Title of Project: **Stem Eyespot Resistance in Creeping Red Fescue**
Report Title: Annual Report
Report Covering Period: April 1, 2000 to March 31, 2001
Organization(s): Peace Region Forage Seed Association
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Objectives:

- Develop improved creeping red fescue cultivars starting from the "Boreal" genetic background
- Develop creeping red fescue with enhanced turf performance characteristics including leaf texture, colour and disease resistance
- Develop additional fine fescue germplasm to enhance diversification of the seed production base in the Peace River region

Accomplishments:

- Maintained two polycross nurseries in Peace and kept them weed and insect free
- Harvested samples and processed data from Baldonnel site where 3 UBC lines were included in forage seed variety trials
- Harvested plant resource material from Peace sites
- Establsihed plant resources: project currently has the following plant resources:
  1. Breeder's seed stock of "Boreal II" related to 'Boreal', but with some potential improved turf quality, improved stem eyespot tolerance and equal or better seed yield.
  2. 20 to 60 lines of material for testing in turf quality plots to evaluate their potential as Clonal parents for additional breeding.
  3. 2 polycross nurseries that should produce sufficient seed in 2001 to enter into yield and turf quality trials in 2002. Breeder's seed multiplication could be initiated parallel to the yield and quality testing.

Tasks in progress:

- Processing harvested samples of selected clones from polycross breeding blocks and nurseries.
- Maintaining some on-going research into improved cultivars.
- Developing sufficient interest in the cultivar development to move the plant material to commercial marketplace.

Extension and demonstration:

- Presentation/ participation at annual tour hosted by Peace Region Forage Seed Association in Baldonnel in July, 2000.
- Presentation by Brian Holl at AGM/Seed Production & Marketing Seminar in Fairview on March 13 and Fort St. John, March 14, 2001
- Distributed 250 copies of Creeping Red Fescue Breeding report March, 2001.

Finances:

Total Multi –Year Project Budget	$17,500.00
Total Revenue from 3 associations	$ 8,500.00
Total Revenue from PRAD	$ 7,200.00
Total Expenses to March, 2001	$17,500.00
Holdback Request from both 1999 ($1500) & 2000 ($300)	**$ 1,800.00**

Variances from original work plan, schedule or budget: none

Summary comments, conclusions: none

Attachments: Detailed Financial Summary supplied by Ed Hadland, Treasurer
Creeping Red Fescue Breeding Report by Brian Holl March, 2001

Creeping Red Fescue Breeding

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Background:
In excess of 90% of the seed production of creeping red fescue in Canada occurs in the Peace River region of BC and Alberta. The cultivar 'Boreal' has been a significant component of that production and has been widely used in turf grass mixes as well as pasture and reclamation seeding. The attraction of 'Boreal' to seed producers has been its superior seed yields in the Peace region climate. Many of the newer cultivars of fine fescue have been lower yielding under the growing conditions of the region. In the past decade, however, 'Boreal' has declined in competitiveness as a quality turf cultivar in comparison to newer introductions and competitive species of fine fescue, while it has remained as a commodity for export into the low to mid-quality grass seed mix market. In UK turf trials, where 'Boreal' has performed successfully for an extended period, it has slid steadily downward in the competitive rankings, and since 1995 has been found at or near the bottom of the performance tables (#20/20 in the 2001 STRI Trial report). The majority of seed exported to the USA trades as a price-sensitive commodity.

Continued production of 'Boreal' has also been constrained by the impact of stem eyespot disease - a disease of the flowering culm caused by the fungal pathogen *Didymella festucae (= Phleospora idahoensis)*. Stem eyespot is most infective when there is a specific coincidence of plant growth stage, environmental conditions and the pathogen. In years where those factors do not occur during the same relatively narrow window, the disease is of minor significance; nevertheless, when conditions are appropriate, the disease can reduce seed yields by up to 60% and result in significant economic loss.
With increasing interest in the use of fine fescues in lawns and golf courses to take advantage of the lower water and fertility requirements of these species, there should be a strong developing market for quality fine fescues over the next decade. New cultivars of creeping red fescue are likely to be attractive to Peace region seed producers if they retain the seed production capabilities of 'Boreal', carry improved resistance to stem eyespot, and are competitive in the premium turf seed marketplace.

This project was initiated in 1993 to develop improved cultivars to service the potential demand for fine fescues in the premium turfgrass sector. New cultivars will help to diversify the genetic base for seed production, and have the potential to enhance returns to grass seed producers in the region. Since it's inception, the project has been supported by funding from The BC Branch of the Canadian Seed Grower's Association, The BC Grain Producers' Association, the Peace River Forage Seed Association, Agricore™, and the BC Ministry of Agriculture, Food and Fisheries Applied Research Partnership Program.

Objectives:
The specific objectives of this project were to:

- Develop improved creeping red fescue cultivars starting from the 'Boreal' genetic background
- Develop creeping red fescue with enhanced turf performance characteristics including leaf texture, colour and disease resistance

- Develop additional fine fescue germplasm to enhance diversification of the seed production base in the Peace River region

Breeding Strategy & Progress:
The breeding strategy involved a variety of approaches - field selection, tissue culture/in vitro testing, incorporation of selected materials into polycross nurseries, and field testing for yield and turf quality characteristics.

Field selections for eyespot resistance, and some growth characteristics were made from rejuvenated fescue fields (these facilitate selection of individual clones). The initial selections were made by Jack Dobb of the BCMAFF, with subsequent selections by F.B. Holl. Plants were selected for evidence of stem eyespot resistance, shatter resistance, growth habit and seed production. These materials have been maintained in field nurseries in the Peace (Dawson Creek, Baldonnel and Fort St. John) and at the Totem Research site at UBC in Vancouver. Selected clones were incorporated into the polycross breeding blocks. In 2000, the remaining field grown clonal material was evaluated critically and reduced significantly in number for on-going maintenance and/or evaluation.

Additional genetic variation was developed using plant material regenerated from tissue culture of 'Boreal' germplasm. *In vitro* callus cultures were established and allowed to multiply before being induced to develop new shoots. These shoots were excised and transferred to another medium for root development. Approximately 250 regenerants from this process were grown out in the field at the Totem Research site for assessment.

Testing for stem eyespot resistance normally requires the presence of a flowering culm. In the field at UBC, and with plants grown in the greenhouse or growth cabinets, we were unable to stimulate flowering quickly under controlled environment conditions, or to produce significant disease pressure to screen material effectively for disease resistance. While primarily a disease of the inflorescence, Smith (1971) noted that lesions could also be observed on leaves. We examined whether a non-destructive vegetative assessment for eyespot resistance might be possible. Vegetative samples of clonal material were excised from the intact plant and an agar plug of the cultured *Didymella* fungus was inserted at the junction of the leaf and stem. After incubation in a moist environment for 72 h, the plugs were removed and the leaves examined for evidence of fungal attack. Our tests indicated that resistant lines showed little evidence of response to the fungus, while susceptible lines developed lesions that varied from slight discoloration to extensive browning and localized necrosis. This technique was used to assess field-selected material and to screen for additional eyespot tolerant lines.

The initial polycross breeding nursery was established using the following clonal material:
- 5 - 'Barcrown' clones ('Barcrown' is a top performing (STRI Trial report-2001) slender creeping red fescue)
- 5 - 'Cindy' clones ('Cindy' is a top five performer (STRI Trial report-2001) strong creeping red fescue
- 5 - 'Boreal' clones selected for shatter resistance
- 3 - 'Boreal' clones selected for resistance to stem eyespot

In the fall of 1995 - 66 selections from the original polycross nursery were planted at UBC for turf quality evaluation in 1996. Approximately eight of those lines warranted further evaluation

on the basis of their turf quality. Vegetative samples of the clones of interest were used to provide clonal material for a second generation polyclonal nursery - established in 1997. This nursery was composed of the following clones:

- 3 - 'Cindy' clones
- 4 - 'Barcrown' clones
- 3 - 'Boreal' stem eyespot resistant clones
- 2 - 'Boreal' shatter resistant clones
- 4 - Regenerant clones from the tissue culture program
- 3- Clonal selections from 'Boreal' for growth habit and seed production

In 1998, a third polycross breeding block was established at both Totem Field and Baldonnel, consisting of selections from material evaluated for quality characteristics from the 1995 nursery. In the summer of 1999, approximately 600 individual segregating lines from open-pollinated clones were planted at a site north of Fort St. John. They were evaluated for performance in 2000 and selections of higher performing lines retained for further incorporation into the breeding program. Many of these lines had vigorous growth characteristics and maintained seed yield capability that was most typical of their 'Boreal' genetic background.

Harvested samples of selected clones from the nurseries and from the polyclonal breeding blocks have yet to be processed to the clean seed stage.

In 1998 a polyclonal synthetic (UBC Syn-1) was entered in the Baldonnel Forage Seed Variety Trials. The 1999 harvest data is summarized in the table below (2000 harvest data were not available to the author at the time of completing this report):

Entry	Yield (kg/ha)	Yield (% Boreal)	
Kauni	1778	291	a*
Jasper	1686	276	a
UBC Syn1	1488	241	a
LSFF CT 98-1	1038	170	b
UGG 2001	703	115	bc
LSFF CT 98-2	658	108	bcd
Boreal	610	100	cd
UGG 2002	351	58	cde
LSFF CT 98-3	288	47	de
SW Kristina	217	36	e

* Yields followed by the same letter are not statistically significantly different ($P \leq 0.05$).

The 1999 seeded fine fescue trial at Baldonnel included three UBC entries. The 2000 harvest yields from that trial are summarized below:

Entry	Yield (kg/ha)	Yield (% Boreal)
ARCFS-1	632	47
ARCFS-1	586	44
ARCFS-1	1072	80
Boreal	1345	100
Casanova	1065	79
RU1511	1789	133
SW Kristina	479	36
UBC # 1	988	73
UBC # 2	1301	97
UBC # 3	1452	108

Project Status & Future:

The project currently has the following plant resources:

1. Breeder's seed stock of 'Boreal II' - related to 'Boreal. But with some potential improved turf quality, improved stem eyespot tolerance, and equal or better seed yield. This material needs to be multiplied for commercial release.
2. Twenty to sixty lines of material for testing in turf quality plots to evaluate their potential as clonal parents for additional breeding.
3. Two polycross nurseries that should produce sufficient seed in 2001 to enter into yield and turf quality trials in 2002. Breeder's seed multiplication could be initiated in parallel to the yield and quality testing.

Further development of the project will be dependent on our ability to secure sufficient interest in potential cultivar development to move the plant material into the commercial marketplace, and to maintain some on-going research into improved cultivars.

Acknowledgements:

In addition to the funding agencies noted in the introduction, I wish also to acknowledge the contributions of individuals who have helped to keep this project alive since its inception. They include Jack Dobb and Ken Nickel BCMAFF, Arthur and Ed Hadland, Glen Aalhus, Lothar Torheiden, Raymond Verboven, and Sandra Burton in the Peace region as well as Seane Trehearne and Bryan Grim at UBC. There are numerous others who have supported this research or worked on the plots at various times as summer students etc. - their contributions are also acknowledged with thanks.

Peace Region Forage Seed Association
Financial Summary for
Stem-eyespot Resistance in Creeping Red Fescue Project

Revenue:

BC Branch CSGA		4,500.00
Fine Seeds Committee		3,070.83
Peace Region Forage Seed Association		929.17
PRAD Funding:		8,500.00
June 1998	1,500.00	
Aug 1999	3,000.00	
May 2000	1,800.00	
July 2000	900.00	
		7,200.00
		15,700.00

Expenditures:

Travel Expenses, June 98 (UBC to FSJ)	1,251.60
Travel Expenses, Sept. 98 (UBC to FSJ)	1,070.06
Advance, Oct. 98 (on invoices received Feb. and Mar. 1999 for lab and greenhouse expenses)	3,250.00
Analysis and Preparation Expenses, August 1999	3,000.00
1999 Harvest / 2000 Seeding and Plot Maintenance, July 2000	3,000.00
Contract Work and Machine Rental (BCGPA), January 2001	2,276.96
Plot Maintenance, harvest and supplies, analysis etc. March 2001	3,651.38
	17,500.00