Variety-specific management for seed production of creeping red fescue

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Introduction

Almost all of Canada's production of seed of creeping red fescue is produced in the Peace River region of Alberta and British Columbia. Although some of the seed is used domestically, the majority is exported to the USA for amenity purposes. Since the mid-1970s, the publicly bred and genetically diverse variety Boreal has dominated the creeping red fescue landscape in Canada because of its consistently superior seed yield over most other varieties, and its broad adaptation in North America and Europe. Although most creeping red fescue seed is produced and exported as "common" production (i.e., non-pedigreed), its origin can usually be traced back to the and widely adapted Boreal. This project was conducted for Pickseed Canada who were interested in determining whether some variety-specific management practices could be identified that would result in more economically competitive seed production of their Jasper and Jasper E (a *Neotyphodium* endophyte-infected version) varieties of creeping red fescue in the Peace River region.

Materials and Methods

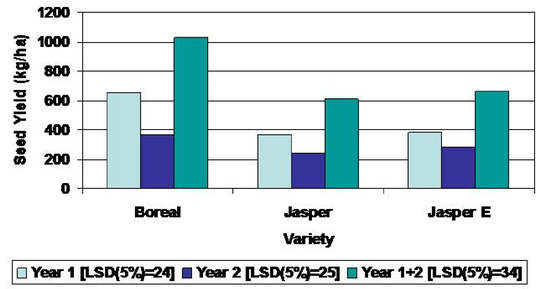
A field study was designed and established in 1998 at Beaverlodge Research Farm to evaluate the seed-producing potential of three varieties of creeping red fescue under a broad range of crop management practices. The varieties were the local standard, Boreal, and the industry partner's Jasper and Jasper E. The experimental treatments included 4 methods of stand establishment (Broadcast; 30 cm rows; 15 cm rows; 15 cm rows with sulfur soil supplement [50 lb/ac SulFer 0-0-0-95]), 3 methods of post-harvest management (flail mowing to 10 cm growth in fall and residue removal; disc-mowing to 5 cm in fall and residue removal; short-duration, intensive grazing to 5 cm in fall with sheep) in addition to crop residue removal at seed harvest, and 10 nitrogen (N) fertilizer treatments for which all the N was surface-broadcast as ammonium nitrate (34-0-0). Five of the 10 N treatments supplied N in the fall only at 34, 51, 68, 85, or 102 lb/acre N, while the other 5 supplied the same total amount of N but with 50-80% applied in the fall and the remainder in the following spring (i.e., fall+spring lb/ac N being 34+17, 34+34, 51+34, 68+17, and 68+34). By the fall of 1998, the experimental stands had established well, although the plants in the broadcast-seeded stands were more sparse than those in the row-seeded stands. The N fertilizer treatments were applied as scheduled in fall 1998 and spring 1999, and the first seed crop was harvested in July/August 1999. The 3 post-harvest management treatments were applied in the fall of 1999, and the sheep for the grazing treatment were provided and managed by local personnel from the industry partner, Randy Yaklin. The N fertilizer treatments were applied again in the fall of 1999 and the spring of 2000 to support the growth of the seed crop in 2000. The second seed crop was harvested in July/August 2000. The plants in the central 0.6 m x 4.5 m of each 1.8 m x 6.0 m treatment plot were harvested for the 1999 and 2000 seed crops.

Results

The environmental conditions were somewhat drier and cooler than normal during the growing seasons in which this study was conducted. The seed yields from the 5 fall+spring split N treatments were never greater than those for the same amount of N applied in the fall only; therefore, to improve clarity, this presentation will be restricted to the 5 treatments in which the N was applied in the fall only. Seed yield information is presented for the 1999 and 2000 seed crops individually and for the two years combined. The yields over the two production years are presented to conform with the natural cycle of seed production for creeping red fescue in the Peace region, as commercial stands are usually harvested for two consecutive years, rejuvenated without re-seeding (by plowing or cultivation and possibly seeding to an annual grain crop), and then harvested again for another two consecutive years.

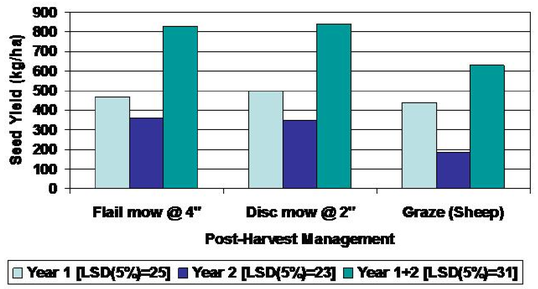
The majority of the variation in seed yield for the first and second production years, and over the two years combined, was associated with the main effects of method of seeding, variety, N fertilizer treatment, and post-harvest management. There was no statistically significant interaction of either variety, or N fertilizer treatment, with the method of seeding for the combined seed yield over the two years. Although the other two-way treatment interactions were statistically significant (i.e., variety x method of seeding for the first and second year seed crops, variety x N treatment and post-harvest management x N treatment for the first, second and combined seed crops, and post-harvest management x method of seeding for the second and combined seed crops), the variances associated with them were so small that their agronomic importance is of little practical or economic value. Thus, the results illustrated will be restricted to the those associated with the main effects of method of seeding, variety, N fertilizer treatment, and post-harvest management.

Effect of Variety on Seed Yield of Creeping Red Fescue



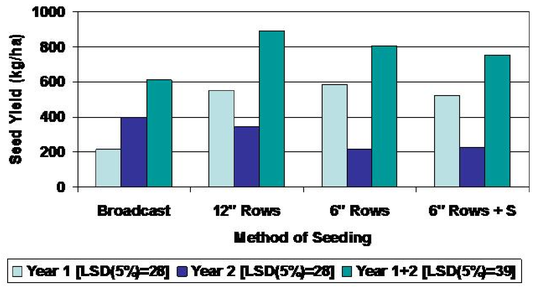
Seed Yield as affected by Variety:
First production year: Boreal >> Jasper E = Jasper
Second production year: Boreal >> Jasper E > Jasper
Two years combined: Boreal >> Jasper E > Jasper

Effect of Post-Harvest Management on Seed Yield of Creeping Red Fescue



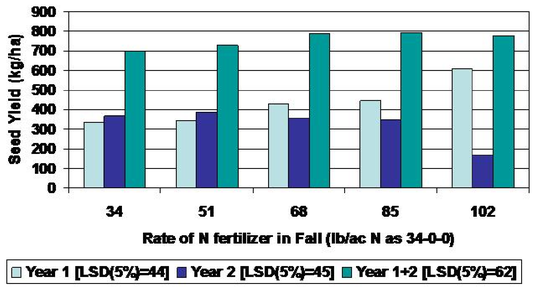
Seed Yield as affected by Post-Harvest Management:
First production year (before treatment applied): Disc Mow = Flail Mow = Graze
Second production year: Flail Mow = Disc Mow >> Graze
Two years combined: Disc Mow = Flail Mow >> Graze

Effect of Method of Seeding on Seed Yield of Creeping Red Fescue



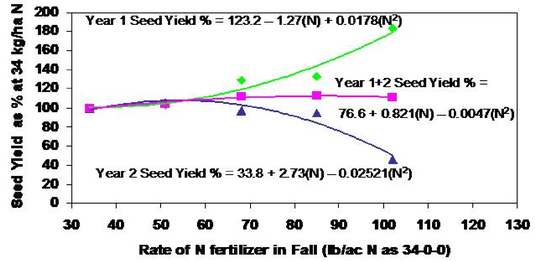
Seed Yield as affected by Method of Seeding:
First production year: 6" rows > 12" rows = 6" rows with S >> Broadcast
Second production year: Broadcast > 12" rows > 6" rows with S = 6" rows
Two years combined: 12" rows > 6" rows > 6" rows with S >> Broadcast

Effect of Rate of Nitrogen Fertilizer on Seed Yield of Creeping Red Fescue



Seed Yield as affected by fall-applied N:
First production year: Yield increased by N to at least 102 lb/ac N
Second production year: Yield unaffected between 34 and 85 lb/ac N but reduced at 102 lb/ac N
Two years combined: Yield increased up to 68 lb/ac N but then no further yield response

Relative Seed Yield of Creeping Red Fescue as affected by Rate of Nitrogen (In equations, N = lb/ac fertilizer nitrogen and must be between 34 and 102 lb/ac)



Relative seed yield response to fall-applied N:
First production year: Yield as a % of that at 34 lb/ac N increased steadily from 100% at 34 lb/ac of fall-applied N to 180% at 102 lb/ac of fall-applied N.
Seed Yield (%) = 123.2 - 1.27(N) + 0.0178(N^2) with an R^2 = 89%

Second production year: Yield as a % of that at 34 lb/ac N was unaffected (i.e., constant at 100%) by rate of N between 34 and 75 lb/ac N but was Decreased steadily to 50% as N rate increased from 75 to 102 lb/ac N.
Seed Yield (%) = 33.8 + 2.73(N) - 0.02521(N^2) with an R^2 = 84%

Two years combined: Yield as a % of that at 34 lb/ac N increased from 100% at 34 lb/ac of fall-applied N to 110% at 70 lb/ac of fall-applied N but then remained constant up to 102 lb/ac N.
Seed Yield (%) = 76.6 + 0.821(N) - 0.0047(N^2) with an R^2 = 87%

Acknowledgements: Pickseed Canada, Randy Yaklin, Lois Connelly, Tom Cramer and Marlene Probst

After grazing by sheep (4/10/1999)

After disc mowing and residue removal

After flail mowing and residue removal

Conclusions

1. Seed yield of creeping red fescue was greatest over two consecutive production years when sown on 12" rows, although a higher first-year yield may be realized using 6" rows. In the first production year, seeding in rows resulted in higher seed yield than broadcasting but, in the second, the converse was true.
2. There was no beneficial effect of supplemental fertilization with sulfur in this trial.
3. In the first, second and combined production years, the seed yield of Boreal was 655, 372 and 1027 kg/ha, respectively; for the corresponding production years, Jasper produced 56, 65 and 60% of Boreal, and Jasper E produced 58, 76 and 65% of Boreal. The endophyte infection of Jasper E was particularly beneficial for seed yield in the second production year.
4. For the year subsequent to the application of the post-harvest treatments, the effects of flail and disc mowing were similar (360 versus 347 kg/ha seed, respectively) but grazing by sheep reduced seed yield to 188 kg/ha, almost by 50%.
5. The seed yield response of creeping red fescue to the fall-applied N fertilizer differed for consecutive years of production. For the first production year, seed yield increased continuously over the range from 34 to 102 kg/ha of fall-applied N. For the second production year, fall-applied N at rates in excess of 75 lb/ac N markedly suppressed seed yield. A repeated fall application of 50 to 70 lb/ac N, in the establishment year and after the first year's seed harvest, is sufficient to maximize the combined seed yield over two consecutive production years.
6. The results suggest that, over the two-year production cycle, seed yield of creeping red fescue might be enhanced further by a fall application of N of 70 to 100 lb/ac in the establishment year followed by one of 30 to 50 lb/ac after the first seed crop. However, this strategy of N fertilization requires experimental verification.