PEACE COUNTRY BEEF & FORAGE ASSOCATION

2022 Annual Report

"Strengthening Agriculture, One Farm At A Time"

PCBFA

PEACE COUNTRY BEEF & FORAGE ASSOCIATION

APPLIED RESEARCH

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About Us

The Peace Country Beef & Forage Association was founded in 1982 by livestock producers in the Fairview and Hines Creek area for the purpose of demonstrating new forage varieties and technology. The PCBFA is a charitable, producer-driven organization that strives to develop regenerative, profitable, and sustainable agricultural systems. We provide leading edge, credible, and locally viable information to Peace Country producers, through our applied research and knowledge transfer programs. We are currently made up of 10 producer directors 8 staff, and approximately 250 member farms from across the Peace Region.

Mission

The Peace Country Beef & Forage Association is a producer group with the goal to be a hub of innovative, relevant and local beef, forage, soil health, and crop information for Peace Country Producers.

Vision

A Peace Country producer's first stop for optimizing beef, forage and crop production, and soil health, to maximize profitability with innovative and credible information.

Mandate

The Peace Country Beef & Forage Association believes that the sustainability of rural communities in the Peace River region will be dependent upon a strong agricultural economy with livestock production as its foundation.

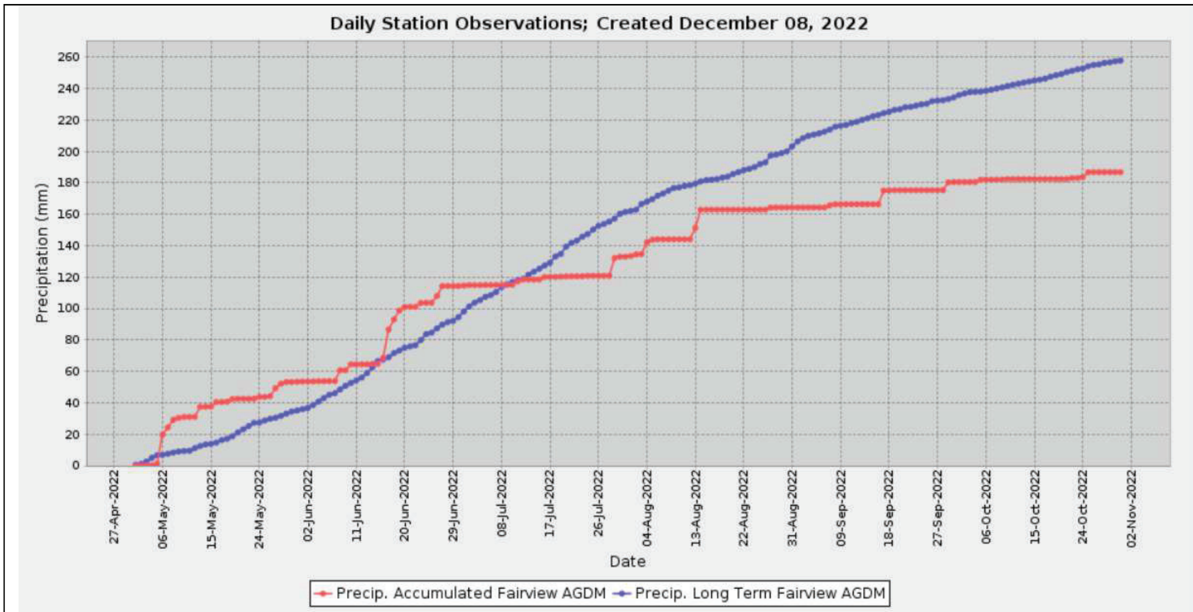
Our Region

PCBFA works with producers in an area stretching from High Prairie to the B.C. border and from Manning to Valleyview. Our focus area has 1.9 million acres of pasture land and 118,000 breeding cows.

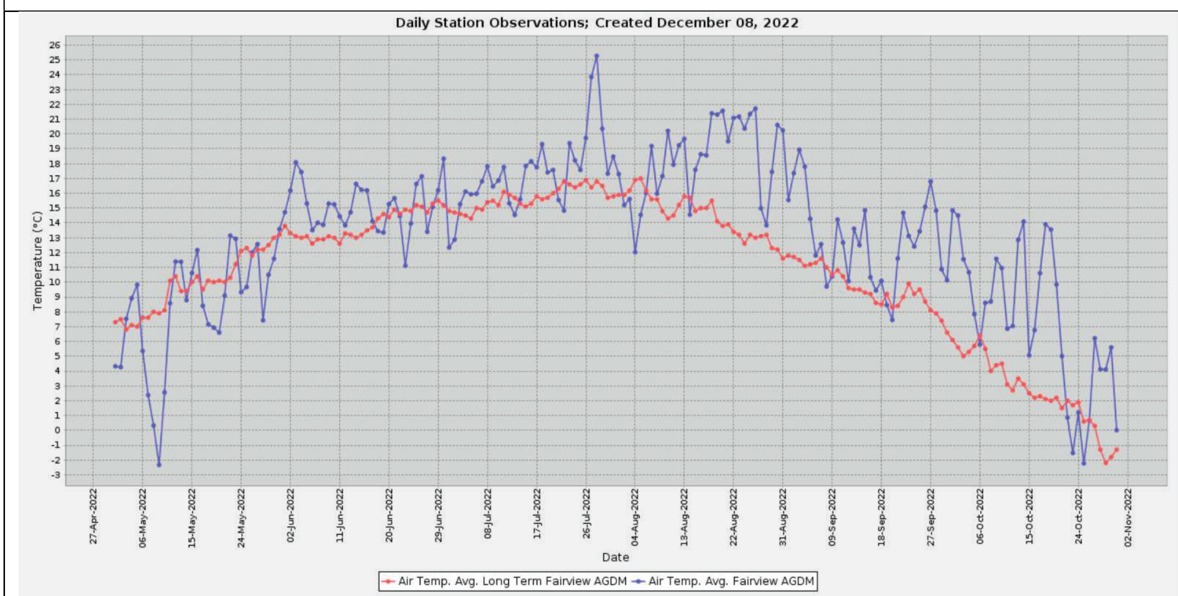
Climatic Conditions

Precipitation and Temperature

taken from May 1, 2022 to October 31, 2022

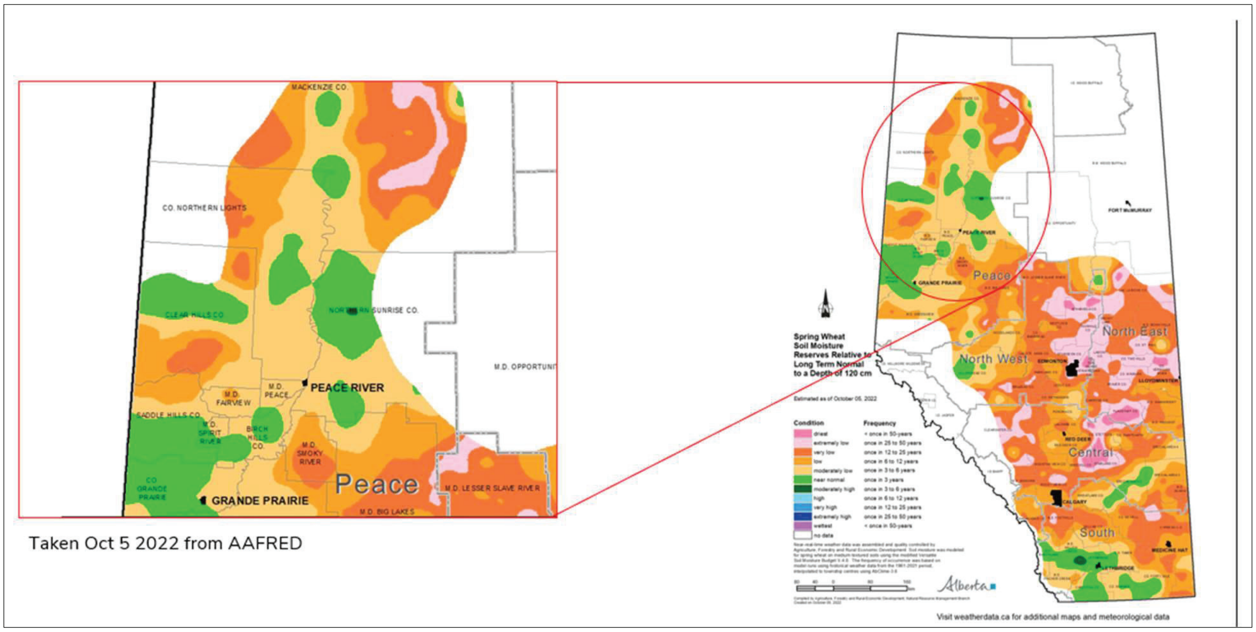


Accumulated Precipitation (2022 and Long-Term Average) taken from ACIS, Fairview



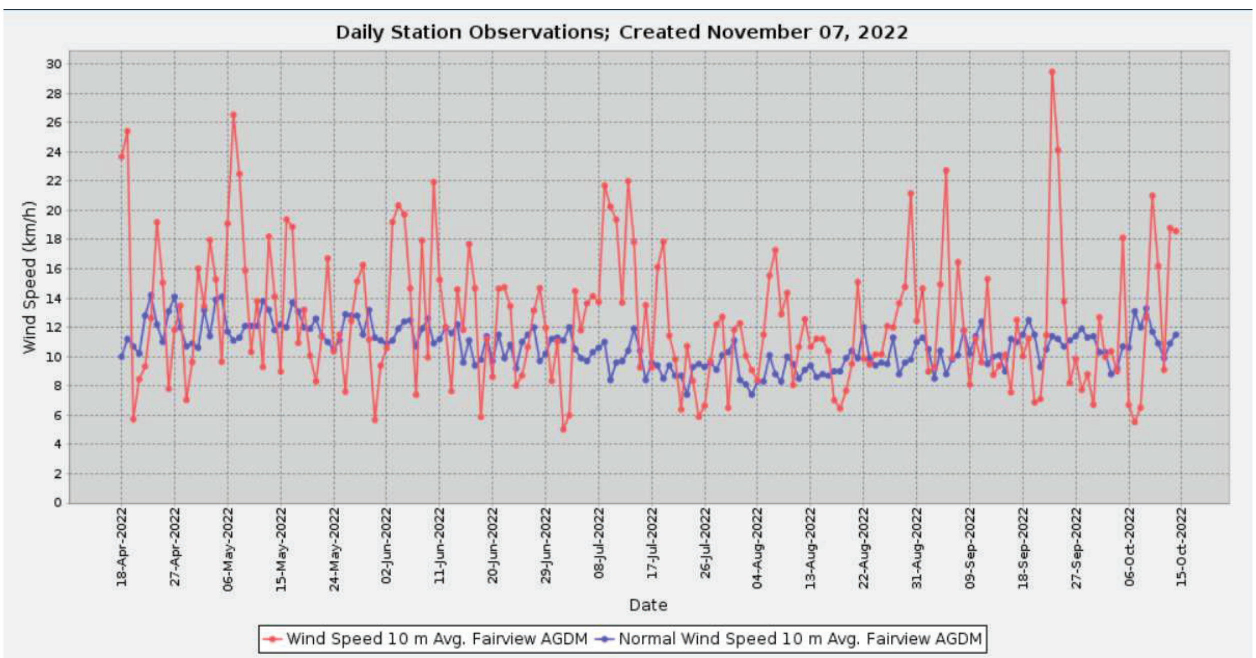
Average Daily Temperature (2022 and Long-Term Average) taken from ACIS, Fairview

Soil Moisture Reserves



Taken Oct 5 2022 from AAFRED

Wind Speed



2022 PCBFA Member Feed Quality Test Reports

Introduction

PCBFA encourages producers to test their forage feed samples for quality in a laboratory. Forage analysis includes determining crude protein (protein), total digestible nutrients (a measure of energy), minerals (macro, trace or both) and detergent fibres. PCBFA facilitates feed testing of samples sent in by producers, interpretation of the laboratory results and assisting producers of the Peace Country region to formulate rations for different categories of beef cattle. These efforts give producers a chance to assess their feed inventory (e.g. hay, greenfeed, silage) and have a good feeding plan in place for their cattle. Knowing the nutrient content of the feed resources on farms and comparing them with the animal's nutrient requirements enables a producer to see if supplements are needed to improve animal performance or health. Livestock are most productive when fed a ration balanced according to their nutrient needs and producers will not know if the rations meet the nutrient requirements of their livestock if they do not regularly send feed samples to the lab for analyses. This report provides a summary of the 2022 feed types (different forage-type feeds and grains) submitted by producers for feed testing from different parts of the Peace Region, particularly within the various municipalities that PCBFA serves. The results are discussed in relation to the nutrient requirements of beef cattle stock.

Methods

From spring to fall 2022, a total of 158 feed samples from producers were analyzed for feed quality at the Central Testing Laboratory in Winnipeg, Manitoba using standard laboratory procedures for wet chemistry and/or near-infrared reflectance (NIRS) spectroscopy. For this report, the feed types have been organized into 25 groups as submitted by producers with minor adjustments made to reflect main feed types (Table 1). The results are presented and discussed in relation to feed types meeting the minimum daily nutrient requirements for crude protein, total digestible nutrients (energy), calcium (Ca), phosphorous (P), magnesium (Mg), potassium (K) and micro minerals (Cu – copper; Mn – manganese; Fe – iron) of dry, mid-gestating beef cows (low nutrient requirement) and finishing beef calves (high nutrient requirement) as recommended by the National Academies of Sciences, Engineering and Medicine (NASEM, 2016). In addition, the data for each feed type was analyzed and where possible, sums, means, percentages/frequencies and modal values were calculated.

Table 1. Average forage quality indicators (dry matter basis) of producer feed test reports in 2022

	CP (%)	TDN (%)	Ca (%)	P (%)	Mg (%)	K (%)
Alfalfa Grass Hay (n=43)	9.7	57.8	0.95	0.13	0.21	1.5
Alfalfa grass Silage (n=1)	9.5	63.4	0.58	0.14	0.21	1.8
Alfalfa hay (n=6)	11.8	56.8	1.24	0.14	0.30	1.5
Alfalfa silage (n=1)	12.5	50.2	1.94	0.16	0.47	1.7
Barley silage (n=3)	10.5	67.0	0.30	0.17	0.13	1.3
Barley straw (n=3)	4.9	46.9	0.28	0.07	0.12	1.1
Canola screenings (n=1)	19.8	64.5	0.96	0.47	0.31	0.9
Canola straw (n=1)	4.1	37.7	0.44	0.04	0.08	0.5
Clover silage (n=1)	15.2	54.7	1.45	0.21	0.38	3.1
Corn standing (n=6)	7.4	63.2	0.21	0.22	0.15	2.1
Greenfeed - Cocktail (n=1)	7.2	66.2	0.52	0.16	0.19	1.1
Greenfeed – unspecified (n=7)	9.6	63.6	0.23	0.15	0.12	1.9
Hay-Grass (n=20)	7.4	53.4	0.45	0.11	0.13	1.3
Haylage (n=3)	8.0	54.0	0.54	0.16	0.12	1.4
Hay-unspecified (n=26)	9.2	56.9	0.82	0.14	0.17	1.5
Mixed Silage (n=10)	11.4	60.7	0.77	0.20	0.25	1.7
Oat grain (n=7)	12.1	77.3	0.07	0.29	0.12	0.5
Oat greenfeed (n=2)	12.7	55.2	0.47	0.24	0.19	1.6
Oat silage (n=4)	11.0	64.4	0.30	0.20	0.14	1.9
Oat straw (n=1)	3.6	45.2	0.27	0.04	0.12	2.1
Silage-unspecified (n=4)	11.5	58.6	1.09	0.18	0.22	2.0
Wheat Screening (n=1)	16.9	86.2	0.07	0.38	0.14	0.5
Wheat Silage	11.1	67.8	0.19	0.19	0.13	1.5

na – not analyzed

Results

Categories of Feed Samples - The bulk of samples (60%) consisted of alfalfa grass hay mixes, hay-unspecified, hay-grass and alfalfa-hay coming in that order (Figure 1). Silages came in second (18%) as one of the main feed type groups sent in by producers for analysis and were composed of mixed silages and various cereal (wheat, barley and oat) silages. The remaining feed types were made up of greenfeed (6.5%), grains (6%) and other minor feed types such as standing corn (4%) and straws (3%).

Protein – The crude protein (CP) content of forage ranged from 3.6% to 19.8%. Among the different straws (barley, oat, and canola), canola screenings had the highest protein content (19.8% CP), followed by wheat screenings (16.9% CP) (Table 2). The silages, including alfalfa grass silage and clover silage, had appreciable protein ranging from 9.5% to 15.2%. Protein serves as a building block. According to the Beef Cow Rule of Thumb (Table 3), the protein

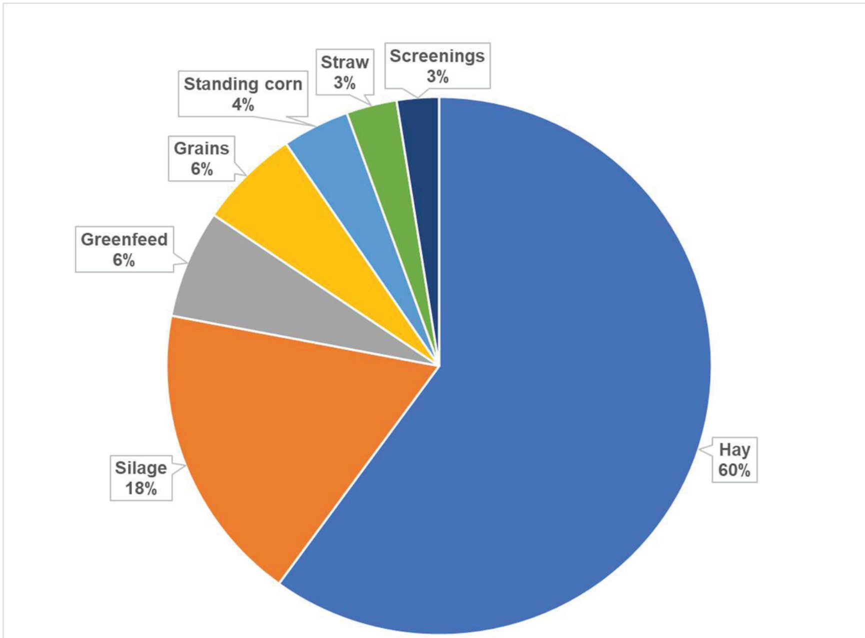


Figure 1. Categories of feed types analyzed in 2022

requirements for an average mature beef cattle are 7%, 9%, and 11% CP in mid-pregnancy, late pregnancy, and after calving, respectively. If the diet of beef cattle has less than 7% protein, the fermentation process of feedstuff in the rumen by microbes will not function properly, leading to high levels of undigested fibre in the manure. The Feeder Calf Rule of Thumb suggests that feeder calves weighing between 550 and 800 lbs require a ration with 14% CP, those weighing between 800 and 1,050 lbs need 12% CP, and those weighing 1,050 lbs to the finishing stage need 10% CP. Based on these two rules and referring to Table 1, it is evident that most feed types, except for straws and standing corn, meet the nutritional requirements of a dry mid-gestating beef cow. However, the same is not true for the protein requirements of finishing calves. The feed types listed in Table 1 do not meet the 12-14% CP necessary for growing and finishing calves during backgrounding. Hence, additional protein supplementation, such as leguminous forage, is required for all feed types except grains and some silages, to meet the needs of growing calves.

Table 2: Percent of feeds containing less than recommended amounts of minimum daily nutrient requirements

	% of feeds not meeting Protein requirements for		**% of feeds not meeting Energy requirements for**		**% of feeds not meeting Calcium requirements for**		**% of feeds not meeting Phosphorus requirements for**		**% of feeds not meeting Magnesium requirements for**	**% of feeds not meeting Potassium requirements for**
	Dry cow	Finishing calf	Dry cow	Finishing calf	Dry cow	Finishing calf	Dry cow	Finishing calf	Dry cow and finishing calf	Dry cow and finishing calf
Alfalfa Grass Hay (n=43)	2	**84**	12	**100**	0	0	**79**	**100**	0	0
Alfalfa grass Silage (n=1)	0	**100**	0	**100**	0	**100**	**100**	**100**	0	0
Alfalfa hay (n=6)	0	34	0	**100**	0	0	**84**	**100**	0	0
Alfalfa silage (n=1)	0	0	**100**	**100**	0	0	0	**100**	0	0
Barley silage (n=3)	0	**67**	0	**67**	0	**100**	0	**100**	0	0
Barley straw (n=3)	**100**	**100**	**100**	**100**	0	**100**	**100**	**100**	0	0
Canola screenings (n=1)	0	0	0	0	0	0	0	0	0	0
Canola straw (n=1)	**100**	**100**	**100**	**100**	0	**100**	**100**	**100**	0	0
Clover silage (n=1)	0	0	0	**100**	0	0	0	**100**	0	0
Corn standing (n=6)	**83**	**100**	0	**83**	**67**	**100**	0	**100**	0	0
Greenfeed-Cocktail (n=1)	0	**100**	0	0	0	0	0	0	0	0
Greenfeed – unspecified (n=7)	0	100	0	**57**	0	**57**	0	**100**	0	0
Hay-Grass (n=20)	40	**95**	**50**	**100**	5	**70**	**75**	**100**	0	0
Hay-unspecified (n=26)	12	**73**	19	**100**	4	23	**46**	**100**	4	0
Haylage (n=3)	33	**100**	**66**	**100**	33	**100**	**66**	**100**	33	33
Mixed Silage (n=10)	0	43	0	**80**	0	10	0	**90**	0	0
Oat grain (n=7)	0	**50**	0	0	**100**	**100**	**100**	**100**	0	**100**
Oat greenfeed (n=2)	0	**75**	**50**	**50**	50	**50**	0	**50**	0	0
Oat silage (n=4)	0	**100**	0	25	0	**100**	0	**100**	0	0
Oat straw (n=1)	0	**75**	**100**	**100**	0	0	**100**	**100**	0	0
Silage-unspecified (n=4)	0	0	25	**75**	0	25	0	**75**	0	0
Wheat Screening (n=1)	0	**50**	0	0	**100**	**100**	0	0	0	**100**
Wheat Silage	0	**75**	0	25	0	**100**	0	**100**	0	0

n=# of samples tested in category

Table 3. Suggested nutrient requirements for beef cows (NASEM, 2016)

Nutrient	Requirement		
	Growing & finishing calves	Dry gestating cows	Lactating cows
CP (%)	12-14	7-9*	11
Ca (%)	0.57	0.18	0.33
P (%)	0.30	0.16	0.26
Mg (%)	0.1	0.12	0.2
K (%)	0.6	0.6	0.7
Na (%)	0.06-0.08	0.06-0.08	0.1
S (%)	0.15	0.15	0.15
Cu (ppm)	10	10	10
Zn (ppm)	30	30	30
Fe (ppm)	50	50	50
Mn (ppm)	20	40	40
NE_M (MCal kg^{-1})	1.08-2.29	0.97-1.10	1.19-1.28
NE_G (MCal $kg^{-1)}$	0.53-1.37	NA[Y]	NA
TDN (%)	65-70[W]	55-60[Z]	65

* 7% for middle 1/3 of pregnancy, 9% for late 1/3 of pregnancy.

Z - 55% for middle 1/3 of pregnancy, 60% for late 1/3 of pregnancy.

Y - NA, not available. W - for 6-10 months old growing bulls.

Energy – The total digestible nutrients (TDN), commonly referred to as energy, are important for beef cow rations that primarily consist of forage. It serves as a good indicator of the energy content provided by a feed. The rule of thumb for energy is 55-60-65 (Table 3). This means that a mature beef cow needs a TDN energy reading of 55% in mid-pregnancy, 60% in late pregnancy, and 65% after calving (nursing beef cows) to maintain a body condition score (BCS) throughout winter. The energy content of the feeds in this study ranged from 37.7% to 79% (Table 1). From Table 2, it is evident that all the straws, about one-tenth of the mixed alfalfa grass hay-mixed, and half of the hay-grass feed types will not meet the energy requirements of a dry beef cow. Most feed types (except for grains) will also fall short in meeting the energy requirements of growing and finishing calves, which need 65-70% TDN. Only wheat silage and cocktail greenfeed met the 65-70% TDN requirement for weaned calves. Among the feeds, wheat screening had the highest TDN content (86% TDN), followed by oat grain (77% TDN).

Minerals – The mineral contents of the tested feeds varied as follows (Table 1):

Calcium (Ca) – Ranging from 0.07% for oat grain to 1.94% for alfalfa silage.
Phosphorus (P) – Ranging from 0.13% for alfalfa grass to 0.47% for canola screenings.

Magnesium (Mg) – Ranging from 0.12% for barley straw, greenfeed-unspecified, haylage, and oat grain to 0.31% for canola screenings.
Potassium (K) – Ranging from 0.5% for canola straw, oat grain, and wheat screenings to 2.1% for oat straw and corn standing.

Based on Table 2, almost all feed types met the calcium requirements for gestating dry cows. However, deficiencies were noted for most feeds in meeting the calcium requirements for finishing calves (0.57%). Barley silage and straw, corn standing, over half of the hay-grass feed type, and all the hay-unspecified and grain products were deficient in meeting the calcium requirements for finishing calves. The situation for phosphorus is similar to calcium, with deficiencies observed in most hay feed types and all oat grain and straw feeds for dry cows. From Table 1, it is evident that almost all feed types (except for some grains) provided less than 0.3% of the phosphorus needed daily by growing calves. For magnesium and potassium, most feed types contained adequate amounts to meet the requirements for both dry gestating cows and growing calves. The analysis of trace minerals in most feed samples (data not provided) indicated deficiencies in meeting the minimum copper requirements of 10 ppm (Table 3).

Implications and Recommendations

- Most feed types, except for straws and standing corn, can meet the protein requirements for dry cows but not for finishing calves. Supplementation with high protein feed types, such as leguminous forages (e.g., alfalfa or alfalfa-dominated hay), is recommended.

- The TDN content was generally low for straws and far below the requirements of a dry gestating beef cow. Additionally, most feed types were found to be deficient in TDN for finishing calves. Producers feeding these feed types will need to supplement with additional energy sources to compensate for the energy shortfall in the diets of growing and finishing calves.

- The Ca and P requirements for finishing calves were not met by most feed types. Producers should consider providing custom mineral supplements to compensate for these deficiencies. Brassicas are a rich source of Ca and P and can be included in diets to make up for these shortfalls.

- Producers should provide mineral supplementation to ensure that all beef cattle have sufficient minerals in their diets. Previous studies have reported copper deficiencies in most forages grown in the Peace Region. Producers are encouraged to request micro-mineral analysis when submitting forage samples to the lab.

- Nitrates were not specifically analyzed in this study, likely because the year had near-normal weather conditions with no extreme events that could lead to nitrate accumulation in forages, such as hail and drought. However, producers are advised to request nitrate analysis if they have any concerns.

- It is recommended that producers harvest forages at the appropriate stage (see Table 4 for annual forage crops) to optimize both yield and quality. Proper storage practices should also be followed to prevent deterioration in forage quality.

Table 4. Suggested harvest stage for annual forage crops cut for greenfeed or silage

Crop	**Harvest stage**
Barley	Soft dough
Oats	Milk
Spring Triticale/Soft white wheat	Late milk
Spring or fall rye	Early dough
Spring or winter wheat	Early dough
Foxtail millet (e.g., German)	Early heading
Crown millet (e.g., white or red proso)	Milk
Peas	First pods wrinkle
Pulse/Cereal mixture	When cereals are at the right stage (up to + 7 days)
Cover crop cocktail mixture (for silage)	60-70% moisture (preferably 65% moisture)

References

NASEM (National Academies of Sciences, Engineering, and Medicine). 2016. Nutrient requirements of beef cattle. 8th revised edition. The National Academies Press, Washington, DC. doi:10.17226/19014.

Experimental Research and Demonstration Plots: Highlights of Field Work, Laboratory and Statistical Analysis, and Reporting

The Peace Country Beef and Forage Association (PCBFA) ensures strict adherence to best management practices for grain and forage crop production, including crop rotation, soil tests, fertilizer application, and spraying. The amount of seeds used in our plots is determined based on factors such as seed germination, seed weight, plot size, seed coating, and seedling mortality. Herbicide applications are carried out according to The Crop Protection Guide (also known as the "Blue Book"). Prior to harvest, small plots are trimmed back to a minimum of 6.5 m from 8.0 m.

Grain and Feed Analysis

Representative samples of both grain and forage (after drying) from various trials and demonstrations are sent to A&L Canada Laboratories Inc., in London, Ontario, for quality determination. All quality indicators presented in this report are reported on a dry matter (DM) basis.

Field Data Analysis

The field trials conducted by PCBFA undergo rigorous statistical analysis to provide readers with a comprehensive understanding of the trial and demonstrate the reliability of the obtained data. Outliers are identified through data testing and excluded from the statistical analysis. When ANOVA indicates significant treatment effects, means are separated using the least significant difference (LSD) at the 0.05 probability level. Differences between two treatments are considered significant only if they are equal to or greater than the LSD value. If a particular variety outperforms another variety by an amount equal to or greater than the LSD value, we can be 95% certain that the yield difference is real, with only a 5% probability that the difference is due to chance alone.

Presentation of Results

The findings from the 2022 research and demonstrations, as well as their implications, are emphasized in this report. Beef cattle have specific nutrient requirements to support body maintenance, reproduction, lactation, and growth. The interpretation of our feed test results from forage crop-related research focuses on nutrition quality in relation to the "Beef Ration Rules of Thumb" (Yurchuk and Okine, 2004) and the nutrient requirements of beef cattle established by the National Academies of Sciences, Engineering, and Medicine (NASEM, 2016) throughout various stages of the production cycle.

Soil Sampling and Analysis

Here at PCBFA, we recognize that soil sampling plays a crucial role in determining the optimal rate of nutrients for maximum growth and yield, as well as monitoring nutrient use efficiency. Regular soil nutrient sampling and analysis are integral parts of our nutrient management planning and monitoring. We employ various sampling strategies, including pre-seed sampling for all sites, post-harvest sampling for specific trials, and troubleshooting. Our tests include soil fertility and soil health indicators to provide a comprehensive assessment of the soil.

References

NASEM (National Academies of Sciences, Engineering, and Medicine). 2016. Nutrient requirements of beef cattle. 8th revised edition. The National Academies Press, Washington,

Yurchuk, T., and E. Okine. 2004. Agri-facts: Beef ration rules of thumb. Alberta Agriculture Food and Rural Development. Agdex 420/52-4.

Fairview Research Farm Site

Cool Season Annual Forage Type Cereal Varieties for Silage

Funded by the Canadian Agricultural Partnership (Government of Canada and Government of Alberta)

Forages play a crucial role in the cow-calf and backgrounding sectors of the beef industry, serving as a major feed component. This includes annual forage crops that are primarily used as stored feed, such as greenfeed, silage, and baleage. In Alberta, oats and barley are the main types of annual forage crops and are considered traditional resources for this purpose. However, as new cereal crop species and varieties become available, it is important to evaluate their potential as forage and their nutritional value in the Peace Region. This study aimed to test different varieties of oat, barley, wheat, and triticale to assess their forage yield and quality.

Objective

To compare some top-performing forage barley, oat, wheat and triticale varieties for yield and quality, and to encourage further adoption of these varieties and integration into the livestock production systems in The Peace.

What we did

The study was carried out at PCBFA's Fairview Research Farm located on RR#35, MD of Fairview in 2022. The cropping history of the site where the study was conducted was summer fallowed in the previous year. Before seeding, the site was tilled with a plot cultivator followed by harrowing.

Experimental design and treatments: A randomized complete block design was used in four replications in small plots measuring 8 m by 1.14 m.

The following crops/varieties were tested in the trial:

1. Canmore Barley- 2-row general purpose (feed/malting) with rough awns, seeded at 2.67 bu/ac
2. AB Advantage Barley- Dual-purpose 6-row feed/forage with smooth awns, seeded at 2.66 bu/ac
3. CDC Cowboy Barley- 2-row dual-purpose with rough awns, seeded at 3.44 bu/ac
4. CDC Maverick Barley- 2-row forage/feed with smooth awns, seeded at 3.73 bu/ac
5. AAC Paramount VB soft white wheat with spike awns, seeded at 1.60 bu/ac
6. Whistler general purpose wheat, awnletted (awn tipped), seeded at 2.17 bu/ac
7. AAC Awesome VB soft white general purpose wheat, has spike awns, seeded at 2.67 bu/ac
8. Candem Oats, seeded at 3.48 bu/ac
9. CDS Arborg Oats, seeded at 3.00 bu/ac
10. Ore3542M Oats, seeded at 3.50 bu/ac
11. CDC Haymaker Oats, seeded at 3.91 bu/ac
12. AC Sadash VB triticale (spring triticale), has awns, seeded at 2.67 bu/ac

Seeding

- Seeds were treated with Vibrance Quattro® cereal seed treatment before seeding.
- Target seeding rates were: 300 plants/m2 (barley); 333 plants/m2 (oats); 333 plants/m2 (triticale), and 333 plants/m2 for wheat. The target seeding rate calculation was based on the 1000 kernel weight, germination, plot area, and 5 % mortality rate. The seeding rate equivalents in bushels/acre (excluding 5 % mortality rate) are provided above for the crops used in this trial.
- Seeding was done on May 20, 2022 and the soil temperature and moisture at seeding were 10.1° C and 8.1 % volumetric water content (VWC) measured at 6".

Fertility

Soil test results from 0-6" were used to determine fertilizer rates for N, P, K and S. The fertilizer blend applied was 283 lbs/acre (blended NPKS).

Spraying

- A pre-emergent spray was carried out with glyphosate at 0.67 L/acre
- In-crop spraying was with Prestige XL at 0.81 L/acre as early as when the plants were at 4 to 5 leaf stage.

Harvesting

Harvesting was completed on August 12, 2022 with a forage harvester when the barley was at the soft dough stage and oats at the late milk stage.

What we found out

Forage dry matter yield varied significantly between varieties with all cool-season cereals yielding more than 3,000 lbs/acre of forage dry matter. Sadash Triticale, Maverick Barley, CDC Cowboy barley, and Paramount short white wheat were the high yielders with each yielding more than 5,000 lbs/acre.

Crude protein (CP) ranged between 7.1 and 12.6% and varied significantly between cool season cereals (Table 5). Only four crop varieties, particularly barley varieties (Canmore, AB Advantage, CDC Cowboy Barley, CDC Maverick) produced forage with greater than 10% CP. Oats, triticale and soft white wheat varieties tested here all had less than 10% CP.

Fibre (NDF and ADF) and energy (TDN) both varied significantly (0.001) between cool season cereals with ranges of 43 - 58% for NDF; 24 - 35% for ADF and 69 - 73% for TDN (Table 5).

The forage quality analysis included a select number of macro and trace minerals (Table 5). Calcium ranged from 0.22 - 0.32%; K ranged from 0.97 to 1.57% while Na ranged from 0.05 to 1.06% and varied significantly between cool-season cereals. Phosphorus and Mg did not vary significantly between cereal species and varieties and ranged from 0.12 to 0.16% and 0.22 to 0.27% respectively. Copper (not shown) ranged from 3.4 to 4.5 ppm; Zn (24 to 30 ppm); Mn (39 to 87 ppm); Cl (0.3 to 0.6 ppm).

Table 5. Forage dry matter yield and quality (DM basis) of Cool Season Cereals grown in Fairview

Cool Season Cereals	CP (%)	NDF (%)	ADF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)	Na (%)	Cu (ppm)
Canmore Barley	11.1	48	32	69	0.31	0.14	1.11	0.24	0.50	3.7
Paramount SWW	8.7	45	24	71	0.24	0.14	1.20	0.23	0.16	4.0
Camden Oats	8.1	56	33	60	0.30	0.12	1.38	0.25	1.06	3.9
AB Advantage Barley	12.6	45	31	70	0.31	0.16	1.40	0.26	0.42	4.2
CDC Cowboy Barley	11.1	48	32	69	0.32	0.14	1.02	0.27	0.55	4.0
CDC Arborg Oats	7.1	58	35	60	0.32	0.10	1.57	0.24	0.75	4.1
ORe3542M Oats	7.3	57	33	61	0.27	0.11	1.44	0.23	0.95	4.0
Whistler GP Wheat	9.2	43	24	71	0.23	0.13	1.14	0.26	0.05	4.5
CDC Haymaker Oats	9.6	52	29	66	0.29	0.15	1.24	0.25	0.89	3.4
Maverick Barley	10.9	48	32	70	0.30	0.15	0.97	0.26	0.45	4.3
Sadash Triticale	9.0	46	25	70	0.22	0.15	1.27	0.22	0.05	3.4
AAC Awesome SWW	9.6	45	24	73	0.24	0.14	1.31	0.25	0.14	3.9
MEAN	**9.5**	**49**	**30**	**68**	**0.28**	**0.14**	**1.25**	**0.25**	**0.50**	**3.9**
p value	0.001	0.001	0.001	0.001	0.05	0.59	0.001	0.66	0.001	0.74
$LSD_{0.05}$	3.1	10.7	7.2	6.2	0.11	0.08	0.39	0.07	0.51	1.6

What do the results mean?

In 2022, the growing season was dry, though not as dry as the previous year (2021) so, in general, the cereal species and varieties tested produced lower dry matter yield (Figure 1) than the normal growing season years. Nevertheless, 4 crop varieties (AAC Paramount VB soft white wheat, CDC Maverick barley, CDC Cowboy barley and AC Sadash VB triticale) tested here conveniently produced 2.5 tons/acre forage DM yield or slightly more indicating a greater resiliency of these varieties in dry weather conditions than other crops. For producers whose greenfeed bales weigh about 1,500 lb/bale, this means that these same 4 crop varieties were still able to produce at least 3.3 bales/acre compared to lower than that for other crop varieties with less 2.5 tons/acre forage DM yield.

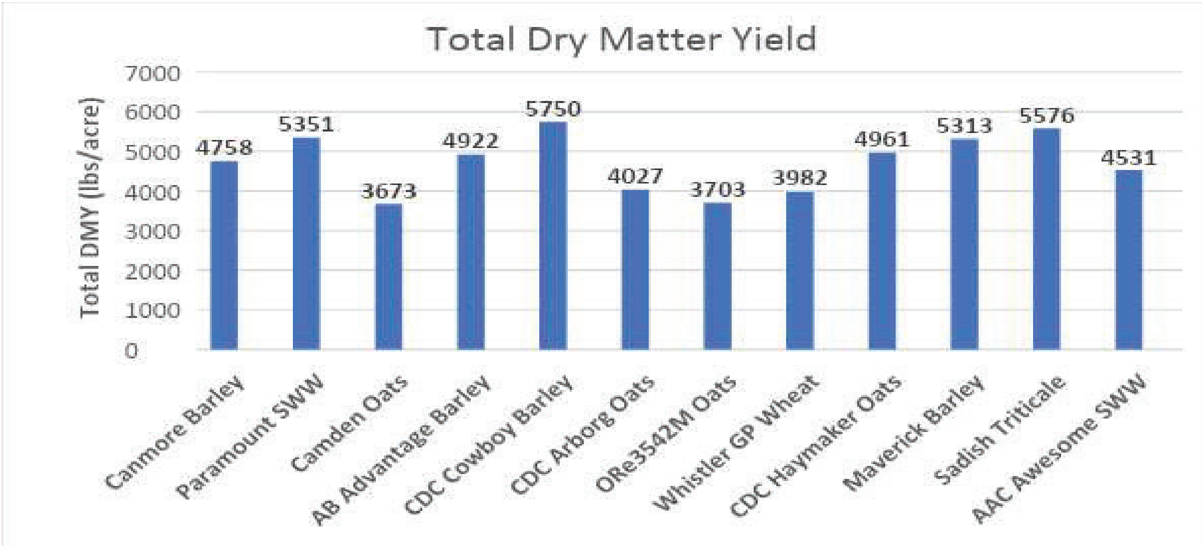


Figure 2. Forage DM (lbs/acre) yield of cool-season cereals tested in Fairview in 2022

Protein wise, the nutrient requirements for dry pregnant cows at mid-term (7% CP) were made by all tested forages while at least 75% of tested forages will meet the nutrient requirements of dry pregnant cows at the third trimester of pregnancy (9% CP). Only the barley varieties (Canmore, AB Advantage, CDC Cowboy Barley, CDC Maverick) tested here adequately met the CP needs of a lactating beef cow (11% CP). AB Advantage barley distinguished itself as the lone forage that could meet the minimum CP requirements of growing beef calves which require 12-14% CP.

All tested forages were energy-rich and will conveniently meet and even surpass the energy requirements of all beef cattle stock (55-60-65% TDN). Unlike the oat varieties, the forage barley, triticale, general purpose and soft white wheat were in excess of the TDN requirements of mature beef cattle.

According to the information provided, Table 5 shows that all crop varieties had sufficient amounts of Ca needed by a beef cow in mid and late pregnancy. However, after calving, none of the crop varieties met the required Ca level of 0.33%. Only AB Advantage was able to meet the 0.16% P requirement for gestating beef cows.

In terms of K and Mg levels, all crop varieties had adequate amounts for both young and mature beef cattle. However, neither Whistler GP wheat nor Sadash triticale met the minimum Na requirements for beef cattle.

To meet the nutritional needs of growing and finishing calves as well as lactating cows, supplementation with Ca and P mineral sources will be necessary when feeding solely each of these cereal varieties. Additionally, the micro-mineral Cu will require supplementation as the levels were below the required 10 ppm for beef cattle.

In summary, while the crop varieties tested had varying levels of Ca, P, Na, and Cu, supplementation will be needed to meet the specific nutritional requirements of beef cattle at different stages of production.

Conclusion

In terms of forage DM yield under a dry weather, four crop varieties in particular, i.e., AAC Paramount VB soft white wheat, CDC Maverick barley, CDC Cowboy barley and AC Sadash VB triticale did better than others. The levels of Cu in the crop varieties tested here were far below the 10 ppm required by beef cattle, so mineral supplementation that includes Cu would be needed when feeding any of these cereal crops.

Evaluation of Cereal Mixtures for Forage Yield and Quality

Funded by the Canadian Agricultural Partnership
(Government of Canada and Government of Alberta)

The selection of a suitable site and an appropriate choice of crop type for the livestock intended to utilize it is crucial. Intercropping winter cereals with spring cereals may enhance forage quality and provide additional forage that can extend fall grazing. The combination of spring and winter cereals could provide an ideal yield distribution throughout the growing/grazing season. Breeding efforts in winter cereals have led to the improvement of multiple traits to maintain and improve western Canadian winter cereal productivity, enabling extension of the growing season. Understanding the regional adaptability of these new varieties in a mixture is critical for Alberta producers to make the most economic decisions for their feeding operations. This trial evaluated forage yield and quality, winter/spring cereal mixtures and monoculture cereal varieties, selected based on producer and industry input from varieties widely available in Alberta.

What we did

The study was carried out at PCBFA's Fairview Research Farm located on RR#35, MD of Fairview in 2022. Before seeding, the site was tilled with a plot cultivator followed by harrowing.

Experimental design and treatments: A randomized complete block design was used in four replications in small plots measuring 8 m by 1.14 m. The following 9 spring winter cereal mixtures and 3 spring cereal monocultures were tested in the trial:

1. Prima fall rye + CDC Austenson barley
2. Prima fall rye + CDC Baler oats
3. Prima fall rye + Taza triticale (spring type)
4. Bobcat triticale + CDC Austenson barley
5. Bobcat triticale + CDC Baler oats
6. Bobcat triticale + Taza triticale (spring type)
7. AAC Wildfire winter wheat + CDC Austenson barley
8. AAC Wildfire winter wheat + CDC Baler oats
9. AAC Wildfire winter wheat + Taza Triticale (spring type)
10. Taza triticale (spring type)
11. CDC Baler oats
12. CDC Austenson barley

Seeding

- Seed was treated with Vibrance Quattro cereal seed treatment before seeding.
- Target seeding rates were 75% for each of the cereal crops in the mixture. The 75% was based on:
    1. 300 plants/m2 (28 plants/ft^2) for oats
    2. 370 plants/m2 (34 plants/ft^2) for spring triticale and winter wheat

3. 250 plants/m2 (23 plants/ft^2) for fall rye
4. The target seeding rate calculation for small plots was based on 1,000 kernel weight, germination, plot area and 5% mortality rate.

- Seeding was done on May 27, 2022 with a 6-row Fabro plot drill equipped with disc-type openers on 23 cm row spacing. The seeding depth was 0.75". The soil temperature at seeding was 11.7 °C.

Fertility

Soil test results from 0-6" before seeding were used to determine fertilizer rates for N, P, K and S. The desired nutrients applied consisted of 72 lbs/acre N, 35 lbs/acre P, 27 lbs/acre K, and 13 lbs/acre S.

Spraying

- A pre-emergent spray application was carried out with StartUp® herbicide.
- In-crop spraying was with Prestige XL at 0.81 L/acre as early as when the plants were at 4 to 5-leaf stage.

Harvest

Plots were harvested based on crop development and this was when most of the spring cereals were in the appropriate growth stage for silage:

- Late milk stage for oats and oats monocrops
- Soft dough stage for mixtures with barley and barley monocrop
- Late milk stage for mixtures with spring triticale and spring triticale monocrop

The three middle rows were harvested using a plot-type forage harvester between August 8th and 16th. Forage samples for each treatment were sent to A & L Lab in Ontario for quality analysis.

Results Obtained and Implications

Forage Dry Matter Yield

From Table 6, forage dry matter yield (DMY) between treatments varied between 5,056 to 7,588 lbs/acre. The spring/winter mixtures showed no yield advantage over the monoculture spring cereals and consistently under yielded compared to their respective controls. Amongst the spring/winter cereal mixtures, those with Taza triticale yielded higher than mixtures having CDC Baler oats and CDC Austenson barley. The results from this study showed that spring/winter cereals mixtures would be described as high yielding having all produced more than 5,000 lbs/acre of forage DMY even though they did not provide any forage yield advantage over their respective monocrops.

Crude Protein and Energy

The forage crude protein (CP) ranged between 7.4 to 10.3% with mixtures containing CDC Austenson barley having slightly higher CP compared to the other mixtures. Relatively high energy (TDN) values were obtained with a range of 66 to 73% TDN with higher values for mixtures containing CDC Austenson barley compared to the other spring cereals.

Table 6. Forage dry matter yield and some quality indicators (DM basis)

Mixture	DMY (lbs/acre)	CP (%)	NDF (%)	ADF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)	RFV
Prima fall rye + CDC Austenson barley	5056	10.2	42	24	73	0.3	0.15	1.9	0.23	154
Prima fall rye + CDC Baler oats	5113	7.6	51	29	67	0.3	0.13	1.4	0.20	121
Prima fall rye + Taza triticale	6657	8.6	44	26	70	0.2	0.17	1.3	0.17	144
Bobcat triticale + CDC Austenson barley	5666	9.8	40	22	72	0.3	0.16	1.5	0.22	168
Bobcat triticale + CDC Baler oats	5643	8.6	49	28	66	0.3	0.16	1.5	0.23	128
Bobcat triticale + Taza triticale	7111	7.4	48	28	69	0.2	0.13	1.1	0.18	132
AAC Wildfire wheat + CDC Austenson barley	5257	10.3	42	24	73	0.3	0.16	1.5	0.20	156
AAC Wildfire winter wheat + CDC Baler oats	6330	8.1	47	27	68	0.4	0.20	1.6	0.22	127
AAC Wildfire winter wheat + Taza Triticale	7058	8.3	44	25	70	0.2	0.16	1.3	0.16	147
Taza triticale	7588	7.5	49	28	67	0.3	0.15	1.8	0.16	126
CDC Baler oats	6492	9.5	50	28	67	0.3	0.21	1.9	0.25	126
CDC Austenson barley	6261	8.0	42	24	71	0.3	0.13	1.5	0.19	158
MEAN	**6186**	**8.7**	**45.7**	**26.1**	**69.4**	**0.28**	**0.16**	**1.5**	**0.20**	**141**

In general, the protein and energy requirements of dry gestating beef cows were met by the tested spring cereal mixtures. The relatively higher protein and energy values obtained for mixtures with CDC Austenson barley make this spring cereal a good candidate to be included in mixtures with winter cereals while higher yields for Taza triticale for mixtures aiming at higher forage CP and TDN yields/acre.

Macro-minerals

For macro minerals, a range of 0.2 to 0.3% (Ca), 0.13 to 0.21% (P), 1.1 to 1.9% (K), 0.16 to 0.25% (Mg) were measured. The relatively low Ca and P ranges measured in spring/wheat mixtures which meet only the requirements for dry gestating cows imply that for growing and finishing cows as well as for lactating cows, mineral supplementation would have to be done.

Prima Fall Rye/Taza Triticale mixture **Prima fall rye monoculture**

Conclusions

Overall, the mixtures did not clearly provide a forage yield advantage over their respective monocrops. But the advantage of mixing winter and spring cereals together would be the potential of winter cereals to re-grow for fall grazing after an initial harvest (greenfeed and silage) in the summer of the main cereal crop in a spring/winter cereal mixture. The re-growth can provide a good amount of forage for extending the grazing season without any extra inputs in carrying the winter cereals from summer through early fall for fall grazing.

Pulse Cereal Mixtures for Improved Forage Production

Funded by the Canadian Agricultural Partnership
(Government of Canada and Government of Alberta)

There are numerous annual forage crops available, each crop has its own strengths and weaknesses, and should be compared to your own situation and requirements. Results obtained from the Regional Silage Trials over the past 10 years have shown that the inclusion of pulses in a silage mixture can increase protein contents on average by 2 - 5 %. Also, intercropping cereals with peas can potentially help curb the lodging of pea varieties with no or short vines. Much of the work was done with field peas but producers are also taking an interest in the use of faba bean varieties as a potential silage option. In addition, newer forage-type peas with greater forage potential have recently been released warranting their assessments with cereal crops for forage production and feed quality. This study evaluates forage yield and quality of pulse-cereal mixtures with pea and faba bean varieties.

What we did

The trial was carried out at the Fairview Research Farm (NW-5-82-W6M) on RR #35, MD of Fairview. The field soil information from the surface (0-6" soil depth) before seeding: pH = 6.1 and organic matter = 6.6 %. The site was summer fallowed the year before this trial was established. Before seeding, the site was tilled with a plot cultivator followed by harrowing.
A randomized complete block design was used in 4 replications in small plots measuring 8 m x 1.14 m. For this trial, the following 24 treatments in total, consisting of 16 pulse/cereal mixtures, 4 monoculture spring cereal varieties, 4 monoculture pulses were seeded:

1. AAC Awesome SWW 1.16 bu/ac + AAC Aberdeen peas 2.45 bu/ac
2. AAC Awesome SWW 1.16 bu/ac + DL Delicious peas 2.16 bu/ac
3. AAC Awesome SWW 1.16 bu/ac + DL Tesoro faba beans 150 lb/ac
4. AAC Awesome SWW 1.16 bu/ac + Snowbird faba beans 159 lb/ac
5. CDC Austenson barley 1.55 bu/ac + AAC Aberdeen peas 2.45 bu/ac
6. CDC Austenson barley 1.55 bu/ac + DL Tesoro faba beans 150 lb/ac
7. CDC Austenson barley 1.55 bu/ac + DL Delicious peas 2.16 bu/ac
8. CDC Austenson barley 1.55 bu/ac + Snowbird faba beans 159 lb/ac
9. CDC Baler Oats 1.86 bu/ac + Snowbird faba beans 159 lb/ac
10. CDC Baler Oats 1.86 bu/ac + AAC Aberdeen peas 2.45 bu/ac
11. CDC Baler Oats 1.86 bu/ac + DL Delicious peas 2.16 bu/ac
12. CDC Baler Oats 1.86 bu/ac + CDC Tesoro faba beans 150 lb/ac
13. Taza Triticale 1.56 bu/ac + AAC Aberdeen peas 2.45 bu/ac
14. Taza Triticale 1.56 bu/ac + DL Delicious peas 2.16 bu/ac
15. Taza Triticale 1.56 bu/ac + DL Tesoro faba beans 150 lb/ac
16. Taza Triticale 1.56 bu/ac + Snowbird faba beans 159 lb/ac
17. AAC Awesome SWW monoculture 2.31 bu/ac
18. CDC Austenson barley monoculture 3.11 bu/ac
19. CDC Baler Oats monoculture 3.40 bu/ac
20. Taza Triticale monoculture 3.11 bu/ac
21. DL Delicious peas monoculture 2.8011 bu/ac
22. DL Tesoro Faba beans monoculture 200 lb/ac
23. AAC Aberdeen peas monoculture 3.17 bu/ac
24. Snowbird Faba beans monoculture 211 lb/ac

Seeding

- Target seeding rates were 75% for each of the cereal crops in the mixture and 50% of the pulse crop in a mixture.
    - The 75% for the cereals was based on:
      300 plants/m^2 (28 plants/ft^2) for oats and barley
      370 plants/m^2 (34 plants/ft^2) for spring triticale and winter wheat
      250 plants/m^2 (23 plants/ft^2) for fall rye
    - The 50% for pulses was based on:
      88 plants/m^2 (5.15 plants/ft^2) for peas
      44 plants/m^2 (4.07 plants/ft^2) for faba beans
- The target seeding rate calculation for small plots was based on 1,000 kernel weight, germination, plot area and 5% mortality rate.
- Seeding was done on May 27, 2022 with a 6-row Fabro plot drill equipped with disc-type openers on 23 cm row spacing. The seeding depth was 0.75". The soil temperature at seeding was 11.7 °C.

Fertility

Soil test results from 0-6" before seeding were used to determine fertilizer rates for N, P, K and S. For both cereal monocultures and mixtures, the actual nutrients applied were: 30 lbs/acre P, 17 lbs/acre K, and 8 lbs/acre S.

Spraying

In-crop spraying was with Basagran Forte at 0.81 L/acre for mixtures and monocultures.

Harvest

Plots were harvested based on crop development and this was when most of the spring cereals were in the appropriate growth stage for silage:

- Milk stage for oats monoculture and pulse/oats mixtures
- Soft dough stage for mixtures with barley and pulse/barley monocultures
- Late milk stage for mixtures with spring triticale and soft white wheat and their monocultures with pulses

The three middle rows were harvested using a plot-type forage harvester on August 8th for barley and August 16th for oats. Forage samples for each treatment were sent to A & L Lab in Ontario for quality analysis.

Results

Forage DM yield

From the forage DMY and quality in Table 7, yields varied significantly and ranged between 2,784 to 6,146 lbs/acre amongst treatments with all pulse monocultures yielding comparatively lower to pulse cereal mixtures and cereal monocultures. A closer look reveals that both faba bean varieties yielded lowest as monocultures and in mixtures with triticale and oats but not with barley and wheat. Amongst the cereal monocultures, Awesome soft white wheat was the highest yielder; with 1,373-2,047 lbs/acre more forage DM yield than other cereal monocultures. No obvious forage DM yield advantages were produced by any of the pulse/cereal mixtures over the respective cereal monocultures.

Table 7. Forage DM yield and nutritional quality of monocultures and pulse/cereal mixtures

Pulse Cereal Mixtures	DMY (lb/ac)	CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)	Na (%)
AAC Awesome SWW/AAC Aberdeen peas	5190	10.0	28.5	43.3	69.1	0.41	0.23	1.58	0.19	0.10
AAC Awesome SWW/DL Delicious peas	5247	9.0	24.9	43.2	69.8	0.36	0.23	1.42	0.17	0.09
AAC Awesome SWW/DL Tesoro faba beans	4420	10.1	30.5	44.9	68.9	0.45	0.24	1.91	0.19	0.12
AAC Awesome SWW/Snowbird faba beans	5529	9.1	24.6	42.5	70.5	0.44	0.23	1.13	0.20	0.10
CDC Austenson barley/AAC Aberdeen peas	4800	9.5	26.2	45.8	71.0	0.37	0.21	1.68	0.18	0.24
CDC Austenson barley/DL Tesoro faba beans	4549	9.4	24.0	43.8	72.5	0.41	0.23	1.67	0.19	0.18
CDC Austenson Barley/DL Delicious peas	4499	9.6	25.6	46.0	72.3	0.34	0.20	1.55	0.17	0.24
CDC Austenson barley/Snowbird faba beans	5394	9.5	24.0	43.6	72.3	0.33	0.18	1.42	0.18	0.25
CDC Baler Oats/Snowbird faba beans	3416	10.1	29.0	45.3	66.9	0.62	0.28	1.91	0.20	0.02
CDC Baler Oats /AAC Aberdeen peas	4585	10.5	29.4	47.1	66.6	0.66	0.24	1.73	0.23	0.12
CDC Baler Oats/DL Delicious peas	4013	9.6	28.2	45.1	68.3	0.55	0.27	1.85	0.23	0.04
CDC Baler Oats /DL Tesoro faba beans	3202	10.8	27.2	46.2	67.5	0.61	0.25	1.70	0.21	0.06
Taza Triticale/AAC Aberdeen peas	6094	8.1	30.4	47.7	66.9	0.41	0.23	1.56	0.20	0.08
Taza Triticale / DL Delicious peas	5759	6.9	34.5	51.3	65.8	0.46	0.22	1.48	0.19	0.06
Taza Triticale/DL Tesoro faba beans	4161	11.4	29.2	42.7	68.9	0.47	0.25	1.68	0.20	0.04
Taza Triticale/Snowbird faba beans	5269	7.0	27.2	47.5	67.8	0.46	0.20	1.21	0.19	0.04
AAC Awesome SWW monoculture	6146	9.9	26.3	45.8	71.9	0.33	0.20	1.43	0.19	0.07
CDC Austenson barley monoculture	4773	8.8	26.8	48.1	71.6	0.35	0.16	1.64	0.18	0.26
CDC Baler Oats monoculture	4099	7.4	28.5	49.5	65.3	0.54	0.24	1.90	0.21	0.17
Taza Triticale monoculture	4627	8.8	30.7	50.5	66.4	0.47	0.20	1.65	0.20	0.05
DL Delicious peas monoculture	3925	11.0	26.2	37.5	68.6	1.08	0.28	1.14	0.25	0.02
DL Tesoro Faba beans monoculture	2784	16.6	31.4	43.4	68.7	1.30	0.34	2.20	0.22	0.16
AAC Aberdeen peas monoculture	3690	12.7	33.1	41.0	63.9	1.18	0.29	1.97	0.28	0.08
Snowbird Faba beans monoculture	3272	15.6	30.6	42.0	68.3	1.58	0.34	1.90	0.29	0.02
MEAN	***4536***	***9.9***	***27.7***	***45.2***	***69.3***	***0.55***	***0.23***	***1.63***	***0.20***	***0.13***
CV, %	*29.5*	*23.4*	*13.5*	*10.0*	*4.3*	*59.2*	*24.0*	*21.0*	*17.0*	*10.0*
p-value	*0.002*	*0.00*	*0.07*	*0.4*	*0.00*	*0.001*	*0.00*	*0.08*	*0.001*	*0.26*
$LSD_{0.05}$	*2532*	*3.2*	*8.2*	*11.2*	*5.2*	*0.22*	*0.1*	*0.78*	*0.05*	*0.27*

Forage quality

The forage CP varied significantly and ranged 6.9 to 16.6% CP between treatments. Despite the higher CP values of pulse monocultures (especially the faba bean varieties), seeding them with cereals did not result in any significant changes in the protein content of pulse cereal mixtures.

Fibre did not vary significantly between treatments and ranged from 24.0 to 34.5 % (ADF) and 37.5 to 51.3 % (NDF).

Energy (TDN) varied significantly between treatments and ranged between 65.3 to 71.9% TDN with pulse cereal mixtures having CDC Austenson barley consistently showing a TDN > 71.0%.

The Ca content also varied significantly between treatments, with pulses having significantly higher Ca values compared to pulse cereal mixtures and cereal monocultures. Ranges of 0.16 to 0.34%, 1.14 to 1.91%, and 0.17 to 0.25% were noted for P, K, and Mg respectively. The P contents of pulse monocultures, just like the Ca contents reported earlier, were also higher than their respective pulse cereal mixtures and cereal monocultures.

Implication of Results

No forage DM yield advantage was produced by the pulse/cereal mixtures over their respective monoculture cereals.

Interestingly, protein contents of forage mixtures were not improved despite the higher protein contents of monoculture pulses. In general, pulse cereal mixes would meet the nutritional requirements of dry gestating cows at mid and last trimester. The energy contents of the cereal pulse mixtures were mostly above 65% and will constitute a high energy diet. Calcium levels of pulse cereal mixes were generally high and would meet the requirements of gestating and lactating cattle but some form of supplementation would be needed for growing and finishing calves. Pulse monocultures proved to be really high in Ca and P and will make for good Ca supplementation in diets deficient in Ca and P. The phosphorus levels in treatments were adequate for a dry gestating beef cow, but short of the 0.26% P needed by lactating beef cows.

Forage peas are a valuable crop for forage. Older forage peas tended to have long vines, normal leaf-type, purple flowers, and produced a lot of biomass. An older variety call 40-10 which is still grown today - has a very small seed size and produces a lot of biomass. However, 40-10 has an indeterminate growth habit and tends to lodge and fall over at the flowering stage, making it more difficult to handle at harvest. The newer forage varieties produce as much or more biomass as 40-10, but are easier to manage and have better lodging resistance. Generally, newer forage pea varieties tend to be semi leafless, have more basal branching, a determinate growth habit, and increased biomass. In peas/cereal intercrops, the cereal component prevents the pea component from lodging. Intercrops can contribute to low input systems in particular. We observed that in terms of lodging, spring triticale and semi-leafless forage are ideal intercropping partners; with no lodging expected even with strong winds.

Snowbird faba bean

Taza Triticale + DL Delicious peas

Snowbird faba bean + Baler oats mixture

40-10 pea monoculture with some lodging

Screening of Alternate Annual Crops, Grasses, and Forbs for Forage Production

Funded by the Canadian Agricultural Partnership
(Government of Canada and Government of Alberta)

In the Peace Region, the traditional annual forage crops, which are largely utilized as stored feed (greenfeed, silage, baleage, etc.) and for swath grazing are oats and barley. Interest has been growing on cropping options which can considerably reduce the daily feed cost of beef cattle during the fall and winter months. The use of 'alternative' or 'high nutritive value forages' such as chicory, plantains, forage beet and kale in the rations of beef cattle could procure many environmental, economic and production benefits to Alberta producers. Research carried out on these alternate forage-type crops in other areas have shown these benefits. Continued research efforts are needed to test these alternative forages under Peace Region conditions to determine their adaptability, suitability, and benefits. The objective of this trial was to determine the forage yield and forage quality of different alternative forage species while comparing this to traditionally grown forages such as barley and oats.

Methods

The study was carried out at the Fairview Research Farm (NW-5-82-W6M) in RR #35, MD of Fairview.

Experimental design was a randomized complete block design with 4 replications using warm and cool season grasses, brassicas and forbs as provided below.

Warm season grasses

1. Japanese Millet 20 lb/ac
2. White Proso Millet 25 lb/ac
3. NSB Sorghum Sudan grass 22 lb/ac
4. Pearl Millet 15 lb/ac

Cool season cereals

1. AB Tofield Barley 2.7 bu/ac
2. Bunker Triticale 2.7 bu/ac
3. CDC Baler Oats 3.7 bu/ac

Brassicas

1. Finito Rape 10 lbs/ac
2. Forage brassica Vivant 5 lb/ac
3. Forage Collards 5 lb/ac
4. Forage kale- Inka 5 lb/ac
5. Forage radish- Daikon 5 lb/ac
6. Hercules Forage Turnip 10 lb/ac

Forbs

1. Plantain 8 lb/ac
2. Phacelia 8 lb/ac
3. Chicory 5 lb/ac

Legume

1. Chickling vetch 70 lb/ac

What we found out

Forage DM yield ranged from 206 to 5,552 lbs/acre with the traditional cool season forage crops outyielding the other 3 main groups (Table 8). Forbs and brassicas produced generally lower DM forage yields with chicory, plantains, forage collards and forage kale-inka. Among the brassicas, forage radish-Daikon yielded the highest (3,170 lbs/acre). The warm season annual grasses produced moderate yields to that obtained from traditionally grown cool season forage crops. White Proso Millet yielded highest with almost 4,000 lbs/acre of forage DM.

For crude protein content, the brassicas came in first position with relatively high value (>22% CP), while the cool season grasses were the lowest in CP (7.3 to 11.0% CP).

The total digestible nutrient (TDN) values were generally high, averaging > 64% TDN.

Calcium ranged from 0.3 to 3.5% with brassicas having relatively high calcium levels.
Phosphorus ranged from 0.1 to 0.3% with brassicas registering consistently high P values.
Ranges for Potassium: 1.0 to 3.5%.
Magnesium (0.25 to 0.74) were obtained with brassicas again showing consistently high P values.
Copper values were mostly < 10 ppm while manganese ranged from 79 to 398 ppm.

Table 8. Forage DM yield and quality for alternative forages Fairview 2022

	TDMY (lb/ac)	**CP (%)**	**NDF (%)**	**ADF (%)**	**TDN (%)**	**Ca (%)**	**P (%)**	**K (%)**	**Mg (%)**	**Cu (ppm)**	**Mn (ppm)**
AB Tofield Barley	5552	11.0	46.6	27.7	69.1	0.4	0.1	1.2	0.36	4.6	79
Bunker Triticale	4467	7.3	50.8	28.9	67.3	0.3	0.1	1.0	0.25	3.1	105
CDC Baler Oats	4006	7.3	51.2	28.7	66.1	0.3	0.2	1.1	0.28	3.7	103
Chickling vetch (legume)	368	13.4	49.0	39.5	58.1	1.0	0.2	1.1	0.33	9.8	309
Balo Phacelia	1465	16.8	41.2	36.0	60.9	3.5	0.3	2.7	0.82	8.0	208
Chicory	206	15.6	33.9	30.9	64.8	1.0	0.2	1.8	0.36	10.2	290
Plantain	186	10.9	48.8	34.5	60.1	1.1	0.2	1.2	0.35	11.0	398
Finito Rape	1553	29.6	26.7	23.4	70.6	2.0	0.3	3.2	0.63	6.0	123
Forage brassica Vivant	1179	26.3	25.0	23.3	70.7	2.3	0.3	3.2	0.74	6.3	125
Forage Collards	269	21.7	40.1	33.6	62.7	1.9	0.3	2.4	0.44	8.6	270
Forage kale- Inka	459	26.1	33.2	28.4	66.8	2.4	0.3	2.5	0.60	5.7	179
Forage radish- Daikon	3170	21.8	41.0	37.4	59.8	1.9	0.3	2.5	0.57	5.3	156
Hercules Forage Turnip	1859	27.4	29.2	27.2	68.6	2.0	0.3	3.5	0.63	6.3	103
Japanese Millet	1794	14.9	57.5	34.9	62.5	0.7	0.2	1.5	0.55	8.7	299
White Proso Millet	3914	14.2	54.4	34.8	64.3	0.3	0.1	1.5	0.52	5.3	82
NSB Sorghum Sudan grass	2375	12.2	61.1	37.4	62.4	0.4	0.1	1.2	0.38	5.8	112
Pearl Millet	1313	17.8	55.4	34.5	63.9	0.7	0.2	1.6	0.63	7.8	207
MEAN	***2206***	***16.1***	***46.7***	***32.7***	***64.3***	***1.2***	***0.2***	***1.8***	***0.48***	***6.6***	***172***
p value	*0.001*	*0.001*	*0.00*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.004*	*0.001*
$LSD_{0.05}$	*1887*	*3.1*	*6.5*	*5.2*	*4.5*	*0.5*	*0.06*	*0.7*	*0.7*	*0.2*	*63.0*

Implications of what we found out

Except for the Forage Radish Daikon which yielded above 3,000 lbs/acre, the brassicas and forbs tested were all low forage yielders having all produced less than 3,000 lbs/acre. White Proso millet and Forage Radish Daikon can be considered as alternatives in terms of yields to oats and barley, the latter being used traditionally as forage crops.

But for CDC Baler oats and Bunker Triticale which can meet protein requirements of mostly gestating cattle in mid-term, most of the other forages tested (such as the brassicas) will meet and even surpass the protein requirements of growing and finishing calves. The brassicas can indeed be considered as protein supplements with very high protein contents. Most of the tested forages here will meet protein requirements of late gestating cattle. The brassicas with their high protein contents can be included as very excellent protein supplements to beef cattle diets.

The relatively high energy values obtained from these tested forages imply that mid-term pregnant cows on these tested forages will not need energy supplementation. Some of the forages could well serve as energy supplements having yielded almost 65% or more in energy.

The forbs and brassicas were on average higher in Ca content compared to the warm and cool season annual grasses which will need some mineral supplementation to meet nutritional requirements of mostly growing/finishing calves. Levels of phosphorus in the forages were borderline to the nutritional requirements for most beef cattle stock while potassium, magnesium and manganese levels were generally adequate. For copper, only the forbs seem to have enough (> 10 ppm) of this nutrient to meet the requirements of beef cattle stock while the other forages fell short of the requirements as is common with most forages grown in the Peace Region.

Conclusions

Results obtained here indicate that brassicas and forbs do not produce high forage DM yields compared to traditional forage barley and oats but together with warm season grasses, could serve as protein supplements to the low protein values of traditional forages. Alternative forages compared well to the traditional forage options in terms of energy. Brassicas are a rich source of calcium. Cattle on most of the forages will need copper supplementation.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Screening of Alternative Forage
Type Annual Crops Grasses
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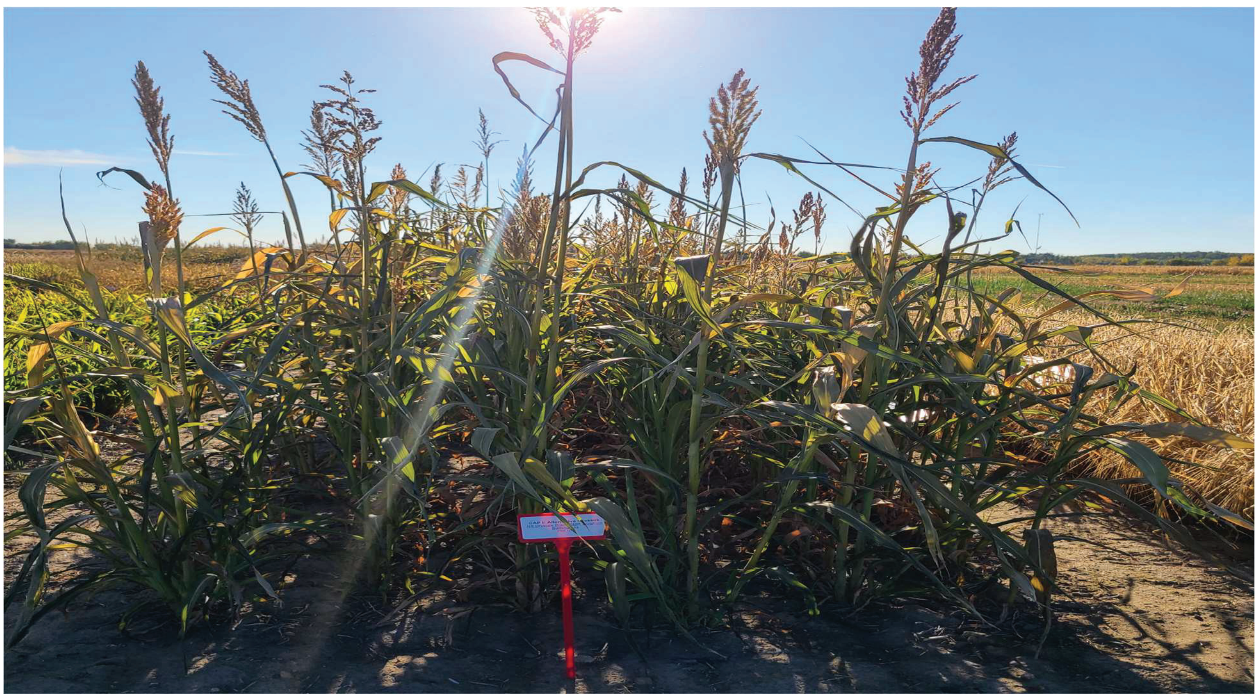


Proso millet

Sorghum Sudan grass

Evaluating of forage-type pulse crop varieties for seed and forage potential

Funded by Results Driven Agriculture Research (RDAR)

Forage peas are similar to traditional field peas in many agronomic aspects but breeding efforts have prioritized increased biomass, lodging resistance and small seed size rather than grain yield. They are grown for their biomass yield, digestibility, protein and relative feeding values. With the release of several new forage pea varieties in the past years, assessing these varieties and other forage-type pulse crops such as faba beans for their forage potential under the agroecology conditions of the Peace Region will provide useful information to producers currently using them or having interest in them. Due to their high nutritive value, peas are an important feed grain legume for animal production operations. Reductions in forage and seed yield have been attributed to lodging in forage peas. When forage peas are grown as a monoculture, they exhibit severe lodging after flowering. The newer forage varieties produce as much or more biomass as older forage peas, but are easier to manage and have better lodging resistance.

What we did

The trial was conducted at the PCBFA's Research Farm (NW-5-82-3W6M) on RR 35, MD of Fairview, AB. The site was summer fallowed the previous year. Before seeding the site was disced and harrowed and later pre-pass sprayed with glyphosate at 0.67L/acre.

The trial was set up as a randomized complete block design with 4 replications of the following 3 faba bean and 12 pea varieties (including forage and maple peas):

1. Snowbird Faba Bean seeded at 221 lbs/acre
2. Fabelle Faba Bean seeded at 225 lbs/acre
3. CDC 219-16 Faba Bean seeded at 166 lbs/acre
4. 40-10 Peas- forage peas, an older forage variety, seeded at 1.63 bu/ac
5. CDC Blazer Peas- maple field pea variety, seeded at 2.30 bu/ac
6. AAC Liscard Peas- semi-leafless maple pea, seeded at 2.53 bu/ac
7. Goldeneye Peas- yellow, leafy-type new forage pea, seeded at 2.32 bu/ac
8. DL Delicious Peas- semi-leafless new forage pea, seeded at 2.86 bu/ac
9. AAC Profit Peas- semi-leafless leaf new yellow pea, seeded at 3.63 bu/ac
10. DL Lacross Peas- semi-leafless new forage pea, seeded at 2.53 bu/ac
11. CDC Leroy Peas- semi-leafless leaf type, forage-type, seeded at 1.80 bu/ac
12. CDC Horizon Peas- semi-leafless leaf yellow pea, forage-type, seeded at 2.16 bu/ac
13. CDC Meadow Peas- semi-leafless yellow pea, seeded at 3.28 bu/ac
14. AAC Aberdeen Peas - semi-leafless yellow pea, seeded at 3.23 bu/ac
15. CDC Amarillo peas- semi-leafless yellow pea, seeded at 3.210 bu/ac

The following cultural practices were carried out:

- Seeding date was on May 26, 2022 with a Fabro plot drill equipped with disc-type openers on 9” row spacing and a mid row bander for fertilizer.
- Six rows that were 8 m long were sown per plot.
- Seeding depth was ¾ - 1". Fertility was 60 lbs/acre of 11-52-0.
- Peas were seeded at a full seeding rate of 90 seeds per sq. m., while faba beans were at 44 seeds per sq. m.
- Peas were inoculated with granular Pea Rhizobium Inoculant before seeding.
- In-crop weed control measure was done with Basagran Forte herbicide at 0.81 L/acre on June 24, 2023

Results and Implications

Total dry matter yields, plant height and NDVI did not vary significantly between pulse crop species and varieties.

Plant height ranged from 81 to 108 cm.

Results for pulse crop varieties for forage and seed production are provided in Table 9.

Forage DM yield ranged between 2500 - 5500 lbs/acre. Amarillo and DL Lacross peas produced more than 2.5 tonnes/acre of DM forage. Pea varieties produced, on average, more forage DM than faba bean varieties.

Forage crude protein content was high (>15.0% CP) and indicated the excellent protein nature of pulse forages. The pulse-type crop species and varieties had >60% TDN.

Macro and micro minerals varied significantly between pulse crop species and varieties only for Mg, K, and Zn. Ca levels in the forage-type pulse crop varieties were relatively high and ranged from 0.7 – 1.2% while the following ranges were obtained for P (0.17 – 0.22%); Mg (0.33 – 0.57%); K (1.1 – 1.6 %); Fe (286 – 1681 ppm); Zn (23 – 57 ppm); Cu (4 – 20 ppm) and Mn (37 – 113 ppm). CDC Blazer pea had a relatively high Cu content (20 ppm).

Seed yield and seed yield attributes varied significantly ($p<0.05$) between forage-type pulse crop varieties and species. The results ranged between 16 – 46 bu/acre for seed yield, 23 – 27% for seed protein, 173 – 509 g/1,000 kernels for thousand kernel weight (TKW) and 56 – 60 lbs/bu for bushel weight (Figure 3).

Comparing the results obtained over 3 years (2020, 2021 and 2022) of this trial, forage DM yield varied between years with the following yield trend observed 2020 > 2022 > 2021. This trend also coincides with the trend in the amount of precipitation received. No variety distinguished itself consistently over the years as DL Delicious, 40-10 forage pea and Horizon pea did exceptionally well in 2020, all underperformed in 2021 (the drought year with just about a quarter of 2020 yields obtained) and almost all produced > 4,000 lbs/acre in the near normal year of 2022. The drought conditions appeared to have positively affected the micro-mineral content of the forages, potentially leading to an increase in their overall quality.

In conclusion, the results obtained from some of the pulse crop varieties, indicate that some peas can constitute good forage material (high forage DM yield and quality) with very little need for mineral supplementation.

Table 9. DMY, agronomic attributes, and chemical composition of faba bean and pea varieties

TREATMENT	**TDMY (lbs/ac)**	**NDVI**	**Plant height (cm)**	**CP (%)**	**ADF (%)**	**NDF (%)**	**TDN (%)**	**Ca (%)**	**P (%)**	**Mg (%)**	**K (%)**	**Fe (%)**	**Zn (%)**	**Cu (%)**	**Mn (%)**
AAC LISCARD Pea	4387	0.58	91	14.8	30.1	35.2	63.0	1.0	0.17	0.46	1.20	622	28	6	73
AAC PROFIT Pea	4565	0.68	88	15.7	25.6	30.5	64.0	0.9	0.19	0.35	1.20	346	31	4	55
ABERDEEN Pea	4423	0.61	86	15.2	28.6	34.2	63.0	1.1	0.21	0.33	1.46	590	39	4	77
AMARILLO Pea	5206	0.68	94	15.4	29.7	35.3	62.5	0.7	0.17	0.36	1.12	369	23	4	37
CDC 219-16 faba bean	3817	0.56	96	19.5	27.2	31.8	64.0	1.0	0.19	0.47	1.61	823	42	7	93
CDC BLAZER Pea	4350	0.56	81	16.8	27.8	33.2	63.5	1.2	0.20	0.50	1.25	1681	32	20	90
CDC LEROY Pea	4792	0.60	85	16.5	24.5	28.6	65.0	1.0	0.22	0.42	1.14	285	34	5	50
DL DELICIOUS Pea	4133	0.63	102	15.3	29.6	34.8	63.0	1.0	0.18	0.39	1.09	725	31	5	70
DL LACROSS Pea	5461	0.65	106	15.0	30.8	36.3	62.5	1.0	0.19	0.41	1.28	542	29	5	66
GOLDENEYE Pea	4506	0.66	105	16.9	29.1	34.8	63.0	1.0	0.19	0.57	1.12	507	31	6	42
HORIZON Pea	4920	0.57	90	15.6	28.1	32.5	63.5	1.0	0.20	0.42	1.23	286	30	4	49
MEADOW Pea	4545	0.59	90	15.1	28.4	34.0	63.0	1.2	0.19	0.55	1.15	760	32	7	93
40-10 Pea	4512	0.71	108	17.1	27.4	32.0	64.0	1.1	0.22	0.50	1.30	518	30	6	66
FABELLE Faba bean	3649	0.56	102	18.9	28.0	30.8	64.5	0.9	0.23	0.45	1.82	668	39	7	94
SNOWBIRD Faba bean	2534	0.55	82	18.7	29.9	35.4	62.5	1.0	0.20	0.56	1.40	1225	57	9	113
MEAN	***4387***	***0.61***	***94***	***16.4***	***28.3***	***33.3***	***63.4***	***1.0***	***0.19***	***0.45***	***1.29***	***663***	***34***	***6***	***71***
p value	*0.72*	*0.45*	*0.96*	*0.02*	*0.08*	*0.04*	*0.05*	*0.07*	*0.44*	*0.04*	*0.05*	*0.25*	*0.001*	*0.40*	*0.17*
Significance	*ns*	*ns*	*ns*	*	*ns*	*	*	*ns*	*ns*	*	*	*ns*	**	*ns*	*ns*
$LSD_{0.05}$	*3441*	*0.22*	*60.4*	*3.8*	*5.05*	*5.83*	*2.05*	*0.33*	*0.07*	*0.20*	*0.56*	*1315*	*13*	*15.6*	*73.4*
CV, %	*24.4*	*12.0*	*18.0*	*10.8*	*7.3*	*7.7*	*14.1*	*13.6*	*12.3*	*19.7*	*18.8*	*7.7*	*25*	*8.3*	*39*

LSD – Least significant difference; CV – coefficient of variation; ns – not significant; * $p \leq 0.05$; ** $p \leq 0.001$

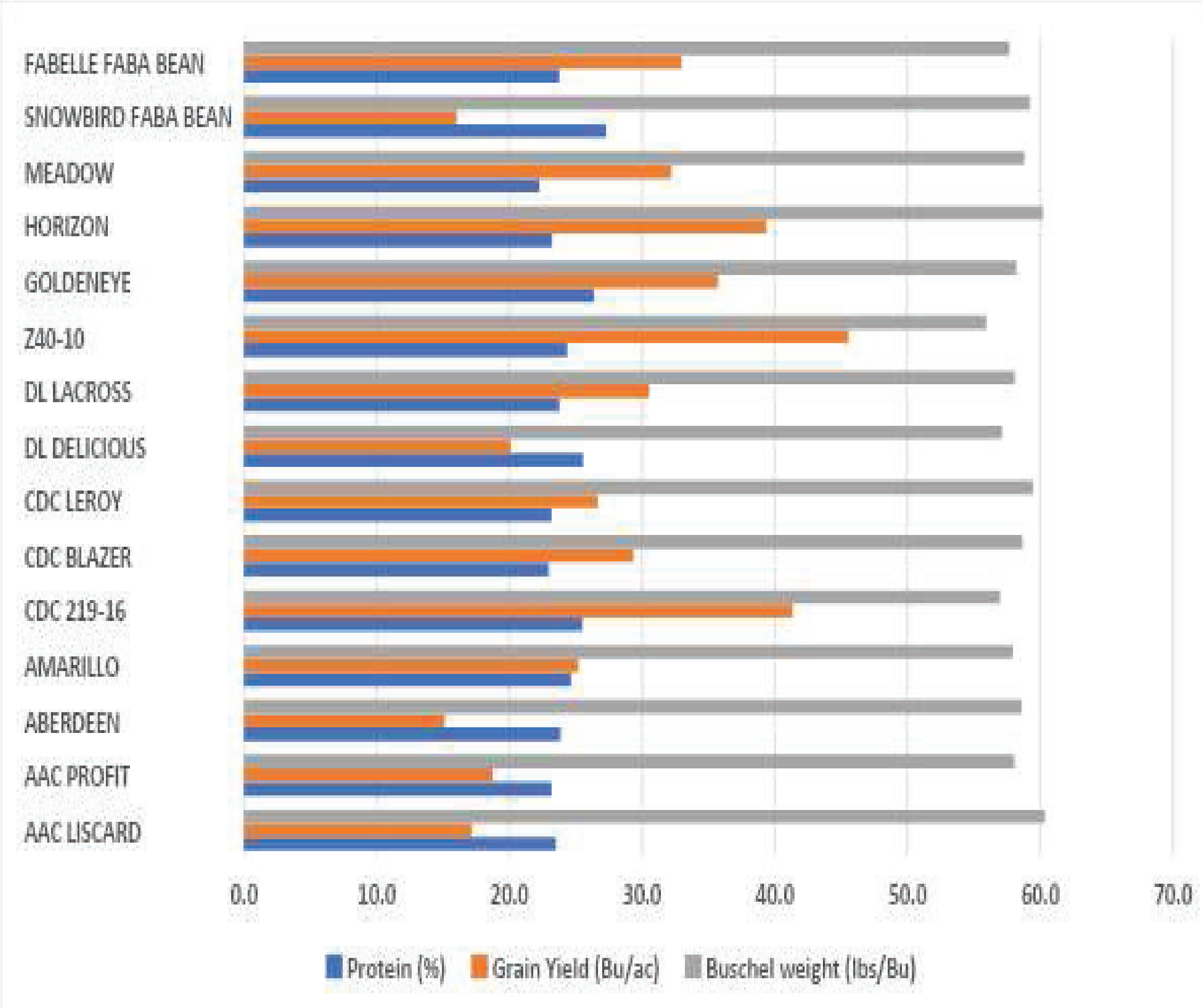


Figure 3. Grain attributes of peas and faba bean varieties

How biostimulants and micronutrients can impact crop production

Biostimulants have been described as substances and/or microorganisms whose function, when applied to plants or the rhizosphere, is to stimulate natural processes to benefit nutrient uptake, nutrient use efficiency, tolerance to abiotic stress, and/or crop quality, independently of its nutrient content. Peace Region producers are on the lookout for information on how effective these products are under their agroecological conditions and depend on applied research and extension groups like the Peace Country Beef and Forage Association to furnish them with reliable, relevant and local data on this. We tested a variety of biostimulant products such as biochar, humalite, Ecotea seed treatment and Ecotea foliar fertilizer on yield and grain quality attributes of wheat grain.

What we did

The trial was carried out at the Fairview Research Farm (NW-5-82-W6M) on RR #35, MD of Fairview. The field soil information from the surface (0-6" soil depth) before seeding: pH = 6.1, organic matter = 6.6 %. The site was summer fallowed the year before this trial was established. Before seeding, the site was tilled with a plot cultivator followed by harrowing.

A randomised complete design was used in 4 replications of small plots measuring 8 m x 1.14 m with 2 m alleyways between plots and 8 m between replicates. The following biostimulants and micronutrient treatments were implemented on AAC Brandon wheat variety:

- Control (chemical fertilizer only) [Con]
- Biochar (+ chemical fertilizer) [Biochar]
- Humalite (+ chemical fertilizer) [Huma]
- Foliar applied micronutrients (+ chemical fertilizer) [FAM]
- Biochar + Humalite (+ chemical fertilizer) [Biochar + Huma]
- ATG seed treatment + ATG foliar fertilizer (+ chemical fertilizer) [ATGST + ATGFF]
- ATG seed treatment + ATG foliar fertilizer + Foliar Micronutrients (+ chemical fertilizer) [ATGST + ATGFF + FAM]
- ECOTEA seed treatment + ECOTEA foliar fertilizer (+ chemic fertilizer) [ECOST + ECOFF]

Seeding

- Seeds were treated with Vibrance Quattro cereal seed treatment for all seeds and the respective specific seed treatments.
- Target seeding rates were 320 plants/m^2 (128 lbs/acre). The target seeding rate calculation for small plots was based on seed germination, 1,000 kernel weight (41.6 g), plot area and 4 % mortality rate.
- Seeding was done on May 20, 2022 with a 6-row Fabro plot drill equipped with disc-type openers on 23 cm row spacing. The seeding depth was ¾ - 1". The soil temperature and moisture at seeding were 15.9 °C and 7.1 % VWC at 4".

Fertility

Soil test results from 0-6" before seeding were used to determine fertilizer rates for N, P, K and S for a target grain yield of 50 bu/acre. The breakdown of the applied fertilizer blend was 183 lbs/acre N, 63 lbs/acre P, 28 lbs/acre K and 33 lbs/acre of S.

Spraying

In-crop spraying was with Prestige at 0.81 L/acre as early as when the plants were at 4 to 5-leaf stage. The ATG treatments were applied on July 5, 2022 at the Code 6 and 8 stages.

Harvest

The three middle rows were combined, and grain yield determined. Grain and straw quality samples for each plot were sent to A & L Lab in Ontario for quality analysis.

Data collection consisted of: Plant emergence, Green seeker canopy NDVI, crop residue yield and quality, head counts, grain yield, test weight, 1,000 kernel weight, and protein content.

What we found out

All wheat plant and grain attributes (Table 10) did not differ significantly between treatments.

Table 10. Wheat plant, grain and straw attributes of biostimulant treatments

	Plant Count	Plant Height (cm)	NDVI	Grain Yield (bu/acre)	TKW (g)	Bushel weight (lbs)	Grain CP (%)
Con	33	71	0.54	42	40	59	21
Biochar	38	72	0.66	42	35	58	23
Huma	33	67	0.60	40	39	58	24
FAM	31	67	0.57	42	38	58	23
Biochar + Huma	34	67	0.67	45	39	58	24
ATGST + ATGFF	32	67	0.61	42	39	58	22
ATGST + ATGFF + FAM	34	71	0.68	45	38	58	23
ECOST + ECOFF	34	66	0.59	40	37	59	23
MEAN	**34**	**68**	**0.61**	**42**	**38**	**58**	**23**
p value	*0.56*	*0.22*	*0.14*	*0.95*	*0.44*	*0.39*	*0.76*
LSD	*7.6*	*7.1*	*0.16*	*11.9*	*6.0*	*1.58*	*2.75*

Straw quality (data not shown) ranged 7 - 10% for CP; 45 - 50% for ADF; 79 - 89% for NDF; 50 - 53% for TDN; 0.19 - 0.32% for Ca; 0.03 - 0.08% for P; 0.24 - 0.32% for Mg; 0.44 - 0.64% for K; 116 - 157 ppm for Fe; 8 - 25 ppm for Zn and 56 - 91 ppm for Mn. Copper and molybdenum values of wheat straw treatments were all less than 1 ppm. Most of the values reported here were higher than those obtained in a similar trial at the same site done the previous year (2021).

Implication of what we found

In conclusion, the biostimulants and micronutrients tested here had very little or no impact on crop production as hardly any variable investigated was influenced by their addition. A similar experiment carried out in 2021 (PCBFA Annual Report, 2021) also did not show any impact of biostimulants and micronutrient addition on crop production but produced comparatively lower values for most of the parameters. This was most likely due to the different growth (water and temperature) conditions in the two years, where water was limited in 2021 because of the drought conditions. It remains unclear to us why biostimulants did not produce any significant impact on crop production.

References

PCBFA 2021 Research. (2021). Effect of biostimulants and micro nutrients on yield and grain characteristics of wheat and canola. Pages 63-66.

Productivity, quality, and water-use efficiency of commercial and producer cocktails

Funded by Results Driven Agriculture Research (RDAR)

Introduction

Cocktail crop mixtures (i.e., three or more crop species) are integral components for the feeding regimes of cattle producers as they provide high-quality forage feed to livestock. Apart from this, cocktails with the right proportions and combinations of species can impact soil health. Although many commercial cocktails exist on the market, producers also combine various species to create their own cocktails. However, the question of comparative advantages between the commercial and the producer cocktails over the usual mono-crops needs to be explored. So, in this study, we examined forage productivity, feed quality and water-use efficiency of cover crop cocktails.

Method

This study was carried out at the Fairview Research Farm (NW-5-82-3-W6M) on RR35, MD of Fairview. The field was previously seeded to canola in 2021.

The study used a randomized complete block design with four replications. A total of 13 treatments were used comprising 6 multispecies cocktail samples from local producers in the Peace region, 4 common commercial cocktails, 2 cereal mono-crops as control and a warm-season dominated local cocktail mix. The breakdown of treatments is as follows:

1	Producer Cocktail 1	Haymaker oats, Amarillo peas, Berseem clover, Tetra brand annual ryegrass, Hairy vetch.
2	Producer Cocktail 2	Morgan oats, Hairy vetch, Horizon peas, Proso millet, Phacelia, Hercules turnip, and Inke marrowstem kale.
3	Producer Cocktail 3	Hairy vetch, Hercules turnip, Forage turnip, Collards, Kale, Berseem clover, Phacelia, Haymaker oats, and Maverick barley.
4	Producer Cocktail 4	Crimson clover, Italian ryegrass, Hairy vetch, Hunter leaf turnip, Graza forage radish, Winifred Goliath, Maverick barley, and Goldeneye peas.
5	Producer Cocktail 5	Maverick barley, Goliath forage rape, Green globe turnip, Hunter leaf turnip, and Goldeneye peas.
6	Producer Cocktail 6	Horizon peas, Maverick barley, Haymaker oats, Hairy vetch, and Hercules turnip.
7	Commercial Cocktail 1	(Imperial Seed TG extend): Melquatro Italian ryegrass, Japanese millet, Ebena brand common vetch, Goldeneye german millet, Finito turnip rape, Akela brand forage rape, Ho brand crimson clover, Winner brand berseem clover, Pearl millet, Goldeneye peas, and Haymaker oats.
8	Commercial Cocktail 2	(Pickseed Annual Forage Pro Haygraze): Forage kale, Firkin Italian ryegrass, Crimson clover, Tillage radish, Crown millet, Purple top forage, Hairy vetch, Goldeneye peas, and Maverick barley.
9	Commercial Cocktail 3	(Performance seed): Nabucco Italian ryegrass, Spring green festulilum, Premiere forage kale, Impact forage brassica, Frosty berseem clover, Purple bounty hairy vetch, Fixation balsana clover, Goldeneye peas, and Haymaker oats.
10	Commercial Cocktail 4	(Imperial Seed TG Silage Biomass 2): Sorghum Sudangrass, Japanese millet, Winner brand berseem clover, and Forage collards.
11	Local Cocktail	(Warm-season grass-dominated cocktail): Proso millet, Sorghum Sudangrass, Pearl millet, and DL Delicious peas.
12	CDC Maverick Barley	Monocrop (control 1)
13	CDC Haymaker Oats	Monocrop (control 2)

The site was seeded on 27 May 2022 using a Fabro plot drill with disc-type openers on 9" row spacing at a depth 1" depth with a soil temperature of 9.6 degrees Celsius. Six rows of 8-metre-long were sown per plot. Bi-weekly volumetric water content measurement was undertaken to assess the moisture availability within the soil during the growing season and to aid in water-use efficiency estimates. The water-use efficiency refers to how adequate plants use water for biomass production. This was determined by dividing the total biomass of forage by the total amount of precipitation during the growing season. The cocktail was subsequently harvested on August 23, 2022 and analyzed for forage productivity and quality.

Results

Forage dry matter yield and quality indicators

The average forage yield for all treatments was 4,852 lb/ac. The CDC Haymaker oats had the highest forage yield of 6,055 lb/ac while commercial cocktail 4 recorded the lowest of 3,374 lb/ac (Table 11). Forage yield for producer cocktails varied between 5,329 lb/ac for producer mix 2 to 3,926 lb/ac for producer cocktail 3. In commercial cocktails, a significantly higher yield of 5,685 lb/ac was noted in commercial cocktail 3, while commercial cocktail 4 had the lowest of 3,374 lb/ac (Table 11). Generally, except for commercial cocktails 2 and 4, all commercial cocktails were better compared to producer cocktails and the CDC Maverick barley. The results for 2022 demonstrated a substantial increase in forage yield compared to the previous year (2021, see PCBFA 2021 Research Report) when the same treatments were investigated.

Crude protein (CP): CP content was highest in commercial cocktail 4 (22.2%), followed by local cocktail mix dominated by warm-season crops (15.8%). The lowest CP was recorded in CDC Haymaker oat (12.1%), producer cocktail 4 (12.2%), producer cocktail 1 (12.4%), and CDC Maverick barley CT (12.6%). Overall, producer cocktail 3 (14.6%), producer cocktail 5 (14.3%), and commercial cocktail 4 (22.2%) were above the average CP content of 14% (Table 11). Generally, the producer cocktails were superior in CP to commercial cocktails and mono-crops. However, all treatments herein had adequate CP contents to meet the requirements of all classes of mature beef cattle (7, 9 and 11% CP) and growing calves (12-14% CP).

Total digestible nutrients (TDN): Energy levels within cocktails ranged between 46% for commercial cocktail 4 to 64.7% for CDC Maverick barley. Except for producer cocktail 1 (48.3%), all producer cocktails were above 60% of TDN (Table 11). On the other hand, commercial cocktails were generally low in TDN (between 46.3 to 48.3%). Only producer cocktails contained adequate energy for dry gestation cows. Overall, TDN in 2022 decreased substantially compared to 2021 when the same treatments were investigated.

Neutral detergent fibre (NDF) and acid detergent fibre (ADF): NDF was significantly different among treatments ranging from 47.3% for producer cocktail 5 to 53.9% for commercial cocktail 4. Commercial cocktails 4 (47.3%) and 5 (47.7%) had better NDF, an indication of better uptake and consumption by cattle. Conversely, ADF was low for all treatments ranging from 30% for producer cocktail 5 to 43% for commercial cocktail 5. Here, producer cocktails 3 (30.8%), 4

(30.5%), and 5 (30%) were the best performers (Table 11). This indicates a better digestibility over the other treatments.

*Table 11. Forage dry matter yield and quality indicators for cocktails and monocrops, Fairview 2022. *NA, data not available.*

Cocktail treatment	DMY (lbs/acre)	CP (%)	ADF (%)	NDF (%)	TDN (%)
Producer cocktail 1	4,883	12.4	36.6	52.7	46.3
Producer cocktail 2	5,329	13	35	51.8	48.3
Producer cocktail 3	3,926	14.6	30.8	49.3	63.5
Producer cocktail 4	4,620	14.3	30	47.3	64.5
Producer cocktail 5	4,366	12.2	30.5	47.7	63.3
Producer cocktail 6	4,876	13.1	31.9	52.0	63.3
Commercial cocktail 1	5,672	12.7	36.4	53.9	46.0
Commercial cocktail 2	4,076	12.9	33.4	50.4	62.5
Commercial cocktail 3	5,685	13.4	35.9	51.9	47.3
Commercial cocktail 4	3,374	22.2	33.7	NA*	NA
CDC Maverick barley	4,731	12.6	32.4	50.0	64.7
CDC Haymaker oats	6,055	12.1	34	53.4	52.5
Local cocktail mix	5,480	15.8	43	NA	NA
MEAN	***4,852***	***14***	***34.1***	***50.9***	***56.4***
P-Value	*0.05*	*0.001*	*0.001*	*0.003*	*0.001*
Lsd 0.05	*1484*	*2*	*3.9*	*3.9*	*4.8*

Water-use efficiency (WUE)

The ability of treatments to use water efficiently varied significantly. The CDC Haymaker oat was the highest (3,167 lb/inch of water), while commercial cocktail 4 had the lowest (1,891 lb/inch of water). This is reflected in the observed biomass production during the year (2022). Overall, the average WUE was 2,645 lb/inch (Table 12). Except for commercial cocktail mix 2 (2,246 lb/inch) and 4 (3,215 lb/inch), and CDC Maverick barley monocrop (2,478 lb/inches), the other commercial treatments were above the average WUE. Conversely, with the exception of producer cocktail 2 (2,961 lb/inch) and 6 (2,726 lb/inch), WUE for all producer cocktails was below the mean WUE. Overall, highly multispecies cocktails were better in WUE compared to fewer species cocktails (Table 12).

Soil infiltration rate and normalized difference vegetative index (NDVI)

The soil coverage and greenness (NDVI) of individual treatments were significant during the growing season. The results showed values between 0.69 and 0.76 for all treatments indicating a good growth of plant species. Except for commercial cocktail 5 (0.69), all treatments had values above 0.70 (Table 12). Soil infiltration rate also ranged between 8.4 inches/min for CDC Maverick barley to 63 inches/min for producer cocktail 1. Evidently, producer cocktail 1 had the highest infiltration rate followed by commercial cocktail 1. Generally, soil infiltration rates for producer cocktails were better than commercial cocktails and mono-crops. This indicated that producer cocktails in part improved the soil better than other treatments.

Table 12: Normalized difference vegetative index (NDVI), soil infiltration rate, and water use efficiency of cocktails and mono-crops, Fairview 2022.

*NS indicates not significant; * shows a significant difference.*

Cocktail Treatments	**NDVI**	**Infiltration (inches/min)**	**WUE (lb/ac)**
Producer cocktail 1	0.73	63	3215
Producer cocktail 2	0.73	13.4	2961
Producer cocktail 3	0.75	13.2	2105
Producer cocktail 5	0.74	7.4	2412
Producer cocktail 4	0.72	7.4	2540
Producer cocktail 6	0.73	8.1	2726
Commercial cocktail 1	0.75	31.8	3215
Commercial cocktail 2	0.71	13.6	2246
Commercial cocktail 3	0.76	10.4	3083
Commercial cocktail 4	0.77	20.2	1891
CDC Maverick Barley	0.74	8.4	2478
CDC Haymaker Oat	0.76	17	3167
Local cocktail mix	0.69	10.6	2928
MEAN	0.74	17.3	2645
p value Treatment	0.03	0.42	0.039
p value Year	NS	NS	*
p value Treatment x Year	NS	NS	*
LSD 0.05	0.06	NS	757

Conclusion

This study showed that the highest dry matter yields were in CDC Haymaker oats, commercial cocktail 1 and commercial cocktail 3. Generally, commercial cocktails yielded higher than producer cocktails and CDC Maverick barley monocrop. Overall, all treatments would provide adequate crude protein for all classes of beef cattle. Only producer cocktails had the right energy levels for dry gestation cows. Forage intake and digestibility would be better in commercial cocktails 4 and 5 and producer cocktails 3, 4, and 5. The CDC Haymaker oat and commercial cocktail 4 used water more efficiently to produce biomass. In addition, sufficient water infiltration rate improvements were noted under producer cocktails.

Productivity Potential and Ecosystem Functions of Perennial Forage Mixtures

By Hayford Gyamfi
Department of Renewable Resources, University of Alberta

Introduction

Perennial forages in one form or another provide feed to livestock all year round. In the Peace region, producers use several grasses and legumes in their forage establishments. In addition, grass-legume mixtures have been noted to increase yield and improve quality compared to grass monocrops. However, across Alberta, questions from producers focus on how to improve their pastures or hay lands using combinations of grass and legume species to optimize forage-livestock systems. Apart from the enormous benefits of perennial mixtures to the cattle sector, mixed perennial forages can also provide beneficial effects within the soil-plant ecosystems which include water use efficiency. The objective of this study was to examine a variety of grass-legume mixtures and compare them to grass monocrops in terms of their yielding abilities, qualities, and water use efficiencies (WUE).

What we did to evaluate the different perennial forage mixtures

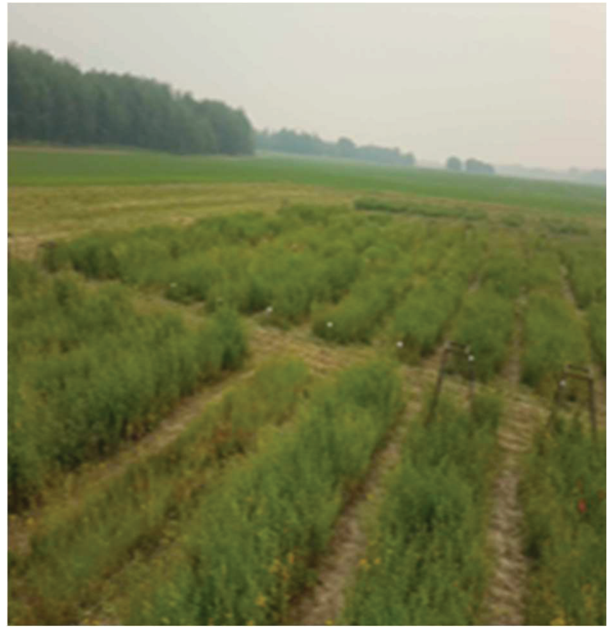
The trial was established in 2020 at the Fairview Research Farm in Fairview, AB. The field had a history of several years of wheat-canola rotation for grain production.

Experimental design and seeding: The research was arranged in a randomized complete block design with four replications. The treatments comprised of six simple grass-legume (1 grass:1 legume) and 18 complex diverse perennial forage species (i.e.: 3 or more grass-legume) mixtures, thus 3 grass-only mixtures, 2 legume-only mixtures and 13 grass-legume mixtures. In addition, there were 5 pure stands of perennial grasses, which were used for comparisons (controls). The grass species used in mixtures and monocultures were wheat grass (kirk crested wheatgrass and Greenleaf pubescent), orchardgrass, timothy grass, meadow bromegrasses, and 2 hybrid bromegrasses (Table 13).

Seeding was done using the 6-row Fabro plot drill equipped with disc-type openers at 9" on 2m wide x 8m long plots. Volumetric water content measurement was undertaken during the growing seasons of 2022 to aid in estimating the water-use efficiency of treatments.

In the first and second production years (2021 and 2022) forage dry matter (DM) yield was determined, and forage samples were analyzed for feed quality at A&L Canada Laboratory. The results for the first production year (2021) are available in the PCBFA annual report of 2021 (pages 50-53).

Grass-legume mixtures prior to harvest



Small plots of perennial forage mixtures

Our findings in the second production year

Forage DM yield and quality indicators of perennial forage for 2022

Forage yields were variably significant between treatments, ranging from 1,445 lb/ac for Mix 15 to 4,256 lb/ac for pure fleet meadow bromegrass (FMB). The top 5 highest yields were recorded in FMB (4,256 lb/ac), Mix 4 (3,631 lb/ac), Mix 14 (3,390 lb/ac), Mix 21 (3,480 lb/ac), and Mix 23 (3,346 lb/ac). Overall, monocrop grasses and "only-grasses" mixtures were poor in DM yield compared to grass-legume mixtures (Table 14).

Crude protein (CP): CP contents for all treatments were between 11 and 17% (Table 14). Grass-legume mixtures were generally superior to grass monocrops as observed in mix 1 (17%), mix 12 (16.7%), mix 14 (17%), mix 16 (16.6%), and mix 21 (16.6%) that contained both grasses and legumes. The number of legumes present in a particular treatment did not significantly affect the amount of CP in forage. CP contents in all forage treatments were adequate or even above adequate to meet the protein needs of beef cattle at different development stage (i.e., gestation, lactation, calving).

Neutral detergent fibre (NDF), Acid detergent fibre (ADF) and Neutral detergent fibre digestibility (NDFD-48hr): NDF across all treatments ranged from 44.2 to 57.6%, while ADF varied from 34.2 to 37.1%. Mix 14 and mix 16 were better in NDF (44.2 and 44.5%, respectively), while mix 13 ranked best in ADF (34.2%) when compared to all the other forage treatments. This makes mix 13, mix 14, and mix 16 the treatments with the lowest NDF and ADF, hence the best performers in terms of detergent fibre contents (Table 14). Furthermore, grass monocrops and all “grass-alone” mixtures recorded the highest NDFD (averagely 62.2%) compared to grass-legume mixtures. A higher NDFD will allow cows to eat more and digest efficiently to support their performance.

Total digestible nutrients (TDN): Energy levels in all forage treatments were above 60%. The highest %TDN was in grass monocrops and “grass-alone” mixtures such as orchard grass (67% TDN), timothy grass (67% TDN), mix 13 (68% TDN), and mix 15 (67% TDN). Notably, grass-legume mixtures were similar to grass-alone mixtures and pure grass stands (Table 14). The energy levels in forages are adequate to meet the requirement for dry pregnant beef cows (55% TDN mid pregnancy and 60% TDN at late pregnancy) and 65% for lactating beef cattle.

Water use efficiencies (for biomass and crude protein production)

The top performers for biomass WUE were mixes 4, 14, 21, and FMB. Among these treatments, mix 4 (76.3 lb/inch) and FMB (75.8 lb/inch) had the highest WUE (Table 15). Generally, grass-legume mixtures were better at using water efficiently to produce biomass compared to grass monocrops. Crude protein WUE significantly varied from 400 lb CP/inch for mix 15 to 1,185 lb CP/inch for mix 21. Overall, mix 14 (1,184 lb CP/inch), mix 21 (1,185 lb CP/inch), mix 22 (1,089 lb CP/inch), and mix 23 (1,082 lb CP/inch) had the highest crude protein WUE (Table 15).

Conclusion

The study has shown the forage yielding abilities and quality indicators of both grass-legume mixtures and grass monocrops and “grass-alone” mixtures. Generally, grass-legume mixtures were the highest in DM yield, CP and NDF while grass monocrops and “grass-alone” mixtures were better in ADF and %TDN. Even though several grass-legume mixtures contained different species of legumes, this did not seem to significantly influence the CP content. Furthermore, grass-legume mixtures were better at using water efficiently to produce biomass and crude protein compared to grass monocrops and “grass-alone” mixtures.

References

PCBFA 2021 Research. (2021). Progress Report on the forage production and quality potential and ecosystem functions of perennial forage mixes. Pages 50-53.

Table 13. Treatments (mixtures and grass monocrops) seeded in June 2020

Treatments	Forage species	Treatments	Forage species
Mix 0	Fleet meadow bromegrass AC Knowles hybrid bromegrass AC Success hybrid bromegrass Kirk crested wheatgrass Greenleaf pubescent wheatgrass	Mix 10	AC Yellowhead alfalfa AC Mountain view sainfoin Veldt cicer milkvetch AC Success hybrid bromegrass
Mix 1	Fleet meadow bromegrass AC Yellowhead alfalfa	Mix 11	Fleet meadow bromegrass Greenleaf pubescent wheatgrass AC Yellowhead alfalfa
Mix 2	AC Success hybrid bromegrass AC Yellowhead alfalfa	Mix 12	AC Success hybrid bromegrass Greenleaf pubescent wheatgrass AC Yellowhead alfalfa
Mix 3	AC Success hybrid bromegrass AC Yellowhead alfalfa	Mix 13	AC Saltander grass Slender wheatgrass Tall fescue
Mix 4	Fleet meadow bromegrass Spredor 5 alfalfa	Mix 14	AAC Mountain view sainfoin Veldt cicer milkvetch Spredor 5 alfalfa
Mix 5	AC Success hybrid bromegrass Spredor 5 alfalfa	Mix 15	AC Success hybrid bromegrass Greenleaf pubescent wheatgrass Kirk crested wheatgrass Italian rye grass Manchar smooth brome grass
Mix 6	AC Knowles hybrid bromegrass Spredor 5 alfalfa	Mix 16	AC Yellowhead alfalfa Rugged alfalfa Veldt cicer milkvetch AC Mountain view sainfoin Birdsfoot Trefoil
Mix 7	Fleet meadow bromegrass AC Yellowhead alfalfa AC Mountain view sainfoin	Mix 17	AC Success hybrid bromegrass AC Yellowhead alfalfa AC Mountain view sainfoin
Mix 8	AC Success hybrid bromegrass AC Yellowhead alfalfa AC Mountain view sainfoin	Mix 18	AC Success hybrid bromegrass Greenleaf pubescent wheatgrass AC Yellowhead alfalfa AC Mountain view sainfoin
Mix 9	Fleet meadow bromegrass AC Yellowhead alfalfa AC Mountain view sainfoin Veldt cicer milkvetch	Mix 19	AC Success hybrid bromegrass Greenleaf pubescent wheatgrass Italian rye grass AC Yellowhead alfalfa AC Mountain view sainfoin

Mix 20	AC Success hybrid bromegrass Greenleaf pubescent wheatgrass Rugged alfalfa AC Yellowhead alfalfa Veldt cicer milkvetch AC Mountain view sainfoin	Mix 23	AC Success hybrid bromegrass Greenleaf pubescent wheatgrass Kirk crested wheatgrass Italian rye grass AC Yellowhead alfalfa Rugged alfalfa Veldt cicer milkvetch AC Mountain view sainfoin
Mix 21	AC Success hybrid bromegrass AC Yellowhead alfalfa AC Mountain view sainfoin	Pure Grasses	Greenleaf pubescent wheatgrass Timothy grass Fleet meadow bromegrass Orchard grass Kirk crested wheatgrass
Mix 22	AC Success hybrid bromegrass Greenleaf pubescent wheatgrass AC Yellowhead alfalfa Veldt cicer milkvetch AC Mountain view sainfoin Birdsfoot Trefoil		

Table 14. Forage DM yield and quality indicators of perennial forage 2022

Treatment	DM yield (lb/ac)	CP (%)	ADF (%)	NDF (%)	TDN (%)	NDFD- 48
Mix 0	2738.9	12.3	35.7	54.1	65.8	62.1
Mix 1	3078.0	17.0	35.7	46.9	63.6	54.1
Mix 2	2738.9	16.1	35.5	48.6	63.9	55.5
Mix 3	2515.9	16.6	36.5	46.3	63.0	53.9
Mix 4	3631.2	15.7	37.2	49.3	62.6	54.4
Mix 5	2560.6	16.4	35.2	47.1	64.0	54.0
Mix 6	2649.8	16.6	36.2	45.1	63.8	52.6
Mix 7	2738.9	14.3	36.7	50.1	63.9	55.9
Mix 8	2498.1	15.3	35.6	47.1	64.5	54.2
Mix 9	2141.2	15.3	35.5	46.6	64.5	55.1
Mix 10	2426.7	15.4	35.9	49.0	64.1	55.3
Mix 11	2498.1	15.2	38.1	50.0	61.4	54.3
Mix 12	2185.8	16.7	35.0	45.2	64.6	53.7
Mix 13	1650.5	13.3	34.2	49.7	67.6	62.5
Mix 14	3390.4	17.0	35.5	44.2	62.7	52.9
Mix 15	1445.3	13.8	35.0	49.4	66.8	60.1
Mix 16	2899.6	16.6	35.0	44.5	64.2	54.3
Mix 17	2854.9	15.7	35.1	46.2	65.0	54.9
Mix 18	3006.6	15.9	35.7	46.7	63.9	54.1
Mix 19	2944.2	14.5	36.8	48.8	63.7	54.5
Mix 20	2765.8	14.4	35.6	47.8	64.3	54.8
Mix 21	3479.5	16.6	35.8	45.2	63.9	54.6
Mix 22	3122.6	17.0	35.5	46.6	62.8	53.4
Mix 23	3345.7	15.5	36.2	47.8	62.9	54.2
OG	2631.9	12.7	36.8	52.3	67.2	62.6
FMB	4255.7	10.8	39.0	57.7	64.9	62.4
GPWG	3214.5	11.2	38.0	56.7	64.8	61.9
KCG	3111.0	13.3	37.2	51.7	64.7	58.3
TG	2069.9	13.5	36.4	50.9	67.0	62.4

OG is orchard grass, FMB is fleet meadow bromegrass, GPWG is Greenleaf pubescent wheatgrass, KCG is Kirk crested wheatgrass, and TG is timothy grass.

Table 15. Biomass and CP as water use efficiencies of perennial forage treatments

Treatment	WUE	
	Biomass (lb DM/inch)	**CP (lb CP/inch)**
Mix 0	50.7	649.5
Mix 1	59.5	1023.6
Mix 2	52.7	849.0
Mix 3	52.5	872.8
Mix 4	76.3	548.8
Mix 5	51.6	876.8
Mix 6	52.3	872.2
Mix 7	53.4	759.5
Mix 8	50.3	759.9
Mix 9	41.5	630.7
Mix 10	50.0	764.6
Mix 11	49.4	756.6
Mix 12	44.1	735.0
Mix 13	32.2	414.7
Mix 14	70.1	1184.3
Mix 15	29.3	400.4
Mix 16	59.1	980.4
Mix 17	56.4	866.9
Mix 18	59.8	947.9
Mix 19	59.5	857.6
Mix 20	57.3	821.7
Mix 21	70.1	1184.8
Mix 22	64.2	1089.1
Mix 23	70.6	1081.6
TG	74.7	687.8
OG	49.6	627.4
FMB	75.8	819.2
GPWG	67.9	756.6
KCG	61.10	804.00

Intercropping Systems for Forage, Seed, and Ecosystem Functions in Fairview

Funded by Results Driven Agriculture Research (RDAR)

Intercropping is an eco-functional intensification practice that can boost crop productivity and address some of the major problems associated with modern farming practices such as pest and pathogen accumulation, soil degradation, and environmental deterioration. Intercropping is the practice of growing two or more crops in proximity. The most common goal of intercropping is to produce a greater yield on a given piece of land by making use of resources that would otherwise not be utilized by a single crop. With very few guidelines available to producers on this practice in the Peace Region, this project worked at providing producers with the information they need before embarking on large-scale intercropping operations.

What did we do?

The trial was conducted at PCBFA's Research Farm (NW-5-82-3W6M) on RR 35, MD of Fairview, AB. The site for the trial was summer fallowed the previous year. Before seeding the site was disced and harrowed and later pre-pass sprayed with glyphosate at 0.67 L/acre.

The experimental design was a 3 x 2 factorial design with 4 repetitions consisting of the following factors:

Intercropping combinations (3 mixes & 5 monocultures)

3 intercropping treatments:

1. Amarillo Peas at 1.64 bu/ac + 45H37 canola at 2.71 lb/ac (we seeded at 50% peas & 50% canola)
2. AAC Brandon Wheat at 1.10 bu/ac + Kentucky Pride Crimson Clover 6 lb/ac (we seeded at 60% wheat & 40% clover)
3. Arborg Oats at 1.72 bu/ac + Amarillo Peas at 2.45 bu/ac (we seeded at 50% oats & 75% peas)

5 monocrop treatments (controls):

1. Amarillo Peas monoculture at 3.33 bu/ac
2. 45H37 canola monoculture at 5.4 lb/ac
3. AAC Brandon Wheat monoculture at 1.83 bu/ac
4. Kentucky Pride Crimson Clover 15 lb/ac
5. Arborg Oats monoculture at 3.43 bu/ac

Seeding methods (2):

1. Same-row seeding (i.e., 2 crops in the same rows)
2. Alternate row seeding (i.e., side-by-side seeding)

The plots were seeded on May 27, 2022.

The average soil temperature and moisture at seeding were 15.5°C and 8.5% VWC (volumetric water content) respectively.

A fertilizer blend of NPKS at 141 lbs/acre at seeding was applied between rows (mid-row banding).

Peas, wheat, and oats were seeded at ¾ - 1" while clovers and canola were seeded at 0.5".

Data collection included canopy NDVI measurements, forage yield and quality, grain yield and grain protein content.

The plots were handed a few times.

What we found out

Results from testing of various intercropping treatments for grain and forage production are shown in Table 16.

Grain yields differed significantly between treatments with higher yields observed in monocultures compared to mixtures.

Grain protein values were generally >18 % with relatively high values for treatments with canola as monocrop or in mixtures. But for forage dry matter yields which varied significantly between the various treatments, NDVI readings and all forage quality indicators did not significantly differ between treatments. Crimson clover yielded the least (883 lbs/acre) while peas and canola seeded both in the same and alternate rows, each produced over 6,000 lbs/acre. Intercrops yielded better than monocultures highlighting the advantages that intercrops can bring to cropping systems while alternate row seeding showed a trend to higher yields compared to same row seeding. Forage crude protein levels were high and ranged between 12.1 to 15.8 %. Calcium contents were also relatively high with a range of 0.35 - 1.02 %, while phosphorus levels were < 0.20 %.

Water use efficiency, which measures the amount of grain/and or forage produced per unit of water used by a crop, was significantly influenced by the intercropping system. Peas and Canola intercrop, in both seeding methods of the same and alternative rows, had a significantly lower grain yield (bu/ac) and water use efficiency (Figure 4). On the other hand, when seeded in the same row, intercropping Wheat and Clover optimized water the most and was able to have a higher grain yield than all the other intercropping systems and was comparable to seeding a wheat monocrop. Intercropping Peas and Wheat in alternative rows had a greater advantage in terms of grain yield (bu/ac) and water use than seeding it in the same rows. Noteworthy is the observation that the treatments which came in high in terms of WUE in grain yield were lower in terms of forage yield.

Implication of results

In conclusion, intercrops bring an advantage in mostly forage production but not grain production as monocrops yielded better in terms of grain yields while intercrops yielded better in terms of forage yield. This increased forage yield advantage from intercrops did not produce a corresponding forage quality advantage as both crops in the intercropping mixture seem to have 'diluted' themselves quality-wise in the mixture. This also is the case with WUE, for blends which used water more efficiently in terms of grain yield did not produce corresponding high forage yields. A better picture of WUE will be obtained when both grain and forage yield are considered in its calculation.

Picture: Wheat and Clover Intercrop

Table 16. Grain and forage yield and quality of intercropping of cereals and pulses at alternate and same row seeding

	Grain		Forage														
Intercropping treatments	**Yield (Bu/ac)**	**CP (%)**	**TDMY (lb/ac)**	**NDVI**	**CP (%)**	**TDN (%)**	**Ca (%)**	**P (%)**	**Mg (%)**	**K (%)**	**Na (%)**	**Mo (ppm)**	**Fe (ppm)**	**Zn (ppm)**	**Cu (ppm)**	**Mn (ppm)**	**RFV**
Canola Monoculture	21.0	38.4	4742	0.66	12.0	59.7	0.87	0.14	0.40	1.05	0.15	0.29	2499	40	10	133	107
Clover Monoculture	0.1*	31.8	883	0.62	15.8	62.0	0.72	0.17	0.35	0.90	0.16	0.20	1181	42	9	92	142
Oats Monoculture	31.9	17.8	4613	0.72	12.1	56.5	0.64	0.13	0.39	0.84	0.33	0.17	1320	33	8	101	108
Oats/Pea-Alternate row	27.5	17.5	6265	0.71	12.2	60.3	0.35	0.15	0.26	0.77	0.44	0.20	1024	33	7	92	129
Oats/Pea-Same row	20.0	19.0	5702	0.72	12.1	60.3	0.36	0.15	0.23	0.90	0.18	0.18	1074	33	8	94	119
Peas Monoculture	7.8	28.2	3126	0.70	15.5	58.7	1.02	0.18	0.46	1.07	0.20	0.35	1953	36	10	106	126
Peas/Canola-Alternate row	11.4	31.4	6880	0.56	13.0	59.0	0.70	0.15	0.32	0.92	0.41	0.25	1341	34	7	100	119
PeasCanola-Same row	8.9	35.4	6406	0.61	14.3	62.7	0.70	0.17	0.30	0.99	0.27	0.19	678	34	6	78	126
Wheat Monoculture	45.7	24.4	4048	0.75	14.3	60.0	0.82	0.19	0.40	1.19	0.29	0.36	1355	32	7	107	110
Wheat/Clover-AR	38.3	20.2	6309	0.69	13.1	60.3	0.55	0.16	0.30	0.94	0.45	0.23	1008	35	8	95	113
WheatClover-SR	39.8	19.4	3506	0.77	14.1	61.7	0.89	0.18	0.38	1.16	0.17	0.19	769	31	7	78	128
MEAN	23.8	25.8	5042	0.68	13.5	60.2	0.69	0.16	0.34	0.98	0.28	0.24	1294	35	8	98	120
p value of treatments	0.001	0.04	0.02	0.65	0.36	0.91	0.62	0.77	0.59	0.77	0.81	0.60	0.83	0.92	0.93	0.87	0.74
$LSD_{0.05}$	16.2	18.4	4201	0.31	5.3	10.4	1.0	0.09	0.33	0.68	0.62	0.31	3165	19.9	8.5	90.0	52.8

*bushel weight of clover = 60 lbs

AR – alternate row

SR – same row

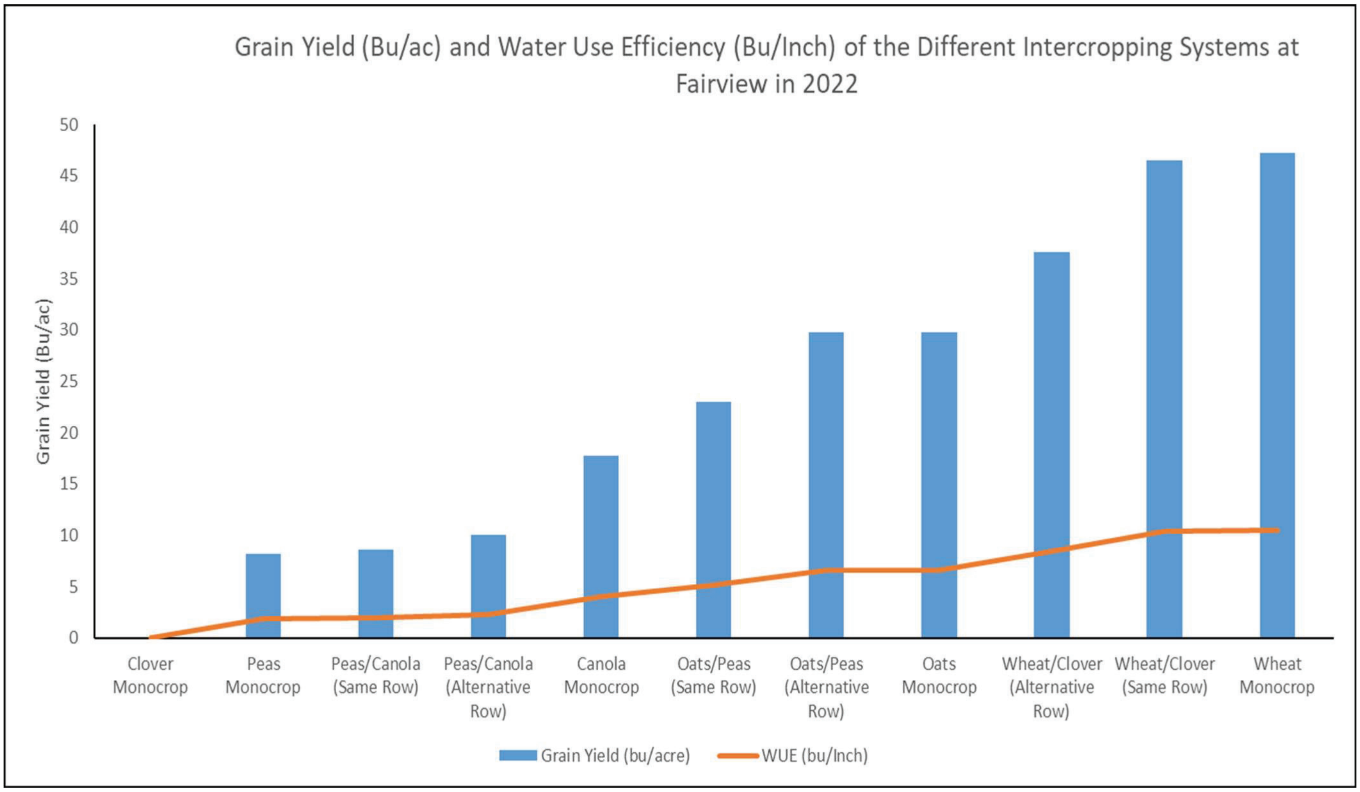


Figure 4. Grain Yield (bu/ac) and Water Use Efficiency (bu/inch) of the Different Intercropping Systems at Fairview in 2022

Exploring the merits of EcoTea™ seed treatment and foliar application on crop production

Privately Funded by the Overton Environmental (makers of EcoTea™)

Objective

To quantify the effects of EcoTea™ seed treatment and foliar applications on plant health and crop production.

Methodology

Site: Fairview Research Farm on RR 35, Fairview. Some surface soil characteristics of soil samples taken just before seeding in 2022 are shown in Table 17.

Table 17. Surface soil organic matter (SOM), cation exchange capacity (CEC) and pH information

Treatment	SOM (%)	CEC (meq/100g)	pH
EcoTea™ foliar feeder alone on stubble in fall (T4) (Soil rejuvenation)	7.6	17.6	5.4
EcoTea™ foliar feeder alone (T2)	7.3	19.4	5.0
EcoTea™ dry seed treatment + EcoTea™ foliar feeder (T3)	7.3	19.6	5.2
EcoTea™ dry seed treatment alone (T1)	7.1	20.6	5.1
Untreated control (T0)	7.7	16.2	5.2

- Cropping History: In rotation of Canola (2020) - Wheat (2021). Eco Tea treatments have been applied to the plots since 2019
- Crop seeded in 2022: Canola (CS2500CL)
- Experimental design: Randomized complete block design with 4 replications and the following 4 treatments:
    - Untreated control (T0)
    - EcoTea™ dry seed treatment alone (T1)
    - EcoTea™ foliar feeder alone (T2)
    - EcoTea™ dry seed treatment + EcoTea™ foliar feeder (T3)
    - EcoTea™ HDI Residue Digestor sprayed on plots Fall of 2021
- The trial had a total of 20 test plots (6 m x 20 m). A guard plots (also 6 m x 20 m in size) on both sides of the test plots to eliminate any crop contamination of the test plots.
- Seeding rate of canola: 75 plants per square meter.
- Seeding Date: May 24, 2022, with a 6-row drill at soil Moisture of 20.4 VMC%, and soil temperature of 10.3°C
- Pre-emergent was with StartUp glyphosate. Hand weeding of plots was done once.

Results

Grain Production & Quality

Eco Tea products have been applied on plots since the fall of 2019. In 2022, there was no significant difference in grain yield between the control and Eco tea Treatments imposed on Canola (ANOVA, p-value = 0.705). However, the grain yield showed some tendencies for improvement following the application of a residue digester on the crop stubble in the fall of the previous year (2021) (Figure 5).

Similarly, EcoTea Treatments had no significant improvement in Canola grain protein content (ANOVA= 0.30) (Figure 6).

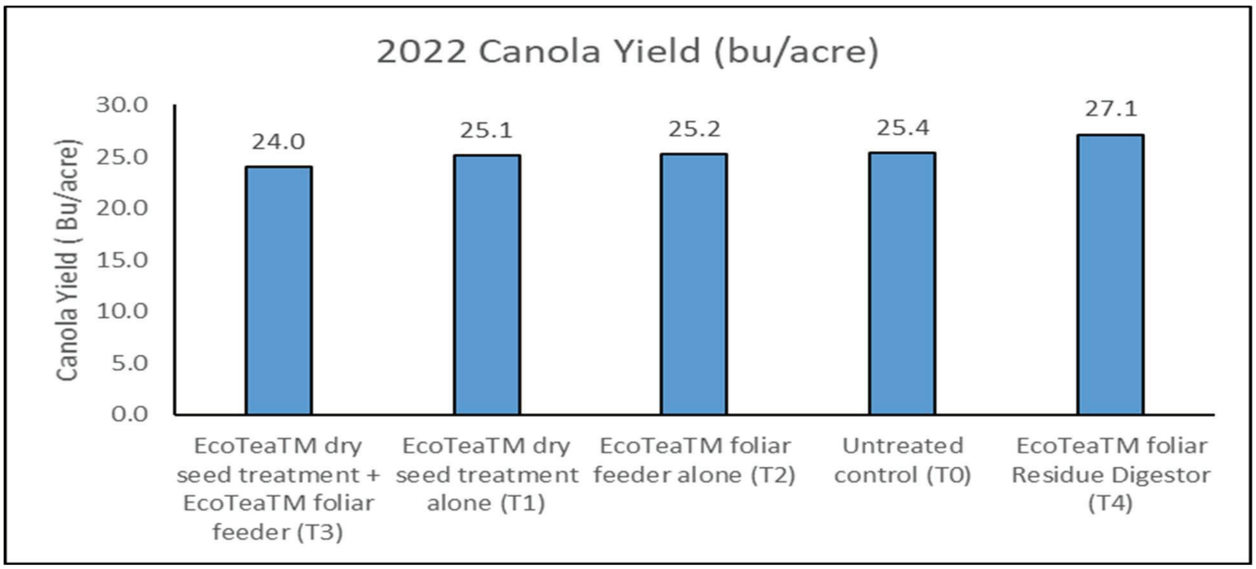


Figure 5. Canola yield in 2022 following the Eco Tea treatment applications

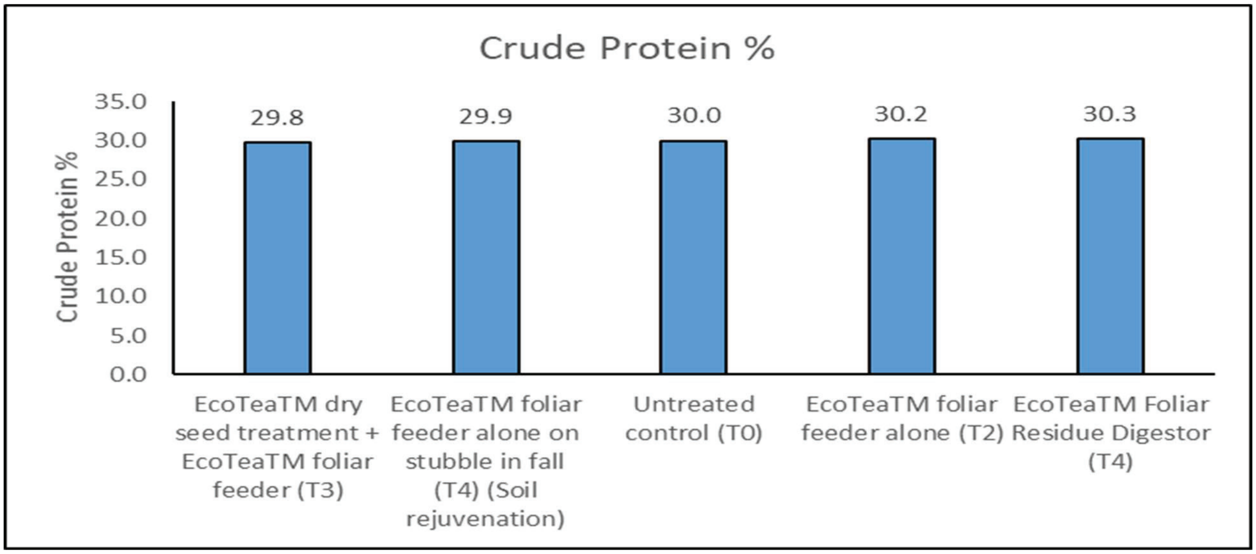


Figure 6. Canola grain protein content in 2022 following Eco Tea treatment applications

Picture: EcoTeaTM dry seed treatment + EcoTeaTM foliar feeder (T3)

Teepee Creek Research Sites

Forage Dry Matter Yield and Nutritional Qualities of Alternative Forages

Forages are crucial to the sustainability of the livestock industry in Alberta. Over the years, producers have relied on a plethora of annual and perennial forage crops to supply feed for their farm animals. Although many traditional annual forages such as barley, oat, and triticale have been tested and used in animal feeding, there is still the need to focus on alternative forages of brassicas, forbs, and warm-season crops such as sorghum and millet which can equally complement the feeding regimes of producers. There is a concerted effort by PCBFA to examine non-conventional forage-type plant species as they become available. Such effort is geared toward collecting data on their agronomic performance, yield, and nutritional values under the Peace Region's local conditions.

The objective of this field trial was to evaluate the agronomic performance, DM yield and feed quality of 3 cool-season grasses, 2 forbs, 5 warm-season grasses, 4 brassicas, and a legume.

How we evaluated the alternative forage-type crops

The study was carried out at Garth Isaac's farm in Teepee Creek (Hwy 733 and Hwy 674). The previous crop at the site before seeding in June 2022 was wheat.

The crops were arranged in randomized complete block design in 4 replications. Table 18 shows the crops seeded and their respective seeding rates.

Table 18. The alternative crops seeded and their seeding rates

Cool-season annual grasses
1. AB Tofield Barley @ 2.74 bu/ac 2. Bunker Triticale @ 2.69 bu/ac 3. CDC Baler Oats @ 3.4 bu/ac
Brassicas
1. Forage Brassica Vivant @ 5 lb/ac 2. Forage radish @ 5 lb/ac 3. Hercules Forage Turnip @ 10 lb/ac 4. Akela Forage Rape @ 10 lb/ac
Warm-season annual grasses
1. Japanese Millet @ 20 lb/ac 2. Millet (Proso) @ 25 lb/ac 3. NS B Sorghum Sudangrass @ 22 lb/ac 4. NS D BMR Sorghum Sudangrass @ 22 lb/ac 5. Pearl millet @ 15 lb/ac
Forbs
1. Phacelia @ 8 lb/ac 2. Plantain @ 8 lb/ac
Legume
1. Chickling vetch @ 70 lb/ac

Our Findings

Forage Dry Matter (DM) Yield

Forge DM yield ranged from 1,040 lb/ac for Pearl millet to 4,972 lb/ac for AB Tofield barley. In general, cool-season forage crops had the highest DM yield, while warm-season annual grasses were the lowest in terms of forage production. However, the 3 lowest producing treatments, NSB Sorghum Sudangrass, plantain, and NSD BMR Sorghum Sudangrass produced DM yield above 1,000 lb/ac (Table 19). Comparing the AB Tofield barley to Pearl millet, the former produced 3,932 lb/ac of forage over the latter, confirming the poor adaptation and productivity of Pearl millet in the Peace Region (Table 19).

For the forbs and brassicas, phacelia produced 3,722 lb/ac of forage making it the second highest treatment followed by the forage radish and chickling vetch with 3,700 and 3,569 lb/ac, respectively.

Overall, the cool-season annual grasses ranked 1st, followed by brassicas (2nd), legume (hairy vetch, 3rd), forbs (4th), and warm-season annual grasses (5th).

Forage Quality

Forage Crude protein (CP) content - The forage CP ranged from 6.9% for Bunker triticale to 18% for Akela forage rape. Plantain produced the second-highest CP content (17.7%). Except for Akela forage rape, other brassicas produced similar CP content, approximately between 15.3 and 15.8% (Table 19). For warm-season grasses, only Pearl and Japanese millet produced CP content greater or equal to brassicas (15.8 and 15.9%). Overall, cool-season grasses did not contain adequate CP to meet the requirements of all classes of cattle, while brassicas, forbs, legume, and warm-season grasses had adequate CP content for dry gestation and lactating cows. Evidently, CP content in forages was in the order of brassicas>forbs>warm-season grass>legume>cool-season grass was observed.

Neutral detergent fibre (NDF) and Acid detergent fibre (ADF) - NDF ranged from 32.7% for Akela forage rape to 61.5% for NS B Sorghum Sudangrass while ADF ranged from 23.4% for AB Tofield barley to 38.5% for NS B Sorghum Sudangrass. The Akala forage rape had the best NDF of 32.7% while AB Tofield barley was the best in ADF with 23.4%. Generally, warm-season grasses were higher in both NDF (between 54.2 and 61.5%) and ADF (between 32.8 to 38.5%). This indicates that forage consumption and digestibility by cattle will be limited due to the higher fibre content in these grasses. In addition, both phacelia (44.5%) and plantain (43.8%) were better in NDF compared to all cool-season grasses but were similar in NDF contents (Table 19). However, the NDF (41.9%) and ADF (31.7%) of chickling vetch were better than both forbs and warm-season grasses.

Total digestible nutrients (TDN) - The forage TDN measured as a form of energy was different for all the treatments in the study. Except for NS B Sorghum Sudangrass (59.1%), the %TDN was mostly above 60%. The AB Tofield barley had the highest TDN (70.8%) while NS B Sorghum Sudangrass had the lowest (59.1%). Overall, cool-season grasses were higher in %TDN than warm-season grasses and forbs while the chickling vetch (64.2%) was also higher compared to forbs. Generally, the %TDN of treatments is adequate for matured beef cattle (55-65%) for either pregnant or lactating cows and 65-70% for calves.

Table 19. Forage DM yield and feed nutritional quality of different cool and warm-season grasses, brassicas, forbs, and legume

Alternative Forage	**Forage DM Yield (lbs/acre)**	**CP (%)**	**NDF (%)**	**ADF (%)**	**TDN (%)**	**RFV**
AB Tofield Barley	4972	8.6	41.8	23.4	70.8	157
Akela Forage Rape	2793	18	32.7	28	67.1	213
Bunker Triticale	4213	6.9	51.3	30.7	64.7	119
CDC Baler Oats	4474	7.9	49	32	65.2	122
Chickling vetch	3569	14.3	41.9	31.7	64.2	143
Vivant forage brassica	2971	15.3	30.8	26.8	68	213
Forage radish	3700	15.8	43.2	36.3	60.6	130
Hercules Forage Turnip	2197	15.8	34.9	24.9	69.5	183
Japanese Millet	2207	15.8	56	35.6	62.5	102
Millet (Proso)	2542	13.1	54.2	32.9	64.3	109
NSB Sorghum Sudangrass	1607	14.1	61.5	38.5	59.1	89
NSD BMR Sorghum Sudangrass	1371	15.1	58.1	35.9	61.9	98
Pearl millet	1040	15.9	55.7	36.4	64.1	101
Phacelia	3722	11.8	44.5	35.7	61.1	128
Plantain	1167	17.7	43.8	32.3	63.8	135
MEAN	**2832**	**13.4**	**48**	**32.3**	**64.4**	**132**
p value Forage	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
p value Year	*0.02*	*0.04*	*0.5*	*0.00*	*0.99*	*0.33*
p value Forage x Year	*0.48*	*0.63*	*0.1*	*0.09*	*0.24*	*0.6*

Minerals - Calcium (Ca) content varied from 3.4% for phacelia to 0.3% for Bunker triticale. Notably, Ca content was lower in both cool and warm-season grasses compared to brassicas, legume, and forbs (Table 20). This result indicated that all treatments met the Ca requirements in diets for lactating cows (0.31%), dry cows (0.18%), and calves (0.58%).

Phosphorus (P) ranged between 0.25 and 0.11%. The forage radish had the highest (0.25%) while NS B Sorghum Sudangrass had the lowest (0.11%). Generally, cool and warm season grasses had the lowest levels of P while brassicas, legume and forbs were high (Table 20). Nevertheless, only brassicas and the plantain forb (≥0.21%) met P requirement for lactating and dry cows (0.16%) but not growing calves (0.26%). Forbs, legume, and CDC baler oats met the P requirements for dry cows but did not meet the needs of both lactating cows and growing calves. Furthermore, Potassium (K) contents varied between 3.0% for forage brassica vivant and 1.1% for Bunker triticale. All tested crops were adequate to meet the K requirement of both lactating cows (0.60%) and growing calves (0.70%). Magnesium (Mg) was generally higher in all forage crops tested except for Bunker triticale (0.19%) which was slightly deficient. Sodium (Na) on the other hand was lower in legume, phacelia, and all warm-season grasses. However, all cool-season, brassicas and plantain forage crops were adequate in sodium for all classes of cattle.

Relative feed value (RFV) - The RFV was highest in both Akela forage rape and forage brassica vivant (213.0, respectively) and lowest in NS B Sorghum Sudangrass (89.0). With the exception of forage radish (130.0), brassicas were superior in RFV to all other forage crop treatments. However, cool-season grasses, legume, and forbs had better RFV compared to warm-season grasses (Table 19). Overall, brassicas ranked as 1st, legume as 2nd, cool-season grasses as 3rd, forbs as 4th, and warm-season grasses as 5th. This result indicates higher expected consumption and digestibility of brassicas compared to other forage treatments in the trial.

Table 20. Mineral content of alternatives compared to oats, barley and triticale

	Minerals				
Alternative Forage	**Ca (%)**	**P (%)**	**K (%)**	**Mg (%)**	**Na (%)**
AB Tofield Barley	0.4	0.13	1.4	0.2	0.32
Akela Forage Rape	2.0	0.22	2.8	0.55	0.38
Bunker Triticale	0.3	0.12	1.1	0.19	0.18
CDC Baler Oats	0.4	0.16	1.4	0.24	0.39
Chickling vetch	1.1	0.17	1.5	0.29	0.05
Vivant forage brassica	2.3	0.23	3.0	0.58	0.42
Forage radish	1.9	0.25	2.1	0.37	0.29
Hercules Forage Turnip	2.3	0.21	2.8	0.49	0.43
Japanese Millet	0.7	0.13	2.0	0.37	0.02
Millet (Proso)	0.4	0.12	1.2	0.31	0.04
NS B Sorghum Sudangrass	0.5	0.11	1.3	0.27	0.05
NS D BMR Sorghum Sudangrass	0.6	0.13	1.5	0.28	0.01
Pearl millet	0.9	0.14	1.4	0.34	0.04
Phacelia	3.4	0.19	2.5	0.62	0.04
Plantain	1.8	0.21	2.1	0.35	0.6
MEAN	***1.1***	***0.16***	***1.8***	***0.35***	***0.2***
p value Forage	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
p value Year	*0.14*	*0.001*	*0.04*	*0.1*	*0.93*
p value Forage x Year	*0.23*	*0.14*	*0.4*	*0.91*	*0.98*

Conclusion

This trial demonstrated that cool-season grasses (barley, oats, and triticale) are high-yielding forage compared to other forage crops tested. However, it was also noted that brassicas, legume, and the phacelia forb can equally do well in forage yield. The lowest producing forage treatments were warm-season grasses confirming their poor adaptability and growth in the Peace region. Though cool-season grasses were better at biomass yield it was the poorest in nutritional qualities such as CP content, while brassicas, legume and forbs were better in feed nutritional value. Minerals were also adequate in all forage crops tested; however, it is recommended that free-choice minerals be supplied through feeding in their right proportions to ensure better absorption and utilization by cattle.

Pulse/Cereal Mixtures for Improved Forage Production

Funded by the Canadian Agricultural Partnership
(Government of Canada and Government of Alberta)

Pulse cereal mixtures provide an alternative option for forage crop production in the Peace Country (PC). Pulses added to cereals can improve yields and feed quality. Forage peas are the most common pulse added to cereal mixes but faba beans are an interesting alternative which is gaining popularity as a pulse crop amongst PC producers. Pulse cereal mixtures allow for symbiotic relationships, nitrogen fixation capabilities, and resource use complementarities amongst seeded cereal and pulse crop species. Such mixtures can be used for greenfeed, silage or grazing as an annual pasture. Forage peas are a valuable crop for forage. In the PC, cultivated as a pure crop, a few forage peas are prone to lodging and susceptible to biotic and abiotic stress. This can lead to diminished crop performance and inferior forage quality. This therefore shows the importance of intercropping peas with cereals.

Objective

To compare cereal/pulse mixtures to monocrops of oats, barley, and spring triticale in terms of forage DM yield and quality.

Methods

Location: This project was conducted at Garth Isaac's farm in Teepee Creek.
Cropping history: Summer fallow.
Experimental design and treatments: A randomized complete block design was used in four replications on small plots measuring 8 m x 1.14 m and 0.65 m alleyways between plots. Three cereal monocrop varieties and 12 cereal pulse mixtures were seeded to determine the forage yield and quality advantages of the mixtures. Refer to Table 21 for the complete list of mixtures and monocrops and their seeding rates in lbs/acre.

Table 21. Pulse/Cereal mixture seeding rates

No	Treatment	Seeding Rate (lbs/acre)
1	CDC Austenson Barley (Monocrop)	141
2	CDC Baler Oats (Monocrop)	111
3	Taza Triticale (Monocrop)	170
4	CDC Austenson Barley/Aberdeen Peas	72/192
5	CDC Austenson Barley/Tesoro Faba Beans	72/150
6	CDC Austenson Barley/Delicious peas	72/150
7	CDC Austenson Barley/Snowbird Faba Beans	72/130
8	CDC Baler Oats/Snowbird Faba Beans	61/159
9	CDC Baler Oats/Aberdeen Peas	61/192
10	CDC Baler Oats/DL Delicious Peas	61/130
11	CDC Baler Oats/DL Tesoro Faba Beans	61/150
12	Taza Triticale/Aberdeen Peas	85/192
13	Taza Triticale/Tesoro Faba Beans	85/150
14	Taza Triticale/DL Delicious Peas	85/130
15	Taza Triticale/Snowbird Faba Beans	85/159

Seeding

- Cereal seeds were treated with Vibrance Quattro cereal seed treatment before seeding.
- Cereal monocultures (controls) were seeded at 100% (300 plants/m^2 for barley and oats and 370 plants/m^2 for triticale), while mixtures were targeted at 50% of cereal crop and 75% for pulse crop in a mixture, as follows:
    1. Barley and Oats: 150.0 plants/m^2 (13.9 plants/ft^2)
    2. Spring Triticale: 185 plants/m^2 (17.2 plants/ft^2)
    3. Peas: 68 plants/m^2
    4. Faba beans: 33 plants/m^2
- The target seeding rate calculation for the small plot area was based on 1,000 kernel weight, germination, plot area and 5% mortality rate.
- This project was seeded on June 1, 2022, with a 6-row Fabro Plot drill and at a seed depth of 1''.
- The soil temperature and moisture measured in the top 6'' was 22.0°C and 30.0% Volumetric water content (VWC), respectively.

Fertility

Fertilizer was applied through mid-row banding. The fertilizer rate was determined based on soil test results completed at 0-6'' before seeding. The N, P, K, and S application rate was 0 lbs/acre, 20 lbs/acre, 0 lbs/acre, and 10 lbs/acre, respectively.

Spraying

A pre-pass spray was performed prior to seeding using StartUp® herbicide at a rate of 0.67 L/acre on May 20, 2022. No pre-emergence spray was carried out. In-crop spraying was performed with Basagran Forte at 0.8 L/acre on June 24, 2022.

Harvest

Time of harvest was determined based on crop development, which was when barley was at the soft dough stage, while oat was at the milk stage and triticale at the late milk stage. Plots were harvested on August 9, 2022, using a forage harvester. Forage samples for each variety were sent to A&L Laboratory in Ontario for quality analysis.

Results

Table 22 shows the summary results for pulse-cereal mixtures and cereal monocultures at Teepee Creek. Forage DM yields obtained from seeding monoculture cereals were mostly higher than those obtained with the same cereals seeded with pulses. Spring taza triticale monoculture was exceptionally higher than other cereal monocultures and their mixtures.

As expected, the CP contents of mixtures were mostly higher than those of cereal monocultures (Table 22). Surprisingly, fibre (NDF and ADF) contents of cereal pulse mixtures were mostly not different from those of the monoculture cereals (Table 22). The energy (TDN) values obtained from the pulse-cereal mixtures and monocultures were mostly above 65% and will meet the nutrient requirements of lactating as well as growing beef cattle stock. Calcium levels were generally higher for all treatments and greatly surpassed the needed 0.31% Ca by mature beef cattle (Table 23).

P ranged from 0.22 to 0.50% (Table 23). Mixtures containing faba beans produced forages with far more P content than other mixtures and cereal monocultures. The level of K in pulse cereal mixtures/monocultures ranged from 1.27 to 1.60% (Table 23) and will meet and surpass minimum nutrient requirements for all beef cattle stock.

Implications and Conclusions

Intercrops usually have a yield advantage over the same crops grown separately. This is not the case here in this trial, but the results of this trial can still help producers optimize the use of this type of intercropping. These intercrops are resilient and require no nitrogen fertilizer or herbicide applications. The cereal component prevents the pea component from lodging. Intercrops can contribute to low input systems in particular. We observed that in terms of lodging, spring triticale and semi-leafless forage are ideal intercropping partners; with no lodging expected even with strong winds.

Table 22. Forage DMY and some quality indicators of pulse-cereal mixtures grown at Teepee Creek

Pulse cereal mixtures	TDMY (lbs/acre)	CP (%)	NDF (%)	ADF (%)	TDN (%)
CDC Austenson Barley (Mono)	5,710	9.0	47.9	31.1	68.8
CDC Austenson Barley/Aberdeen Peas	3,988	9.6	43.0	28.3	69.1
CDC Austenson Barley/Tesoro Faba Beans	6,410	10.4	48.2	31.6	68.3
CDC Austenson Barley/Delicious peas	3,798	10.1	44.8	29.2	67.9
CDC Austenson Barley/Snowbird Faba Beans	4,572	10.4	45.7	29.5	69.7
CDC Baler Oats (Mono)	4,875	9.9	51.2	33.2	66.4
CDC Baler Oats/Snowbird Faba Beans	4,392	10.8	49.4	32.9	66.7
CDC Baler Oats/Aberdeen Peas	3,428	10.7	47.3	32.7	66.1
CDC Baler Oats/DL Delicious Peas	3,230	10.8	51.5	32.4	67.3
CDC Baler Oats/DL Tesoro Faba Beans	4,673	11.1	50.1	34.2	67.0
Taza Triticale (Mono)	7,347	8.4	51.5	30.2	68.2
Taza Triticale/Aberdeen Peas	5,314	12.0	53.5	38.5	63.9
Taza Triticale/Tesoro Faba Beans	6,268	8.8	8.8	33.4	67.1
Taza Triticale/DL Delicious Peas	6,359	9.7	50.0	31.0	66.1
Taza Triticale/Snowbird Faba Beans	4,564	10.7	49.0	32.0	65.7

Table 23. Forage Ca, P, K and Mg, and Relative Feed Value (RFV)of pulse-cereal mixtures grown at Teepee Creek

Pulse cereal mixtures	**Ca (%)**	**P (%)**	**K (%)**	**Mg (%)**	**RFV**
CDC Austenson Barley (Mono)	0.80	0.37	1.34	0.23	122
CDC Austenson Barley/Aberdeen Peas	0.68	0.20	1.28	0.25	147
CDC Austenson Barley/Tesoro Faba Beans	0.88	0.45	1.55	0.22	128
CDC Austenson Barley/Delicious peas	0.74	0.21	1.27	0.25	137
CDC Austenson Barley/Snowbird Faba Beans	0.91	0.43	1.53	0.23	132
CDC Baler Oats (Mono)	0.86	0.39	1.54	0.25	118
CDC Baler Oats/Snowbird Faba Beans	0.97	0.43	1.60	0.24	124
CDC Baler Oats/Aberdeen Peas	0.88	0.22	1.50	0.27	131
CDC Baler Oats/DL Delicious Peas	0.85	0.23	1.54	0.28	125
CDC Baler Oats/DL Tesoro Faba Beans	1.02	0.40	1.50	0.26	117
Taza Triticale (Mono)	0.89	0.50	1.48	0.15	127
Taza Triticale/Aberdeen Peas	1.16	0.46	1.35	0.26	109
Taza Triticale/Tesoro Faba Beans	0.85	0.43	1.42	0.21	116
Taza Triticale/DL Delicious Peas	0.50	0.32	1.59	0.21	117
Taza Triticale/Snowbird Faba Beans	0.71	0.42	1.47	0.23	123

In Search of Adaptable Low-Heat Corn Hybrids for Winter Feeding Systems

Funded by Results Driven Agriculture Research (RDAR)

Though several corn hybrids are available on the market, Peace Country (PC) producers will benefit more from silage and grazing corn hybrids with lower heat units suited for the unique agroecology of a short growing season. Being able to identify corn hybrids that can produce substantial forage biomass and moderate feed quality, will reduce winter feed costs by extending the grazing season into the later part of fall and even winter. Hence the need to test several corn hybrids with the required corn heat units (CHU) for parts of the PC for their forage production potential and water use efficiency.

What we did

The trial was conducted at Mack Erno's farm on RR #2, Teepee Creek, near Sexsmith.

We tested 16 corn hybrids. These hybrids, their CHU and sources are presented in Table 24.

Table 24. Corn hybrids and Corn Heat Units

Corn hybrid	Corn Heat Unit (CHU)	Company
39F44	2000	Corteva
6909	1950	Corteva
6910	1950	Corteva
7005	2000	Corteva
7202	2050	Corteva
7211	2050	Corteva
7213	2050	Corteva
XP21070G2	2000	Pride Seed
A3993G2 RIB	2025	Pride Seed
DKC21-36	2075	BAYER- Dekalb
DKC24-06	2100	BAYER- Dekalb
EXP70-21	2025	BAYER- Dekalb
PS Ex Seed LFRR	2550	PICKSeeds
PS2320RR	2300	PICKSeeds
PS2210VT2P RIB	2125	PICKSeeds
PS2420RR	2400	PICKSeeds

The corn hybrids were seeded on May 20, 2022, with a 12-row corn planter. The seeding rate used was 32,000 kernels per acre and seeds were placed at a depth of 1.25". The soil temperature and moisture (volumetric moisture content) at seeding from a 4" soil depth were 8°C and 19.5%, respectively.

No fertilizer was applied.

An in-crop spraying of Round-up at a rate of 0.67 L/acre was done on July 6, 2022.
The corn was harvested for forage on October 17, 2022. Data was collected for plant height, forage yield, quality and water use efficiency.

What we found and implications

Differences were observed between corn hybrids for corn forage dry matter yield and plant height with ranges of 1,962 to 3,803 lbs/acre and 113 - 163 cm, respectively (Table 25). Five of the 16 corn hybrids tested (6909 Corteva, 6910 Corteva, 7005 Corteva, DKC21-36, PS23200RR (PickSeeds) gave almost 2 tonnes/acre of forage DM.

Crude protein ranged between 7.1 - 10.7 % and varied significantly for the 16 corn hybrids (Table 25). Fibre and energy contents of the corn hybrids did not significantly differ from each other (Table 25), while for macro and microminerals, significant differences were observed for Ca (range of 0.14 – 0.32 %), Mg (range of 0.26 – 0.51 %), Fe (range 72 – 160 ppm) and Zn (range 18 -52 ppm) (Table 26). Although not significant, some corn varieties showed a greater advantage in WUE over other varieties (data not shown). This advantage is correlated to an increase in dry matter yield (lbs/ac) for some varieties.

Table 25. Corn forage DM yield and whole corn plant forage quality attributes of 17 corn hybrids planted in Teepee Creek 2022

Variety	TDMY (lbs/acre)	NDVI	Plant height (cm)	CP (%)	ADF (%)	NDF (%)	TDN (%)
39F44 (Corteva)	2,758	0.67	132	8.3	26.2	48.7	60.7
6909 (Corteva)	3,658	0.65	137	7.1	29.0	49.7	59.7
6910 (Corteva)	3,803	0.66	127	7.5	30.7	52.2	60.3
7005 (Corteva)	3,665	0.67	129	7.7	30.2	51.3	61.3
7202 (Corteva)	3,304	0.72	131	7.8	30.4	51.6	59.0
7211 (Corteva)	3,450	0.70	147	8.7	31.1	52.2	57.0
7213 (Corteva)	3,226	0.65	138	8.6	28.8	52.6	59.3
A3993G2 (Pride Seed)	2,288	0.67	126	9.0	28.8	51.5	57.7
DKC21-36(BAYER- Dekalb)	3,634	0.67	138	7.6	27.8	50.4	57.7
DKC24-06(BAYER- Dekalb)	3,426	0.64	154	7.8	27.9	49.6	61.7
EXP70-21(BAYER- Dekalb)	2,085	0.65	119	9.1	31.4	55.0	59.0
PS Ex Seed LFRR	2,180	0.59	121	10.3	35.4	59.9	58.7
PS2210VT2P RIB	2,467	0.66	135	10.7	30.3	54.0	59.7
PS2320RR(PICKSeeds)	3,743	0.63	163	8.3	30.6	53.7	59.3
PS2420RR(PICKSeeds)	2,078	0.63	113	10.2	31.1	52.2	59.7
XP21070G2 (Pride Seed)	1,962	0.57	131	8.3	29.3	53.2	58.0
7211 (Corteva)	3,814	-	126	8.0	30.3	51.1	60.0
MEAN	**2,991**	**0.65**	**133**	**8.6**	**29.9**	**52.3**	**59.4**
p value	0.002	-	0.001	0.02	0.09	0.52	0.95
$LSD_{0.05}$	1631	-	26.3	3.0	6.6	11.4	7.8

Table 26. Yield, plant forage quality attributes of 17 corn hybrids planted in Teepee Creek 2022

Variety	Ca (%)	P (%)	Mg (%)	K (%)	Fe (ppm)	Zn (ppm)	Mn (ppm)
39F44 (Corteva)	0.22	0.16	0.28	1.02	111	42	49
6909 (Corteva)	0.20	0.14	0.26	0.88	83	24	29
6910 (Corteva)	0.18	0.13	0.26	0.81	72	26	34
7005 (Corteva)	0.19	0.17	0.26	0.83	92	30	28
7202 (Corteva)	0.22	0.14	0.29	0.79	113	27	33
7211 (Corteva)	0.32	0.15	0.34	1.02	134	31	48
7213 (Corteva)	0.23	0.15	0.42	0.75	115	32	47
A3993G2 (Pride Seed)	0.24	0.15	0.41	0.70	102	38	55
DKC21-36(BAYER- Dekalb)	0.16	0.16	0.30	1.01	81	40	43
DKC24-06(BAYER- Dekalb)	0.14	0.14	0.29	0.93	84	36	46
EXP70-21(BAYER- Dekalb)	0.21	0.15	0.41	0.80	132	42	59
PS Ex Seed LFRR	0.28	0.14	0.40	1.22	168	39	68
PS2210VT2P RIB	0.25	0.16	0.51	0.84	150	53	72
PS2320RR(PICKSeeds)	0.20	0.14	0.34	0.88	106	36	58
PS2420RR(PICKSeeds)	0.23	0.16	0.41	1.04	160	44	53
XP21070G2 (Pride Seed)	0.25	0.14	0.38	0.77	124	53	63
7211 (Corteva)	0.21	0.14	0.27	0.87	107	18	32
MEAN	**0.22**	**0.15**	**0.35**	**0.89**	**114**	**37**	**49**
p value	0.001	0.38	0.03	0.88	0.001	0.006	0.23
$LSD_{0.05}$	0.08	0.04	0.21	0.78	52.7	22.7	49.2

Comparison of Some Common Annual Cereals for Forage Production

Funded by the Canadian Agricultural Partnership
(Government of Canada and Government of Alberta)

Forages are a major feed component for the cow-calf and backgrounding sectors of the beef industry and include annual forage crops which are largely utilized as stored feed (greenfeed, silage, baleage, etc.). Livestock producers grow large amounts of annual crops for feed (silage, greenfeed, and swath grazing). Both oats and barley form the bulk of these crops and are considered conventional annual forage resources. Triticale is growing in popularity amongst livestock producers. Peace Region (PR) producers are on the lookout for alternative annual forage crop with good forage potential able to considerably reduce the daily feed cost of beef cattle during the fall and winter months without sacrificing animal productivity. This project sought to evaluate alternative annual forage crops against the traditional Hay Maker oats and Maverick barley forage crops.

Methods

Location: This project was conducted at Garth Isaac's farm in Teepee Creek.

Experimental design and treatments: A randomized complete block design was used in four replications on small plots measuring 8 m x 1.14 m and 0.65 m alleyways between plots. Four barley varieties, 4 oat varieties, 3 wheat varieties and 1 triticale variety (all spring cereal varieties – see Table 27 for characteristics and seeding rates in lbs/acre) were seeded as monocrops to evaluate their forage yield and quality potential against traditional used Hay Maker oats and Maverick barley forage crops. Refer to Table 27 for the complete list of forage, their characteristics and seeding rates in lbs/acre.

Table 27. Treatments, characteristics and seeding rates in lbs/acre

No	Treatment	Characteristics	Seeding Rate (lbs/acre)
1	AAC Awesome SW Wheat	Awns variety	138
2	AAC Paramount SW Wheat	Awns variety	156
3	Whistler Gen Purpose Wheat	Awnless variety	125
4	AB Advantage Barley	6-row smooth awn forage	124
5	Canmore Barley	2 row rough awn feed and forage	124
6	CDC Cowboy Barley	2 row rough awn forage	160
7	CDC Maverick Barley	2 row smooth awn forage	181
8	CDC Arborg Oats	Milling oats	115
9	CDC Haymaker Oats	Forage oats	128
10	Camden Oats	Milling oats	114
11	ORe3542M Oats	Milling oats	116
12	Sadash Triticale		133

Seeding

- Cereal seeds were treated with Vibrance Quattro cereal seed treatment before seeding.
- Forages were seeded at 100%:
- Barley and Oats: 300 plants/m^2
- Spring Triticale and Wheat: 370 plants/m^2
- The target seeding rate calculation for the small plot area was based on 1,000 kernel weight, germination, plot area and 5% mortality rate.
- This project was seeded on June 1, 2022, with a 6-row Fabro Plot drill and at a seed depth of 1.0''.
- The soil temperature and moisture measured in the top 6'' was 22.0°C and 30.0% VWC, respectively.

Fertility

Fertilizer was applied through mid-row banding at a rate of 149 lbs/acre. The fertilizer rate was determined based on soil test results completed at 0-6'' before seeding. The actual N, P, K, and S application rate was 45 lbs/acre, 20 lbs/acre, 0 lbs/acre, and 10 lbs/acre, respectively.

Spraying

A pre-pass spray was performed prior to seeding using StartUp® herbicide at a rate of 0.67 L/acre on May 20, 2022. No pre-emergence spray was carried out. In-crop spraying was performed with Prestige XL at 0.81 L/acre on June 24, 2022.

Harvest

Time of harvest was determined based on crop development, which was when barley, wheat and triticale were at the dough stage and oat was at the milk stage. Plots were harvested on August 9, 2022 using a forage harvester. Forage samples for each variety were sent to A&L Laboratory in Ontario for quality analysis.

Results and Implications

Results obtained testing cool season cereals in Teepee Creek for 2022 are shown in Table 28. Forage DM ranged from 3,935 to 6,134 lbs/acre and varied significantly between treatments. In general, barley varieties were among the high yielders with CDC Maverick Barley, AB Advantage Barley, CDC Cowboy Barley, Canmore Barley (in that order) producing above 2.5 tons/acre of forage DM each. Whistle General Purpose Wheat yielded lowest (3,935 lbs/acre) in forage DM.

Crude protein values narrowly ranged between 7.1 and 8.7% and did not vary significantly between treatments (Table 28).

Fibre (NDF and ADF) and energy (TDN) all varied significantly between treatments and ranged from 38.5 to 50.1% for NDF; 20.7 to 29.2% for ADF and 64.3 to 71.4% for TDN (Table 28).

Ranges of 0.20 to 0.34% for Ca; 0.12 to 0.17% for P; 1.19 to 1.79% for K; 0.13 to 0.18% for Mg and 0.02 to 0.77% for Na were obtained. For the micro minerals (Table 29), Cu levels ranged from 3.2 to 4.8 ppm; Fe 155 to 427 ppm; Zn from 27.0 to 48.0 ppm; Mn from 54 to 136 ppm and Cl from 0.68 to 0.98 ppm. The RFV varied significantly (0.001) between cereal species and varieties and ranged from 123 to 177.

Overall, in 2022, CDC Maverick Barley and CDC Haymaker oats lived up to their billing as traditional cool season forage crop resources in the PR by producing the highest forage DM amongst the tested barley and oat varieties. The CP contents of the treatments were all less than 9.0% and will satisfy the nutritional requirements of only mid gestating beef cattle stock. Late gestating, lactating and growing beef stock on these forage resources will require some form of protein supplementation such as inclusion of leguminous forage species. The NDF contents of tested forages were quite high compared to the normal (< 40 %) for traditional cool season forages and this will likely impair intake. Contrarily, ADF was generally lower than 30 % and indicates a potential for good digestibility of these forage resources. Treatments had exceedingly high energy contents and will meet and even surpass what is required for high demanding beef cattle stock such as growing, finishing, and lactating beef cattle (which require 65 % TDN). Mineral content wise, Ca, P and Cu were mostly deficient in most of the tested forages and supplementation will be required for beef cattle stock on solely these forages.

Conclusion

All tested varieties can be described as high forage yielders but of moderate CP contents. The fibre contents of the tested varieties did indicate potential for low intake (high NDF) but high digestibility (low ADF) and consequently high energy (high TDN). The forages were deficient in minerals, notably Ca, P and Cu. Beef cattle stock on these forages will need some form of mineral supplementation.

Table 28. Forage dry matter and quality of Cool Season Cereals 2022 Teepee Creek

Cool Season Cereals	**TDMY (lb/ac)**	**CP (%)**	**NDF (%)**	**ADF (%)**	**TDN (%)**	**Ca (%)**	**P (%)**	**K (%)**	**Mg (%)**	**Na (%)**
AAC Awesome SW Wheat	4,974	8.3	49.1	26.7	71.4	0.20	0.15	1.56	0.14	0.03
AAC Paramount SW Wheat	5,095	8.0	49.7	27.4	69.0	0.20	0.14	1.51	0.13	0.03
AB Advantage Barley	5,822	7.9	43.6	24.6	68.2	0.34	0.12	1.63	0.15	0.27
Camden Oats	4,601	7.9	48.4	28.4	64.5	0.31	0.16	1.62	0.15	0.68
Canmore Barley	5,774	8.7	38.8	20.7	71.6	0.28	0.14	1.40	0.14	0.19
CDC Arborg Oats	5,221	7.1	50.1	29.2	64.3	0.27	0.14	1.79	0.15	0.70
CDC Cowboy Barley	5,785	6.8	44.3	24.2	70.3	0.30	0.13	1.58	0.18	0.26
CDC Haymaker Oats	5,671	7.6	50.0	28.3	67.4	0.29	0.17	1.67	0.16	0.63
CDC Maverick Barley	6,134	7.7	38.5	20.5	72.1	0.24	0.14	1.19	0.15	0.21
ORe3542M Oats	5,408	7.1	49.6	29.1	64.4	0.25	0.16	1.68	0.14	0.77
Sadash Triticale	5,124	7.6	48.0	27.3	69.5	0.21	0.12	1.58	0.14	0.02
Whistler GP Wheat	3,935	8.6	47.0	27.0	69.8	0.30	0.16	1.61	0.18	0.05
MEAN	**5,295**	**7.8**	**46.4**	**26.1**	**68.5**	**0.27**	**0.14**	**1.57**	**0.15**	**0.32**
p value	0.001	0.21	0.00	0.00	0.00	0.00	0.08	0.00	0.02	0.00
$LSD_{0.05}$	995	2.1	6.0	3.2	3.3	0.07	0.05	0.33	0.04	0.21

Table 29. Some forage minerals of commonly grown cool cereal forages in Teepee Creek

Cool Season Cereals	**Cu (%)**	**Fe (ppm)**	**Zn (ppm)**	**Mn (ppm)**	**Cl (ppm)**	**RFV (ppm)**
AAC Awesome SWW	3.2	265	33.2	93	0.70	129
AAC Paramount SW wheat	3.8	243	32.5	88	0.69	127
AB Advantage Barley	3.9	169	31.3	54	0.88	149
Camden Oats	4.0	155	31.0	133	0.99	128
Canmore Barley	4.6	232	28.8	58	0.71	176
CDC Arbotg Oats	3.4	237	36.5	131	0.97	123
CDC Cowboy Barley	4.3	334	31.0	71	0.68	148
CDC Haymaker Oats	3.7	238	32.3	136	0.93	124
CDC Maverick barley	4.8	157	32.5	58	0.60	177
ORe3542M Oats	3.8	322	27.0	122	0.98	124
Sadash Triticale	3.4	266	27.3	80	0.74	132
Whistler Gen Purpose Wheat	5.2	427	48.0	133	0.89	135
MEAN	**4.0**	**254**	**32.6**	**96**	**0.81**	**139**
p value	0.002	0.59	0.02	0.001	0.001	0.001
$LSD_{0.05}$	1.24	364	14.3	41	0.24	26.3

Yield and Quality of Spring and Cereal Mixes

Funded by the Canadian Agricultural Partnership
(Government of Canada and Government of Alberta)

Feeding livestock through the winter is costly to production when pastures are not grazable and feed intake generally increases. Methods to extend potential grazing days towards the end of the growing season, while pastures go dormant, can help to preserve winter feed resources. Common cereals grown for feed include barley, oats, rye, triticale, and wheat. One advantage to a spring-winter cereal mix is the spring cereal can be harvested, while allowing the regrowth of the winter cereal to be used as winter pasture when perennial pastures are entering dormancy.

Objective

The objective of this study was to determine forage yield and nutritional quality differences between spring planted spring-winter cereal mixtures used for silage, annual pasture, or fall pasture compared to annual monocrop varieties.

Methods

Location: This project was conducted at Garth Isaac's farm in Teepee Creek, Cropping history: Summer fallow

Experimental design and treatments: A randomized complete block design was used in four replications on small plots measuring 8m x 1.14m and 0.65m alleyways between plots. Nine spring-winter cereal mixture crops and six monocrop varieties were seeded to determine the forage yield and quality advantages of the mixtures. Refer to Table 30 for the complete list of mixtures and monocrops.

Table 30. Crop varieties tested and their seeding rates

Variety	Seeding Rate (lbs/acre)
AAC Wildfire Winter Wheat / CDC Austenson Barley	92/41
AAC Wildfire Winter Wheat / CDC Baler Oats	92/91
AAC Wildfire Winter Wheat / Taza Triticale (spring)	92/125
Bobcat Triticale (winter) / CDC Austenson Barley	73/41
Bobcat Triticale (winter) / CDC Baler Oats	73/91
Bobcat Triticale / Taza Triticale (spring)	73/125
Prima Fall Rye / CDC Austenson Barley	67/41
Prima Fall Rye / CDC Baler Oats	67/91
Prima Fall Rye / Taza Triticale (spring)	67/125
AAC Wildfire Winter Wheat	123
Bobcat Triticale (winter)	120
CDC Austenson Barley	55
CDC Baler Oats	121
Prima Fall Rye	89
Taza Triticale (spring)	167

Seeding

- Seeds were treated with Vibrance Quattro cereal seed treatment before seeding.
- Seeding rate was targeted at 75% for each cereal crop in a mixture, as follows:
- Barley, Oats, and Rye: 225.0 plants/m2 (20.9 plants/ft2)
- Spring Triticale and Winter Wheat: 277.5 plants/m2 (25.8 plants/ft2)
- The target seeding rate calculation for the small plot area was based on 1,000 kernel weight, germination, plot area and 5% mortality rate.
- This project was seeded on May 27, 2022, with a 6-row Fabro Plot drill and at a seed depth of 0.75''.
- The soil temperature and moisture measured in the top 6'' was 11.7°C and 9.0% VWC, respectively.

Fertility

Fertilizer was applied through mid-row banding and at a rate of 279 lbs/acre using dry fertilizer blend. The fertilizer rate was determined based on soil test results completed at 0-6'' before seeding. The N, P, K, and S application rate was 72 lbs/acre, 35 lbs/acre, 27 lbs/acre, and 13 lbs/acre, respectively.

Spraying

A prepass spray was performed prior to seeding using StartUp® herbicide at a rate of 0.67 L/acre on May 20, 2022. No pre-emergence spray was carried out. In-crop spraying was performed with Prestigue XL at 0.81 L/acre on June 24, 2022.

Harvest

Time of harvest was determined based on crop development, which was when barley was at soft dough stage and oat was at late dough stage. Plots were harvested on August 8 and 16, 2022 using a forage harvester. Forage samples for each variety were sent to A&L Laboratory in Ontario for quality analysis.

Results

Forage Dry Matter Yield

Forage dry matter yield (DMY) ranged from 955-5,552 lbs/acre (Table 31). The monocrops AAC Wildfire Winter Wheat, Bobcat Triticale, and Prima Fall Rye had the lowest DMY at 955 lbs/acre, 1,899 lbs/acre, and 1,985 lbs/acre, respectively. The monocrop CDC Austenson Barley had the highest DMY at 5552 lbs/acre and was statistically significant compared to AAC Wildfire WW/CDC Austenson Barley mixture (3,375 lbs/acre) and the monocrops AAC Wildfire Winter Wheat (955 lbs/acre), Bobcat Triticale (1,899 lbs/acre) and Prima Fall Rye (1,985 lbs/acre). The second and third highest DMY was Bobcat Triticale/Taza Triticale mixture at 5524 lbs/acre and the monocrop Taza Triticale at 5235 lbs/acre but were only significantly different from AAC Wildfire Winter Wheat (955 lbs/acre), Bobcat Triticale (1899 lbs/acre), and Prima Fall Rye (1985 lbs/acre).

Crude Protein

Crude Protein content (CP) varied between the varieties (8.1-18.9%), refer to Table 31. The varieties with significantly higher CP which meet all beef cattle stock nutritional requirements were AAC Wildfire WW (18.9%), Bobcat Triticale (16.4%), and Prima Fall Rye (15.5%). Monocrop CDC Baler Oats had the lowest CP at 8.1% followed by Taza Triticale and AAC Wildfire WW/Taza Triticale mixture both at 8.3%.

Detergent Fibres

In this study, neutral detergent fibre (NDF) was significantly higher in CDC Baler Oats (48.5%) and Taza Triticale (48.3%) than AAC Wildfire Winter Wheat (38.8%) and Bobcat Triticale/CDC Austenson Barley (38.2%) but not significantly different from any other variety (Table 31). AAC Wildfire Winter Wheat (38.8%) and Bobcat Triticale/CDC Austenson Barley (38.2%) were also significantly lower in NDF than Prima Fall Rye/CDC Baler Oats (45.2%), AAC Wildfire Winter Wheat/Taza Triticale (47.2%), and Bobcat Triticale/CDC Baler Oats (47.1%). Acid detergent fibre (ADF) value is inversely related to digestibility. Bobcat Triticale/CDC Austenson Barley (19.9%) had a significantly lower ADF% than all other varieties but not significantly different from the monocrop CDC Austenson Barley (21.4%), AAC Wildfire Winter Wheat/CDC Austenson Barley (21.4%), and Prima Fall Rye/CDC Austenson Barley (22.0%). The least digestible variety, based on higher ADF content, was Taza Triticale (27.4%) but was only statistically different from Bobcat Triticale/CDC Austenson Barley (19.9%), CDC Austenson Barley (21.4%), AAC Wildfire Winter Wheat/CDC Austenson Barley (21.4%), and Prima Fall Rye/CDC Austenson Barley (22.0%).

Total Digestible Nutrients

The total digestible nutrients (TDN) is a measure of the digestible components of feed and also the energy available to the animal. Depending on the life stage of the animal, TDN is recommended to be between 55-70%. The results from this study showed that all varieties were within or exceeded this general recommendation. The varieties that exceeded the recommendation were AAC Wildfire Winter Wheat (78.9%), AAC Wildfire Winter Wheat/CDC Austenson Barley (73.6%), AAC Wildfire Winter Wheat/CDC Baler Oats (70.7%), Bobcat Triticale (74.8%), Bobcat Triticale/CDC Austenson Barley (72.7%), Bobcat Triticale/Taza Triticale (71.4%), CDC Austenson Barley (72.8%), Prima Fall Rye (79.5%), Prima Fall Rye/ CDC Austenson Barley (71.9%), and Prima Fall Rye/ CDC Baler Oats (71.1%). Prima Fall Rye monocrop was significantly higher (79.5%) in TDN than most other varieties except the monocrops AAC Wildfire Winter Wheat (78.9%) and Bobcat Triticale (74.8%).

Minerals

Mineral balance is important for animal function and growth. Results for mineral contents of seeded mixtures and monocrops are provided in Table 31. The ideal calcium (Ca):phosphorus (P) ratio should not be lower than 1.5:1. All varieties and mixtures were within this recommendation, except AAC Wildfire Winter Wheat/Taza Triticale, Bobcat Triticale/Taza Triticale, Prima Fall Rye/Taza Triticale, and Taza Triticale monocrop which were below the recommended Ca:P ratio. All treatments exceeded Ca requirements for all life stages of beef cattle, except AAC Wildfire Winter Wheat/Taza Triticale (0.22%), Prima Fall Rye/Taza Triticale (0.22%), and Taza Triticale (0.22%) monocrop which fell below minimum requirements. Only one treatment, Prima Fall Rye (0.25%), met P requirements for a dry cow. All varieties exceeded potassium (K) requirements and ranged from 1.52-3.77%. The only treatment that was within magnesium (Mg) requirements for cattle was AAC Wildfire Winter Wheat (0.22%).

Relative Feed Value

All monocrop varieties and mixtures have a relative feed value (RFV) above 100 (Table 31). Bobcat Triticale/CDC Austenson Barley had the greatest RFV at 179% and was significantly different from Prima Fall Rye/CDC Baler Oat (142%), Bobcat Triticale/CDC Baler Oat (137%), AAC Wildfire Winter Wheat/Taza Triticale (136%), Prima Fall Rye/Taza Triticale (133%), CDC Baler Oat (131%), Taza Triticale (130%).

Conclusion

Overall, the mixtures did not clearly provide a forage yield advantage over their respective monocrops. But the advantage of mixing winter and spring cereals together would be the potential of winter cereals to re-grow for fall grazing after an initial harvest (greenfeed and silage) in the summer of the main cereal crop in a spring/winter cereal mixture. The re-growth is able to provide a good amount of forage to extend the grazing season without any extra inputs in carrying the winter cereals from summer through early fall for fall grazing. Quality wise, lower forage quality was observed for spring/winter cereal mixtures resulting from 'dilution' of higher quality forage of winter cereals by the early maturing spring cereals. Furthermore, all mixtures and respective monocrops yielded exceedingly high forage material (< 68.0 %) in TDN. Spring-winter cereal mixtures generally had a lower mineral content compared to their respective winter cereal monocrops and beef cattle stock on them will need mineral supplementation to avoid deficiencies.

Table 31. Forage quality indicators of crops tested in 2022

Variety	**TDMY (lbs/acre)**	**CP (%)**	**NDF (%)**	**ADF (%)**	**TDN (%)**	**Ca (%)**	**P (%)**	**K (%)**	**Mg (%)**	**RFV (%)**
AAC Wildfire Winter Wheat (winter)	9,55	18.9	38.8	26.1	78.9	0.52	0.2	2.7	0.22	165
AAC Wildfire Winter Wheat / CDC Austenson Barley	3,375	9.7	39.4	21.4	73.6	0.29	0.15	1.78	0.14	172
AAC Wildfire Winter Wheat / CDC Baler Oats	4,689	8.7	44.9	25.7	70.7	0.37	0.15	1.96	0.18	143
AAC Wildfire Winter Wheat / Taza Triticale (spring)	4,392	8.3	47.2	25.7	69.8	0.22	0.15	1.57	0.13	136
Bobcat Triticale (winter)	1,899	16.4	41.6	24.9	74.8	0.45	0.23	3.00	0.20	156
Bobcat Triticale (winter) / CDC Austenson Barley	3,954	9.0	38.2	19.9	72.7	0.27	0.15	1.77	0.14	179
Bobcat Triticale (winter) / CDC Baler Oats	4,260	9.2	47.1	25.8	70.0	0.37	0.17	1.99	0.18	137
Bobcat Triticale / Taza Triticale (spring)	5,524	8.9	44.0	25.0	71.4	0.23	0.17	1.83	0.13	147
CDC Austenson Barley	5,552	8.8	41.3	21.4	72.8	0.26	0.13	1.69	0.13	164
CDC Baler Oats	5,077	8.1	48.5	26.8	69.9	0.33	0.16	1.58	0.17	131
Prima Fall Rye	1,985	15.5	41.7	25.7	79.5	0.49	0.25	3.77	0.19	154
Prima Fall Rye / CDC Austenson Barley	4,543	9.2	40.6	22.0	71.9	0.27	0.14	1.81	0.14	165
Prima Fall Rye / CDC Baler Oats	4,500	8.9	45.2	26.1	71.1	0.38	0.16	1.91	0.19	142
Prima Fall Rye / Taza Triticale (spring)	5,085	8.5	47.7	26.7	70.0	0.22	0.14	1.52	0.13	133
Taza Triticale (spring)	5,235	8.3	48.3	27.4	68.0	0.22	0.14	1.68	0.12	130

Debolt Research Site

Seed treatment, inoculant response and phosphorus fertilizer application on pea production and residual soil nitrogen

Funded by Results Driven Agriculture Research (RDAR)

When placed in the soil, seeds face a lot of challenges from diseases to pests to environmental stresses. While seeds can overcome some of these challenges on their own, the chances of success can be improved with seed treatments which is a way to support the growth of seeds and reduce the challenges they face. Inoculation of pulse seeds with various chemical and biological seed treatments such as rhizobia inoculation, bio-stimulants, and chemical fertilizers before or during seeding can therefore give the young seedling a good head start in its growth. This project sought to demonstrate the importance of various chemical and biological seed treatments on pea crop growth, production and soil nitrogen (N) levels.

What we did

The trial was conducted at the Debolt site in the MD of Greenview. The previous crop at the site was canola. Before seeding, the site was harrowed.

The trial was set up as a randomized complete block design with 4 replications of the following 10 seed treatments on the Amarillo pea variety:

1. Peas alone (PCon)
2. Peas+seed treatment (PST)
3. Peas+seed treatment+30 lbs phosphorus/acre (PST30P)
4. Peas+seed treatment+30 lbs phosphorus/acre + rhizobia inoculation (PST30PR)
5. Peas+seed treatment+60 lbs phosphorus/acre (PST60P)
6. Peas+rhizobia inoculation (PR)
7. Peas+60 lbs phosphorus/acre (P60P)
8. Peas+bio-stimulants (PBioS)
9. Peas+rhizobia inoculation+bio-stimulants (PRBioS)
10. Peas+rhizobia inoculation+60 lbs phosphorus/acre (PR60P)

Other management practices carried out on plots were:

- The seeding date was May 30, 2022 with a 6-row Fabro plot drill equipped with disc-type openers on 9” row spacing and a mid-row bander for fertilizer.
- Six rows that were 8m were seeded per plot.
- Average soil temperature and moisture at 4" soil depth were 14.5°C and 19.2% volumetric moisture content (VMC), respectively.
- Seeding depth was 1.0".
- Peas were seeded at a full seeding rate of 180 lbs/acre

- For treatments PST30P and PST30PR, the fertilizer drill was calibrated to deliver 59 lbs P/acre of 11-52-0 while for PST60P, P60P and PR60P, the drill was calibrated to deliver 118 lbs P/acre of 11-52-0.
- Pea treatments with rhizobia inoculation were inoculated with Nodulator Duo SCG® granular inoculant at a rate of 3.7 lbs/acre.
- Pre-emergent herbicide application was with StartUp a day after seeding. In-crop weed control measures were done with Basagran Forte herbicide on June 20, 2022.
- Combine harvesting was done at full maturity stage on September 14, 2022.

What we found out

Results obtained through testing the various biological and chemical seed treatments on pea production and residual soil nitrogen, are shown in Table 32.

Plant emergence and normalized difference vegetative index (NDVI) readings ranged from 13 – 17 per sq m and 0.67 – 0.70 respectively and did not differ significantly amongst pea seed treatments.

Grain yield ranged from 11.8 – 17.0 bu/acre, bushel weight 57.3 – 59.0 lbs/bu and thousand kernel weight 203 – 210 g, and were not significantly different for all 9 seed treatments compared to the control.

Pea seed crude protein content was similar for the treatments and ranged from 22.3% – 23.2%.

Remarkably, most soil chemical parameters did not differ between the treatments and the control (data not shown). An exception to this was nitrate nitrogen (NO3N) for 2022, which showed higher values (9.5 ppm) for both PST60P and PR60P compared to control and other treatments (Table 33). The higher NO3N observed for both PST60P and PR60P may be due to some additional nitrogen from the monoammonium phosphate fertilizer applied at a higher rate of 60 lbs/acre.

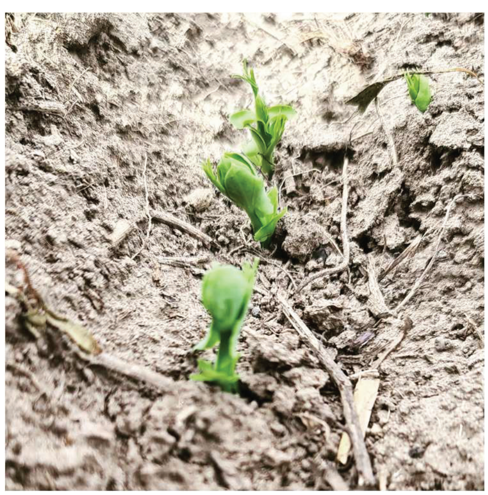


Table 32: Agronomic and grain attributes of Pea seed treatments (n=2)

Pea Seed Treatment	Plant emergence (per sq m)	NDVI	Grain Yield (bu/acre)	Bushel weight (lbs/bu)	Crude protein (%)	TKW (g/1000 seeds)
Peas alone (control)	15	0.69	15.0	57.9	22.7	209
Peas+seed treatment	14	0.68	13.6	59.0	23.2	206
Peas+seed treatment+30 lbs P/acre	13	0.70	15.0	57.3	22.9	203
Peas+seed treatment+30 lbs P/acre+RHZB	15	0.68	15.6	58.9	23.0	206
Peas+seed treatment+60 lbs P/acre	16	0.70	15.0	54.4	22.5	209
Peas+rhizobia inoculation+60 lbs P/acre	17	0.70	14.9	57.7	22.8	215
Peas+rhi	17	0.67	14.8	57.8	22.7	204
Peas+60 lbs P/acre	15	0.70	17.0	58.2	22.8	210
Peas+bio-stimulants (ATG)	14	0.67	11.8	58.3	22.8	208
Peas+RHZB+bio-stimulants	17	0.69	13.4	58.5	22.4	205
MEAN	**15.3**	**0.69**	**14.6**	**57.8**	**22.8**	**208**
p value	*0.49*	*0.02*	*0.63*	*0.52*	*0.99*	*0.82*
Significance	ns	ns	ns	ns	ns	ns
$LSD_{0.05}$	5.4	0.03	8.0	6.1	2.2	19.5
CV (%)	12	8.4	24.7	4.7	4.2	4.2

Table 33. Soil Parameters of Pea seed treatments (n=2)

Pea Treatment	$N0_3N$	NH_3N	ENR
Peas alone (control)	7.5	667	63
Peas+60 lbs P/acre	7.5	621	63
Peas+bio-stimulants	7.5	593	64
Peas+rhiz	7.0	621	60
Peas+rhizo + 60 lbs P/acre	9.5	609	59
Peas+rhizo+bio-stimulants	5.0	622	63
Peas+seed treatment	7.5	543	61
Peas+ST+30 lbs P/acre	6.5	594	64
Peas+ST+30 lbs P/acre+rhiz	6.5	608	63
Peas+ST+60 lbs P/acre	9.5	640	62
MEAN	**7.4**	**612**	**62**

Screening of Perennial Forage grasses, Legumes, and Mixtures

Funded by Results Driven Agriculture Research (RDAR)

This project screened perennial forage grasses, legumes, and mixtures for productivity, adaptation, and water use efficiency in strengthening drought survival strategies of perennial forages in the heavy clay soil type of the Peace Country region.

What we did

The trial was conducted at the Debolt site in the MD of Greenview. In total, 24 straight grass varieties, 20 straight legume varieties (including alfalfa and sainfoin) and 15 grass/legume mixtures (simple to complex mixtures) were screened.

The list of grass species and varieties and mixtures screened for the trial are shown in Table 34.

Table 34. List of grass and legume species and varieties, mixtures screened

Grass species/varieties	Legume species/varieties	Mixtures
Rocky Mountain Fescue	55Q27 Alfalfa	Cattlemans Forage Mixture
Cache Meadow Brome	Boost HG	Dry Forage Mixture
Meryn Festulolium	Peace Alfalfa	Horsemans Forage Mixture
Fleet Meadow Brome	PV Ultima Alfalfa	Haygraze Forage Mixture
Timothy Tryguve	Rugged Alfalfa	Legumaster Mix
Peak bromegrass	Veldt Cicer milkvetch	Grass/Legume mix 33.3% each
Cowgirl Tall Fescue	Alfalfa Dalton B	Grass Mix 20% each
Savoury Tall Fescue	Beaver Alfalfa	Legume Mix 20 % each
Admiral Meadowbrome	Halo Alfalfa	Extreme Legume Mix
Comtail Timothy	AC Mv Sainfoin	Pasture Mix Golden Acres
Hktor Festulolium SPG	AC Grazeland alfalfa	Saline Master Mix
MBA Meadowbrome	Spredor 5 Alfalfa	Bloat Free Legume Mix
AC Saltlander GWG	Glenview Sainfoin	Same row mix (50 %)
Palaton Reed Canary grass	54VQ52 Alfalfa	40:60 Mix
Greenleaf Pubescent	AC YH Alfalfa	HayMix #1 Golden Acres
Kirk CWG	Trueman Alfalfa	
Richmond Timothy	Assault Alfalfa	
Fojtan Festulolium	Anik Alfalfa	
Milkway Tall Fescue	Algonquin Alfalfa	
AC Knowles bromegrass	Bull Birdsfoot Trefoil	
Succession Hybrid Bromegrass		
Killerney Orchardgrass		
Blizzard Orchardgrass		

What we found out

Grasses

Results obtained from screening perennial forage grasses for the first production year (2022) in Debolt are shown in Tables 35a,b,c.

Total dry matter (DM) forage yields for grasses differed significantly and ranged between 600 – 6,000 lbs/acre. Higher DM yields were obtained for first cut compared to second cut with ranges of between 6% to 46% of first cut total yields. MBA Meadow brome, AC Knowles Bromegrass and Fleet Meadow Brome produced the highest DM yields in the first cut. Crude protein (CP) also varied significantly between grass varieties and between cuts with mostly higher contents observed for the second cut compared to the first cut. Fibre (NDF and ADF) contents varied significantly between grass varieties. There were generally higher values in the first cut compared to the second cut. Energy values on the first cut ranged from 61.3% - 68.2% and for the second cut from 61.4% - 71.3% and reflected the general higher fibre values obtained in the first cut compared to the second cut. The macro minerals (Ca, P, K, Mg and Na) all varied significantly between grass varieties and across the two cuts with mostly higher contents observed in the second cut samples compared to the first cut samples. Ranges of 0.3 - 1.4 % (Ca), 0.1 - 0.28 % (P), 1.53 - 3.11 % (K), 0.10 - 0.50 % (Mg) were obtained. Micro minerals (Cu, Fe, Zn and Mn) also varied significantly between grass varieties and cuts with mostly higher contents in the second compared to the first. A significant variety by cut interaction observed for most of the yield and quality attributes indicates that different varieties behaved differently with cut.

Legumes

Results obtained from the screening of the 20 different legume species and varieties are shown in Tables 36a,b. Total DM forage yields varied significantly between legume species and varieties and across two cuts. Alfalfa varieties out yielded other legumes (sainfoin, cicer milkvetch and birdsfoot trefoil). The following alfalfa varieties: Algonquin, Boost HG, Trueman and Assalt produced more than 5,000 lbs/acre of forage dry matter across two cuts. Generally, higher dry matter yields were obtained in the first cut compared to the second cut. Crude protein values were high and varied significantly between legume species/varieties with most alfalfa varieties having higher CP contents compared to the other 3 legume species. A significant cut effect on fibre (NDF and ADF) contents was observed with higher values for the first compared to the second cut. This interestingly, did not influence energy values as there were no significant differences between species and varieties and across cuts. All macro minerals (Ca, P, K, Mg and Na) varied significantly between legume species and varieties and from the first to the second cut. Ca and K contents of the legumes were relatively high and ranged from 1.3% - 2.8% and 1.58% - 2.62% respectively while P values were low and ranged from 0.13% - 0.33%.

Micromineral contents of the legume forage varied significantly between species and varieties and across cuts (except for Mn).

Mixtures

Results obtained for screening the different forage mixtures for the first production year (2022) are shown in Tables 37a,b,c. Total DM forage yields ranged from 1,660 to 6,500 lbs/acre and varied significantly between mixtures as well as between cuts. Generally, higher yields were obtained for the first cut compared to the second cut. LegumeMaster yielded almost 40% of the first cut yields in the second cut while Grass Mix 20% yielded just about 7% of first cut yields. Crude protein values obtained for various mixtures were relatively high averaging 13.6% and 14.0% in the first cut and second cut respectively. Fibre contents (NDF and ADF) were mostly higher in the first cut compared to the second cut and reflected the higher energy content observed in the second cut samples compared to the first cut. Energy values for all mixtures were > 60.0%. A significant effect of the mixture, as well as cut, was observed in the macromineral concentration in the various mixtures with ranges of 0.3% - 2.5% for Ca, 0.12% - 0.27% for P, 1.4% - 2.7% for K, 0.11% - 0.37% for Mg. Similar effects (significant mixture and cut effects and higher second cut values compared to first cut) to that for macrominerals were observed for the micromineral concentrations in mixtures. Ranges of 2ppm - 10ppm for Cu, 83ppm - 944ppm for Fe, 10.8ppm - 41.7ppm for Zn, 25ppm - 100ppm for Mn were obtained between species and cuts.

In conclusion, perennial grasses yielded far better in the first cut compared to the second cut, highlighting the need to go in just for one cut for perennial grasses under the Peace Country conditions. High yielders amongst the tested varieties were mostly from the brome family of grasses. Most of the tested grasses were moderately high in protein contents and relatively high in energy contents. Mixtures also showed higher first cut yields compared to second cut yields which is the same as the perennial grasses above though some mixtures (LegumeMaster Mix, Haygraze Forage Mixture and HayMix #1 Golden Acres) showed relatively high second cut yields. For the perennial legumes, alfalfa varieties out yielded all the other 3 legume species (sainfoin, cicer milkvetch and birdsfoot trefoil), thus living up to its billing as 'queen of the legumes'. Here comparable yields were obtained between two cuts for most of the alfalfa varieties but not for the other legume species. For perennial legumes, a second cut may be recommended for alfalfa but not for the other legume species and varieties.

Table 35a: Yield and quality attributes for 23 perennial grass varieties Debolt in 2022

Grass Variety	DMY (lbs/acre)			CP (%)		ADF (%)		NDF (%)		TDN (%)	
	1st Cut	2nd Cut	Total	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut
Rocky Mountain Fescue	727	338	1065	15.1	14.8	37.0	35.7	49.7	46.2	63.7	65.2
Cache Meadow Brome	4295	446	4741	8.6	14.2	40.7	36.7	59.3	53.5	65.7	68.7
Meryn Festulolium	1441	396	1837	11.7	8.0	36.7	34.1	51.6	55.8	68.2	62.1
Fleet Meadow Brome	5126	612	5738	9.8	14.9	39.6	36.9	58.5	52.1	65.5	66.1
Timothy Tryguve	3034	285	3319	11.7	12.9	40.0	33.1	57.1	50.3	63.8	61.4
Peak bromegrass	3976	658	4634	11.1	15.7	36.3	38.3	55.7	52.7	67.6	69.2
Cowgirl Tall Fescue	2724	258	2982	13.1	14.3	36.9	32.2	52.0	47.5	66.0	67.6
Savoury Tall Fescue	3528	238	3766	11.2	11.7	39.0	31.1	54.3	51.9	65.1	66.6
Admiral Meadowbrome	2909	562	3471	13.6	13.2	37.6	33.4	54.1	54.1	64.4	69.2
Comtail Timothy	1287	407	1694	10.5	14.9	38.1	36.4	56.9	47.3	65.8	64.2
Hktor Festulolium SPG	4199	363	4562	10.7	12.1	37.8	29.0	53.0	50.5	66.5	68.6
MBA Meadowbrome	5662	376	6038	9.9	14.3	39.5	33.9	57.9	54.7	65.3	69.8
AC Saltlander GWG	1039	-	1039	15.8	-	36.8	-	49.3	-	63.3	-
Palaton Reed Canary grass	4177	381	4558	11.8	16.0	40.5	33.5	56.9	50.3	61.3	71.3
Greenleaf Pubescent	3108	462	3570	14.1	16.3	38.9	35.6	55.4	51.3	61.3	69.1
Kirk CWG	1695	421	2116	13.8	14.6	37.5	31.6	53.4	49.1	63.0	65.1
Richmond Timothy	1557	725	2282	12.8	-	39.6	-	49.6	-	63.9	-
Fojtan Festulolium	3534	221	3755	11.4	12.8	37.5	30.8	52.5	51.4	66.4	66.9
Milkway Tall Fescue	2171	392	2563	12.4	11.7	37.6	32.2	51.8	50.5	66.5	65.4
AC Knowles bromegrass	5220	460	5680	10.4	16.5	38.4	35.8	56.9	51.3	65.7	71.3
Succession Hybrid Bromegrass	2221	909	3130	13.5	15.3	36.7	35.1	52.2	51.6	66.6	66.9
Killerney Orchardgrass	594	-	594	18.4	-	35.1		46.7	-	62.9	-
Blizzard Orchardgrass	2514	666	3180	11.9	12.9	41.6	32.5	59.6	56.5	63.3	72.2
MEAN	**2969**	**435**	**3404**	**12.2**	**13.8**	**38.2**	**33.7**	**54.4**	**51.4**	**64.9**	**63.7**
p value Variety	0.001			0.001		0.07		0.001		0.001	
p value Cut	0.001			0.001		0.001		0.001		0.001	
p value Variety x Cut	0.001			0.004		0.08		0.19		0.001	
$LSD_{0.05\ Variety}$	984			3.0		4.2		5.8		2.6	

Table 35b: Yield and quality attributes for 23 perennial grass varieties cont'd

Grass Variety	Ca (%)		P (%)		K (%)		Mg (%)		Na (%)	
	1st Cut	**2nd Cut**	**1st Cut**	**2nd Cut**	**1st Cut**	**2nd Cut**	**1st Cut**	**2nd Cut**	**1st Cut**	**2nd Cut**
Rocky Mountain Fescue	1.0	1.3	0.23	0.26	2.09	2.41	0.28	0.33	0.03	0.03
Cache Meadow Brome	0.4	0.8	0.10	0.17	1.86	2.55	0.10	0.30	0.02	0.02
Meryn Festulolium	0.5	0.7	0.23	0.27	2.06	2.29	0.15	0.22	0.02	0.02
Fleet Meadow Brome	0.4	0.7	0.14	0.15	1.94	2.10	0.11	0.17	0.02	0.02
Timothy Tryguve	0.3	1.4	0.18	0.28	2.03	2.76	0.11	0.50	0.02	0.06
Peak bromegrass	0.4	0.7	0.10	0.24	1.67	3.11	0.12	0.27	0.02	0.02
Cowgirl Tall Fescue	0.6	1.2	0.16	0.22	2.11	2.68	0.21	0.43	0.05	0.08
Savoury Tall Fescue	0.4	0.9	0.14	0.20	1.97	2.39	0.16	0.36	0.08	0.10
Admiral Meadowbrome	0.4	0.7	0.10	0.17	1.88	2.69	0.11	0.26	0.02	0.02
Comtail Timothy	0.7	1.0	0.19	0.25	1.91	2.36	0.21	0.37	0.02	0.03
Hktor Festulolium SPG	0.4	0.8	0.13	0.18	1.75	2.57	0.17	0.38	0.04	0.07
MBA Meadowbrome	0.3	0.7	0.11	0.13	1.84	2.64	0.11	0.26	0.02	0.02
AC Saltlander GWG	1.1	-	0.23	-	2.06	-	0.27	-	0.03	-
Palaton Reed Canary grass	0.3	0.7	0.11	0.26	1.53	2.68	0.16	0.35	0.04	0.02
Greenleaf Pubescent	0.6	0.6	0.15	0.21	1.97	2.56	0.15	0.21	0.02	0.03
Kirk CWG	0.8	1.3	0.16	0.25	1.56	2.68	0.20	0.42	0.03	0.03
Richmond Timothy	0.9	-	0.20	-	1.78	-	0.25	-	0.02	-
Fojtan Festulolium	0.4	0.9	0.16	0.20	1.84	2.57	0.17	0.38	0.05	0.06
Milkway Tall Fescue	0.6	0.9	0.15	0.19	2.06	2.61	0.17	0.29	0.05	0.04
AC Knowles Bromegrass	0.3	0.6	0.11	0.20	1.61	2.71	0.10	0.24	0.04	0.02
Succession Hybrid Bromegrass	0.9	0.9	0.18	0.18	2.13	2.39	0.21	0.22	0.02	0.02
Killerney Orchardgrass	1.6	-	0.30	-	2.46	-	0.40	--	0.03	-
Blizzard Orchardgrass	0.4	0.7	0.16	0.21	3.18	3.32	0.18	0.34	0.08	0.03
MEAN	**0.56**	**0.88**	**0.15**	**0.21**	**1.9**	**2.6**	**0.17**	**0.32**	**0.03**	**0.04**
p value Variety	0.001		0.001		0.005		0.002		0.001	
p value Cut	0.001		0.001		0.001		0.001		0.23	
p value **Variety x Cut**	0.19		0.002		0.03		0.15		0.007	
$LSD_{0.05\ Variety}$	0.4		0.05		0.57		0.16		0.03	

Table 35c: Yield and quality attributes to 23 perennial grass varieties cont'd

Grass Variety	**Cu (ppm)**		**Fe (ppm)**		**Zn (ppm)**		**Mn (ppm)**		**RFV**	
	1st Cut	**2nd Cut**	**1st Cut**	**2nd Cut**	**1st Cut**	**2nd Cut**	**1st Cut**	**2nd Cut**	**1st Cut**	**2nd Cut**
Rocky Mountain Fescue	5.3	6.9	467	625	28	43	80	58	113	123
Cache Meadow Brome	4.3	6.1	105	428	9	22	38	88	90	105
Meryn Festulolium	2.9	4.5	125	355	26	35	55	60	109	104
Fleet Meadow Brome	1.7	4.4	159	491	15	22	39	73	92	107
Timothy Tryguve	3.2	6.7	159	554	18	57	32	67	94	117
Peak bromegrass	3.4	8.4	128	550	11	28	33	56	101	104
Cowgirl Tall Fescue	3.2	7.4	213	612	18	32	51	57	108	125
Savoury Tall Fescue	2.7	5.2	116	509	19	29	35	60	101	116
Admiral Meadowbrome	2.7	5.4	102	345	11	22	29	53	103	108
Comtail Timothy	4.3	5.6	200	555	25	42	40	47	97	119
Hktor Festulolium SPG	1.9	5.1	172	428	18	24	45	68	104	122
MBA Meadowbrome	2.4	6.1	93	405	12	20	46	80	93	106
AC Saltlander GWG	5.0	-	334	-	24	-	37	-	114	-
Palaton Reed Canary grass	2.5	8.1	167	643	15	34	47	96	94	116
Greenleaf Pubescent	4.7	6.1	259	532	18	26	33	34	98	111
Kirk CWG	5.1	7.3	199	446	20	42	27	57	104	122
Richmond Timothy	4.3	-	247	-	25		35	-	109	-
Fojtan Festulolium	2.5	6.0	115	571	15	27	43	68	106	117
Milkway Tall Fescue	3.4	6.0	167	431	16	21	39	49	107	118
AC Knowles bromegrass	3.0	7.5	104	417	13	25	38	54	97	111
Succession Hybrid Bromegrass	6.4	6.9	250	568	24	27	56	53	107	111
Killerney Orchardgrass	4.9	-	723	-	39	-	87	-	123	-
Blizzard Orchardgrass	3.0	6.6	213	322	16	28	116	153	88	105
MEAN	**3.5**	**6.4**	**196**	**490**	**18**	**30**	**45**	**65**	**102**	**114**
p value Variety	0.01		0.05		0.001		0.001		0.001	
p value Cut	0.001		0.001		0.001		0.001		0.001	
p value Variety x Cut	0.25		0.97		0.14		0.36		0.41	
$LSD_{0.05\ Variety}$	2.8		329		15.5		38.4		13.5	

Table 36a. Forage dry matter yield and quality for perennial legumes grown in Debolt, AB 2022

	TDMY (lbs/acre)		CP (%)		ADF (%)		NDF (%)		TDN (%)		Ca (%)		P (%)		K (%)	
Perennial Legumes	**1ST CUT**	**2ND CUT**	**1ST CUT**	**2ND CUT**	**1ST CUT**	**2ND CUT**	**1ST CUT**	**2ND CUT**	**1ST CUT**	**2ND CUT**	**1ST CUT**	**2ND CUT**	**1ST CUT**	**2ND CUT**	**1ST CUT**	**2ND CUT**
55Q27 Alfalfa	5325	4195	19.2	14.5	38.8	32.6	46.1	46.9	61.6	64.3	2.2	2.8	0.16	0.21	1.95	2.55
Boost HG	5533	4675	18.2	13.4	40.5	33.1	46.9	42.6	61.5	63.7	1.9	2.4	0.15	0.18	2.02	2.36
Peace Alfalfa	5230	4453	18.6	14.7	40.3	31.6	45.8	40.3	62.2	65.3	2.0	2.2	0.13	0.18	2.13	2.42
PV Ultima Alfalfa	5061	4320	19.0	15.0	39.0	32.5	45.7	45.2	62.5	64.7	2.3	2.7	0.14	0.18	1.96	2.19
Rugged Alfalfa	5306	3095	20.1	15.5	37.3	33.0	42.7	41.5	65.0	63.5	2.1	2.5	0.15	0.22	1.92	2.55
Veldt Cicer milkvetch	1010	270	15.8	12.7	36.0	29.7	44.8	43.0	64.3	62.8	1.5	1.8	0.28	0.29	2.62	2.74
Alfalfa Dalton B	5315	4068	18.6	12.1	38.3	30.1	44.6	41.6	63.5	66.1	2.0	2.3	0.15	0.19	2.00	2.20
Beaver Alfalfa	5187	3772	19.2	14.0	39.2	31.6	44.3	40.3	64.8	66.2	1.9	2.2	0.16	0.21	2.43	2.41
Halo Alfalfa	4528	4135	18.7	13.6	39.4	33.3	44.2	43.0	64.9	63.2	1.7	2.3	0.15	0.19	2.01	2.42
AC Mv Sainfoin	1072	261	12.6	12.1	36.5	23.1	46.2	36.6	65.1	63.7	1.4	1.6	0.20	0.26	1.58	1.94
AC Grazeland alfalfa	5244	4302	17.6	13.4	41.8	32.4	48.1	42.2	62.8	64.3	1.8	2.3	0.14	0.18	1.96	2.20
Spredor 5 Alfalfa	5878	4109	18.6	13.9	39.9	30.9	47.1	39.1	64.8	65.8	2.1	2.3	0.16	0.19	2.18	2.35
Glenview Sainfoin	1706	732	14.2	10.8	37.8	26.2	46.5	40.8	63.5	62.7	1.8	1.5	0.21	0.24	2.07	1.88
54VQ52 Alfalfa	4187	4316	19.0	12.3	39.2	33.9	45.5	43.8	63.7	62.3	2.0	2.4	0.15	0.17	2.02	2.27
AC YH Alfalfa	4582	1553	19.5	16.2	37.8	30.1	43.2	36.3	65.4	67.2	2.0	2.6	0.16	0.23	1.95	2.23
Trueman Alfalfa	5397	4668	19.1	15.4	38.9	29.4	44.5	37.8	64.8	66.4	1.9	2.5	0.15	0.20	2.17	2.20
Assalt Alfalfa	4912	5524	19.1	13.0	39.2	31.9	44.8	42.0	64.3	64.7	1.9	2.1	0.15	0.16	2.13	2.15
Anik Alfalfa	3568	1547	18.6	17.3	37.6	29.7	44.6	39.8	66.4	66.7	1.7	2.1	0.20	0.26	2.08	2.19
Algonquin Alfalfa	6503	4292	18.8	15.0	39.7	28.7	46.2	36.1	63.7	67.5	1.8	2.3	0.13	0.20	1.96	2.15
Bull Birdsfoot Trefoil	1265	266	15.0	13.6	36.9	27.6	47.2	41.4	64.3	63.2	1.3	1.8	0.23	0.33	2.14	2.32
MEAN	**4340**	**3228**	**18.0**	**13.9**	**38.7**	**30.6**	**45.5**	**41.0**	**63.9**	**64.7**	**1.9**	**2.2**	**0.17**	**0.21**	**2.06**	**2.28**
p value for **Legume**	0.001		0.001		0.001		0.49		0.14		0.001		0.001		0.002	
p value for **Cut**	0.001		0.001		0.001		0.001		0.08		0.001		0.001		0.001	
p value for **Legume x Cut**	0.26		0.11		0.37		0.69		0.63		0.18		0.16		0.60	
$LSD_{0.05\ Legume}$	1605		2.7		4.4		7.1		4.1		0.38		0.04		0.44	

Table 36b. Forage dry matter yield and quality for perennial legumes cont'd

	Mg (%)		Na (%)		Cu (ppm)		Fe (ppm)		Zn (ppm)		Mn (ppm)		RFV (%)	
	1ST CUT	**2ND CUT**	**1ST CUT**	**2ND CUT**	**1ST CUT**	**2ND CUT**	**1ST CUT**	**2ND CUT**	**1ST CUT**	**2ND CUT**	**1ST CUT**	**2ND CUT**	**1ST CUT**	**2ND CUT**
55Q27 alfalfa	0.22	0.25	0.05	0.05	3.9	7.5	195	143	20	32	31	31	119	128
Boost HG	0.23	0.25	0.08	0.04	4.3	6.8	96	109	18	29	26	30	114	139
Peace Alfalfa	0.23	0.24	0.05	0.03	4.3	8.2	91	129	19	31	23	32	117	149
PV Ultima Alfalfa	0.26	0.26	0.06	0.05	4.6	7.2	120	105	20	27	26	27	119	135
Rugged Alfalfa	0.24	0.25	0.06	0.04	4.1	8.8	105	172	17	33	22	27	131	142
Veldt Cicer milkvetch	0.34	0.36	0.04	0.02	5.8	8.1	245	528	33	43	94	63	127	142
Alfalfa Dalton B	0.24	0.23	0.06	0.04	4.1	6.4	95	135	19	30	25	24	123	146
Beaver alfalfa	0.23	0.22	0.04	0.02	4.1	7.0	100	102	17	29	21	27	123	149
Halo alfalfa	0.20	0.27	0.06	0.06	4.2	7.0	73	143	17	25	19	23	126	136
AC Mv sainfoin	0.29	0.30	0.04	0.03	4.2	9.8	152	517	24	49	51	50	122	181
AC Grazeland alfalfa	0.22	0.24	0.07	0.03	3.9	7.2	100	122	20	36	20	26	110	141
Spredor 5 Alfalfa	0.21	0.23	0.05	0.03	4.3	6.7	120	128	22	29	25	25	114	154
Glenview sainfoin	0.35	0.27	0.05	0.02	5.4	7.3	190	261	27	37	67	34	119	156
54VQ52 alfalfa	0.22	0.24	0.09	0.06	4.5	7.2	93	118	19	26	24	29	119	133
AC YH alfalfa	0.28	0.31	0.05	0.02	3.9	8.3	112	206	22	39	25	34	128	168
Trueman alfalfa	0.22	0.27	0.05	0.02	3.7	6.4	101	143	21	32	21	28	123	162
Assalt alfalfa	0.21	0.21	0.06	0.03	4.4	6.2	97	102	19	23	20	22	122	142
Anik alfalfa	0.26	0.31	0.04	0.02	4.4	7.9	140	269	28	48	43	45	125	154
Algonquin alfalfa	0.22	0.26	0.06	0.03	3.9	6.7	117	174	18	29	22	27	117	171
Bull Birdsfoot Trefoil	0.28	0.32	0.04	0.02	4.9	10.8	176	623	38	66	51	61	119	152
MEAN	**0.25**	**0.26**	**0.05**	**0.03**	**4.3**	**7.6**	**126**	**211**	**22**	**35**	**33**	**33**	**121**	**149**
p value for **Legume**	0.001		0.001		0.02		0.001		0.001		0.001		0.21	
p value for **Cut**	0.04		0.001		0.001		0.001		0.001		0.83		0.001	
p value for **Legume x Cut**	0.78		0.04		0.44		0.001		0.85		0.02		0.31	
$LSD_{0.05\ Legume}$	0.08		0.02		2.4		95		16		16.4		27.3	

Table 37a. Forage yield, protein, detergent fibres and total digestible nutrients of mixtures

	Forage Dry matter yield			CP		ADF		NDF		TDN	
Mixture	**1st cut**	**2nd Cut**	**Total**	**1st cut**	**2nd Cut**	**1st cut**	**2nd Cut**	**1st cut**	**2nd Cut**	**1st cut**	**2nd Cut**
Cattlemans Forage Mixture	4324	783	5107	11.8	13.1	40.2	33.3	55.7	47.8	62.3	65.2
Dry Forage Mixture	3260	550	3810	11.7	13.2	42.1	32.7	58.2	45.6	61.1	65.3
Horsemans Forage Mixture	2039	249	2288	11.7	12.8	40.3	32.5	56.0	50.7	63.6	68.1
Haygraze Forage Mixture	4602	1175	5777	16.7	13.1	40.4	32.7	47.7	42.3	62.4	63.3
Legumaster Mix	4711	1780	6491	16.7	14.3	39.6	31.5	48.0	38.8	60.4	64.9
Grass/Legume (1/3 mix)	2585	332	2917	14.0	15.3	38.9	30.9	49.2	46.3	63.7	68.7
Grass Mix 20% each	3460	232	3692	10.1	13.6	39.3	35.3	57.8	52.7	65.3	65.8
Legume Mix 20 % each	3372	849	4221	16.8	15.2	36.1	29.3	43.7	37.0	64.8	66.4
Extreme Legume Mix	2167	293	2460	14.8	15.1	38.5	29.2	47.5	40.0	64.4	65.0
Pasture Mix Golden Acres	3498	281	3779	9.9	13.0	40.3	32.9	58.0	51.1	64.6	69.3
Saline Master Mix	3991	345	4336	9.5	14.0	38.4	34.6	56.6	54.2	66.2	68.2
Bloat Free Legume Mix	1507	157	1664	13.4	13.8	36.1	25.9	45.7	39.2	66.1	63.0
Same row mix (50 %)	2829	430	3259	15.9	15.1	38.0	28.9	45.3	38.4	63.6	65.7
40:60 Mix	3679	419	4098	12.6	13.2	39.8	32.8	54.6	49.3	63.1	67.4
HayMix #1 Golden Acres	4831	1176	6007	18.3	14.9	38.7	31.2	45.7	39.0	63.2	66.2
MEAN	**3390**	**621**	**4011**	**13.6**	**14.0**	**39.1**	**31.6**	**51.3**	**44.8**	**63.7**	**66.2**
p value Mixture	*0.001*			*0.001*		*0.001*		0.001		*0.003*	
p value Cut	*0.001*			*0.36*		*0.001*		0.001		*0.001*	
p value Mixture x Cut	*0.001*			*0.03*		*0.13*		0.41		*0.04*	
$LSD_{0.05}$	841			3.32		2.95		5.00		3.3	

Table 37b. Mineral content of forage mixtures

	Ca		P		K		Mg		Cu	
Mixture	**1st cut**	**2nd Cut**	**1st cut**	**2nd Cut**	**1st cut**	**2nd Cut**	**1st cut**	**2nd Cut**	**1st cut**	**2nd Cut**
Cattlemans Forage Mixture	0.7	1.6	0.13	0.20	1.5	2.2	0.13	0.27	2	7
Dry Forage Mixture	0.5	1.5	0.12	0.20	1.7	2.4	0.12	0.24	3	7
Horsemans Forage Mixture	0.5	0.9	0.14	0.19	1.6	2.6	0.13	0.25	3	7
Haygraze Forage Mixture	1.6	2.2	0.14	0.19	2.0	2.4	0.23	0.29	4	7
Legumaster Mix	1.8	2.5	0.13	0.20	1.9	2.3	0.24	0.29	4	7
Grass/Legume (1/3 mix)	1.4	1.3	0.17	0.22	1.8	2.6	0.27	0.29	4	7
Grass Mix 20% each	0.3	0.8	0.12	0.23	1.4	2.7	0.11	0.22	2	8
Legume Mix 20% each	1.8	2.2	0.19	0.24	2.1	2.2	0.28	0.27	5	9
Extreme Legume Mix	1.5	1.8	0.19	0.26	2.1	2.2	0.34	0.34	5	7
Pasture Mix Golden Acres	0.4	0.8	0.14	0.19	2.0	2.7	0.13	0.23	3	6
Saline Master Mix	0.3	0.6	0.11	0.18	1.5	2.4	0.12	0.17	3	6
Bloat Free Legume Mix	1.4	1.6	0.22	0.27	2.0	2.1	0.31	0.37	4	10
Same row (50% mix)	1.7	2.1	0.18	0.24	1.9	2.1	0.32	0.30	4	8
40:60 Mix	0.8	1.1	0.12	0.19	1.9	2.6	0.17	0.25	3	6
HayMix #1 Golden Acres	1.9	2.4	0.17	0.22	2.5	2.4	0.16	0.31	5	9
MEAN	**1.3**	**1.6**	**0.15**	**0.21**	**1.9**	**2.4**	**0.21**	**0.27**	**3.5**	**7.4**
p value Mixture	*0.001*		*0.001*		0.009		*0.001*		*0.001*	
p value Cut	*0.001*		*0.001*		0.001		*0.001*		*0.001*	
p value Mixture x Cut	*0.29*		*0.964*		0.001		*0.28*		*0.44*	
$LSD_{0.05}$	0.46		0.06		0.39		0.09		1.9	

Table 37c: Mineral content of forage mixtures cont'd

	Fe		Zn		Mn		RFV	
Mixture	**1st cut**	**2nd Cut**	**1st cut**	**2nd Cut**	**1st cut**	**2nd Cut**	**1st cut**	**2nd Cut**
Cattlemans Forage Mixture	126	504	12.8	23.5	26	61	96	122
Dry Forage Mixture	109	499	11.4	29.9	25	47	90	130
Horsemans Forage Mixture	153	621	14.2	27.3	41	82	96	117
Haygraze Forage Mixture	162	281	19.6	24.1	29	34	113	139
Legumaster Mix	83	198	15.9	27.6	23	32	113	154
Grass/Legume (1/3 mix)	148	587	17.6	28.3	39	74	112	131
Grass Mix 20% each	121	550	13.1	24.2	38	99	94	109
Legume Mix 20 % each	149	453	21.2	32.1	50	35	129	166
Extreme Legume Mix	227	465	19.4	35.5	49	49	115	154
Pasture Mix Golden Acres	167	491	12.4	20.2	42	100	92	115
Saline Master Mix	175	500	12.0	18.3	35	61	97	106
Bloat Free Legume Mix	290	944	29.1	41.7	75	73	124	163
Same row mix (50 %)	156	355	20.2	32.6	35	34	122	161
40:60 Mix	165	488	10.8	21.7	36	88	99	120
HayMix #1 Golden Acres	121	314	21.0	29.1	32	43	120	154
MEAN	**157**	**483**	**16.7**	**27.7**	**38.4**	**60.8**	**107**	**136**
p value Mixture	*0.006*		*0.001*		*0.001*		*0.001*	
p value Cut	*0.001*		*0.001*		*0.001*		*0.001*	
p value Mixture x Cut	*0.212*		*0.40*		*0.01*		*0.03*	
$LSD_{0.05}$	257		7.1		30.8		15.0	

Biomass Yield, Nutritive Value and Silage Potential of 16 Corn Hybrids – Selecting Corn Varieties Suitable for The Peace

Funded by Results Driven Agriculture Research (RDAR)

Due to changing climatic conditions, warmer season crops such as corn are an attractive option to Prairie beef producers for both in silage production and/or grazing. This is due to the fact that grazing corn has the potential to extend the grazing season into the fall and winter months, ultimately leading to a reduction in winter feeding expenses. This reduction is particularly significant as it is a key factor in the overall production costs for beef cattle operations in the Canadian prairies. Corn as a winter grazing group can stand above snow; able to resist lodging and with minimal leaf loss; and can provide windbreak for cattle grazing it. As a forage crop, it is high yielding, has low fibre levels and consequently high feed intake and digestibility in cattle consuming it.

The corn heat unit (CHU) provides an indexing system to assist farmers in selecting the most suitable corn hybrids for their area. A hybrid with a higher CHU rating than the local conditions provide will not have time to reach maturity before it is harvested or frozen, and will contain more fibre, more moisture, fewer cobs and less starch than ideal. It will also be less palatable and nutritious, whether harvested for silage or left for grazing. On average, 150-200 fewer CHUs are required for grazing or silage corn to reach 65% whole moisture (35% dry matter) as compared to grain corn. In The Peace region, where the long-term average CHUs during the growing season can be quite close to the minimum CHU rating of available hybrids, it is important to continuously assess the suitability of new corn hybrids to this unique agroecology.

Materials and Methods

The trial took place at Mark Pellerin's Farm in Debolt. Sixteen (16) corn hybrids were seeded in strips. The corn hybrids tested and their corn heat unit (CHU) requirements are provided in Table 38.

The following methods were used:

Seeding rate: 33, 000 kernels per acre

Seeding depth: 1.5"

Seeding date: May 30, 2022

Seeding method: Fabro plot drill. Row spacing used for corn = 18"

Fertility and fertilizer application: 102 lbs/ac N, 20 lbs/ac P, 80 lbs/ac K, and 10 lbs/ac S.

Harvesting was done on October 13, 2022.

Table 38. Corn Hybrids and their heat units

N0	**Hybrid Name**	**Company**	**CHU**
1	P6909R	Corteva	1950
2	39F44	Corteva	2000
3	P7202YHR	Corteva	2050
4	P7211HR	Corteva	2050
5	P7005AM	Corteva	2000
6	P7213R	Corteva	2025
7	XP21070G2	Pride Seed	2075
8	A3993G2 RIB	Pride Seed	2025
9	DKC21-36 RIB	BAYER	2075
10	DKC24-06 RIB	BAYER	2100
11	EXP70-21	BAYER	2100
12	PS Ex Seed LFRR	PICKSEED	2400
13	PS2320RR	PICKSEED	2300
14	PS2210VT2P RIB	PICKSEED	2125
15	PS2420RR	PICKSEED	2400
16	PSExpandLFRR	PICKSEED	2725

Results and Implications

The yield and forage quality attributes of the 16 corn hybrids are given in Table 39. Plant height varied by 7.1 % from 149 to 171 cm but did not significantly differ between corn hybrids. The total DM yield ranged from 1.74 – 3.81 tons/acre with 3 PICKSEED hybrids PS2320RR, PS Ex Seed LFRR and PS2420RR topping the chart in terms of this parameter. These yields compare poorly with those obtained planting nine of these hybrids in Teepee Creek in 2020 where yields of between 5.0 – 6.0 tons/acre were obtained (PCBFA, 2020). Favorable growing conditions in Teepee Creek (higher OM, soil nutrients, absence of drought) certainly accounted for this difference. Crude Protein narrowly ranged between 6.2 – 9.8 % and varied significantly ($p = 0.04$) between corn hybrids. This will meet the nutritional requirements of mostly cows at mid and late pregnancy. High protein requiring beef cattle stock, such as growing or finishing calves or lactating cows, will need some form of protein supplementation. Fibre (NDF and ADF) contents ranged from 48.4 – 55.1 % and 26.9 – 32.8 % respectively and did not significantly differ between corn hybrids. Contrarily, energy (TDN) significantly differed ($p = 0.001$) despite narrowly (6.8 %) ranging 51.3 – 63.0 % between corn hybrids. High-requirement beef cattle grazing most of these corn hybrids will need some form of energy supplementation, typically in the form of additional grain. This is necessary because the energy values of these hybrids averaged below 60%. Hybrids with the highest CHU had the lowest energy such as PSExpandLFRR hybrid (CHU 2725; TDN 51 %) and PSExSeed LFRR (CHU 2400; TDN 54 %). For minerals, ranges of 0.18 – 0.27 % for Ca (Table 39); 0.08 – 0.1 % for P; 0.19 – 0.31 % for Mg; 0.48 – 0.68 % for K; 48.4 – 55.1 ppm for Fe; 26.9 – 32.8 for Zn and 54 – 63 ppm for Mn where recorded (Table 40). Mineral supplementation would be needed as most corn hybrids had concentrations that were just at the borderline of meeting requirements for most beef cattle stock.

Conclusion

The corn hybrids tested produced appreciable forage biomass with most surpassing the 3,000 lbs/acre mark and with potential for higher forage DM yields under better growing conditions. Protein supplementation will be needed for high producing beef cattle stock grazing only these corn hybrids. The hybrids with very high CHU (>2400), such as PSExpandLFRR hybrid and PSExSeed LFR, produced low energy forage and may not be recommended for the short growing season of The Peace region. Also, mineral supplementation will be required as most hybrids had just borderline concentrations regarding nutrient requirements.

Table 39. Yield and forage quality attributes of corn hybrids grown at Debolt, AB

Corn Hybrids	**Plant Height (cm)**	**Total DM Yield (tons/acre)**	**CP (%)**	**NDF (%)**	**ADF (%)**	**TDN (%)**	**Ca (%)**
PS2210VT2P RIB	166	2.78	8.5	55.1	31.0	57.3	0.27
EXP70-21	171	2.02	8.9	49.8	28.2	58.0	0.23
39F44 with 2000 CHU	155	2.57	8.1	49.1	29.2	63.0	0.19
PSExpandLFRR	166	2.85	9.6	53.9	32.8	51.3	0.23
PS Ex Seed LFRR	159	3.10	9.8	54.2	32.1	54.0	0.21
PS2420RR	155	3.01	8.9	51.7	29.0	62.7	0.20
P6909R with 1950 CHU	161	2.12	7.2	52.3	30.7	57.3	0.19
XP21070G2	161	2.40	7.6	52.5	30.0	60.0	0.24
PS2320RR	168	3.81	7.8	48.4	27.8	63.0	0.20
A3993G2 RIB	161	2.41	8.3	51.3	28.8	59.0	0.24
DKC21-36 RIB 2075 CHU	160	1.74	9.0	51.7	30.2	54.0	0.25
P7202YHR with 2050 CHU	152	2.48	8.3	52.0	30.2	60.3	0.18
DKC24-06 RIB 2100 CHU	166	2.88	6.2	49.6	26.9	60.7	0.20
P7211HR with 2050 CHU	154	2.40	8.0	51.4	29.9	59.3	0.22
P7213R	164	2.97	7.5	53.7	30.4	60.0	0.24
P7005AM	149	1.95	8.5	51.4	29.3	60.7	0.25
MEAN	**160**	**2.59**	**8.3**	**51.8**	**29.8**	**58.8**	**0.22**
p value	*0.32*	*0.02*	*0.04*	*0.61*	*0.63*	*0.001*	*0.007*
$LSD_{0.05}$	23.7	1.12	2.7	8.7	6.9	6.9	0.68
CV	7.1	30.3	15.3	6.7	9.3	6.8	15.9

Table 40. Forage mineral attributes of corn hybrids grown at Debolt, AB

	P (%)	**Mg (%)**	**K (%)**	**Fe (ppm)**	**Zn (ppm)**	**Mn (ppm)**
PS2210VT2P RIB	0.09	0.31	0.57	55.1	31.0	57.3
EXP70-21	0.09	0.29	0.48	49.8	28.2	58.0
39F44 with 2000 CHU	0.09	0.23	0.65	49.1	29.2	63.0
PSExpandLFRR	0.08	0.21	0.58	53.9	32.8	51.3
PS Ex Seed LFRR	0.09	0.25	0.62	54.2	32.1	54.0
PS2420RR	0.10	0.23	0.67	51.7	29.0	62.7
P6909R with 1950 CHU	0.09	0.20	0.54	52.3	30.7	57.3
XP21070G2	0.09	0.24	0.71	52.5	30.0	60.0
PS2320RR	0.10	0.24	0.61	48.4	27.8	63.0
A3993G2 RIB	0.09	0.28	0.51	51.3	28.8	59.0
DKC21-36 RIB 2075 CHU	0.08	0.26	0.54	51.7	30.2	54.0
P7202YHR with 2050 CHU	0.09	0.19	0.66	52.0	30.2	60.3
DKC24-06 RIB 2100 CHU	0.10	0.22	0.60	49.6	26.9	60.7
P7211HR with 2050 CHU	0.10	0.22	0.62	51.4	29.9	59.3
P7213R	0.09	0.26	0.68	53.7	30.4	60.0
P7005AM	0.10	0.21	0.67	51.4	29.3	60.7
MEAN	**0.09**	**0.24**	**0.61**	**51.8**	**29.8**	**58.8**
p value	*0.49*	*0.001*	*0.15*	*0.84*	*0.58*	*0.88*
$LSD_{0.05}$	0.03	0.07	0.23	34	11.5	38.1
CV	12.7	16.7	21.2	43.4	28.7	42

Productivity and quality of commercial and producer cocktails tested at Debolt in 2022

Funded by Results Driven Agriculture Research (RDAR)

Introduction

In the Peace region producers depend on various annual and perennial forages to feed their livestock. Over the years, diverse annual crop mixtures, commonly known as cocktails are gaining more attention due to its ability to provide increased forage yield. In addition, diverse cocktail could also improve water and soil quality, increase nutrient cycling, and improve moisture conservation and crop productivity. Many commercial cocktails exist on the market while producers have been able to come up with cocktails for specific needs including silage on their farms. The objective of this study was to compare forage yield and quality of different cocktails that producers use for livestock feed in the Peace.

Methods

This study was carried out at Debolt on farm site (RGE Rd #740).

Experimental design: The study used a randomized complete block design with four replications. A total of 14 treatments were used comprising 6 multispecies cocktail samples from producers (Allan McLachlan, Garry These, Clay Armstrong, John Prince, and Garth Shaw), 5 common commercial cocktails, and 3 cereal monocrops as control. The breakdown of treatments are as follows:

- Producer cocktail 1 (Clay Armstrong): Haymaker oats, Amarillo peas, Berseem clover, Tetra brand annual ryegrass, Hairy vetch.
- Producer cocktail 2 (Allan McLachlan): Morgan oats, Hairy vetch, Horizon peas, Proso millet, Phacelia, Hercules turnip, and Inke marrowstem kale.
- Producer cocktail 3 (Garth Shaw): Hairy vetch, Hercules turnip, Forage turnip, Collards, Kale, Berseem clover, Phacelia, Haymaker oats, and Maverick barley.
- Producer cocktail 4 (John Prince swath grazing): Crimson clover, Italian ryegrass, Hairy vetch, Hunter leaf turnip, Graza forage radish, Winifred Goliath, Maverick barley, and Goldeneye peas.
- Producer cocktail 5 (John Prince Ultimate mix): Maverick barley, Goliath forage rape, Green globe turnip, Hunter leaf turnip, and Goldeneye peas.
- Producer cocktail 6 (Gary These): Horizon peas, Maverick barley, Haymaker oats, Hairy vetch, and Hercules turnip.
- Commercial cocktail 1 (Imperial Seed TG extend): Melquatro Italian ryegrass, Japanese millet, Ebena brand common vetch, Goldeneye german millet, Finito turnip rape, Akela brand forage rape, Ho brand crimson clover, Winner brand berseem clover, Pearl millet, Goldeneye peas, and Haymaker oats.

- Commercial cocktail 2 (Pickseed): Forage kale, Firkin Italian ryegrass, Crimson clover, Tillage radish, Crown millet, Purple top forage, Hairy vetch, Goldeneye peas, and Maverick barley.
- Commercial cocktail 3 (Performance seed): Nabucco Italian ryegrass, Spring green festulolium, Premiere forage kale, Impact forage brassica, Frosty berseem clover, Purple bounty hairy vetch, Fixation balsana clover, Goldeneye peas, and Haymaker oats.
- Commercial cocktail 4 (Imperial Seed 2 extend): Sorghum Sudangrass, Japanese millet, Winner brand berseem clover, and Forage collards.
- Commercial cocktail 5 (Warm-season cocktail): Proso millet, Sorghum Sudangrass, Pearl millet, and DL delicious peas.
- CDC Maverick barley monocrops (control 1)
- CDC Haymaker oats monocrops (control 2)
- AAC Awesome wheat (control 3)

The site was seeded using a Fabro plot drill with disc-type openers on 9" row spacing at a depth 1" depth with a soil temperature of 12.6 degrees Celsius. Six rows of 8-meter-long were sown per plot. The cocktail was subsequently harvested on August 13, 2022 and analyzed for forage productivity and quality.

Our findings

Forage moisture

The forage moisture content at harvest was significant for all forage treatments. At harvest, moisture for producer cocktails was between 74 – 77% while commercial cocktails ranged between 55.4 – 78% (Table 41). Overall, all treatments had moisture content (>50%). The high moisture content observed in some cocktails would make preservation as hay crops impractical in this region, which has a very small window of opportunity to dry down harvested crops in early fall. However, cocktails could better be suitable for direct grazing or silage making which requires a substantial amount of moisture in forage (approximately 65-70%).

Dry matter yield

The CDC Maverick barley had the highest forage yield of 5,873 lb/ac while commercial cocktail 4 (Imperial seed 2 TG extend) recorded the lowest of 1,939 lb/ac (Figure 6). This was approximately 3,934 lb/ac more than the commercial cocktail 4. Forage yield for producer cocktails ranged from 4,431 lb/ac for producer mix 4 (John prince swath grazing) to 2,890 lb/ac for producer mix 3 (Garth Shaw). In commercial cocktails, a significantly higher yield of 4,217 lb/ac was noted in commercial cocktail 2 (Pick seed) while commercial cocktail 4 (Imperial seed 2) had the lowest of 1,939 lb/ac (Figure 7). Overall, except for CDC Haymaker oat, monocrops were higher in yield than both commercial and producer cocktails. Alternatively, producer cocktails were generally better than commercial cocktails.

Crude protein (CP)

CP content was highest in commercial cocktail 4 (22.3%), followed by commercial cocktail 1 (15.4%). The lowest CP was recorded in CDC Maverick barley (10.4%), producer cocktail 4 (11.7%), CDC Haymaker oats (12.1%), and AAC Awesome wheat (12.6%). Overall, producer cocktail 1 (14.8%), producer cocktail 2 (14.2%), producer cocktail 3 (14.8%), commercial cocktail 1 (15.4%), commercial cocktail 3 (15.5%), and commercial cocktail 5 were above the average CP content of 13.9% (Table 41). Generally, producer cocktails were superior in CP to both commercial cocktails and monocrops. However, all treatments herein had adequate CP contents to meet the requirements of all classes of cattle.

Total digestible nutrients (TDN)

Energy levels within cocktails ranged between 64.3% for commercial cocktail 1 to 68.7% for commercial cocktail 5. All commercial and producer cocktails were above 64.0 % of TDN (Table 41). However, commercial cocktails were generally better in %TDN than both producer cocktails and monocrops. Using the rule of thumb for beef cow energy requirement (55-60-65), cocktails could meet the needs of cows in mid-gestation (55%), during mid-gestation (60%), and after calving (65%). Only producer cocktail 1, commercial cocktail 1, commercial cocktails 3, and 4, and CDC Haymaker oat could not meet the requirement for calves.

Neutral detergent fibre (NDF) and acid detergent fibre (ADF)

NDF was significantly different among treatments ranging from 37.4% for commercial cocktail 4 to 53.1% for CDC Haymaker oats. Commercial cocktail 4 (37.4%) and producer cocktail 5 (40.9%) had better NDF, an indication of better uptake and consumption by cattle. Conversely, ADF was low for all treatments ranging from 27.2% for commercial cocktail 4 to 32.0% for CDC Haymaker oat. Here, producer cocktail 4 (29.1%), commercial cocktail 5 (29.3%), and producer cocktails 3 and 4 (29.8%, each) were the best performers (Table 41). This indicates a better digestibility over the other treatments.

Relative feed value (RFV)

The RFV was highest in commercial cocktail 4 (170) and commercial cocktail 5 (152) but lowest in CDC Haymaker oat (112). With the exception of CDC Haymaker oat (112), all treatments in this study were above 120. However, both commercial and producer cocktails had better RFV compared to monocrops (Table 41). Overall, producer cocktails ranked as 1st, commercial cocktails 2nd, and monocrops 3rd. The result for all treatments indicates higher expected consumption and digestibility of cocktails treatments.

Minerals

Calcium (Ca): content varied from 0.2% for AAC Awesome wheat to 1.5% for commercial cocktail 5. Notably, Ca contents was higher in both commercial and producer cocktails compared to monocrops (Table 42). This result indicated that all treatments, but AAC Awesome wheat met the Ca requirements in diets for lactating cows (0.31%), dry cows (0.18%), and calves (0.58%).

Phosphorus (P) and Potassium (K): P ranged between 0.20 and 0.10%. Except for producer cocktail 4, 5, and 6, commercial cocktail 2 and CDC Haymaker oat, all treatments recorded P values of 0.2%. Generally, commercial cocktails had better levels of P compared to both producer and cocktails and producer cocktails (Table 42). Nevertheless, treatments could meet P requirement for lactating and dry cows (0.16%) but not growing calves (0.26%). Furthermore, K contents varied between 1.3% for producer cocktail 5, commercial cocktail 5 and CDC Maverick barley (1.3% each) to 2.1% for commercial cocktail 4. All tested treatments were adequate to meet the K requirements for both lactating cows (0.60%) and growing calves (0.70%).

Magnesium (Mg), Sodium (Na), Iron (Fe), Zinc (Zn), Manganese (Mn): Magnesium was generally higher in all forage crops tested ranging between 0.2% to 0.4%. Sodium on the other hand was better except for commercial cocktail 5 (0.1 ppm). Fe, Mn, and Zn were comparatively at optimum level requirement in forage treatments. The study also showed considerably higher Fe in both producer and commercial cocktails compared to monocrops, while similar trends was observed for Zn and Mn. These were adequate for all classes of cattle.

Conclusion

The CDC Maverick barley, AAC Awesome wheat, producer cocktail 4 (John Prince swath grazing) and 2 (Allan McLachlan) produced >4,400 lb DM yield/acre making them the highest producing treatments. Commercial cocktails 1 and 4 were superior in CP contents to all cocktail treatments in particular monocrops. CP contents were adequate to meet the requirement of all classes of cattle. In addition, energy levels in all treatments were sufficient to meet the needs of cattle except for producer cocktail 1, commercial cocktail 1, commercial cocktails 3, and 4, and CDC Haymaker oat which could not meet the needs for growing calves. Minerals were variable in treatments tested, hence it is recommended that free choice minerals be supplied through feeding in their right proportions to ensure better absorption and utilization by cattle.

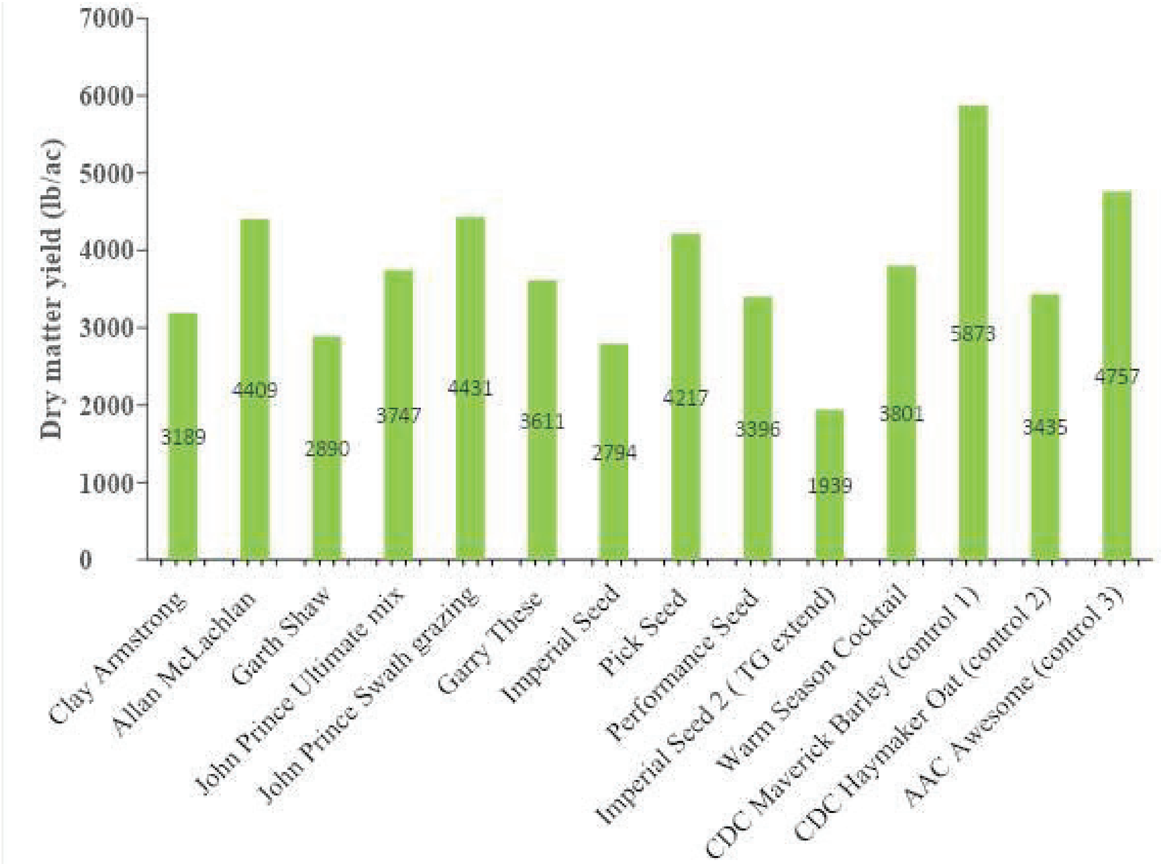


Figure 7. Forage dry matter yield of commercial and producer cocktails tested in 2022 at Debolt

P value = 0.001, mean= 3773 lb/ac, LSD0.05 = 425

Table 41. Forage quality indicators of cocktails mixtures tested at Debolt (2022)

Treatment	Moisture (%)	CP (%)	ADF (%)	NDF (%)	TDN (%)	RFV
Clay Armstrong	74.0	14.8	30.8	49.0	64.5	124.0
Allan McLachlan	72.9	14.2	30.0	45.4	67.8	134.0
Garth Shaw	77.3	14.8	29.8	45.6	65.0	134.0
John Prince Ultimate mix	71.3	12.4	29.8	48.3	65.5	127.0
John Prince Swath grazing	74.6	11.7	29.1	44.6	68.5	139.0
Garry These	74.1	13.1	30.5	49.0	65.5	124.0
Imperial Seed	64.6	15.4	31.1	47.7	64.3	127.0
Pick Seed	55.4	12.7	30.3	46.2	66.0	132.0
Performance Seed	78.2	15.5	31.4	46.6	64.8	129.0
Imperial Seed 2	62.7	22.3	27.2	37.4	64.3	170.0
Warm Season Cocktail	57.4	15.1	29.3	40.9	68.7	152.0
CDC Maverick Barley	66.3	10.4	29.7	45.5	66.8	135.0
CDC Haymaker Oat	73.2	12.1	32.0	53.1	64.3	112.0
AAC Awesome	66.7	12.6	30.0	49.5	65.3	124.0
MEAN	**69.2**	**13.9**	**30.1**	**46.6**	**65.8**	**132**
LSD0.05	4.7	3.1	3.8	5.1	4.2	21
P value	0.65	0.001	0.13	0.001	0.03	0.001

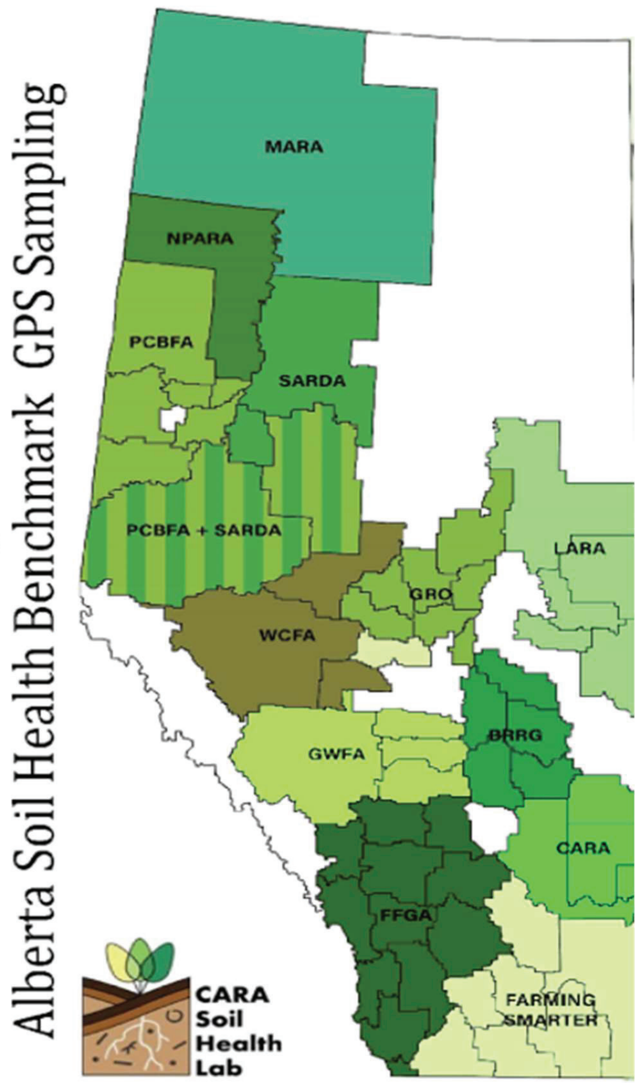
Table 42. Mineral contents in cocktails mixtures tested at Debolt (2022)

Treatment	Ca (%)	P (%)	Mg (%)	K (%)	Na (%)	Fe (ppm)	Zn (ppm)	Mn (ppm)
Clay Armstrong	0.7	0.2	0.2	1.4	0.4	372.0	23.8	57.0
Allan McLachlan	0.7	0.2	0.2	1.7	0.3	194.0	26.0	43.0
Garth Shaw	1.3	0.2	0.4	2.0	0.4	376.0	25.0	60.0
John Prince Ultimate mix	0.5	0.1	0.2	1.3	0.4	296.0	19.0	43.0
John Prince Swath grazing	0.7	0.1	0.2	1.5	0.2	214.0	21.5	31.0
Garry These	0.7	0.1	0.2	1.7	0.5	275.0	20.8	59.0
Imperial Seed	0.9	0.2	0.3	1.7	0.5	309.0	20.5	71.0
Pick Seed	0.8	0.1	0.3	1.5	0.3	190.0	20.7	34.0
Performance Seed	1.1	0.2	0.3	1.7	0.5	337.0	21.0	60.0
Imperial Seed 2	1.4	0.2	0.5	2.1	0.4	316.0	25.3	63.0
Warm Season Cocktail	1.5	0.2	0.4	1.3	0.1	390.0	24.3	59.0
CDC Maverick Barley	0.3	0.2	0.2	1.3	0.2	158.0	22.5	26.0
CDC HayMaker Oat	0.4	0.1	0.2	1.6	0.6	225.0	15.5	66.0
AAC Awesome	0.2	0.2	0.2	1.4	0.0	267.0	19.5	42.0
MEAN	**0.76**	**0.15**	**0.26**	**1.6**	**0.34**	**279**	**21.7**	**51**
LSD0.05	0.45	0.05	0.14	0.64	0.24	213	8.1	22
P value	0.001	0.02	0.001	0.01	0.001	0.04	0.03	0.001

On-Farm Trials & Demonstrations

Soil Health Benchmark Study Update

Dianne Westerlund, CARA



The Chinook Applied Research Association (CARA) is heading a provincial initiative funded by the Canada Agricultural Partnership (CAP) designed to generate a database of soil parameters related to physical, biological and chemical indicators. The Alberta Soil Health Benchmark study is led by CARA's Soil Health and Crop Management Specialist Dr. Yamily Zavala. Dr. Zavala was instrumental in the development of CARA's Soil Health Lab (CARASHLab), the first farmer-focused lab evaluating physical and biological soil qualities in western Canada. The lab utilizes protocols from Cornell University and the former Canadian SoilFoodWeb Lab.

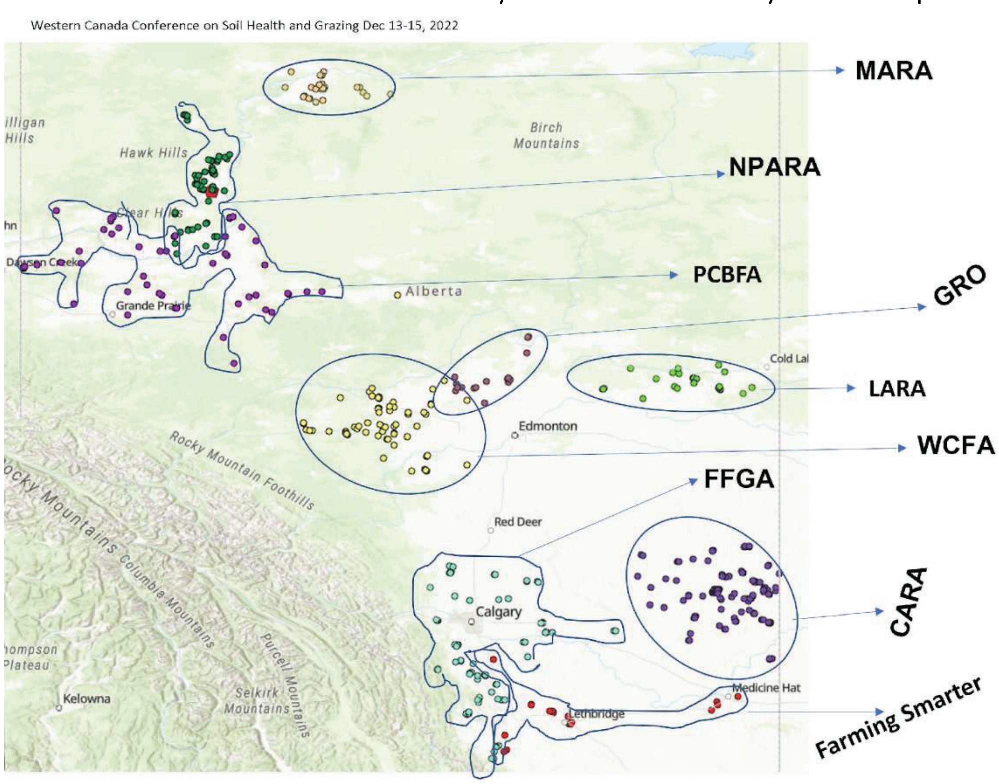
Eleven of Alberta's applied research and forage associations participate in the soil health Benchmark Study, working with farmers and ranchers in several soil zones throughout the province. Each group documents field history and management information and uses the same protocols when collecting soil samples. Samples are received and processed through CARA's Soil Health Lab. Dr. Zavala supervises the analysis of biological and bio-physical characteristics, including soil respiration rate, texture and wet aggregation stability, the level of active carbon rate and total and potential biological biomass. Analyses of chemical components are currently contracted to A&L Labs and the University of Alberta's soil lab determines the total organic carbon, carbon and nitrogen levels. All information is being summarized into a database which will help generate strategic management practices targeting specific regional soil constraints in the future. Monitoring (re-visiting) sample sites will help determine if those managements are working or not. Funding for the Benchmark project wrapped up in 2022, but further verification of management practices at over 200 of the original benchmark sites will be made through a new project supported by Results Driven Agricultural Research (RDAR).

The CARASHLab generates a comprehensive report for each site sampled, which is compiled and shared with the local association and landowners. The report captures a picture of the soil health and is a point of reference for comparison for future sampling or following management changes. It includes measurements of the individual soil indicators as well as a ranking of whether the measurement is an area of concern or constraint for overall soil productivity. Suggestions for mitigation or improvement of problem soil components may also be added to the soil health report card. Discussion of these report cards has been the focus of several extension activities held by participating producer associations.

Although not all samples collected to date have been processed or added to the data bank, Dr. Zavala has observed a few trends from samples in hand. Compaction and poor water infiltration are common concerns at many sites and are often associated with lower biological components. A great diversity of beneficial soil creatures has been observed including, protozoa functional groups, fungal hyphae and nematode-feeding groups as well as predatory species. Each soil sample evaluated has its own 'biological signature' with no two samples having the same biological 'fingerprint'. The biology in some soils just needs to be 'woken up' whether from adding diversity to the forage mix or crop rotation, maintaining green growth longer during the growing season or adding biological amendments to the soil.

Specific strategic management practices and recommendations will be identified during the final phases of the Benchmark Study as well as the management verification project which is just beginning. The Benchmark Study is intended to be a working tool that helps managers better understand soil health, how various management practices impact it and which practice might contribute to improving land resilience. It is Dr. Zavala's intention that it continues to grow and provide valuable information to producers into the future.

Note: 1525 soil samples, from 1138 fields managed by 434 farmers have been received to date under the Soil Health Benchmark Study. Data from the analyses of samples submitted by individual farmers, or as part of other studies, will also be included in the database.



PCBFA has sampled 77 fields across the Peace Country since 2019; some sites are revisited after a 3-year period to monitor changes to soil health with change in field management.


Province-Wide Project




Evaluation of the ecosystem services and profitability of perennial grain crops for integrated grain and forage production in Alberta

Funder: Results Driven Agriculture Research (RDAR)
By Chelsey Hostettler

Background

Perennial cereal grain crops (PCGC) are grain crops that live and remain productive in the field for more than two growing seasons. PCGCs can produce grain every year, have no requirements for annual tillage, pre-pass, seed and seeding costs, which are in most cases required for annual cropping systems. PCGCs can provide producers. with mixed farming enterprises. the flexibility of using a grain crop or a forage crop for their farm needs.

Information on PCGC adaptation, intercropping systems, grain and forage productivity, ecological stability, and agroecosystem services, as well as economic viability, will assist producers in making future decisions on which PCGCs to use in their farming systems. Our hypotheses, on this project, are that: 1) PCGC productivity can be maintained by including a forage legume component, 2) PCGC/legume intercropping will provide ecosystem functions, soil health benefits and offer opportunity for integrated crop-forage-livestock production, and 3) PCGC/legume intercropping will reduce annual fertility and production costs, as well as insight into cost benefit analysis.

Objective

The 2022 crop year is considered an establishment year for the PCGCs and legume-cereal mixtures. A collection of baseline data was completed for soil chemical and physical characteristics, and biological activities to enable proper assessments of soil health indicators including mycorrhizal root colonization under different soil types and ecozones in Alberta. Plant count establishment was a key indicator in the plant populations following first year seeding at each project site.

Potential Benefits to Agricultural Industry

The benefits of any PCGC/legume intercrop system will depend on establishment, management, and harvesting factors. The project will provide information on management practices in order to optimize production potential of PCGCs and PCGC intercropping systems. One crucial goal is to inform farmers throughout Alberta about the potential of a perennial cereal crop when it's planted with a nitrogen-fixing legume. There is opportunity to reduce fertility inputs while also utilizing multi-year harvesting strategies. There is additional industry potential for continued work on perennial cereal crop seed breeding in Alberta.

Methods

PCBFA seeded a site at the Fairview Research Farm along with project partners from five other agricultural organizations from across the province. They are: GRO at Westlock, MARA at Fort Vermillion, University of Alberta at Breton, BRRG near Forestburg and CARA at Oyen.

At the Fairview Research Farm, we are testing the resiliency and productivity of two PCGCs: ACE-1 and Kernza®. ACE-1 perennial rye was developed by Agri-Food Canada Research Centre in Lethbridge. This particular cultivar was developed for silage and greenfeed. ACE-1 establishes quickly and competes well with weeds. It produces more biomass than barley and fall rye and the forage quality was found to be similar to barley. A drawback is that it has shown to produce less seed than high yielding fall rye, however improvement through breeding continues. Kernza® is a type of intermediate wheatgrass, which was further developed by the Land Institute. It serves a dual purpose as a crop, with some farmers choosing to let livestock graze on the remaining leaves and stems after harvesting the grain using a combine.

Treatments
Perennial Wheat Mono
Perennial Wheat + Alfalfa
Perennial Wheat + White Clover
Perennial Wheat + Sainfoin
Perennial Rye Mono
Perennial Rye + Alfalfa
Perennial Rye + White Clover
Perennial Rye + Sainfoin

What we are testing:

- Spring forage harvest production then fall grain yield
- Summer grain yield then fall forage harvest production
- Soil health metrics
- Forage legume fixation
- Water use efficiency

Year 1 – All sites were established except CARA's site at Oyen (due to drought conditions). Plans to re-establish this site in 2023 are underway.

Years 2 & 3 – Evaluate forage and grain production, take plant and soil measurements for nutrient analysis. Complete an economic analysis. Employ two masters students to assist with project analysis and evaluation.

Kernza® wheat alternate row seeded with white clover at GRO, Westlock project site.

ACE-1 rye alternate row seeded with sainfoin at MARA, Mackenzie project site.

Seeding

Seeding was completed on June 15. Seed treatment was applied on the cereals and an inoculant was applied on the legumes. PCGC monocultures were at 100% normal seeding rates, while the intercropping treatments were seeded at 100% PCGC and 50% legume. The seeding rate calculations were based on normal seeding rates for the various crop types provided in Table 43.

Table 43. Normal Seeding Rates

Crop Type	*Plant Population (m^2)*
Perennial Wheat	320
Perennial Rye	260
Alfalfa	300
White Clover	350
Sainfoin	125

Seeding was completed in 6 rows with row spacing at 9" and plot size of 11.7 m^2. The site was tilled and harrowed prior to seeding, allowing a uniform, shallow coverage of the seed and preventing the seedbed from drying out. Seed placement for the legumes was at 0.5" and for the cereals was 1".

Fertility

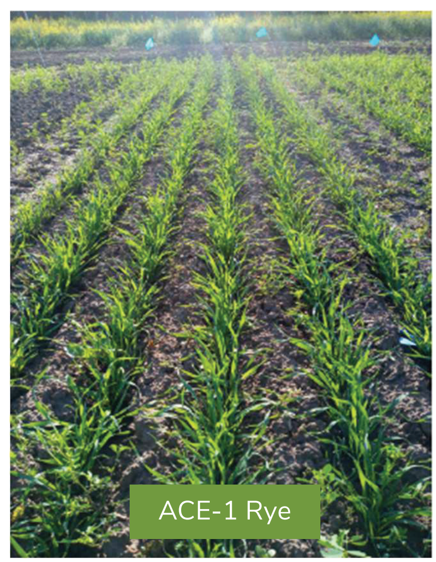
A blended fertilizer of N-P-K-S was applied based on the fertilizer recommendations from soil reports obtained from conducting a composite soil sample. Fertilizer recommendations for grass-legume mixture was 56-35-21-10 lb/acre for an average yielding forage crop.

Spraying

At the Fairview site, Startup was applied at 0.67 L/acre on May 30 and Basagran Forte was applied on July 22 with a rate of 910 mL/acre. To reduce the volunteer canola from setting seed, the plots were mowed on August 22 at an increased height so as not to harm the vegetative undergrowth of the PCGC and cereal-legume mixtures.

Data Collection

- Baseline infield measurements were taken for soil compaction, soil infiltration, soil temperature and moisture
- Bi-weekly monitoring: NDVI, soil moisture and temperature. The four lowest readings (between 0.32 and 0.39) were measured in plots with perennial wheat, perhaps further indicating the slow establishment of perennial wheat at the Fairview site.
- Establishment plant counts were conducted 30 days and 45 days after seeding. Same row seeding of perennial cereal with legumes provided very low to no plant counts of legumes. Generally, the plant counts decreased between the 30 day and

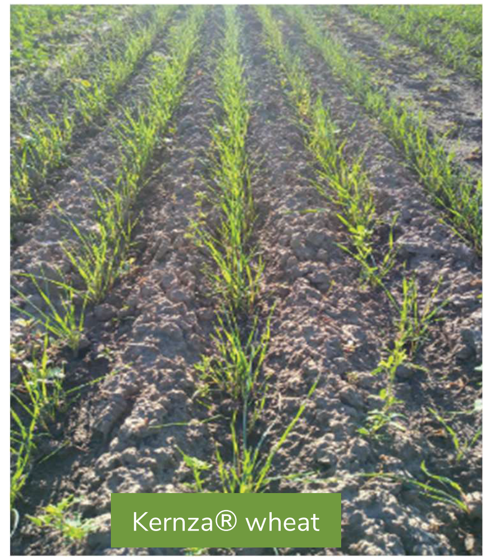

ACE-1 Rye

45-day count. This may have been due to plant mortality, lack of moisture and the cereals out-competing the legumes.

- Mycorrhizal root colonization (MRC) samples were taken and submitted to AAFC for analysis.

2022 Field Observations

1. Four of the six group sites experienced similar difficulties with same row legume and perennial cereal establishment versus alternate row.
2. Kernza® wheat's first year heading was evident in plot sites from all the project groups.
3. Overall, ACE-1 rye performed better than wheat for all project group sites.
4. Thicker leaves when both perennial cereal crops where tillering was evident on the ACE-1 rye.


Kernza® wheat

Results

Plant Establishment Counts

To determine plant stand viability, plant establishment counts were conducted on 4 rows at 50 cm in length. These counts were conducted 45 days after seeding.

Table 44. Variations amongst project sites for top performing plant establishments

	Top Performing Establishment (plants/ft^2)		
Project Location	#1	#2	#3
PCBFA, Fairview	rye/clover (AR)	wheat/clover (AR)	wheat/alfalfa (AR)
MARA, Fort Vermillion	rye/alfalfa (SR)	wheat/sainfoin (SR)	wheat/alfalfa (SR)
GRO, Westlock	wheat/clover (AR)	rye/clover (AR)	rye/alfalfa (AR)
BRRG, Forestburg	wheat/clover (SR)	rye/sainfoin (AR)	wheat/clover (AR)
U of A, Breton	wheat/clover (AR)	rye/clover (AR)	wheat/alfalfa (AR)

AR – alternate row seeding
SR – same row seeding

The plant counts observed for alternate row and same row seeded plots provided results where the same row seeded plots were generally less than the plant stands that were seeded in alternate rows. Alfalfa and clover were generally in the top 3 when interseeded with wheat or rye. Table 45 outlines the legume and cereal plant count percentages within each plot.

Table 45. Percentage of legume and cereal within each plant stand

Seeding Method	Crop Name	%Cereal	%Legume
Mono	Rye	100%	
	Wheat	100%	
Same row	Rye-Clover	98%	2%
	Rye-Alfalfa	91%	9%
	Rye-Sainfoin	87%	13%
	Wheat-Clover	96%	4%
	Wheat-Alfalfa	93%	7%
	Wheat-Sainfoin	94%	6%
Alternate row	Rye-Clover	44%	56%
	Rye-Alfalfa	60%	40%
	Rye-Sainfoin	63%	37%
	Wheat-Clover	54%	46%
	Wheat-Alfalfa	61%	39%
	Wheat-Sainfoin	67%	33%

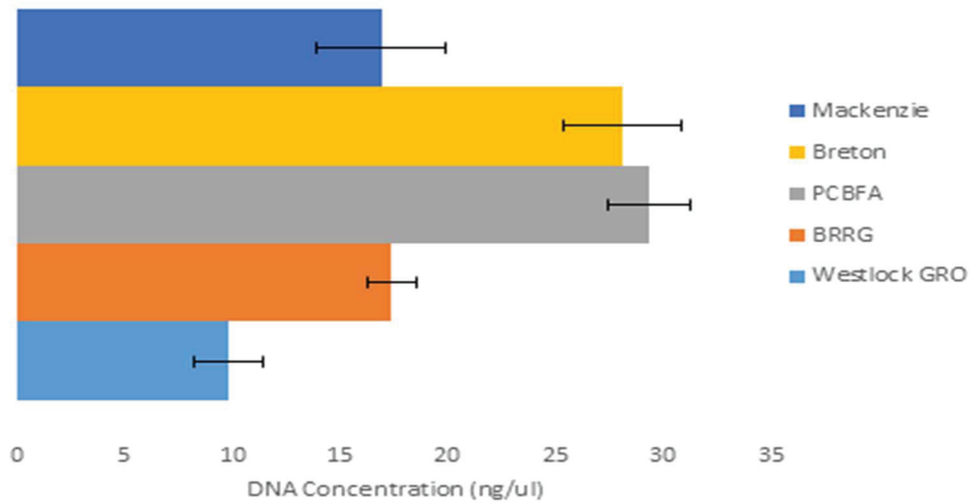
Preliminary Metrics for Soil Biomass

Baseline data from bulk soil samples were analyzed at AAFC Lethbridge. DNA concentrations can be used as a preliminary metric of biomass in soils but the project groups will be considering a multitude of other parameters to determine beneficial microbial activity.

The highest DNA concentrations were observed at U of A, Breton and PCBFA plots while the lowest DNA concentrations are in Westlock. DNA concentrations below 10 ng/ul are generally considered problematic, suggesting that some Westlock samples may be difficult to sequence.

DNA quality is assessed through 260/280 ratios with optimal readings between 1.8 and 2.0. All sample averages were within this acceptable range with the lowest being 1.8 at the MARA site and the highest at GRO, Westlock and BRRG at 2.0.

The initial analysis is outlined for all groups in Figure 8.



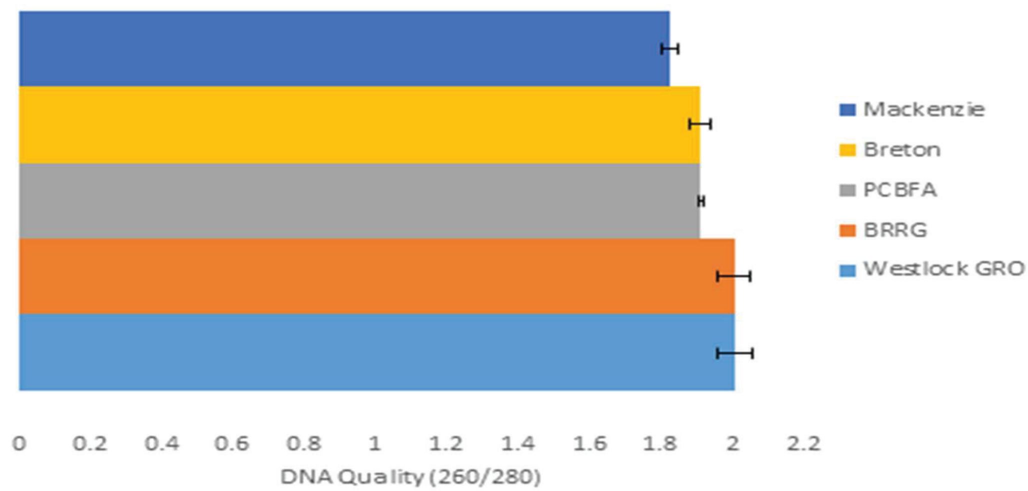


Figure 8. Initial analysis of baseline soil DNA concentrations

Conclusion

Overall, the perennial rye proved to have good establishment with a lot of tillering for weed suppression potential. Same row seeded plots had less legume plant counts than alternate row plots. Although alternate row seeding may prove to be difficult to complete on-farm as seed drill implements are not designed for alternate row seed placement, the plant counts observed within small plots were generally higher for legume survivability.

Unseasonably hot and dry fall weather conditions may have impacted the perennial stands' continuation of establishment. Plant stands will be assessed in the spring of 2023.

PEACE REGION LIVING LAB PROJECT

Enhancing AgroEcosystem Services – A Peace Region Living Lab Project

Agriculture and Agri-Food Canada through the Agricultural Climate Solutions Living Labs program

By Chelsey Hostettler

Background

The Peace Region Living Lab project is a region-wide collaboration led by the Peace Region Forage Seed Association (PRFSA). Seven other producer groups and an Indigenous Partner, Fourth Sister Farm, have joined the PRSFA to bring together a project that will serve agricultural producers and land stewards of the region. Enhancing agroecosystem services in the Peace River Region is the focus of the Peace Region Living Lab (PRLL), with the goal of adoption of practices that improve productivity, profitability and environmental resiliency. This Living Lab is unique in that it will encompass the Peace Region in both Alberta and BC. The PRLL will look at agricultural operations as whole systems, considering land management, economic analysis and the social aspect of implementing innovative practices.

The priority of Agriculture and Agri-Food Canada's (AAFC) Agricultural Climate Solutions (ACS) program is to contribute to Canada's plan to reduce greenhouse gas (GHG) emissions by 30% below 2005 levels by 2030 and net-zero emissions by 2050. Its objective is to find farm-level climate solutions that will contribute to reducing GHG emissions, mitigating effects of climate change, and supporting environmental benefits while increasing sectoral resilience. The vision for the Peace Region Living Lab aligns with the top priorities of the ACS program which include carbon sequestration, GHG emissions reduction and other environmental benefits (improved soil health, biodiversity, water quality). The Peace Region of Alberta and British Columbia boasts an expansive and diverse northern agriculture and agro-forestry environment. Ranging from between 50⁰ and 60⁰ N latitude, the opportunities for carbon sequestration, greenhouse gas emission reduction and enhanced biodiversity are bountiful. Examples of BMPs that will be analyzed on producer's operations include relay cropping, cover cropping in a variety of contexts, grazing management and livestock integration with annual cropping and vegetable systems. Knowledge exchange and extension are a cornerstone of the project and the program will encompass a range of activities including peer-to-peer learning, co-development of BMPs, and various learning materials such as a video series and podcast. Specific activities designed to support Indigenous land stewards and youth in agriculture are included in the project.

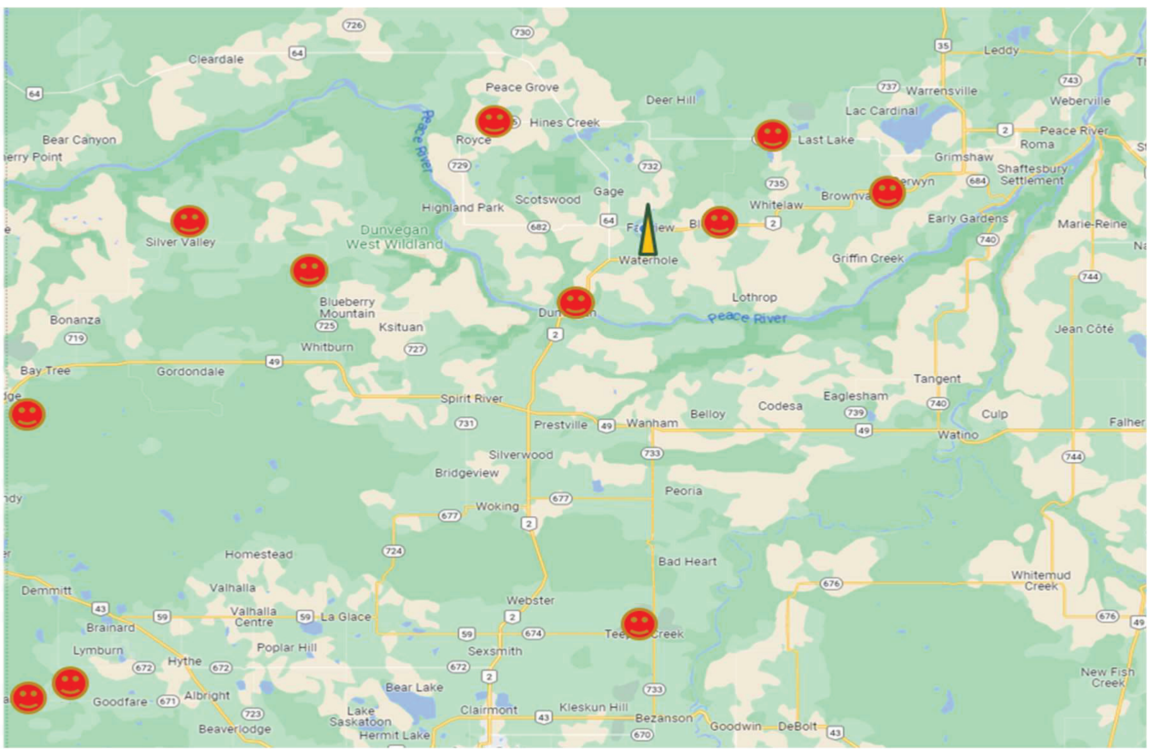
The approval of this application secures the delivery of these critical activities and ensures that the region continues to be on the cutting edge of innovative management practices. The identification and documentation of BMPs that can build resiliency into farm and ranch operations gives producers practical management tools needed to manage the many risks, particularly due to climate change, that are associated with agriculture and land stewardship.

Objective and Potential Benefits to Agricultural Industry

The PRFSA has a strong history of working collaboratively with Agriculture and Agri-Food Canada, particularly the Beaverlodge Research Station. This multi-stakeholder partnership involving AAFC, regional research and extension associations, academia, and provincial associations has accomplished successful studies and technology transfer, contributing to the resiliency in production systems. The PRFSA is also highly active in collaborating on work with many of the other consultants and AAFC research scientists stationed at various research centres across Canada. The PRFSA feels the information gained from this project is critical to the agriculture industry not only in the Peace River Region but across western Canada.

Methods

PCBFA has collaborated with 11 producers across the Peace Country and has developed plans to monitor a BMP and check site within each farmer's operation. Below is a map outlining the locations of sites we are monitoring.



Examples of Best Management Practices that are part of this project are:

- Increase Crop Diversity and Nutrient Management through Intercropping and green manure in cash crop rotation
- Nutrient Management by applying compost to hay land
- Increasing Crop Diversity with Companion Cropping
- Pasture Rejuvenation through bale grazing, direct seeding, feeding hay bales dominated by mature pods of cicer milkvetch (CMV), with seed pods passing through cattle digestion for germination
- Increase Diversity through utilization of cover crops and extending grazing season

PCBFA is also coordinating a field scale project that has been seeded on the Fairview Research Farm. The project is looking at methods of improving nutrient availability on grain production fields through green manure and managed grazing. We are evaluating:

- Benefits of integrating cows into grain production crop rotation
- Comparison of soil improvement, crop fertility savings and soil organic carbon sequestration of adding nutrients to fields through green manure and cow manure
- Effectiveness of grazing crop residues
- Evaluate the economic feasibility of integrated crop-livestock-infrastructure as a barrier

We are also observing as the land manager, what are the options for a grain farmer to partner with a livestock producer in facilitating livestock integration. The planned crop rotation is as follows:

	2022	2023	2024	2025	2026
BMP	**Barley**	Cover Crop (grazed)	Canola	Oats	Canola
Control	**Barley**	Cover Crop (green manure)	Canola	Oats	Canola

Figure 9. Plans to monitor the effects of grazing and green manure in a 5 year crop rotation

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