Peace Region Forage Cultivar Testing (PRFCT) Program

Annual Report 2021

Coordinated by

Peace Region Forage Seed Association in collaboration with Agriculture and Agri-Food Canada
Beaverlodge Research Farm, Alberta

Prepared by

Nityananda Khanal
Calvin Yoder
Noabur Rahman
Talon Gauthier

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

CANADIAN AGRICULTURAL PARTNERSHIP

Peace Region Forage Seed Association

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Acknowledgments

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Foster's Seed & Feed Ltd
Limoges Forage & Grasses Ltd
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Mike Leighton, Agriculture and Agri-Food Canada

Contacts on PRFCT Co-operative Research Program

Talon Gauthier
PRFSA General Manager
Community Futures Peace Liard
904 102nd Ave, Dawson Creek, BC V1G 2B7
Phone: 1 877 630 2198
E-mail: coordinator@peaceforageseed.ca

Calvin Yoder
Forage Seed Specialist
PRFSA/SARDA Ag Research
Phone: 780 864 7663
E-mail: calvinyoder123@gmail.com

Nitya Khanal, Ph.D., P.Ag.
Research Scientist
Beaverlodge Research Farm
Agriculture and Agri-Food Canada
100038 Township Rd 720, P.O. Box 29
Beaverlodge, AB T0H 0C0
Telephone: 780 354 4264
Fax: 780 354 4299
E-mail: nityananda.khanal@agr.gc.ca

Noabur Rahman, Forage Research Assistant
Research Assistant
Agriculture and Agri-Food Canada
100038 Township Rd 720, P.O. Box 29
Beaverlodge, AB T0H 0C0
Phone 780 354 4292 (Lab)
Fax: 780 354 4299
E-mail: noabur.rahman@agr.gc.ca

Pat Gansevles
Forage Research Technician
Agriculture and Agri-Food Canada
100038 Township Rd 720, P.O. Box 29
Phone: 780 354 4288
Fax: 780 354 4299
E-mail: pat.gansevles@agr.gc.ca

Protocol for Peace Region Forage Cultivar Testing (PRFCT) Program

Updated – February ….., 2022

1. Research Sponsorship

An annual research sponsorship of **$350 CAN/entry/year/location** is requested, this sponsorship will be paid for the establishment year as well as for the harvest years. Peace Region Forage Cultivar Testing Program funds will be administered by the Peace Region Forage Seed Association (PRFSA). Each seed company will be invoiced annually by the PRFSA General Manager.

2. Eligibility of Entries

Released and experimental lines of all tame and native grass species will be considered if they are of interest to commercial seed companies. We reserve the right not to initiate tests:

- if seed is not received on time
- if there is a restriction of space in any year at a particular location
- if entries are too few in any year for a particular location
- if the germination percentage of the seed is below 75%

3. Seed Requirements and Deadline for Seed Entry

The applicant will provide for **EACH TEST LOCATION**:

- 50 g of timothy, bentgrass, or Kentucky bluegrass
- 100 g of fescues - creeping red, chewings, hard, meadow, sheep or tall fescue; orchardgrass, annual or perennial ryegrass
- 200 g of bromegrasses – meadow, smooth, hybrid, and wheatgrasses
- 200 g of leguminous species such as alfalfa, birdsfoot trefoil, clovers
- The germination percentage of each cultivar

Approved seed entries shall be supplied by **April 1st** of the establishment year and **will include the percent germination and relative maturity** (early, medium or late) of each cultivar. Please indicate if the submission is **a turf type or forage** for grass cultivars.

Please ship approved seed to*:

Peace Region Forage Seed Association
904 102 Ave
Dawson Creek, BC V1G 2B7

* *European companies submitting entries need to ship their seeds to their US or Canadian head office then to the PRFSA. Seed shipped from the US to Canada needs to be accompanied by all phytosanitation paperwork to clear customs.*

4. Publication of Results

Data will undergo appropriate statistical analysis and each applicant will receive an annual report. Seed producers will be provided information on cultivars upon request. Results will be posted by the end of the fiscal year on the research page of the website www.peaceforageseed.ca

All reasonable care will be taken to ensure a successful test; however, no guarantee can be made that a particular test will be successful. If a test is not successful it can be reseeded.

The cultivars will be tested for two harvest seasons after the establishment. Cultivar performance is reported in terms of biomass and seed yields for each harvest season. In some cases, data may not be reported due to extreme variations that cannot be accounted for in the statistical design.

Disclaimer

Reference to trade names or commercial products are made with the understanding that no discrimination is intended, and no endorsement is implied.

5. Use of Seed

Seed submitted will only be used for the establishment of the agreed upon trials. The seed will **NOT** be used for increase, selection or distribution.

Peace Region Forage Cultivar Testing (PRFCT) Program

2022 Application for PRFCT Entry

Company: **Telephone:**

Contact person: **Fax:**

Mailing address: **Email:**

Species	Cultivar Name/Code	Type Forage/Turf	Relative Maturity Early/Medium/Late	% Germination

Send application form no later than March 31, 2020 to:

Nitya Khanal
Beaverlodge Research Farm
Agriculture and Agri-Food Canada
100038 Township Rd 720, P.O. Box 29
Beaverlodge, AB T0H 0C0
Phone: 780 354 4264
Fax: 780 354 4299
E-mail: nityananda.khanal@agr.gc.ca

Or

Talon Gauthier
Community Futures Peace Liard
904 102nd Ave
Dawson Creek, BC V1G 2B7
Phone: 1 877 630 2198
E-mail: coordinator@peaceforageseed.ca

Executive Summary

The COVID-19 pandemic created a lag in the forage seed cultivar evaluation activities at Beaverlodge Research farm in 2020. The pandemic curtailed intensive research activities and no cultivar testing trials were established in 2020. With the arduous effort of Calvin Yoder, forage seed specialist affiliated with Peace Region Forage Seed Association (PRFSA) and SARDA Ag Research, three trials on cultivar evaluation of creeping red fescue (*Festuca rubra* L. var. *rubra*), various fine fescues (*Festuca* spp.) and crested wheatgrass (*Agropyron cristatum* [L.] Gaertn.) were conducted in the farmers' fields in Donnelly, AB. In 2021, a total of six cultivar evaluation trials were established in Beaverlodge Research Farm. Various cultivars of creeping red fescue (*Festuca rubra* L. var. *rubra*), perennial ryegrass (*Lolium perenne* L.), timothy (*Phleum pratense* L.), alfalfa (*Medicago sativa* L.), red clover (*Trifolium pratense* L.), and alsike clover (*Trifolium hybridum* L.) are being evaluated for their seed yield in comparison with popular cultivars of respective species in the region. The test cultivars were received from various Canadian seed companies and their foreign affiliates including Foster's Seed & Feed Ltd, Limoges Forage & Grasses Ltd, BrettYoung, DLF Moore Seed and Northstar Seed.

This report includes the interim results 2020-established on-farm trials, observation notes on Serbian alfalfa, red clover and vetch (*Vicia sativa* L.) cultivars established in 2020, and establishment status of 2021-seeded trials in the Beaverlodge Research Farm. While the 2020 weather conditions were generally favourable for crop growth, the weather in 2021 was characterized by intense heatwave and drought causing high evapo-transpiration, excessive moisture stress and pre-mature senescence of crop foliage. For the harvestable seed crops established in previous seasons, the inclement weather in 2021 caused pollen desiccation, poor fertilization, impaired seed development resulting in low yield, high dockage and light weight of seeds. For the newly seeded crops, the weather impaired seed germination resulting in staggered and uneven emergence. The plant stand will be evaluated in the coming spring to determine the suitability of establishment for continuation of the 2021-seeded trials.

Introduction

Agricultural systems need to adapt to new challenges and opportunities brought about by global climate change and globalization of market. Innovations in crop breeding provide continuous flux of new crop cultivars that require assessment of their regional adaptability and end use quality. To address this need in forage seed crops in the Peace region, Agriculture and Agri-Food Canada (AAFC) - Beaverlodge Research Farm and Peace Region Forage Seed Association (PRFSA) have established a long-term collaborative program known as Peace Region Forage to Cultivar Testing (PRFCT), formerly known as Peace Region Grass Seed Testing (PRGST). Funded by the Government of Canada through Canadian Agriculture Partnership (CAP) with contribution from PRFSA, the primary objective of the program is to evaluate new proprietary and public cultivars to support production and marketing decisions for producers and seed companies.

The crop growing season in the Peace River region of Canada is typified by long day, cool night and modest soil water deficit. This condition provides relative advantage for seed production of turf and forage crops for the domestic and export market. About 25,000 metric tons (55 million lbs.) of forage and turf grass seeds are sold annually from this region. The forage seed production provides farmers with on-farm diversification options for improved crop rotation, distribution of labour and equipment over the season, and niche market opportunities.

Various collaborative initiatives have received funding support from the Government of Canada through Growing Forward and the Canadian Agricultural Partnership programs, along with fund contributions from PRFSA. A forage cultivar testing program originally initiated in mid 1990's as Western Grass Seed Testing Program (WGST) has now evolved to be a more embracing Peace Region Forage Cultivar Testing (PRFCT) program including both grasses and legumes species. The PRFCT validates adaptability, productivity and seed quality of public and proprietary forage and turfgrass cultivars, and provides the most recent yield data for the farmers of Pease region and the whole province.

This report includes the interim results 2020-established on-farm cultivar evaluation trials on creeping red fescue (*Festuca rubra* L. var. *rubra*), various fine fescues (*Festuca* spp.) and crested wheatgrass (*Agropyron cristatum* [L.] Gaertn.). It also documents observation notes on Serbian alfalfa, red clover and vetch cultivars established in Beaverlodge Research Farm 2020, and establishment status of 2021-seeded trials creeping red fescue (*Festuca rubra* L. var. *rubra*), perennial ryegrass (*Lolium perenne* L.), timothy (*Phleum pratense* L.), alfalfa (*Medicago sativa* L.), red clover (*Trifolium pratense* L.), and alsike clover (*Trifolium hybridum* L.) in the Farm.

General description of study sites and test cultivars

In 2020, COVID-19 pandemic related restrictions jeopardized research activities in the spring season in the Beaverlodge Research Farm. The cultivar testing activity was limited to establishment of non-replicated plots of Serbian cultivars of alfalfa, red clover and vetch to observe their establishment, growth, winter survival and fitness in the new environmental conditions in the Peace River region (Table 1).

In the restricted situation in 2020, Calvin Yoder, forage seed specialist affiliated with Peace Region Forage Seed Association (PRFSA) and SARDA Ag Research stepped up to establish three separate field trials on creeping red fescue, hard, slender and chewing fescues, and crested wheatgrass in farmers' fields in Donnelly, Alberta. Three separate field trials were established on creeping red fescue, hard, slender and chewing fescues and crested wheatgrass. A total of 10 proprietary cultivars of creeping red fescue, six proprietary cultivars of hard, slender and chewing fescues and three cultivars of crested wheatgrass were included in the trial. For creeping red fescue trial, Boreal and Oracle were included as check cultivars to compare the performance of proprietary cultivars. Boreal was also used as check cultivar in the hard, slender and chewing fescue trial (Table 1).

In 2021, cultivar testing trials were seeded on six different species including timothy, creeping red fescue, perennial ryegrass, alfalfa, alsike clover and red clover at Beaverlodge Research Farm. The trials had altogether 29 cultivars of different species, which included four cultivars of timothy, five cultivars of creeping red fescue, six cultivars of perennial ryegrass, four cultivars of alfalfa, four cultivars of alsike clover and six cultivars of red clover (Table 2).

The trials were laid out in randomized complete block design. In all trials, the entries were replicated four times. Specific trial management information are provided in the individual trial description in the following sections.

The perennial forage species have predominantly vegetative growth and no seed production in the establishment year. The trials established in 2020 were evaluated in 2021 growing season. Plant heights, seed yields and seed dockage percentage were recorded. The data were analyzed by using Excel and ARM software. Cultivar means were compared using Student-Newman-Keuls method at 5% level of significance ($P<0.05$).

Table 1. Location, species, cultivars, and their sources for the cultivar testing trials established in 2020.

Location	Species	SN	Cultivar	Source
Beaverlodge	Alfalfa	1	Nijagara	Dept. of Forage Crops, Serbia
		2	Banat VS	Dept. of Forage Crops, Serbia
	Red Clover	3	Una	Dept. of Forage Crops, Serbia
	Vetch	4	Novi Beograd	Dept. of Forage Crops, Serbia
Donnelly	Creeping red fescue	5	Boreal	AAFC - Check
		6	BY-2889	BrettYoung
		7	BY-17-8070	BrettYoung
		8	DLF MSP-05-17	DLF Moore Seed
		9	DLF MSP-06-17	DLF Moore Seed
		10	2020-05	Foster's Seed & Feed Ltd
		11	2018-01	Foster's Seed & Feed Ltd
		12	2018-08	Foster's Seed & Feed Ltd
		13	Brynn	Foster's Seed & Feed Ltd
		14	2018-10	Foster's Seed & Feed Ltd
		15	2018-11	Foster's Seed & Feed Ltd
		16	Oracle	AAFC - Check
	Hard, slender & chewings fine Fescue	17	Boreal	AAFC - Check
		18	2020-02	Foster's Seed & Feed Ltd
		19	2020-03	Foster's Seed & Feed Ltd
		20	2020-04	Foster's Seed & Feed Ltd
		21	2020-06	Foster's Seed & Feed Ltd
		22	2018-05	Foster's Seed & Feed Ltd
	Crested Wheatgrass	23	2018-06	Foster's Seed & Feed Ltd
		24	Fairway	Limoges Forage and Grasses Ltd
		25	Kirk	Limoges Forage and Grasses Ltd
		26	AC Newkirk	Limoges Forage and Grasses Ltd

Table 2. Location, species, cultivars, and their sources for the cultivar testing trials established in 2020.

Location	Species	SN	Cultivar	Source
Beaverlodge	Timothy	1	NSE20EA	North Star Seed
		2	NSEZ1SW	North Star Seed
		3	NSEZ1AT	North Star Seed
		4	Alma	AAFC
	Perennial Ryegrass	5	21PR50	Fosters Feed & Seed
		6	21PR51	Fosters Feed & Seed
		7	21PR55	Fosters Feed & Seed
		8	21PR53	Fosters Feed & Seed
		9	21PR54	Fosters Feed & Seed
		10	21PR60 (Check)	Fosters Feed & Seed
	Creeping Red Fescue	11	Rufi	North Star Seed
		12	BLMT	Limoges Forage and Grasses Ltd
		13	RCRF	Limoges Forage and Grasses Ltd
		14	Oracle	AAFC
		15	Boreal	AAFC
	Alfalfa	16	Nijagara	Dept. of Forage Crops, Serbia
		17	Banat VS	Dept. of Forage Crops, Serbia
		18	CRS1001BWR	AAFC
		19	Beaver	AAFC
	Alsike Clover	20	Menta	DLF Moore Seed
		21	Aurora	AAFC
		22	CRS 111	AAFC/Burnett Agronomic Resources
		23	Aurora Common	AAFC
	Red Clover	24	Una	Dept. of Forage Crops, Serbia
		25	AC Christie	Quality seed, Ontario
		26	Janico	DLF Moore Seed
		27	CRS32	AAFC/Burnett Agronomic Resources
		28	CRS33	AAFC
		29	Altaswede Common	AAFC

2020-2021 growing season weather conditions

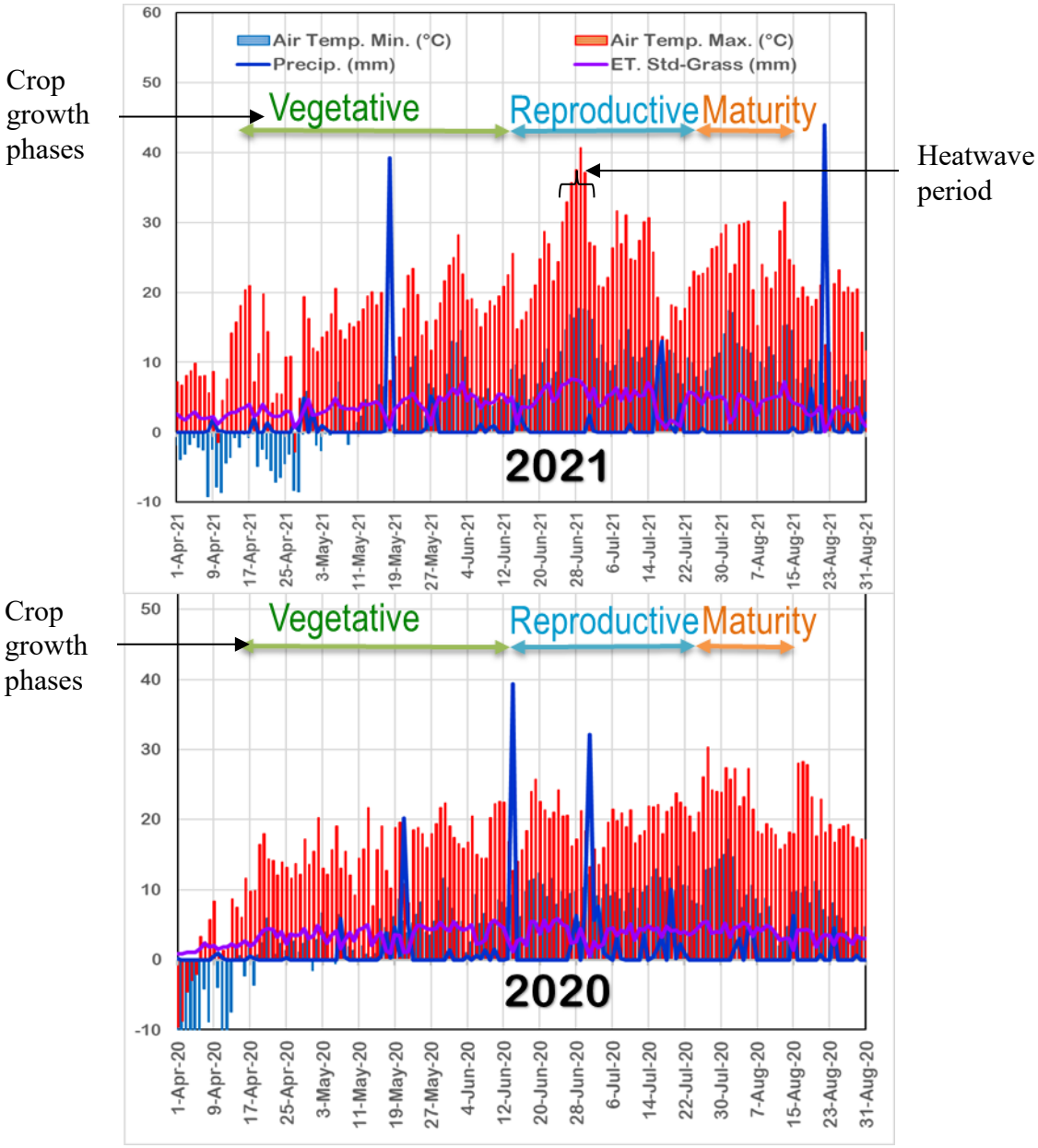

Figure 1. Weather conditions in 2020 and 2021 growing season. Note the period of intense heatwave and drought during reproductive stage of the forage seed crops.

The weather in 2020 was characterized by moderate temperatures and well distributed rainfall providing favourable crop growth conditions. The evapotranspiration was relatively low due to moderate temperatures. However, the moist condition favoured high intensity of foliar diseases on the crops. Still, it was relatively satisfactory year for both crop yields and harvest conditions (Fig 1).

The weather condition in 2021 had two episodes of high rainfalls in the beginning and end of the growing season, while active growth and reproductive phase of the crops met with intense heatwave, drought and high evapo-transpiration resulting in excessive moisture stress and pre-mature senescence of foliage. The weather condition caused pollen desiccation, poor fertilization, impaired seed development resulting in low yield, high dockage and light weight of seeds.

Serbian forage legumes cultivar observation, Beaverlodge, 2020

Objective

To evaluate adaptability of Serbian forage legumes cultivars in the Peace region.

Materials and Methods

Newly introduced Serbian forage legumes cultivars of alfalfa – Nijagara and Banat VS, red clover – Una, common vetch - Novi Beograd were seeded in non-replicated strips on May 20, 2020. The plots were under forage-pea-wheat-canola rotation, where canola was terminated with herbicides at vegetative stage for the management of weeds in the preceding season. In season weed control included a pre-emergence application of herbicide Round-up 1 L ha^{-1}, a week prior to seeding, and one manual weeding in both in 2020 and 2021 growing season. These plots were intended to observe their establishment, growth, winter survival and fitness in the new environmental conditions in the Peace River region.

Results

Figure 2. Photographs of Serbian forage legumes in the observation plots at Beaverlodge Research Farm in 2020 and 2021.

The annual vetch cultivar Novi Beograd showed satisfactory growth and fruit set, attaining harvestable maturity in mid-September. The red clover and alfalfa cultivars overwintered without any sign of winterkill in 2020-2021. Despite intense heatwave and drought, both red clover and alfalfa cultivars had some seed production in 2021 growing season. Overall, the Serbian cultivars showed promising performance under Beaverlodge weather condition. All the cultivars are grown in the selection nurseries for population improvement for local adaptation. The red clover and alfalfa cultivars are also included in the cultivar testing trials in 2021.

Creeping red fescue cultivar trial, Donnelly, 2020

Objective

To evaluate seed yield potential of creeping red fescue cultivars submitted by various forage seed companies, compared to locally adapted popular cultivars Boreal and Oracle.

Materials and methods

The trial comprising 12 cultivars (Table 1, Fig 3) was laid out in randomized complete block design with four replicates. Trial was conducted on a grower's field, where he previous crop was Invigor canola. The trial was seeded on June 5th, 2020 with the SARDA small plot drill. Seeding rate was 3 kg ha^{-1} for each variety. The plot dimensions were 13 m x 1.4 m (18.2 m^2), which accommodated 5 rows of 13 m long with row spacing of 28 cm. About 34 kg ha^{-1} (30 lbs/acre) of nitrogen and the same amount of phosphate was applied at the time of seeding. For weed control, a pre-emergent herbicide PrePass was applied on June 11, followed by post emergence herbicide Infinity FX applied on June 29 and August 5. The trial area was fertilized on October 21 with 75 kg ha^{-1} (0 lbs/acre) of nitrogen in the form of urea.

In 2021, the trial area was sprayed with Stellar to control broad-leaved weeds. Plant heights were measured on June 28. The entire trial was swathed on July 19. Individual plots were combined on July 23. The net harvest area was 14 m^2. Samples were dried and cleaned for the determination of clean seed, dockage and 1000-seed weights

The plant height, seed yield and dockage data were analyzed by using Excel and ARM software. Cultivar means were compared using Student-Newman-Keuls method at 5% level of significance ($P<0.05$).

Results and discussions

The plant heights of the test cultivars ranged from 42 to 57 cm. Boreal, Oracle, 2018-08 and 2018-11 were taller cultivars; DLF MSP-06-17, DLF MSP-05-17 and 2020-05 were shorter cultivars with significant difference between these groups ($P < 0.01$), while the rest of the cultivars fell between the two groups range (Fig 3).

Oracle, Brynn, 2018-18 and Boreal had significantly higher yield than the rest of the cultivars ($P < 0.01$) except for 2018-11, which was on par with 2018-8 and Boreal. DLF MSP-05-17 and DLF

MSP-06-17 had the lowest seed yield (Fig 3). The cultivars also differed significantly ($P < 0.01$) for both the seed dockage percentage and 1000-seed weights. Boreal, BY-2889, 2018-08 and Brynn had significantly less seed dockage than DLF MSP-06-17 and DLF MSP-05-17 ($P < 0.01$), while the rest of the cultivars were on par with both groups. Boreal, 2018-08, 2018-11 and Oracle had significantly higher 1000-seed weight than DLF MSP-06-17, DLF MSP-05-17, 2018-10 and BY-17-8070 ($P < 0.01$), while BY-2889, 2020-05, 2018-01 and Brynn were on par with bolder-seeded groups.

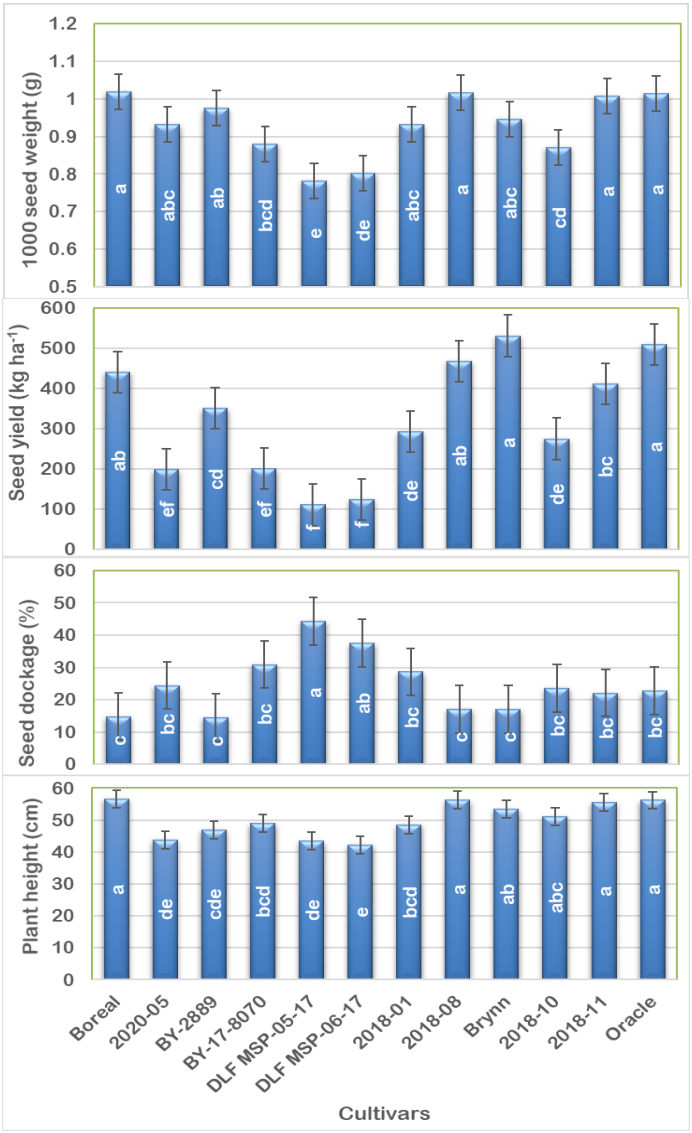

Figure 3. Seed yield, seed dockage, 1000-seed weight and plant heights of creeping red fescue cultivars in 2021 growing season. The trial was established in 2020 in Donnelly, AB. Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls). The error bars are standard deviation.

For mean seed yield, Brynn, Oracle and 2018-08 ranked, first, second and third respectively with 20%, 16% and 6% higher yield than that of Boreal (Table 3). Rest of the cultivars had lower mean seed yield than that of Boreal.

Table 3. Seed yield of creeping red fescue cultivars in comparison with Boreal in 2021 growing season. The trial was established in 2020 in Donnelly, AB.

Cultivars	Seed Yield		
	kg ha^{-1}	lb acre^{-1}	% of Boreal
Boreal	441	393	100
2020-05	199	178	45
BY-2889	351	313	80
BY-17-8070	201	179	46
DLF MSP-05-17	111	99	25
DLF MSP-06-17	125	112	28
2018-01	293	261	66
2018-08	468	418	106
Brynn	531	474	120
2018-10	275	245	62
2018-11	412	368	93
Oracle	510	455	116

The plant heights and seed yields were highly correlated (r = 0.89) and the plant height explained about 80% of variation (R^2 = 0.80) in the seed yield (Fig 4). It is apparent from both Fig 3 and Fig 4 that high yielding cultivars of creeping red fescue had taller plants. Seed yield also had strong correlation with 1000-seed weight (r = 0.86) and the later explained about 75% variation in seed yield, suggesting that 1000-seed weight contribute to seed yield. On the other hand, the seed yield and dockage percentage had strong negative correlation (r = 0.82) and the seed dockage explained about 67% variation (R^2 = 0.67) in the seed yield (Fig 4). The cultivars which produced higher seed yields had lower dockage, and vice versa. This implies that low seed yield was mainly due to floret abortion rather than low spikelet numbers.

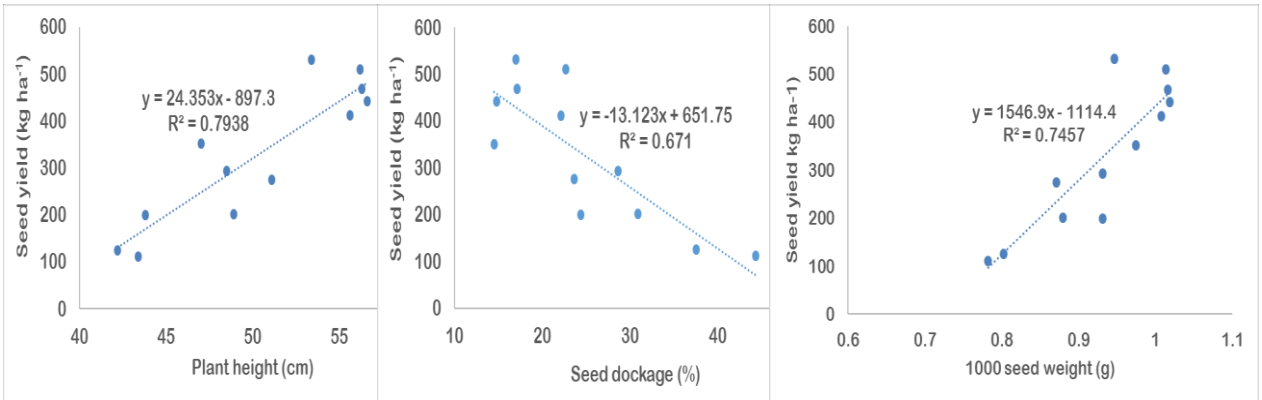

Figure 4. Relationship between seed yield, seed dockage, 1000-seed weight and plant heights of creeping red fescue cultivars in 2021 growth season. The trial was established in 2020 in Donnelly, AB.

Hard, slender and Chewings fescue cultivar trial - Donnelly, 2020

Objective

To evaluate seed yield potential of hard, slender and Chewings fescue cultivars submitted by various forage seed companies, compared to locally adapted popular cultivars Boreal.

Materials and methods

In this trial, six proprietary cultivars of hard, slender and Chewings fescues were compared with creeping red fescue cultivar Boreal (Table 1, Fig 5). The trial was laid out in randomized complete block design with four replicates. Trial was conducted on a grower's field, where the previous crop was Invigor canola. The trial was seeded on June 5th, 2020 with the SARDA small plot drill. Seed rate was 3 kg ha^{-1} for each variety. The plot dimensions were 13 m x 1.4 m (18.2 m^2), which accommodated 5 rows of 13 m long with row spacing of 28 cm. About 34 kg ha^{-1} (30 lbs/acre) of nitrogen and the same amount of phosphate was applied at the time of seeding. Weed control measures included application of a pre-emergent herbicide PrePass on June 11, followed by post emergence herbicide Infinity FX applied on June 29 and August 5. The trial area was fertilized on October 21 with 70 lbs/acre of nitrogen in the form of urea.

In 2021, the trial area was sprayed with Stellar to control broad-leaved weeds. Plant heights were measured on June 28. The hard, slender and Chewings fescue cultivars matured about one week earlier than Boreal creeping red fescue. Two of the cultivars were swathed on July 9, four of them were swathed on July 13, and Boreal was swathed on July 19. Individual plots were combined on July 23. The net harvest area was 14 m^2. Samples were dried and cleaned for the determination of clean seed, dockage and 1000-seed weights.

The plant height, seed yield and dockage data were analyzed by using Excel and ARM software. Cultivar means were compared using Student-Newman-Keuls method at 5% level of significance ($P<0.05$).

Results and discussion

The plant heights of the test cultivars ranged from 40 to 50 cm. The cultivars 2020-02 and 2020-06 had significantly shorter plants ($P < 0.01$), while rest of the cultivars were on par with Boreal for plant height (Fig 5).

Boreal outperformed all the test cultivars for seed yield and 1000-seed weight ($P < 0.01$). All test cultivars had less mean seed yield by 20% to 63% than that of Boreal (Table 4). Among rest of the cultivars, 2020-02 had significantly higher seed yield than 2020-03 and 2018-05, while remaining on par with 2020-04, 2020-06 and 2018. The 1000-seed weight was lowest in 2018-06, differing significantly from that of 2020-02 and 2018-05 ($P < 0.01$) (Fig 5).

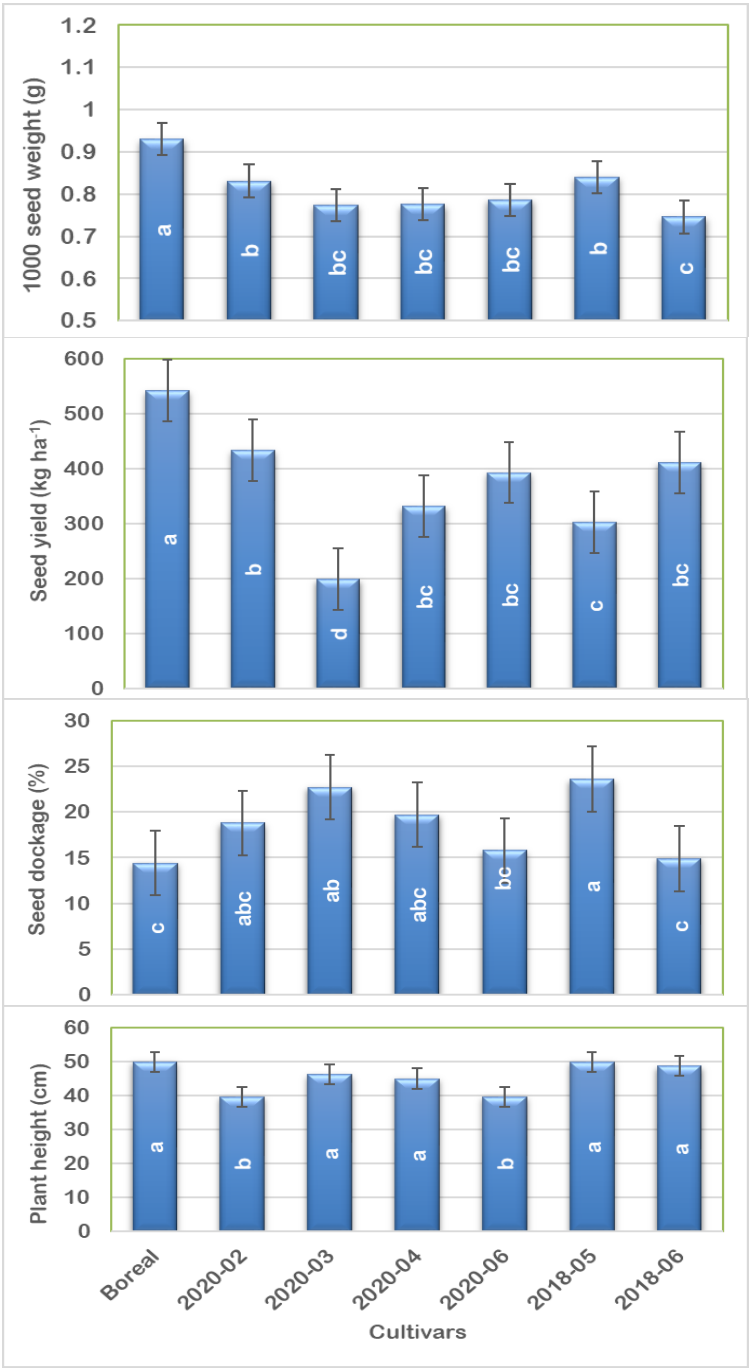

Figure 5. Seed yield, seed dockage, 1000-seed weight and plant heights of hard, slender and Chewings fescue cultivars, in comparison with Boreal creeping red fescue in the first production year in 2021 growing season. The trial was established in 2020 in Donnelly, AB. Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls). The error bars are standard deviation.

Table 4. Seed yield of hard, slender and Chewings fescue cultivars in comparison with Boreal in 2021 growing season. The trial was established in 2020 in Donnelly, AB.

Cultivars	Seed Yield		
	kg ha^{-1}	lb acre^{-1}	% of Boreal
Boreal	542	484	100
2020-02	433	386	80
2020-03	199	178	37
2020-04	331	295	61
2020-06	393	351	73
2018-05	303	270	56
2018-06	411	367	76

The plant heights did not show any correlation with seed yields (r = 0.003), hence failed to explain any variation in seed yield (R^2 = 1E-05) (Fig 6). The seed yield and dockage percentage had strong negative correlation (r = 0.83), and the dockage percentage explained 69% variation (R^2 = 0.67) in seed yield (Fig 6). The cultivars which produced higher seed yields had lower dockage, and vice versa. This implies that low yield was mainly due to floret abortion rather than low spikelet numbers.

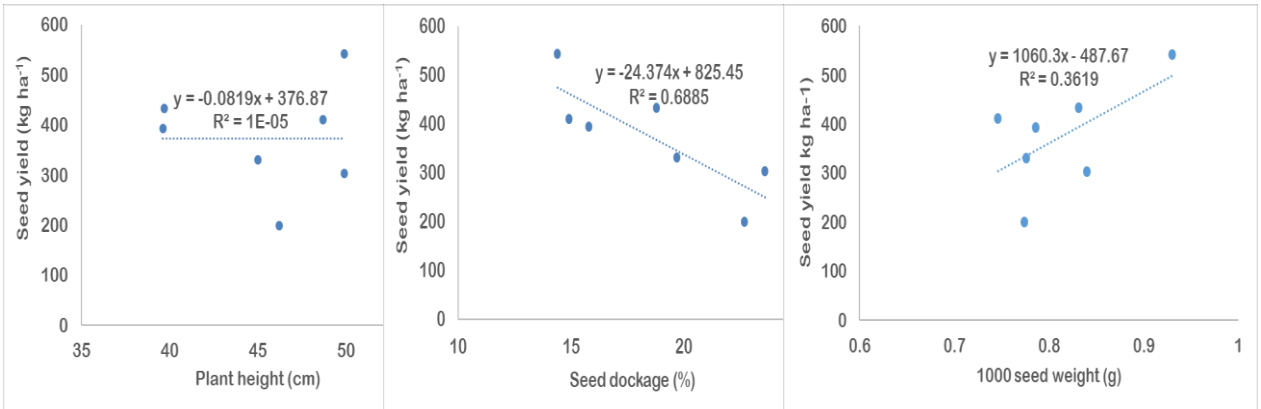

Figure 6. Relationship between seed yield, seed dockage, 1000-seed weight and plant heights of hard, slender and Chewings fescue cultivars in 2021 growth season. The trial was established in 2020 in Donnelly, AB.

Crested wheatgrass cultivar trial, Donnelly, 2020

Objective

To identify locally adapted, high seed-yielding cultivars of crested wheatgrass.

Materials and methods

The crested wheatgrass trial comprising three cultivars – Fairway, Kirk and Newkirk, was laid out in randomized complete block design with four replicates. The trial was seeded on a grower's field on June 5, 2020 with the SARDA small plot drill. The previous crop was Invigor canola. Seed rate was 4 kg ha^{-1}. Plot size was 18.2 sq. m. with 5 rows of 13 m length spaced 28 cm apart. About 34 kg ha^{-1} (33 lbs/acre) of nitrogen and phosphate each was applied at the time of seeding. Weed control measures included application a pre-emergent herbicide PrePass on June 11, and two applications of in-crop herbicide Infinity FX on June 29 and August 5, 2020. The crop was fertilized on October 21, 2021 with 93 kg ha^{-1} (83 lbs/acre) of nitrogen.

In 2021, the trial area was sprayed with Stellar to control broad-leaved weeds. Plant heights were measured on June 28 when the crop was in reproductive phase. The entire trial was swathed on August 11 and combined on August 18. Harvest area per entry was 15 sq. m. Samples were dried and cleaned to determine seed yield, dockage and 1000-seed weights.

The plant height, seed yield and dockage data were analyzed by using Excel and ARM software. Cultivar means were compared using Student-Newman-Keuls method at 5% level of significance ($P<0.05$).

For the following year crop, the trial was fertilized on October 21 with 112 kg ha^{-1} (100 lbs/acre) of nitrogen in the form of urea.

Results and discussion

The plant heights of crested wheatgrass test cultivars ranged from 72 to 89 cm. Kirk and Newkirk had significantly taller plants than that of Fairway cultivar ($P <0.01$) (Fig 7).

For seed yield, Fairway outperformed both Kirk and Newkirk ($P = 0.03$). Kirk and Newkirk produced 36% and 34% less seed yield respectively than Boreal (Table 5). However, both Kirk and Newkirk had significantly higher 1000-seed weights that that of Fairway ($P = 0.01$). Fairway had significantly less seed dockage than that of Kirk and Newkirk. The later two cultivars were on par to each other for both seed yield, 1000-seed weight and dockage percentage (Fig 7).

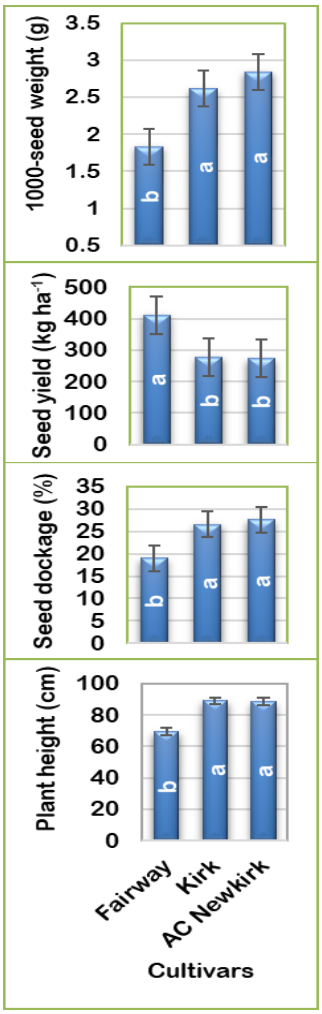

Figure 7. Seed yield, seed dockage and plant heights of crested wheatgrass cultivars in the first production year in 2021 growing season. The trial was established in 2020 in Donnelly, AB. Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls). The error bars are standard deviation.

Table 5. Seed yield comparison of crested wheatgrass cultivars 2021 growing season. The trial was established in 2020 in Donnelly, AB.

Cultivars	Seed Yield		
	kg ha^{-1}	lb acre^{-1}	% of Fairway
Fairway	411	367	100
Kirk	278	248	68
AC NewKirk	273	244	66

The plant heights and seed yields had perfect negative correlation ($r \approx 1.0$), hence the plant height explained entire variation ($R^2 = 0.997$) in the seed yield (Fig 7). It is apparent from both Fig 7 and Fig 8 that crested wheatgrass cultivar with shorter plant heights yielded higher seed yield. The seed yield was negatively correlated with 1000-seed weight ($r = 0.98$) and the later explained 97% ($R^2 = 0.97$) variation in seed yield. This suggests that 1000-seed weight did not contribute to seed yield in crested wheatgrass. The dockage percentage also had perfect negative correlation ($r \approx 1.0$) with seed yield, explaining the entire variation ($R^2 = 0.995$) in seed yield (Fig 8). The cultivar which produced higher seed yields had lower dockage, and vice versa. This implies that low seed yield was mainly due to floret abortion rather than low spikelet numbers.

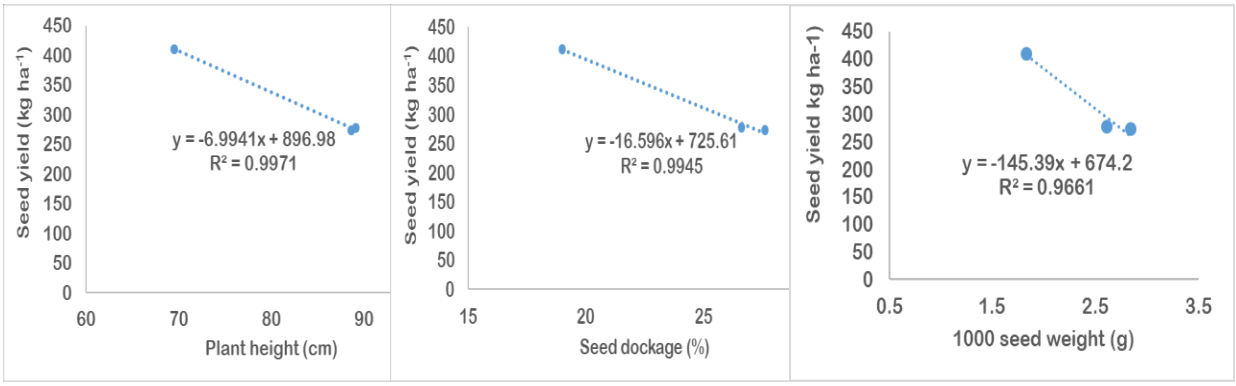

Figure 8. Relationship between seed yield, seed dockage and plant heights of crested wheatgrass cultivars in 2021 growth season. The trial was established in 2020 in Donnelly, AB.

Turf-grass, forage grass and legume cultivar testing trials, Beaverlodge, 2021

Objective

To evaluate seed yield and adaptive performance of turf-grass, forage grass and legume cultivars submitted by various companies, compared to those originated from AAFC breeding programs.

Materials and methods

Altogether six cultivar testing trials, three each of forage grasses and legumes were established at two different fields at 55°20'05.21"N, -119.38'59.43"W and 55°20'16.19"N, -119°39'25.48"W respectively in the Beaverlodge Research Farm. In the spring of 2021, four cultivars of timothy, three cultivars of creeping red fescue and six cultivars of perennial rye grass were seeded along with the widely cultivated and common varieties for relative comparison of productivity. The legume trial included four cultivars each of alfalfa and alsike clover, and six cultivars of red clover. The cultivar and relevant companies' information are summarized in Table 2. The experimental set up was randomized complete block design (RCBD) with four replicates (Fig. 9). Individual plot dimensions were 2 m by 8 m. The grass cultivars were seeded with 30 cm row spacing and legume cultivars with 60 cm row spacing under no tillage condition using a Hege seed driller. Recommended seed rates of Alberta Agriculture and Forestry were used for respective species planting (https://www.agric.gov.ab.ca/app19/calc/forageseed/seedingtable.html). Both grass and legume cultivars were seeded on June 3, 2021, except for the perennial ryegrasses that were seeded on July 23, 2021. Both pre-emergence and post-emergence herbicides were applied for weed control. Manual weeding was done on August 30, 2021 prior to fall fertilization. The trials were broadcast-fertilized on September 15, 2021. The grass trials were fertilized with 80:43:18:18 kg N ha^{-1}, while the legume trial received 30:16:7:7 kg N ha^{-1}, using commercial fertilizer blend of 26-14-6-6.

Based on our experience with forage legumes trials on rhizobium inoculation, chitosan application, grass+legume mixtures, and cultivar trials, 30 cm row spacing proved difficult in extracting precise samples because of overlap of plants between rows. Additionally, because of differential maturity, and Beaverlodge being refuge of flocks of deer, grazing by deer confounded true evaluation of adaptability for seed yield. So, we decided to adopt wider spacing of 30 cm and deer-deterring measures for legumes cultivar evaluation and plant selection nurseries. Closer spacing is better for weed suppression, but wider spacing allows us more precise sampling for cultivar comparison. Other measures could be to have whole-plot harvest (swathing+combine) for seed yield, plus weigh-wagon to measure fresh biomass and sub-sampling for dry biomass yield. Currently, we do not have appropriate machinery for the whole-plot harvest option for proper comparison between treatments.

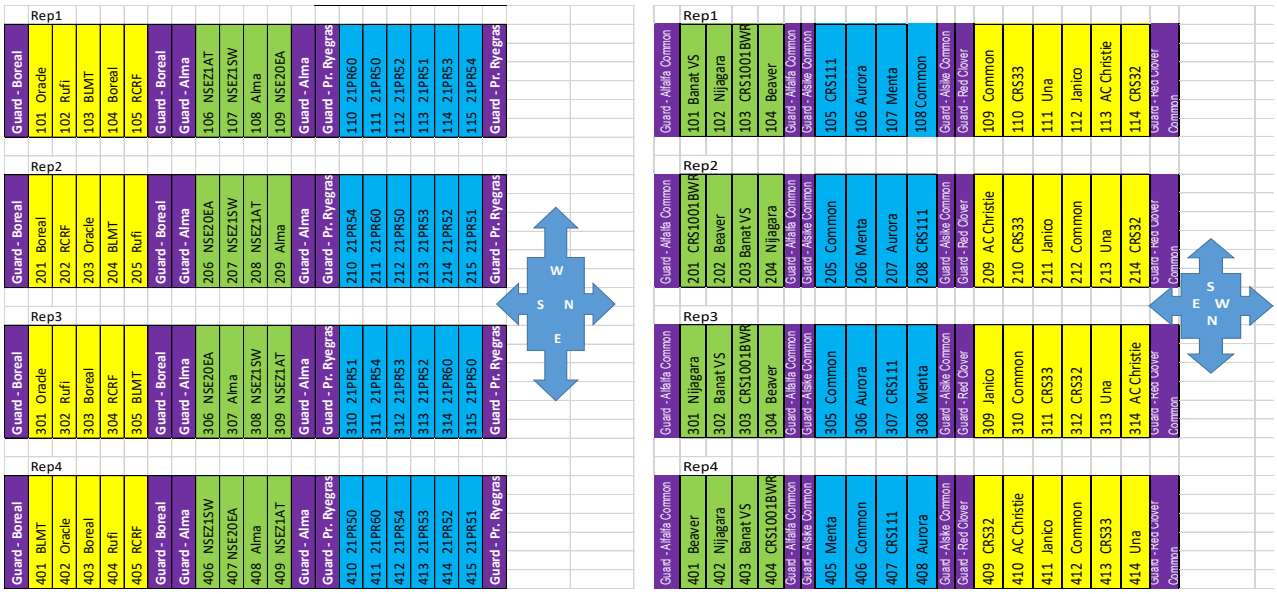

Figure 9. Experimental layout of turf-grass, forage grasses (left panel) and legumes (right panel) trials established at Beaverlodge Research Farm, AB in 2021.

Results and discussion

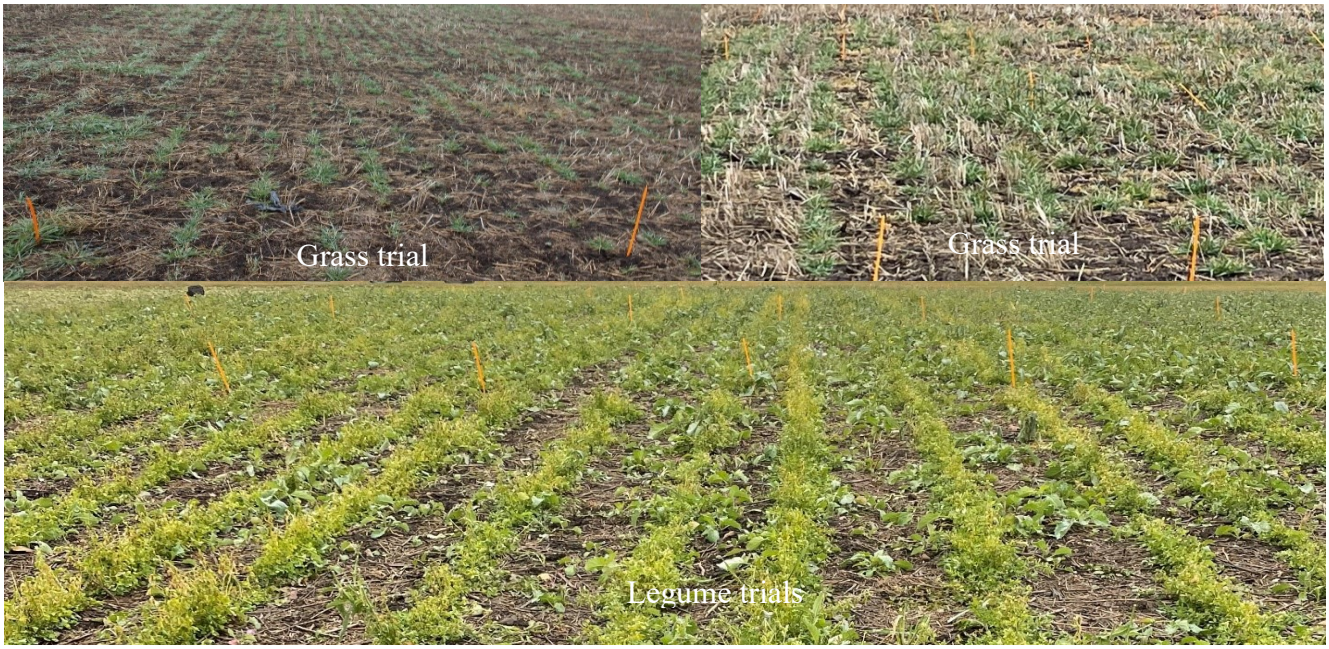

Figure 10. Conditions of grass and legume trials established in 2021 at Beaverlodge Research Farm, AB. Staggered emergence is evident with different sizes of seedlings in grass trials. Photographs were taken at the end of growing season, on October 21, 2021.

Because of the intense heatwave and prolonged drought conditions causing high evapotranspiration and moisture stress, there was a delayed and staggered emergence until early in grasses. Legumes also underwent delayed emergence, but the plots attained satisfactory plant population after few weeks of seeding.