

## Wear Tolerant Grasses for Use on Sports Fields in a Cold Climate

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### Summary

This trial was initiated to examine the effects of traffic on various grasses for sports fields in a cold climate. Two locations were seeded in 2003 one in Calgary and one in Edmonton. The Calgary site was seeded in late June, and under irrigated conditions, established normally. The Edmonton site was seeded in early September on an unirrigated site. Due to drought stress in 2004 and physical damage from construction equipment working in the area, this site was abandoned in the spring of 2005.

At the Calgary site, athletic events were initiated in the fall of 2004. The plots endured moderate to heavy traffic from mid August through to and the end of October. Cleat injury was visible throughout the site. Damage ranged from moderate shearing of the above ground plant portion (verdure) to the more severe physical up rooting of the plants.

The best overall Kentucky bluegrass for colour was Showcase, while for overall turfgrass quality, the best three were: Showcase, Award, and Moon Shadow. Award and Showcase appeared to be the most resistant of encroachment from *Poa supina*. For the perennial ryegrass, the best two for turfgrass colour seasonal average were: Fiesta 3 and Pick RC2. The best perennial ryegrass for quality was Pick RC2, while Pick RC2, PR A-97 and the Fiesta 3 were the best cultivars for resisting the encroachment of *Poa supina*. The best tall fescue cultivars were SR8600 and Grande for turfgrass colour, however, there were no differences in turfgrass quality. An analysis of the turf area cover data revealed that Grande and SR8600 had best area cover. Not surprisingly, they also had the least encroachment of *Poa supina*. During the summer and fall, the Calgary Parks Mix and the perennial ryegrasses had better colour than the other grasses, when comparing the species and the mixtures. In the fall and for the overall turfgrass quality the perennial ryegrass, the Calgary Parks Mix and the 10% *Poa supina* mix were the highest rated. The perennial ryegrass resisted encroachment of the *Poa supina* the best.

The area cover rating provides an indication of wear tolerance of the grasses. The *Poa supina* by itself and the *Poa supina* mix had the highest wear tolerance ratings. The *Poa supina* is a very aggressive grass and went from 10% in the original mix to 98% by the end of 2006. It also encroached on the other grass species and would be expected to eventually dominate in those plots as well. Its area cover was superior to the other grasses, but may have a problem overwintering.

### Introduction

During the summer of 2001, the Prairie Turfgrass Research Centre conducted a site visit to the County of Strathcona (Sherwood Park, Alberta) to examine the condition of their sports fields and to assist in the development of a long-term plan for their improvement. Many of the high use fields were characterized by bare areas and thin turf that was a result of extremely high levels of traffic and was exacerbated by drought conditions that were prevalent throughout much of Alberta.

Sports participation, and in particular soccer, has increased dramatically in the last few years. These high participation levels have resulted in sports fields receiving far more traffic than the existing grasses are capable of withstanding. In addition, highly organized

leagues in football, softball and baseball have also served to increase traffic on sports fields, particularly in urban areas.

Sports fields grasses in this climate are predominately Kentucky bluegrass and creeping red fescue. These grasses are considered to have only a moderate tolerance to traffic and wear (the effects of abrasive activity from foot traffic). These grasses are, however, quite cold tolerant and as a result survive Canadian Prairie winters quite well. In areas with a moderate climate i.e. the lower mainland of British Columbia, perennial ryegrass and tall fescue are frequently used in high traffic areas due to their good wear tolerance. However, in Alberta, their lack of cold tolerance has made them unsuitable for use on sports fields or other high traffic areas.

In recent years many new varieties of perennial ryegrass and tall fescue have been developed, but have never been tested for their cold tolerance. As there are often differences in cold tolerance between varieties, some of these new wear tolerant perennial ryegrasses or tall fescues may have better cold tolerance. In addition, other grasses, such as *Poa supina*, have been successfully used in sports fields in other parts of North America due to their good recovery from traffic but have not been adequately tested for their cold tolerance.

The objective of this trial is to develop additional information regarding wear and cold tolerant grasses that can be used on sports fields.

### **Specific Objectives of this Trial**

- Screen new species and varieties of grasses for improved cold tolerance
- Evaluate the most promising cold tolerant species and varieties for their wear tolerance and turfgrass quality under field conditions
- Evaluate these cold tolerant grasses in different climate zones throughout the province
- Evaluate mixtures of the best cold and wear tolerant grasses from the field study

### **Methodology – Initial Screening**

A preliminary screening of forty-eight grass cultivars for cold tolerance was conducted in order to identify the most suitable cultivars for field-testing. Grasses were grown on in the greenhouse and then were subjected to a standard freeze test to determine their relative hardiness levels (Table 1). Twenty-one grasses were chosen for the field study component of this trial. In addition, *Poa supina*, a *Poa supina* and Touchdown Kentucky bluegrass mix, and the City of Calgary standard sports field mix were added.

### **Methodology – Field Study**

Plots that measured 1.5 by 2 meters were arranged in a randomized complete block design (RCBD) and replicated four times. The Calgary site was seeded June 30, 2003, and the Edmonton site was seeded September 3, 2003. Seeding rates were 0.5 kg/100m<sup>2</sup> for Kentucky bluegrass, and 3.2 kg/100m<sup>2</sup> for the tall fescue and perennial ryegrasses. The plots were seeded by hand using a shaker bottle and were then lightly raked to ensure good seed to soil contact. Irrigation was available at the Calgary site, while the Edmonton site relied solely on natural precipitation.

Over the course of 2004 season, poor seed germination combined with some physical damage to the plots as a result of further construction at the Edmonton site left most of

the turf plots sparse and patchy. After the initial spring rating of 2005, the stand of turf were deemed as not acceptable and the collection of data for this site was discontinued.

At the Calgary site, athletic field events were periodically held on the turf, but particularly during the fall when flag football was played. The plots endured moderate to heavy traffic from mid August through to the end of October. The site was routinely mowed at a height of 6.25cm (2½") and regularly fertilized at a rate of 0.5kg N/100m<sup>2</sup> (1b N/1000ft<sup>2</sup>) per growing month. Irrigation was carried out to prevent moisture stress.

The plots were evaluated on a monthly basis for three quality factors, colour density and area cover. These ratings were based on the National Turfgrass Evaluation Program (NTEP) protocols where numeric values are assigned to individual plots where 9 is best and 1 is poorest, and 6 is considered acceptable. Colour was evaluated by 1 is a brown dormant turf and 9 is a very uniform dark green colour. Turf density, a measure of the number of shoots per unit area, was rated based on 1 is a thin, weak turf stand and 9 is a very dense tight-knit stand. The third factor rated was area cover and values ranged from a 1 for a complete absence of turf to a 9 for complete cover with the desired turf. The presence of weeds or voids in the turf reduced this rating.

To compare the overall turf quality of the cultivars, the average of the combined colour, density and area cover scores for each plot was calculated and statistically analyzed.

## **Results and Discussion**

### *Initial Screening for Winter Hardiness*

All of the Kentucky bluegrasses selected for this study had winter hardiness levels >-26°C, which is considered good (Table 1). Winter hardiness levels for the perennial ryegrasses were -17°C, while the tall fescues had winter hardiness levels of -22°C. These values would be considered moderate to poor winter hardiness levels. *Poa supina* values were not determined.

Table 1. List of grasses seeded and their relative winter hardiness level.

Grass Species	Cultivar	Relative Hardiness (LT <sub>50</sub> Values)
Kentucky Bluegrass	SR 2284	>-26°C
Kentucky Bluegrass	Showcase	>-26°C
Kentucky Bluegrass	Award	>-26°C
Kentucky Bluegrass	Total Eclipse	>-26°C
Kentucky Bluegrass	Tsunami	>-26°C
Kentucky Bluegrass	America	>-26°C
Kentucky Bluegrass	Langara	-26°C
Kentucky Bluegrass	Moon Shadow	-26°C
Kentucky Bluegrass	Touchdown	>-26°C
Kentucky Bluegrass	Rambo	>-26°C
Kentucky Bluegrass	Argyle	>-26°C
Perennial Ryegrass	Fiesta 3	-17°C
Perennial Ryegrass	Pennfine	-17°C
Perennial Ryegrass	Pick RC2	-17°C
Perennial Ryegrass	PR A-97	-16°C
Tall Fescue	Grande	>-22°C
Tall Fescue	SR 8600	>-22°C
Tall Fescue	Arid 3	>-22°C
Tall Fescue	Pixie	>-22°C
Tall Fescue	Mustang II	>-22°C
Tall Fescue	Watchdog	>-22°C
Poa supina	Supranova	Unknown
Poa supina Mix	10% Poa supina	Unknown
	90% Touchdown (KentuckyBluegrass)	>-26°C
Sport Field Mix	25% Award (Kentucky Bluegrass)	>-26°C
	25% Liberator (Kentucky Bluegrass)	Unknown
	25% Odyssey (Kentucky Bluegrass)	>-26°C
	25% Champion (Perennial Ryegrass)	Unknown

### *Overall Traffic Injury*

Injury from football cleats was visible throughout the site in the fall of 2004 and 2006. Damage ranged from moderate shearing of the verdure (above ground plant portion) to more severe physical up rooting of the plants.

### **Kentucky Bluegrass**

#### *Colour Ratings*

Those grasses which showed the best turf colour in the spring were: Showcase, Award, Touchdown, Tsunami, SR228 and Argyle (Table 2). Spring colour is an indication as to which grasses green up most quickly in the spring. Summer rating revealed that the best Kentucky bluegrasses for colour were: Showcase, Award, Tsunami, Moon Shadow and SR228. The cultivars that showed good colour retention under the cooler and frost-prone conditions of October were: Showcase, Award, Tsunami, and Touchdown (Table 2). The best overall Kentucky bluegrass for colour was Showcase.

Table 2 - Combined year data for Kentucky bluegrass turf colour, 2004 – 2006.

Cultivar	Rating Period			
	Spring	Summer	Fall	Seasonal Average
	1-9 scale			
Showcase	5.5a	6.3a	6.5a	6.2
Award	5.5a	6.1ab	6.2ab	5.8
Tsunami	5.3ab	6.0ab	6.1abc	5.8
Touchdown	5.2ab	5.8bc	6.1abc	5.8
Moon Shadow	5.1b	6.1a	6.0bc	5.8
Argyle	5.2ab	5.8bc	6.0bc	5.7
Langara	5.1b	5.8bc	5.8bc	5.6
Total Eclipse	5.1b	5.8bc	5.8b	5.6
SR228	5.3ab	6.0ab	5.7c	5.5
America	5.1b	5.5cd	5.9bc	5.5
Rambo	4.5c	5.2d	5.0d	5.0
LSD <sub>0.05</sub> =	0.3	0.4	0.4	

\* Values that have the same letter as a suffix are not significant from each other.

### *Turf Quality*

Seasonal means were developed by combining the three quality factors for each of the cultivars. The cultivars were ranked from highest to lowest based on overall turf quality (Table 3). The Kentucky bluegrasses that ranked highest for spring quality were: Showcase, Award, Moon shadow, Touchdown and Argyle. Spring quality is an indication of the overwintering capabilities of the various grasses. For the summer rating period, the best cultivars were: Showcase, Award, Moon Shadow, Tsunami, and Langara. In the fall, the grasses were much closer in their quality and the best cultivars were: Showcase, Award, Moon Shadow, Touchdown, Argyle, Tsunami, Langara and America. Overall the best three were: Showcase, Award, and Moon Shadow.

Table 3 - Combined year data for Kentucky bluegrass turf quality, 2004 - 2006

Cultivar	Rating Period			
	Spring	Summer	Fall	Seasonal Average
	Mean of 3 quality factors			
Showcase	5.3a	6.0a	6.0a	5.6
Award	5.3a	5.7ab	5.6abcd	5.5
Moon Shadow	4.9abc	5.8a	5.7abc	5.4
Touchdown	5.1ab	5.4bc	5.7abc	5.3
Argyle	4.9abc	5.5b	5.7abc	5.1
Tsunami	4.7bcd	5.8ab	5.8ab	5.3
Langara	4.5cd	5.8a	5.6abcd	5.3
America	4.8bc	5.4bc	5.8abc	5.2
Total Eclipse	4.7bcd	5.4b	5.4b	5.2
SR228	4.8bc	5.4bc	5.3cd	4.9
Rambo	4.3d	5.0c	5.2d	4.7
LSD <sub>0.05</sub> =	0.4	0.4	0.4	

\* Values that have the same letter as a suffix are not significant from each other.

### Area Cover

There were no statistical differences between the Kentucky bluegrass cultivars for the fall of 2005, or the spring and summer ratings of 2006. However, there were differences in the fall of 2006, and the best cultivars were: Award, America and Showcase (Table 3). The best two grasses for overall area cover were: Award and America.

### Poa Encroachment

It was thought that encroachment into the Kentucky bluegrass was as a result of the establishment of *Poa supina* in the plots rather than *Poa annua*. However, this was not specifically determined but will be more closely examined in 2007. The extent of the encroachment was not expected, but is a valuable piece of information if the *Poa supina* is to be seeded in close proximity to the Kentucky bluegrass. Award and Showcase appeared to be the most resistant of encroachment.

Table 4 - Kentucky bluegrass area cover rating and *Poa Supina* encroachment, 2006

Cultivar	Rating Period				Seasonal Average	Poa Encroachment
	Fall 2005	Spring	Summer	Fall		Aug 2006
	1-9 scale					%
Award	5.8a	4.8a	5.8a	5.8a	5.5	18a
America	4.8a	5.0a	5.3a	5.5ab	5.3	38abcd
Showcase	5.5a	5.0a	5.0a	5.3abc	5.1	25ab
Touchdown	5.5a	5.0a	5.3a	5.0bc	5.1	33ab
Total Eclipse	5.0a	5.0a	5.3a	5.0bc	5.1	48bcd
Langara	5.8a	4.8a	5.5a	4.8c	5.0	63de
Tsunami	5.5a	5.0a	5.0a	5.0bc	5.0	43abcd
Moon Shadow	5.3a	5.0a	5.3a	4.8c	5.0	53bcd
Argyle	5.5a	4.8a	5.0a	4.8c	4.9	60cde
SR228	5.0a	4.8a	5.2a	4.8c	4.9	50bcd
Rambo	5.0a	4.5a	4.8a	4.0d	4.4	88e
LSD <sub>0.05</sub> =	n/s	n/s	n/s	0.7		28

\* Values that have the same letter as a suffix are not significant from each other.

### Perennial Ryegrass

#### Colour Ratings

An analysis of the spring and summer colour revealed no significant difference between the Perennial Ryegrass cultivars (Table 5). In the fall, the cultivar Fiesta 3, Pick RC2, and PR A-97 were showed the best colour. The best two for a seasonal average were: Fiesta 3 and Pick RC2.

Table 5 - Combined year data for Perennial Ryegrass turf colour, 2004-2006.

Cultivar	Rating Period			Seasonal Average
	Spring	Summer	Fall	
	1-9 scale			
Fiesta 3	5.4a	6.3a	6.8a	6.3
Pick RC2	5.3a	6.1a	6.9a	6.2
PR A-97	5.5a	6.3a	6.4ab	6.0
Pennfine	5.3a	5.8a	6.0b	5.6
LSD <sub>0.05</sub> =	n/s	n/s	0.5	

\* Values that have the same letter as a suffix are not significant from each other.

### *Turf Quality*

Seasonal means were developed by combining the three quality factors for each of the cultivars. The cultivars were ranked from highest to lowest based on overall turf quality (Table 6). There were no significant differences between cultivars for turfgrass quality.

Table 6 - Combined year data for Perennial Ryegrass turf quality, 2004-2006.

Cultivar	Rating Period			Seasonal Average
	Spring	Summer	Fall	
	1-9 scale			
Pick RC2	5.3a	5.8a	6.1a	5.8
Pennfine	5.3a	5.9a	5.8a	5.8
Fiesta 3	5.5a	5.9a	6.3a	5.6
PR A-97	5.3a	5.8a	6.1a	5.6
LSD <sub>0.05</sub> =	n/s	n/s	n/s	

\* Values that have the same letter as a suffix are not significant from each other.

### *Area Cover*

The ratings for the fall (2005), and the spring and summer (2006) showed that there were no significant differences between the cultivars of the perennial ryegrasses. However, in the fall of 2006, the cultivar, Pick RC2 had the best area cover. The Pick RC2, PR A-97 and the Fiesta 3 were the best cultivars for resisting the encroachment of *Poa supina* (Table 7).

Table 7 - Perennial Ryegrass Area Cover 2006

Cultivar	Rating Period				Seasonal Average	Poa Encroachment Aug 2006 %
	Fall 2005	Spring	Summer	Fall		
	1-9 scale					
Pick RC2	5.8a	5.0a	6.0a	6.8a	5.9	4a
PR A-97	5.8a	4.5a	5.5a	5.5b	5.2	8a
Fiesta 3	5.8a	4.5a	5.5a	5.8ab	5.1	13a
Pennfine	4.8a	4.8a	5.5a	5.3b	5.2	45b
LSD <sub>0.05</sub> =	n/s	n/s	n/s	1.0		22

\* Values that have the same letter as a suffix are not significant from each other.

### **Tall Fescue**

#### *Colour Ratings*

An analysis of the data for spring colour revealed that the cultivars SR8600, Grande, Pixie, Arid 3, and Mustang II all had significantly better colour than Watchdog (Table 8). The summer rating showed that SR8600, Grande and Arid 3 had the best colour. In the fall and for the overall seasonal average, the best cultivars were SR8600 and Grande.

Table 8 - Combined year data for Tall Fescue turf colour, 2004-2006.

Cultivar	Rating Period			Seasonal Average
	Spring	Summer	Fall	
	—————1-9 scale—————			
SR8600	5.4a	6.3a	6.0ab	5.9
Grande	5.3a	6.3a	6.1a	5.8
Pixie	5.0ab	5.7b	5.4bc	5.4
Arid 3	4.9ab	5.9ab	5.3c	5.3
Watchdog	4.6b	5.8b	5.3c	5.3
Mustang II	5.0ab	5.5b	5.2c	5.2
LSD <sub>0.05</sub> =	0.5	0.4	0.6	

\* Values that have the same letter as a suffix are not significant from each other.

### Turf Quality

There were no significant differences between the tall fescue cultivars for turf quality (Table 9).

Table 9 - Combined year data for Tall Fescue turf quality, 2004-2006.

Cultivar	Rating Period			Seasonal Average
	Spring	Summer	Fall	
	—————1-9 scale—————			
SR8600	4.9a	5.6a	5.6a	5.3
Grande	4.8a	5.8a	5.3a	5.3
Mustang II	4.7a	5.3a	4.8a	5.0
Arid 3	4.6a	5.5a	5.2a	5.0
Watchdog	4.3a	5.4a	5.1a	5.0
Pixie	4.3a	5.4a	5.1a	5.0
LSD <sub>0.05</sub> =	n/s	n/s	n/s	

\* Values that have the same letter as a suffix are not significant from each other.

### Area Cover

The tall fescue plots exhibited more physical uprooting than the other grasses and the bare patches created in the fall of 2004 required most of the season to fill-in (data not shown). An analysis of the area cover data revealed that Grande and SR8600 were the best (Table 10). Not surprisingly, they also had the least encroachment of *Poa supina*.

Table 10 - Tall Fescue Area Cover 2006

Cultivar	Rating Period				Seasonal Average	Poa Encroachment Aug 2006
	Fall 2005	Spring	Summer	Fall		
	—————1-9 scale—————					%
Grande	5.0a	4.8a	5.5a	5.3a	5.2	21a
SR8600	5.0a	4.8a	5.0b	5.3a	5.0	33a
Pixie	5.3a	4.8a	5.0b	4.5a	4.8	70b
Watchdog	4.8a	4.8a	5.0b	4.3a	4.7	78b
Arid 3	4.8a	4.5a	5.0b	4.5a	4.7	66b
Mustang II	4.5a	4.5a	5.0b	4.5a	4.7	75b
LSD <sub>0.05</sub> =	n/s	n/s	0.4	n/s		24

\* Values that have the same letter as a suffix are not significant from each other.

## Comparing the Grass Species

In order to compare species (i.e., Bluegrasses vs. tall fescue), all cultivars within each species were combined to yield a single value for that species.

### *Turf Colour*

Except for the spring rating the Calgary Parks Mix, the perennial ryegrass, the Kentucky bluegrass and the tall fescue showed better colour than the *Poa supina* (Table 11). During the summer and fall, the Calgary Parks Mix and the perennial ryegrasses had better colour than the other grasses.

Table 11 - Combined year data for turf colour for various species and mixes, 2004-2006.

Cultivar	Rating Period			Seasonal Average
	Spring	Summer	Fall	
	————— 1-9 scale —————			
Calgary Parks Mix	5.3a	6.2a	6.5a	6.1
Perennial Ryegrass	5.3a	6.3a	6.8a	5.9
Kentucky Bluegrass	5.2a	5.8b	6.0b	5.8
Tall Fescue	5.2a	6.1ab	5.6c	5.6
10% <i>Poa supina</i> Mix	5.1ab	5.2c	5.5c	5.3
<i>Poa supina</i>	4.7b	4.8d	5.5c	4.9
LSD <sub>0.05</sub> =	0.4	0.3	0.3	

\* Values that have the same letter as a suffix are not significant from each other

### *Turf Quality*

There were no significant differences between the various grass species for the spring and summer ratings (Table 12). However, in the fall and for the seasonal average the perennial ryegrass, the Calgary Parks Mix and the 10% *Poa supina* mix were the highest rated.

Table 12 - Combined year data for turf quality for various species and mixes, 2004-2006.

Cultivar	Rating Period			Seasonal Average
	Spring	Summer	Fall	
	————— 1-9 scale —————			
Perennial Ryegrass	5.3a	5.8a	6.1a	5.7
Calgary Parks Mix	5.1a	5.8a	5.9ab	5.7
10% <i>Poa supina</i> Mix	5.0a	5.8a	5.8ab	5.6
<i>Poa supina</i>	4.8a	5.5a	5.5bc	5.3
Kentucky Bluegrass	4.9a	5.6a	5.6bc	5.1
Tall Fescue	4.7a	5.6a	5.2c	5.0
LSD <sub>0.05</sub> =	n/s	n/s	0.4	

\* Values that have the same letter as a suffix are not significant

### *Area Cover*

In the fall of 2005, the 10% *Poa supina* was the best for area cover (Table 13). However, in the spring there were no differences between species or mixes which would indicate that there had been a reduction in area cover of the *Poa supina* i.e. winter kill. In the summer and fall of 2006, the 10% *Poa supina* mix and the *Poa supina* had the best area cover. The perennial ryegrass resisted encroachment of the *Poa supina* the best.

Table 13 - Area Cover of various species and mixes, 2006.

Cultivar	Rating Period				Seasonal Average	Poa Encroachment
	Fall 2005	Spring	Summer	Fall		Aug 2006
	1-9 scale					%
Poa supina	5.3b	4.8a	6.0a	7.0a	6.0	100a
10% Poa supina Mix	7.0a	5.0a	6.0a	6.3ab	5.8	98a
Perennial Ryegrass	5.5b	5.0a	6.0a	6.0b	5.5	17c
Calgary Parks Mix	5.3b	4.8a	5.5ab	5.3cd	5.3	25c
Kentucky Bluegrass	5.5b	5.0a	5.0b	5.0d	5.0	47b
Tall Fescue	5.0b	4.8a	5.0b	5.0d	5.0	57b
LSD <sub>0.05</sub> =	0.8	n/s	0.7	0.9		12

\* Values that have the same letter as a suffix are not significant from each other.

### Discussion

At times, turf injury was visible throughout the site from foot traffic. Damage ranged from moderate shearing of the verdure to the more severe physical up rooting of the turf plants. While all the plots showed some effects from the traffic, the tall fescue plots exhibited more physical uprooting than the other grasses.

The *Poa supina* is a very aggressive grass and went from 10% in the original mix to 98% by the end of 2006. It also encroached on the other grass species and would be expected to eventually dominate in those plots as well. Its area cover was superior to the other grasses, but may have a problem overwintering. The merits of this grass need to be examined for a longer period of time.

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