

Shade and Wear Effects on Alternative Grasses for Sports Field Mixtures

Matt Johns, Gwen Stahnke and Eric Miltner

INTRODUCTION

Because of its wear and drought tolerance and quick recovery after wear, Kentucky bluegrass (*Poa pratensis*) continues to be an important option for sports turf in the Pacific Northwest. Perennial ryegrass (*Lolium perenne*) has been the preferred species in both initial establishment and reseeding procedures. Mixing and growing the two species produces a turf that is wear tolerant, stable and improves the playability of athletic fields. Recently, there has been an interest in planting improved annual ryegrass (*L. multiflorum*) and intermediate ryegrasses (*L. hybridum*) with Kentucky bluegrass. These species germinate and establish very quickly, and are less persistent than perennial ryegrass, which allows the Kentucky bluegrass to dominate the stand.

MATERIALS AND METHODS

Three studies were seeded in September 2003. The studies are located at the R. L. Goss Turfgrass Research Facility, Washington State University, Puyallup Research and Extension Center and are 35 miles southeast of Seattle, Washington, USA.

Study 1: Kentucky bluegrass-annual ryegrass, Kentucky bluegrass-intermediate ryegrass and Kentucky bluegrass-perennial ryegrass mixtures were seeded and established in 8-12" deep 90% sand, (USGA standards), 5% Sphagnum peat moss and 5% Isolite fired diatomaceous earth; (crystalline SiO₂ [Axis, AMS Inc., Oregon City, Oregon]) (v/v). A shade structure was constructed with stationary louvers made of high-density polyethylene material. The louvers hang in a North-South direction and allow sunlight to the turf in a seasonal time pattern of shade and sun throughout the day light hours. Puyallup, WA is at 47.2° N latitude. The sun angle at mid-day is 24° from directly overhead on the summer solstice and at 47° at the fall and spring equinox. Heights from canopy level to the bottom of the panels are 8' and the panels are equally spaced at 3'2" apart. Light levels are measured in Photosynthetically Active Radiation (PAR). The PAR sensors have a measurement range of 0 to 2500 $\mu\text{mol m}^{-2} \text{s}^{-1}$, wave length 400 to 700 nm. A PAR sensor located on the weather station takes full daylight readings for comparisons.

Study 2: Mixtures consistent with study 1 were seeded and established in 95% sand, (USGA standards), and 5% Sphagnum peat moss (v/v). All mixtures are growing in full sun.

Turfgrass mixtures (Table 1, 2, 3 & 4):

Kentucky bluegrass (KBG) mixture #1 = Llmousine, Langara, Shamrock.

Kentucky bluegrass (KBG) mixture #2 = SR 2284, Northstar, Blackstone.

Three-way perennial ryegrass (P.R.) blend = Admire, SR 4220, Aberelf.

Trans "EZE" Intermediate ryegrass (I.R.).

Axcella annual ryegrass (A.R.).

Treatment application and data collection

- ◆ All treatments in each study received simulated wear with the Brinkman Traffic Simulator. Eight weeks of wear was applied in the spring of 2005 and again in the fall of 2005. This type of wear coincided with spring soccer and fall football. Shear strength was measured 4 and 8 weeks after treatment (WAT) (Table 1 & 2). Measurements were taken with the Clegg Turf Shear Tester, a device for rapidly obtaining an index of the "shear strength" at the surface in a horizontal direction for turf and soil. The output is in terms of kilograms-force (kg-f). The shear-testing tip used was TST, model CCB1C, Tip2A at 3" deep. Tip 2A is 5" wide. Six readings were taken from each plot; three on the non-wear area and three on the wear area and then an average was produced.
- ◆ All treatments were evaluated visually for turf quality on a monthly basis (0 = dead, 5 = acceptable, 9 = ideal). Tables 3 & 4 reflect quality means for the months wear was applied to the turf. Turf recovery data was collected after wear applications were finished until 100% recovery was achieved for each plot. All ryegrass cultivars in studies 1, 2, & 3 were over-seeded in mid-November after fall wear.
- ◆ The Clegg Impact Soil Tester was used to indicate the strength and stiffness of the soil layer under test. It is recorded as the Clegg Impact Value (CIV). Impact testing was done at 4 WAT and 8 WAT during fall wear. (Data not shown).
- ◆ Data analyzed by analysis of variance ($P = 0.05$), with means separation by Least Significant Difference (LSD) when appropriate.

RESULTS AND DISCUSSION

Shear Strength comparisons (Table 1 & 2):

- ◆ KBG #2 + ryegrass mixtures exhibited higher shear strength than the KBG #1 + ryegrass mixtures. This was consistent for the spring and fall.
- ◆ KBG mixtures + P.R. 1 were consistently higher in shear strength compared to the KBG + I.R. and A.R. throughout fall and spring wear.
- ◆ The full sun plots exhibited greater shear strength than the shade plots during the wear process.

- ◆ Greater recuperation after wear was evident in the KBG + P.R. plots than any of the other mixtures. Recuperation of KBG mixtures was quicker in the full sun plots compared to the shade plots. All of the plots are competing with annual bluegrass (*Poa annua*) pressure. Percent annual bluegrass infestation is being recorded at the same time as quality ratings. (Data not shown).
- ◆ There was a significant reduction of shear strength due to wear for all the plots during the fall. Shear strength means were consistently lower during fall application for all mixtures compared to spring.

Table 1: Shear strength means for Kentucky bluegrass/ryegrass mixtures grown on sand in full sun in spring and fall 2005.

	Spring 4 WAT	Spring 8 WAT	Fall 4 WAT	Fall 8 WAT
<u>Treatment</u>				
KBG1+P.R.1	80.5b	71.1a	62.7a	56.8a
KBG1+I.R.	61.6d	50.6d	44.5c	44.8b
KBG1+A.R.	61.6c	50.6d	52.8b	49.0ba
KBG2+P.R.1	85.5a	74.3a	66.0a	55.0a
KBG2+I.R.	62.8d	57.5c	51.3cb	42.3b
KBG2+A.R.	61.6c	66.8b	60.8a	55.3a
LSD	2.9	4.9	7.1	8.8
<u>Treatment</u>				
No wear	71.9a	70.6a	63.3a	62.1a
Wear	70.7a	56.2b	49.4b	39.0b
	ns	**	**	**

*, ** Significantly different At P = 0.05, 0.01 respectively.
WAT = Weeks After treatment.
ns = not significant

Table 2: Shear strength means for Kentucky bluegrass/ryegrass mixtures grown on sand under variable shade in spring and fall 2005.

	Spring 4 WAT	Spring 8 WAT	Fall 4 WAT	Fall 8 WAT
<u>Treatment</u>				
KBG1+P.R.1	73.6a	64.5a	48.2a	43.8a
KBG1+I.R.	43.5c	39.3d	27.0c	29.8c
KBG1+A.R.	45.8cb	44.1c	31.5cb	35.5b
KBG2+P.R.1	71.5a	60.5a	49.2a	42.3a
KBG2+I.R.	52.1b	42.0dc	34.2b	32.7cb
KBG2+A.R.	51.3b	53.1b	43.8a	41.5a
LSD	6.9	4.3	6.1	3.2
<u>Treatment</u>				
No wear	56.8a	59.5a	50.3a	51.4a
Wear	55.8a	41.7b	27.7b	23.8b
	ns	**	**	**

*, ** Significantly different At P = 0.05, 0.01 respectively.
WAT = Weeks After treatment.
ns = not significant

PAR Sensors (Figure 1)

- ◆ Two PAR sensors were placed under the shade structure to measure light readings in $\mu\text{mol m}^{-2} \text{s}^{-1}$. The sensors were located 14' from each other and $\frac{1}{2}$ " above the plant canopy. Another PAR sensor was placed in the full sun. Fig. 1 shows measured PAR during a 14 hr period.
- ◆ The PAR sensor under the shade structure recorded light readings that were directly affected by the sun angle throughout the day. Strips of shade moving across the sensor caused the fluctuations in light levels under the shade structure.
- ◆ Correlation of lower light level effect on quality and shear strength to the KBG + ryegrass mixtures will be evaluated and be included in future publications.

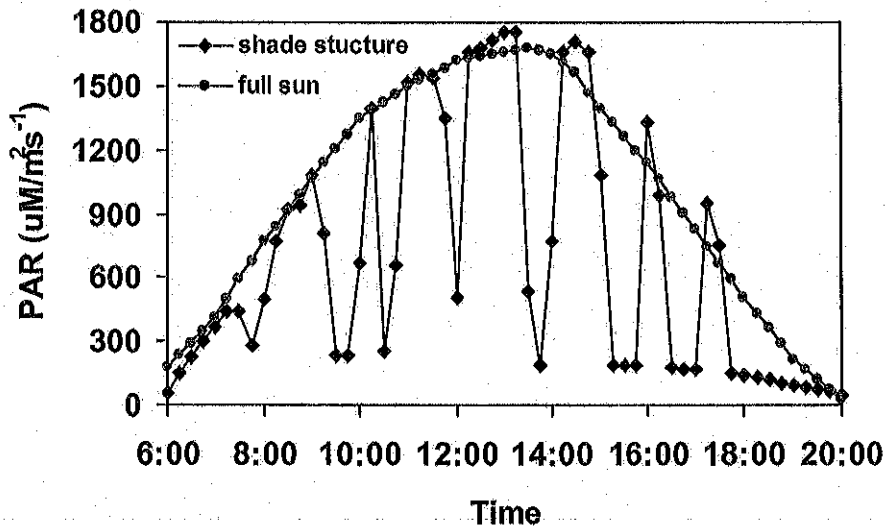


Figure 1. Photosynthetically Active Radiation (PAR) measured in full sun and underneath shade structure, 25 May 2005.

Table 3: Quality means for Kentucky bluegrass/ryegrass mixtures grown on sand in full sun during wear application in spring and fall 2005.

	April 2005	May 2005	June 2005	Sept 2005	Oct 2005	Nov 2005
Treatment						
KBG1+P.R.1	4.6b	6.0b	4.1a	5.2b	4.0a	3.3ba
KBG1+I.R.	4.0d	5.3d	3.1b	3.8d	2.6cb	2.8c
KBG1+A.R.	4.3c	5.3d	3.1b	3.1e	2.5c	2.7c
KBG2+P.R.1	5.0a	6.5a	4.5a	5.8a	4.2a	3.8a
KBG2+I.R.	4.3c	5.8cb	4.1a	4.5c	2.8cb	2.8bc
KBG2+A.R.	5.0a	5.6c	4.5a	4.5c	3.2b	2.8c
LSD	0	0.3	0.5	0.5	0.6	0.5
Treatment						
No wear	4.5a	5.9a	4.9a	5.2a	3.9a	3.9a
Wear	4.5a	5.6b	2.9b	3.8b	2.5b	2.2b
	ns	**	**	**	**	**

*, ** Significantly different At P = 0.05, 0.01 respectively.

WAT = Weeks After treatment.

ns = not significant

Quality comparisons (Table 3 & 4):

- ◆ The full sun and shade plots were similar in quality for the duration of the fall wear. The quality means for the spring wear showed the plots in the shade were higher than the plots in the sun.
- ◆ The KBG + A.R. were similar in quality to the KBG + I.R. plots during both spring and fall wear. Annual ryegrass transitioned out 6 months after planting in all mixtures. Visually, the KBG dominated the stand.
- ◆ Quality means were consistently better for all plots in the spring than in the fall for both sun and shade plots throughout the wear process.
- ◆ The Kentucky bluegrass was noted for recovering quicker than the I.R. and A.R. after spring and fall wear treatment. All studies were rated for recovery 2, 4, 6, & 8 weeks after the wear was finished. (Data not shown).

Table 4: Quality means for Kentucky bluegrass/ryegrass mixtures grown on sand under variable shade during wear application in spring and fall 2005.

	April 2005	May 2005	June 2005	Sept 2005	Oct 2005	Nov 2005
<u>Treatment</u>						
KBG1+P.R.1	7.3a	7.1b	6.0a	5.5a	3.8b	3.5b
KBG1+I.R.	5.3d	6.3d	3.8c	3.0c	2.5c	2.5d
KBG1+A.R.	6.0b	6.5cd	4.5b	3.1c	2.6c	3.2bc
KBG2+P.R.1	7.3a	7.8a	6.0a	5.8a	4.6a	4.0a
KBG2+I.R.	5.3d	6.5cd	4.6b	3.6cb	2.8c	2.8dc
KBG2+A.R.	5.6c	7.0cb	4.5b	4.0b	3.0c	3.2bc
LSD	0	0.5	0.5	0.7	0.6	0.5
<u>Treatment</u>						
No wear	6.1a	7.2a	6.2a	5.2a	4.1a	4.2a
Wear	6.1a	6.5b	3.6b	3.2b	2.3b	2.1b
	ns	**	**	**	**	**

*, ** Significantly different At P = 0.05, 0.01 respectively.
WAT = Weeks After treatment.
ns = not significant

CONCLUSIONS

- ◆ The overall difference in the wear plots showed a reduction in shear strength and quality compared to the plots that did not receive wear.
- ◆ The Kentucky bluegrass added stability when planted in mixtures with the ryegrasses and was visually observed as the first grass to recover after wear.
- ◆ The KBG + P.R. mixtures withstood the spring and fall wear applications better than the KBG + I.R. and the KBG + A.R. This allowed for quicker recovery and stronger competition to annual bluegrass invasion.
- ◆ Over all, the KBG + P.R. mixtures out performed the KBG + I.R and KBG + A.R. mixtures in study 1 & 2. The KBG + P.R. mixtures would be the recommended blend for integrity, wear tolerance and quicker response in wear recovery for sports turf west of the Cascades in the Pacific Northwest. Other studies we have conducted have shown that A.R. and I.R. could be useful for over-seeding during the cooler months.