

## CULTURAL PRACTICE INTERACTIONS ON GOLF COURSE TURF

### INTERACTIVE EFFECTS OF IRRIGATION FREQUENCY, CLIPPING REMOVAL OR RETURN, NITROGEN RATE AND TRAFFIC ON 'PENNCROSS' CREEPING BENTGRASS COMPETITION WITH ANNUAL BLUEGRASS (Poa annua L.)

#### INTRODUCTION

Expectations for turf quality and playability on golf courses have increased to levels that require highly intensive maintenance. The typical conditions found on greens, tees, and fairways of current golf courses are high fertility, close mowing, and frequent watering, inclusive of compacted soils caused by traffic of vehicles, equipments, and golfers. Under these conditions, annual bluegrass (Poa annua L.) tends to invade, persist and become a major component. In other words, the cultural practices and soil conditions on current golf courses are ideal for the invasion of annual bluegrass.

Annual bluegrass is recognized as a serious weed problem in highly maintained turf. The invasion of annual bluegrass has negatively influenced turf quality and playability on golf courses. More and more golfers, more use of carts and equipments and more playing, even on wet turf grasses will be expected continuously in the future, resulting in increased soil compaction. Thus annual bluegrass invasion will also be anticipated to be one of big problems on the golf course of tomorrow because the tolerance of annual bluegrass to compacted, poorly aerated soil conditions is excellent, so it gains a competitive advantage over preferred turfgrass under these conditions. Attempts at controlling this pest with chemicals date back to the 1930's and numerous herbicides have been reported as promising for annual bluegrass control. Chemicals can be of help in the battle, but chemical control by itself is not enough at the present time. Even if the existing Poa annua can be eliminated, it will doubtlessly return unless a good cultural program is established. A basic principle of turfgrass science states that each grass species will thrive best under a specific environmental and cultural regime, and that the regime for each species will be different. Thus by structuring a cultural maintenance program to fit a desirable species as much as possible, it would be possible to reduce the population of Poa annua in a turfgrass stand.

Trying to contain the Poa population on a golf course to a reasonable level is a difficult and somewhat frustrating problem even under the best of circumstances. By knowing which cultural practices will optimize fairway turf quality and playability yet limit Poa annua to a relatively small population in fairways, the golf course superintendents can then choose a proper fairway maintenance program.

**Objectives:** This study was initiated to determine the effects of irrigation frequency, clipping removal or return, nitrogen nutrition and traffic or nontraffic on

turf quality and color, fairway playing condition and annual bluegrass encroachment under creeping bentgrass fairway conditions with annual bluegrass competition.

## MATERIALS AND METHODS

A creeping bentgrass fairway turf was established from seed in May of 1988 on a native Sharpsburg silty-clay soil (Typic Argiudoll), located on the 'John Seaton Turfgrass Research Facility' at Mead, Nebraska. Since the traffic effects are an obvious interaction, trafficked versus nontrafficked areas are considered as separate studies and the fairway management study has been conducted under both trafficked and nontrafficked conditions.

### **Experimental Design & Treatments**

The experimental design for this study is a split-split plot design with the two irrigation frequencies as the main plots, the two clipping treatments as the subplots, and the three nitrogen rates as the sub-subplots, making a total of twelve treatments with three replications.

Main-plot treatment : The irrigation schedule is changed weekly to two different frequencies with the same irrigation replacement, i.e, 7 times per week (7x; light frequent irrigation) and 1 times per week (1x; heavy infrequent irrigation). Irrigation replacement is based on ET rates as determined by Nebraska modified Penman equation. The 80% ETp rate of the previous week is applied for the replacement in the following week.

Sub-plot treatment : Clipping treatments in this study are divided into two different applications, i.e, clippings return (C+) and clippings removal (C-) after the mowing. Clippings removal is made by using the mower with baskets attached.

Sub-Sub-plot treatment : Three nitrogen rates are included; 5g N/m<sup>2</sup>/season (1 lb N/1000 ft<sup>2</sup>/season), 15g N/m<sup>2</sup>/season (3 lb N/1000 ft<sup>2</sup>/season), and 25g N/m<sup>2</sup>/ season (5 lb N/1000 ft<sup>2</sup>/season).

### **General Cultural Practices**

General cultural practices except for treatments, follow a general fairway maintenance of the golf courses. The bentgrass fairway turf is mowed at half inch height of cut four times weekly during the growing season. According to the soil test recommendation before the study, 5g P/m<sup>2</sup>/season (1 lb P/1000 ft<sup>2</sup>/season) and 15g K/m<sup>2</sup>/season (3 lb K/1000 ft<sup>2</sup>/season) were applied. Pesticides were applied as needed.

Plots were core cultivated during the growing season to reduce soil compaction and to improve turfgrass growth. Vertical mowing was applied before coring in fall to control thatch. Traffic application was 2 times weekly over trafficked areas, using 5 passes of traffic simulator during the growing season. The traffic simulator was constructed of a 700 lb steel drum, with metal golf spikes attached on 3-inch centers.

Topdressing practice was applied after the coring cultivation in spring and fall to introduce the annual strain of annual bluegrass, Poa annua var. annuum. Thus annual biotypes were attempted to be introduced using topdressing materials obtained from local golf courses that were known to be contaminated with Poa annua var. annuum. Perennial-type annual bluegrass (Poa annua var. reptans) was obtained from the University of Minnesota, propagated in the greenhouse, and was transplanted to the research area in the form of vegetative plugs.

#### **Data Collection**

Turfgrass quality & color: Visual rating scales from 1 to 9 with 9 being the most desirable characteristic, were used to gauge turfgrass color and quality. Visual quality and color ratings are taken on all plots monthly during the growing season.

Fairway playability: Treatment effects on the fairway playing conditions are determined for such growth parameters as fairway ball speed, load bearing capacity, tolerance to divoting and recovery of divots damaged. Fairway speed is decided by using a modified stimpmeter. Two rolls in every direction are taken on each plot (eight measurements per plot) monthly during the growing season. Load bearing capacity is measured four times per plot every month during the growing season with a special device which was designed and built in the Agricultural Engineering Department. Divoting treatments are given three times during the growing season, using a specially designed divot simulator. Six divots are made per plot in each divoting treatment. Divot tolerance is determined by measuring length, width, depth, area, and volume of each divot. Soil moisture content is monitored together with divot tolerance. Right after the evaluation of divot tolerance, three of six divots are returned to the site divoted (D+, divot-return) and the other three divots are removed (D-, divot-removal). Recovery of D+ and D- is estimated weekly on a visual scale from 1 to 9 with 9 = complete recovery.

Poa annua encroachment: Lateral growth measurements were made in spring and fall as four perpendicular vectors per plug for perennial-type annual bluegrass (Poa annua var. reptans) while an estimate of annual bluegrass population was made for annual-type (Poa annua var. annuum).

### **PRELIMINARY RESULTS**

#### **Turfgrass Quality and Color:**

1. Turfgrass quality and color ratings increased with irrigation frequency and nitrogen rate in both traffic conditions, with a exception of contrasting nitrogen response under nontrafficked condition in heat stress period of 1989.
2. Green-up of spring season was mainly associated with increased nitrogen rate and slowest green-up was observed with low nitrogen rate (1 lb N/M/S).

3. Irrigation x nitrogen interaction for color and quality in 1990 September was found in both traffic areas and high N rate associated with frequent irrigation produced highest quality and color ratings while high N rate associated with infrequent irrigation produced least.

**Fairway Playing Conditions:**

4. The same responses to fairway ball speed and load bearing capacity were found under both trafficked and nontrafficked conditions and reduced irrigation frequency, clippings removal and low nitrogen rate produced faster ball speed and better load bearing capacity than their contrasting treatments. Fairway playability under trafficked conditions was better than that under nontrafficked conditions.
5. Irrigation x nitrogen interaction was found with 1989 September ball speed evaluation and fastest speed was associated with 1 lb N rate under reduced irrigation frequency but 3 lb N rate under increased irrigation frequency. These interactive responses were equally observed in both traffic areas.
6. Treatments subjected to increased irrigation frequency, clipping return and increased nitrogen rate generally produced more divot damage but faster recovery than their contrasting treatments.
7. Interactions among irrigation, clippings, and nitrogen treatments were observed under nontrafficked conditions in May-divoting application of 1990 and treatments associated with infrequent irrigation, clippings removal and medium nitrogen rate (3 lb N/M/S) produced least divot injury among all 12 treatment combinations. The same interactive responses were also observed on 1990 August-divoting treatment with the exception of infrequent irrigation, clippings return and low nitrogen rate under nontrafficked conditions.

**Annual Bluegrass Competition:**

8. Panicle counts of perennial-biotype annual bluegrass increased with clippings return and high nitrogen level and its lateral verdure spread increased with nitrogen level in both traffic areas.
9. Interaction of irrigation x nitrogen was observed under nontrafficked conditions and low nitrogen rate (1 lb N/M/S) with any irrigation frequency produced least counts in panicles.
10. Thus it can be concluded that perennial-type annual bluegrass encroachment over creeping bentgrass is least in treatments of low nitrogen application and clippings removal with no difference in irrigation frequency treatment.

## PRELIMINARY CONCLUSIONS

1. Reduced frequency, clipping removal and low nitrogen rate associated with improved fairway playing conditions are always accompanied by a loss of turf quality.
2. Divot tolerance was negatively associated with soil moisture level at a time of divoting application.
3. Treatments of frequent irrigation, clippings return and high nitrogen rate produced more divot injury but provided more rapid recovery than their counterpart treatments.
4. Different cultural practices play a significant role in enhancing or deterring turfgrass color and quality, fairway playing conditions, and annual bluegrass competition.
5. The numerous interactions indicate that any one management practice can not easily meet demands desirable for the maintenance of quality creeping bentgrass fairway, suggesting the necessity for a combination of management practices.
6. Different results between trafficked and nontrafficked conditions suggest a careful application of research data done under nontrafficked conditions.

## **GRADUATE STUDENTS**

Currently, the Ph.D. work being conducted by Kyoung Nam Kim is being completed. The thesis of Tom Salaiz was completed this year: Mowing height and vertical mowing frequency effects on putting green quality. M.S. Thesis.