Regional Annual Silage Trials

Partners: Alberta Agriculture, Forestry and Rural Development
Battle River Research Group
Chinook Applied Research Association
Gateway Research Organization
North Peace Applied Research Association
McKenzie Applied Research Association
West-Central Forage Association
SECAN
Association of Albert Co-op Seed Cleaning Plants
Alberta Brand, Canadian Seed Growers Association
A & L Canada Laboratories
Imperial Seeds
Canadian Agriculture Partnership

The Annual Forage Trial (AFTs) began at LARA in 2008 with the purpose of comparing annual forage crops for whole-plant production when considering both yield and quality. Funding was obtained from the Alberta Beef Producers and the Ag and Food Council. The trial was seeded in four blocks of plots (barley, oats, triticale and alternatives) in three locations (Fort Kent, St. Paul and Lac La Biche).

The trial was expanded in 2009 to form the Regional Silage Trials, a provincial partnership between six applied research and forage associations with 11 plot sites across the province. The Alberta Beef Producers provided funding for this initiative and Alberta Agriculture helped coordinate seed. While many of the associations involved have been growing silage trials for a number of years, this is the first coordinated effort to standardize the protocol, variety selection and data reporting. Provincial protocol was established for five blocks of plots: barley, oats, triticale, pulse and late-seeded.

In 2022, the LARA Regional Annual Silage Trial included six blocks: barley (21 varieties), oats (12 varieties), triticale and wheat (10 varieties), winter/spring intercrop (15 treatments), pulse/cereal intercrop (12 treatments) and alternative (10 varieties).

In partnership with the Association of Alberta Co-op Seed Cleaning Plants and the Alberta Seed Growers Association, the Regional Annual Silage Trial information are annually printed in the Alberta's Seed Guide (seed.ab.ca). The Regional Silage Trial data for 2021 and 2022 have been printed in the most recent seed guide.

Regional Annual Silage Trial

Cereals

Partners: Canadian Agriculture Partnership
Alberta Agriculture, Forestry and Rural development
Battle River Research Group
Chinook Applied Research Association
Gateway Research Organization
West-Central Forage Association
Peace Country Beef and Forage Association
Mary Carson and Michael Carson

Objectives:

1. To determine the best yielding cereal forage varieties (barley, oats, triticale/wheat) for whole plant forage production in Northeastern Alberta.
2. To determine the best quality cereal forage varieties (barley, oats, triticale, wheat) for cattle feed in Northeastern Alberta.

Background:

An important aspect of crop production is variety selection and, with new varieties continually becoming available, current and comprehensive forage variety yield and quality data is essential for Alberta producers. Previous experience with cereal production and the Regional Variety Trials has shown that there can be a 15% increase in production from selecting the best variety, which, on average, can be an increase of $25/acre.

Through the use of experience, neighbors and publication such as the Alberta Seed Guide (seed.ab.ca), we make variety selection decisions to benefit producers. However, there has been a lack of whole-plant annual forage production information to aid us in making cropping decision for forage production.

The purpose of this trial is to supply producers with current and comprehensive annual forage variety yield and quality data for silage, greenfeed or swath grazing in Northeastern Alberta (crop zones 3 and 5) and across the province.

Method:

The cereal trials were grown in three blocks of plots: barley, oats and triticale/wheat, in two locations: LARA Fort Kent (NE25-61-5-W4) and Smoky Lake (SE 14-59-18-W4). The trial blocks were seeded as a randomized complete block design (RCBD) with four replicates to reduce error. The plots measured 1.15 m by 6 m in area.

Agronomic information on the trials can be found in Table 19. The trials were seeded using the LARA five-row zero-till small plot drill and blend fertilizer was side-banded at the time of seeding. The trials in Fort Kent were seeded on May 27, 2022 (oats) and the trials in Smoky Lake were

seeded on May 25, 2022 (barley and triticale/wheat). The trials were sprayed with a 3-point hitch sprayer once during the growing season.

Crop height and stage of maturity was recorded prior to harvest with the LARA alfalfa-Omega self-propelled forage harvester. The total plot weight was recorded and samples were taken to assess dry matter content. Additional composite samples were taken from each variety, frozen and sent to A & L Canada Laboratories for wet chemistry analysis. Statistical analysis was conducted using R statistical software, $p = 0.05$.

The following varieties were grown in the Regional Annual Silage Trials in 2022:

Barley

- *CDC Austenson* – 2-row barley variety with semi-smooth awns, short and strong straw and high feed yield.
- *Altorado* – 2-row, spring feed barley with good resistance to lodging and a fair to good resistance to drought conditions.
- *Amisk* – rough awned, 6-row, semi-dwarf general purpose barley with strong straw for decreased lodging potential.
- *Canmore* – high yielding, 2-row general purpose barley variety with good resistance to lodging.
- *CDC Cowboy* – high yielding, 2-row feed barley variety with excellent standability and improved disease resistance.
- *AB Advantage* – 6-row, smooth-awned feed and forage barley with high grain yield and good agronomic performance.
- *Claymore* – 2-row barley variety developed from CDC Copeland x Xena.
- *AB Cattlelac* – semi-smooth awned barley variety with good lodging resistance, good grain yield and excellent disease resistance.
- *AB Wrangler* – 2 row feed grin and silage variety with high tonnage potential, early to medium maturing, moderate disease resistance.
- *Sundre* – high yielding, 6-row barley variety with good disease resistance.
- *CDC Maverick* – 2-row, smooth-awned forage barley with high forage yields and good drought tolerance.
- *AB Hauge*- 2 row hulled general purpose barley with potential for forage production, high protein, low NDF and ADF.
- *CDC Churchhill* – high yielding 2-row malt barley variety with lower grain protein than AC Metcalfe and an overall excellent agronomic package.
- *AB Prime* – barley variety developed in Alberta.
- *Esma* – 2-row barley variety with strong yields and agronomic package.
- *Stockford* – hooded, 2-row barley variety suitable for grain production, hay, and forage.
- *AB Tofield* - 6-row, awned forage and feed barley with high yields and good lodging resistance.
- *CDC Renegade* - 2 row smooth awn, mid-height barley with excellent forage yield and great grain yield.
- *CDC Fraser*- 2 row malt variety that is multi-use with high grain and good forage yields.

- *KWS Kellie*- very short, strong strawed 2-row European barley with excellent grain yield.

Oats

- *CDC Baler* – very leafy, forage oat variety.
- *AC Juniper* – early maturing, general purpose oat variety with high yields and strong straw.
- *AC Morgan* – high yielding, later maturing milling oat with good lodging resistance and is commonly used for silage or greenfeed.
- *CDC Haymaker* – later maturing forage oat variety with high forage yields and quality.
- *CS Camden* – milling oat, excellent yield potential, great lodging resistance, short height, and big leaf biomass
- *CDC Arborg* – is a milling oat with good yield potential, early maturing, lodge resistant.
- *Murphy* – widely adapted forage oat with high yields, improved lodging resistance and is well suited for silage, swath grazing or greenfeed.
- *CDC Nasser* – feed oat variety with low lignan hull and high oil content.
- *ORE 3542M* – white hulled milling oat variety with short, strong straw, good lodging resistance and good grain yields.
- *CDC Endure* – oat variety with excellent yield and standability.
- *CDC SO-1* – early maturing, very high digestible brown oat variety with high fat content and does not need to be rolled. Short strong straw for reduced lodging.
- *AAC Douglas* - is a high β-glucan white hulled milling oat with high grain yield potential and excellent groat percentage.

Triticale and Wheat

- *Taza* – reduced awn forage and grain triticale variety with good lodging resistance.
- *Bunker* – early maturing, reduced awn forage variety with great digestibility, high fat content and high silage yields.
- *Sunray* – early maturing, spring triticale variety with improve ergot resistance. Short statured for increased resistance to lodging.
- *AAC Paramount* – soft white spring wheat, midge tolerant, high grain protein, good fit for silage production
- *AAC Awesome* – soft white spring wheat, midge tolerant, high yield, and excellent straw strength, good for silage production.
- *AAC Delight* – spring triticale, reduced awn forage variety with low ergot susceptibility and quality high tonnage.
- *AB Stampeder* – new spring forage triticale variety with reduced awns, shorter stature and increased digestibility.
- *AC Andrew* – soft white spring wheat variety with high yields and short, strong straw.
- *AC Sadash* – semi-dwarf soft white spring wheat variety with high yields, high quality and short, strong straw.
- *KWS Alderon* – high yielding special purpose red spring wheat, short stature, strong straw, late maturing, no awns, does well in cooler growing seasons.

Table 19. Agronomic Information 2022.

Trial	Site	# of Varieties	Seeding Date	Seeding Rate	Fertility (lbs/ac)	Weed Control	Harvest Date
Barley	Smoky Lake	21	25-May-22	250 lbs/ac	No additional fertilizer required as per soil test.	Buctril M	8-Aug-22
Oats	Fort Kent	12	27-May-22	250 lbs/ac	80-30-30-10 @ 290 lbs/ac	Buctril M	12-Aug-22
Triticale/Wheat	Smoky Lake	10	25-May-22	250 lbs/ac	No additional fertilizer required as per soil test.	Buctril M	11-Aug-22

Results:

Barley

The barley trials are aimed to be harvested at the soft dough stage. There were 21 barley varieties grown in the trials this year at both locations. There were 3 new 2-row barley varieties added to the trial in 2022, CDC Renegade, CDC Fraser and KWS Kellie.

This year, we only had one barley site, which was in Smoky Lake County. Yield and quality results for the Smoky Lake can be found in Figure 1 and Table 20, respectively. The barley silage variety trial was harvested 75 days after seeding. Average moisture content was 54%.

With the continued dry conditions, we saw lower yields compared to average precipitation years. The average dry matter yield was 3.28 ton/acre in 2022 at Smoky Lake. The highest yielding variety was CDC Churchill at 3.89 ton/ac. AB Cattlelac was a close second at 3.78 ton/ac dry matter yield, however, there was lots of variability in yield with this variety. Overall, there were no significant differences between any of the varieties tested.

In contrast to previous years, we saw significant variability between varieties when considering nutritional quality. For crude protein (CP), the general rule of thumb is 7-9-11 percent for mid-gestation, late-gestation and after calving. Most of the varieties are adequate to meet the nutrients requirements through mid-gestation to late-gestation, with some varieties (AB Advantage, CDC Austenson, Esma and Sundre) having adequate protein content to meet post- calving requirements. Total digestible nutrients (TDN), which is the easiest method to estimate the amount of energy in the feed, was consistent between varieties and generally was adequate to meet the nutritional requirements through mid-gestation to post-calving, following the rules of 55-60-65.

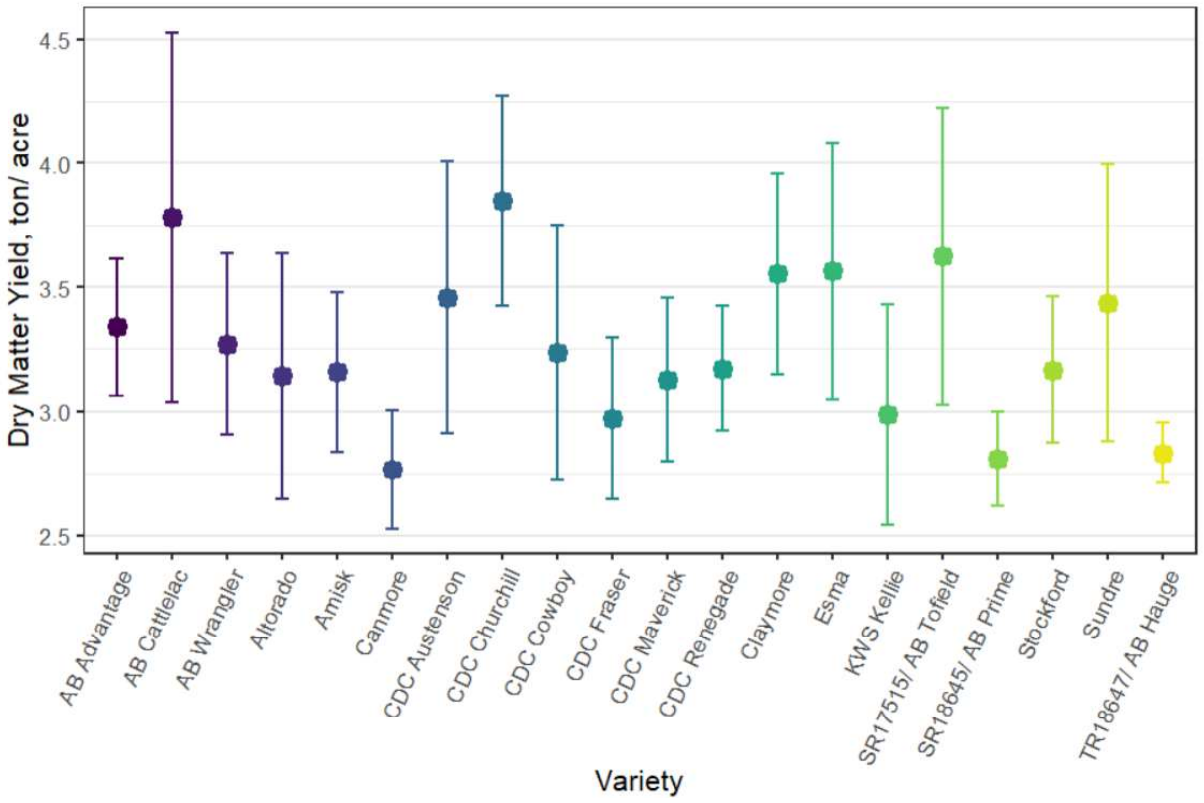

Figure 1. RST Barley Smoky Lake dry matter yield, 2022 (ton/acre, 1 ton = 2000 lbs).

Table 20. RST Barley Smoky Lake nutritional quality, 2022.

Variety:	Moisture (%)	2022 Quality Results							
		CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
AB Advantage	48.6	11.57	27.17	48.53	67.73	0.33	0.31	1.98	0.11
AB Cattlelac	62.1	8.43	25.24	47.12	69.24	0.45	0.15	1.62	0.23
AB Wrangler	50.8	10.17	21.66	48.71	72.03	0.35	0.27	1.38	0.11
Altorado	49.9	9	30.45	55.63	65.18	0.39	0.3	1.75	0.11
Amisk	49.9	9.58	26.15	47.62	68.53	0.37	0.29	1.92	0.11
Canmore	62.6	8.93	20.76	38.84	72.73	0.47	0.24	1.59	0.15
CDC Austenson	58.4	11.23	16.54	36.09	76.02	0.39	0.22	1.47	0.18
CDC Churchill	50.8	9.93	23.95	43.26	70.24	0.39	0.31	1.43	0.11
CDC Cowboy	53.3	8.96	23.33	42.62	70.73	0.39	0.23	1.52	0.14
CDC Fraser	54.4	8.54	21.81	42.52	71.91	0.33	0.19	1.22	0.12
CDC Maverick	52.6	10.41	24.25	46.55	70.01	0.47	0.18	1.28	0.14
CDC Renegade	54.8	8.92	33.75	55.42	62.61	0.47	0.3	1.69	0.12
Claymore	46.9	8.17	28.5	54.02	66.7	0.48	0.21	1.62	0.11
Esma	40.5	13.16	27.63	49.56	67.38	0.31	0.45	1.97	0.12
KWS Kellie	58.9	10.02	27.95	51.76	67.13	0.47	0.3	1.66	0.13
SR17515/ AB Tofield	58.7	9.81	26.23	47.47	68.47	0.48	0.25	1.92	0.16
SR18645/ AB Prime	48.4	10.96	26.37	48.87	68.36	0.41	0.24	1.43	0.15
Stockford	51.7	8.51	25.44	48.71	69.08	0.42	0.23	1.35	0.1
Sundre	61.2	14.43	35.38	51.76	51.76	0.55	0.17	1.74	0.16
TR18647/ AB Hauge	56.2	9.85	22.29	44.45	71.54	0.39	0.22	1.91	0.11
Average	**53.5**	**10.03**	**25.74**	**47.48**	**68.37**	**0.42**	**0.25**	**1.62**	**0.13**

Oats

The oat trials are aimed to be harvested at the milk stage. There were 12 oat varieties grown in the trial this year in Fort Kent. The results of oat silage variety trial can be found in Figure 2 and Table 21. The average moisture content at the time of harvest was 66%. AAC Douglas was a new variety that was included in the silage trials this year. The Fort Kent trial was harvested at 77 days after seeding.

This year, the average yield was almost one ton per acre higher than last year. The average dry matter yield of the oat trial in Fort Kent was 3.68 ton/ acre in 2022. The highest yielding variety was Murphy at 4.19 ton/acre of dry matter, which was a significantly higher than the CDC SO-1 yield of 3.05 ton/acre. Murphy was also the highest yielding variety in 2021 at the St. Paul site.

The average CP and TDN in the 2022 oat variety trials were 6.93% and 61.26%, respectively. Several of the varieties grown had CP content that would not meet CP requirements at any stage of gestation for cattle. However, TDN content was generally sufficient to meet requirements until post calving. Although Murphy had the highest yields, it also had the lowest CP and TDN content of all the varieties grown.

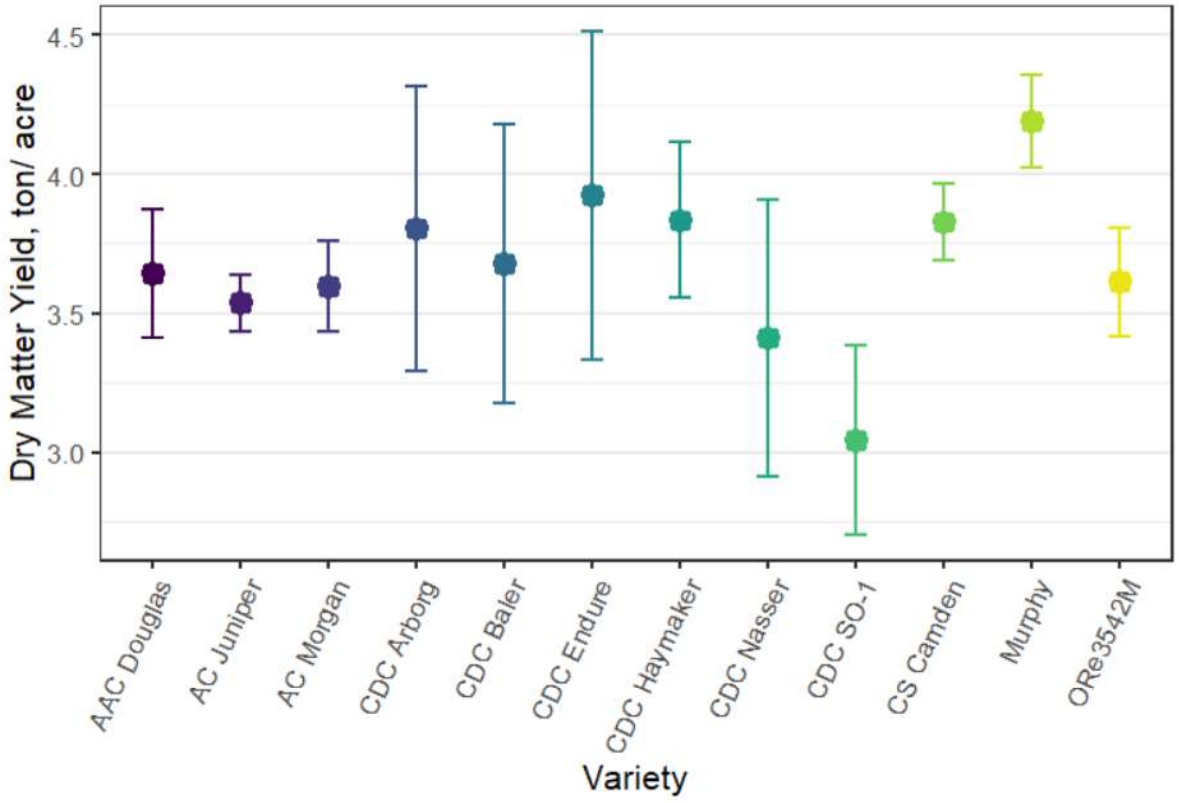

Figure 2. RST Oats Fort Kent dry matter yield, 2022 (ton/acre, 1 ton = 2000 lbs).

Table 21. RST Oats Fort Kent nutritional quality, 2022.

Variety	Moisture (%)	2022 Quality Data							
		CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
ORe3542M	66.23	7.98	35.08	59.41	61.57	0.22	0.21	1.29	0.25
AAC Douglas	66.83	8.65	31.14	55.94	64.64	0.16	0.21	1.16	0.19
CDC Baler	64.78	7.2	36.15	61.45	60.74	0.47	0.25	1.78	0.33
AC Morgan	66.95	6.98	35.02	58.69	61.62	0.33	0.23	1.63	0.21
CDC Endure	65.98	7.05	36.25	59.88	60.66	0.27	0.23	1.77	0.21
CS Camden	67.64	7.46	34.96	58.42	61.67	0.29	0.2	1.37	0.27
CDC Nasser	68.79	6.15	34.65	62.53	61.91	0.21	0.18	1.07	0.2
CDC SO-1	62.66	6.74	30.77	57.17	64.93	0.2	0.21	1.1	0.25
AC Juniper	65.39	6.49	33.69	58.12	62.45	0.31	0.2	1.56	0.24
CDC Haymaker	70.73	6.66	38.73	65.95	58.73	0.32	0.16	1.64	0.26
CDC Arborg	61.29	8.19	27.79	50.06	67.25	0.2	0.27	1.01	0.2
Murphy	68.16	3.65	51.27	78.73	48.96	0.29	0.1	1.68	0.24
Average	**66.3**	**6.93**	**35.46**	**60.53**	**61.26**	**0.27**	**0.20**	**1.42**	**0.24**

Triticale and Wheat

The triticale and wheat trials are targeted to be harvested at the late milk stage. This year, the triticale and wheat silage variety trials were in Smoky Lake County. There were 5 wheat varieties and 5 triticale varieties in the trials. The results can be found in Figure 3 and Table 22. Harvest occurred 78 days after seeding.

The trials yielded higher in this year in Smoky Lake, then last year in St. Paul at an average of 3.20 tons/acre dry matter yield. Like last year, Sunray was the highest yielding variety at 3.58 tons/ac of dry matter, but this was not significantly different from any of the other varieties in the trial.

In 2022, CP and TDN averaged 12.96% and 63.94%, respectively. CP of every variety in the trial met requirements throughout gestation and post calving. TDN was adequate to meet requirements during the second and third trimester of pregnancy for cattle, but will not meet TDN requirements post calving.

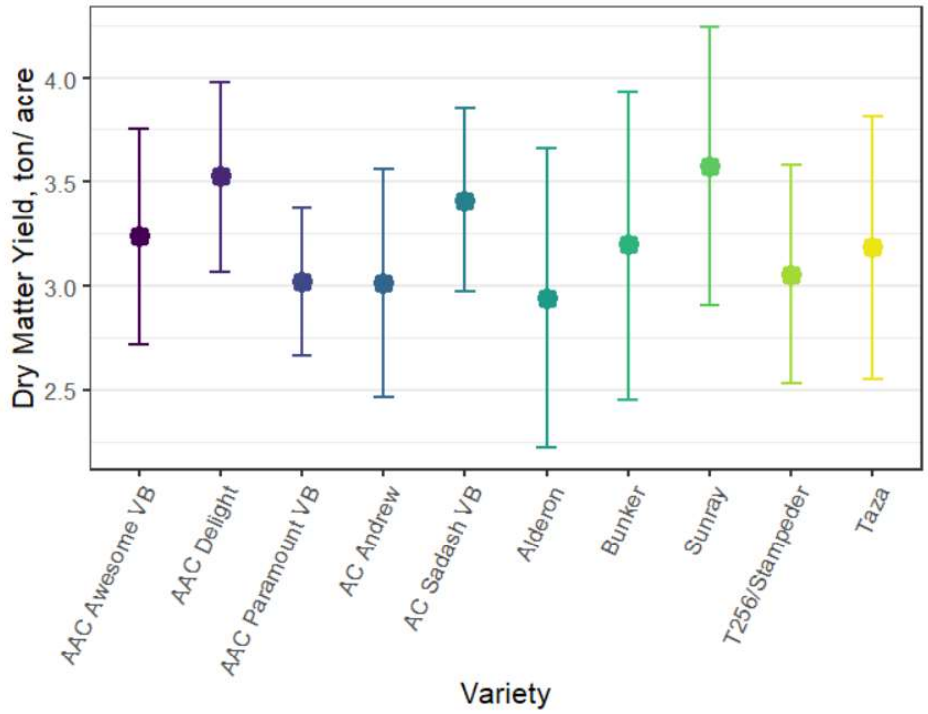

Figure 3. RST Triticale Smoky Lake dry matter yield, 2022 (ton/ac, 1 ton = 2000 lbs).

Table 22. RST Triticale Smoky Lake forage nutritional quality, 2022.

Variety	Moisture (%)	2022 Quality Data							
		CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
Sunray	58.16	12.02	32.6	47.65	63.5	0.28	0.27	1.35	0.12
AAC Delight	56.6	11.23	32.25	48.11	63.78	0.18	0.21	1.13	0.08
AAC Paramount VB	53.24	11.64	33.23	45.99	63.01	0.25	0.22	1.68	0.1
AC Andrew	54.41	13.07	34.25	46.58	62.22	0.27	0.31	2.02	0.12
AAC Awesome VB	57.37	11.76	33.71	49.74	62.64	0.24	0.18	1.31	0.13
AC Sadash VB	52.23	14.24	34.03	44.19	62.39	0.32	0.29	2.14	0.12
T256/Stampeder	54.55	13.78	33.66	49.08	62.68	0.28	0.31	1.65	0.14
Bunker	57.16	13.68	32.85	48.82	63.31	0.37	0.33	1.83	0.13
Taza	57.77	11.57	34.82	50.84	61.78	0.21	0.24	1.5	0.1
Alderon	59.96	13.95	31.83	46.48	64.1	0.3	0.27	1.54	0.16
Average	**56.1**	**12.69**	**33.32**	**47.75**	**62.94**	**0.27**	**0.26**	**1.62**	**0.12**

Regional Annual Silage Trial

Winter/Spring Cereal Intercrop

Partners: Alberta Agriculture, Forestry and Rural Development
SECAN
Chinook Applied Research Association
West-Central Forage Association
SARDA Crop Research
Battle River Research Group
Canadian Agriculture Partnership

Objectives:

1. To determine which winter/spring cereal intercrop mixtures are a feasible option when compared to conventional cereal forage crops for whole plant forage production, considering both yield and quality.

Background:

The intercropping of winter cereals with spring cereals may enhance forage quality and provide limited quantities of high-quality forage that could be used to extend fall grazing. Work done by Baron et al. (1990) found that spring-planted winter cereals can maintain yield and quality late in the summer and into the fall under simulated pasture treatment. This is an important advantage to their use as spring cereal production tends to decline after the end of July (Berkenkamp 1984). Consequently, the combination of spring and winter cereals could provide an ideal yield distribution throughout the growing/grazing season. Advancements in crop breeding technology and new varieties released in recent years has not been tested in spring/winter cereal mixtures. Understanding the regional adaptability of these new varieties in a mixture will be key for Alberta producers to make the most economic decisions for their operations.

Method:

The winter/spring cereal intercrop trial was established in Fort Kent and Smoky Lake County and The trial was established at the LARA Fort Kent Research Site (NE25-61-5-W4) on May 26, 2022 and at our Smoky Lake site (SE 14-59-18-W4) on May 25, 2022 in a randomized complete block design (RCBD) with four replicates to reduce error. The plots were seeded with the LARA five-row zero-till small plot drill with fertilizer side banded at the recommended rates as per soil tests. harvested at the recommended stage for the spring cereals.

The following four winter cereal varieties were used in mixtures with Taza triticale, CDC Austenson barley, and CDC Baler oats:

- *AAC Wildfire* – hard red winter wheat, short strong straw, good winter survival, excellent lodging resistance.
- *Prima* – fall rye variety with high yields and is well adapted to Western Canada.
- *Luoma* – winter triticale, has no awns, high yield potential, and good disease resistance.
- *Metzger*- winter triticale, has reduced awn expression, good winter hardiness.

The trial in Fort Kent was harvested at the recommended stage for the spring cereals on August 15, 2022 at 81 days after seeding. Results of the Fort Kent trial can be found in Figure 4 and Table 23. The highest yielding mixtures were CDC Baler with Metzger or Wildfire at 6.61 and 6.59 dry matter tons/acre, respectively. In general, the mixtures with CDC Baler were among the top yielding varieties, however, there was quite a bit of variability in yields.

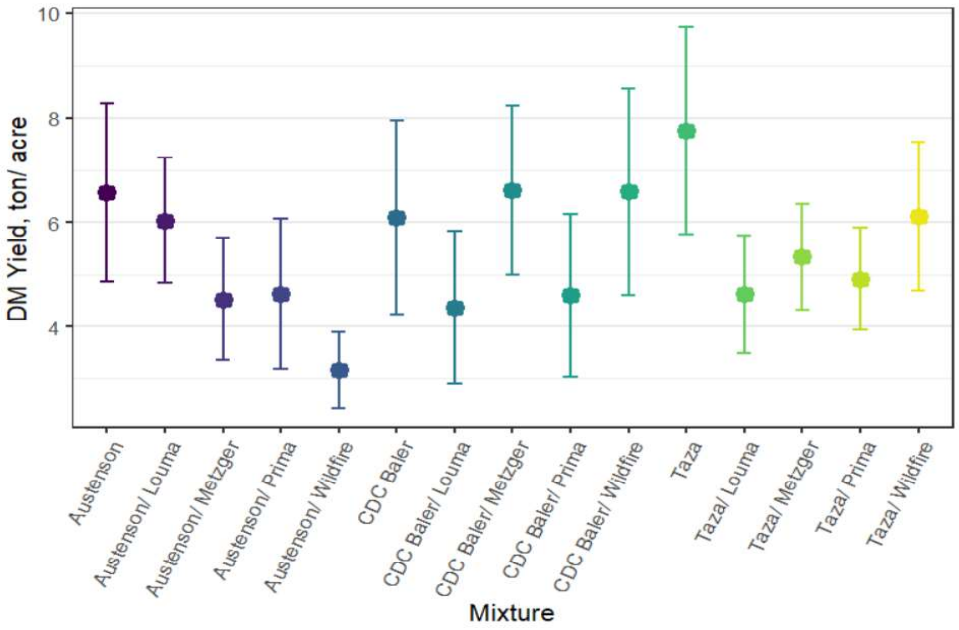

Figure 4. RST winter/ spring cereal intercrop dry matter forage yield for Fort Kent in 2022 (ton/ac, 1 ton = 2000 lbs).

Table 23. RST Winter/Spring Cereal Intercrop Quality Fort Kent, 2022.

Variety	CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
Austenson	10.78	38.56	54.86	58.86	0.62	0.11	1.52	0.23
Austenson/ Louma	7.98	30.87	53.96	64.85	0.16	0.18	0.83	0.18
Austenson/ Metzger	6.83	36.95	63.37	60.58	0.22	0.16	0.9	0.22
Austenson/ Prima	5.64	38.39	67.07	58.99	0.27	0.1	1.06	0.25
Austenson/ Wildfire	7.67	37.83	63.36	59.43	0.3	0.15	0.94	0.27
CDC Baler	9.29	30.53	55.83	65.12	0.18	0.19	0.82	0.21
CDC Baler/ Louma	9.01	34.66	61.65	61.9	0.21	0.19	0.93	0.22
CDC Baler/ Metzger	6.82	41.52	70.28	56.56	0.28	0.11	1.06	0.25
CDC Baler/ Prima	9.87	39.96	69.16	57.77	0.25	0.17	0.94	0.26
CDC Baler/ Wildfire	9.7	30.46	55.15	65.17	0.22	0.2	0.93	0.23
Taza	7.28	30.85	56.88	64.88	0.25	0.17	1.03	0.23
Taza/ Louma	9.17	28.28	49.86	66.93	0.17	0.2	1.08	0.18
Taza/ Metzger	7.06	38.36	61.72	59.02	0.3	0.11	1.13	0.31
Taza/ Prima	8.86	35.88	63.2	60.95	0.25	0.18	1.19	0.27
Taza/ Wildfire	7.68	36.01	60.39	60.85	0.16	0.17	0.83	0.16
Average	***8.24***	***35.27***	***60.45***	***61.46***	***0.26***	***0.16***	***1.01***	***0.23***

The trial in Smoky Lake was harvested at the recommended stage for the spring cereals on August 11, 2022, at 78 days after seeding. Results of the Smoky Lake RST winter/ spring intercrop trial can be found in Figure 25 and Table 24. Smoky Lake yielded significantly less than the Fort Kent trail. The highest yielding mixtures were CDC Baler or Austenson with Wildfire at 3.27 and 3.14 ton/acre of dry matter, respectively. In general, the mixtures with Wildfire as the winter cereal tended to yield higher than mixtures with the other winter cereals.

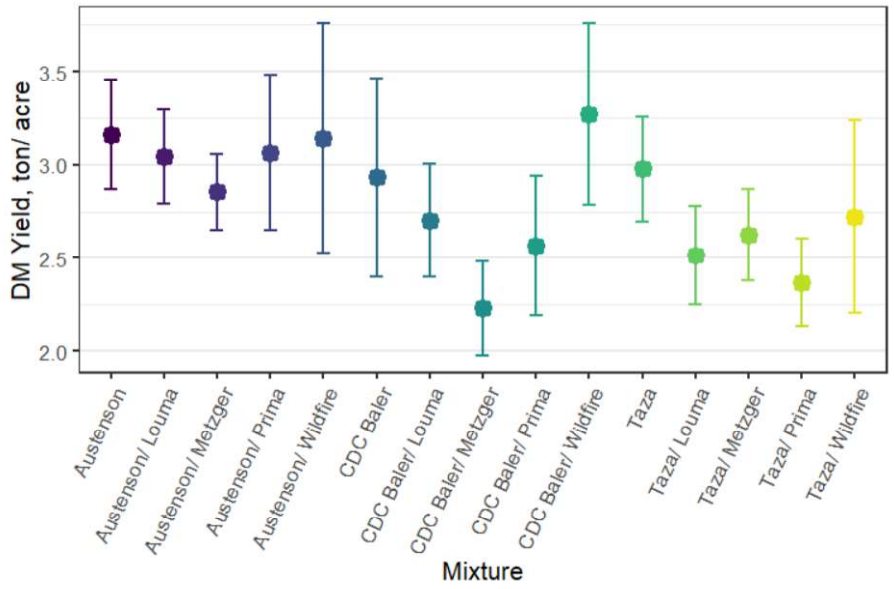

Figure 5. RST winter/spring cereal intercrop dry matter forage yield for Smoky Lake, 2022 (ton/ac, 1 ton = 2000 lb).

Table 24. RST winter/spring cereal intercrop forage quality for Smoky Lake in 2022.

Variety	CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
CDC Baler	10.15	29.85	51.85	65.65	0.52	0.3	2	0.19
CDC Baler/ Louma	9.63	29.17	51.14	66.18	0.54	0.25	2.39	0.17
CDC Baler/ Metzger	8.51	31.66	57.03	64.24	0.39	0.21	1.4	0.16
Austenson/ Metzger	8.63	23.64	44.04	70.48	0.35	0.17	1.32	0.14
Austenson/ Louma	9.1	25.27	45.91	69.21	0.41	0.2	1.69	0.15
CDC Baler/ Prima	10.6	31.54	55.64	64.33	0.54	0.35	2.49	0.17
Taza/ Louma	10.44	28.28	51.7	66.87	0.29	0.24	1.64	0.11
Taza/ Metzger	9.67	33.76	58.21	62.6	0.34	0.26	1.72	0.12
Austenson	7.81	28.26	50.33	66.89	0.42	0.16	1.35	0.15
Austenson/ Wildfire	10.54	31.85	55.25	64.09	0.59	0.31	2.71	0.15
Taza	11.08	28.03	49.32	67.06	0.37	0.34	1.66	0.13
Taza/ Prima	10.21	30.58	53.95	65.08	0.46	0.2	1.52	0.19
CDC Baler/ Wildfire	10.44	31.25	55	64.56	0.28	0.32	1.84	0.1
Austenson/ Prima	8.39	32.98	55.89	63.21	0.32	0.23	1.53	0.13
Taza/ Wildfire	10.49	31.46	53.88	64.39	0.33	0.39	1.79	0.11
Average	***9.71***	***29.84***	***52.61***	***65.66***	***0.41***	***0.26***	***1.80***	***0.14***

Regional Annual Silage Trial

Pulse Mixtures

Partners: Alberta Agriculture, Forestry and Rural Development
SECAN
Chinook Applied Research Association
West-Central Forage Association
SARDA Crop Research
Battle River Research Group
Canadian Agriculture Partnership

Objectives:

1. To determine which pea-cereal mixtures are a feasible option when compared to conventional cereal forage crops for whole plant forage production, considering both yield and quality.

Background:

The most commonly utilized forage crops are typically monocultures of barley, oats or triticale. However, intercrops grown for forage production are gaining popularity. Adding a pulse to a silage mix, such as faba beans or peas can reduce fertilizer costs since they can fix nitrogen thereby increasing soil fertility. Pulses also have high protein content which can boost feed quality, by increasing the amount of crude protein in feed. This is the second year that the pea/cereal trial expanded its pulse species and incorporated a faba bean treatment.

Method:

The trial was established at the LARA Fort Kent Research Site (NE25-61-5-W4) May 31, 2022 and at our St. Paul site (SE16-58-9-W4) on June 1, 2022 in a randomized complete block design (RCBD) with four replicates to reduce error. The plots were seeded with the LARA five-row zero-till small plot drill to a depth of 1.5 – 2" to try and reach an intermediate between cereal and pea recommendations. The peas were inoculated prior to seeding.

Cereal monocultures of CDC Bale oats, Taza triticale and AB Cattlelac barley were established as check treatments for comparison to the pea/cereal mixtures in Fort Kent. At St. Paul, the cereals established were SO-1 oats, Bunker triticale and AB Cattlelac barley. The trials were seeded with 12 treatments and each cereal variety was seeded in a mixture with Aberdeen peas, DL Delicious peas, and DL Tesoro faba beans. The St. Paul location used Meadow peas in place of DL Tesoro faba beans.

Agronomic information on the trial can be found in Table 25. No in-crop herbicide applications were performed for weed control due to the mixture of broadleaf and grassy plants. Therefore, hand-weeding was done where necessary.

The LARA self-propelled forage harvester was used to harvest the plots at the recommended cereal harvest stage + 10 days. The individual plot weights were recorded and samples were taken to assess dry matter content. A composite sample was taken from each variety, frozen and sent to A & L Canada Laboratories for forage analysis. Statistical analysis of the data was conducted using R statistical software, P= 0.05.

Varieties used in the pulse/cereal trial in 2022:

- *CDC Austenson barley* - 2-row barley variety with semi-smooth awns, short and strong straw, and high feed yield.
- *AB Cattlelac barley*- semi-smooth awned barley variety with good lodging resistance, good grain yield and excellent disease resistance
- *CDC Baler oats* - very leafy, forage oat variety.
- *SO-1 oats*- early maturing, very high digestible brown oat variety with high fat content and does not need to be rolled. Short strong straw for reduced lodging.
- *Taza triticale* – reduced awn forage and grain triticale variety with good lodging resistance.
- *Bunker triticale*- early maturing, reduced awn forage variety with great digestibility, high fat content and high silage yields.
- *Aberdeen peas*– semi leafless yellow field pea variety with high yield and excellent standability.
- *DL Delicious peas*– new semi leafless forage pea with high yields, good standability and early maturity.
- *DL Tesoro faba beans*- high yielding, zero tannin bean variety with great agronomic traits.
- *Meadow peas*- semi leafless yellow field pea, good standability, disease resistance, and yields.

Table 25. RST Pea/Cereal Mixture Agronomic Information, 2022.

Site	Date Seeded	Date Harvested	Treatments	Seeding Rate	Fertility
Fort Kent	31-May-22	22-Aug-22	AB Cattlelac	300 plants/m2	50% of recommended cereal rate
St. Paul	1-June-22	23-Aug-22	CDC Baler or SO-1	300 plants/m2	50% of recommended cereal rate
			Taza or Bunker	370 plants/m2	50% of recommended cereal rate
			AB Cattlelac/Aberdeen	150 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
			AB Cattlelac/DL Delicious	150 pl/m2, 5 pl/m2	50 lbs/acre of 11-52-0-0
			AB Cattlelac/DL Tesoro or Meadow	150 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
			CDC Baler or SO-1/ Aberdeen	150 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
			CDC Baler or SO-1 /DL Delicious	150 pl/m2, 5 pl/m2	50 lbs/acre of 11-52-0-0
			CDC Baler/DL Tesoro or SO-1/Meadow	150 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
			Taza or Bunker/Aberdeen	185 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
			Taza or Bunker/DL Delicious	185 pl/m2, 5 pl/m2	50 lbs/acre of 11-52-0-0
			Taza/DL Tesoro or Bunker/Meadow	185 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0

Results:

The trial is aimed to be harvested at the recommended cereal stage plus 10 days to try and account for the increased moisture content of the forage with the inclusion of peas. In previous years, the trial was harvested at the recommended cereal stage. However, the Forage Pea trials conducted at LARA for four years found that optimal yields and quality could be achieved if harvest was delayed by at least 10 days. The results of the pea-cereal trial are summarized in Figures 6 and 7 and Tables 26 and 27. Unfortunately, in cereal mixtures at both sites, DL Delicious was seeded at 10% of the rate that was supposed to be seeded.

The average plot yield at Fort Kent was 4.19 ton/ac dry matter yield. The highest yielding mixture at the Fort Kent site was CDC Austenson/Aberdeen at 4.28 ton/ac dry matter. Mixtures with CDC Austenson and CDC Baler with DL Tesoro were among the top yielding as well. While the CDC Austenson monoculture had the highest yield, this was only significantly different than Taza + DL Delicious.

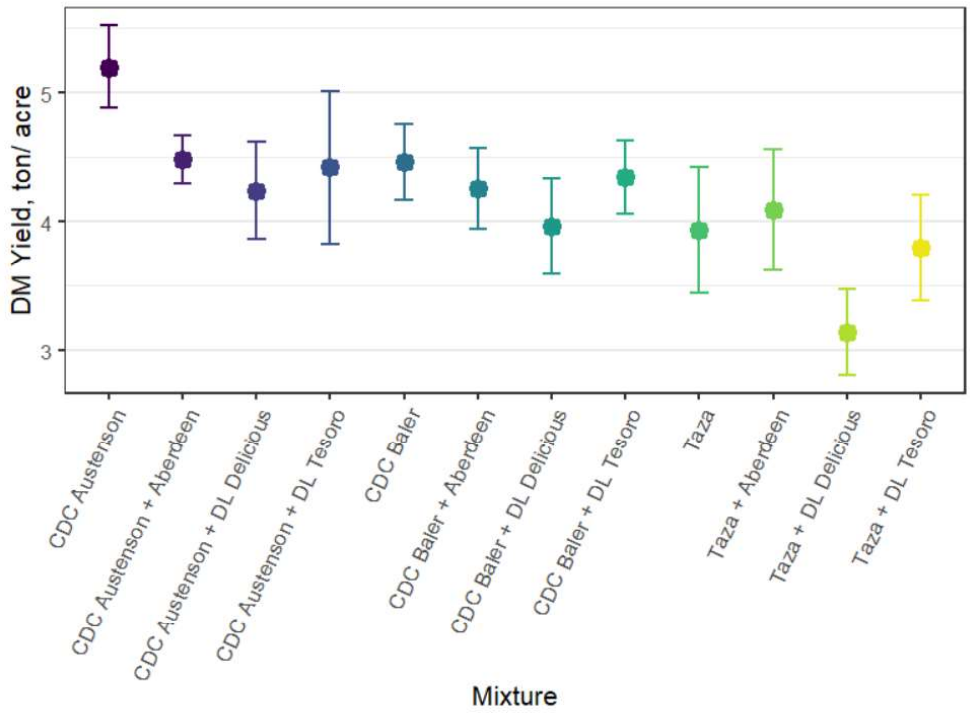

Figure 6. RST Pulse/Cereal Mixture Fort Kent dry matter yield, 2022 (ton/ac, 1 ton = 2000 lbs).

Table 26. RST Pulse/Cereal Mixture Fort Kent forage nutritional quality, 2022.

Variety	Moisture (%)	Quality Results 2022							
		CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
CDC Baler + DL Delicious	61.81	7.78	29.99	51.49	65.54	0.31	0.18	1.44	0.18
CDC Austenson	54.74	8.85	33.32	43.53	62.94	0.46	0.13	1.28	0.21
Taza + DL Tesoro	64.47	8.06	31.81	49.01	64.12	0.31	0.14	1.03	0.21
CDC Baler	60.42	7.88	38.17	52.57	59.17	0.25	0.15	1.21	0.18
CDC Baler + Aberdeen	54.62	7.62	31.6	53.79	64.28	0.48	0.18	1.11	0.26
CDC Austenson + DL Delicious	54.49	7.29	40.43	53.53	57.41	0.39	0.13	1.22	0.24
CDC Austenson + DL Tesoro	56.49	6.1	41.66	65.2	56.45	0.76	0.1	0.92	0.2
Taza	61.49	8.42	35.63	48.14	61.14	0.24	0.17	1.17	0.21
Taza + DL Delicious	53.59	7.42	36.49	58.01	60.47	0.23	0.1	1.29	0.18
CDC Baler + DL Tesoro	68.78	6.41	39.85	52.17	57.86	0.37	0.14	0.97	0.21
CDC Austenson + Aberdeen	58.66	6.85	32.5	52.16	63.58	0.42	0.14	1.41	0.3
Taza + Aberdeen	58.64	7.53	38.44	48.99	58.96	0.38	0.11	1.47	0.23
Average	**59.02**	**7.52**	**35.82**	**52.38**	**60.99**	**0.38**	**0.14**	**1.21**	**0.22**

The average plot yield at St. Paul was 4.31 ton/ac dry matter yield, which was higher than in Fort Kent. The highest yielding mixture at the St. Paul site was Cattlelac + Meadow at 4.92 ton/ac dry matter. Bunker + Aberdeen was a close second at 4.87 ton/ac. Cattlelac + Meadow and Bunker + Aberdeen had a significantly higher yield than Bunker and Bunker + DL Delicious.

One of the primary reasons for including pulses in a silage mixture is for the potential boost in protein. In contrast to previous years of this trial, we did not see a significant improvement in nutritional quality with pulses included in the mixture. This may have been the result of the dry growing conditions experienced later in the summer.

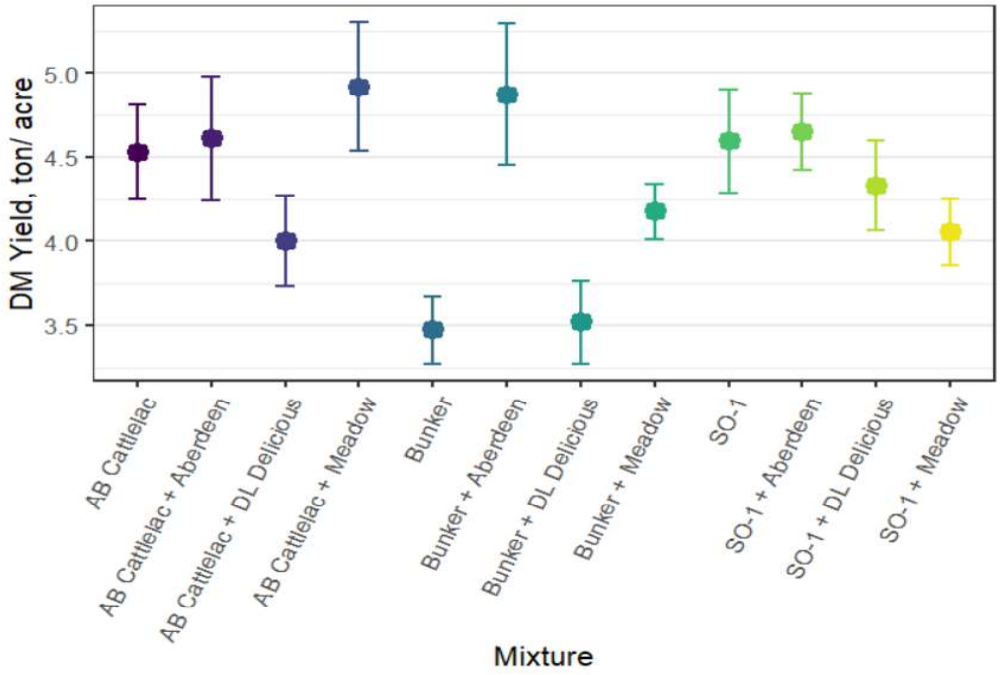

Figure 7. RST Pulse/Cereal Mixture St. Paul dry matter yield, 2022 (ton/ac, 1 ton = 2000 lbs).
Table 27. RST Pulse/Cereal Mixture St. Paul forage nutritional quality, 2022.

Variety	Moisture (%)	Quality Results 2022							
		CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
Bunker + Meadow	48.92	7.53	34.24	53.32	62.23	0.95	0.2	1.66	0.29
SO-1 + Aberdeen	61.01	8.78	35.22	56	61.46	0.7	0.21	1.79	0.28
SO-1 + DL Delicious	50.54	7.12	34.98	59.35	61.65	0.34	0.17	1.49	0.24
AB Cattlelac + DL Delicious	47.2	6.44	29.88	50.18	65.62	0.37	0.18	1.47	0.21
AB Cattlelac + Meadow	48.91	9.43	29.59	47.27	65.85	0.66	0.21	1.67	0.19
SO-1 + Meadow	48.44	7.25	31.48	54.32	64.38	0.48	0.27	1.97	0.17
AB Cattlelac + Aberdeen	51.34	8.08	35.48	55.87	61.25	0.89	0.17	1.8	0.28
Bunker + DL Delicious	52.44	8.68	31.55	51.92	64.32	0.28	0.3	1.3	0.18
Bunker	49.39	7.93	33.16	56.02	63.07	0.28	0.2	1.5	0.15
Bunker + Aberdeen	53.47	7.22	32.33	52.02	63.71	0.42	0.23	1.25	0.17
SO-1	48.9	7.33	34.92	60.41	61.7	0.24	0.14	1.52	0.16
AB Cattlelac	53.23	6.88	34.02	56	62.4	0.63	0.12	1.8	0.24
Average	**51.15**	**7.72**	**33.07**	**54.39**	**63.14**	**0.52**	**0.20**	**1.60**	**0.21**

Regional Annual Silage Trial

Alternative Crops

Partners: West-Central Forage Association
Chinook Applied Research Association
Peace Country Beef and Forage Association
Battle River Research Group
North Peace Applied Research Association
Canadian Agriculture Partnership
Imperial Seeds

Objectives:

1. To determine the best yielding alternative forage crops for whole plant forage production in Northeastern Alberta.
2. To determine the best quality alternative forage crops for cattle feed in Northeastern Alberta.

Background:

The most utilized forage crops are typically monocultures of barley, oats or triticale. Despite this, there are other annuals available that could provide an alternative crop for forage production or to extend the grazing season. The use of corn has significantly increased in recent years as a method of extending the grazing season. However, alternative annual crops can provide a break in disease from cereal production or as a break in perennial cropping rotation while still providing a forage crop.

The inclusion of 'alternative' or 'high nutritive value' forages, including chicory and plantain that are known for increased energy and protein content and reduced neutral detergent fiber (NDF), in the rations of beef cattle could have an environmental, economical and production benefit to Alberta producers. Currently, research has focused on assessing the yield and quality of cocktail mixtures that contain from 2 to 20 different species with very little data available on individual species. As well, there has been limited research focusing on replicated trials to establish baseline information on these forage species. Consequently, most current recommendations to producers on the use of these crops is coming from anecdotal sources.

Recent research from New Zealand on the use of 'alternative' crops in sheep and cattle diets is showing promising results in feed intake and environmental impacts. A study on chicory and plantain has shown the potential of reduced environmental impacts of these forages through decreased rumen ammonia and urine nitrogen in dairy cattle. These results are supported by similar research on plantain-fed dairy heifers. Another study has showed high consumption of forage beet, kale and kale-oat mixtures by grazing dairy cows and almost complete consumption of forage beet.

The purpose of this trial is to provide current and comprehensive regional yield and quality data on annual 'alternative' forage species and varieties for silage, greenfeed and grazing producers across Alberta and Saskatchewan to improve on-farm feed production and efficiency.

Method:
The trial was established at the LARA Fort Kent Research Site (NE25-61-5-W4) on May 26, 2022, and at our St. Paul site (SE16-58-9-W4) on June 1, 2022, in a randomized complete block design (RCBD) with four replicates to reduce error. The plots were seeded using the LARA five-row Fabro zero-till drill to a depth of ½ inch.

Soil tests were taken in the spring at both sites and a blend fertilizer (80-30-30-10) was side-banded during seeding at 290 lbs/ac. The trial was hand-weeded during the growing season when necessary. There was no in-crop herbicide application in these trials.

Crop height and stage of maturity was recorded prior to harvest with the LARA alfalfa-omega self-propelled forage harvester. The total plot weight was recorded, and samples were taken to assess dry matter content. Additional composite samples were taken from each treatment, frozen and sent to A & L Canada Laboratories for wet chemistry analysis. Statistical analysis of the data was conducted using R statistical software, P = 0.05.

The following alternative crops were used for the trial in 2022:

- *Japanese Millet* – annual, warm season grass that is commonly grown as a late season green forage. The most rapidly growing of the millet, its fibrous root system makes it an excellent smother crop, erosion protector and trap crop. Highly tolerant of frequent cutting, is fairly drought tolerant once established and tolerant of wet soils.
- *Sorghum Sudan Grass* – tall, fast-growing, heat-loving warm season grass is unrivaled for adding organic matter to worn-out soils. High biomass production and can be a good soil aerator particularly if mowed/cut at least once during the growing season. High seeding rates can allow for excellent weed suppression and can be used as a good crop to break the life cycle of disease pests.
- *Forage Brassica* – fast-growing, high yielding and high-quality forages that are excellent for use in fall pastures. Protein content can range from 18 to 25%. Can be difficult to ensile due to high moisture content but holds quality late into the season.
- *Forage Kale* – fast growing, very competitive against annual weeds, can be planted in the spring or fall time in pastures and cover crops, fast germination rate, winter hardy brassica, and has good feed value.
- *DoubleMax Radish* – Late maturing, forage radish with a long slender taproot.
- *Forage Turnip* – cold and drought tolerant, can be planted late in the season if wanting to graze in the fall, good feed quality for feeding livestock.
- *Plantain* – highly palatable herb with a fibrous root system that establishes rapidly under the right conditions. Highly tolerant to heat, good pest tolerance and has a high mineral content. Plantain will las 2 to 3 years under grazing conditions.
- *Chicory* – short-lived, leafy herb with a high feed value for livestock. Can be incorporated into rotational grazing systems with good summer forage yields. Has a deep taproot that can support growth in dry conditions and breaks up soil compaction.
- *Phacelia* – unique cover crop species with a very intense soil conditioning effect in the top two inches of the soil. Not a deep-rooted plant, but can be very effective to aggregate soil

particles into the crumbly aggregate structure. Fast growing with purple flowers that is excellent as a beneficial insect plant.

- *Daikon Radish*– deep rooted forage radish with a large root. Can help break up tough, compacted soil, improve water infiltration, and stores nitrogen.

Results:

The trial was harvested at the industry recommended stage for each individual crop. The yield and quality results from the trial are summarized in Table 28 and 29. The trial at the Fort Kent Site (LARA) was harvested on August 29, 2022. Unfortunately, due to equipment breakdowns the St. Paul site was harvested on two dates: August 23, 2022 and August 28, 2022.

The 2022 alternative trial yielded higher on average than in 2021. The Fort Kent site yielded lower than the St. Paul site due to extensive flea beetle damage. At Fort Kent, Japanese millet and Daikon radish had the highest dry matter forage yield at 3.05 ton/ac and 2.84 ton/ac, respectively. The lowest yielding varieties in Fort Kent were Hercules forage turnip at 0.91 ton/ac and phacelia at 0.96 ton/ac. At the St. Paul site, Double Max radish was the highest yielding variety at 4.70 ton/ac dry matter. Chicory, plantain, and Sorghum Sudan grass were the lowest yielding varieties at 0.82 ton/ac, 0.61 ton/ac, and 0.73 ton/ac, respectively.

The species with the highest CP content in Fort Kent was Finito rape at 16.74%, followed by forage collards at 16.37%. Chicory had the highest crude protein at 19.85% in St. Paul. Alternative forage species are well known for their high nutritive quality, which has led to their use in cocktail mixtures to boost nutritional content of cattle feed. Many varieties grown, except for the forage radishes, Japanese millet and Sorghum Sudan grass are adequate to meet cattle CP requirements through gestation and into lactation. Due to the species high nutritional value of these species, it is recommended to include them in cattle rations in combination with at least one cereal species.

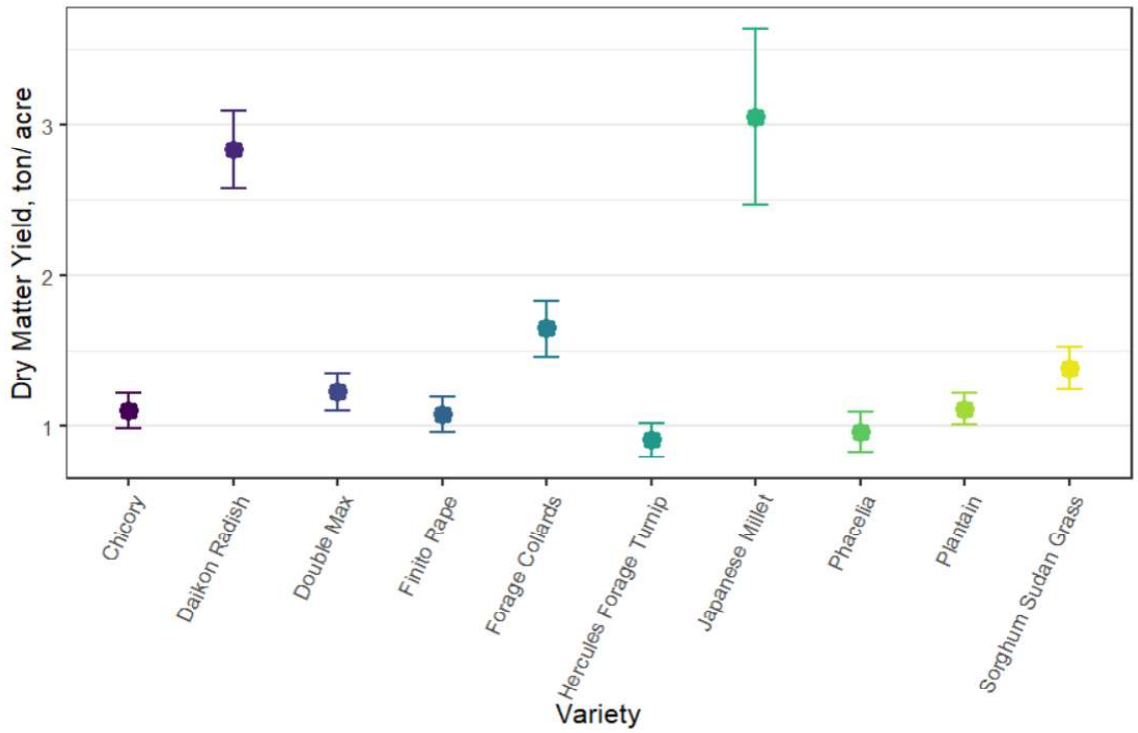

Figure 8. RST Alternative crops Fort Kent dry matter yield, 2022 (ton/ac, 1 ton = 2000 lbs).

Table 28. RST Alternative crops Fort Kent forage nutritional value, 2022.

Variety:	Moisture (%)	2022 Quality Results							
		CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
Hercules Forage Turnip	73.76	12.84	22.61	31.1	71.29	1.28	0.19	2.37	0.63
Chicory	73.98	11.89	22.91	34.2	71.05	1.1	0.13	1.65	0.44
Sorghum Sudan Grass	65.49	9.98	27.96	52.85	67.12	0.69	0.14	1.69	0.42
Phacelia	69.14	12.86	35.06	46.77	61.59	1.66	0.2	2.44	0.72
Finito Rape	82.37	16.74	15.26	21.3	77.01	1.59	0.27	2.76	0.73
Forage Collards	78.26	16.37	17.2	26.47	75.5	1.37	0.23	2.61	0.63
Plantain	72.71	11.19	32.43	46.13	63.64	0.79	0.17	1.47	0.43
Double Max	79.36	11.4	37.07	46.99	60.02	1.22	0.2	2.16	0.62
Japanese Millet	70.33	10.19	30.44	58.56	65.19	0.5	0.15	1.69	0.5
Daikon Radish	77.18	9.17	42.76	51.24	55.59	0.93	0.12	1.58	0.47
Average	**74.26**	**12.26**	**28.37**	**41.56**	**66.80**	**1.11**	**0.18**	**2.04**	**0.56**

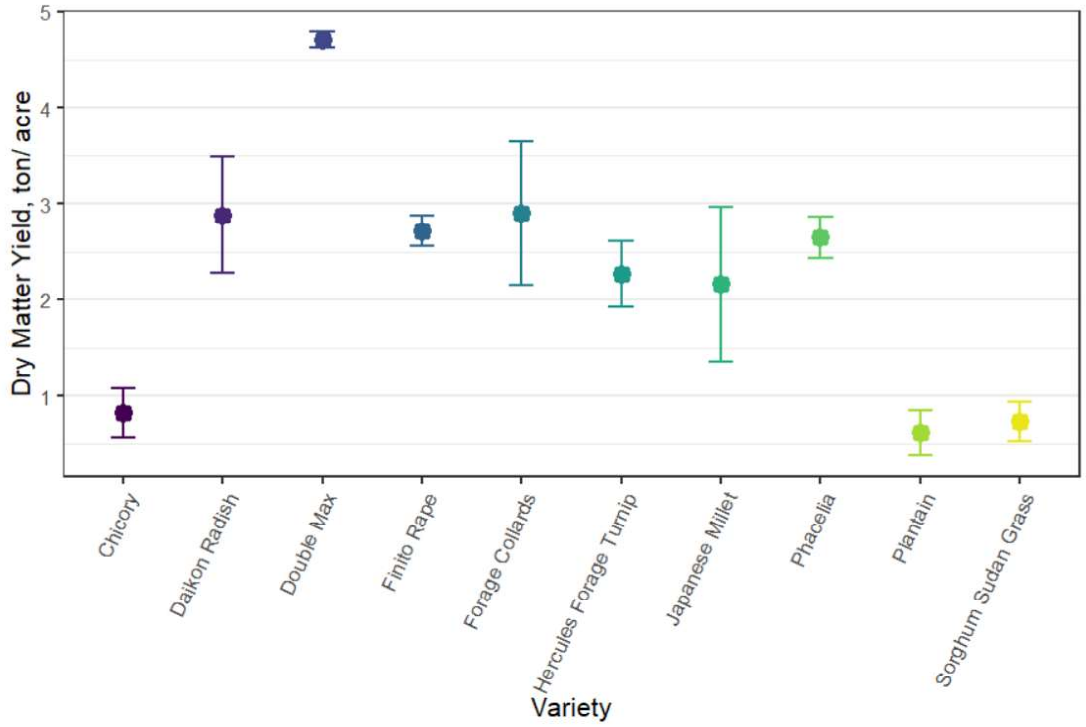

Figure 9. RST Alternative crops St. Paul dry matter yield, 2022 (ton/ac, 1 ton = 2000 lbs).

Table 29. RST Alternative crops St. Paul forage nutritional value, 2022.

Variety:	Moisture (%)	2022 Quality Results							
		CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
Daikon Radish	83.89	11.14	44.83	54.29	53.98	1.28	0.26	3.2	0.41
Hercules Forage Turnip	85.07	12.49	21.18	22.89	72.4	2.37	0.29	4.05	0.51
Chicory	84.75	19.85	27.59	37.31	67.41	1.62	0.27	4.23	0.44
Plantain	78.01	14.12	36.71	46.91	60.3	1.91	2.59	2.59	0.43
Phacelia	71.98	12.34	35.72	44.91	61.07	2.82	0.26	3.26	0.72
Sorghum Sudan Grass	71.29	9.39	32.77	59.35	63.37	0.47	0.34	1.94	0.28
Japanese Millet	72.6	10.49	31.27	59.22	64.54	0.77	0.33	2.56	0.42
Forage Collards	82.77	15.28	23.03	26.16	70.96	1.67	0.37	3.39	0.38
Finito Rape	84.47	17.45	19.93	22.42	73.37	2.33	0.39	3.73	0.52
Double Max	79.57	8.06	50.56	61.91	49.44	1.16	0.2	2.71	0.3
Average	**79.44**	**13.06**	**32.36**	**43.54**	**63.68**	**1.64**	**0.53**	**3.17**	**0.44**