

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 the end of October. Cleat injury was visible throughout the site. Damage ranged from moderate shearing of the above ground plant portion to more severe physical up rooting of the plants.

An initial study was conducted to test the various grasses for their tolerance of cold temperatures, also referred to as relative hardiness. The Kentucky bluegrass varieties generally had relative hardiness levels of colder than -26°C , while the tall fescues had hardiness levels that were colder than -22°C , and the perennial ryegrass had hardiness levels of -17°C .

The best overall Kentucky bluegrass cultivars for colour were Showcase and Award, while for overall turfgrass quality, the best cultivars were: Showcase, Award, Touchdown, Moon Shadow, Tsunami and Langara. Award, Showcase, Touchdown, Total Eclipse, America and SR228 appeared to be the most resistant of encroachment from *Poa supina*. For the perennial ryegrass, there were very little differences between cultivars for colour and quality. Pennfine was the best cultivar for resisting the encroachment of *Poa supina*. Once again, there were no major differences between the cultivars for colour and turfgrass quality. SR8600 and Grande had the least encroachment of *Poa supina*. When comparing the species and the mixtures, the Calgary Parks Mix, Kentucky bluegrass and the perennial ryegrasses had best colour ratings. For overall turfgrass quality the perennial ryegrass, the Calgary Parks Mix, the *Poa supina* and the 10% *Poa supina* mix were the highest rated. The Calgary Parks Sport Mix and the perennial ryegrass resisted encroachment of the *Poa supina* the best.

Area cover was thought to be an indication of injury from traffic, particularly during the fall when football was played. In the fall of 2006, 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* possibly due to winter kill. In the summer, the 10% *Poa supina* mix produced the best area, while in the fall that same mix plus the Calgary Parks Sport mix, and the *Poa supina* showed the best area cover. The same three were the best overall. The Calgary Parks Sport mix and the perennial ryegrass resisted encroachment of the *Poa supina* the best.

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 field 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 was 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/100m² for Kentucky bluegrass, and 3.2 kg/100m² 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 was deemed as unacceptable 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/100m² (1b N/1000ft²) 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 visual estimate 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. In August 2007, plots were rated for the amount of encroachment of the *Poa supina*. This was determined by visually estimating the area covered by *Poa supina* versus the grass that was originally seeded into the plots. To determine the overall turf quality of the cultivars, colour, density and area cover ratings were combined to yield a single value. All values were then statistically analyzed using the M-STAT statistical analysis program.

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 ₅₀ 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, and Tsunami (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, Touchdown and SR228. The cultivar that showed good colour retention under the cooler and frost-prone conditions of October was Showcase (Table 2). The best overall Kentucky bluegrass cultivars for colour were Showcase and Award.

Table 2 - Combined year data for Kentucky bluegrass turf colour, 2004–2007.

Cultivar	Rating Period			Overall Colour
	Spring	Summer	Fall	
————— 1-9 scale —————				

Showcase	5.2ab	6.4a	6.3a	6.1a
Award	5.4a	6.3a	5.9b	5.9ab
Tsunami	5.1abc	6.1ab	5.9b	5.7bc
Moon Shadow	4.9bc	6.1ab	5.8b	5.6bc
Touchdown	4.9bc	6.0ab	5.8b	5.6bc
Argyle	4.9bc	5.8b	5.8b	5.5c
SR228	4.9bc	6.1ab	5.6b	5.4c
Total Eclipse	4.9bc	5.8b	5.6b	5.4c
Langara	4.9bc	5.8b	5.6b	5.4c
America	4.8cd	5.7b	5.7b	5.4c
Rambo	4.5d	5.2c	5.0c	5.0d
LSD _{0.05} =	0.3	0.4	0.3	0.3

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

Turf Quality

Seasonal data 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, Touchdown, Moon shadow, Tsunami, Argyle and Total Eclipse. Spring quality is an indication of the overwintering capabilities of the various grasses. For the summer rating period, the best cultivars were: Showcase, Award, Touchdown, Moon Shadow, Tsunami, Langara, Argyle, America and SR228. In the fall, the grasses were much closer in their quality and there were no significant differences. Overall the best cultivars were: Showcase, Award, Touchdown, Moon Shadow, Tsunami and Langara.

Table 3 - Combined year data for Kentucky bluegrass turf quality, 2004–2007.

Cultivar	Rating Period			Overall Quality
	Spring	Summer	Fall	
	Mean of 3 quality factors			
Award	5.1a	5.8ab	5.6a	5.5a
Showcase	5.1a	5.9a	5.7a	5.4a
Touchdown	4.9ab	5.7ab	5.5a	5.3ab
Moon Shadow	4.8abc	5.9a	5.5a	5.3ab
Tsunami	4.8abc	5.9a	5.6a	5.3ab
Langara	4.5cd	5.8ab	5.4a	5.3ab
Argyle	4.8abc	5.6ab	5.5a	5.1bc
Total Eclipse	4.8abc	5.5bc	5.3a	5.1bc
America	4.6bcd	5.6ab	5.6a	5.1bc
SR228	4.7bc	5.7ab	5.3a	5.0cd
Rambo	4.3d	5.2c	5.3a	4.8d
LSD _{0.05} =	0.3	0.3	n/s	0.2

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

Area Cover

The best Kentucky bluegrass cultivars for the fall of 2006 were Award, Showcase, and America. However, there were no significant differences during the 2007 growing season for area cover (Table 4).

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*. 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, Showcase, Touchdown, Total Eclipse, America and SR228 appeared to be the most resistant of encroachment.

Table 4 - Kentucky bluegrass area cover rating and *Poa Supina* encroachment, 2007.

Cultivar	Rating Period				Seasonal Average	Poa Encroachment
	Fall 2006	Spring	Summer	Fall		Aug 2007
	-----1-9 scale-----					%
Award	5.8a	4.5a	5.5a	5.5a	5.1a	28d
Showcase	5.3abc	4.3a	5.3a	5.3a	4.9a	32d
Touchdown	5.0bc	4.8a	4.8a	4.8a	4.8a	39d
Total Eclipse	5.0bc	4.3a	5.5a	4.8a	4.8a	43cd
America	5.5ab	4.0a	5.0a	5.0a	4.7a	53bcd
SR228	4.8c	4.3a	5.0a	4.8a	4.7a	55abcd
Tsunami	5.0bc	3.8a	5.5a	5.0a	4.7a	72abc
Moon Shadow	4.8c	4.5a	4.8a	5.0a	4.6a	73abc
Langara	4.8c	4.0a	5.0a	4.8a	4.6a	81ab
Argyle	4.8c	3.8a	5.0a	4.8a	4.5a	79ab
Rambo	4.0d	4.0a	4.8a	4.8a	4.5a	88a
LSD _{0.05} =	0.7	n/s	n/s	n/s	n/s	32

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

Perennial Ryegrass

Colour Ratings

An analysis of the spring colour revealed no significant difference between the Perennial Ryegrass cultivars (Table 5). In the summer, Pick RC2, Fiesta 3 and PR A-97 were somewhat better than Pennfine, while in the fall, Fiesta 3 and Pick RC2 showed the best colour. For overall colour, Pennfine was somewhat lighter in colour than the other three varieties.

Table 5 - Combined year data for Perennial Ryegrass turf colour, 2004-2007

Cultivar	Rating Period			Overall Colour
	Spring	Summer	Fall	
	-----1-9 scale-----			
Pick RC2	5.0a	6.3a	6.6a	6.1a
Fiesta 3	5.1a	6.4a	6.3ab	6.0a
PR A-97	5.3a	6.4a	6.1bc	5.9ab
Pennfine	5.3a	5.9b	5.8c	5.6b

LSD _{0.05} =	n/s	0.3	0.4	0.3
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* 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), but they were not significantly different.

Table 6 - Combined year data for Perennial Ryegrass turf quality, 2004-2007

Cultivar	Rating Period			Overall Quality
	Spring	Summer	Fall	
	—————1-9 scale—————			
Pennfine	5.1a	6.0a	5.6a	5.6a
Fiesta 3	5.3a	5.9a	5.9a	5.4a
PR A-97	5.1a	5.8a	5.8a	5.4a
Pick RC2	5.1a	5.8a	5.8a	5.3a
LSD _{0.05} =	n/s	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 of 2006 and the spring of 2007 showed that there was considerable winter injury, one of the main problems with Perennial Ryegrass in the cold climate of Alberta. The seasonal average showed that the area cover remained low and the encroachment of *Poa supina* was high (Table 7).

Table 7 - Perennial Ryegrass Area Cover 2007

Cultivar	Rating Period				Seasonal Average	Poa Encroachment
	Fall 2006	Spring	Summer	Fall		Aug 2007
	—————1-9 scale—————					%
Pennfine	5.3b	3.0a	5.5a	4.8a	4.3a	19c
PR A-97	5.5b	2.3b	5.0a	4.8a	4.0a	38bc
Fiesta 3	5.8ab	2.3b	4.8a	4.3a	3.8a	44b
Pick RC2	6.8a	2.0b	4.8a	4.0a	3.8a	88a
LSD _{0.05} =	1.0	0.5	n/s	n/s	n/s	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, and Arid 3 had significantly better colour (Table 8). The summer rating showed that SR8600, and Grande 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, 2004-2007

Cultivar	Rating Period			Overall Colour
	Spring	Summer	Fall	
	—————1-9 scale—————			
Grande	5.1ab	6.4a	5.9a	5.8a
SR8600	5.2a	6.4a	5.8a	5.8a
Arid 3	4.8ab	5.9b	5.3b	5.3b
Pixie	4.9ab	5.8b	5.3b	5.3b
Mustang II	4.7bc	5.6b	5.1b	5.1b
Watchdog	4.3c	5.8b	5.3b	5.1b
LSD _{0.05} =	0.4	0.3	0.4	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 tall fescue cultivars for turf quality (Table 9).

Table 9 - Combined year data for Tall Fescue turf quality, 2004-2007

Cultivar	Rating Period			Overall Quality
	Spring	Summer	Fall	
	—————1-9 scale—————			
SR8600	4.9a	5.7a	5.5a	5.4a
Grande	4.7a	5.9a	5.3a	5.3a
Arid 3	4.6a	5.6a	5.2a	5.0a
Pixie	4.4a	5.7a	5.2a	5.0a
Mustang II	4.4a	5.4a	5.0a	5.0a
Watchdog	4.3a	5.6a	5.2a	5.1a
LSD _{0.05} =	n/s	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 and bare patches than the other grasses. An analysis of the area cover data revealed that Grande and SR8600 had the least encroachment of *Poa supina* (Table 10).

Table 10 - Tall Fescue Area Cover 2007.

Cultivar	Rating Period				Seasonal Average	Poa Encroachment Aug 2007
	Fall 2006	Spring	Summer	Fall		
	—————1-9 scale—————					%
SR8600	4.5a	4.0a	6.3a	5.0a	5.1a	35c
Grande	5.3a	4.0a	5.3b	5.0a	4.8a	46c
Arid 3	4.5a	3.8a	5.0b	5.1a	4.6a	73b
Pixie	5.3a	3.8a	5.0b	5.0a	4.6a	85ab
Watchdog	4.3a	4.0a	4.8b	5.0a	4.6a	91a
Mustang II	4.5a	3.7a	4.8b	5.0a	4.5a	86ab

LSD _{0.05} =	n/s	n/s	0.9	n/s	n/s	16
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* 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

During the summer and overall, the Calgary Parks Mix, the Perennial Ryegrass and the Kentucky bluegrass had the best overall colour and the *Poa supina* had the poorest colour (Table 11).

Table 11 - Combined year data for turf colour for various species and mixes, 2004-2007

Cultivar	Rating Period			Overall Colour	
	Spring	Summer	Fall		
	—————1-9 scale—————				
Calgary Parks Sport Mix	5.3a	6.5a	6.3a	6.0a	
Perennial Ryegrass	5.0a	6.3ab	6.0a	6.0a	
Kentucky Bluegrass	4.8a	6.0abc	5.8a	5.8ab	
10% <i>Poa supina</i> Mix	5.0a	5.5cd	5.3a	5.3bc	
Tall Fescue	4.8a	5.8bcd	5.5a	5.3bc	
<i>Poa supina</i>	4.5a	5.3d	5.5a	5.0c	
	LSD _{0.05} =	n/s	0.5	n/s	0.5

* 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 three rating periods (Table 12). However, overall the Calgary Parks Mix, the 10% *Poa supina* mix, the Perennial Ryegrass and the *Poa Supina* were the highest rated.

Table 12 - Combined year data for turf quality for various species and mixes, 2004-2007

Cultivar	Rating Period			Overall Quality	
	Spring	Summer	Fall		
	—————1-9 scale—————				
Calgary Parks Sport Mix	5.3a	6.0a	5.8a	5.8a	
10% <i>Poa supina</i> Mix	5.0a	6.3a	6.0a	5.8a	
Perennial Ryegrass	5.3a	5.8a	5.8a	5.5ab	
<i>Poa supina</i>	4.8a	5.8a	5.5a	5.5ab	
Kentucky Bluegrass	4.8a	5.8a	5.5a	5.0b	
Tall Fescue	4.5a	5.5a	5.0a	5.0b	
	LSD _{0.05} =	n/s	n/s	n/s	0.5

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

Area Cover

In the fall of 2006, 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* possibly due to winter kill. In the summer, the 10% *Poa supina* mix produced the best area, while in the fall that same mix plus the Calgary

Parks Sport mix, and the *Poa supina* showed the best area cover. The same three were the best overall. The Calgary Parks Sport mix and the perennial ryegrass resisted encroachment of the *Poa supina* the best.

Table 13 - Area Cover of various species and mixes, 2007

Cultivar	Rating Period				Seasonal Average	Poa Encroachment Aug 2007
	Fall 2006	Spring	Summer	Fall		
	1-9 scale					%
10% <i>Poa supina</i> Mix	6.3ab	3.5a	7.5a	5.5ab	5.5a	95a
Calgary Parks Sport Mix	5.3cd	3.5a	6.0b	5.5ab	5.0ab	44d
<i>Poa supina</i>	7.0a	3.3a	6.0b	5.8a	5.0ab	100a
Kentucky Bluegrass	5.0d	4.0a	5.8b	4.8cd	4.9b	63c
Perennial Ryegrass	6.0b	3.8a	5.0c	5.0bc	4.6bc	51d
Tall Fescue	5.0d	3.3a	5.0c	4.3d	4.2c	79b
LSD _{0.05} =	0.9	n/s	0.7	0.6	0.5	11

* 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 more severe physical uprooting 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 95% by the end of 2007. 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.

Financial support and maintenance of the trial site was provided by the City of Calgary and the City of Edmonton parks departments.