Annual Bluegrass/Creeping Bentgrass Competition

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INTRODUCTION

Mixed stands of annual bluegrass and creeping bentgrass are common on fairways north of the transition zone. The desired species is normally creeping bentgrass, with the annual bluegrass present as an invading species. Annual bluegrass re-establishes open areas in the turf from seed present in the soil and/or vegetatively via rapid tillering or rhizomes. Turf managers are than faced with two options. 1) Manage the turf to favor creeping bentgrass or, if the annual blugrass population is very high, 2)manage to favor the annual bluegrass. Investigations into management practices which favor either species would be of immediate benefit to turf managers. Turf scientists also benefit by gaining a better understanding of the annual bluegrass/creeping bentgrass competition complex.

METHODS

A field study, initiated in May of 1984 and completed in October of 1986 was conducted to investigate management factors affecting annual blugrass/creeping bentgrass competition. The study was conducted at the Hancock Turfgrass Research Center. The treatment design was a five factor factorial arranged as a split-split plot with 72 treatment combinations. The five management factors investigated were: Irrigation (daily at 75% of open pan evaporation (OPE), 3X per week at 110% of OPE, and irrigation at wilt); clipping removal or return; N-fertility (2 or 6 #/N/M/YR);plant growth regulator (PGR) treatment (spring applications of Embark at 1/8 # a.i./A, Cutless at 1 # a.i./A, or a control); or overseeding or no overseeding with bentgrass at 1 #/M. Data was collected on the change in annual bluegrass population for each treatment. Population was estimated using a 112 point grid system. Population of annual bluegrass was estimated in 1984 prior to treatment initiation and in the fall of 1984, 1985 and 1986 to estimate the population change per year and combined shift over three years. Data were also collected on nutrient levels of clipping samples from the clipping removal and returned plots and from soil samples from both clipping and N-fertility treatments. Data were also collected on clipping removal effects on soil seed reservoir by collecting soil samples from the clipping treatments, breaking up the soil sample and applying the sample to a flat in the greenhouse. The number of viable annual blugrass plants present were then counted.

Results & Discussion

Results of the analysis of variance are shown in Table 1. This report will discuss main effects which were significant in a given year or combined over three years and also any significant interactions in the combined year analysis. Under the main effects sub-heading in Table 1 is significance levels for a factor termed covariate. The covariate factor was included in the analysis to determine if the initial annual bluegrass population had an influence on the annual bluegrass population shift, independent of treatment. The covariate factor was significant in 1984 and for the combined year analysis. Therefore, means for 1984 and for the combined year are adjusted for the covariate using a statistical procedure known as least squares.

After three years clipping removal significantly decreased the annual bluegrass population when compared to plots where clippings were returned. For individual years clipping removal reduced the annual bluegrass population in 1984 and 1986 but not in 1985 (Fig. 1). Two possibilities might exist for this response. First, the annual bluegrass clippings may contain a substance which inhibits the growth of creeping bentgrass. Substances which are produced by plants which are harmful to other plants have been discovered, these substances are termed allelo-chemicals. Second, when clippings are returned a substantial amount of viable annual bluegrass seed is also returned. Returning clippings is, in effect, annual bluegrass overseeding.

Nitrogen fertility significantly affected the annual bluegrass population in only one year of the three year investigation. In 1985 plots that received 2 lbs/N/M/YR had significantly less annual bluegrass than plots which received 6 lbs/N/M/YR (Fig., 2). The vertical bars in Fig. 2 represent the rainfall for May-September, for each year. 1985, the only year when N-fertility had a significant effect on annual bluegrass, had the lowest rainfall of the three years indicating that environmental factors play a significant role in annual bluegrass/creeping bentgrass competition.

PGR's did not significantly affect the annual bluegrass population in any one year of the study, but when the data are combined over all three years PGR's were a significant source of variability. In the combined year analysis Embark had significantly more annual bluegrass than either the control or Cutless treated plots (Fig. 3). Embark inhibits grass seedhead production. Spring applications of Embark coincide with a period when annual bluegrass seedhead production is very high. The energy normally used for flowering in annual bluegrass may , after Embark applications, be reallocated to other portions of the plant such as roots or crown tissue. This may make the annual bluegrass plant more vigorous and competitive.

The response of Embark was significantly affected, while the Cutless and control treated plots were unaffected by N-fertility (Fig. 4). High N-fertility in combination with Embark significantly increased annual bluegrass populations.

Plots which were not overseeded and irrigated daily at 75% of OPE had significantly more annual bluegrass than the non-overseeded plots irrigated at 110% OPE 3x/week or at wilt (Table 2). Table 2 also shows that, when compared to not overseeding, overseeding was effective in increasing bentgrass populations only when plots were irrigated daily. This reinforces the importance of maintaining a moist soil condition to enhance sucessful overseeding.

Table 3 displays the data for the PGR X Clipping Removal X Overseeding interaction for the combined year analysis. Several interesting points can be seen in Table 3. Within the Embark plots, overseeding and clipping removal significantly decreased annual bluegrass when compared to the overseeded, clipping returned plots. Within the control plots clipping removal, overseeded or not, had significantly less annual bluegrass than the corresponding clipping returned plots. This was also true of the Cutless treated plots. Also within the Cutless treatments overseeded, clipping returned plots had less annual bluegrass than the clipping returned, non-overseeded plots. Within the overseeded plots PGR applications had no effect in the clipping returned plots, but in the clipping removed plots the Embark treated plots had significantly more annual bluegrass than the control or Cutless treated plots. This was also true of the non-overseeded plots.

The nutrient content of clipping samples was significantly affected by clipping removal (Table 4). Samples from plots where clippings were removed had less potassium (K), boron (B), copper (Cu), and zinc (Zn) and more calcium (Ca) than plots where clippings were returned.

Soil nutrient levels were also affected by clipping removal as well as N-fertility treatment (Table 5). Clipping removal significantly reduced the K and nitrate-N (NO_3) content of the soil. High N-fertility reduced the magnesium but increased the K in the soil when compared to the Low-N treated plots. It would be expected that the NO_3 levels would be different in different N-fertility treatments. The date the soil samples were obtained were after a period of unusually high rainfall (see Fig. 2) and the NO_3 may have been leached in the High-N plots to levels comparable to the Low-N treated plots.

Results of clipping and soil analysis indicate that if clipping removal is practiced close monitoring of nutrient levels is required.

Clipping treatments had a pronounced effect on the annual bluegrass seed reservoir (Fig. 5). Samples from plots where clippings were returned had over 4 times the amount of viable seed than plots where clippings were removed. This data supports the conclusion that returning clippings is a passive form of annual bluegrass overseeding.

Summary of results of the 5 factor management study are shown in Table 6. Caution should be exercised for implementation of practices which are noted with an asterisk.

Table 1. Analysis of Variance. 5 Factor Field Study: 1984–1986. HTRC.

	YEAR 84	85	86	COMB.
MAIN EFFECTS				
CLIP. REM.(CR)	*	NS	*	**
N–FERT(F)	NS	**	NS	NS
PGR	NS	NS	NS	*
COVARIATE	**	NS	NS	**
INTERACTIONS				
IRRIG X CR	**	NS	NS	NS
IRRIG X OS	*	NS	NS	*
IRRIG X F	NS	*	NS	NS
PGR X F	NS	NS	NS	*
PGR X F X CR	NS	NS	*	NS
O X I X CR X F	NS	*	NS	NS
O X PGR X CR	NS	NS	*	*

Table 2. 5 Factor Field Study. Irrigation X Overseeding Interaction. Combined Year Analysis. HTRC.

	IRRIGATION TREATMENT 75%	110%	AT WILT
OS	–17.5	–14.1	–20.8
NOT OS	–9.7	–15.6	–18.7

NOTE:DATA REPRESENT DECREASE IN ANNUAL BLUEGRASS

Table 3. 5 Factor Management Study. PGR X Clipping Removal X Overseeding Interaction. Combined Year Analysis. 1984–1986. HTRC.

	EMBARK C+	EMBARK C–	CUTLESS C+	CUTLESS C–	CONTROL C+	CONTROL C–
OS*	–10.1	–20.5	–14.4	–23.3	–8.2	–28.4
NOS*	–9.6	–13.3	–6.8	–25.1	–11.1	–22.2

* INDICATES OVERSEEDED OR NOT OVERSEEDED WITH BENTGRASS, RESPECTIVELY.

NOTE:DATA REPRESENT DECREASE IN ANNUAL BLUEGRASS

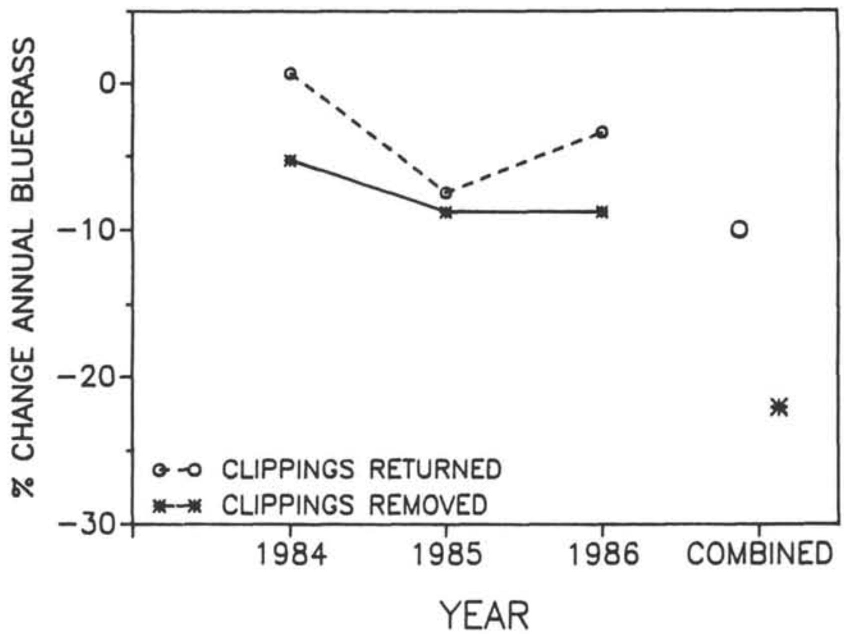

Fig. 1. 5 Factor Management Study. Clipping Removal Effects. 1984–1986. HTRC.

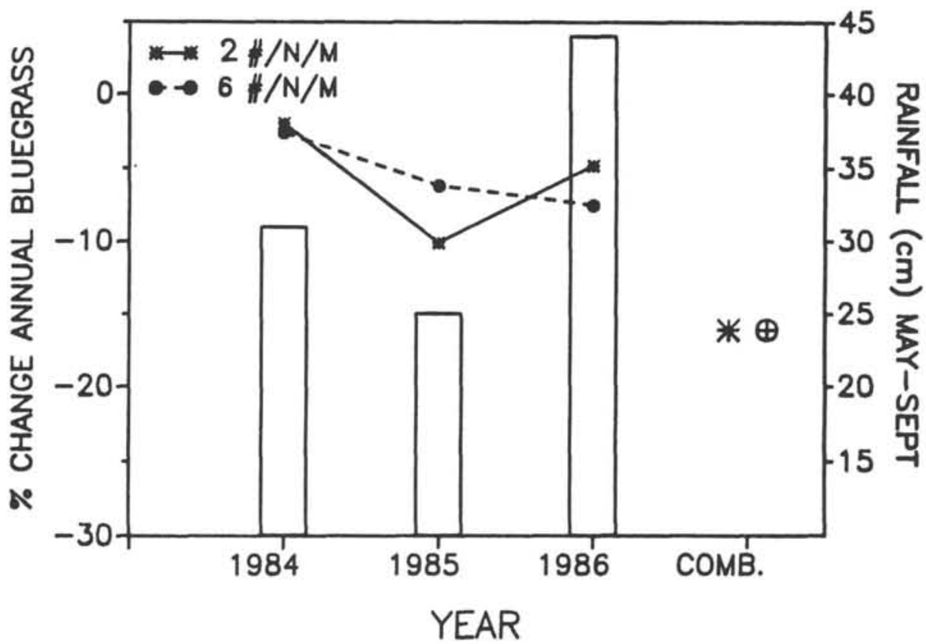

Fig. 2. 5 Factor Management Study. N–Fertility Effects. 1984–1986. HTRC.

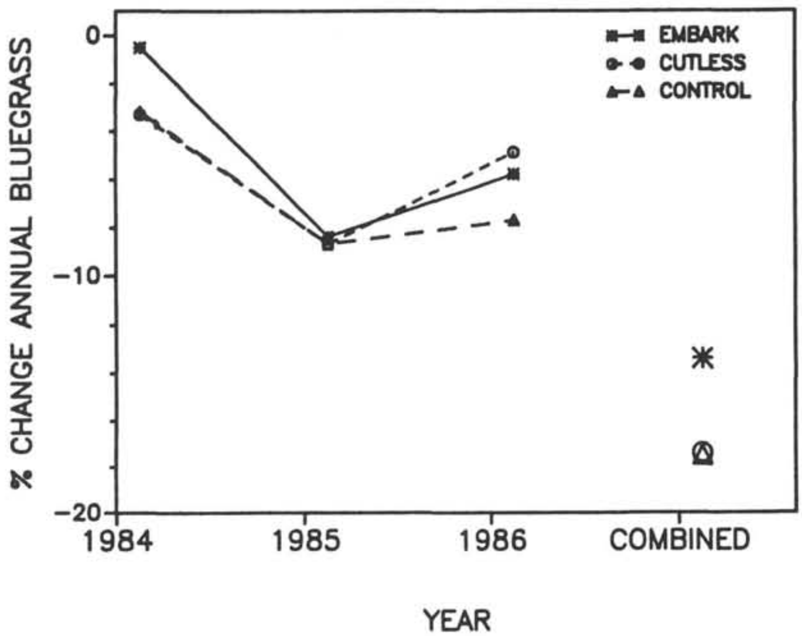

Fig. 3. 5 Factor Management Study. PGR Effects. 1984–1986. HTRC.

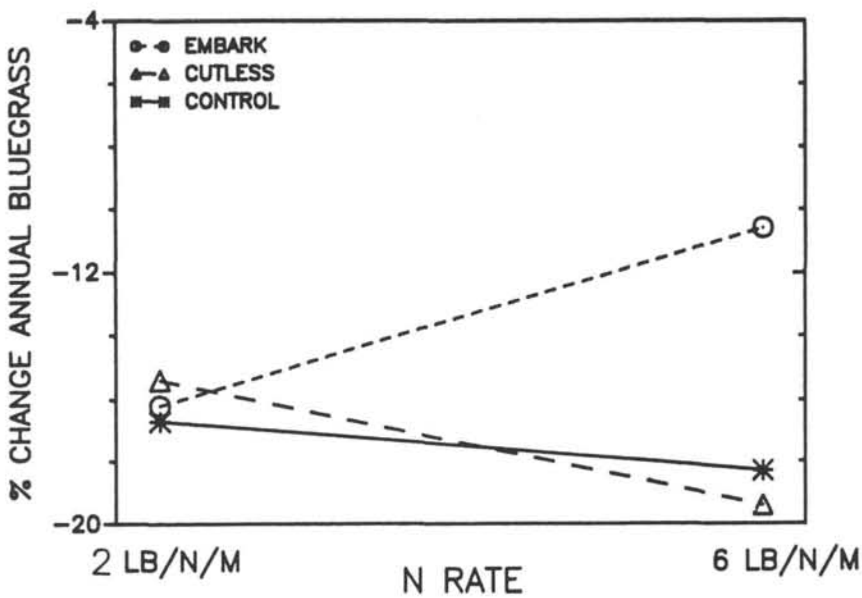

Fig. 4. 5 Factor Management Study. PGR X Fert. Interaction. Combined Year Analysis.

Table 4. Clipping analysis. 5 Factor Management Study. Sampled 6/6/86

ELEMENT	AOV	REMOVAL
% N	NS	--------
P ($\mu g/g$)	NS	--------
K	*	DECREASED
Ca	**	INCREASED
Mg	NS	--------
Mn	NS	--------
Fe	NS	--------
B	*	DECREASED
Cu	*	DECREASED
Zn	**	DECREASED
Al	NS	--------
Na	NS	--------

Table 5 . Soil analysis. 5 Factor Management Study. Sampled Oct 27,1986

	CLIPPINGS		FERTILITY	
NUTRIENT	C+	C−	LOW−N	HI−N
P(lbs/a)	--	--	--	--
*K	103	78	109	72
Ca	--	--	--	--
*Mg	--	--	329	356
*NO_3(ppm)	4	3	--	--

* Indicates significant main effect AOV for Clipping and/or N treatments

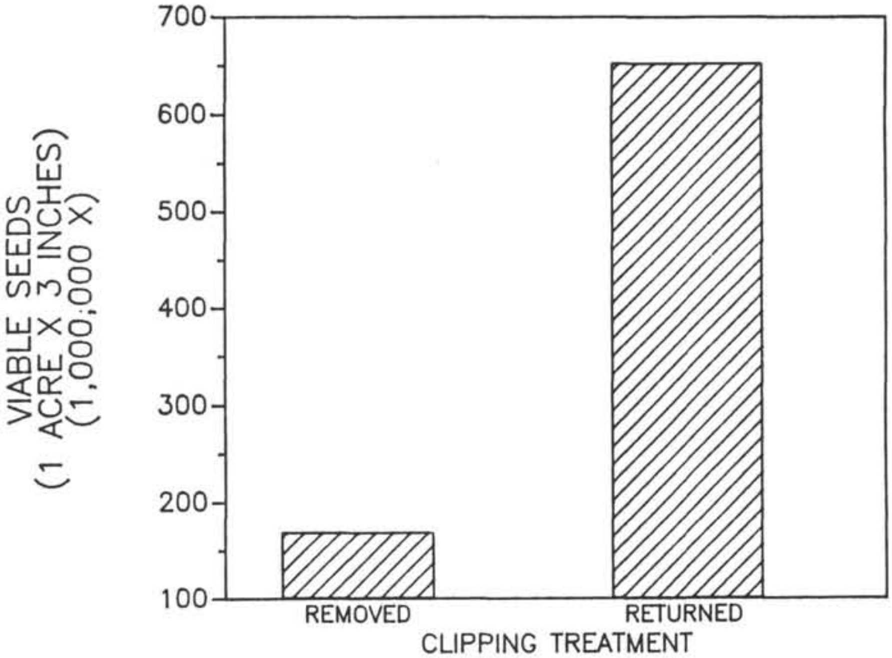

Fig. 5. Seed reservoir. 5 Factor Management Study.

Table 6. Summary of results of 5 factor field study. 1984–1986

MANAGEMENT FACTORS FAVORING:	
ANNUAL BLUEGRASS	CREEPING BENTGRASS
RETURN CLIPPINGS	REMOVE CLIPPINGS
DAILY IRRIG.*	LOW WATER
HIGH–N**	LOW–N**
EMBARK	???
	OVERSEEDING*

*GIVEN "RIGHT" MANAGEMENT
**GIVEN "RIGHT" ENVIRONMENTAL CONDITIONS