

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

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### **Summary**

This trial was established in order to determine the wear and cold tolerance of various grasses for use on sports fields in the Prairie Provinces of Canada. An initial screening of 48 different grasses to determine their cold tolerance was conducted in a controlled environment during the winter of 2002-03. From this 21 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 to the treatment list. Cultivars of perennial ryegrass and tall fescue established more rapidly than did the Kentucky bluegrass cultivars, the *Poa supina*, the *Poa supina*/Kentucky bluegrass mix and the City of Calgary standard sports field mix. The perennial ryegrass cultivars that established most quickly were Fiesta 3 and Pick RC2, while Grande and SR8600 tall fescue were equal to the two perennial ryegrasses. On the second rating date, Touchdown Kentucky bluegrass, all four perennial ryegrasses and all six tall fescue were the top rated grasses for establishment.

### **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 as 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.

Grasses on these fields 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 is often great differences in cold tolerance between varieties, some of these new wear tolerant perennial ryegrasses or tall fescues may also 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 information regarding new grasses that can be used on sports fields that are more wear and cold tolerant.

### **Specific Objectives**

- 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 in 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**

An initial screening of cold tolerance was conducted to identify the most suitable cultivars for field-testing. Flats of each individual grass species and cultivar were grown on in the greenhouse. Once the grasses were sufficiently established 10 plants of each species and cultivar were transplanted in 5cm pots and allowed to mature. Once mature pots were placed in a growth chamber and allowed to cold harden for three weeks. In the growth chamber, plants were exposed to 6°C daytime temperature and 2°C night-time temperature. A combination of cool white fluorescent and incandescent lighting (8:1) was used, with an irradiance of 360µm and 94w/m<sup>2</sup> as determined by a Li-Cor LI-1000 photometer. The photoperiod was 10 hours of light followed by 14 hours of darkness. These conditions simulate fall conditions in Alberta. Plants were then transferred to an incubator (Revco Freezer/incubator BOD 30A) where they were stored at -4°C until they were submitted for the freeze test.

A low temperature programmable freezer (Forma Model 8270/759M Freezer with Watlow 982 programmable controller) was used for the freeze test. Plants in individual pots were allowed to acclimatize in the freezer for a minimum of two hours at -2°C. The temperature was then decreased in a step-wise fashion by 2°C/hour. When the temperature was in the selected range, a pot for each treatment was removed before the temperature was further decreased by 2°C. Following the freeze test, plants were thawed for 24 hours at 4°C and transferred to the greenhouse for four weeks. After four weeks, plant re-growth was rated for survival in order to establish LT<sub>50</sub> values. LT<sub>50</sub> values are considered to be the lethal temperature that is required to kill 50% of the plants. Four successive freeze tests were used as replicates.

In year two, those grasses which were determined to have the greatest cold tolerance levels were seeded into field trials in Calgary and Edmonton. These grasses are being established in soil based, high traffic areas of sports fields and will be evaluated for turf quality and wear tolerance. In previous studies, plots have been established just off the centre line of these sports fields where wear is quite consistent. These grasses will be evaluated over a two-year period.

Once these tolerance levels have been evaluated, mixtures of the best individual cultivars will be seeded in year three at new sites and evaluated over a two-year period. The complete study will then be conducted over a four-year period.

### **Methodology – Field Study**

Eleven cultivars of Kentucky bluegrass, four cultivars of perennial ryegrass, six cultivars of tall fescue, *Poa supina*, a mixture of *Poa supina* (25%) and Touchdown Kentucky bluegrass (75%), and the standard City of Calgary athletic field mix were seeded on one site in each of Edmonton and Calgary (Table 2). The City of Calgary athletic field mix consisted of (25% Award, 25% Liberator, 25% Odyssey, and 25% Champion Perennial Rye Champion).

The Calgary site was seeded 30 June 03 while the Edmonton site was seeded 3 Sept 03. 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. Seed was broadcast onto plots with a shaker bottle. Following seeding plots were lightly raked to ensure good seed to soil contact. Irrigation was conducted on an as needed basis at the Calgary site to ensure that the plots remained moist at all times, while the Edmonton site was unirrigated.

Plots were replicated four times in a Randomized Complete Block Design (RCBD). The plots measured 1.5m by 2m. The plots were mowed initially at a mowing height of 2.5” and were fertilized at a rate of 0.5kg N/100m<sup>2</sup> (1b N/1000ft<sup>2</sup>) per growing month.

In 2003, plots were evaluated for area cover only in order to determine turfgrass establishment rates. In the future, plots will be rated on a monthly basis, for three quality factors colour, density and area cover. Rating of the plots is 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.

### **Results**

#### ***Initial Screening of the Grasses***

Results of the freeze test show that generally the most cold tolerant species of grasses were Kentucky bluegrass, followed by tall fescue and then by perennial ryegrass (Table 1). Many of the relative hardiness values exceeded the selected test values and are indicated by a ‘greater than’ (>) symbol. The grasses that showed the best hardiness levels were chosen for the field study.

The variability within the results was quite great which brings into question the reliability of the results of the initial screening of the various grasses. At some point during the

establishment phase, the hardening phase or during the freeze test, plants were put into stress which affected their ability to either harden or resist freezing. Further testing to confirm results was not conducted due to the short timelines for field seeding of the grasses.

Table 1 – Relative hardiness levels of various grasses, 2002.

| <b>Grass Species</b>   | <b>Cultivar</b> | <b>Relative Hardiness (LT<sub>50</sub> Values)</b> |
|------------------------|-----------------|--|
| 1. Kentucky Bluegrass  | Odyssey         | -22°C  |
| 2. Kentucky Bluegrass  | Fairfax         | -22°C  |
| 3. Kentucky Bluegrass  | Showcase        | >-26°C   |
| 4. Kentucky Bluegrass  | SR 2284         | >-26°C   |
| 5. Kentucky Bluegrass  | Award           | >-26°C   |
| 6. Kentucky Bluegrass  | Impact          | -16°C  |
| 7. Kentucky Bluegrass  | J-1368          | -26°C  |
| 8. Kentucky Bluegrass  | NuGlade         | -24°C  |
| 9. Kentucky Bluegrass  | Rugby II        | -22°C  |
| 10. Kentucky Bluegrass | Total Eclipse   | >-26°C   |
| 11. Kentucky Bluegrass | Tsunami         | >-26°C   |
| 12. Kentucky Bluegrass | America         | >-26°C   |
| 13. Kentucky Bluegrass | Explorer        | -22°C  |
| 14. Kentucky Bluegrass | Langara         | -26°C  |
| 15. Kentucky Bluegrass | Marquis         | -24°C  |
| 16. Kentucky Bluegrass | Moon Shadow     | -26°C  |
| 17. Kentucky Bluegrass | Touchdown       | >-26°C   |
| 18. Kentucky Bluegrass | Rambo           | >-26°C   |
| 19. Kentucky Bluegrass | Able 1          | -24°C  |
| 20. Kentucky Bluegrass | Argyle          | >-26°C   |
| 21. Perennial Ryegrass | Hawkeye         | -13°C  |
| 22. Perennial Ryegrass | SR 4220         | -13°C  |
| 23. Perennial Ryegrass | SR 4420         | <-8°C  |
| 24. Perennial Ryegrass | SR 4500         | -10°C  |
| 25. Perennial Ryegrass | Admire          | -8°C   |
| 26. Perennial Ryegrass | Caddieshack     | -13°C  |
| 27. Perennial Ryegrass | Extreme         | -15°C  |
| 28. Perennial Ryegrass | Goalkeeper      | -15°C  |
| 29. Perennial Ryegrass | Fiesta 3        | -17°C  |
| 30. Perennial Ryegrass | Pennfine        | -17°C  |
| 31. Perennial Ryegrass | Pick RC2        | -17°C  |
| 32. Perennial Ryegrass | PR A-97         | -16°C  |
| 33. Perennial Ryegrass | PR C-97         | -11°C  |
| 34. Perennial Ryegrass | Prizm           | -15°C  |
| 35. Perennial Ryegrass | Player          | -15°C  |
| 36. Tall Fescue        | Grande          | >-22°C   |

|                 |              |        |
|-----------------|--------------|--------|
| 37. Tall Fescue | Grande II    | -17°C  |
| 38. Tall Fescue | SR 8600      | >-22°C |
| 39. Tall Fescue | SR 8250      | -17°C  |
| 40. Tall Fescue | Arid 3       | >-22°C |
| 41. Tall Fescue | Pixie        | >-22°C |
| 42. Tall Fescue | Quest        | -17°C  |
| 43. Tall Fescue | FA 6-91      | -17°C  |
| 44. Tall Fescue | Leprechaun   | -17°C  |
| 45. Tall Fescue | Mini-Mustang | >-22°C |
| 46. Tall Fescue | Mustang II   | >-22°C |
| 47. Tall Fescue | Mustang 3    | -17°C  |
| 48. Tall Fescue | Watchdog     | >-22°C |

***Turfgrass Establishment***

On the initial rating date, the species that established most quickly was the perennial ryegrass, while the Kentucky bluegrass was the slowest. The perennial ryegrass cultivars that established most quickly were Fiesta 3 and Pick RC2 and Grande and SR8600 tall fescue were equal to the two perennial ryegrasses.

On the second rating date, Touchdown Kentucky bluegrass, all four perennial ryegrasses and all six tall fescue were the top rated grasses for establishment.

Table 1 – Area cover of cold and wear tolerant grasses Calgary, 2003.

| Species/Cultivar                            | Aug 13 (44 DAT) | Sept 10 (72 DAT) |
|---|-----------------|------------------|
| 1. Kentucky Bluegrass SR228                 | 2.00 E          | 4.25 CD          |
| 2. Kentucky Bluegrass Showcase              | 3.00 DE         | 4.25 CD          |
| 3. Kentucky Bluegrass Award                 | 3.00 DE         | 4.75 BCD         |
| 4. Kentucky Bluegrass Total Eclipse         | 2.00 E          | 4.25 CD          |
| 5. Kentucky Bluegrass Tsunami               | 2.50 E          | 4.00 D           |
| 6. Kentucky Bluegrass America               | 2.50 E          | 4.50 BCD         |
| 7. Kentucky Bluegrass Langara               | 3.00 DE         | 4.00 D           |
| 8. Kentucky Bluegrass Moon shadow           | 2.25 E          | 4.50 BCD         |
| 9. Kentucky Bluegrass Touchdown             | 2.50 E          | 5.00 ABCD        |
| 10. Kentucky Bluegrass Rambo                | 2.00 E          | 4.00 D           |
| 11. Kentucky Bluegrass Argyle               | 2.50 E          | 4.50 BCD         |
| 12. Perennial Ryegrass Fiesta 3             | 6.25 A          | 5.50 ABC         |
| 13. Perennial Ryegrass Pennfine             | 5.25 B          | 5.75 AB          |
| 14. Perennial Ryegrass Pick RC2             | 6.50 A          | 5.75 AB          |
| 15. Perennial Ryegrass PR A-97              | 5.00 BC         | 5.00 ABCD        |
| 16. Tall Fescue Grande                      | 5.75 AB         | 6.25 A           |
| 17. Tall Fescue SR8600                      | 6.00 AB         | 5.75 AB          |
| 18. Tall Fescue Arid 3                      | 5.00 BC         | 5.25 ABCD        |
| 19. Tall Fescue Pixie                       | 5.00 BC         | 5.50 ABC         |
| 20. Tall Fescue Mustang II                  | 3.75 D          | 5.00 ABCD        |
| 21. Tall Fescue Watchdog                    | 4.00 CD         | 5.25 ABCD        |
| 22. <i>Poa supina</i>                       | 3.75 D          | 4.00 D           |
| 23. <i>Poa Supina</i> (10%) Touchdown (90%) | 3.00 DE         | 5.00 ABCD        |
| 24. Mixture #2 City of Calgary Blend        | 4.00 CD         | 5.75 AB          |
| <b>LSD<sub>0.05</sub> =</b>                 | <b>1.23</b>     | <b>1.26</b>      |

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