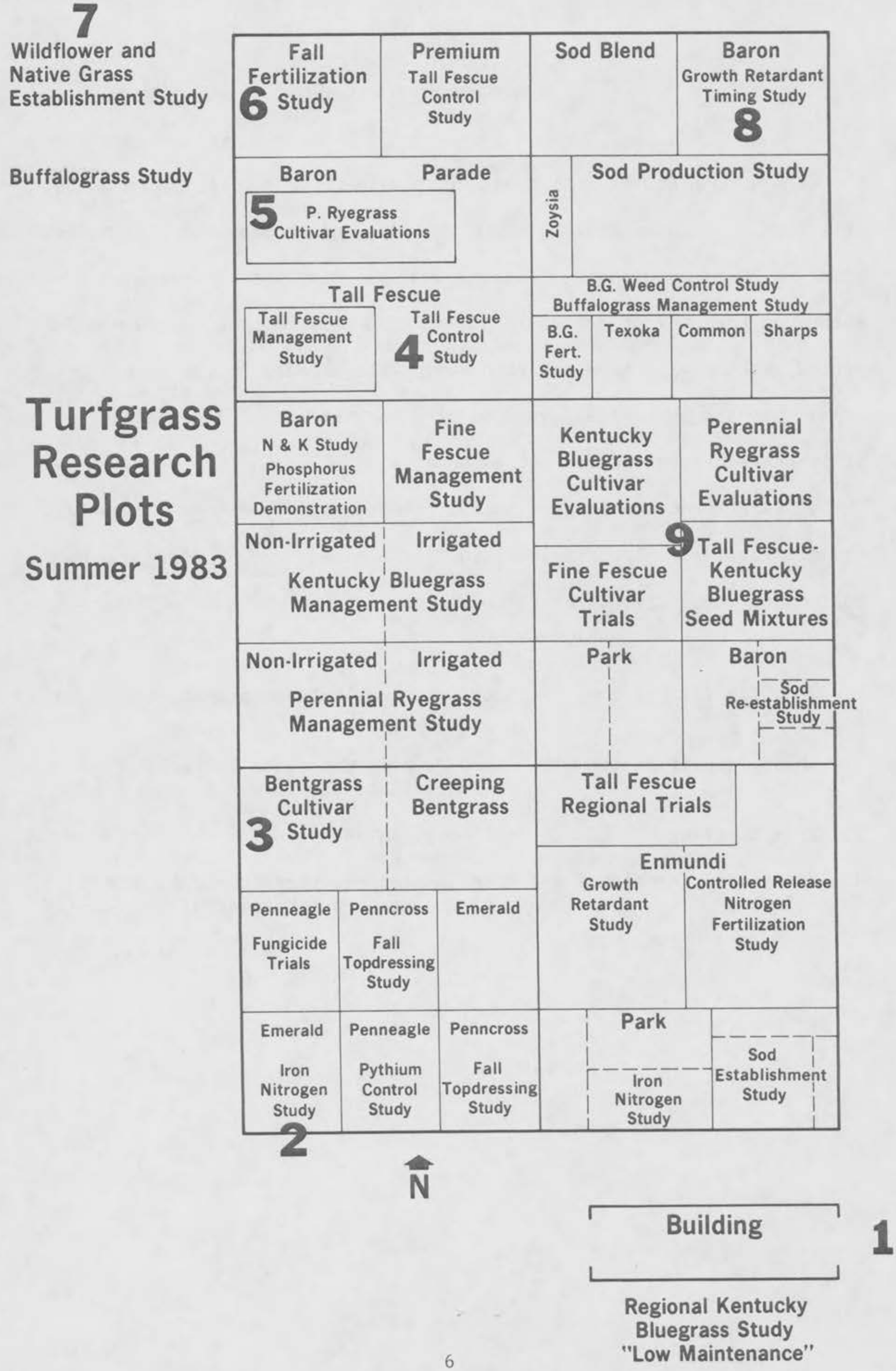
There are four demonstrations planned for our program this afternoon. The program will begin at 1:30, and each of the four stops will be 20 minutes long. Groups will be divided according to the number on the back of the lunch tickets. At the end of the 20-minute period, a horn will blow and your group will proceed to the next area. After the program, feel free to stop back at one of the stations or visit the equipment demonstration area.

This afternoon's program should be both enjoyable and educational for all involved in professional turfgrass management. Here are the topics and the individuals presenting the program:

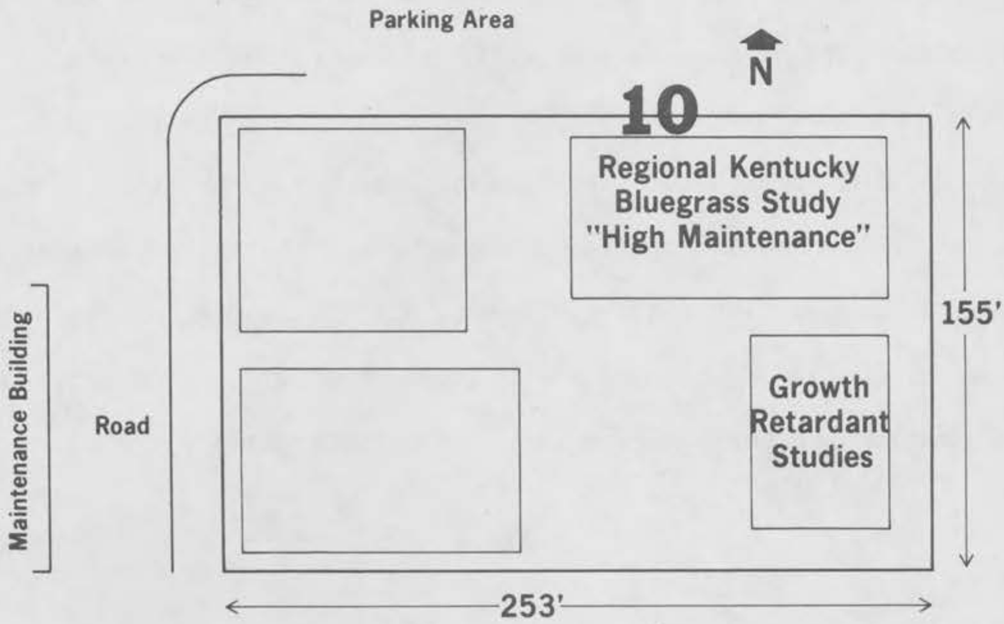
| | |
|---|---|
| 1. Weed Identification | Bob Hartzler, Extension Associate, Weed Science, ISU |
| 2. Grass Identification | Norm Hummel, Extension Turfgrass Specialist, ISU |
| 3. Tree Spraying | Al Duey, Jay-Lan, Inc. |
| 4. Recognizing Herbicide Injury | Gene Rozenboom, Linn County Extension Associate, Pest Management |

# Turfgrass Research Plots

## Summer 1983



## Map of New Field Research Area
## Established in the Fall of 1981




Total Area 39,215 $ft^2$
0.90 Acres

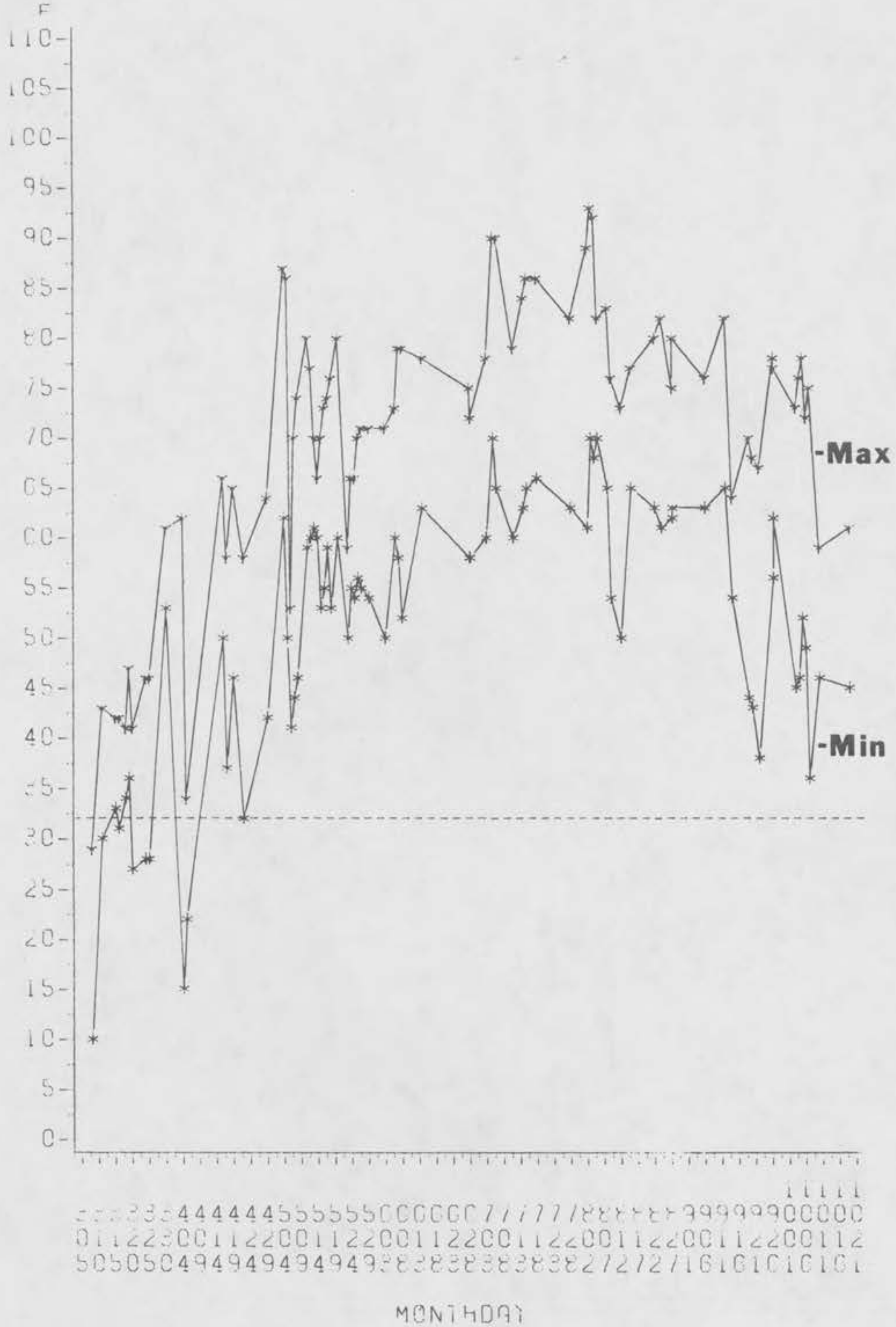
## Environmental Information in the 1982 Season

The next two pages include information on the environmental conditions at Ames in the 1982 season.

The 1982 season was cool and wet. May was a particularly wet month, with some precipitation reported nearly every day.

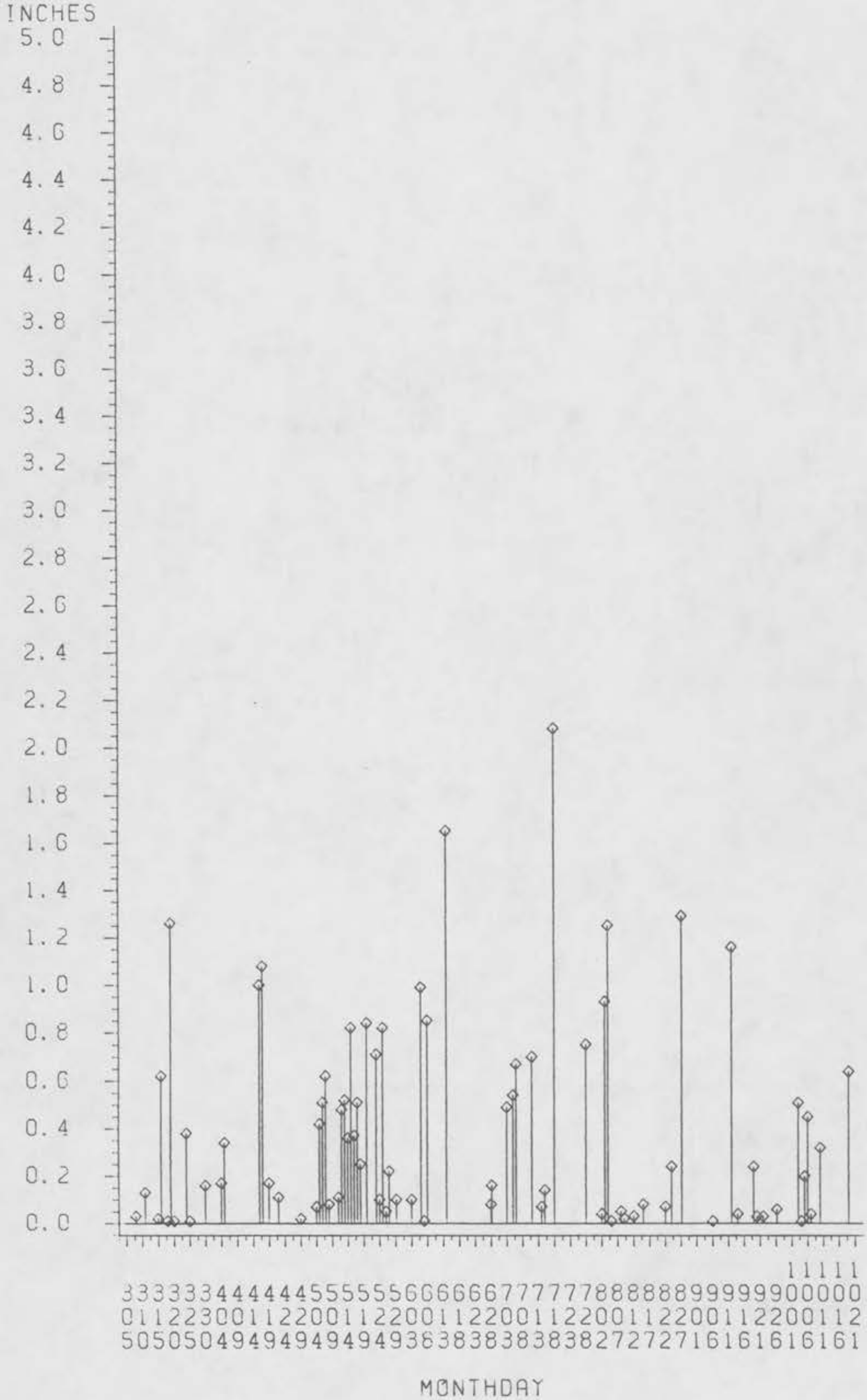
The plots of rainfall and temperature are representative of one of the many ways in which the computer is being used to increase the efficiency of the faculty and staff at Iowa State University. The 1982 environmental data were entered on the computer by Dr. Henry Taber of the Horticulture Department. He then sorted the information, calculated means, and printed the graphs exactly as they appear on the next two pages. The entire process, which has previously required days to complete, required 4.1 seconds of computing time once the information had been entered into the computer memory.

# TEMPERATURE 1982




Average maximum and minimum temperatures in Ames for the 1982 growing season.

# RAINFALL 1982




Rainfall in the Ames area for the 1982 season.

Table of Contents

Table of Contents
Page 2

# Kentucky Bluegrass Cultivar Evaluations

The 49 Kentucky bluegrass cultivars located in section 2 of the turfgrass research area were seeded in the fall of 1979. These plots were fertilized at a rate of 4 lb N/1000 sq ft (urea) in both the 1980 and 1981 seasons and with 4 lbs N/1000 sq ft (SCU) in 1982. No insecticides or fungicides have been used on the area. Irrigation was applied as needed to prevent drought. The results of 1981 evaluations are listed in Table 1.

The values listed under each month are the averages of ratings made on 3 replicated plots. Yearly means of all the months in which data were taken are listed in the last column. The first cultivar received the highest average rating for the entire 1982 season. The cultivars are then listed in descending order of average quality. Color ratings performed in April are also listed in Table 1.

These cultivars have been maintained for 3 full seasons and are becoming quite useful for determining which cultivars can be expected to perform well in Iowa.

It is not unusual for a cultivar to look good at the beginning of the season, only to deteriorate in quality during mid-summer stress. For instance, Columbia and Wabash both exhibited very good April color; however, their quality decreased considerably during stress periods. Therefore it is very important that the cultivars be observed over the entire season. Likewise, it is common for cultivars to maintain good season long quality for the first 1 or 2 seasons and then to deteriorate rapidly. These cultivars will be observed for several seasons to come.

The best cultivar in 1982 was Midnight. This cultivar has been outstanding wherever it has been used at the research station. Reports from other research stations in the midwest substantiate this observation and this new cultivar is likely to be widely used in this area over the next few years. The next 13 cultivars, Aspen through Aquilla, all received average ratings of 8.0. Each performed very satisfactorily throughout the season.

The 1982 season was very moist and moderately cool, and there was little severe stress on the grasses. A rating of 6 is considered to be acceptable, and even the lowest rated cultivar, K76-86-4, maintained a satisfactory quality when averaged over the season. It should be noted that some of the lower rated cultivars were observed to be unsatisfactory in certain months, however.

After the cultivars have been maintained from 5 to 6 years, data from all years of the test will be compiled and a ranking of averages over all years of the test will be printed.

Table 1. The 1982 quality ratings for the Kentucky bluegrass study which was established in the Fall of 1979.

| Cultivar | April Color | May | June | July | Aug | Sept | Oct | Mean |
|---|---|---|---|---|---|---|---|---|
| 1. Midnight | 6.0 | 8.5 | 8.0 | 8.0 | 9.0 | 8.5 | 9.0 | 8.5 |
| 2. Aspen | 7.0 | 7.0 | 7.5 | 8.0 | 7.5 | 8.0 | 9.0 | 8.0 |
| 3. Ram I | 5.5 | 8.0 | 7.0 | 7.5 | 8.0 | 8.0 | 8.5 | 8.0 |
| 4. Nugget | 5.0 | 8.5 | 8.0 | 7.5 | 7.5 | 7.5 | 8.5 | 8.0 |
| 5. N535 | 6.5 | 8.0 | 7.5 | 7.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| 6. Baron | 5.5 | 7.5 | 7.5 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| 7. Arista | 5.5 | 8.0 | 7.0 | 7.0 | 8.0 | 7.5 | 9.0 | 8.0 |
| 8. Victa | 5.5 | 8.5 | 7.5 | 7.5 | 7.0 | 7.5 | 9.0 | 8.0 |
| 9. Glade | 6.5 | 7.5 | 7.5 | 7.5 | 8.5 | 8.5 | 9.0 | 8.0 |
| 10. Bristol | 6.5 | 8.5 | 7.5 | 6.5 | 8.0 | 8.0 | 9.0 | 8.0 |
| 11. Enmundi | 5.5 | 8.0 | 7.5 | 7.5 | 8.0 | 8.0 | 9.0 | 8.0 |
| 12. P-164 | 6.5 | 7.5 | 7.5 | 8.0 | 7.5 | 8.0 | 8.5 | 8.0 |
| 13. Merit | 5.0 | 8.5 | 8.0 | 7.0 | 7.0 | 8.0 | 9.0 | 8.0 |
| 14. Aquilla | 6.0 | 8.0 | 7.5 | 7.0 | 7.5 | 8.5 | 8.0 | 8.0 |
| 15. Sydsport | 6.5 | 7.5 | 6.5 | 7.0 | 7.0 | 6.5 | 9.0 | 7.5 |
| 16. Senic | 7.0 | 7.5 | 6.5 | 8.0 | 7.5 | 7.5 | 9.0 | 7.5 |
| 17. Touchdown | 6.5 | 7.0 | 6.0 | 7.0 | 8.0 | 7.5 | 8.0 | 7.5 |
| 18. K3-160 | 6.0 | 7.5 | 7.0 | 7.5 | 6.5 | 6.5 | 8.5 | 7.5 |
| 19. Sving | 5.0 | 8.0 | 7.5 | 7.0 | 6.0 | 7.5 | 8.5 | 7.5 |
| 20. Kimono | 6.0 | 8.0 | 7.5 | 7.0 | 8.0 | 7.0 | 8.0 | 7.5 |
| 21. Barbie | 5.0 | 8.0 | 7.0 | 7.0 | 7.0 | 7.5 | 8.5 | 7.5 |
| 22. Cheri | 6.5 | 7.5 | 6.5 | 7.0 | 7.5 | 8.5 | 9.0 | 7.5 |
| 23. America | 6.0 | 8.0 | 7.0 | 6.5 | 8.5 | 8.0 | 8.0 | 7.5 |
| 24. Fanfare | 7.0 | 8.0 | 7.0 | 7.5 | 6.0 | 7.0 | 8.0 | 7.5 |
| 25. Fylking | 4.5 | 7.5 | 6.5 | 6.5 | 7.0 | 8.0 | 8.0 | 7.5 |
| 26. Birka | 6.5 | 7.5 | 7.0 | 7.5 | 7.5 | 7.5 | 8.5 | 7.5 |
| 27. Pennstar | 5.5 | 7.5 | 8.0 | 7.5 | 7.5 | 7.5 | 8.5 | 7.5 |
| 28. Vantage | 7.0 | 7.0 | 6.5 | 8.0 | 7.0 | 7.0 | 8.5 | 7.5 |
| 29. Bonnieblue | 7.0 | 8.0 | 7.0 | 7.5 | 7.5 | 7.5 | 8.5 | 7.5 |
| 30. Adelphi | 7.0 | 7.0 | 7.0 | 6.5 | 7.5 | 8.5 | 8.5 | 7.5 |
| 31. SV01617 | 5.0 | 8.0 | 7.5 | 7.0 | 7.5 | 7.5 | 8.0 | 7.5 |
| 32. Escort | 5.5 | 7.5 | 7.5 | 7.5 | 8.0 | 7.5 | 8.5 | 7.5 |
| 33. A-20 | 6.0 | 7.0 | 7.0 | 6.5 | 6.0 | 6.5 | 8.0 | 7.0 |
| 34. Merion | 6.0 | 7.5 | 6.5 | 6.5 | 7.0 | 7.0 | 8.0 | 7.0 |
| 35. Parade | 7.0 | 7.5 | 6.5 | 6.5 | 6.5 | 7.0 | 8.5 | 7.0 |
| 36. Columbia | 7.5 | 7.0 | 6.5 | 6.5 | 6.5 | 7.5 | 8.5 | 7.0 |
| 37. Plush | 6.5 | 7.5 | 6.5 | 7.0 | 6.0 | 7.5 | 8.0 | 7.0 |
| 38. Majestic | 6.5 | 7.0 | 6.0 | 7.0 | 7.0 | 6.5 | 8.0 | 7.0 |
| 39. Trenton | 6.5 | 7.0 | 6.5 | 7.0 | 6.5 | 7.5 | 8.0 | 7.0 |
| 40. (WTN) I | 5.5 | 7.0 | 6.5 | 6.5 | 6.0 | 7.0 | 8.0 | 7.0 |
| 41. Rugby | 6.0 | 7.0 | 6.5 | 6.5 | 6.5 | 7.0 | 8.5 | 7.0 |
| 42. A-20-6 | 6.5 | 7.5 | 7.0 | 7.5 | 6.0 | 7.0 | 7.5 | 7.0 |
| 43. Wabash | 7.5 | 7.0 | 6.5 | 6.5 | 6.0 | 7.0 | 7.5 | 7.0 |
| 44. A-34 | 6.3 | 7.5 | 6.5 | 7.0 | 6.0 | 7.5 | 7.5 | 7.0 |
| 45. Common | 7.0 | 7.0 | 6.5 | 6.5 | 6.0 | 6.5 | 7.5 | 6.5 |
| 46. (WTN) H-7 | 4.5 | 7.0 | 6.5 | 7.0 | 5.5 | 6.5 | 7.0 | 6.5 |
| 47. Park | 6.5 | 7.0 | 6.0 | 6.5 | 6.0 | 6.5 | 7.5 | 6.5 |
| 48. BFB-35 | 6.5 | 7.0 | 6.0 | 6.5 | 6.0 | 7.5 | 7.5 | 6.5 |
| 49. K76-86-4 | 7.3 | 5.5 | 5.5 | 7.0 | 6.0 | 7.0 | 7.0 | 6.5 |
| LSD 0.05 | | 1.0 | 1.0 | 1.5 | 1.0 | 1.0 | 1.0 | 0.5 |

Quality is rated on a scale of 9-1; 9=best quality and 1=dead turf.
Color is based on a scale of 9-1, where 9=best color.

## High Maintenance and Low Maintenance Kentucky Bluegrass Regional Cultivar Trials

In 1980, the United States Department of Agriculture (USDA) initiated a regional Kentucky bluegrass cultivar trial which is presently being conducted at most of the northern agricultural experiment stations. The test consists of 84 cultivars, with each cultivar replicated 3 times.

Two separate trials are underway at Iowa State University. One is a high maintenance study which receives 4 lbs N/1000 $ft^2$/yr and which is irrigated as needed, and the other is a low maintenance study that receives 1 lb N/1000 $ft^2$ in September and is not irrigated. The objective of the high maintenance study is to investigate the performance of the 84 cultivars under a cultural regime similar to that used on home lawns in Iowa. The objective of the low maintenance study is to observe the performance of the 84 cultivars under conditions similar to those which would be present in a park, school yard or other low maintenance area. The high maintenance study was established in August, 1981. The fall of 1981 was an excellent time for the seeding of grasses in central Iowa and the cultivars were well established by October, 1981. The data reported is from the first full year of the study. The low maintenance study was established in September, 1980. The data reported represent the second complete year of observation.

The 1982 ratings for the high maintenance study are listed in Table 2. Glade, Ram 1, and Midnight were the highest rated cultivars in the first season. A rating of 6 or greater is considered to be acceptable. Notice that nearly every cultivar maintained an acceptable quality. This is not unusual for the early evaluations of a Kentucky bluegrass cultivar trial. A complete understanding of the cultivars' performance will not be achieved for several years.

The results of the low maintenance study are listed in Table 3. Victa was the highest rated cultivar in 1982, followed by Baron, Enoble, and NJ735. There is a great deal of variability in this early stage of the investigation and, from a statistical standpoint, there were no real differences among the yearly averages for the cultivars. From an observational standpoint; however, the highest ranked cultivars clearly were the best under these low maintenance conditions.

Table 2. The 1982 quality ratings for the high maintenance, regional Kentucky bluegrass test established in Fall 1981.

| Cultivar | April Color | May | June | July | Aug | Sept | Oct | Nov | Mean |
|---|---|---|---|---|---|---|---|---|---|
| 1. Glade | 5.5 | 5.5 | 7.5 | 7.5 | 8.0 | 7.5 | 8.5 | 6.0 | 7.5 |
| 2. RAM-1 | 5.5 | 5.5 | 7.5 | 8.0 | 8.0 | 8.5 | 7.5 | 5.5 | 7.5 |
| 3. 1528T (Midnight) | 5.5 | 5.5 | 8.5 | 8.0 | 9.0 | 8.5 | 9.0 | 4.5 | 7.5 |
| 4. 243 | 5.5 | 5.5 | 6.5 | 7.5 | 8.0 | 8.0 | 7.5 | 5.5 | 7.0 |
| 5. Nugget | 5.5 | 5.0 | 7.5 | 8.5 | 8.0 | 7.5 | 7.5 | 5.5 | 7.0 |
| 6. PSU-150 | 7.0 | 6.5 | 6.0 | 7.5 | 8.0 | 7.5 | 8.0 | 7.5 | 7.0 |
| 7. PSU-173 | 6.5 | 6.5 | 6.0 | 7.0 | 7.5 | 7.5 | 8.5 | 7.0 | 7.0 |
| 8. MLM-18011 | 5.0 | 5.5 | 7.5 | 6.5 | 7.0 | 7.5 | 7.5 | 6.0 | 7.0 |
| 9. Majestic | 4.5 | 5.5 | 7.0 | 6.5 | 7.5 | 8.5 | 8.0 | 6.5 | 7.0 |
| 10. Bonnieblue | 4.5 | 5.5 | 7.0 | 6.5 | 7.5 | 8.5 | 8.0 | 6.5 | 7.0 |
| 11. Merit | 4.5 | 6.0 | 7.0 | 8.0 | 7.5 | 7.0 | 7.5 | 5.5 | 7.0 |
| 12. N535 | 6.5 | 5.5 | 8.5 | 7.5 | 7.5 | 7.5 | 8.0 | 5.5 | 7.0 |
| 13. Bristol | 6.5 | 5.5 | 7.0 | 7.5 | 7.5 | 8.0 | 7.0 | 5.5 | 7.0 |
| 14. Victa | 5.5 | 6.0 | 7.0 | 8.0 | 7.0 | 7.5 | 8.0 | 5.0 | 7.0 |
| 15. Admiral | 6.5 | 6.5 | 6.5 | 6.5 | 7.5 | 7.5 | 7.5 | 6.0 | 7.0 |
| 16. Adelphi | 6.0 | 6.0 | 7.5 | 5.5 | 7.5 | 7.0 | 6.5 | 5.0 | 6.5 |
| 17. Birka | 4.5 | 6.5 | 7.0 | 6.5 | 7.5 | 6.5 | 6.5 | 6.0 | 6.5 |
| 18. Fylking | 5.5 | 6.0 | 7.0 | 6.5 | 7.5 | 6.5 | 6.5 | 4.5 | 6.5 |
| 19. Cheri | 5.0 | 5.0 | 6.5 | 7.5 | 7.5 | 7.5 | 6.5 | 5.5 | 6.5 |
| 20. Wabash | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 7.0 | 7.0 | 5.5 | 6.5 |
| 21. PSU-190 | 6.5 | 6.5 | 7.0 | 5.5 | 6.5 | 7.5 | 7.5 | 5.5 | 6.5 |
| 22. Kimono | 4.5 | 5.5 | 7.5 | 7.5 | 7.0 | 6.5 | 7.0 | 5.5 | 6.5 |
| 23. Baron | 5.0 | 4.5 | 7.0 | 7.5 | 7.5 | 7.5 | 7.5 | 5.0 | 6.5 |
| 24. Enmundi | 7.0 | 4.5 | 6.5 | 7.5 | 7.5 | 7.5 | 7.0 | 6.0 | 6.5 |
| 25. Rugby | 6.0 | 6.5 | 7.0 | 6.0 | 6.5 | 7.5 | 7.0 | 6.5 | 6.5 |
| 26. Banff | 7.0 | 6.5 | 6.5 | 5.5 | 7.0 | 7.0 | 6.5 | 5.5 | 6.5 |
| 27. Holiday | 4.5 | 6.0 | 6.5 | 6.0 | 7.0 | 7.0 | 6.0 | 5.5 | 6.5 |
| 28. CEBVB3965 | 5.5 | 5.5 | 7.5 | 7.0 | 6.5 | 7.0 | 7.0 | 6.0 | 6.5 |
| 29. Welcome | 5.0 | 6.5 | 6.5 | 7.5 | 7.0 | 6.5 | 7.5 | 6.0 | 6.5 |
| 30. WWAg463 | 6.5 | 6.5 | 6.0 | 5.5 | 6.0 | 7.5 | 6.5 | 5.5 | 6.5 |
| 31. Bono | 6.5 | 6.5 | 6.5 | 6.0 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 |
| 32. American | 5.0 | 5.5 | 6.5 | 6.5 | 7.5 | 7.5 | 6.5 | 5.5 | 6.5 |
| 33. Vanessa | 5.0 | 5.5 | 7.0 | 6.5 | 6.5 | 7.5 | 7.5 | 6.0 | 6.5 |
| 34. Mona | 4.5 | 5.0 | 7.5 | 7.5 | 7.0 | 7.5 | 7.5 | 5.5 | 6.5 |
| 35. WWAg478 | 4.5 | 5.5 | 6.5 | 6.5 | 6.5 | 7.5 | 7.5 | 5.5 | 6.5 |
| 36. Charlotte | 6.0 | 6.5 | 5.5 | 6.5 | 7.5 | 8.0 | 7.0 | 4.5 | 6.5 |
| 37. Shasta | 6.5 | 6.5 | 6.5 | 5.5 | 7.0 | 7.5 | 7.0 | 5.5 | 6.5 |
| 38. Columbia | 7.5 | 6.5 | 6.5 | 6.0 | 7.5 | 7.5 | 7.5 | 5.5 | 6.5 |
| 39. Sydsport | 6.0 | 5.5 | 6.5 | 7.0 | 7.0 | 6.5 | 6.5 | 6.0 | 6.5 |
| 40. Mer pp 300 | 5.5 | 5.5 | 6.0 | 6.5 | 6.5 | 7.5 | 7.0 | 5.5 | 6.5 |
| 41. Mer pp 43 | 6.5 | 6.5 | 7.0 | 6.5 | 6.5 | 6.5 | 6.5 | 5.0 | 6.5 |
| 42. Mena | 7.5 | 7.0 | 6.0 | 5.5 | 6.5 | 7.5 | 7.0 | 5.5 | 6.5 |

Table 2 (Continued)

| Cultivar | April Color | May | June | July | Aug | Sept | Oct | Nov | Mean |
|---|---|---|---|---|---|---|---|---|---|
| 43. Enoble | 5.5 | 5.5 | 7.0 | 6.0 | 7.0 | 7.0 | 6.5 | 5.0 | 6.5 |
| 44. SH-2 | 6.5 | 6.5 | 6.5 | 6.0 | 6.5 | 7.5 | 6.5 | 5.0 | 6.5 |
| 45. BA-61-91 | 5.5 | 5.0 | 6.5 | 7.0 | 6.5 | 7.5 | 8.0 | 5.5 | 6.5 |
| 46. 225 | 7.0 | 6.5 | 6.0 | 5.5 | 7.0 | 8.0 | 7.5 | 5.5 | 6.5 |
| 47. P141 (Mystic) | 6.5 | 6.5 | 6.0 | 7.5 | 6.5 | 6.5 | 6.5 | 5.5 | 6.5 |
| 48. Eclipse | 5.0 | 5.0 | 7.5 | 6.0 | 7.0 | 7.5 | 6.5 | 5.5 | 6.5 |
| 49. K3-178 | 7.0 | 6.5 | 6.5 | 5.5 | 6.0 | 7.5 | 6.5 | 5.5 | 6.5 |
| 50. Monopoly | 6.0 | 5.5 | 6.5 | 6.0 | 5.5 | 7.5 | 6.0 | 5.5 | 6.0 |
| 51. 239 | 6.5 | 6.5 | 6.5 | 6.0 | 6.5 | 7.0 | 6.5 | 5.5 | 6.0 |
| 52. S-21 | 7.0 | 6.5 | 5.0 | 5.5 | 6.0 | 6.5 | 6.5 | 4.5 | 6.0 |
| 53. Plush | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.5 | 6.5 | 5.5 | 6.0 |
| 54. Parade | 5.5 | 6.5 | 6.0 | 5.5 | 6.0 | 7.5 | 6.5 | 5.5 | 6.0 |
| 55. Trenton | 5.5 | 5.5 | 6.5 | 6.0 | 6.5 | 6.5 | 5.5 | 5.5 | 6.0 |
| 56. SV-01617 | 5.0 | 6.5 | 6.5 | 5.5 | 6.0 | 7.5 | 6.5 | 4.5 | 6.0 |
| 57. Dormie | 5.5 | 5.5 | 7.0 | 6.5 | 6.5 | 6.5 | 5.0 | 4.0 | 6.0 |
| 58. Geronimo | 5.5 | 5.5 | 6.5 | 6.0 | 6.5 | 6.5 | 6.0 | 5.5 | 6.0 |
| 59. Aspen | 5.5 | 5.0 | 6.5 | 6.5 | 6.5 | 6.0 | 6.5 | 5.0 | 6.0 |
| 60. Touchdown | 5.5 | 6.5 | 5.5 | 6.0 | 6.5 | 6.5 | 6.5 | 5.0 | 6.0 |
| 61. WWAg480 | 5.5 | 5.5 | 6.5 | 7.0 | 6.0 | 6.5 | 5.5 | 5.5 | 6.0 |
| 62. Kenblue | 6.0 | 6.5 | 5.5 | 5.5 | 5.5 | 6.5 | 7.0 | 4.0 | 6.0 |
| 63. Harmony | 5.5 | 6.5 | 6.5 | 6.0 | 5.5 | 7.0 | 6.5 | 5.5 | 6.0 |
| 64. Vantage | 6.0 | 6.5 | 5.0 | 4.5 | 6.0 | 6.5 | 6.5 | 5.5 | 6.0 |
| 65. Argyle | 6.5 | 6.5 | 5.5 | 5.5 | 7.5 | 7.0 | 7.0 | 4.5 | 6.0 |
| 66. A20-6 | 5.5 | 6.5 | 7.0 | 5.5 | 5.5 | 6.0 | 6.5 | 5.5 | 6.0 |
| 67. A20 | 6.5 | 6.5 | 6.5 | 6.0 | 5.5 | 6.5 | 6.5 | 5.0 | 6.0 |
| 68. H-7 | 6.0 | 6.0 | 6.5 | 5.0 | 5.5 | 6.5 | 6.0 | 5.5 | 6.0 |
| 69. I-13 | 5.5 | 5.5 | 6.5 | 5.5 | 6.0 | 6.0 | 6.0 | 5.5 | 6.0 |
| 70. A20-6A | 6.5 | 6.5 | 6.5 | 5.5 | 5.5 | 6.5 | 6.5 | 5.5 | 6.0 |
| 71. Apart | 6.0 | 6.0 | 6.5 | 6.0 | 6.5 | 7.0 | 6.0 | 4.5 | 6.0 |
| 72. A-34 | 6.0 | 6.0 | 5.5 | 5.0 | 6.5 | 6.5 | 6.5 | 5.0 | 6.0 |
| 73. Lovegreen | 5.0 | 6.5 | 6.5 | 5.5 | 6.0 | 6.0 | 6.0 | 4.5 | 6.0 |
| 74. S. D. Common | 7.0 | 6.5 | 5.0 | 5.5 | 5.5 | 7.0 | 6.5 | 5.0 | 6.0 |
| 75. Merion | 5.5 | 6.0 | 6.5 | 6.0 | 5.5 | 6.0 | 6.5 | 5.5 | 6.0 |
| 76. Bayside | 6.5 | 6.5 | 5.0 | 5.5 | 7.0 | 7.5 | 7.0 | 5.0 | 6.0 |
| 77. Escort | 5.0 | 6.0 | 7.5 | 6.0 | 6.5 | 6.5 | 6.0 | 5.0 | 6.0 |
| 78. K3-162 | 8.0 | 6.5 | 5.5 | 6.0 | 5.5 | 6.5 | 6.5 | 6.5 | 6.0 |
| 79. K3-179 | 5.5 | 6.5 | 6.5 | 6.0 | 6.5 | 6.5 | 6.0 | 5.0 | 6.0 |
| 80. K1-152 | 6.0 | 6.5 | 6.5 | 5.5 | 6.5 | 7.5 | 6.5 | 5.0 | 6.0 |
| 81. Bar Blue | 5.5 | 4.5 | 6.5 | 5.5 | 5.0 | 7.0 | 6.5 | 5.5 | 6.0 |
| 82. Cello | 5.0 | 5.5 | 6.5 | 6.0 | 5.5 | 4.5 | 5.5 | 4.5 | 5.5 |
| 83. Piedmont | 6.0 | 6.5 | 5.0 | 4.5 | 6.5 | 6.0 | 6.5 | 4.5 | 5.5 |
| 84. NI735 | 5.5 | 5.0 | 6.0 | 5.5 | 5.5 | 6.5 | 6.0 | 5.0 | 5.5 |
| LSD 0.05 | 1.5 | 1.0 | 1.0 | 1.0 | 1.0 | 1.5 | 1.0 | 1.0 | 0.5 |

Quality is rated at 9=best quality and 1=dead turf. A rating of 6 or higher constitutes acceptable quality. Color is rated on a scale of 9-1, where 9=best color.

Table 3. The 1982 quality ratings for the low maintenance, regional Kentucky bluegrass test established Fall 1980.

| Cultivar | April Color | May | June | July | Aug | Sept | Oct | Mean |
|---|---|---|---|---|---|---|---|---|
| 1. Victa | 7.0 | 8.0 | 7.0 | 6.5 | 7.5 | 7.5 | 7.5 | 7.5 |
| 2. Baron | 5.5 | 7.5 | 7.5 | 6.5 | 6.0 | 5.5 | 6.0 | 6.5 |
| 3. Enable | 5.5 | 6.5 | 7.5 | 5.5 | 6.0 | 7.0 | 6.5 | 6.5 |
| 4. NJ735 | 6.5 | 7.0 | 6.0 | 5.0 | 6.5 | 7.0 | 6.5 | 6.5 |
| 5. Fylking | 4.5 | 5.5 | 6.0 | 5.5 | 5.5 | 6.5 | 6.0 | 6.0 |
| 6. Nugget | 5.0 | 6.5 | 7.0 | 5.5 | 5.5 | 5.0 | 5.0 | 6.0 |
| 7. PSU-190 | 5.0 | 5.5 | 6.0 | 7.0 | 5.5 | 6.5 | 5.5 | 6.0 |
| 8. PSU-150 | 5.0 | 7.0 | 6.5 | 6.5 | 5.5 | 4.5 | 5.5 | 6.0 |
| 9. PSU-173 | 5.5 | 6.5 | 6.5 | 5.5 | 6.0 | 5.5 | 5.5 | 6.0 |
| 10. Kimono | 4.5 | 5.5 | 6.5 | 6.0 | 6.0 | 5.5 | 5.5 | 6.0 |
| 11. Enmundi | 4.0 | 5.5 | 6.5 | 5.5 | 5.5 | 6.5 | 5.5 | 6.0 |
| 12. Plush | 4.5 | 5.5 | 6.5 | 6.0 | 5.5 | 6.0 | 6.0 | 6.0 |
| 13. Geronimo | 5.0 | 6.0 | 7.0 | 6.0 | 5.5 | 4.5 | 6.0 | 6.0 |
| 14. MLM18011 | 4.5 | 6.0 | 7.5 | 5.5 | 5.5 | 5.0 | 4.5 | 6.0 |
| 15. CEBVB3965 | 4.5 | 6.5 | 7.5 | 5.5 | 6.0 | 5.0 | 5.0 | 6.0 |
| 16. Touchdown | 4.5 | 6.5 | 7.0 | 6.5 | 5.5 | 4.5 | 6.5 | 6.0 |
| 17. WWAg463 | 5.5 | 6.5 | 6.0 | 6.0 | 5.5 | 5.5 | 5.5 | 6.0 |
| 18. Bono | 4.0 | 5.0 | 6.5 | 6.0 | 6.5 | 6.5 | 5.5 | 6.0 |
| 19. Vanessa | 4.5 | 5.5 | 7.0 | 6.5 | 6.0 | 6.0 | 6.5 | 6.0 |
| 20. Cello | 4.5 | 6.5 | 6.5 | 6.5 | 6.0 | 5.0 | 5.5 | 6.0 |
| 21. WWAg478 | 4.5 | 5.0 | 6.5 | 6.5 | 5.5 | 5.5 | 5.5 | 6.0 |
| 22. Majestic | 5.5 | 6.0 | 6.5 | 6.0 | 5.5 | 5.5 | 5.5 | 6.0 |
| 23. Merit | 4.5 | 5.5 | 6.5 | 6.0 | 5.5 | 6.0 | 5.5 | 6.0 |
| 24. Shasta | 5.0 | 5.5 | 6.5 | 5.5 | 5.5 | 6.5 | 5.5 | 6.0 |
| 25. Sydsport | 5.5 | 6.5 | 7.0 | 5.5 | 5.5 | 6.5 | 6.0 | 6.0 |
| 26. Mer pp 300 | 5.0 | 6.0 | 6.5 | 5.5 | 5.5 | 6.0 | 6.0 | 6.0 |
| 27. Lovegreen | 3.5 | 5.5 | 7.0 | 6.5 | 5.5 | 5.5 | 5.5 | 6.0 |
| 28. Bristol | 5.5 | 6.0 | 6.5 | 5.5 | 6.0 | 5.5 | 6.0 | 6.0 |
| 29. SH-2 | 6.5 | 6.5 | 7.0 | 5.5 | 6.5 | 6.5 | 6.0 | 6.0 |
| 30. P141 (Mystic) | 4.5 | 5.0 | 6.5 | 5.5 | 6.5 | 5.5 | 5.5 | 6.0 |
| 31. Eclipse | 4.5 | 5.5 | 6.5 | 5.5 | 6.0 | 6.5 | 5.5 | 6.0 |
| 32. K3-162 | 5.5 | 5.5 | 6.0 | 5.5 | 6.5 | 5.5 | 6.5 | 6.0 |
| 33. Barblue | 5.5 | 5.5 | 6.0 | 6.5 | 6.0 | 5.5 | 6.0 | 6.0 |
| 34. Adelphi | 5.5 | 5.0 | 6.5 | 5.5 | 4.5 | 4.5 | 6.0 | 5.5 |
| 35. Glade | 5.0 | 6.0 | 6.5 | 5.5 | 5.5 | 5.5 | 5.0 | 5.5 |
| 36. Birka | 4.5 | 5.5 | 6.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 |
| 37. Monopoly | 4.5 | 5.0 | 6.0 | 5.5 | 5.5 | 5.0 | 5.0 | 5.5 |
| 38. RAM-1 | 4.5 | 5.5 | 6.0 | 5.5 | 5.5 | 4.5 | 5.0 | 5.5 |
| 39. Cheri | 4.5 | 5.5 | 6.5 | 6.0 | 5.5 | 5.5 | 5.5 | 5.5 |
| 40. 243 | 5.5 | 5.5 | 7.0 | 6.0 | 5.0 | 5.0 | 5.5 | 5.5 |
| 41. Wabash | 6.5 | 6.0 | 5.5 | 5.5 | 5.5 | 5.0 | 6.0 | 5.5 |
| 42. S-21 | 6.5 | 6.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 |

Table 3 (Continued)

| Cultivar | | April Color | May | June | July | Aug | Sept | Oct | Mean |
|---|---|---|---|---|---|---|---|---|---|
| 43. | Parade | 4.0 | 5.0 | 5.5 | 5.5 | 4.5 | 5.5 | 5.5 | 5.5 |
| 44. | Trenton | 5.0 | 5.0 | 6.0 | 6.5 | 4.5 | 5.5 | 5.5 | 5.5 |
| 45. | SV-01617 | 5.0 | 4.5 | 7.0 | 6.0 | 5.5 | 5.0 | 5.5 | 5.5 |
| 46. | Banff | 5.5 | 5.5 | 7.0 | 5.5 | 5.0 | 4.5 | 5.0 | 5.5 |
| 47. | Dormie | 5.5 | 5.5 | 7.0 | 5.5 | 5.0 | 5.5 | 5.0 | 5.5 |
| 48. | Aspen | 4.5 | 5.5 | 7.0 | 5.5 | 4.5 | 4.5 | 5.0 | 5.5 |
| 49. | Welcome | 4.0 | 5.0 | 6.0 | 5.5 | 6.0 | 5.5 | 4.5 | 5.5 |
| 50. | WWAg480 | 5.0 | 6.0 | 7.0 | 6.0 | 4.5 | 4.5 | 5.0 | 5.5 |
| 51. | Kenblue | 5.5 | 5.5 | 5.0 | 5.5 | 5.5 | 5.5 | 6.0 | 5.5 |
| 52. | Harmony | 4.0 | 4.5 | 6.0 | 6.5 | 5.0 | 6.0 | 5.5 | 5.5 |
| 53. | American | 4.5 | 5.5 | 7.5 | 5.5 | 4.5 | 5.5 | 5.0 | 5.5 |
| 54. | Mosa | 4.0 | 5.5 | 6.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 |
| 55. | Piedmont | 5.5 | 5.5 | 5.5 | 5.5 | 4.5 | 6.5 | 5.5 | 5.5 |
| 56. | Bonnieblue | 5.5 | 5.5 | 7.0 | 5.5 | 5.0 | 5.0 | 5.0 | 5.5 |
| 57. | Vantage | 5.0 | 5.0 | 4.5 | 5.5 | 5.0 | 6.0 | 5.5 | 5.5 |
| 58. | Argyle | 6.0 | 6.0 | 5.5 | 6.0 | 5.5 | 5.0 | 6.5 | 5.5 |
| 59. | Charlotte | 4.5 | 5.0 | 6.5 | 5.5 | 5.5 | 5.5 | 6.0 | 5.5 |
| 60. | A20-6 | 5.0 | 5.0 | 6.5 | 5.5 | 4.5 | 5.5 | 5.5 | 5.5 |
| 61. | N535 | 5.0 | 5.0 | 6.5 | 5.5 | 5.0 | 6.0 | 5.5 | 5.5 |
| 62. | 1528T (Midnight) | 5.5 | 6.0 | 6.5 | 6.0 | 4.5 | 4.5 | 5.5 | 5.5 |
| 63. | Apart | 4.5 | 6.0 | 6.5 | 5.5 | 4.5 | 5.5 | 5.5 | 5.5 |
| 64. | A-34 | 5.0 | 5.0 | 5.5 | 5.5 | 5.5 | 6.5 | 5.5 | 5.5 |
| 65. | Mer pp 43 | 5.0 | 5.0 | 6.0 | 6.0 | 6.0 | 5.5 | 6.0 | 5.5 |
| 66. | Mona | 5.5 | 5.0 | 6.5 | 6.0 | 5.5 | 5.5 | 5.5 | 5.5 |
| 67. | S.D. Common | 6.0 | 5.5 | 5.5 | 5.0 | 5.5 | 6.0 | 5.5 | 5.5 |
| 68. | Merion | 5.5 | 6.0 | 6.5 | 5.0 | 4.5 | 4.5 | 5.5 | 5.5 |
| 69. | BA-61-91 | 5.0 | 5.0 | 7.0 | 5.0 | 5.5 | 5.5 | 5.5 | 5.5 |
| 70. | Bayside | 5.5 | 6.5 | 6.5 | 6.0 | 5.5 | 4.5 | 5.0 | 5.5 |
| 71. | 225 | 4.5 | 5.5 | 6.5 | 5.5 | 5.5 | 5.5 | 5.0 | 5.5 |
| 72. | Admiral | 5.0 | 5.0 | 6.5 | 6.0 | 5.0 | 5.5 | 5.5 | 5.5 |
| 73. | Escort | 4.5 | 5.5 | 6.5 | 4.5 | 5.5 | 5.5 | 5.5 | 5.5 |
| 74. | K3-179 | 5.0 | 5.0 | 6.0 | 5.5 | 5.0 | 5.5 | 5.0 | 5.5 |
| 75. | K3-178 | 5.0 | 5.5 | 5.5 | 5.0 | 5.5 | 6.0 | 5.0 | 5.5 |
| 76. | 239 | 5.0 | 5.5 | 6.0 | 4.5 | 4.5 | 4.5 | 5.0 | 5.0 |
| 77. | Rugby | 4.5 | 5.0 | 6.0 | 5.5 | 5.0 | 5.5 | 4.5 | 5.0 |
| 78. | Holiday | 4.5 | 5.0 | 5.5 | 5.5 | 4.5 | 5.5 | 5.0 | 5.0 |
| 79. | A20 | 5.5 | 5.5 | 6.5 | 4.5 | 4.5 | 4.5 | 4.5 | 5.0 |
| 80. | H-7 | 5.5 | 5.0 | 6.0 | 5.0 | 4.5 | 5.0 | 5.5 | 5.0 |
| 81. | I-13 | 5.5 | 5.5 | 6.5 | 4.5 | 4.5 | 4.5 | 5.0 | 5.0 |
| 82. | A20-6A | 5.5 | 5.5 | 6.5 | 5.0 | 4.5 | 4.5 | 5.0 | 5.0 |
| 83. | Columbia | 6.5 | 5.5 | 6.0 | 4.5 | 5.0 | 5.0 | 5.5 | 5.0 |
| 84. | K1-152 | 5.0 | 4.5 | 6.5 | 5.5 | 4.5 | 5.0 | 4.5 | 5.0 |
| | LSD 0.05 | 1.5 | N.S. | N.S. | N.S. | 1.0 | 1.5 | 1.0 | N.S. |

Quality is rated at 9=best quality and 1=dead turf. A rating of 6 or higher constitutes acceptable quality. Color is rated on a scale of 9-1, where 9=best color.

## Fine Fescue Cultivar Trial

The fine fescue cultivar trial was established in the fall of 1979. At that time, 20 cultivars of chewings, creeping red, and hard fescue were established in 3 replications. The area received 4 lb N/1000 $ft^2$/yr and was watered as needed to prevent drought stress.

The cultivars which received the highest ratings in 1982 were Rolax, Checker, and Syn W. All of the cultivars received an acceptable rating of 6 or greater for the season. By 1982, some of the cultivars had been infested with Kentucky bluegrass. This was due to heavy rains shortly after seeding an adjacent area to bluegrass in 1979. Data are reported for April through August only. In August, 1982, sod from the 1979 fine fescue cultivar trial was removed, the area was tilled and allowed to lie fallow for 2 weeks. The area was then sprayed with Roundup and a new, more extensive, fine fescue cultivar trial was established. The first data from this new trial will be reported in 1984.

Table 4. The 1982 quality ratings for fine fescue cultivars established in Fall 1979.

| Cultivar | April | June | July | Aug | Mean |
|---|---|---|---|---|---|
| 1. Rolax | 7.0 | 7.0 | 8.0 | 7.0 | 7.5 |
| 2. Checker | 7.0 | 6.0 | 8.0 | 8.0 | 7.5 |
| 3. SYN-W | 6.5 | 7.0 | 8.0 | 7.5 | 7.5 |
| 4. Canada | 7.0 | 6.5 | 7.0 | 6.5 | 7.0 |
| 5. Reliant | 6.5 | 6.5 | 7.5 | 6.5 | 7.0 |
| 6. Jamestown | 7.0 | 6.5 | 7.5 | 7.0 | 7.0 |
| 7. Atlanta | 7.0 | 6.0 | 7.5 | 7.0 | 7.0 |
| 8. Dawson | 6.5 | 7.0 | 7.5 | 7.0 | 7.0 |
| 9. Ensylva | 6.5 | 6.5 | 7.5 | 7.5 | 7.0 |
| 10. K4-21 | 6.5 | 6.5 | 7.5 | 7.0 | 7.0 |
| 11. Pennlawn | 7.0 | 6.5 | 6.5 | 6.0 | 6.5 |
| 12. K4-29 | 7.0 | 6.5 | 7.0 | 6.0 | 6.5 |
| 13. Ruby | 7.0 | 6.5 | 6.5 | 6.5 | 6.5 |
| 14. Fortress | 6.0 | 6.5 | 7.0 | 7.0 | 6.5 |
| 15. Biljart | 6.0 | 5.5 | 7.5 | 7.5 | 6.5 |
| 16. Scaldis | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 |
| 17. Engina | 7.0 | 6.5 | 6.0 | 6.0 | 6.5 |
| 18. Tournament | 6.5 | 6.0 | 6.5 | 6.0 | 6.5 |
| 19. Waldina | 5.5 | 5.5 | 7.5 | 6.5 | 6.5 |
| LSD 0.05 | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 |

Quality is rated on a scale of 9 to 1; 9=best quality and 1=dead turf.

## Tall Fescue Regional Trial

The tall fescue regional trial is being conducted at a number of state research stations in the central and southern U.S. under the direction of the USDA. This test was established in the fall of 1979. The cultivars are maintained at a 3" mowing height and the area receives 3 lbs of N/1000 sq ft/yr.

The results of 1982 evaluations can be found in table 5. Two experimental cultivars, Belt TF-25 and Belt Syn 16-1, received the highest ratings last year. Rebel, Falcon, and AG-125 also performed very well. Even the lowest rated cultivars received rather high ratings of 7.0-7.5. In 3 years, there has been little difference among the 19 tall fescue cultivars.

Ames is on the edge of what is normally considered to be the northern range for tall fescue turf and we normally do not recommend this species north of Interstate 80 in Iowa. There have, however, been no problems with winter kill at this location, even during the very severe winter of 1981-1982.

Table 5. Tall fescue quality ratings for the 1981 season.

| Cultivar | April Color | May | June | July | Aug | Sept | Oct | Mean |
|---|---|---|---|---|---|---|---|---|
| 1. Kenhy | 6.0 | 8.0 | 7.5 | 7.5 | 7.5 | 7.5 | 8.0 | 7.5 |
| 2. PHB-1-5 | 5.5 | 8.0 | 7.5 | 7.0 | 7.0 | 7.5 | 8.5 | 7.5 |
| 3. LA-FA-Syn I | 6.0 | 7.5 | 7.0 | 6.5 | 6.5 | 7.5 | 7.5 | 7.0 |
| 4. AG-125 | 5.0 | 8.5 | 8.5 | 8.0 | 7.5 | 7.5 | 8.5 | 8.0 |
| 5. Falcon (NJ-78) | 5.0 | 8.0 | 8.0 | 7.5 | 8.0 | 8.0 | 8.5 | 8.0 |
| 6. Kenwell | 6.5 | 7.5 | 7.0 | 6.5 | 7.0 | 8.0 | 8.5 | 7.5 |
| 7. Blend 36-1, SOFM | 6.0 | 7.5 | 7.5 | 7.5 | 7.5 | 7.0 | 8.5 | 7.5 |
| 8. K5-27 | 5.0 | 7.5 | 7.0 | 8.0 | 8.0 | 7.5 | 8.5 | 8.0 |
| 9. Rebel (T-5) | 5.5 | 7.5 | 8.0 | 7.5 | 7.5 | 8.0 | 8.0 | 8.0 |
| 10. Kentucky-31 | 6.0 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 8.5 | 7.5 |
| 11. Kenmont | 5.5 | 8.0 | 7.5 | 6.5 | 7.5 | 7.5 | 8.0 | 7.5 |
| 12. Goar | 5.0 | 8.0 | 7.5 | 7.5 | 7.5 | 8.0 | 8.0 | 8.0 |
| 13. Belt Syn 16-1 | 6.0 | 8.0 | 8.5 | 8.5 | 8.5 | 8.5 | 9.0 | 8.5 |
| 14. Belt KPH-1 | 6.0 | 7.5 | 6.5 | 6.0 | 7.0 | 7.5 | 8.5 | 7.0 |
| 15. Belt TF-11 | 6.0 | 8.0 | 8.0 | 8.0 | 8.5 | 8.0 | 9.0 | 8.0 |
| 16. Belt TF-25 | 6.0 | 8.0 | 8.5 | 8.5 | 8.5 | 8.5 | 9.0 | 8.5 |
| 17. T.F. 14801 | 6.0 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 8.5 | 8.0 |
| 18. T.F. 14802 | 5.5 | 8.0 | 7.0 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 |
| 19. T.F. 14803 | 5.5 | 8.0 | 7.5 | 7.5 | 7.5 | 7.5 | 8.5 | 8.0 |
| LSD 0.05 | 1.0 | 0.5 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 |

## Bentgrass Management Study

The bentgrass management study was begun in the fall of 1980. It includes five creeping bentgrass cultivars: Emerald, Penncross, Penneagle, Prominent, and Seaside, and one velvet bentgrass cultivar, Kingstown. Each cultivar planting is split into 3 fertility levels: 0.5, 0.8, and 1.2 lbs N/1000 sq ft/growing month. This results in a total N application rate of 3.5, 5.6, and 8.4 lbs N/1000 sq ft/yr. The area is maintained as a golf course green with each cultivar replicated 4 times.

Nitrogen increased the quality of each of the cultivars up to the highest application rate of 1.2 lb N/1000 sq ft/month (Table 6). Penncross and Penneagle maintained the highest quality rating at all levels of nitrogen. At the 0.5 lb N/1000 sq ft/mo, these two cultivars were the only ones to maintain an acceptable quality.

When quality was averaged over all N treatments and months of observation, Penneagle was the highest rated cultivar in 1982 (Table 7). Penncross ranked second and all cultivars, with the exception of Seaside, maintained acceptable quality. Kingstown has been damaged over the past two seasons by disease and winter kill and much of the plot area originally seeded to Kingstown has been taken over by other cultivars. This would account for its fourth place rating in 1982 and for its poorer rating in 1981.

Table 6. The effects of fertility level on the quality of bentgrass cultivars.

| | lb N/growing month | | |
|---|---|---|---|
| | 0.5 | 0.8 | 1.2 |
| 1. Emerald | 5.0 | 6.0 | 7.0 |
| 2. Kingstown* | 5.5 | 6.0 | 7.0 |
| 3. Penncross | 6.0 | 6.5 | 7.5 |
| 4. Penneagle | 6.5 | 7.0 | 7.5 |
| 5. Prominent | 5.5 | 6.0 | 7.0 |
| 6. Seaside | 5.0 | 5.5 | 6.5 |

LSD 0.05 for comparison of fertility levels within cultivar = 0.5.
* velvet bentgrass

Table 7. Quality ratings for six bentgrass cultivars in the 1982 season.

| Cultivars | May | June | July | Sept | Oct | Mean |
|---|---|---|---|---|---|---|
| 1. Penneagle | 7.0 | 6.0 | 7.5 | 7.5 | 7.0 | 7.0 |
| 2. Penncross | 6.5 | 6.0 | 7.0 | 7.5 | 6.0 | 6.5 |
| 3. Emerald | 6.5 | 6.0 | 6.5 | 7.0 | 5.5 | 6.0 |
| 4. Kingstown | 7.0 | 5.5 | 6.0 | 7.0 | 5.5 | 6.0 |
| 5. Prominent | 6.5 | 5.5 | 6.0 | 7.0 | 6.0 | 6.0 |
| 6. Seaside | 6.0 | 5.0 | 6.0 | 6.0 | 5.5 | 5.5 |
| LSD 0.05 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |

Quality is based on a scale of 9 to 1; 9=best quality and 1=dead turf.

## Kentucky Bluegrass Management Study

The Kentucky bluegrass management study was established on August 16, 1979. The study, which includes 10 cultivars of Kentucky bluegrass, is divided into irrigated and non-irrigated sections. Each cultivar is maintained at two mowing heights, one and two inches, and is fertilized with IBDU at two rates, one and three lbs N/1000 sq ft/yr.

Under irrigated conditions, Aquila maintained the best quality during 1982 at the 1" mowing height (Table 8). At the 2" mowing height, Aquila and Adelphi had the best quality.

Increasing fertilizer rates from 1 to 3 lb N/1000 sq ft/yr improved quality on irrigated plots at both mowing heights (Table 9). With highest quality observed at the 2" mowing height and 3 lb N/1000 sq ft/yr.

Under non-irrigated conditions, only Glade maintained an acceptable quality at a 1" mowing height. At the 2" mowing height Glade, Aquila, Victa, and Touchdown were observed to have the best quality (Table 10). An overall acceptable quality was obtained under non-irrigated conditions only at a 2" mowing height and 3 lb N/1000 sq ft/yr (Table 11).

Dollar spot became a problem in mid-summer of 1982 on some of the cultivars in both irrigated and non-irrigated areas. Sydsport and Merion were most seriously affected under irrigated conditions. Only Sydsport was damaged on the non-irrigated area (Table 12).

Thatch measurements were made at the end of the 1982 season. There were no cultivar differences in thatch development in the non-irrigated area. Under irrigated conditions, Sydsport and Glade developed the greatest amount of thatch and Baron developed the least (Table 13).

The greatest development of thatch occurred at a fertilization rate of 3 lb N/1000 sq ft/yr and a mowing height of 2" (Table 14). Thatch development was greater at the higher mowing height at both fertility levels, regardless of irrigation regime (Table 14). The study will be continued in 1983.

Table 8. Kentucky bluegrass cultivar quality ratings for the irrigated section of the Kentucky bluegrass management study as affected by mowing height.

| | Mowing Height | |
|---|---|---|
| Cultivar | 1" | 2" |
| 1. Merion | 6.0 | 6.0 |
| 2. Park | 6.0 | 6.0 |
| 3. Aquila | 7.0 | 7.0 |
| 4. Glade | 6.5 | 6.5 |
| 5. Baron | 6.0 | 6.0 |
| 6. Victa | 6.0 | 6.5 |
| 7. Sydsport | 6.0 | 6.0 |
| 8. Touchdown | 6.5 | 6.5 |
| 9. Majestic | 6.5 | 6.5 |
| 10. Adelphi | 6.5 | 7.0 |

Table 9. Kentucky bluegrass quality ratings for the irrigated section of the Kentucky bluegrass management study as affected by fertilizer rate and mowing height.

| Fertilizer Treatment | 1" | 2" |
|---|---|---|
| 1* | 5.5 | 6.0 |
| 3 | 6.5 | 7.0 |

* lbs N/1000 $ft^2$ applied in the form of IBDU

Table 10. Kentucky bluegrass cultivar quality ratings for the non-irrigated section of the Kentucky bluegrass management study as affected by mowing height.

| Cultivar | Mowing Height | |
|---|---|---|
| | 1" | 2" |
| 1. Merion | 4.5 | 5.5 |
| 2. Park | 5.0 | 5.5 |
| 3. Aquila | 5.5 | 6.5 |
| 4. Glade | 6.0 | 6.5 |
| 5. Baron | 4.5 | 5.5 |
| 6. Victa | 5.0 | 6.5 |
| 7. Sydsport | 5.0 | 5.5 |
| 8. Touchdown | 5.5 | 6.5 |
| 9. Majestic | 5.5 | 6.0 |
| 10. Adelphi | 5.0 | 5.5 |

Table 11. Kentucky bluegrass quality ratings for the non-irrigated section of the Kentucky bluegrass management study as affected by fertilizer rate and mowing height.

| Fertilizer Treatment | Mowing Height | |
|---|---|---|
| | 1" | 2" |
| 1* | 4.5 | 5.5 |
| 3 | 5.5 | 6.5 |

* lbs N/1000 $ft^2$ applied in the form of IBDU

Table 12. Dollar spot ratings for the Kentucky bluegrass cultivar study taken in August 1982.

| Cultivar | Irrigated | Non-Irrigated |
|---|---|---|
| 1. Merion | 3.5 | 5.0 |
| 2. Park | 4.5 | 5.0 |
| 3. Aquila | 4.5 | 5.0 |
| 4. Glade | 4.5 | 5.0 |
| 5. Baron | 5.0 | 5.0 |
| 6. Victa | 4.5 | 5.0 |
| 7. Sydsport | 2.0 | 3.5 |
| 8. Touchdown | 5.0 | 5.0 |
| 9. Majestic | 5.0 | 5.0 |
| 10. Adelphi | 4.5 | 5.0 |
| LSD 0.05 | 0.5 | 0.5 |

* A rating of 5 indicates no disease, a rating of 1 indicates dead turf.

Table 13. Thatch development differences among 10 cultivars in the irrigated Kentucky bluegrass management study.

| Cultivar | Thatch |
|---|---|
| | -cm- |
| 1. Merion | 1.6 |
| 2. Park | 1.4 |
| 3. Aquila | 1.4 |
| 4. Glade | 1.9 |
| 5. Baron | 1.3 |
| 6. Victa | 1.6 |
| 7. Sydsport | 1.9 |
| 8. Touchdown | 1.8 |
| 9. Majestic | 1.5 |
| 10. Adelphi | 1.4 |
| LSD 0.05 | 0.5 |

Table 14. The effect of fertilizer rate and mowing height on thatch development of Kentucky bluegrass under irrigated and non-irrigated conditions.

| | Fertilization | | | |
|---|---|---|---|---|
| | 1 Mowing Height | | 3 Mowing Height | |
| | 1" | 2" | 1" | 2" |
| Irrigated | 1.0 | 1.7 | 1.2 | 2.4 |
| Non-Irrigated | 0.9 | 1.0 | 0.9 | 1.2 |

## Perennial Ryegrass Management Study

The perennial ryegrass management study, like the Kentucky bluegrass management study, includes 10 cultivars and is divided into irrigated and non-irrigated sections. Each cultivar is maintained at two mowing heights: one and two inches. Each plot is divided into two fertilizer treatments, one and three lbs N/1000 sq ft, applied as IBDU. The study was established on August 16, 1979.

Yorktown maintained the best quality under irrigated conditions in 1982 (Table 15). Pennfine, Citation, and Loretta also performed quite well. Only Linn failed to maintain an acceptable quality for the season. None of the cultivars maintained an acceptable quality under non-irrigated conditions when data were averaged over all fertility levels and mowing heights (Table 15). By further partitioning the data for non-irrigated areas into 1" and 2" mowing heights, it becomes apparent that the low ratings were due primarily to the poor condition of plots mowed at 1" (Table 16). At the 2" mowing height, Yorktown maintained the best season long quality. With Manhattan, Pennfine, Derby, Diplomat, and Loretta also maintaining an acceptable quality. Caravelle, Citation, Linn, and NK 200 were not acceptable under non-irrigated conditions at the 2" mowing height.

Table 15. Quality ratings for perennial ryegrass cultivars maintained under both irrigated and non-irrigated conditions.

| Cultivar | Irrigated | Non-Irrigated |
|---|---|---|
| 1. Manhattan | 6.5* | 5.5 |
| 2. Pennfine | 7.0 | 5.5 |
| 3. NK 200 | 6.0 | 4.5 |
| 4. Derby | 6.5 | 5.5 |
| 5. Citation | 7.0 | 5.0 |
| 6. Diplomat | 6.5 | 5.5 |
| 7. Yorktown | 7.5 | 5.5 |
| 8. Caravelle | 6.5 | 5.0 |
| 9. Linn | 4.5 | 4.5 |
| 10. Loretta | 7.0 | 5.5 |
| LSD 0.05 | 1.0 | 0.5 |

* data are the means of months May through October for both mowing heights and both fertility levels.

Table 16. The effect of mowing height on perennial ryegrass cultivars maintained under non-irrigated conditions.

| | Mowing Height | |
| --- | --- | --- |
| Cultivar | 1" | 2" |
| 1. Manhattan | 5.0 | 6.0 |
| 2. Pennfine | 5.0 | 6.0 |
| 3. NK 200 | 4.0 | 5.0 |
| 4. Derby | 5.0 | 6.0 |
| 5. Citation | 4.5 | 5.5 |
| 6. Diplomat | 4.5 | 6.0 |
| 7. Yorktown | 5.0 | 6.5 |
| 8. Caravelle | 4.0 | 5.5 |
| 9. Linn | 4.0 | 5.0 |
| 10. Loretta | 5.0 | 6.0 |

## Fine Fescue Management Study

The fine fescue management study includes the following cultivars:

| | | | |
|---|---|---|---|
| 1. | Pennlawn Red Fescue | 6. | Dawson Red Fescue |
| 2. | Scaldis Hard Fescue | 7. | Reliant (FL-1) Hard Fescue |
| 3. | Ruby Red Fescue | 8. | Ensylva Red Fescue |
| 4. | Atlanta Chewings Fescue | 9. | Highlight Chewings Fescue |
| 5. | K5-29 Red Fescue | 10. | Jamestown Chewings Fescue |

Each cultivar is maintained at two mowing heights: one and two inches. Each plot is also divided into two fertilizer treatments: one and three lbs N/1000 sq ft, applied as IBDU. The study was established on September 8, 1979, and is irrigated as needed.

Reliant hard fescue was the best fine fescue at both 1 and 2 inch mowing heights (Table 17). Scaldis hard fescue, Atlanta chewings fescue, and Jamestown chewings fescue ranked second. Pennlawn red fescue performed satisfactorily under a 2" mowing height, but not under a 1" mowing height. Ruby red fescue, K5-29 red fescue, Dawson red fescue, Ensylva red fescue, and Highlight chewings fescue were not satisfactory under either mowing height.

Table 17. The effect of mowing height on the quality ratings of the fine fescues.

| Cultivar | Mowing Height | |
|---|---|---|
| | 1" | 2" |
| 1. Pennlawn R. F. | 5.5 | 6.0 |
| 2. Scaldis Hard Fescue | 6.5 | 6.5 |
| 3. Ruby R. F. | 4.5 | 5.5 |
| 4. Atlanta Chewings F. | 6.5 | 6.5 |
| 5. K5-29 R. F. | 4.5 | 4.5 |
| 6. Dawson R. F. | 5.5 | 5.5 |
| 7. FL-1 Hard Fescue (Reliant) | 7.5 | 7.5 |
| 8. Ensylva R. F. | 5.5 | 5.5 |
| 9. Highlight Chewings F. | 4.5 | 5.5 |
| 10. Jamestown Chewings F. | 6.5 | 6.5 |

## Perennial Ryegrass Cultivar Evaluations

In the fall of 1979, 22 perennial ryegrass cultivars were established at the research station in 3 replications. The study receives 4 lbs N/1000 $ft^2$/yr, receives no fungicide or insecticide applications and is mowed at a 2" mowing height.

Results of winter damage evaluations and yearly quality ratings are listed in table 3. Winter damage can be a serious problem for perennial ryegrass cultivars. The data listed were taken in spring, 1982. The values in the table represent the % of the plot area damaged; 100=total kill and 0=no damage. Linn, Delray, and K5-94 were damaged to the greatest extent in 1982. NK-200, J186 R24 D, Med. North and Regal were least damaged. In most cases, the damage recovered quickly. For instance, Blyes was listed as having 23% damage, but maintained the highest yearly quality.

Blyes, Regal, Citation, Fiesta, Pennfine, Yorktown, and Belle received the highest yearly quality ratings in 1982. Although most of the cultivars received acceptable quality ratings of 6 or greater, the top rated cultivars were clearly superior through most of the season.

During July the perennial ryegrasses were uniformly affected by a disease believed to have been pythium blight. This accounts for some of the lower ratings in that month. All of the cultivars were affected, whereas the surrounding Kentucky bluegrass was unaffected.

A new, more extensive, perennial ryegrass cultivar study was established in the fall of 1982.

Table 18. The 1982 quality ratings for perennial ryegrass cultivars established in 1979.

| Cultivar | | Winter Kill | May | June | July | Aug | Sept | Oct | Mean |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Blyes | 23 | 8.0 | 6.5 | 6.5 | 7.0 | 8.5 | 9.0 | 7.5 |
| 2. | Regal | 8 | 7.5 | 8.0 | 7.5 | 8.0 | 6.0 | 9.0 | 7.5 |
| 3. | Citation | 15 | 7.5 | 6.0 | 7.5 | 7.0 | 8.0 | 9.0 | 7.5 |
| 4. | Fiesta | 23 | 6.5 | 6.5 | 7.5 | 7.5 | 8.5 | 9.0 | 7.5 |
| 5. | Pennfine | 17 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 9.0 | 7.5 |
| 6. | Yorktown | 23 | 7.5 | 6.5 | 7.0 | 6.5 | 9.0 | 9.0 | 7.5 |
| 7. | Belle | 18 | 6.5 | 6.5 | 7.0 | 7.0 | 8.5 | 9.0 | 7.5 |
| 8. | K5-88 | 13 | 7.0 | 6.0 | 5.5 | 5.5 | 8.5 | 8.5 | 7.0 |
| 9. | Elka | 22 | 7.5 | 6.5 | 5.5 | 6.0 | 7.5 | 7.5 | 7.0 |
| 10. | Med. North | 7 | 7.0 | 6.0 | 6.5 | 6.5 | 6.5 | 8.5 | 7.0 |
| 11. | Delray | 33 | 7.0 | 6.5 | 6.0 | 7.0 | 7.0 | 9.0 | 7.0 |
| 12. | Derby | 25 | 7.5 | 7.0 | 7.5 | 7.0 | 5.0 | 8.5 | 7.0 |
| 13. | Diplomat | 13 | 7.5 | 6.5 | 6.5 | 7.0 | 7.0 | 9.0 | 7.0 |
| 14. | Manhattan | 11 | 8.0 | 5.5 | 5.5 | 6.5 | 4.5 | 8.5 | 6.5 |
| 15. | Loretta | 18 | 7.0 | 7.0 | 5.5 | 5.5 | 7.5 | 7.5 | 6.5 |
| 16. | Goalie | 28 | 6.5 | 5.5 | 5.5 | 6.5 | 7.0 | 9.0 | 6.5 |
| 17. | K5-94 | 32 | 7.0 | 5.0 | 5.0 | 6.5 | 5.5 | 8.5 | 6.5 |
| 18. | J186 R24 D | 4 | 7.0 | 5.5 | 5.5 | 5.5 | 5.5 | 7.5 | 6.0 |
| 19. | NK-200 | 2 | 7.0 | 6.0 | 5.5 | 5.5 | 5.0 | 7.5 | 6.0 |
| 20. | Caravelle | 27 | 7.5 | 5.0 | 4.5 | 5.5 | 5.5 | 7.5 | 6.0 |
| 21. | NK-100 | 23 | 5.5 | 4.5 | 4.0 | 3.5 | 5.0 | 6.5 | 5.0 |
| 22. | Linn | 40 | 5.5 | 4.0 | 3.5 | 3.0 | 4.5 | 4.5 | 4.0 |
| | LSD 0.05 | 20 | 1.5 | 1.0 | 1.0 | 1.0 | 1.5 | 1.0 | 0.5 |

Quality is rated on a scale of 9 to 1; 9=best quality and 1=dead turf. Winter kill is based on a % scale; 100%=total kill and 0%=no damage.

## Growth Retardant Study

In 1982, a series of growth retardants were tested on a Kentucky bluegrass turf at the research station. They included MBR 12325 (Embark), BAS 106 00 W (an experimental material from BASF Wyandote Corporation), Ethrel (ethephon), and EL 500 (an experimental from Elanco Products Company).

The materials were applied on July 2, 1982. The areas was mowed uniformly 7 days later at 2 inches. The area then remained unmowed for the rest of the season. Week 1 data were taken 7 days following mowing. Weekly measurements of growth and quality were performed for 9 weeks.

MBR 12325 2S inhibited growth for only a short period of time at the 0.28 kg ai/ha rate (0.25 lb/acre) (Table 19). This inhibition was followed by a postinhibition stimulation of growth, where growth exceeded that of the untreated control. At the higher rate, MBR 12325 inhibited growth for a slightly longer period of time. Again, this was followed by a postinhibition increase in growth. The unusally short growth inhibition of the MBR material is likely due to the very wet conditions which followed treatments.

The BAS 106 00 W reduced growth for 8 weeks at the 1.68 kg/ha rate and for the full 9 weeks at the two higher rates (Table 19). However, this material also tended to be quite phytotoxic (Table 20).

Ethrel did not reduce growth at the lowest rate, although it was effective at the two higher rates. Ethrel did not have a detrimental effect on the turf and, in some cases, the plots treated with this material had a higher quality then the control plots (Table 20).

EL 500 was very effective in reducing growth at all 3 rates of application. However, it did not reduce quality to unacceptable levels at the two higher treatment rates.

The treatments were applied quite late in the season because of the unusually wet conditions in spring 1982. Still, many of the materials were quite effective in reducing growth, even during the stress period of mid-summer.

Table 19. The measured height of growth of Kentucky bluegrass over a nine week period, following treatment with growth retarding chemicals.

| Treatment | kg a.i./ha | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Control | -- | 10.0 | 10.0 | 10.5 | 10.5 | 11.5 | 11.5 | 13.5 | 14.5 | 14.5 | 12.0 |
| 2. MBR 12325 2S | 0.28 | 7.0 | 10.0 | 10.5 | 10.5 | 13.0 | 14.0 | 16.0 | 18.5 | 19.0 | 13.0 |
| 3. MBR 12325 2S | 0.56 | 6.0 | 9.0 | 10.5 | 10.5 | 11.5 | 12.0 | 15.0 | 16.5 | 17.5 | 12.0 |
| 4. BAS 106 00 W | 1.68 | 7.5 | 8.5 | 9.0 | 9.0 | 9.0 | 10.5 | 12.5 | 13.5 | 17.0 | 10.5 |
| 5. BAS 106 00 W | 3.36 | 6.5 | 7.5 | 8.0 | 8.0 | 8.5 | 8.5 | 10.5 | 11.0 | 12.5 | 9.0 |
| 6. BAS 106 00 W | 5.04 | 6.5 | 6.5 | 6.5 | 6.5 | 7.0 | 7.0 | 9.5 | 10.0 | 12.5 | 8.0 |
| 7. Ethrel 2S | 2.24 | 11.0 | 10.0 | 10.5 | 11.0 | 11.5 | 13.5 | 15.0 | 15.5 | 16.5 | 13.0 |
| 8. Ethrel 2S | 4.48 | 8.5 | 9.0 | 9.0 | 9.5 | 10.5 | 10.5 | 12.5 | 13.0 | 14.5 | 11.0 |
| 9. Ethrel 2S | 6.72 | 8.5 | 8.0 | 8.5 | 8.5 | 8.5 | 9.5 | 11.0 | 11.0 | 11.5 | 9.5 |
| 10. EL 500 50 W | 0.84 | 6.5 | 7.0 | 8.0 | 8.5 | 9.5 | 9.5 | 10.5 | 11.5 | 13.0 | 9.5 |
| 11. EL 500 50 W | 1.12 | 6.0 | 8.0 | 8.0 | 8.0 | 8.5 | 9.0 | 9.5 | 10.5 | 11.5 | 8.5 |
| 12. EL 500 50 W | 1.40 | 6.0 | 6.5 | 6.5 | 6.5 | 6.5 | 7.0 | 9.0 | 9.0 | 10.5 | 7.5 |
| LSD 0.05 | | 1.5 | 1.5 | 1.5 | 1.5 | 2.5 | 3.0 | 4.0 | 5.0 | 5.0 | 1.5 |

Table 20. Quality ratings for Kentucky bluegrass over a nine week period following treatment with growth retarding chemicals.

| Treatment | kg a.i./ha | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Control | -- | 8.0 | 8.5 | 8.0 | 8.5 | 6.5 | 6.5 | 6.5 | 6.5 | 7.0 | 7.5 |
| 2. MBR 12325 2S | 0.28 | 7.0 | 8.0 | 7.5 | 9.0 | 8.5 | 7.5 | 7.5 | 7.0 | 7.5 | 7.5 |
| 3. MBR 12325 2S | 0.56 | 6.0 | 7.0 | 8.0 | 9.0 | 7.0 | 7.5 | 7.5 | 7.5 | 7.0 | 7.5 |
| 4. BAS 106 00 W | 1.68 | 6.5 | 7.5 | 6.5 | 6.5 | 6.5 | 7.5 | 6.5 | 6.5 | 7.5 | 7.0 |
| 5. BAS 106 00 W | 3.36 | 6.0 | 6.0 | 5.0 | 5.0 | 5.5 | 6.0 | 6.0 | 6.5 | 7.5 | 6.0 |
| 6. BAS 106 00 W | 5.04 | 6.5 | 5.5 | 5.0 | 5.5 | 5.0 | 5.0 | 6.0 | 6.5 | 7.0 | 5.5 |
| 7. Ethrel 2S | 2.24 | 8.5 | 9.0 | 8.0 | 8.0 | 8.0 | 7.5 | 8.0 | 7.5 | 8.0 | 8.0 |
| 8. Ethrel 2S | 4.48 | 8.0 | 8.5 | 8.0 | 9.0 | 8.0 | 8.5 | 8.0 | 7.5 | 8.0 | 8.0 |
| 9. Ethrel 2S | 6.72 | 7.5 | 8.5 | 8.0 | 8.5 | 8.5 | 8.0 | 8.5 | 7.5 | 8.0 | 8.0 |
| 10. EL 500 50 W | 0.84 | 6.5 | 6.0 | 5.5 | 6.5 | 6.5 | 7.0 | 7.0 | 7.5 | 8.0 | 6.5 |
| 11. EL 500 50 W | 1.12 | 6.5 | 6.5 | 5.0 | 5.5 | 5.5 | 6.5 | 6.5 | 7.5 | 8.5 | 6.5 |
| 12. EL 500 50 W | 1.40 | 6.0 | 5.5 | 4.5 | 5.0 | 5.0 | 5.0 | 6.0 | 5.5 | 6.5 | 5.5 |
| LSD 0.05 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.5 | 1.5 | 1.0 | 1.5 | 1.5 | 0.5 |

Quality is rated on a scale of 9-1; 9=best quality and 1=dead turf.

## Growth Retardant Study

J. L. Nus and N. E. Christians

Chemically controlling the growth of turfgrass may be desired in several areas. Examples include hillsides on golfcourses, roadside vegetation, and homeowner lawns. Chemically controlling turf may prove to be cost effective along roadsides, improve mowing safety on hillsides, and add to the leisure time of the homeowner.

To be used effectively as a turfgrass growth retardant, chemical products must meet several goals including: reduction in leaf growth and inhibition of seed head formation, as well as the maintenance of tiller, rhizome, and root growth. Treated turf should also retain disease and insect resistance along with aesthetic value.

Embark, N-(2,4-dimethyl-5-)(trifluoromethyl)sulfonyl)amino)-phenyl)acetamide, is produced by the 3-M company and labeled by the EPA as a turf growth retardant. EL-500 alpha-(1-methyethyl)-alpha-(4-trifluoromethoxy)phenyl)-5-pyrimidinemethanol, is an experimental turfgrass growth retardant produced by Elanco. The Growth Retardant Study was initiated at the Iowa State University turf plots to test the effectiveness of EL-500 by itself and in combination with Embark in controlling turfgrass leaf growth and seedhead formation at the possible expense of the aesthetic value of the turf.

The study is located on the newly-expanded area of the turf plots on the Iowa State University Horticultural Research Station. The area was seeded in September, 1981, with Northrup King premium sod blend. At the time of establishment, 1.0 lb of $P_2O_5$ and 0.5 lb of N per 1000 sq. ft. (as triple super phosphate and urea, respectively) were applied to the area. Since establishment, turf has been maintained in lawn condition including 2 inch mowing height, pre- and post-emergent weed control, and regular nitrogen fertilization. No insecticides or fungicides were applied.

The study is arranged as a complete factorial with three rates of EL-500 (12, 16, and 20 ounces of active ingredient per acre) and three levels of Embark (0, 1.0, and 0.5 oz. a.i./A), plus a control treatment receiving neither retardant, as shown in Table 21.

Table 21. Treatment combinations included in the EL-500 X Embark growth retardant study.

| Treatment | Chemical | oz. a.i./A | Chemical | oz. a.i./A |
|---|---|---|---|---|
| 1. | EL 500 | 0 | Embark | 0 |
| 2. | EL 500 | 12 | Embark | 0 |
| 3. | EL 500 | 12 | Embark | 0.5 |
| 4. | EL 500 | 12 | Embark | 1.0 |
| 5. | EL 500 | 16 | Embark | 0 |
| 6. | EL 500 | 16 | Embark | 0.5 |
| 7. | EL 500 | 16 | Embark | 1.0 |
| 8. | EL 500 | 20 | Embark | 0 |
| 9. | EL 500 | 20 | Embark | 0.5 |
| 10. | EL 500 | 20 | Embark | 1.0 |

Treatments were applied in a randomized complete block design, utilizing 3 blocks. Treatments were applied on May 16, 1982, with a pressure-regulated compressed $CO_2$ plot sprayer over each 5 ft by 5 ft plot. When each plot exhibited approximately 1 inch of clippings above the 2 inch mowing height, that plot was mowed and clippings collected and oven-dried. Data were recorded for number of days to each mowing and oven-dried weight of clippings. In addition, seedhead counts and toxicity ratings were recorded for each treatment. Toxicity ratings were represented by a number from 0 to 5, 5 equalling the most toxicity and 0 no apparent toxicity. Data were taken for two months (62 days).

Results are shown in Table 22.

Table 22. The effects of EL-500 and Embark on Kentucky bluegrass.

| Treatment EL-500/EMBARK (oz. a.i. per A) | Average no. of days between mowings | Total clipping weight over 62 days (g) | Average no. of seedheads per plot | Toxicity ratings |
|---|---|---|---|---|
| 1. 0/0 | 5 a | 232 a | 380 a | 0 b* |
| 2. 12/0 | 8 a | 124 b | 176 b | 0 b |
| 3. 12/0.5 | 7 a | 135 ab | 178 b | 1 ab |
| 4. 12/1.0 | 11 a | 145 ab | 49 d | 2 ab |
| 5. 16/0 | 6 a | 166 ab | 195 b | 0 b |
| 6. 16/0.5 | 7 a | 154 ab | 136 bc | 0 ab |
| 7. 16/1.0 | 12 a | 114 b | 50 d | 2 a |
| 8. 20/0 | 8 a | 124 b | 132 bc | 0 b |
| 9. 20/0.5 | 6 a | 108 b | 77 cd | 2 ab |
| 10. 20/1.0 | 7 a | 101 b | 47 d | 1 ab |

* 0=no toxicity; 5= dead turf.

From Table 22, several tentative points can be drawn:

1. All treatments containing EL-500 increase the number of days between mowings, even though the high amount of variability precluded statistical significance.
2. Addition of Embark at the 1.0 oz. a.i./A rate to EL-500 results in an increase in number of days between mowings, although not statistically significant.
3. The number of days between mowings was hard to evaluate and highly variable.
4. All treatments involving EL-500 showed marked decreases in leaf growth versus controls.
5. EL-500 did result in statistically significant seedhead control even without Embark added.
6. Most effective control of seedheads was found with treatments that

had highest rate of Embark.

7. EL-500 by itself at all rates showed no toxicity.
8. Addition of Embark to EL-500 markedly increased toxicity ratings, especially at 1.0 oz. a.i./A rate, where turf quality was judged to be nonacceptable.

It must be emphasized that these results are tentative, and a follow-up study is needed. This experiment exhibited a great deal of unexplained variation which made treatment mean separation difficult even though actual means were widely spaced. Data at recommended rates of EL-500 (1 oz. a.i./A) exhibited expected trends over all measured parameters with additions of Embark. However, at the 12 ounce and 20 ounce a.i. per acre rates of EL-500, the addition of Embark did not exhibit the same consistent trends.

## 1982 Broadleaf Weed Control Studies

A broadleaf weed control study, which included a number of phenoxy and non-phenoxy herbicides, was conducted on Iowa State University campus in 1982. The objective of the investigation was to compare standard broadleaf weed control materials (primarily phenoxy herbicides) to a series of experimental products which have shown some potential as possible substitutes for the phenoxys. Twenty treatments were included in the study (Table 23).

Treatments 2 through 6 were granular products supplied by the Andersons Company of Maumee, Ohio. These materials included 3 CF/dicamba products which are a combination of chloroflurenol (CF), a plant growth retardant, and dicamba, a benzoic acid herbicide commonly used in turf. These three materials are being tested by the Andersons at a number of locations in the midwest as possible substitutes for 2,4-D. Treatments 7, 8, and 10, products of the Diamond Shamrock Corporation, and treatment 9, a Dow Chemical formulation of 2,4-D, are standard broadleaf weed control products. Treatments 13 and 14 include dicamba and embark, a commercially available plant growth regulator from the 3M Corporation. Treatments 15 through 20 include 2 Du Pont products, at 3 rates each, which are presently being tested as substitutes for the phenoxy herbicides.

The site chosen for the comparisons was a Kentucky bluegrass (*Poa pratensis*) lawn area on Iowa State University campus which had not previously been treated with broadleaf weed controls and which was heavily infested with broadleaf weeds. The primary species of weeds at this location were dandelion (*Taraxacum officinale*), broadleaf

Table 23. Treatments applied in the 1982 Broadleaf Weed Control Studies.

| Treatment | | lb/ai/A | Material/ Plot | Water applied to plot |
|---|---|---|---|---|
| | | | | -ml- |
| 1. | Control | | --- | --- |
| 2. | CF/Dicamba | 0.25 + 0.1575 (G) | 79.5 g | --- |
| 3. | CF/Dicamba | 0.25 + 0.125 (G) | 79.5 g | --- |
| 4. | CF/Dicamba | 0.15 + 0.1575 (G) | 79.5 g | --- |
| 5. | 2,4-D/MCPP | 1.5 + 1.5 (G) | 79.5 g | --- |
| 6. | 2,4-D/MCPP/Dicamba | 1.51 + 0.68 + 0.157 (G) | 79.5 g | --- |
| 7. | 2,4-D/MCPP | 1.5 + 1.5 | 6.5 ml | 379 |
| 8. | Dacamine 360D | 0.873 | 1.3 ml | 379 |
| 9. | Formula 40 | 3.0 | 3.3 ml | 379 |
| 10. | Low Vol 4D | 0.95 | 1.1 ml | 379 |
| 11. | 2,4-D/MCPP/Dicamba | 1.51 + 0.80 + 0.156 | 3.2 ml | 379 |
| 12. | Dicamba | 0.1575 | 0.17 ml | 379 |
| 13. | Embark/Dicamba | 0.031 + 0.1575 | 0.067 + 0.17 ml | 379 |
| 14. | Embark/Dicamba | 0.063 + 0.1575 | 0.135 + 0.17 ml | 379 |
| 15. | Glean 75 | 0.063 | 0.043 g | 379 |
| 16. | Glean 75 | 0.126 | 0.086 g | 379 |
| 17. | Glean 75 | 0.189 | 0.129 g | 379 |
| 18. | DPX-6376 75 | 0.063 | 0.043 g | 379 |
| 19. | DPX-6376 75 | 0.126 | 0.086 g | 379 |
| 20. | DPX-6376 75 | 0.189 | 0.129 g | 379 |

plantain (Plantago major), white clover (Trifolium repens) and black medic (Medicago lupulina). The area was maintained at a 3 inch mowing height throughout the season. No fertilizer beyond that added in the test was applied to the area.

Study I.

The twenty treatments were first applied on May 27, 1982, in 4 replications. An unforecasted rain of 1/2 " fell shortly after the last treatments were completed. Unexpected rainfall shortly after application is not an unusual occurrence in the turfgrass industry. Therefore, rather than discontinue the test, it was decided that data would be collected on the site to compare efficacy of the various materials following a rain.

Study II.

A second area was chosen adjacent to the first study and the same treatments were applied, in 4 replications, on June 16. The weather was clear with a temperature of $75^{\circ}$F. There had been a 1 1/2 " rain 24 hours prior to treatment. No rain occurred for several days following application.

In both studies the plots measured 10' X 5'. The granular products were weighed to the closest 1/10th gram and applied with hand held containers. The liquid materials were applied with a carbon dioxide powered sprayer designed to apply exact quantities of liquids to small plots.

## Results

Study I.

Table 24 contains information on comparative weed response at 7 days, phytotoxicity on turf at 19 days, and weed control, for the first broadleaf control study. Weed counts were made on August 2, 1981, 68 days after application.

At 7 days, weeds were beginning to show signs of damage in several of the treatments. The CF/dicamba (0.25/0.125) treatment (#3), the granular trimec treatment (#6), the liquid 2,4-D/MCPP treatment (#7), and the liquid trimec treatment (#11) demonstrated greatest activity at this date. Although further damage was apparent at 14 days, the greatest activity at that time was still present in the above mentioned treatments.

By the 19th day, phytotoxicity on the Kentucky bluegrass was readily visible only on the plots treated with the 3 DPX-6376 compounds. Damage from these 3 materials was visible throughout the 1982 season.

All treatments reduced the populations of dandelions in spite of the fact that rain had occurred shortly after application. The Du Pont products, Glean and DPX-6376, were very effective. The effectiveness of Formula 40 (#9) was considerably reduced by the rain as was the effectiveness of the 3 liquid dicamba treatments (12, 13 and 14). The 5 granular treatments (2, 3, 4, 5, and 6) were surprisingly effective, with most of these treatments reducing dandelion populations 73 to 90%.

Table 24. Results of the initial postemergence, broadleaf weed control study.

| | Treatments | lb ai/A | Effect on Weeds 7 days | Effect on Turf 19 days | Dandelions |
|---|---|---|---|---|---|
| | | | | | -Number/plot- |
| 1. | Control | ---- | 1 | 9 | 30 |
| 2. | CF/Dicamba * | 0.25/0.1575 (G) | 3 | 9 | 6 |
| 3. | CF/Dicamba | 0.25/0.125 (G) | 4 | 9 | 3 |
| 4. | CF/Dicamba | 0.15/0.1575 (G) | 3 | 9 | 7 |
| 5. | 2,4-D/MCPP | 1.5/1.5 (G) | 3 | 9 | 8 |
| 6. | 2,4-D/MCPP/Dic. | 1.51/0.68/0.157 (G) | 4 | 9 | 3 |
| 7. | 2,4-D/MCPP | 1.5/1.5 | 4 | 9 | 3 |
| 8. | Dacamine 360D | 0.873 | 2 | 9 | 4 |
| 9. | Formula 40 | 3.0 | 2 | 9 | 21 |
| 10. | Low Vol 4D | 0.95 | 3 | 9 | 0 |
| 11. | 2,4-D/MCPP/Dic.** | 1.51/0.80/0.156 | 4 | 9 | 2 |
| 12. | Dicamba | 0.1575 | 3 | 9 | 15 |
| 13. | Embark/Dic. | 0.031/0.1575 | 3 | 9 | 16 |
| 14. | Embark/Dic. | 0.063/0.1575 | 2 | 9 | 14 |
| 15. | Glean 75 | 0.063 | 2 | 9 | 1 |
| 16. | Glean 75 | 0.126 | 2 | 9 | 0 |
| 17. | Glean 75 | 0.189 | 3 | 8 | 0 |
| 18. | DPX-6376 75 | 0.063 | 3 | 7 | 0 |
| 19. | DPX-6376 75 | 0.126 | 3 | 6 | 0 |
| 20. | DPX-6376 75 | 0.189 | 2 | 5 | 0 |
| | LSD 0.05 | | 2 | 2 | 7 |

* Treatments 2, 3, 4, 5, and 6 include 28-3-9 fertilizer applied at a rate of 1 lb N/1000 $ft^2$.

** Trimec Liquid

Study II.

Twenty four hours following application of treatments in the second study, weeds began showing signs of damage (Table 25). Again the CF/Dicamba (0.25/0.125) (#3) and liquid Trimec (#11) treatments demonstrated good initial phytotoxicity symptoms on weeds. By the seventh day, weeds in the plots treated with the 2,4-D/MCPP liquid material (#7) and the Formula 40 (#9) were beginning to also show signs of herbicide toxicity.

Phytotoxicity on the turf was evaluated at termination of the study on August 2, 48 days after treatment. Glean at the highest rate produced unacceptable phytotoxicity, as did DPX-6376 at the two highest rates. The DPX-6376 totally eliminated the bluegrass at the highest rate. Some visible damage was observed on plots treated with 2,4-D/MCPP (1.5/1.5) (#7). This damage was apparent throughout the season, but was not severe.

Prior to treatment, counts were made of all weeds in each plot. At termination on August 2 the counts were repeated. The weed control data in Table 2 was derived by calculating the % reduction in weed populations within the individual plots. The 2,4-D/MCPP (#7), Dacamine 360D (#8), Low Vol 4D (#10), Trimec (#11), Glean (#15, 16, 17) and DPX-6376 (#18, 19, 20) treatments each provided 100 % control of dandelions. Formula 40 (#9), with 95 % control, the embark/dicamba (0.063/0.1575) (#14), the 2,4-D/MCPP granular (#5) and the CF/Dicamba (0.25/0.1575) (#2) provided satisfactory control, with all other treatments demonstrating a less than satisfactory control.

The CF/dicamba and embark/dicamba were not effective in the control of plantain and white clover. Likewise Glean, with the

Table 25. Results of the second application of the postemergence, broadleaf weed control study.

| | Treatments | lb ai/A | Effect on Weeds 1 day | Effect on Weeds 2 days | Effect on Turf 48 days | Dande-lion | Plant-ain | White Clover |
|---|---|---|---|---|---|---|---|---|
| | | | | | | % | | |
| 1. | Control | ----- | 1 | 1 | 9 | 0 | 0 | 0 |
| 2. | CF/Dicamba* | 0.25/0.1575 (G) | 2 | 3 | 9 | 70 | 0 | 53 |
| 3. | CF/Dicamba | 0.25/0.125 (G) | 3 | 4 | 9 | 51 | Nd+ | 65 |
| 4. | CF/Dicamba | 0.15/0.1575 (G) | 2 | 3 | 9 | 56 | 33 | 0 |
| 5. | 2,4-D/MCPP | 1.5/1.5 (G) | 2 | 2 | 9 | 74 | 0 | Nd |
| 6. | 2,4-D/MCPP/Dic. | 1.51/0.68/0.157 (G) | 2 | 3 | 9 | 58 | Nd | 0 |
| 7. | 2,4-D/MCPP | 1.5/1.5 | 2 | 5 | 8 | 100 | 100 | 100 |
| 8. | Dacamine 360D | 0.873 | 2 | 3 | 9 | 100 | 100 | Nd |
| 9. | Formula 40 | 3.0 | 3 | 5 | 9 | 95 | 100 | 66 |
| 10. | Low Vol 4D | 0.95 | 3 | 3 | 9 | 100 | 100 | 0 |
| 11. | 2,4-D/MCPP/Dic.** | 1.51/0.80/0.156 | 3 | 5 | 9 | 100 | 100 | 100 |
| 12. | Dicamba | 0.1575 | 2 | 2 | 9 | 54 | 11 | Nd |
| 13. | Embark/Dic. | 0.031/0.1575 | 2 | 2 | 8 | 51 | 17 | Nd |
| 14. | Embark/Dic. | 0.063/0.1575 | 2 | 3 | 9 | 77 | 66 | 33 |
| 15. | Glean 75 | 0.063 | 1 | 2 | 8 | 100 | 0 | Nd |
| 16. | Glean 75 | 0.126 | 1 | 2 | 7 | 100 | 0 | Nd |
| 17. | Glean 75 | 0.189 | 1 | 3 | 5 | 100 | 100 | 100 |
| 18. | DPX-6376 75 | 0.063 | 1 | 2 | 8 | 100 | 100 | 100 |
| 19. | DPX-6376 75 | 0.126 | 1 | 3 | 4 | 100 | 100 | 100 |
| 20. | DPX-6376 75 | 0.189 | 1 | 2 | 1 | 100 | 100 | 100 |
| | LSD 0.05 | | 2 | 3 | 1 | 30 | 39 | 25 |

* Treatments 2, 3, 4, 5, and 6 include 28-3-9 fertilizer applied at a rate of 1 lb. N/1000 $ft^2$; treatments 8, 9, and 10 also received 1 lb N/1000 $ft^2$ from the same fertilizer source.

** Trimec Liquid

\+ Nd= No data due to lack of weeds in these plots.

exception of the high rate did not give satisfactory control of these species. In general, the 2,4-D materials were quite effective in controlling plantain. However, white clover was controlled with these products only when they were combined with MCPP.

The phenoxy herbicides, 2,4-D and MCPP provided the best weed control, with the least phytotoxicity to Kentucky bluegrass. DPX-6376 was an effective weed control, but proved to be too phytotoxic on bluegrass. Glean shows promise; however, the rate must be carefully controlled to prevent damage to bluegrass. The CF/dicamba materials are safe for use on bluegrass, but provided a lower percentage of weed control in these studies. More work on formulation and rate will be required with this material; however, it shows some potential as a substitute for 2,4-D, in the event that 2,4-D would be removed from the market at some future time. The addition of embark at 0.063 lb a.i./acres to dicamba increased the control of both dandelion and plantain, as compared to dicamba alone in the second study. Again, more information on rate and formulation would be required on this combination.

## 1982 Preemergence Weed Control Studies

A series of experimental preemergence weed control materials were compared to a number of standard, commercially available, preemergent herbicides in the 1982 season. The materials were applied in two locations. The first study was located on an unused, golf course fairway on ISU campus and the second study at the Horticultural Research Station north of Ames.

The 27 treatments included in these two evaluations are listed in Table 26. The Ronstar--Pel-Tech material is an experimental product of the Andersons Company. It is formulated as a water dispersable pellet similar to the Benefin--Pel-Tech, which is already available in Iowa. The active ingredient of this product is oxadiazon, the active ingredient of Ronstar G. The Ronstar 50% wettable powder (WP) is an experimental product of Rhone Poulenc, Inc. Again, oxadiazon is the active ingredient. The Benefin--Pel-Tech 20 is an experimental formulation of the standard Benefin--Pel-Tech 10. The ANDG-1-82 material is another experimental from the Andersons, active ingredient unavailable. The Dacthal 6 is a flowable formulation of Diamond Shamrock's Dacthal. The Balan 2.5 G (active ingredient benefin) and the Betasan 4 E (Betamec 4) are commonly used preemergence herbicides.

The Pel-Tech materials were allowed to dissolve in water for 24 hours prior to application. All liquid materials were applied with a $CO_2$ research plot sprayer in 3.5 gallons of water/1000 $ft^2$ (with the exception of the low volume Ronstar 50% wettable powder treatment). Granular materials were applied with hand held containers. All research plots measured 5' X 5'.

Table 26. Treatments used in the 1982 preemergence herbicide study.

| | Treatments | lb ai/A | Water GPA | Chemical | Water mls/plot |
|---|---|---|---|---|---|
| 1. | Control | - | - | - | - |
| 2. | Ronstar--Pel-Tech 20 | 1 | 150 | 1.3 g | 326 |
| 3. | Ronstar--Pel-Tech 20 | 1½ | 150 | 2.0 g | 326 |
| 4. | Ronstar--Pel-Tech 20 | 2 | 150 | 2.6 g | 326 |
| 5. | Ronstar--Pel-Tech 20 | 3 | 150 | 3.9 g | 326 |
| 6. | Ronstar--Pel-Tech 20 | 4 | 150 | 5.2 g | 326 |
| 7. | Control | - | - | - | - |
| 8. | dropped | - | - | - | - |
| 9. | Control | - | - | - | - |
| 10. | Ronstar 50% WP | 2 | 150 | 1.05 g | 326 |
| 11. | Ronstar 50% WP | 3 | 150 | 1.6 g | 326 |
| 12. | Ronstar 50% WP | 4 | 150 | 2.1 g | 326 |
| 13. | Ronstar 50% WP* | 3 | 30 | 1.6 g | 65 |
| 14. | Ronstar G | 3 | - | 39.0 g | - |
| 15. | Benefin--Pel-Tech 20 | 2 | 150 | 2.6 g | 326 |
| 16. | Benefin--Pel-Tech 20 | 2 + 1½ | 150 | 2.6 + 2.0 g | 326 |
| 17. | Benefin--Pel-Tech 10 | 2 | 150 | 5.2 g | 326 |
| 18. | ANDG-1-82 16 | 1 | 150 | 1.6 g | 326 |
| 19. | ANDG-1-82 16 | 2 | 150 | 3.2 g | 326 |
| 20. | ANDG-1-82 80 | 1 | 150 | 0.3 g | 326 |
| 21. | Dacthal W-75 | 10.5 | 150 | 3.7 g | 326 |
| 22. | Dacthal W-75 | 10.5 + 7.5 | 150 | 3.7 + 2.6 g | 326 |
| 23. | Dacthal 6 (flo) | 7.5 | 150 | 2.7 ml | 326 |
| 24. | Dacthal 6 (flo) | 10.5 | 150 | 3.8 ml | 326 |
| 25. | Balan 2.5 G | 2 | - | 20.8 g | - |
| 26. | Balan 2.5 G | 2 + 1½ | - | 20.8 + 15.6 g | - |
| 27. | Betasan 4E | 7.5 | 150 | 4.2 ml | 326 |

* Applied in .68 gal water/1000 $ft^2$

The treatments were applied on April 30 at the golf course location and May 3 at the research station. Follow up applications for treatments 16, 22, and 26 on both areas, were made on June 4. The golf course area had not been treated with preemergents for several years and natural populations of annual weeds were quite high. The area at the research station was seeded with one pound crabgrass (Digitaria sanguinalis) seed/1000 $ft^2$, 1/2 pound goosegrass (Eleusine indica) seed/1000 $ft^2$ and 1/2 pound spurge (Euphorbia spp) seed/1000 $ft^2$. Germination of the weed seed at the research station was very poor. The results of phytotoxicity evaluations will be the only data reported from the research station location.

## Results

Phytotoxicity evaluations were made on three dates at the golf course area (Table 27) and on two dates at the research station location (Table 28). Plots treated with the Ronstar 50% WP material showed initial damage on May 7, shortly after treatment. This damage was still readily visible on June 4. At the research station, initial damage from the Ronstar 50% WP was not visible on May 8 and on June 4 damage was apparent only on the plots treated with 4 lb a.i./acre.

The grass on the golf course area was a common Kentucky bluegrass which had been established for several years. The grass at the research station was a one year old stand of the following improved cultivars of Kentucky bluegrass: Glade, Parade, Aquila, and Adelphi. It is not unusual to see variations in phytotoxicity among cultivars and it is quite likely that most of the variation between areas can be

Table 27. Results of the 1982 preemergence weed control study at golf course location.

| | Treatments | lb ai/A | Phytotoxicity | | | Weed Counts | |
|---|---|---|---|---|---|---|---|
| | | | May 7 | May 11 | June 4 | Crab-grass | Prostrate Spurge |
| 1. | Control | - | 1** | 1 | 1 | 98 | 2 |
| 2. | Ronstar--Pel-Tech 20 | 1 | 1 | 1 | 1 | 19 | 2 |
| 3. | Ronstar--Pel-Tech 20 | 1½ | 1 | 1 | 1 | 4 | 3 |
| 4. | Ronstar--Pel-Tech 20 | 2 | 1 | 1 | 1 | 2 | 1 |
| 5. | Ronstar--Pel-Tech 20 | 3 | 1 | 1 | 1 | 6 | 0 |
| 6. | Ronstar--Pel-Tech 20 | 4 | 1 | 1 | 1 | 0 | 0 |
| 7. | Control | - | 1 | 1 | 1 | 84 | 4 |
| 8. | dropped | - | - | - | - | - | - |
| 9. | Control | - | 1 | 1 | 1 | 84 | 0 |
| 10. | Ronstar 50% WP | 2 | 3 | 3 | 2 | 3 | 3 |
| 11. | Ronstar 50% WP | 3 | 3 | 3 | 4 | 0 | 2 |
| 12. | Ronstar 50% WP | 4 | 3 | 3 | 3 | 1 | 2 |
| 13. | Ronstar 50% WP* | 3 | 3 | 3 | 1 | 2 | 3 |
| 14. | Ronstar G | 3 | 1 | 1 | 1 | 1 | 4 |
| 15. | Benefin--Pel-Tech 20 | 2 | 1 | 1 | 1 | 52 | 2 |
| 16. | Benefin--Pel-Tech 20 | 2 + 1½ | 1 | 1 | 1 | 4 | 0 |
| 17. | Benefin--Pel-Tech 10 | 2 | 1 | 1 | 1 | 16 | 4 |
| 18. | ANDG-1-82 16 | 1 | 5 | 5 | 1 | 107 | 1 |
| 19. | ANDG-1-82 16 | 2 | 6 | 6 | 1 | 134 | 2 |
| 20. | ANDG-1-82 80 | 1 | 6 | 6 | 1 | 166 | 2 |
| 21. | Dacthal W-75 | 10.5 | 1 | 1 | 1 | 1 | 1 |
| 22. | Dacthal W-75 | 10.5 + 7.5 | 1 | 1 | 1 | 0 | 0 |
| 23. | Dacthal 6 (flo) | 7.5 | 1 | 1 | 1 | 5 | 0 |
| 24. | Dacthal 6 (flo) | 10.5 | 1 | 1 | 2 | 1 | 0 |
| 25. | Balan 2.5 G | 2 | 1 | 1 | 1 | 16 | 4 |
| 26. | Balan 2.5 G | 2 + 1½ | 1 | 1 | 1 | 4 | 0 |
| 27. | Betasan 4E | 7.5 | 1 | 2 | 1 | 1 | 1 |
| | LSD | | 1 | 1 | 1 | 53 | 3 |

* Applied in .68 gal water/1000 $ft^2$
** 1=no damage; 9=dead turf

Table 28. Results of the 1982 preemergence weed control study at the Horticultural Research Station.

| | Treatment | lb ai/A | May 8 | June 4 |
|---|---|---|---|---|
| 1. | Control | - | 1 | 1 |
| 2. | Ronstar--Pel-Tech 20 | 1 | 1 | 1 |
| 3. | Ronstar--Pel-Tech 20 | 1½ | 1 | 1 |
| 4. | Ronstar--Pel-Tech 20 | 2 | 1 | 1 |
| 5. | Ronstar--Pel-Tech 20 | 3 | 1 | 1 |
| 6. | Ronstar--Pel-Tech 20 | 4 | 1 | 1 |
| 7. | Control | - | 1 | 1 |
| 8. | dropped | - | - | - |
| 9. | Control | - | 1 | 1 |
| 10. | Ronstar 50% WP | 2 | 1 | 1 |
| 11. | Ronstar 50% WP | 3 | 1 | 1 |
| 12. | Ronstar 50% WP | 4 | 1 | 4 |
| 13. | Ronstar 50% WP* | 3 | 1 | 1 |
| 14. | Ronstar G | 3 | 1 | 1 |
| 15. | Benefin--Pel-Tech 20 | 2 | 1 | 1 |
| 16. | Benefin--Pel-Tech 20 | 2 + 1½ | 1 | 1 |
| 17. | Benefin--Pel-Tech 10 | 2 | 1 | 1 |
| 18. | ANDG-1-82 16 | 1 | 4 | 1 |
| 19. | ANDG-1-82 16 | 2 | 6 | 1 |
| 20. | ANDG-1-82 80 | 1 | 6 | 1 |
| 21. | Dacthal W-75 | 10.5 | 1 | 1 |
| 22. | Dacthal W-75 | 10.5 + 7.5 | 1 | 1 |
| 23. | Dacthal 6 (flo) | 7.5 | 1 | 1 |
| 24. | Dacthal 6 (flo) | 10.5 | 1 | 1 |
| 25. | Balan 2.5 G | 2 | 1 | 1 |
| 26. | Balan 2.5 G | 2 + 1½ | 1 | 1 |
| 27. | Betasan 4E | 7.5 | 1 | 1 |
| | LSD 0.05 | | 1 | 1 |

* Applied in .68 gal water/1000 $ft^2$

attributed to cultivar differences.

The ANDG-1-82 material proved to be quite phytotoxic at both locations. This material was also observed to inhibit seed head formation of Kentucky bluegrass at both sites.

Between May 1 and May 22, 7 1/2 inches of rain were recorded in the Ames area. The entire season was unusually moist and as a result crabgrass infestations were quite high.

The Ronstar--Pel-Tech 20 material was very effective at controlling crabgrass at all rates above 1 lb a.i./A. The one pound rate of this material reduced crabgrass populations as compared to the control, however populations of this weed were unacceptably high in plots treated with the single one pound application.

The Ronstar 50% WP was effective at controlling crabgrass at all rates. Ronstar G was also quite effective.

The Benefin--Pel-Tech 20 was not effective in controlling crabgrass at the two pound rate (single application). When followed up on June 4 with an additional 1 1/2 pound application, this material was very effective. The Benefin--Pel-Tech 10 was only moderately effective at the two pound rate. Identical results were observed on the plots treated at these same rates with granular Benefin (Balan) (treatments 25 and 26).

Crabgrass populations were higher than the controls on the areas treated with ANDG-1-82. This can be attributed, at least in part, to a growth inhibiting effect observed on the Kentucky bluegrass within treated plots. The growth inhibition apparently reduced the competitive advantage of the bluegrass at the time of crabgrass germination.

Dacthal was effective in controlling crabgrass at all rates, with the flowable formulation being as effective as the 75% WP formulation.

The standard Betasan 4 E product (Betamec-4) was effective in controlling crabgrass.

Lower populations, and greater variability make it more difficult to interpret the prostrate spurge control data. The higher rates of Ronstar--Pel-Tech 20 appear to have provided satisfactory control. Dacthal, which has been shown to be effective against this weed in the past, also provided good control. No spurge could be found in plots treated with Benefin (both liquid and granular) at the 2 + 1 1/2 lb a.i./A application rate (#16 and 26).

Of the experimental products tested, the Ronstar--Pel-Tech 20 and the Dacthal flowable show the greatest potential for commercial release. In another, unreplicated demonstration the Ronstar--Pel-Tech at 2 lb a.i./A gave very good season long control, where single applications of Dacthal at 10.5 lb a.i./A and Benefin--Pel-Tech at 2 lb a.i./A showed some loss of activity due to the high rainfall.

One problem that has been observed with the Ronstar (oxadiazon) in the past has been late season phytotoxicity when the bluegrass comes under moisture stress. There was no late season moisture stress in central Iowa this summer, and further testing of this product is recommended prior to release.

## Tall Fescue Phytotoxicity Screening Study

The five granular postemergence weed control products from the Andersons Company, which were included in the 1982 broadleaf weed control study, were also applied to a one year old stand of Kentucky 31 tall fescue in order to evaluate phytotoxicity.

Table 29. Treatments included in the tall fescue phytotoxicity evaluations.

| Treatment | lb ai/A | Material plot |
|---|---|---|
| 1. Control | | -- |
| 2. CF/Dicamba* | 0.25 + 0.1575 (G) | 79.5 g |
| 3. CF/Dicamba | 0.25 + 0.125 (G) | 79.5 g |
| 4. CF/Dicamba | 0.15 + 0.1575 (G) | 79.5 g |
| 5. 2,4-D/MCPP | 1.5 + 1.5 (G) | 79.5 g |
| 6. 2,4-D/MCPP/Dicamba | 1.51 + 0.68 + 0.157 (G) | 79.5 g |

* All materials were applied as granules to wet tall fescue turf moved to a 3" mowing height.

The study was conducted in three replications on plots measuring 5' X 10'. Treatments were applied on June 9, 1982, on a clear day, with a temperature of 75°F. Each plot was moistened prior to application to assure that the granular particles remained on leaf tissue. The area was irrigated 72 hours after application. The turf was actively growing throughout the study.

Observations were made at 2 days, 5 days, 7 days, 14 days, and at 1 month. No visible symptoms of damage on tall fescue were observed on these dates from any of the products.

## 1982 Postemergence Annual Weed Control Study

In 1982, a postemergence weed control study was conducted at the North Dakota Avenue Cemetery in West Ames. The Kentucky bluegrass on this area was established more than forty years ago and no herbicides have been used on the site. There is a uniform stand of bluegrass which is heavily infested with crabgrass and dandelions.

The treatments include Daconate 6 (MSMA) in single and repeat applications and a combination of Daconate 6 with a MCPP + 2,4-D-Amine broadleaf weed control (Table 30). All treatments were applied in 3 gal water/1000 $ft^2$. The plots measured 5' x 5'. The first treatments were applied on 6/16/82, 24 hours after a 1.5 inch rainfall. The crabgrass was in the 2 to 3 leaf stage and the broadleaf weeds were actively growing.

The first evaluations of phytotoxicity were made 24 hours after application. At that time, there was no visible evidence of phytotoxicity on the Kentucky bluegrass. The dandelions were beginning to curl after only 24 hours. A second evaluation was made at 72 hours on 6/19 (Table 30). On this date, and again on 6/29, some visible phytotoxicity was apparent on the Kentucky bluegrass in plots treated with Daconate 6 and MCPP + 2,4-D (treatments 2 and 3). No damage was present on the bluegrass in any of the other plots following either of the applications of Daconate 6.

Evaluation of weed control were performed on July 7, 1982. All treatments reduced crabgrass and dandelion population in comparison to the control at this location (Table 30). There were no differences among treatments with regard to crabgrass control, as would be expected. There were also no real differences in dandelion control among the treatments. It would have been expected that the addition of the MCPP + 2,4-D would have provided much better control of broadleaves than the Daconate 6 alone. In this study, however, Daconate 6 alone showed a 91-92 percent control of dandelions. There were no broadleaf weeds in plots treated with the Daconate 6 and 2,4-D + MCPP combination.

Table 30. Postemergence weed control data from the 1982 study at the North Dakota Avenue Cemetery in West Ames.

| Treatment | Rate | Date of App. | Phytotoxicity 6/19 | Phytotoxicity 6/29 | Crabgrass | Dandelion |
|---|---|---|---|---|---|---|
| 1. Control | - | - | 1** | 1 | 0 | 0 |
| 2. Daconate 6*+ | 2 | 5/16 | 2 | 2 | 96 | 100 |
| MCPP + 2,4-D Amine | 2 | | | | | |
| Daconate 6 (10 days later) | 2 | 5/26 | | | | |
| 3. Daconate 6 + | 2 | 5/16 | 2 | 2 | 97 | 100 |
| MCPP + 2,4-D Amine | 3 | | | | | |
| Daconate 6 (10 days later) | 2 | 5/26 | | | | |
| 4. Daconate 6 | 2 | 5/16 | 1 | 1 | 92 | 91 |
| 5. Daconate 6 | 2 | 5/16 | 1 | 1 | 94 | 92 |
| Daconate 6 (10 days later) | 2 | 5/26 | | | | |
| LSD 5% | | | 1 | 1 | 21 | 35% |

*All treatments were applied in 3 gal water per 1000 $ft^2$. Plot size = 5' x 5'.

**On a scale of 9-1; 1 = no damage, 9 = dead turf.

# Origin of Increased Ethylene Concentration Associated with the Development of Leaf Spot in Kentucky Bluegrass 'Newport'

by

L. W. Coleman and Clinton Hodges

Leaf spot results in increased levels of ethylene found within infected leaves of Kentucky bluegrass 'Newport'. The elevated ethylene concentration is observed 12 h after inoculation and occurs prior to observable lesions.

It is necessary to understand how ethylene is formed and what role, if any, ethylene plays in disease development before attempts are made to control leaf spot or other diseases by manipulating the physiological status of the plant.

Currently, a method is available that detects the activity of the enzyme thought to control the formation of ethylene in plants. Preliminary work indicates that the determination of the origin of ethylene from vegetative tissue may be difficult. With modification of the current method, it is hoped that the source of ethylene associated with disease can be found.

If the source of ethylene in diseased tissue is learned, and if ethylene proves to be a significant factor in the development of disease, then treatments designed to minimize its effects can be developed.

However, if ethylene plays only an insignificant role in disease expression, then it will be necessary to continue searching for factors that cause plant injury.

## LATE FALL FERTILIZATION STUDY

by

Norman Hummel

In this experiment nine N fertilization programs are being compared for late fall fertilization. The treatments are listed below:

| Treatment Number | Approximate Time of Application | | | | |
|---|---|---|---|---|---|
| | April 20 | June 1 | August 10 | Sept 20 | Nov 10 |
| 1 | 1.25 urea | 1.0 urea | 0.75 urea | 1.0 urea | 0 |
| 2 | 0 | 1.0 urea | 0.75 urea | 1.0 urea | 1.25 urea |
| 3 | 0 | 1.0 urea | 0.75 urea | 1.0 urea | 1.25 CIL |
| 4 | | 2.0 CIL* | 0 | 1.0 urea | 1.00 urea |
| 5 | 0 | 1.0 CIL | 2.00 CIL | 0 | 1.00 CIL |
| 6 | 0 | 2.0 AIM+ | 0 | 2.0 AIM | 0 |
| 7 | | 0 | 2.00 AIM | 0 | 2.00 AIM |
| 8 | 0 | 1.0 urea | 0.75 urea | 1.0 urea | 1.50 IBDU |
| 9 | 1.50 IBDU# | 0 | 0 | 1.0 urea | 1.50 IBDU |

* Sulfur-coated urea manufactured by Canadian Industries Limited
\+ Sulfur-coated urea manufactured by Lakeshore Equipment & Supply Co.
\# Isobutylidenediurea distributed by Par Ex

The test was begun on September 30, 1982, when the first fertilizer treatments were applied. Plot size is 4 x 8 feet. The late fall treatments were applied on November 10. Since most of the September treatments were 1.0 lb N from urea, no data has been collected to date. There were no observed differences between the 1.0 urea and the 2.0 AIM treatments.

Data to be collected include bimonthly assessments of color and bimonthly determination of fresh weight clipping yields. Yields will be obtained by making a single pass up the center of each plot using a rotary mower. Clippings will be collected and weighed.

# NITROGEN FERTILIZATION STUDY

by

Norman Hummel

In this experiment five nitrogen sources are being evaluated at different rates and timings of application for maintenance fertilization of Kentucky bluegrass turf. The treatments include Lakeshore sulfur-coated urea (SCU), Andersons SCU, IBDU, and Ureaform applied at 2, 3, and 4 lb of N/1000 sq ft/year. The treatments were either applied in one or split into two applications. Urea was applied at 2, 3, and 4 lb N/1000 sq ft/year split into four applications.

The highest color ratings following the first fertilization were produced by the Andersons SCU when applied at the 2 and 3 lb rates. Dark green color was also produced by the highest rate of urea and the 3 lb rate of Lakeshore SCU.

Acceptable color was produced by ureaform at the 2 and 3 lb rates. However, color response was initially slow on plots fertilized with ureaform at the 1 lb N rate.

Poorest initial response to fertilization occurred on plots fertilized with IBDU, at all rates. Two weeks after fertilization, color ratings from IBDU plots tended to be no higher than the check plots. Three weeks after fertilization, however, color on IBDU plots was acceptable and continued to improve for several weeks, especially at the higher rates. Through the summer, IBDU at the two and three pound rates produced excellent color.

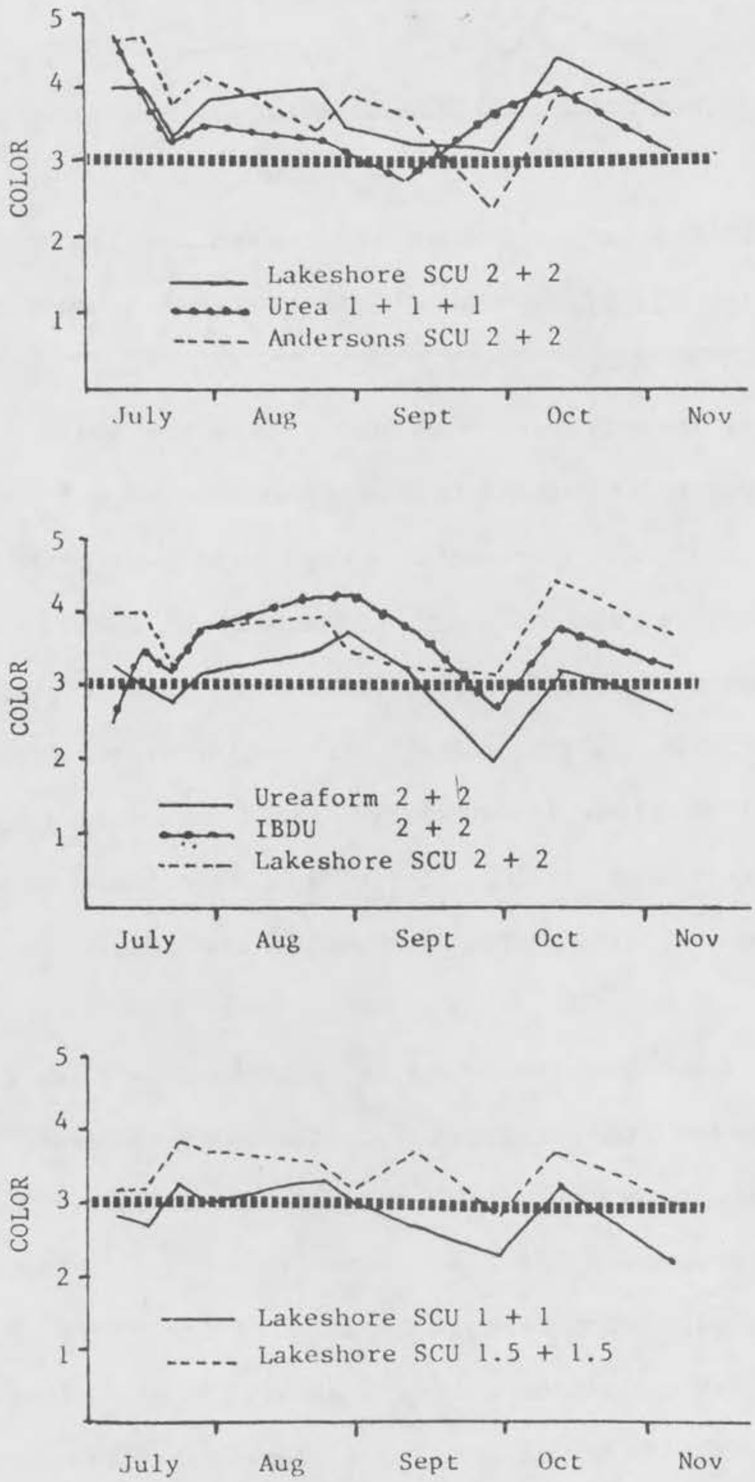
Good color was maintained throughout the summer for all treatments, except for those that did not receive a spring application of N. In early September (9/9), most of the Lakeshore SCU and IBDU treatments continued to produce good color (Figure 1). However, most of the ureaform treatments and the 1 lb rate of the Anderson's SCU did not provide acceptable color. Three months after fertilization (9/27), the only treatments that produced acceptable color were the Lakeshore SCU treatments applied at 2 and 3 lb N/1000 sq ft in the spring.

These results suggest that the Anderson's SCU is a quicker releasing material than the Lakeshore SCU (Figure 1). Although clipping yields were not taken, it was observed that the dark green color produced by Anderson's SCU after fertilization was accompanied by much topgrowth. Use of the Anderson's SCU may necessitate splitting the annual rate of N into three applications to produce uniform quality turf without producing excessive growth.

Although it required more applications, urea, even at the lowest rate, produced turf of acceptable quality throughout most of the season.

It is impossible to draw any valid conclusions from the first year's data. Since many treatments received high rates of N in the fall rather than spring, observations need to be made this spring and summer to compare various treatments. It is also expected that more differences will be observed in the future as the inherent soil N is depleted.

Figure 1:


5
4
3
2
1
COLOR
Lakeshore SCU 2 + 2
Urea 1 + 1 + 1
Andersons SCU 2 + 2
July
Aug
Sept
Oct
Nov
5
4
3
2
1
COLOR
Ureaform 2 + 2
IBDU 2 + 2
Lakeshore SCU 2 + 2
July
Aug
Sept
Oct
Nov
5
4
3
2
1
COLOR
Lakeshore SCU 1 + 1
Lakeshore SCU 1.5 + 1.5
July
Aug
Sept
Oct
Nov

# INSECTICIDE SCREENING FOR WHITE GRUB

by

Norman Hummel and Donald Lewis

Several insecticides were screened for control of the masked chafer white grub (Cyclocephala spp.). This study was conducted at the Logan-Missouri Valley Country Club, Harrison County, Iowa.

In 1982, two new insecticides received labels for white grub control in Iowa: Oftanol 5G (Mobay Chemical Corporation) and Turcam 80SP (BFC Chemicals Inc). An experimental compound (Ciba-Geigy 12223; Triumph) is expected to be released soon. Diazinon and Dursban are insecticides that have a tendency to tie up in thatch, thus decreasing their effectiveness. By applying them in conjunction with a wetting agent, it was hoped that the insecticides could be moved to the rootzone where the grubs are feeding. These, and other insecticides, were applied on August 5, 1982. The treatments are listed in table 31.

Grub counts were made on September 16. Due to a very low grub infestation, there were few significant differences between the treatments. However, trends were noticed. The Ciba-Geigy 12223 and Dasanit were the top treatments, with no grubs found in a 12 square foot sampling area. Although Dasanit is labeled for turf, it is extremely toxic and less toxic materials are generally recommended. Excellent control was also given by Oftanol, Turcam, and Diazinon + wetting agent. Fair control was obtained from Diazinon, Ethoprop, and Dylox. The Dursban treatments gave poor control. Again, it must be stressed that the control of white grubs given by most of these treatments was not significantly different.

Table 31.
Results of Logan-Missouri Valley C. C. White Grub Study

| Treatment | Rate Oz/1000 $ft^2$ | % Control |
|---|---|---|
| Ciba-Geigy Triumph | 0.75 | 100a |
| Ciba-Geigy Triumph | 1.50 | 100a |
| Dasanit 15G | 6.25 | 100a |
| Diazinon + wetting agent | 5 + 2 | 95a |
| Oftanol 5G | 14.50 | 95a |
| Turcam 80SP | 1.00 | 91a |
| Diazinon 4EC | 4.00 | 82ab |
| Ethoprop | 8.00 | 68ab |
| Dylox 80SP | 3.75 | 64ab |
| Dursban + wetting agent | 5 + 2 | 55ab |
| Dursban | 5.00 | 36bc |
| Check | ---- | 0c |

# RESULTS OF 1982 TURFGRASS DISEASE CONTROL TRIALS

L. E. Sweets
Iowa State University

Selected fungicides were tested in field trials for efficacy of control of Helminthosporium leaf spot (Helminthosporium sorokinianum), dollar spot (Sclerotinia homoeocarpa) and Pythium blight (Pythium aphanidermatum). Trials were conducted on the Turfgrass Research Plots at the Horticulture Research Station.

In both trials, fungicides were applied to Penneagle bentgrass maintained at 1/4" cutting height. Application was made with a modified bicycle sprayer at 30 lbs. p.s.i. and a dilution rate of 5 gallons per 1000 square feet. The experimental design was a randomized block plan with four replicates, plot size 4 x 5 feet. Fungicides were applied on a 7, 14 or 21 day schedule as indicated in either Table 32 or 33.Applications began on June 2, 1982 and continued through September 22, 1982.

1. Helminthosporium Leaf Spot/Dollar Spot on Penneagle Bentgrass

   The purpose of this trial was to compare the relative efficiency of standard and experimental fungicides in the control of Helminthosporium leaf spot and dollar spot. Fungicides included in the trial along with rates of application and spray schedules are given in Table 32. The trial was conducted in an area with a history of leaf spot problems. However, during the 1982 season, neither Helminthosporium leaf spot nor dollar spot was severe in this plot area. Disease ratings were made on August 10 and August 24. Ratings were made on the basis of the percentage of plot area showing leaf spot symptoms. Results of ratings are also given in Table 1.

Table 32. Rates, spray schedules and efficacy of fungicides tested in Helminthosporium leaf spot/dollar spot trial.

| Treatment | Rate of Formulated Product (oz./1000 sq. ft.) | Time Interval Between Sprays (Days) | Disease Rating[1] Aug. 10 | Disease Rating[1] Aug. 24 |
|---|---|---|---|---|
| Tersan 1991 | 1.0 | 14 | 9.1 | 7.2 |
| Duosan | 3.0 | 14 | 6.0 | 5.6 |
| Vorlan | 2.0 | 14 | 6.2 | 4.3 |
| Cadminate | 0.5 | 30 | 12.4 | 8.5 |
| Fungo 50 | 1.0 | 14 | 16.5 | 8.2 |
| Bayleton 25 | 1.0 | 14 | 6.4 | 4.5 |
| CGA-64250 | 0.5 | 14 | 12.5 | 5.8[2] |
| CGA-64250 | 1.0 | 14 | 10.8 | 3.6[2] |
| Chipco 26019 | 2.0 | 14 | 5.2 | 4.8 |
| Daconil 2787 | 3.0 | 14 | 14.5 | 10.6 |
| Daconil 2787 | 6.0 | 14 | 8.4 | 5.1 |
| Dyrene | 4.0 | 14 | 15.1 | 8.2 |
| Dyrene | 6.0 | 14 | 10.5 | 6.1 |
| Fore | 6.0 | 14 | 17.2 | 9.2 |
| Fore | 8.0 | 14 | 12.5 | 7.3 |
| Acti-Dione RZ | 1.2 | 14 | 17.1 | 8.7 |
| Acti-Dione TGF | 1.0 | 14 | 15.4 | 7.0 |
| Check | | | 20.6 | 16.4 |

[1]Average of ratings from four replicated plots. Based on percentage of plot showing leaf spot symptoms.

[2]Plots treated with CGA 64250 showed some "greening" of turf.

2. Pythium Blight on Penneagle Bentgrass

The purpose of this trial was to compare the relative efficiency of standard and experimental fungicides in the control of Pythium blight. Fungicides included in the trial along with rates of application and spray schedules are given in Table 2. Although the trial was located in an area with a history of Pythium blight, no Pythium blight symptoms were visible when the trial was initiated. Environmental conditions were not favorable for disease development during the 1982 season and no disease developed in the plot area. Therefore, no disease ratings were made on these plots in 1982.

Table 33. Rates and Spray schedules for fungicides included in Pythium blight trial.

| Treatment | Rate of Formulated Product (oz./1000 sq. ft.) | Time Interval Between Sprays (Days) |
|---|---|---|
| Subdue 2E | 1 | 14 |
| Subdue 2E | 2 | 14 |
| Subdue 2E | 2 | 21 |
| Koban | 2-4 1/2 | 5-10 |
| Banol | 2 | 14 |
| Banol | 4 | 14 |
| Banol | 4 | 21 |
| Tersan SP | 4 | as needed |
| Fore | 8 | 5 |
| Acti-dione RZ | 1.2 | 7-14 |
| Check | | |

Liquid Fertilizer Screening - 1982

by

Sally Johnson

A fertilizer screening study was conducted in 1982 to evaluate a number of liquid fertilizers for potential to burn turfgrass foliage. Treatments were applied with the Spreader King liquid lawn care applicator at rates of 0.25, 0.50, and 1.0 lb. N/1000 sq. ft. in June and July, and at the rates of 0.50, 1.0, and 2.0 lb. N/1000 sq. ft. in August. Materials were applied as a low volume spray, and a non-diluted form of liquid fertilizer was applied when possible. Fertilizers were not watered in, and were applied during midday.

Turfgrass was given a visual rating for degree of fertilizer burn. The scale was from 9-1; 9=no visible burn and 1=dead turf. Ratings less than 5.0 were considered unacceptable.

The study was designed in a randomized complete block with 28 treatments and 3 replications. The entire study was repeated 3 times in 1982.

Table 34. Fertilizers used in the 1982 Liquid Fertilizer Burn Investigations.

| Fertilizer | Nitrogen Source | Analysis | lb. N/Gal. |
|---|---|---|---|
| Fluf | Methyleneurea | 18-0-0 | 1.70 |
| Fluf-Plus | Methyleneurea | 17-0-0 | 1.66 |
| Tuf | Methyleneurea | 18-0-0 | 1.77 |
| Fan | Alkyleneurea | 20-0-0 | 1.90 |
| Fan N-P-K | Alkyleneurea | 16-2-5 | 1.62 |
| Formolene | Methylolurea | 30-0-2 | 3.25 |
| Folian | Urea | 12-4-4 | 1.17 |
| Urea | Urea | 17-0-0 | 1.36 |
| Form. + Urea | Methylol & Urea | 20-2-6 | 2.02 |

Results:

Table 35. Average fertilizer burn ratings for treatments applied in June and July, 1982.

| Fertilizer | lb. N/1000 ft. sq. 0.25 | 0.50 | 1.00 |
|---|---|---|---|
| Fluf-Plus | 9.0 | 8.5 | 8.5 |
| Fluf | 9.0 | 8.5 | 7.5 |
| Tuf | 8.0 | 8.0 | 7.0 |
| Formolene | 8.0 | 7.5 | 5.0 |
| Formolene + Urea | 8.5 | 7.5 | 4.5 |
| Fan N-P-K | 8.0 | 7.0 | 4.5 |
| Urea | 8.5 | 5.5 | 3.5 |
| Folian | 7.5 | 6.0 | 3.5 |

F.S.D. $_{0.05}$=1.5

Table 36. Average fertilizer burn ratings for treatments applied in August, 1982.

| Fertilizer | lb. N/1000 sq. ft. 0.50 | 1.00 | 2.00 |
|---|---|---|---|
| Fluf-Plus | 9.0 | 9.0 | 8.5 |
| Fluf | 9.0 | 8.5 | 8.5 |
| Tuf | 8.5 | 9.0 | 7.5 |
| Formolene | 8.5 | 8.0 | 7.0 |
| Formolene + Urea | 8.5 | 7.5 | 5.5 |
| Fan | 8.5 | 7.0 | 5.0 |
| Fan N-P-K | 7.5 | 5.0 | 5.0 |
| Urea | 8.0 | 6.0 | 4.5 |
| Folian | 7.5 | 6.0 | 4.5 |

F.S.D. $_{0.05}$=1.0

All of the materials tested can be safely applied at 0.25 lb. N/1000 sq. ft. with minimal phytotoxicity. The ureaform materials, Fluf, Fluf-Plus, and Tuf, caused little foliar burn, even when applied at the 2.0 lb. N/1000 sq. ft. rate. Formolene gave good results up to 0.5 lb. N/1000 sq. ft., but could not be consistently applied at the 1.0 lb. rate without phytotoxicity. It should be reemphasized that these were low volume applications. The Formolene + Urea solution behaved much the same as Formolene, but was much more phytotoxic at the 2.0 lb. rate. Fan and Fan N-P-K, both alkylene ureas, gave good results up to 0.5 lb., but were very phytotoxic at higher rates. Folian and urea showed the greatest tendency to burn, and the results of this study indicate there is no difference between these materials when considering burn potential.

In this study, conditions were chosen which would be expected to favor foliar burn. This was done to test the Spreader King and the fertilizer products under the adverse conditions which may occur during commercial use. By watering materials in, by using larger volumes of water during application, by avoiding midday heat, and by applying only when the turf is actively growing, the potential for foliar burn can be decreased considerably.

## Buffalograss Management Study

by

David Brahm

This study was seeded June 16 of 1980 as an evaluation of three buffalograss cultivars under various management practices. Cultural methods include three mowing heights (no mow, 2.5 cm, and 5 cm) and three fertilization rates (0, 1, and 2 lb N/1000 $ft^2$/yr.). The 2 lb N/1000 $ft^2$ treatment is split into two applications of 1 lb N/1000 $ft^2$, with one being applied June 1 and the other July 15. The area is mowed once a week and watered as needed to prevent drought stress. Each treatment is replicated three times and data is collected monthly. Due to a severe encroachment problem of cool-season grasses into the buffalograss treatment area, a study to screen several herbicides which selectively controlled cool-season grasses was established in May of 1982. Information gathered from this study showed that simazine, at the rate of 2.0 lb a.i./A, provided the best control of cool-season grasses along with preemergent control of annual weeds. Simazine also had no phytotoxic effect on buffalograss. Simazine was then applied to the management study to remove the cool-season grasses. As shown in table 37, the quality of all three cultivars improved after the application of simazine. This was due to the removal of competition of both the cool-season grasses and annual weeds.

The data acquired in 1982 indicates that the quality of buffalograss varies with mowing height. The 2.5 and 5.0 cm height provided the most acceptable turf, while the no mow treatment exhibited the poorest quality turf (Table 38). This poor quality could be attributed to low density which occurred due to shading by the previous season's growth. In 1983 the treatments will be mowed uniformly at 5.0 cm height in early April to alleviate the shading problem.

Table 39 contains information on the combined effects of mowing height and simazine. At all three mowing heights the addition of simazine improved the quality of the three cultivars. Again, this was probably due to the removal of competition from both the cool-season grasses and the annual weeds.

This study has provided a better understanding of the management of buffalograss and some of the problems which confront it under higher maintenance conditions. Data will be taken this season on a non-irrigated buffalograss management study. From general observations last season, the non-irrigated study looks very promising.

Another investigation that will be continued this season is the herbicide study which is designed to observe various herbicides that selectively control cool-season grasses in a buffalograss turf. Results of this study will be presented in 1984.

Table 37. Effects of simazine on the quality of three cultivars of buffalograss (1982).

| Simazine (lb a.i./1000 $ft^2$) | Texoka | Sharp's | Common |
|---|---|---|---|
| 0.0 | 2.5 | 2.5 | 2.5 |
| 2.0 | 4.5 | 3.5 | 4.0 |
| LSD (0.05) | 0.5 | 0.5 | 0.5 |

Table 38. Effect of mowing height on the quality of three cultivars of buffalograss (1982).

| Mowing Height (cm) | Texoka | Sharp's | Common |
|---|---|---|---|
| no mow | 2.0 | 1.0 | 1.5 |
| 2.5 | 4.0 | 3.0 | 3.5 |
| 5.0 | 5.0 | 4.0 | 5.0 |
| LSD (0.05) | 2.0 | 1.5 | 1.5 |

Table 39. Interactive effects of mowing height and simazine on the quality of three cultivars of buffalograss (1982).

| Mowing Height (cm) | Simazine (lb a.i./1000 $ft^2$) | Texoka | Sharp's | Common |
|---|---|---|---|---|
| no mow | 0.0 | 1.5 | 1.0 | 1.0 |
| 2.5 | 0.0 | 3.0 | 2.5 | 3.0 |
| 5.0 | 0.0 | 3.0 | 3.5 | 4.0 |
| no mow | 2.0 | 2.5 | 2.0 | 2.0 |
| 2.5 | 2.0 | 5.0 | 4.0 | 4.0 |
| 5.0 | 2.0 | 6.5 | 4.5 | 6.5 |
| LSD (0.05) | | 1.0 | 0.5 | 0.5 |

# Direct Low Temperature Damage of Bentgrass

by

Linda Bartelson and Nick Christians

Winterkill is a comprehensive term that includes all types of injury to turfgrasses that occur during the winter season. The three major types of winterkill are direct low temperature kill, winter desiccation, and low temperature fungal diseases. Past research indicates that cultural factors which stimulate growth and cause a reduction in hardiness can result in an increase of low temperature kill. These factors include excessive nitrogen, a deficiency of potassium, a close mowing height, and inadequate soil drainage.

Soil temperature seems to be a more critical factor in low temperature stress than the air temperature. When temperatures become sufficiently low, direct low temperature kill occurs. The damage may involve ice crystal formation within the cell or between the cells. Freezing within the cell usually results in the explosive growth of ice crystals in tissues that are full of water (hydrated). These large ice crystals disrupt and damage the cellular contents and membranes, leading to the eventual death of the tissue.

Ice formation between cells may or may not damage the cells. This is more of an equilibrium process in which water is redistributed from within the cells to outer regions because of the lower vapor pressure of the ice between cells. As this dehydration continues, the cell becomes brittle and is subjected to extreme tensions during contraction which can result in damage.

In this study, the effect of direct low temperatures on five creeping bentgrass cultivars (Emerald, Penncross, Penneagle, Prominent, Seaside) and one velvet bentgrass cultivar (Kingstown) was investigated to determine the relative tolerance of the cultivars. The bentgrass cultivars were established in September 1980 and were maintained under three fertility levels: 0.5, 0.8, and 1.2 lbs N/1000 $ft^2$/growing month (3.5, 5.6, and 8.4 lbs N/1000 $ft^2$/year). In November 1981, plugs measuring 2.5 inches in diameter by 3 inches deep were taken from each cultivar and fertility treatment. They remained outside under snow cover until February when they were brought in and held at $0^oC$ ($32^oF$). The plugs were placed in a cold chamber and removed at 0, -8, -16, -24, -32, and $-40^oC$. They were then potted and regrown in the greenhouse.

All the bentgrass cultivars were at least somewhat tolerant to the lowest temperature treatment of $-40^oC$ (Fig. 1). None of the plugs were completely killed. In this study the relative degree of kill between cultivars is of more importance than the actual percent kill value because the actual kill value will vary due to year to year differences in many environmental factors such as: the rate of freezing, rate of thawing, number of times frozen, length of time frozen, tissue hydration level, and post-thawing treatment.

After comparing the clipping weights of regrowth and percent kill values, Penneagle appeared to be least damaged by cold temperatures followed by Penncross, Prominent, and Emerald. Kingstown and Seaside were severely damaged with approximately 90% of the plants being killed at $-40^oC$ (Fig. 2 and 3).

The different fertility levels had no significant effect on the cold temperature tolerance of the cultivars. Initially, the 1.2 lbs N/1000 $ft^2$/growing month fertility level showed the most shoot regrowth (Fig. 4), but after 35 days shoot regrowth was the same between fertility levels (Fig. 5). The lack of difference after 35 days can be attributed to a decrease in available N in the soil plugs. No additional fertilizer was applied during regrowth in the greenhouse.

## Conclusions

Based on this study, Penneagle was the most low temperature tolerant of the bentgrass cultivars tested. It sustained the least visual damage, recovered faster, and had the most shoot regrowth. Penncross, Prominent, and Emerald were also relatively tolerant of low temperatures. However, Seaside and Kingstown showed a limited tolerance and probably would not perform as well in Iowa under severe winter temperatures. It is also interesting to note that there was no difference in survival between the fertility levels. However, as fertility increased, the recovery rate and amount of shoot regrowth increased.

Figure 1: Clipping weights over all cultivars and fertility levels.

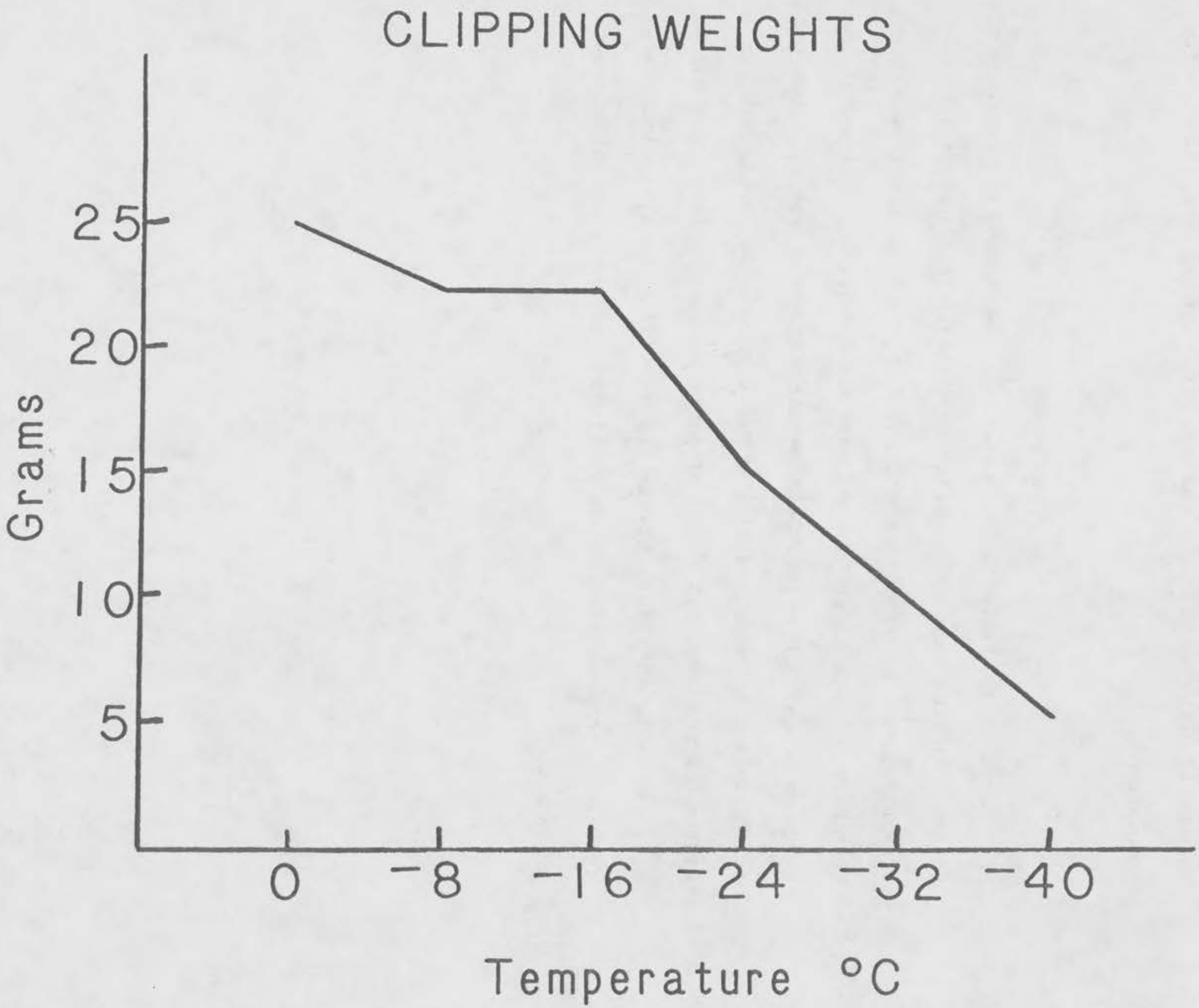


Figure 2: Clipping weights over all temperature treatments and fertility levels.

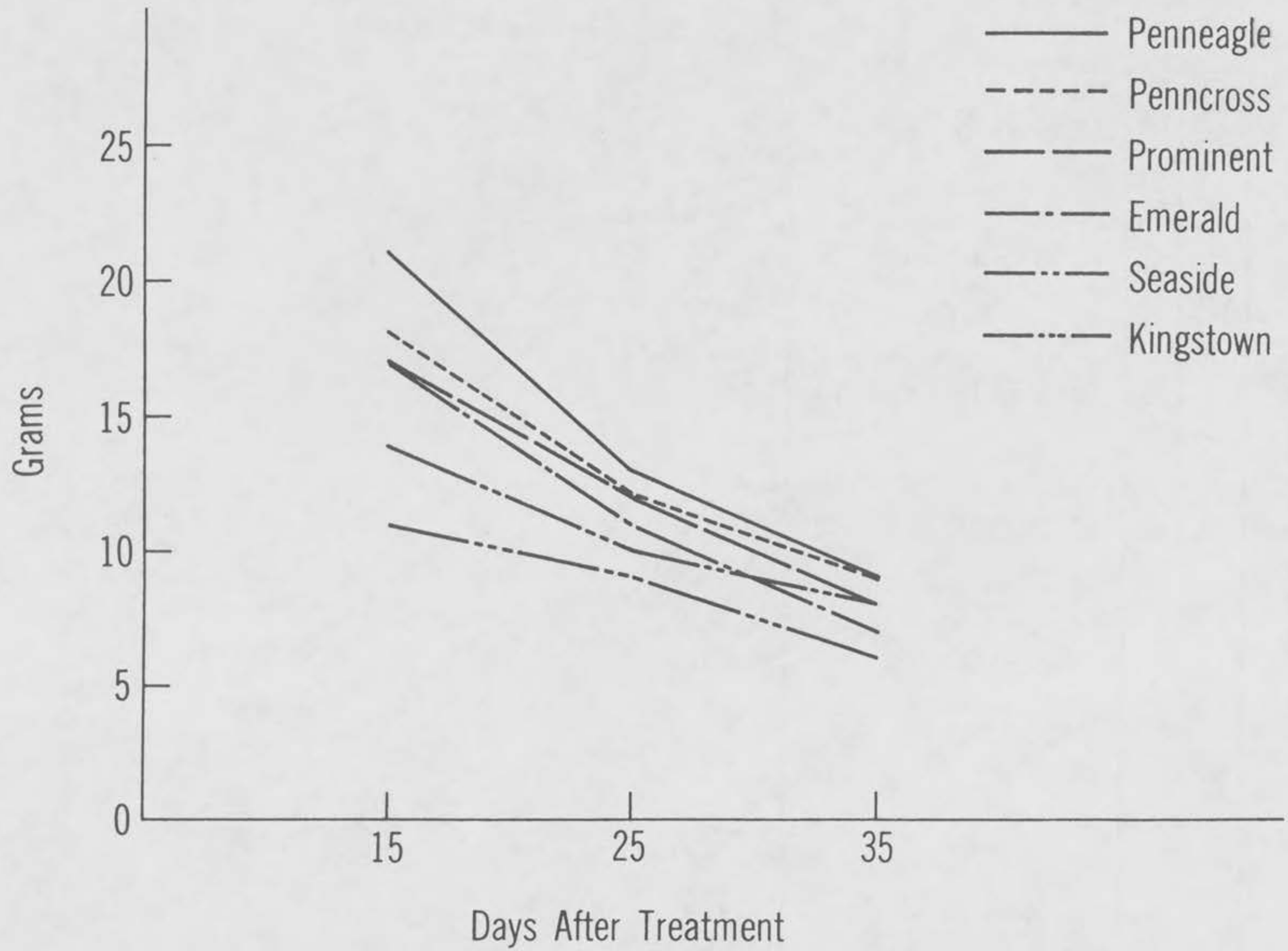


Figure 3: Percent kill over all fertility levels.

% KILL - -40°C

| Cultivar | Days After Treatment 10 | 15 | 25 | 35 |
|---|---|---|---|---|
| Emerald | 79 | 77 | 73 | 67 |
| Kingstown | 87 | 84 | 82 | 78 |
| Penncross | 71 | 69 | 64 | 52 |
| Penneagle | 59 | 55 | 52 | 38 |
| Prominent | 74 | 73 | 69 | 63 |
| Seaside | 93 | 90 | 89 | 86 |
| LSD 5% | 11 | 11 | 10 | 8 |

Figure 4: Clipping weights over all temperature treatments.

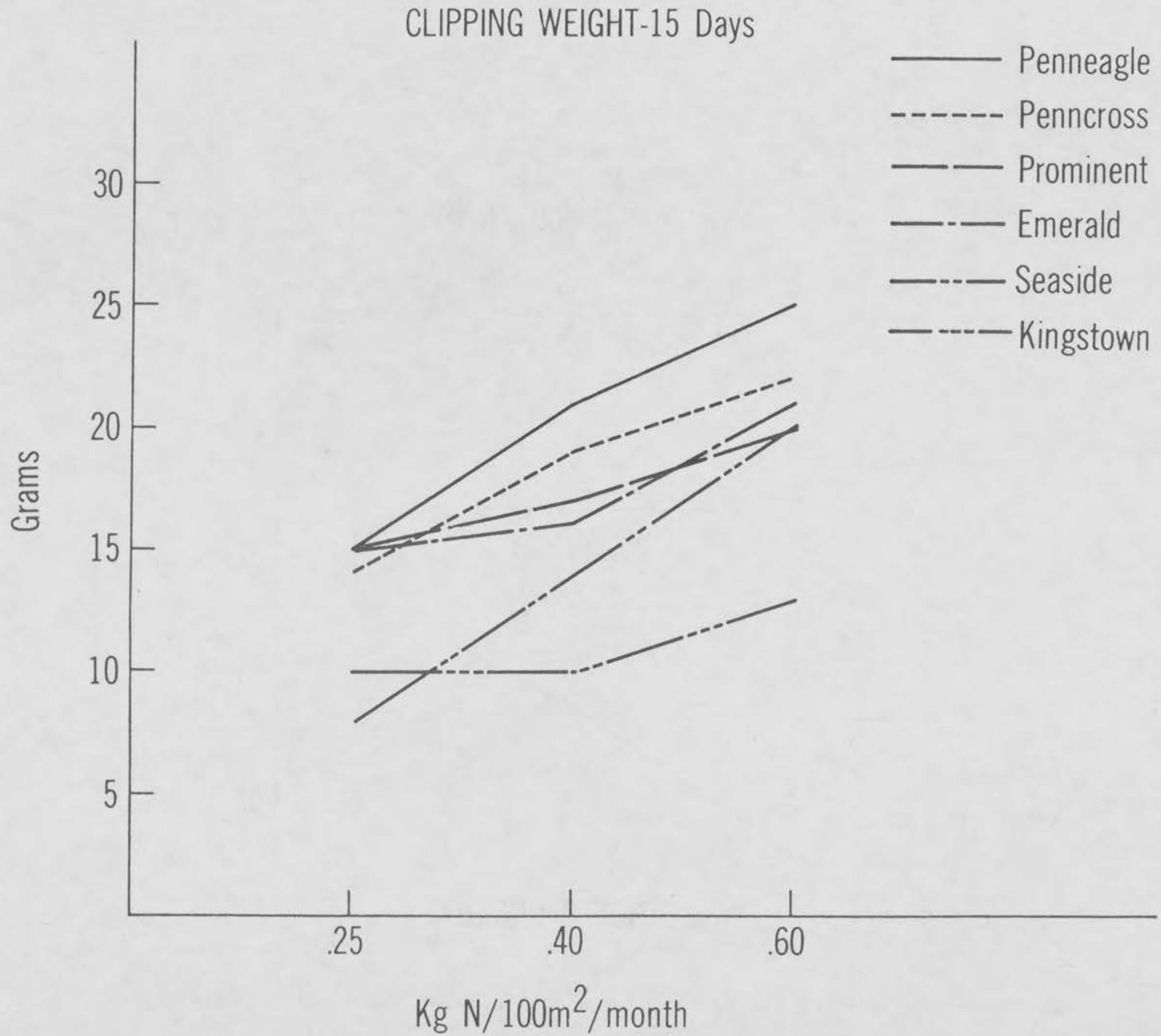
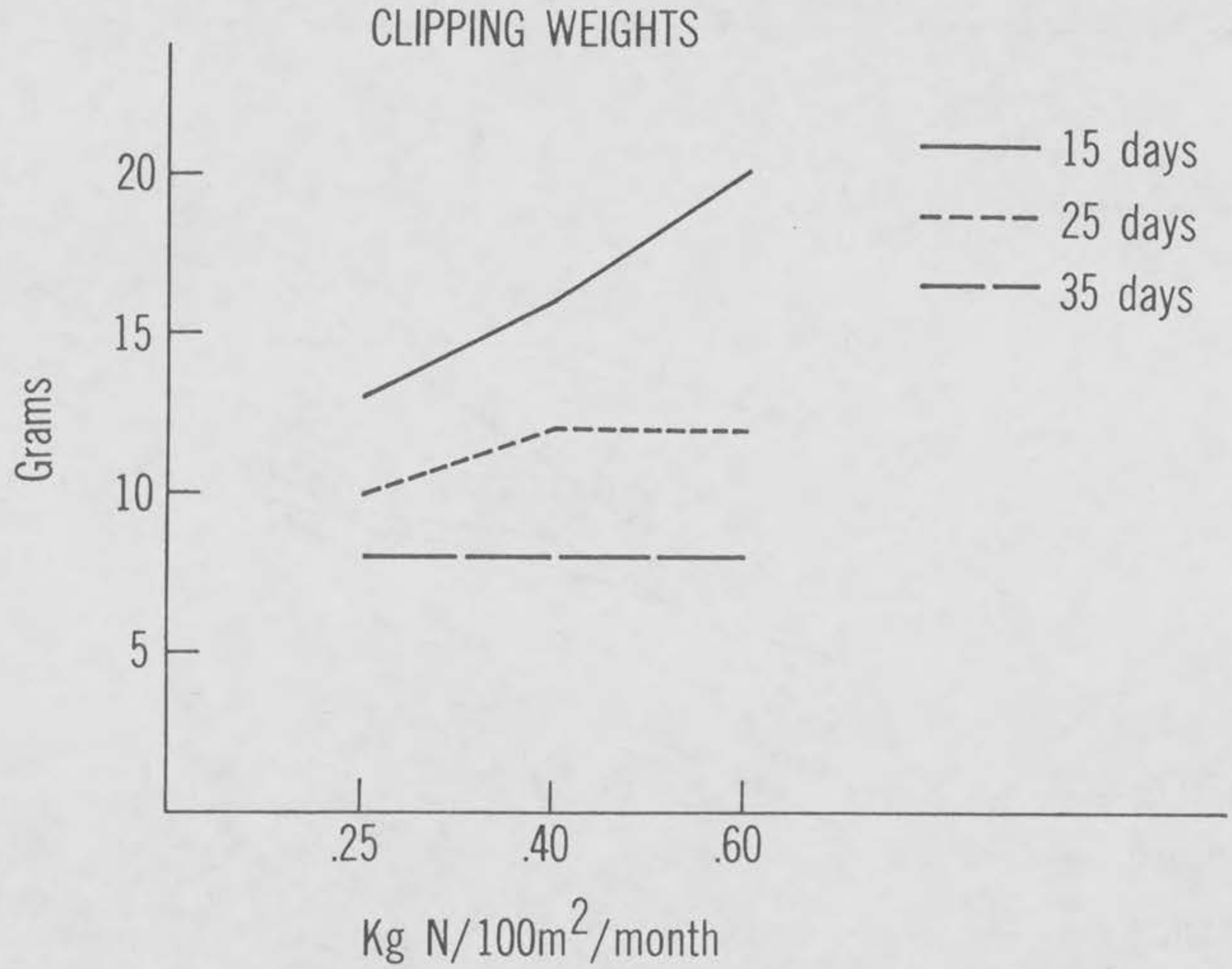


Figure 5: Clipping weights over all cultivars and temperature treatments.



Phosphorus Fertilization Study

by

J. L. Nus and N. E. Christians

The phosphorus (P) fertilization study was initiated in April 1981 to test the response of Kentucky bluegrass to increasing levels of P on a typical Iowa soil.

The study is located on Section V, Block I of the ISU turf plots on the ISU Horticulture Research Station. The area was seeded with 'Baron' Kentucky bluegrass in September, 1979. At the time of establishment, 1.0 lb $P_2O_5$ (as triple super phosphate) and 0.5 lb N per 1000 sq ft (as ammonium nitrate) were applied. The area used for the phosphorus fertilization has been maintained in lawn condition including two inch mowing, pre- and postemergent weed control, and standard fertilization with urea. No insecticides or fungicides have been applied to the area. Initial soil test levels of P on this area were 27 lb/A.

The study was designed in a randomized complete block with six treatments and three replications. Treatments included 0, 1, 2, 4, 8, and 12 lb $P_2O_5$ per 1000 sq ft. Phosphorus was applied as triple super phosphate once per season in approximately the middle of May.

Data was taken for spring greenup, average weekly clipping weight, and quality. Spring greenup was taken in early May and consisted of a rating from 0 to 9, with 0 = dead turf and 9 representing dark green turf. Clipping weight was recorded as the oven dry weight (in grams) of total clippings from a 1 X 2 meter plot. Quality was recorded as a number from 0 to 9, with 6.0 representing acceptable turf. Both spring green up and quality ratings were estimated to the nearest decimal place.

Table 40 shows the results of the Phosphorus Fertilization Study for 1982. The data can be summarized in one sentence: no consistent benefit in spring greenup, clipping yield, or turf quality was realized by fertilizing with phosphorus on these central Iowa soils. This investigation is a very long term study which will be maintained for several years on the same location. Soil tests, to determine P levels in the soil of each plot, will be taken in 1983 to record the progress of the study.

Table 40. Response to increasing levels of P in 1982.

| Treatment | Greenup Rating | Ave. Weekly Clipping Wt. | May Quality | June Quality | July Quality | Aug Quality | Sept Quality | Oct Quality | Overall Quality |
|---|---|---|---|---|---|---|---|---|---|
| lb $P_2O_5$/1000 $ft^2$ | | | | | | | | | |
| 1. 0 | 6.4 | 11.5 | 7.8 | 7.3 | 7.1 | 6.5 | 6.9 | 6.2 | 7.0 |
| 2. 1 | 6.3 | 13.0 | 7.8 | 7.3 | 7.2 | 6.5 | 6.9 | 6.1 | 7.0 |
| 3. 2 | 6.2 | 10.8 | 7.7 | 7.3 | 7.2 | 6.4 | 7.0 | 6.1 | 7.0 |
| 4. 4 | 6.3 | 14.5 | 7.8 | 7.4 | 7.2 | 6.5 | 6.9 | 6.1 | 7.0 |
| 5. 8 | 6.2 | 15.8 | 7.6 | 7.3 | 7.2 | 6.3 | 6.7 | 5.9 | 6.8 |
| 6. 12 | 6.2 | 18.0 | 7.4 | 7.5 | 7.0 | 6.3 | 6.6 | 5.8 | 6.8 |
| LSD (0.05) | 0.2 | 4.0 | 0.4 | N.S. | N.S. | N.S. | N.S. | N.S. | N.S. |

Folian Study

by

J. L. Nus and N. E. Christians

Folian is a liquid fertilizer manufactured by Allied Chemical containing 12.0% N, 4.0% $K_2O$, 0.5% S, and 0.1% chelated Fe. It is being marketed for several crops, including turf. The Folian study was initiated to test whether, in addition to nitrogen, each of the other nutrients enhanced turf quality.

The study is located in Section V, Block 1 of the ISU turf plots on the ISU Horticultural Research Station. The area was seeded with 'Baron' Kentucky bluegrass in September, 1979. At the time of establishment, 1.0 lb $P_2O_5$ per 1000 sq ft (as triple super phosphate) and 0.5 lb N per 1000 sq ft (as ammonium nitrate) were applied. The area used for the Folian study has been maintained in lawn condition including two inch mowing, pre- and postemergent weed control, and standard fertilization with urea. No insecticides or fungicides have been applied to the area.

The experimental design is a randomized complete block with seven treatments and three replications. Treatments consisted of Folian (N+P+K+S+Fe), N, N+P, N+K, N+S, N+Fe, and control (no fertilizer). Sources for the nutrients included urea for N, phosphoric acid for P, KCl for K, sulfuric acid for S, and 10% Sequestrene for Fe. Treatments were applied with a regulated plot sprayer at 6-8 week intervals throughout the growing season. Treatments were calculated to give the same amount of water carrier to each plot. Treatments began in May, 1981.

Data was taken during the 1982 growing season for spring green up, average weekly clipping yield, and turf quality. Data for spring green up was represented by a number of 9 to 0, with 0 = dead turf and 9 = dark green turf. Clipping yield was recorded in grams of oven dried clippings from a 1 X 2 meter plot. Quality was judged from 9 to 0, with 6.0 representing acceptable turf. Both spring green up and quality ratings were estimated to the nearest decimal place.

Data for the 1982 growing season is presented in Table 41. All treatments gave statistically superior spring green up, clipping yield, and turf quality versus non-fertilized control plot. However, no consistent, significant differences could be found between treatments containing only nitrogen, nitrogen with each of the individual nutrients, or Folian.

Table 41. The effects of Folian and Nitrogen with each of the individual components of Folian on Baron Kentucky bluegrass.

| Treatment | Greenup Rating | Ave. Weekly Clipping Wt. | May Quality | June Quality | July Quality | Aug Quality | Sept Quality | Oct Quality | Overall Quality |
|---|---|---|---|---|---|---|---|---|---|
| N + K | 7.1 | 52.9 | 8.1 | 7.7 | 8.1 | 7.9 | 7.4 | 6.9 | 7.7 |
| N + P | 6.8 | 52.0 | 7.8 | 7.7 | 7.9 | 7.6 | 7.4 | 6.9 | 7.5 |
| N + Fe | 7.0 | 45.4 | 7.9 | 7.6 | 7.6 | 7.3 | 7.4 | 7.2 | 7.5 |
| Folian | 6.7 | 50.5 | 7.9 | 7.7 | 7.6 | 7.1 | 7.2 | 7.1 | 7.4 |
| N | 6.6 | 42.4 | 7.9 | 7.7 | 7.5 | 7.2 | 7.3 | 7.1 | 7.4 |
| N + S | 6.9 | 40.9 | 7.9 | 7.5 | 7.3 | 7.0 | 7.1 | 7.1 | 7.3 |
| Control | 4.9 | 9.5 | 5.8 | 5.8 | 6.2 | 5.7 | 6.0 | 6.0 | 5.9 |
| LSD (0.05) | 0.7 | 11.2 | 0.2 | 0.3 | 0.6 | 0.5 | 0.6 | 0.7 | 0.4 |

# N X K Study

by

J. L. Nus and N. E. Christians

The nitrogen x potassium interaction study was initiated to observe the effects of nitrogen (N) and potassium (K) on the growth and development of 'Baron' Kentucky bluegrass and to evaluate the interactions between these two nutrients.

The study is located in Section V, Block 1 of the ISU turf plots at the ISU Horticultural Research Station. The area was seeded with 'Baron' Kentucky bluegrass in September, 1979. At the time of establishment, 1.0 lb $P_2O_5$ per 1000 sq ft (as triple super phosphate) and 0.5 lb N per 1000 sq ft (as ammonium nitrate) were applied. The area used for the N X K interaction study has been maintained in lawn condition including two inch mowing, pre- and postemergent weed control, and standard fertilization with urea. No insecticides or fungicides have been applied to the area.

The study is arranged as a complete factorial with four levels of N (0, 1.0, 1.5, and 2.0 kg/are/year) and four levels of K (0, 1.0, 1.5, and 2.0 kg/are/year). (One kg/are/year equals approximately 2 lb per 1000 sq ft per year.) A randomized complete block design is used for the 16 treatments and 3 reps. Urea is the N source, and KCl is the source of K. Treatments began in April, 1981.

Data were taken for spring greenup, average weekly clipping weight, and quality. Spring greenup was evaluated in early May and consisted of a rating from 9-0, 0=dead turf and 9 representing dark green turf. Clipping weight was recorded as the oven dry weight (in grams) of total clippings from a 1 x 2 meter plot. Quality was recorded as a number from 9-0, with 6.0 representing acceptable turf. Both spring greenup and quality ratings were estimated to the nearest decimal place.

The effects of N and K on quality and clipping weight are shown in tables 42 and 43. Both N and K increased quality ratings with increasing application rates. Nitrogen had the greatest effect on quality. There was an increase in quality on plots receiving 1 kg K/are/yr (approx. 2 lbs/1000 $ft^2$) over plots receiving no K; however, higher rates of K had little effect. Clipping weights increased with each increment of N, as would be expected. Potassium increased growth of Kentucky bluegrass up to the highest level of application, although the size of the response is much less than for N. Notice that most of the increase occurred between 0 and 1 kg/are/yr. The K soil test level on this area was 218 lb/A at initiation of treatments. The application of additional potassium on soils in this soil test range would be recommended.

The only observable effects on spring greenup was from increasing rates of N; K had no effect. The greenup data is not included in the report.

Table 42. The effect of N and K on the quality ratings for Baron Kentucky bluegrass.

| N (kg/are/yr) | K (kg/are/yr) | | | |
|---|---|---|---|---|
| | 0.0 | 1.0 | 1.5 | 2.0 |
| 0.0 | 5.1 | 6.4 | 6.8 | 6.7 |
| 1.0 | 7.0 | 7.4 | 7.1 | 7.4 |
| 1.5 | 7.2 | 7.5 | 7.4 | 7.6 |
| 2.0 | 7.2 | 7.5 | 7.4 | 7.6 |

LSD for comparison of K levels = 0.2
LSD for comparison of N levels = 0.2

Table 43. The effect of N and K on the clipping weight of Baron Kentucky bluegrass.

| N (kg/are/yr) | K (kg/are/yr) | | | |
|---|---|---|---|---|
| | 0.0 | 1.0 | 1.5 | 2.0 |
| 0.0 | 5.7 | 12.3 | 17.0 | 21.7 |
| 1.0 | 22.7 | 37.7 | 34.7 | 38.7 |
| 1.5 | 27.0 | 41.7 | 41.0 | 52.3 |
| 2.0 | 42.0 | 48.7 | 52.7 | 55.0 |

LSD for comparison of K levels = 8.0
LSD for comparison of N levels = 8.0

Postemergent Herbicide Rate Study - 1982

by

Sally Johnson

The postemergent herbicide rate study was initiated in June, 1982. The material used was Trimec. Trimec is a post-emergent herbicide that is a combination of 2,4-D, MCPP, and dicamba. Treatments were applied with the Spreader King liquid lawn care applicator at rates varying from 1/8 to 1 1/2 times the recommended rate of active ingredient. The purpose of the study was to see if the small droplet size emitted from the sprayer, combined with better overall coverage, would give more efficient herbicide action.

The study was located in a weed-infested lawn area south of University Village at Iowa State University. The grass species in the area were primarily bluegrass and tall fescue. Trimec was mixed with enough water for 1 gallon to cover 8000 sq. ft. Broadleaf weeds present at the time of application included dandelion, plantain, white clover, yarrow, and bird's foot trefoil. A randomized complete block design including 3 replications and 7 treatments was used.

Table 44. Effectiveness of Trimec at different rates.

| % of recommended rate applied | Weeds/m2 | Effectiveness |
|---|---|---|
| 0.0 | 160 | Very poor |
| 12.5 | 68 | Very poor |
| 25.0 | 71 | Fair-very poor |
| 50.0 | 34 | Good-poor |
| 75.0 | 25 | Good-fair |
| 100.0 | 7 | Very good-good |
| 150.0 | 4 | Very good |

L.S.D. $_{0.05}$=36

Results were obtained by randomly counting the number of weeds in three subsamples of each test plot. A visual rating of the entire plot was made to correlate outward appearance of weed control with the actual number of weeds counted.

All rates showed some weed control when compared to the non-treated plot, but this control was not very good until at least 50% of the recommended rate was applied. Although the weed number for 50% and 75% of the recommended rate was high, the overall appearance of these plots was fairly good. The more obnoxious looking weeds, such as dandelion, were removed, although other broadleafed types remained.

Preliminary results indicate that lower rates of Trimec may indeed give adequate broadleaf weed control when applied with the Spreader King, or a controlled droplet size-applicator. Further work will need to be done to document these findings.

## Fall Topdressing Investigation

The fall topdressing study was begun in November of 1980. The results of the first 2 years were discussed in the 1981 and 1982 field day reports. This investigation is being conducted on Penncross creeping bentgrass, established on both a native soil and a modified soil. Three different treatments were included; a) a 70-10-20 (sand-soil-peat) mix, b) a 1-1-1 topdressing mix, and c) a control area where no topdressing was applied. The treatments were applied at a depth of 1/4 inch. Each topdressing treatment was further divided into 3 fertilizer treatments that were applied just prior to topdressing; a) no nitrogen, b) 0.5 lb N/1000 sq ft, and c) 1 lb N/1000 sq ft. The treatments applied to the native soil area were exactly the same as those applied to the modified soil.

The 1980-1981 winter was very dry and mild. The topdressing treatments proved to be very beneficial under these conditions, with topdressed areas showing less winter damage and a much improved spring greenup.

The 1981-1982 winter was very cold and the area was covered by snow from December to March. Under these conditions, there was little difference between topdressed and control areas.

The 1982-1983 winter was again somewhat mild and the plot area was not covered by snow through most of the winter. As was the case in the spring of 1981, the topdressed areas greened up much earlier than did the untreated areas (Table 45). By March 3, 1983, the areas topdressed with the 1-1-1 topdressing had attained an acceptable color rating of 6.0 on both native and modified soils. Control areas did not reach a satisfactory rating until 51 days later, on April 23.

The late winter of 1983 was very mild, with unseasonably warm temperatures recorded in late February and early March. These early, warm conditions were followed by cold temperatures in mid-March and early April, and by heavy snowfall. No detrimental effects were observed on the treated areas. Following the early spring snow storms, it was expected that snow mold might develop on treated areas because of the lack of fungicide treatments. No serious snow mold problems were observed.

The application of nitrogen just prior to topdressing improved color ratings for each of the topdressing treatments (Table 46). This dormant application of urea has proven to be beneficial in 2 of the last 3 seasons.

The fall topdressing investigation will be continued for several seasons.

Table 45. Color ratings for the modified (1-1-1) soil green and the native soil green in the spring of 1982.

| | Date | | | | | |
|---|---|---|---|---|---|---|
| Treatment | Mar 3 | Mar 13 | Mar 25 | Apr 15 | Apr 23 | Mean |
| Modified Soil | | | | | | |
| Control | 2.5 | 3.0 | 2.5 | 3.5 | 6.0 | 3.5 |
| 70-10-20 | 5.5 | 6.0 | 5.0 | 6.0 | 7.5 | 6.0 |
| 1-1-1 | 6.0 | 6.5 | 5.5 | 6.0 | 8.0 | 6.5 |
| Native Soil | | | | | | |
| Control | 2.0 | 2.5 | 2.5 | 4.0 | 6.3 | 3.5 |
| 70-10-20 | 5.0 | 6.0 | 5.5 | 6.5 | 8.0 | 5.5 |
| 1-1-1 | 6.0 | 6.5 | 5.5 | 6.0 | 8.0 | 6.0 |

Color is rated on a scale of 9 - 1, where 9 = complete recovery after winter dormancy and 1 = dormant turf.

Table 46. Color ratings for the modified (1-1-1) soil green and the native soil green as affected by fertilizer rate.

| | Topdressing Treatment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Control | | | 70-10-20 | | | 1-1-1 | | |
| Soil | 0* | 0.5 | 1.0 | 0 | 0.5 | 1.0 | 0 | 0.5 | 1.0 |
| Modified | 2.5** | 3.5 | 4.0 | 5.5 | 6.0 | 6.5 | 6.0 | 6.5 | 6.5 |
| Native | 3.0 | 3.5 | 4.5 | 6.0 | 6.5 | 7.0 | 6.0 | 6.5 | 6.5 |

* Pounds N/1000 sq ft applied just prior to topdressing treatments.
** 9 = total recovery, 1 = dormant turf, values listed are the means of the 4 rating dates.

The Effects of Growth Retardants on Three Turfgrass Species

Nick Christians and James Nau

In the winter of 1981-1982 a greenhouse study was performed to evaluate the effects of a number of growth retardants on three turfgrass species. 'Baron' Kentucky bluegrass (Poa pratensis L.), 'Kentucky 31' tall fescue (Festuca arundinacea Schreb.), and 'Reliant' hard fescue (Festuca ovina var. duriuscula L. Koch.) were treated with three growth retardants: N-[2,4-dimethyl-5-[[(trifluromethyl) sulfonyl]amino]phenyl]acetamide (MBR 12325) at 0.25 and 0.50 lb/acre; [2-chloroethyl]-phosphonic acid (ethephon) at 2.0, 4.0, and 6.7 lb/acre; and 5-(4-chlorophenyl)-3,4,5,9,10-pentaaza-tetracyclo $[5,4,1,0^{2,6},0^{8,11}]$ dodeca-3,9-diene (BAS 106 00 W) at 1.5, 3.0, and 4.5 lb/acre.

Data collected on a weekly basis included oven-dry clipping weights and quality ratings based primarily on color, uniformity, and density and rated on a scale of 9-1 (9 highest quality, and 1, dead turf). The study was maintained for six weeks after visible response began. At termination, data were collected on root weight, which was based on the difference between oven-dry and ash weights. Where appropriate, data also were taken on rhizome number per pot, on rhizome length, and on the oven-dry weight of rhizomes.

For purposes of verification, the study was repeated in the same way in the spring of 1982. Samples from the same location were established on March 18, 1982, and treatments were initiated on April 24, 1982. Data from the combined investigations were statistically analyzed to measure the variability between studies. Where no significant differences were found between studies (p=0.01), the data were combined for analysis. Only data verified in this way are discussed.

## Results and Discussion

MBR 12325 (0.25 and 0.50 lb/acre) was effective in reducing the clipping yield of each species (Fig. 1). The figures were prepared for scientific publication and treatments are listed in kg/ha. One kg/ha is equal to .89 lb/acre. The degree of inhibition was very similar for Kentucky bluegrass and hard fescue, with reductions in yield ranging from 17 to 39%. There was a reduction in growth of tall fescue, but to a lesser degree than for the other two species with growth being reduced approximately 10%. The BAS 106 00 W (1.50, 3.00, and 4.50 lb/acre) also was effective in reducing growth of all three species. The Kentucky bluegrass and hard fescue responded in a similar way to the additions of this material, with reductions in clipping yield ranging from 41 to 74%. Again, the tall fescue was inhibited to a lesser extent. The effects of ethephon varied with species. For Kentucky bluegrass, there was a 28% reduction in clipping yield at the 2.0 kg/ha rate. There was less inhibition as the rate of ethephon was increased.

Turfgrass quality was reduced by MBR 12325 (0.25 and 0.50 lb/acre) and BAS 106 00 W (2.0, 4.0, and 6.0 lb/acre) to a similar degree for each of the species (Fig. 2). Reductions in excess of 15% are interpreted as unacceptable phytotoxicity. Although some treatments were unacceptable, there was no severe phytotoxicity observed with any of the materials.

There was considerable variability in root weight data for tall fescue and hard fescue, but repeatable results were obtained for Kentucky bluegrass (Fig. 3). MBR 12325 (0.25 and 0.50 kg/ha) reduced root weights from 19 to 26% for bluegrass, whereas the BAS 106 00 W had no inhibitory effect on root weights. There was a 24% increase in root weight in response to ethephon (2.0 lb/acre) and decreases of 13 and 21% in response to the 4.0- and 6.0-lb/acre rates, respectively.

The results of the study indicate that polystands of Kentucky bluegrass and hard fescue could be expected to respond in a fairly similar way to MBR 12325, BAS 106 00 W, and to the 2.0 lb/acre rate of ethephon. However, where tall fescue is included in the polystand, as is often the case in the northern U.S., variations in response can be expected.

Figure 1.

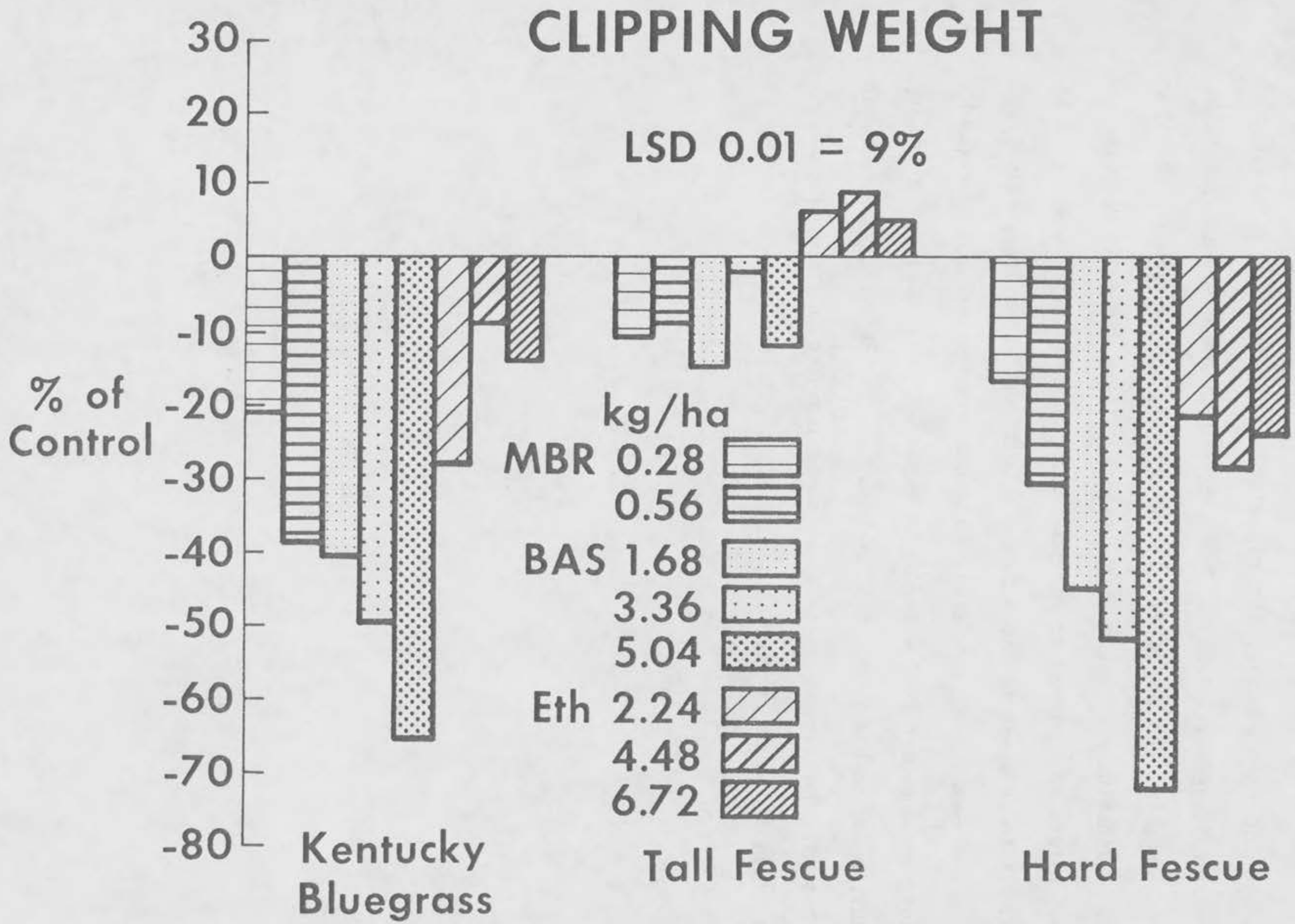

CLIPPING WEIGHT
LSD 0.01 = 9%
% of Control
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
kg/ha
MBR 0.28
0.56
BAS 1.68
3.36
5.04
Eth 2.24
4.48
6.72
Kentucky Bluegrass
Tall Fescue
Hard Fescue

Figure 2.

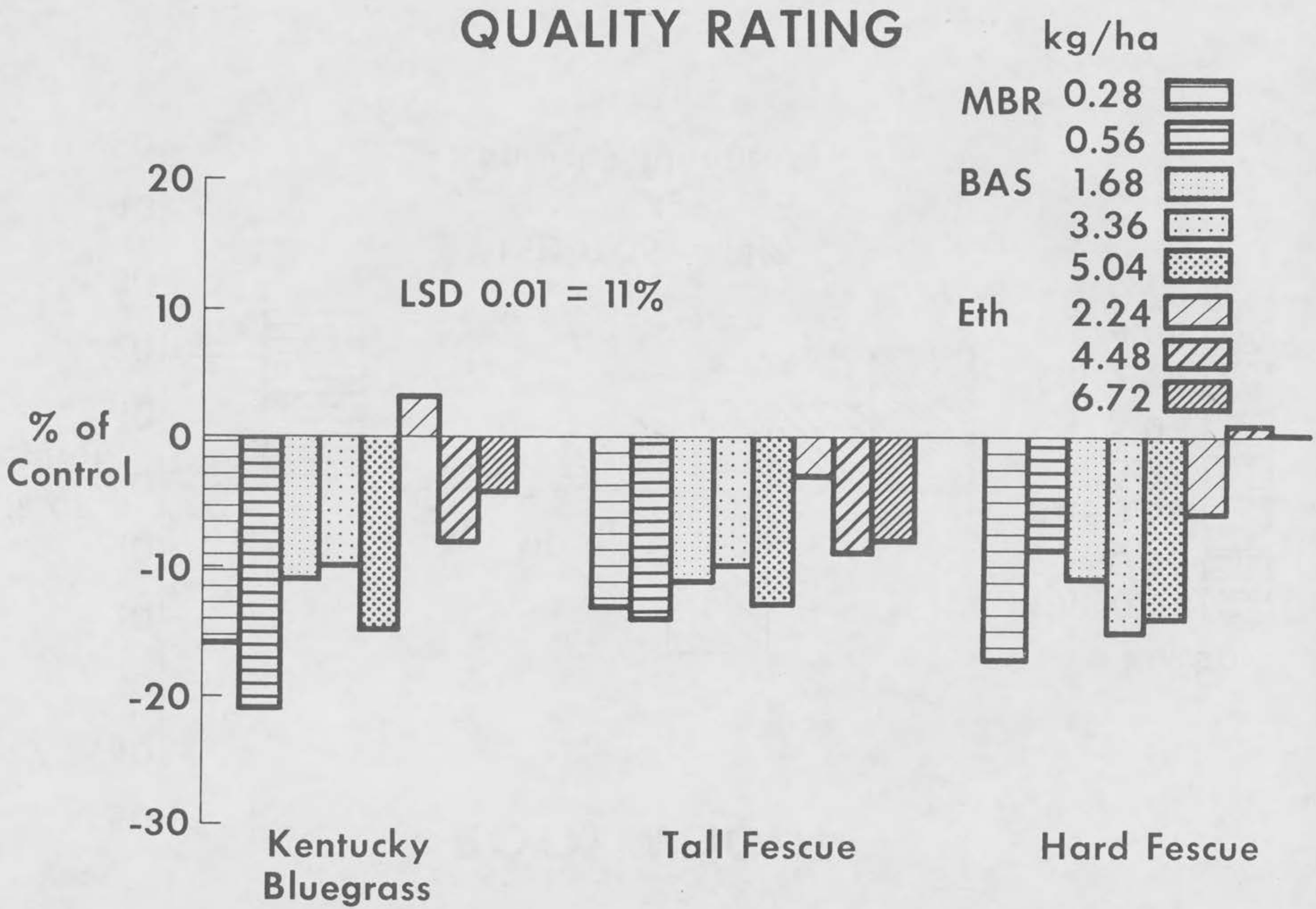
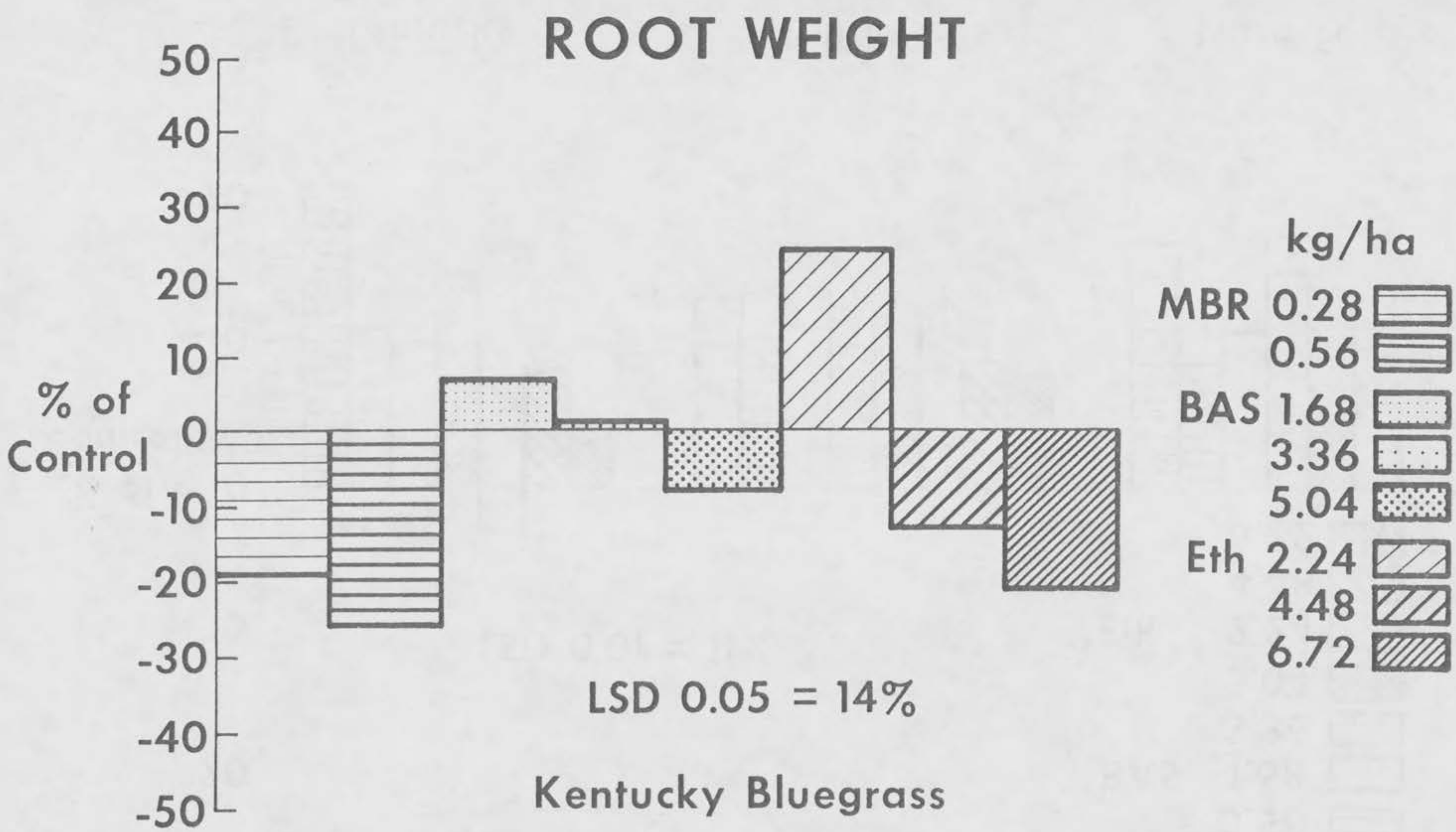

QUALITY RATING
kg/ha
MBR 0.28
0.56
BAS 1.68
3.36
5.04
Eth 2.24
4.48
6.72
LSD 0.01 = 11%
% of Control
20
10
0
-10
-20
-30
Kentucky Bluegrass
Tall Fescue
Hard Fescue

Figure 3.


ROOT WEIGHT
% of Control
50
40
30
20
10
0
-10
-20
-30
-40
-50
kg/ha
MBR 0.28
0.56
BAS 1.68
3.36
5.04
Eth 2.24
4.48
6.72
LSD 0.05 = 14%
Kentucky Bluegrass

## Sod Reestablishment Study

by

Tom Robeson

On May 12, 1981, a Kentucky bluegrass sod was cut and removed from section 3 at the Research Station. Then, on May 14, the reestablishment treatments were applied. The purposes of this study were: a) to evaluate reestablishment of Kentucky bluegrass after sod harvest, and b) to observe the effects of applying phosphorus fertilizer on sod plot reestablishment.

### The Five Methods of Reestablishment

1. Control (sod removed with no further treatment)
2. Spiking
3. Tilling followed by reseeding at 3/4 lb seed per 1000 sq ft
4. Overseeding at 3/8 lb seed per 1000 sq ft
5. Overseeding at 3/4 lb seed per 1000 sq ft

Each of these plots was split in half. To one half of the plot surface, phosphorus fertilizer was applied at 1 lb P per 1000 sq ft. No P was applied to the other half. Percent turfgrass cover was measured once a month until plots were completely covered. Sod strength measurements were collected after 16 months.

The results indicate that after 16 months none of the reestablishment treatments showed a significantly higher percent cover or sod strength over the control (Table 47). The phosphorus fertilizer treatment did improve percent cover, but not sod strength (Table 48).

Further evaluation of the effects of phosphorus fertilization on reestablishment indicate that most of the increase in cover occurred in the plots treated by spiking (Table 49). The purpose of this treatment is to sever rhizomes and thereby to increase regrowth. Surface-applied phosphorus appears to be quite important where this procedure is used.

Table 47. Effects of treatments on percent cover and sod strength.

| Treatment | Percent Cover | Sod Strength |
|---|---|---|
| Control | 93 | 58 |
| Spiking | 86 | 59 |
| 3/8 lb/1000 sq ft | 94 | 62 |
| 3/4 lb/1000 sq ft | 90 | 57 |
| Rototilled | 93 | 52 |
| LSD 0.05 | 6 | 14 |

Table 48. Phosphorus fertilizer test results.

| Treatment | Percent Cover | Sod Strength |
|---|---|---|
| Phosphorus Applied | 95 | 60 |
| Phosphorus Not Applied | 87 | 56 |
| LSD 0.05 | 4 | N.S. |

Table 49. Interaction of reestablishment treatment and phosphorus application.

| Treatment | Control | Spiking | 3/8 lb/ 1000 sq ft | 3/4 lb/ 1000 sq ft | Tilling + |
|---|---|---|---|---|---|
| | -----------% cover----------- | | | | |
| Phosphorus Applied | 93 | 96 | 93 | 92 | 99 |
| Phosphorus Not Applied | 93 | 76 | 93 | 86 | 86 |
| LSD 0.05 | 9 (for the comparison of treatments) | | | | |

*Sod strength is measured in lbs of force required to break sod.

## Sod Production

by

Tom Robeson

This sod production study was established in August, 1980, at the Ames Research Station with the final sod strength measurement taken in September, 1982. The objectives of this study were: a) to compare sod producing characteristics of five different cultivars of Kentucky bluegrass and b) to measure the effects of surface-applied vs. incorporated phosphorus fertilization on seedling establishment and root rhizome development. The five cultivars tested were: Glade, Parade, Ram I, Rugby, and Touchdown. The cultivar plots were further split into incorporated and surface-applied treatments. One half receives 1 lb phosphorus per 1000 sq ft applied to the seedbed surface. The other half received 1 lb phosphorus per 1000 sq ft incorporated into the seedbed to a depth of approximately three inches. Percent cover measurements were collected monthly and sod strength measurements were taken at the end of the second growing season.

### Conclusions

The five cultivars tested varied in percent cover, with Rugby exhibiting the highest percent cover and Ram I the lowest based on average rating over the two seasons (Table 50). Sod strength was not significantly different among cultivars or between fertilization treatments. Percent cover was significantly higher for the plots which received a surface application of phosphorus (Table 51). Final results from this investigation will be available by August, 1983.

Table 50. Cultivar differences in percent cover and sod strength.

| Cultivar | Percent Cover | Sod Strength |
|---|---|---|
| Glade | 47 | 87 |
| Parade | 50 | 79 |
| Ram I | 38 | 80 |
| Rugby | 53 | 85 |
| Touchdown | 47 | 83 |
| LSD 0.05 | 7 | N.S. |

Table 51. The effects of fertilizer placement on percent cover and sod strength.

| Fertilizer | Percent Cover | Sod Strength |
|---|---|---|
| Surface Applied | 50 | 84 |
| Incorporated | 44 | 82 |
| LSD 0.05 | 5 | N.S. |

# *Pythium* - Induced Root Dysfunction of Creeping Bentgrass on High Sand Content Mixes

by

Clinton F. Hodges

The potential importance of *Pythium* species as root-infecting pathogens of creeping bentgrass is not clear. *Pythium* species are known to be associated with the roots of creeping bentgrass and are known to infect seedling roots of this species. Where *Pythium* species are associated with the roots of turfgrass symptoms of slow growth, off-color, and thinning may occur. Some species of *Pythium* have been shown to cause extensive root rotting in turfgrass during periods of hot weather.

A disease of unknown origin, but typical of cottony blight in appearance, destroyed several golf greens in Central Iowa during the midsummer heat and high humidity of 1977. Only greens newly renovated to a high sand content mix (80% sand) were affected by the disease. The greens were entirely killed within a period of 10 days. Attempts to isolate *Pythium* from leaf and stem tissue failed. Root isolations, however, consistently yielded *Pythium* species. It is of special interest that the *Pythium*-infected roots were not rooted. All infected root tissues were intact and showed only a mild yellow-tan discoloration and rarely a surface lesion. Similar root symptoms have been attributed to *Pythium* infection of cereals.

Since the original observation of this *Pythium*-induced root disorder of creeping bentgrass in 1977, the problem has been identified from creeping bentgrass greens as far north as Ontario, Canada, and as far south as Georgia. To date, six *Pythium* isolates have been acquired and at least three of them appear to be pathogenic on the basis of preliminary studies. In all instances, the disease has occurred only on high sand content greens and appears to be most serious on old golf courses where the greens have been renovated to sand.

The occurence of this disease only on high sand content greens is significant both economically and biologically. The present trend of using pure or high sand content mixes for golf green construction and renovation is growing in popularity. The construction of a golf green is a long term investment; in the case of sand greens, it also implies several changes in management practices. Unfortunately, the biological ramifications of the use of sand and the management changes necessary to grow grass on sand require some time to occur. Our observations to date on the *Pythium* root disorder of creeping bentgrass grown in sand is suggestive of a disease that exists only in sand and with the management practices necessary for maintenance of sand greens. It is probable that one of the primary factors responsible for this problem is an incomplete microbiology of the sand medium. Inadequate microbiological competition may permit some *Pythium* species to induce disease in sand and not in soil. Other factors contributing to the problem may include fertilization and irrigation practices on sand greens, and conditions of high temperatures and humidity.

Present research is concerned with the indentity and pathogenicity of the *Pythium* isolates, and with disease-stress interactions.

# SELECTIVE CONTROL OF TALL FESCUE IN KENTUCKY BLUEGRASS WITH CHLORSULFURON

by

Dorothy Larocque and Nick Christians

## Abstract

Kentucky bluegrass, Poa pratensis, L. cv. Baron, and tall fescue, Festuca arundinacea Schreb. cv. Kentucky 31 were treated with single applications of 2 chloro-N (4-methoxy-6 methyl-1,3,5-triazon-2-yl aminocarbonyl) benzenesulfonamide, (Chlorsulfuron) at the rate of 0.25, 0.50, 1.0, 2.0, 3.0, 4.0 oz./A and with split application rates of 0.25 + 0.25, 0.50 + 0.50, 1.0 + 1.0, 2.0 + 2.0, and 3.0 + 3.0 oz/A applied at two-week interval. Data taken during the study included; weekly dry clipping weights, quality ratings. Root and rhizome development were observed and measured at termination. The chlorsulfuron severely damaged the tall fescue at single application rates of 0.50 oz/A and split application rates of 0.50 + 0.50 oz/A and greater. The Kentucky bluegrass showed a much higher tolerance to the chlorsulfuron with little effect at the 4.0 oz/A single application rate and only minor damage at the 3.0 + 3.0 oz/A split application rate.

## Introduction

Tall fescue is a common weed problem in Kentucky bluegrass. It is a major problem because of the incompatibilities between the two species and the lack of a selective control for the tall fescue.

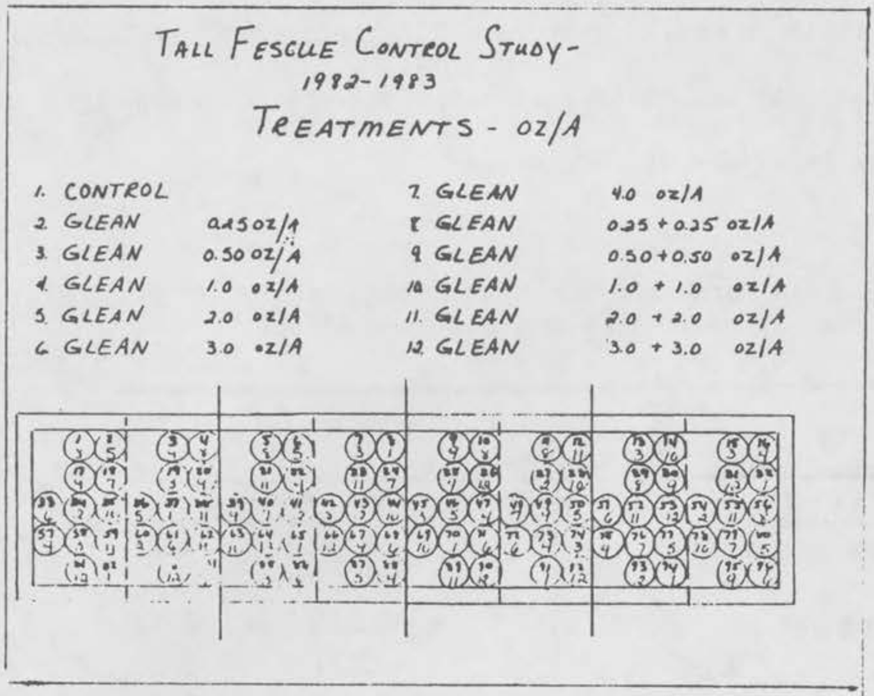
Kentucky bluegrass, Poa pratensis L. cv. Baron is the predominant cool season grass in the U.S. It is used on golf courses, lawns, and other recreational areas. It has a medium texture and dark green color, and forms an attractive turfgrass with the ability to spread and grow by rhizomes and tillers. It also forms a tightly knit turf, which is a most desirable turfgrass characteristic.

Tall fescue, Festuca arundinacea Schreb. cv. Kentucky 31, is also a cool season grass; however, it is better adapted to the hot, dry climate of the transitional zone states, such as western Nebraska and Kansas. It is used mainly on athletic fields due to its tolerance and resistance to heavy traffic. It has a bunch-type growth habit with deep roots enabling it to withstand drought and to penetrate hard, compacted clay soils. However, due to its wide, coarse-textured leaf blades and bunch-type growth habit, the grass will disrupt the uniformity of Kentucky bluegrass and become a serious weed problem.

The objectives of this study were to determine (1) the effects of chlorsulfuron on the two species and (2) to establish the tolerance levels for the species to this chemical.

Fifty sod plugs of Kentucky bluegrass (Poa pratensis) and tall fescue (Festuca arundinacea) were collected from the ISU Horticulture Research Station turf plots. The plugs were potted in 8" pots with field soil and placed in a randomized complete block design with four replications. They were maintained at 70$^{\circ}$F, cut at the heights of 2 inches and 2.5 inches (Kentucky bluegrass and tall fescue, respectively) and fertilized every 2 weeks with a 20-20-20 fertilizer prior to application.

Table 52. Set-up of the randomized complete block design with 4 replications for the greenhouse experiment.




The chemical applied was chlorsulfuron, 2-chloro-N (4-methoxy-6-methyl-1, 3, 5-triazon-2-yl aminocarbonyl) benzenesulfonamide, (Glean). It is a white, odorless, crystalline solid, slightly soluble in methylene chloride, acetone, methanol, and water (depending on pH). It was developed by the DuPont Company for the control of broad-leaf weeds in wheat and barley fields; however, it has shown some selectivity for the control of tall fescue. It is a systemic and active through both the foliage and root system.

All seven chlorsulfuron treatments were applied on the same day in January '83 with the split applications applied after a 2 week interval (Table 52). An atomizer attached to an air pressure pump was used to insure uniform coverage during application. During application, each plug was shielded to eliminate drift, then sprayed with 2 milliliters of the proper chlorsulfuron treatment. The weekly clippings were dried and weighed to determine the amount of growth occuring at each treatment rate. The weekly quality ratings were determined on a scale from 9 to 1, 9 being best quality and 1 being dead turf. Root and rhizome development were determined by a drying and ashing procedure at termination.

Table 53. Chlorsulfuron treatment rates for single and split applications expressed in kg/ha and ounces acre.

| TREATMENTS | | | | | |
|---|---|---|---|---|---|
| SINGLE | | | REPEAT | | |
| | kg/ha | oz/A | | kg/ha | oz/A |
| 1 | CONTROL | | 8 | 0.035 | 0.50 |
| 2 | 0.018 | 0.25 | 9 | 0.071 | 1.0 |
| 3 | 0.035 | 0.50 | 10 | 0.141 | 2.0 |
| 4 | 0.071 | 1.0 | 11 | 0.282 | 4.0 |
| 5 | 0.141 | 2.0 | 12 | 0.424 | 6.0 |
| 6 | 0.212 | 3.0 | | | |
| 7 | 0.282 | 4.0 | | | |

## Results

The responses varied with species and treatment rates. The Kentucky bluegrass showed a much higher tolerance to the chemical, with only minor damage at the highest split application rate of 3.0 + 3.0 oz/A. However, the tall fescue displayed such symptoms as: growth retardation, chlorosis, and necrosis at the 0.50 + 0.50 oz/A split application rate with increasing damage at increased rates. (Fig. 2 and 3) show percent kill and turf quality respectively.

Fig. 2. The relationship between the increasing chlorsulfuron treatment rates and % kill for each species.

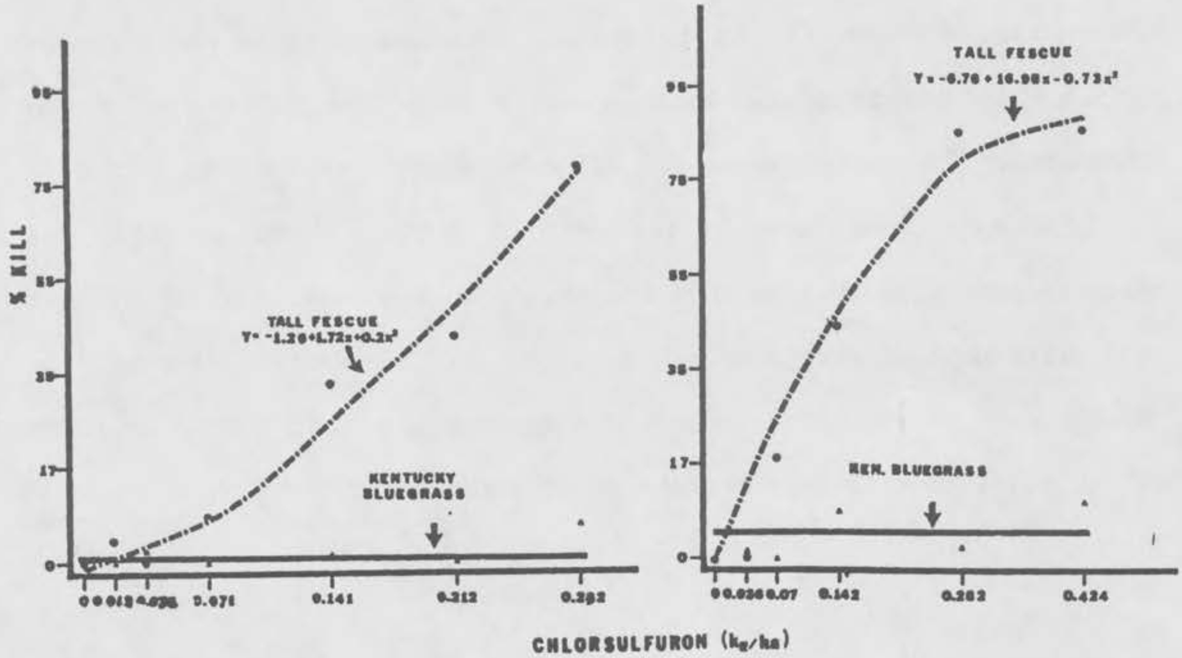
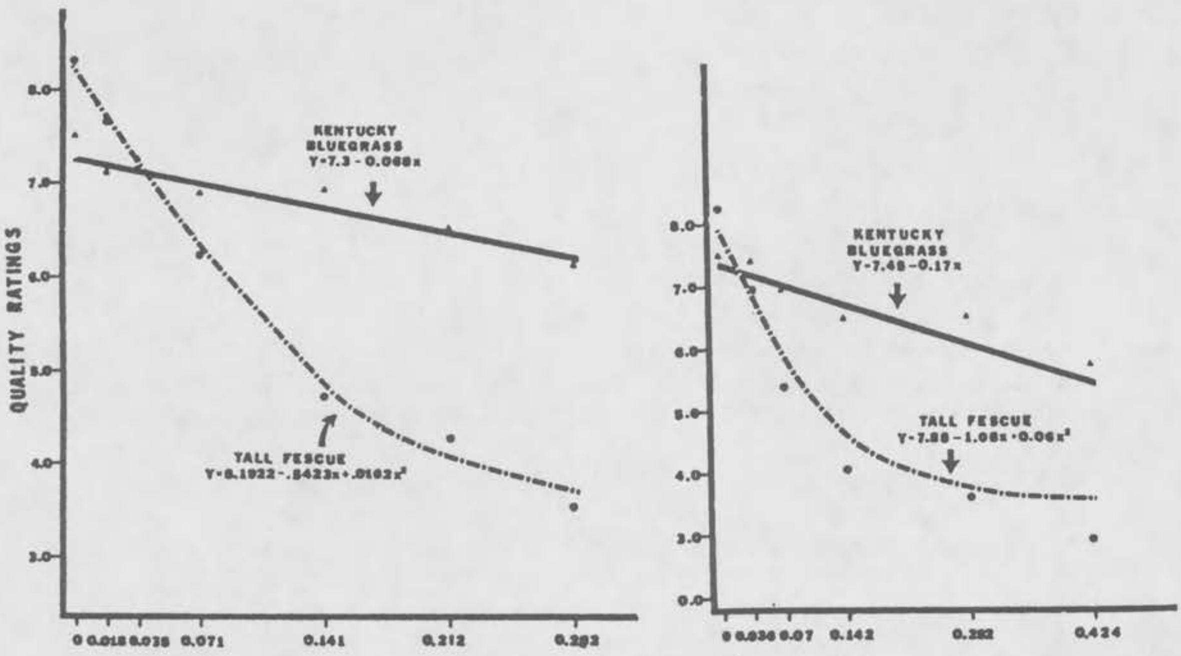



Fig. 3. The decrease in turf quality with increasing chlorsulfuron rates.




*All treatments are listed in kilograms per hectare. The treatments are equal to the following rates in ounces. 1/4, 1/2, 1, 2, 3, 4 oz/A single applications (left), and 1/2, 1, 2, 4, 6 oz/A split applications (right) .

## Conclusion

The Kentucky bluegrass showed a much higher tolerance to the chlorsulfuron than the tall fescue. The tall fescue was effected greatly by the chlorsulfuron, showing very low tolerance to the chemical. The tall fescue was effected at all rates above 0.25 oz/A with the most damage done at the rate of 0.50 oz/A and above. The data from this study show that chlorsulfuron has potential for being a selective control for tall fescue in Kentucky bluegrass. However, the study will be repeated in the greenhouse and then conducted under field conditions to substantiate these conclusions.

United States
Environmental Protection
Agency

Municipal Environmental Research
Laboratory
Cincinnati OH 45268

Research and Development

EPA-600/S2-81-074 May 1981

EPA

# Project Summary

# Safe Disposal Methods for Agricultural Pesticide Wastes

Charles V. Hall, James Baker, Paul Dahm, Loras Freiburger, Greg Gorder, Layne Johnson, Gregor Junk, Fred Williams, and Charles J. Rogers

**During the 3-year period from October 1976 to 1979, comprehensive chemical, biological, climatological, and engineering studies were conducted at Iowa State University, Ames, Iowa, to determine effectiveness of pesticide disposal facilities being used at the school and to compare controlled systems that might provide a basis for improvement. Evaluation of the pit disposal systems included detailed chemical sampling of the systems and their surrounding environments, identification and counts of bacterial populations, entomological studies, estimation of pesticide volatilization rates, and evaluation of pit design for efficiency, effectiveness, and convenience of operation.**

***This Project Summary was developed by EPA's Municipal Environmental Research Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).***

## Introduction

A polyethylene-lined open pit at the Agronomy-Agricultural Engineering Research Center had been used for dumping surplus dilute pesticides, primarily herbicides, for about 14 years. In 1978, a new pit was built; it was lined with two layers of 6-ml-thick polyethylene plastic; filled with sand, soil, and gravel; and covered by a metal building. Sampling wells were installed for monitoring purposes.

To test pit disposal methods under controlled conditions, 56 polyethylene minipits, each with a capacity of 115 liters and equipped with a cover, were installed partially underground. Combinations of four herbicides (alachlor, atrazine, trifluralin, and 2,4-D) and two insecticides (carbaryl and parathion) were studied in mixtures and individually at two concentrations after being incorporated with 15 kg of soil and 55 liters of water per container. One half of the containers were aerated. For each combination of pesticide, chemical dissipation, bacterial activity, and bioassays were conducted.

A concrete pesticide disposal pit at the Horticulture Station, in operation since 1970, was systematically monitored, and the chemical disposal, accumulation, bacterial activity, and evaporation were evaluated. The inside pit dimensions are 3.35 m (width) x 8.84 m (length) x 1 m (depth). It is filled with soil and gravel layers each approximately 30 cm thick. A motorized cover triggered by rainfall closes to prevent flooding. Climatological data were collected on the site and correlated with pan and pit evaporation. Programs were developed to predict pit evaporation rates from local evaporation data. Leakage from the pit was monitored as well as pollution of a lake and well located on the station.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1981-757-012/7133

## Results

After 14 years of dumping dilute pesticides (primarily herbicides) in the open, polyethylene-lined pit at the Agronomy-Agricultural Engineering Research Center, the surrounding area obviously had been affected. The pit was ineffective because it had overflowed, rainfall had not been excluded, and the plastic had deteriorated. A large area, free of all vegetation, was cultivated, planted with corn, soybeans, and selected weed species. Only corn grew, which indicated a high concentration of triazine compounds.

The newly constructed polyethylene-lined pit covered with a metal building appears to have a seepage problem since the water level fluctuates. Obviously two 6-ml-thick layers of plastic are inadequate regardless of the care taken in installation. In areas where the water table is high or where seepage will occur, similar systems for disposal are unsatisfactory. In colder climates, where freezing and thawing of soil occurs to a considerable depth, pit liners must be selected with extreme care.

The reinforced concrete disposal pit at the Horticulture Station appears to be completely environmentally safe and effective for pesticide waste disposal. Following 10 years' use and the disposal of over 40 different pesticides (insecticides, fungicides, herbicides, etc.), the system continues to function efficiently and no leakage has occurred. Aerobic bacterial activity in the soil is highly effective in biodegrading many of the compounds. Liquids continue to evaporate with no detectable atmospheric pollution. The rainfall-activated cover functions to prevent overflowing and excludes all outside water.

Evaporation and climatological data collected on the site were used to develop models for predicting evaporation at other geographic locations. During a normal season, over 6,000 gallons of water are evaporated from this pit.

A new cover design was developed to reduce initial cost and restrict access to the disposal area. All pesticide sprayers being used have been modified to permit excess liquids to be dumped into the pit without the equipment entering the pit.

After 68 weeks, of which only about 30 were conducive to active pesticide decay, data collected from residues in the micropits containing the six selected pesticides were evaluated. The effect of aeration and nutrient supplements on decay rate and bacterial and insecticidal activity were measured. Those compounds most resistant to decay were atrazine, alachlor, and trifluralin; they were, however, contained and did not contaminate surrounding areas.

Complete methodology for all phases of research were developed and are described in the final report.

The full report was submitted in fulfillment of Grant No. R-804533 by Iowa State University under the sponsorship of the U.S. Environmental Protection Agency.

*Charles V. Hall, James Baker, Paul Dahm, Loras Freiburger, Greg Gorder, Layne Johnson, Gregor Junk, and Fred Williams are with the Iowa State University, Ames, IA 50011.*

***Charles J. Rogers** is the EPA Project Officer (see below).*

*The complete report, entitled "Safe Disposal Methods for Agricultural Pesticide Wastes," (Order No. PB 81-197 584; Cost: $18.50, subject to change) will be available only from:*

*National Technical Information Service*
*5285 Port Royal Road*
*Springfield, VA 22161*
*Telephone: 703-487-4650*

*The EPA Project Officer can be contacted at:*

*Municipal Environmental Research Laboratory*
*U. S. Environmental Protection Agency*
*Cincinnati, OH 45268*

SAFE DISPOSAL METHODS FOR AGRICULTURAL PESTICIDE WASTES

## SUMMARY OF RESULTS

Following three years intensive research by scientists in the Ames Laboratory, the Departments of Agronomy, Agricultural Engineering, Bacteriology, Botany, Entomology and Horticulture and co-sponsored by USEPA, evaluating the effectiveness of various waste pesticide disposal systems, the results can be summarized as follows:

(1) A concrete pit equipped with a rain activated mobile cover, filled with layers of gravel, soil and gravel, located at the Horticulture Station, was found to be a highly satisfactory disposal system. The pit which has a volume of approximately 30,000 liters has had over 50,000 grams of waste from over 40 pesticides deposited since 1970 and continues to be fully effective.

(2) No leakage or contamination of the well, lake or other surrounding areas was found.

(3) Bacterial populations continued to be effective in degradation of various compounds.

(4) No harmful environmental effects were found.

(5) A container cleaning and disposal system was established.

(6) Computer models are being developed to predict evaporation based on climatological data collected on site.

A film plastic lined pit constructed at the Agronomy-Agricultural Engineering Station was less effective in containing liquid pesticide wastes. Environmental effects of pit leakage were not determined.

Prepared by:

Charles V. Hall
June, 1983

## Shade Tree Mineral Nutrition Studies - Horticulture Research Farm

This study was started in the fall of 1980 and terminated in the fall of 1982. Data from this study are presently being statistically analyzed and interpreted. Publication of the results is expected by late 1983 or early 1984.

This study consisted of three experiments and a preliminary examination of correcting iron chlorosis in pin oak by soil application of various iron compounds and acids.

One experiment examined fertilizing methods (drill hole, tree stake and water injection) on growth of three tree genera (pin oak, scotch pine, silver maple) and the incidence of "green spotting" of the turf as affected by depth of fertilizer placement (shallow and deep), number of application points (X and 2X) and time of application (spring or fall).

A second experiment examined type of nitrogen (Urea or Nitroform Bluechip) on growth of the same three tree genera as affected by placement zone (dripline or 3 ft. outside dripline), number of application points (X or 2X) and time of application (spring or fall).

The third experiment examined tree stakes (Jobe's or Ross Daniel) on growth of silver maple and scotch pine as affected by placement zone and application time.

The preliminary pin oak iron chlorosis study revealed no visual benefit from soil application of iron sulfate, Ross Daniel "Green Again" injection, sulfuric acid or phosphoric acid.

Wayne Hefley
June, 1983

## NATIVE GRASSES AND WILDFLOWER EVALUATION

Native grass and wildflower plots were established in the fall of 1981. Fall plots were dormant seeded in early December 1981. Spring plots were seeded the last week in May 1982. Plots were prepared by 1) rototilling and a straw mulch applied after seeding; 2) spraying with Roundup and heavy verticutting or 3) spraying with Roundup and lightly verticutting. Seed was uniformly mixed, broadcast over 3 x 3 m plots, and worked into soil contact with a rake. One-half of each plot was fertilized with .5 lb nitrogen and 1.0 lb phosphorus/ 1000 square feet after seeding. Each treatment was replicated three times.

The Pinto Northern Wildflower Mixture contained bachelor button, baby's breath, chicory, evening primrose, scarlet flax, catchfly, clasping coneflower, lanceleafed coreopsis, corn poppy, baby snapdragon, and Lewis flax. The Pinto mix was planted as recommended, 4 pounds per acre wildflower seed plus 26 pounds per acre fine fescue (sheep fescue).

The native grass and prairie flower plots were seeded with 9 pounds pure live seed per acre (pls/a) native grass and 2 ounces per acre of each native prairie flower. The native grass mixture consisted of Blackwell's switchgrass (1 lb pls/a), Kaw big bluestem (2.5 lb pls/a), Blaze little bluestem (1.5 lb pls/a), Nebraska 54 indiangrass (2 lb pls/a), and Trailways sideoats grama (2 lb pls/a). Included with the grasses were 6 prairie flowers, Kaneb purple prairie clover, Sunglow gray-headed prairie coneflower, upright prairie coneflower, Eureka thick spike gayfeather, Nekan pitcher's sage, and the purple coneflower.

### Results and Discussion

The Pinto wildflower mix seeded in the fall produced the heaviest establishment the first season. A good succession of bloom from the annuals-biennials continued from early until late season. The late spring seeding produced very few blooming plants although many were present in a rosette stage. The rototilled plots produced the best establishment, growth, and blossoming the first season. The Roundup treatment with the heavy and light verticutting allowed some establishment but resulted in reduced growth and limited flowering.

Fall seeding of the native grass and prairie flower mixture produced better establishment of the native prairie flowers. A few of the upright coneflowers (a shortlived perennial) bloomed the first season. Other recognizable prairie flowers seen included the purple coneflower, pitcher's sage, the upright coneflower, and the gray-headed coneflower. In the fall seeded plots a few switchgrass seedlings were also identified.

The late spring seeding of the native grass and prairie flower mixture appeared to aid the establishment of the grasses although a few native flowers were present. Rototilling resulted in heavier weed growth in those plots and we are unable to ascertain whether it aided in the establishment of the native grasses. Fertilization increased weed growth and did not, apparently, improve growth of the seeded species. The native grasses and selected native flowers are perennials and take one or two seasons to become established prior to producing seedheads and flowering. Evaluation this second season should indicate the degree of establishment of the native grasses. The native grasses are extremely difficult to detect and positively identify in their vegetative stage.

Evaluation of the Pinto Wildflower mix must continue a second season as well. Many of the species are annuals, biennials, or extremely shortlived perennials. Many must reseed themselves each year for continued flowering. Nearly all would need to reseed if season-long bloom is to occur. There appeared to be very little establishment of the fine leafed fescue. Evaluation the second season will determine longterm effectiveness of the Pinto Wildflower seed mixture.

James Midcap
June, 1983

Table

# NATIVE GRASS AND WILDFLOWER PLOT PLAN

## TREATMENTS

**1981**

1. Fall; Pinto Mixture; Till, seed, mulch.
2. Fall; Pinto Mixture; Roundup, heavy verticut, seed.
3. Fall; Pinto Mixture; Roundup, light verticut, seed.
4. Fall; ISU Mixture; Till, seed, mulch.
5. Fall; ISU Mixture; Roundup, heavy verticut, seed.
6. Fall: ISU Mixture; Roundup, light verticut, seed.

**1982**

7. Spring; Pinto Mixture; Till, seed, mulch.
8. Spring; Pinto Mixture; Roundup, heavy verticut, seed.
9. Spring; Pinto Mixture; Roundup, light verticut, seed.
10. Spring; ISU Mixture; Till, seed, mulch.
11. Spring; ISU Mixture; Roundup, heavy verticut, seed.
12. Spring; ISU Mixture; Roundup, light verticut, seed.

0 = No fertilization

1 = 1 lb $P_2O_5$/1000 $ft^2$; 0.5 lb N/1000 $ft^2$

## PLOT PLAN

S ↑ N

Replication #1

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 ¦ 0 | 1 ¦ 0 | 0 ¦ 1 | 1 ¦ 0 | 0 ¦ 1 | 0 ¦ 1 | 1 ¦ 0 | 1 ¦ 0 | 1 ¦ 0 | 0 ¦ 1 | 0 ¦ 1 | 1 ¦ 0 |
| 4 | 8 | 12 | 2 | 7 | 1 | 11 | 3 | 9 | 6 | 10 | 5 |

Replication #2

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 ¦ 0 | 1 ¦ 0 | 0 ¦ 1 | 0 ¦ 1 | 1 ¦ 0 | 1 ¦ 0 | 0 ¦ 1 | 0 ¦ 1 | 1 ¦ 0 | 1 ¦ 0 | 1 ¦ 0 | 0 ¦ 1 |
| 3 | 6 | 10 | 2 | 9 | 5 | 8 | 11 | 7 | 12 | 1 | 4 |

Replication #3

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 ¦ 1 | 1 ¦ 0 | 0 ¦ 1 | 0 ¦ 1 | 1 ¦ 0 | 0 ¦ 1 | 0 ¦ 1 | 1 ¦ 0 | 0 ¦ 1 | 1 ¦ 0 | 0 ¦ 1 | 0 ¦ 1 |
| 2 | 7 | 6 | 12 | 8 | 1 | 11 | 5 | 10 | 9 | 3 | 4 |

Companies and Organizations Which Have
Made Donations to the Research Program*

Special thanks is expressed to Tri State Toro for providing a Greensmaster III, Triplex Greensmower for use on the research green this year.

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* In the rush to prepare this information for the field day report, some companies may have inadvertently been missed. If your company has provided financial or material support for the research program, and is not mentioned above, please contact me so that it can be added in future reports.