1994 TURF WEED CONTROL AND MANAGEMENT RESEARCH

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In 1994 research focused on several different areas. Projects were initiated or continued that examined disease resistance in creeping bentgrass, the effects of PGR's on quality and recovery from injury on golf course turf, the establishment of creeping bentgrass on sand-based greens, and the response of mixed fairways of creeping bentgrass/annual bluegrass to Prograss.

This research is conducted by a number of graduate and undergraduate students without whom none of the results presented here would be possible. Graduate students active in research in 1994 were Ron Calhoun, Rafael Carrascosa, Darin Lickfeldt, and Scott Warnke. Undergraduate students who helped support these research projects included Allaire Groestchy and Juan Ugalde.

Scott Warnke is studying disease resistance in creeping bentgrass. Creeping bentgrass is the most important golf course turf in Northeastern North America. Diseases are the single biggest pest problem for creeping bentgrass and fungicide usage represents a large portion of the agrichemical budget on golf courses. Dollar spot, although relatively easy to control, occurs frequently throughout the growing season resulting in several fungicide applications each year. An improvement in natural levels of dollar spot resistance in creeping bentgrass could result in large cost savings for most golf courses. Current levels of natural resistance in creeping bentgrass are quite low. Our research seeks to identify clones of creeping bentgrass with good resistance to dollar spot and using biotechnology, determine the heritability of the resistance seen in these elite clones. An initial screen of available bentgrass germplasm showed that just a few clones had a high level of natural resistance to dollar spot(Table 1). Future research will focus on the genetics of the observed resistance, accomplished by crossing resistant clones with susceptible clones and studying the inheritance patterns in the offspring.

Establishment of bentgrass on new sand-based greens should be a fairly straightforward task; however, many superintendents often have had difficulty in getting good establishment. Starter fertilizer programs have emphasized frequent applications of quick release nitrogen sources to push the bentgrass towards rapid establishment. These high rates of nitrogen fertilizer, typically 1 lb N/ 1000 ft^2(M)/wk, could lead to very high rates of nitrogen leaching. The purpose of this study was to examine different starter fertilizer programs for their effect on bentgrass establishment and nitrate leaching through an 80/20 (sand/peat) greens mix. Plots were established by removing the sod from a 2 year old Pennlinks creeping bentgrass turf. Prior to seeding, suction lysimeters were installed into selected plots to allow sampling of soil water solutions. The suction lysimeters were installed at the base of the greens mix, just above the choker layer. Additional 80/20 mix was added to the soil to return the site to its original level and the area was smoothed and seeded on July 27 with 1 lb seed/M.

A number of different fertility programs were used (Table 2) that included different N sources or compared tilling the fertilizer into the soil profile versus surface applications of the fertilizer. Some slight differences in initial establishment were observed; however, these were soon masked by the subsequent fertility applications (Figure 1). Thus, the weekly applications of nitrogen were very effective in promoting rapid establishment and outweighed the effect of starter fertilizer programs.

Leaching data is still being compiled, however, some preliminary data is available (Figure 2). These data show the leaching that resulted from the initial starter fertilizer applications; subsequent fertility applications would come in later leaching events. The data are too preliminary to draw conclusions concerning which treatments may lead to greater nitrate leaching. However, it is clear that very high levels of nitrate leaching can occur during establishment. Care should be taken when the turf is establishing to use nitrogen fertilizers wisely.

Another area of study in 1994 was the use of plant growth regulators for fairway growth suppression. Plant growth regulators have found increasing use upon golf course turf for reduction in mowing requirements and improved turf density. Additionally, claims have been made that PGR's improve recovery from injury and wear tolerance. These factors were investigated on a Penncross creeping bentgrass turf maintained at 5/8" height of cut. Three plant growth regulators (Primo, Cutless, and Scott's Turf Enhancer) at three different rates were applied to the bentgrass on June 1, July 1 and August 1 of 1994. Each PGR application was made on turf fertilized at a high rate of N fertility, 5 lbs N/1000 ft^2/yr, or at a low rate of N fertility, 2.5 lbs N/1000 ft^2/yr. Data on clipping yields were collected on a weekly basis throughout the summer (data not shown). Data in Figure 3 indicates the time in days to 75 % divot fill-in. Nitrogen fertilization had the largest influence on recovery from divot damage (Figure 3). For example, the untreated turf required almost 25 days to reach 75 % divot closure at low N while requiring only 12 days at high N. PGR's did not have as big an influence on recovery rate although some interesting trends were observed. The lowest rate used of each of the three PGR's tested seemed to have a slight stimulatory effect on recovery from divot damage. Faster recovery was also more dramatic at the lower fertility rates. The two highest rate of each PGR caused some slight reduction in time to divot fill-in with the exception of Cutless, which was slightly slower at all three rates. Remember however, in most cases the difference in recovery rates between PGR treatments and untreated turf was small. Nitrogen fertilization will control the rate of recovery from divots. PGR's seem to have a small effect on recovery rate which is interesting since PGR's significantly reduce clipping production, but apparently have a much smaller effect on tillering and lateral growth.

A study on the effect of the number of Prograss applications on the amount of annual bluegrass (AB) control was conducted at Walnut Hills Country Club in East Lansing, MI. Plots were treated with either 2 or 3 applications of Prograss at 0.75 lbs AI/A in the fall or 3 applications in the fall plus one the following spring for a total of 4 applications. Application dates 10/15 and 11/15 for the treatment receiving two applications, 10/15, 11/1, and 11/15 for the three fall applications, and the 4 application treatment had an additional application the following spring on 4/15.

Data were collected on turf quality (Figure 4) and on percent creeping bentgrass (CB) in the plots (Figure 5). These plots provided very striking data on the effects of Prograss. The injury data (Figure 4) shows that all three Prograss treatments caused a significant reduction in turfgrass quality which was caused by a lack of greenup of the CB and AB compared to untreated turf. However by 4/26, the turf receiving fall only applications had recovered nicely and was nearly equal to the control in quality. The plots receiving 4 applications, the last of which was applied on 4/15, showed a serious drop in quality from the 4/11 rating date to the 4/26 rating. This drop in quality occurred because the spring application was enough to push the AB turf over the edge and most of it died leaving large areas of bare ground in those plots. By the 5/25 rating, the plots receiving fall only applications of Prograss had recovered nicely and were then equal or superior in quality to the untreated control. The higher quality ratings resulted from an inhibition of seedhead production by the fall Prograss treatments. This response has been observed in the past but has not been well documented. The effect was quite striking in 1994 due to the intense seedhead production by AB. The plots receiving the April Prograss application still had significant amounts of bare ground resulting in poor quality ratings.

Data on percent CB cover (Figure 5) dramatically shows the results of Prograss use on golf course turf and the dynamics of AB/CB competition. Ratings taken in the early fall of 1994 show the percent CB in the plots prior to treatment averaged 33%. At the first rating in early April the plots had only 17% CB. This difference is due to the fact that AB produces abundant tillers and new seedlings in the fall, increasing its presence in the turfgrass community. During the summer, the tables are turned and CB tends to outperform AB. By using Prograss, the AB in the plots is injured or killed allowing the CB to spread and increase its presence at a time when it normally would be outcompeted by AB. The plots treated three times in the fall showed an increase in percent CB compared to the control treatment. Notice, however, that the Prograss treated plots only returned to their early fall levels. Again, this demonstrates that CB outperforms AB during the summer and the control plots would increase from the percentage CB found in the spring during the course of the summer. The plots receiving four Prograss applications show the difficulty in using Prograss on high quality, high use turf. The spring treatment caused nearly 100% kill of the AB in the plots. This allowed the bentgrass in the plots to expand but also left large areas of bare ground in the plots. In a sense the four applications worked too well resulting in large scale kill of annual bluegrass and a poor quality playing surface. Therefore, as has been stated in the past, use of Prograss on golf course turf with AB populations higher than 25% can result in poor turf quality if the AB control approaches 100%. In the turf receiving 3 fall treatments, the annual bluegrass was injured and some kill resulted but not enough to leave bare areas that the bentgrass could not fill in. Thus, superintendents should exercise great care when using Prograss on golf course turf.

Figure 1. Effect of N Rates on Bentgrass Establishment

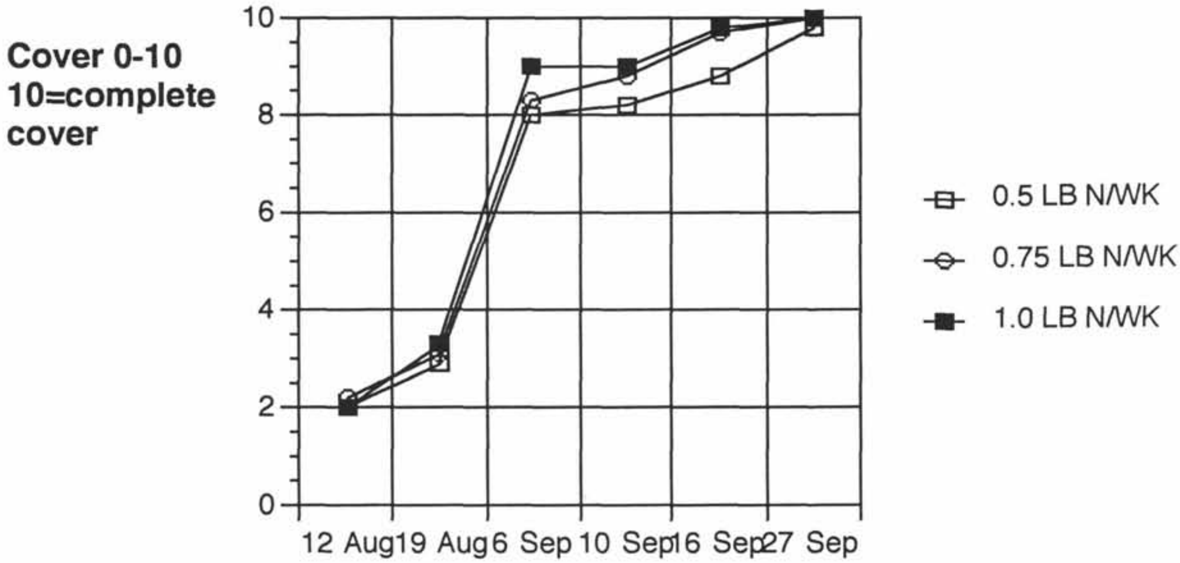

Figure 2. Nitrate Leaching During Bentgrass Establishment

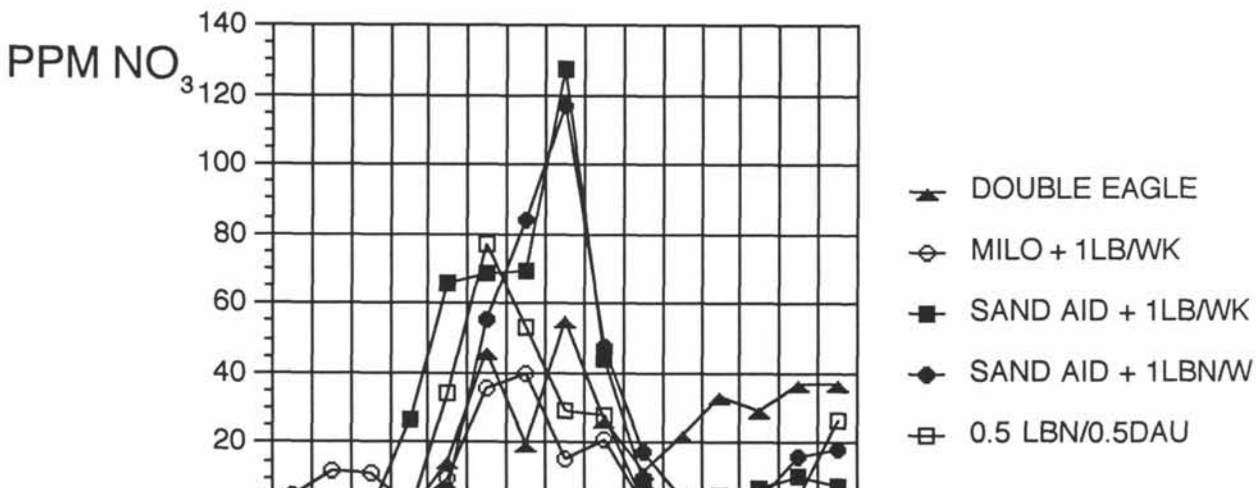

Table 2. Fertility treatments for creeping bentgrass establishment on sand-based greens.

	Starter Treatment	Post-treatments	
1)	4.4 #/M 0-45-0	tilled	0.5 #N/M/wk
	7 #/M 14-28-10	surface	
2)	4.4 #/M 0-45-0	tilled	0.75 #N/M/wk
	7 #/M 14-28-10	surface	
3)	4.4 #/M 0-45-0	tilled	1 #N/M/wk
	7 #/M 14-28-10	surface	
4)	14.3 #/M 14-28-10	surface	0.5 #N/M/wk
5)	14.3 #/M 14-28-10	surface	0.75 #N/M/wk
6)	14.3 #/M 14-28-10	surface	1 #N/M/wk
7)	7 #/M 14-28-10	surface	1 #N/M/2wk
8)	28 #/M 19-26-5	surface	1 #N/M/wk(3wk)
	6.7 #/M 15-0-30	surface	
9)	33.3 #/M Milorganite	tilled	0.5 #N/M/wk
	10.7 #/M 14-28-10	surface	
10)	33.3 #/M Milorganite	tilled	1 #N/M/wk
	10.7 #/M 14-28-10	surface	
11)	30 #/M SandAid	tilled	1 #N/M/wk
	22.9 #/M 14-28-10	surface	
12)	60 #/M SandAid	tilled	1 #N/M/wk
	20.7 #/M 14-28-10	surface	
13)	4.4 #/M 0-45-0	tilled	0.33 #N/M/wk(2-4wk)
	7 #/M 14-28-10	surface	0.5 #N/M/wk(5-7wk)
		1 #N/M/wk(8...wk)	
14)	14.3 #/M 14-28-10	surface	0.25 #N/M MWF
15)	14.3 #/M 14-28-10	surface	1.5 #N/M/wk

Figure 3. Days to 75% Divot Closure

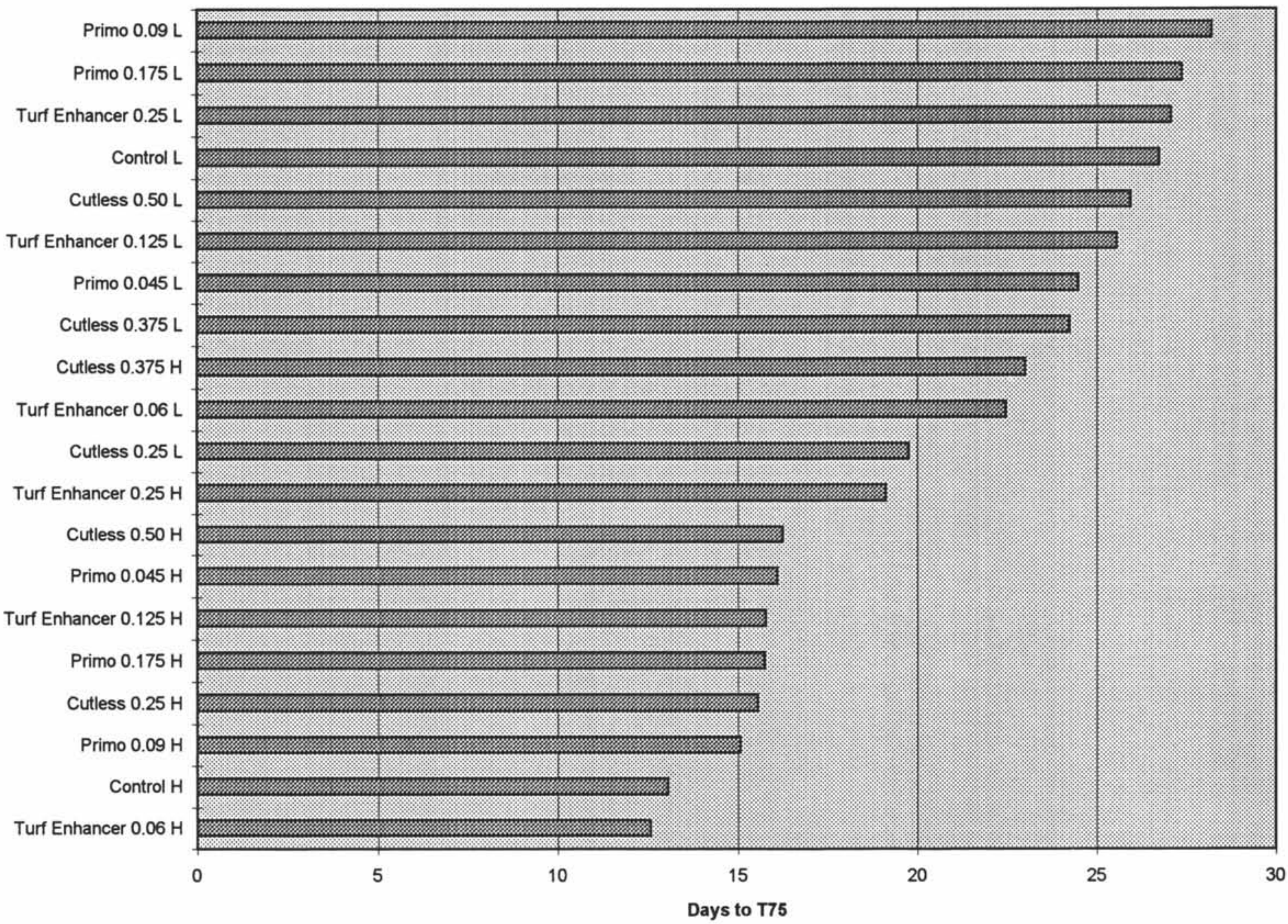

Figure 4. Effects of Prograss Applications on Turf Quality

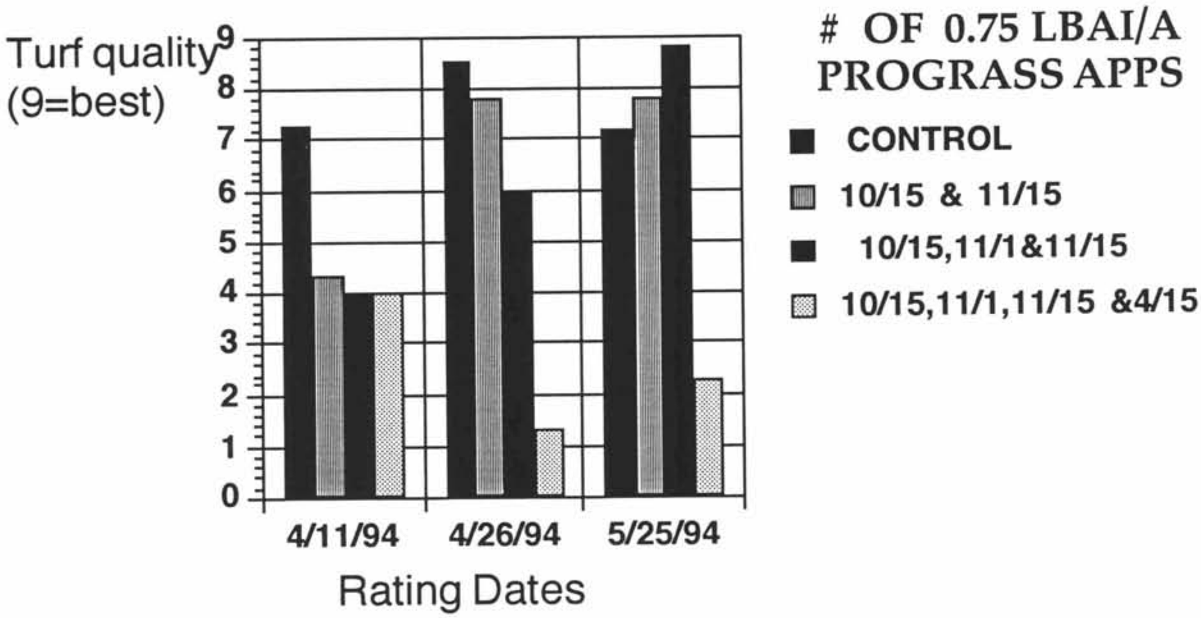

Figure 5. Prograss Application Frequency - Effects On % Bentgrass

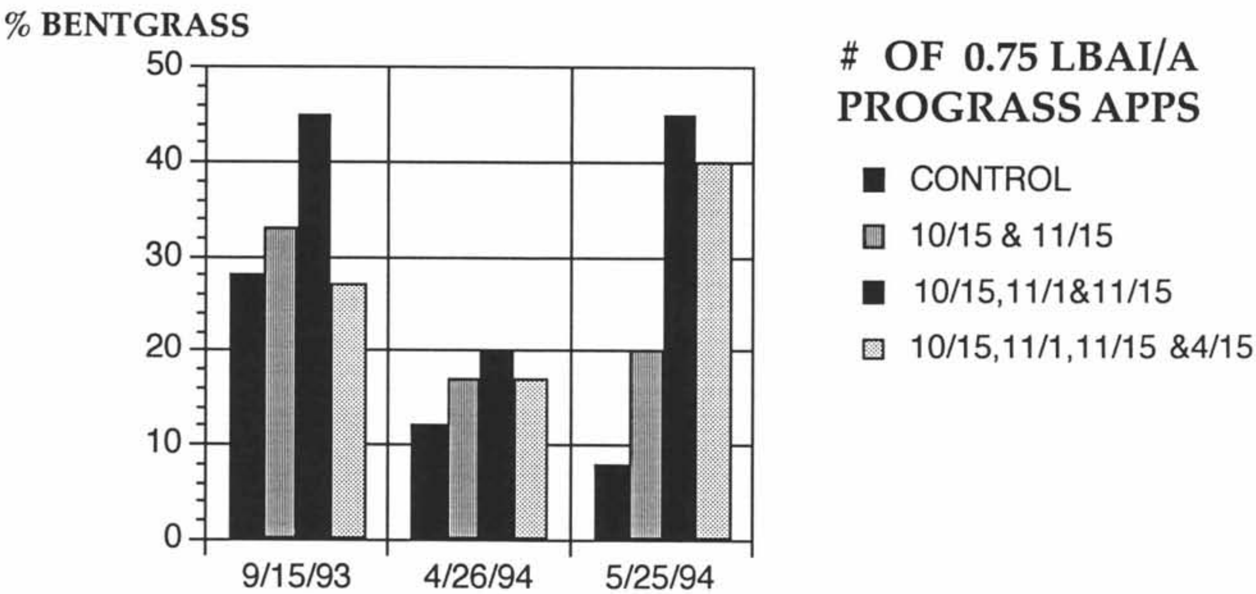

Table 1. Results of dollar spot screening with 31 different creeping bentgrass populations.

Entry	Species	Origin	Mean Disease	Number of Plants in Class							Number
			Rating	* 1	2	3	4	5	6	7	Scored
DF-1	Creeping	Tee-2-Green Corp.	2.6	13	60	3	6	12	4	2	100
A-1	Creeping	Tee-2-Green Corp.	2	27	61	3	4	2	3	0	100
Lopez	Creeping	Finelawn Research, Inc	1.9	24	71	1	3	1	0	0	100
Cobra	Creeping	International Seeds, Inc.	1.7	42	52	2	4	0	0	0	100
Syn 92-1-93	Creeping	Texas A&M University	1.7	52	40	0	6	2	0	0	100
Bar Ws 4210	Creeping	Barenbrug Holland	1.6	48	45	3	3	1	0	0	100
Pennlinks	Creeping	Tee-2-Green Corp.	1.6	58	33	1	7	1	0	0	100
88CBE	Creeping	International Seeds, Inc	1.5	42	32	5	0	0	0	0	79
18th Green	Creeping	Johnson Seeds, Ltd.	1.5	54	46	0	0	0	0	0	100
Southshore	Creeping	Loft's Seed, Inc	1.5	52	46	0	2	0	0	0	100
PI 235541	Creeping	Pullman WA.	1.5	65	20	2	6	1	0	0	94
Providence	Creeping	Seed Research of OR, Inc.	1.5	49	48	0	1	0	0	0	98
G-2	Creeping	Tee-2-Green Corp.	1.5	44	55	0	0	0	0	0	99
G-6	Creeping	Tee-2-Green Corp.	1.5	49	50	0	1	0	0	0	100
Penneagle	Creeping	Tee-2-Green Corp.	1.5	57	40	0	3	0	0	0	100
SR1020	Creeping	Seed Research of OR, Inc.	1.4	61	36	3	0	0	0	0	100
Penncross	Creeping	Tee-2-Green Corp	1.4	63	36	0	1	0	0	0	100
PI 235440	Creeping	Pullman WA.	1.3	70	20	0	2	0	0	0	92
PI 251945	Creeping	Pullman WA.	1.3	72	25	1	2	0	0	0	100
A-4	Creeping	Tee-2-Green Corp.	1.3	78	20	0	1	1	0	0	100
Syn 92-5-93	Creeping	Texas A&M University	1.3	73	23	2	2	0	0	0	100
Syn 92-2-93	Creeping	Texas A&M University	1.3	76	22	0	1	1	0	0	100
Pro/Cup	Creeping	Forbes Seed & Grain, Inc.	1.2	81	19	0	0	0	0	0	100
Emerald	Creeping	International Seeds, Inc.	1.2	81	18	0	1	0	0	0	100
Crenshaw	Creeping	Texas A&M University	1.2	75	25	0	0	0	0	0	100
Cato	Creeping	Texas A&M University	1.2	79	21	0	0	0	0	0	100
Trueline	Creeping	Turf Merchants	1.2	72	20	0	0	0	0	0	92
SR7100	Colonial	Seed Research of OR, Inc.	1.1	90	9	0	0	0	0	0	99
Seaside	Creeping	Standard	1.1	89	11	0	0	0	0	0	100
Tendez	Colonial	Finelawn Research, Inc.	1	94	1	0	0	0	0	0	95
Syn 1-88	Creeping	Texas A&M University	1	86	14	0	0	0	0	0	100
		Total or mean	1.4	1916	1019	26	56	22	7	2	3048
		% of total plants		63	33	0.8	1.8	0.7	0.2	0.1	
		% of plants selected								3.7	
				* Rating from 1-9 1=dead plant 9=no damage							