

Regional Annual Silage Trials

Partners: Alberta Agriculture and Forestry
Battle River Research Group
Chinook Applied Research Association
Gateway Research Organization
North Peace Applied Research Association
McKenzie Applied Research Association
West-Central Forage Association
Farming Smarter
SECAN
Association of Albert Co-op Seed Cleaning Plants
Alberta Brand, Canadian Seed Growers Association
A & L Canada Laboratories
Philip Amyotte
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 2020, the LARA Regional Annual Silage Trial included six blocks: barley (14 varieties), oats (10 varieties), triticale and Wheat (10 varieties), winter/spring intercrop (12 treatments), pulse (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 will appear in the spring 2021 Alberta's Seed Guide (seed.ab.ca).

Regional Annual Silage Trial

Cereals

Partners: Canadian Agriculture Partnership
Alberta Agriculture and Forestry
Battle River Research Group
Chinook Applied Research Association
Gateway Research Organization
Smoky Applied Research and Demonstration Association
West-Central Forage Association
Farming Smarter
Peace Country Beef and Forage Association
Philip Amyotte

Objectives:

1. To determine the best yielding cereal forage varieties (barley, oats, triticale/wheat and winter/spring intercrop) for whole plant forage production in Northeastern Alberta.
2. To determine the best quality cereal forage varieties (barley, oats, triticale, wheat and winter/spring intercrop) 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 location: St. Paul (SW30-60-9-W4) and Fort Kent (NE25-61-5-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 1. 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 25, 2020 (barley, oats and triticale/wheat) and the trials in St. Paul were seeded on May 28, 2020 (oats) and May 29, 2020 (barley and triticale/wheat). The winter/spring cereal trials in St.

Paul were seeded on June 11, 2020 and the trial in Smokey Lake was seeded on June 22, 2020. The trials were sprayed with a 3-point hitch sprayer once during the growing season.

Total rainfall for St. Paul site was 270.5 mm and the Fort Kent site was 239.1 mm.

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 ARM 9, $p = 0.05$.

The following varieties were grown in the Regional Annual Silage Trials in 2020:

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 grain and silage variety with high tonnage potential, early to medium maturing, moderate disease resistance.
- *CDC Bow* – 2-row, hulled malting barley with good agronomic performance and grain quality that is widely adapted across western Canada.
- *SR18524* – 6 row feed and forage barley, high yields, good lodging 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.
- *TR18647*- 2 row hulled general purpose barley with potential for forage production, high protein, low NDF and ADF.

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.
- *CDC Seabiscuit* – high yield milling oat variety with good straw strength for reduced lodging.
- *CS Camden* – milling oat, excellent yield potential, great lodging resistance, short height, and big leaf biomass

- *CDC Arborg* – is a new 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* – new feed oat variety with low lignant hull and high oil content.
- *ORE 3542 M* – new white hulled milling oat variety with short, strong straw, good lodging resistance and good grain yields.

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.
- *T256* – 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, does well in cooler growing seasons.

Table 1. Agronomic Information 2020.

		# of	Seeding	Seeding	Fertility	Weed	Harvest
Trial	Site	Varieties	Date	Rate	(lbs/ac)	Control	Date
Barley	Fort Kent	14	25-May-20	250 lbs/ac	60-30-25-15 @ 239 lbs/ac	Curtail M	14-Aug-20
	St. Paul	14	29-May-20	250 lbs/ac	60-30-25-15 @ 239 lbs/ac	Curtail M	17-Aug-20
Oats	Fort Kent	10	25-May-20	250 lbs/ac	60-30-25-15 @ 239 lbs/ac	Curtail M	18-Aug-20
	St. Paul	10	28-May-20	250 lbs/ac	60-30-25-15 @ 239 lbs/ac	Curtail M	20-Aug-20
Triticale/Wheat	Fort Kent	10	25-May-20	250 lbs/ac	60-30-25-15 @ 239 lbs/ac	Curtail M	18-Aug-20
	St. Paul	10	29-May-20	250 lbs/ac	60-30-25-15 @ 239 lbs/ac	Curtail M	17-Aug-20
Winter/spring	St. Paul	12	11- June- 20		60-30-25-15 @ 239 lbs/ac	Curtail M	8-Sept-20
	Smokey Lake	12	22-June-20		60-30-25-15 @ 239 lbs/ac	-	-

Results: Barley

The barley trials are aimed to be harvested at the soft dough stage. There were 14 barley varieties grown in the trials this year at both locations. There were 3 new varieties added to the trial in 2020 including SR18524 and TR18647 which are experimental varieties which are not yet released but are being

developed for forage use. AB Wrangler is a new variety that was released and it is showing good promise for forage and livestock production. The yield and quality results of the Fort Kent and St. Paul trials can be found in Tables 2 and table 3, respectively. The Fort Kent trials was harvested 81 days after seeding and the St. Paul trial was harvested 80 days after seeding. Average moisture content of the Fort Kent trial was 69% and the St. Paul trial was 50%,

This year we saw higher yields in our St. Paul location of 4.51 ton/acre compared to an average yield in Fort Kent at 3.42 ton/acre. The highest yielding variety in Fort Kent was AB Advantage at 3.99 ton/acre which slightly exceed AB Cattlelac at 3.90 ton/acre. The highest yielding variety in St. Paul was Sundre at 6.45 ton/acre which was significantly higher than the other varieties.

Quality remained relatively consistent throughout the two trials. When considering Crude Protein (CP), the general rule of thumb is 7-9-11 percent for mid-gestation, late-gestation and after calving. The majority of the varieties are adequate to meet the nutrients requirements through mid-gestation to late-gestation. Similar to the CP the total digestible nutrients (TDN), which is an easy method to estimate the amount of energy in the feed, is adequate to meet the requirements through mid-gestation to late-gestation but it lacks for after calving following the rules of 55-60-65.

Table 2. RST Barley Fort Kent, 2020 (ton/acre, 1 ton = 2000 lbs).

Variety	DM Yield		DM Yield	Height	Lodging	2020 Quality Results							
						CP	ADF	NDF	TDN	Ca	P	K	Mg
	(ton/ac)		(% Austenson)	(cm)	(1-9)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
<i>CDC Austenson</i>	3.39	ab	100.00	85	6	11.70	34.92	49.45	61.69	0.25	0.19	1.03	0.18
<i>AB Advantage</i>	3.99	a	117.87	98	3	12.85	33.00	49.69	63.19	0.46	0.23	1.02	0.22
<i>AB Cattlelac</i>	3.90	a	115.16	94	6	12.84	37.73	56.67	56.51	0.56	0.16	1.11	0.23
<i>AB Wrangler</i>	3.37	ab	99.41	83	4	12.35	35.98	51.80	60.87	0.49	0.18	0.94	0.20
<i>Altorado</i>	3.33	ab	98.46	79	6	12.28	38.71	59.38	58.74	0.34	0.20	1.20	0.23
<i>Amisk</i>	2.97	b	87.68	80	7	13.73	32.01	47.56	63.96	0.50	0.21	1.01	0.21
<i>Canmore</i>	3.28	ab	96.75	79	6	13.88	37.15	57.68	59.96	0.52	0.19	1.07	0.26
<i>CDC Bow</i>	3.43	ab	101.33	87	5	12.32	35.91	54.52	60.93	0.25	0.17	1.25	0.16
<i>CDC Cowboy</i>	3.62	ab	107.00	105	4	12.98	35.66	54.39	61.12	0.45	0.21	1.13	0.23
<i>CDC Maverick</i>	3.58	ab	105.73	103	7	13.02	31.49	48.19	64.37	0.35	0.20	0.86	0.18
<i>Claymore</i>	3.59	ab	106.00	81	6	12.26	35.95	52.07	60.90	0.31	0.20	1.18	0.20
<i>SRI8524</i>	3.00	b	88.60	71	6	12.68	34.89	49.96	61.72	0.41	0.23	1.17	0.21
<i>Sundre</i>	3.08	b	90.99	84	5	12.63	40.04	61.68	57.71	0.56	0.16	1.15	0.24
<i>TR18647</i>	3.36	ab	99.20	90	6	13.48	35.07	52.41	61.58	0.35	0.22	1.04	0.21
<i>Average</i>	3.42		87			12.79	35.61	53.25	61.16	4.37	0.20	1.08	0.21
<i>CV</i>	8.89												

*lodging rated on a 1-9 scale where 1 is erect and 9 is completely flat.

**average moisture content at the time of harvest was 69%.

Table 3. RST Barley St. Paul, 2020 (ton/acre, 1 ton = 2000 lbs).

Variety	DM Yield (ton/ac)		DM Yield (% Austenson)	Height (cm)	Lodging (1-9)	2020 Quality Results							
						CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
<i>CDC Austenson</i>	4.31		100.00	86	1	11.30	35.28	53.27	61.41	0.35	0.19	1.30	0.12
<i>AB Advantage</i>	5.30		123.08	103	3	11.55	34.19	46.48	62.27	0.39	0.20	1.39	0.12
<i>AB Cattlelac</i>	5.05		117.28	94	1	10.83	32.72	46.12	63.42	0.30	0.21	1.07	0.12
<i>AB Wrangler</i>	5.56		129.05	87	4	10.42	35.45	51.52	61.28	0.40	0.17	1.21	0.12
<i>Altorado</i>	4.36		101.21	74	1	10.38	35.23	51.04	61.46	0.32	0.19	1.28	0.11
<i>Amisk</i>	3.09		71.76	66	1	11.99	33.82	46.81	62.55	0.33	0.23	1.37	0.10
<i>Canmore</i>	4.84		112.33	90	1	11.99	32.02	45.32	63.95	0.43	0.21	1.28	0.12
<i>CDC Bow</i>	4.27		99.23	75	1	10.11	34.81	51.16	61.78	0.33	0.19	1.06	0.10
<i>CDC Cowboy</i>	5.05		117.35	107	2	10.46	33.01	47.11	63.19	0.29	0.22	1.08	0.14
<i>CDC Maverick</i>	5.46		126.87	107	2	11.04	32.60	48.87	63.51	0.35	0.21	0.97	0.15
<i>Claymore</i>	4.76		110.61	83	3	10.41	35.03	50.27	61.61	0.40	0.19	1.10	0.12
<i>SR18524</i>	3.62		83.95	75	1	11.18	31.10	45.14	64.67	0.31	0.24	1.13	0.13
<i>Sundre</i>	6.45		80.07	85	1	9.87	35.26	50.40	61.43	0.42	0.20	1.24	0.14
<i>TR18647</i>	4.09		94.94	79	1	10.67	32.78	45.75	63.37	0.22	0.21	1.02	0.12
<i>Average</i>	4.51		104.84	86		10.87	33.81	48.52	62.56	0.35	0.20	1.18	0.12
<i>CV</i>	21.8												

*lodging rated on a 1-9 scale where 1 is erect and 9 is completely flat.

**average moisture content at the time of harvest was 50%.

Oats

The oat trials are aimed to be harvested at the milk stage. There were 10 oat varieties grown in the trial this year in Fort Kent (NE25-61-5-W4) and St. Paul (SW30-60-9-W4). The results of Fort Kent trial can be found in table 4 and the results of the St. Paul trial can be found in Table 5. The average moisture content at the time of harvest in Fort Kent was 68% and in St. Paul it was 58%. This is the third year that the experimental variety ORE3542 M has been included in this trial, which is not yet available to commercial producers. Some varieties that were new to our trial this year were CDC Arbourg and CS Camden.

The Fort Kent trial was harvested at 85 days after seeding and the St. Paul trial was harvested at 84 days after seeding.

The varieties yielded higher at the Fort Kent Location with an average of 4.73 tons/acre compared to an average of 4.21 tons/acre at the St. Paul site. CS Camden yielded the highest in Fort Kent at 5.77 tons/acre. CDC Baler yielded in the top three in Fort Kent at 5.51 tons/acre, this is a common variety that

is typically grown for forage production. CDC Baler yielded the highest at the St. Paul site yielding at 4.84 tons/acre.

The new variety CDC Arbourg yielded in the top three at the St. Paul site at 4.61 tons/acre but yielded at bit lower at the Fort Kent site at 4.51 tons/ acre.

Table 4. RST Oats Fort Kent, 2020 (ton/acre, 1 ton = 2000 lbs).

Variety	DM Yield (ton/ac)		DM Yield (% Baler)	Height (cm)	Lodging (1-9)	2020 Quality Results							
						CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
<i>CDC Baler</i>	5.51	a	100.00	136	4	12.38	36.36	55.35	60.55	0.40	0.12	0.99	0.18
<i>AC Morgan</i>	5.07	ab	92.02	119	1	14.35	37.93	59.13	59.35	0.29	0.12	1.70	0.17
<i>AC Juniper</i>	3.91	cd	77.07	110	3	12.42	39.11	58.85	58.43	0.25	0.14	1.53	0.19
<i>CDC Arbourg</i>	4.52	bc	115.55	123	3	12.52	37.96	56.44	59.33	0.26	0.14	1.23	0.19
<i>CDC Haymaker</i>	5.31	a	117.46	120	6	12.98	36.86	55.61	60.16	0.26	0.18	1.37	0.19
<i>CDC Nassar</i>	4.17	cd	78.58	109	5	13.40	40.79	64.56	57.13	0.33	0.12	1.13	0.20
<i>CDC Seabiscuit</i>	5.52	a	132.25	114	7	11.66	37.45	54.64	59.73	0.24	0.16	1.07	0.14
<i>CS Camden</i>	5.77	a	104.55	109	5	12.41	35.28	50.02	61.42	0.20	0.14	1.33	0.14
<i>Murphy</i>	3.45	d	59.75	113	2	13.01	39.46	61.93	58.16	0.32	0.10	1.22	0.25
<i>ORE 3542 M</i>	4.05	cd	117.65	109	2	12.50	38.80	59.16	58.68	0.21	0.11	1.38	0.16
<i>Average</i>	<i>4.73</i>			<i>116</i>		<i>12.76</i>	<i>38.00</i>	<i>57.57</i>	<i>59.36</i>	<i>0.28</i>	<i>0.13</i>	<i>1.30</i>	<i>0.18</i>
<i>CV</i>	<i>8.53</i>												

*lodging rated on a 1-9 scale where 1 is erect and 9 is completely flat.

**average moisture content at the time of harvest was 68%.

Table 5. RST Oats St. Paul, 2020 (ton/acre, 1 ton = 2000 lbs).

1 trVariety	DM Yield (ton/ac)		DM Yield (% Baler)	Height (cm)	Lodging (1-9)	2020 Quality Results							
						CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
<i>CDC Baler</i>	4.84	a	100	121	1	11.58	34.01	50.30	62.41	0.29	0.17	1.38	0.14
<i>AC Morgan</i>	4.09	ab	84.60	97	1	11.33	37.19	52.47	59.93	0.28	0.21	1.92	0.15
<i>AC Juniper</i>	4.03	ab	98.46	96	1	11.54	35.90	49.58	60.93	0.29	0.18	1.70	0.15
<i>CDC Arbourg</i>	4.61	ab	114.27	104	1	10.28	37.47	53.56	59.71	0.19	0.17	1.36	0.11
<i>CDC Haymaker</i>	4.10	ab	89.03	106	1	11.77	34.89	50.53	61.72	0.34	0.17	1.67	0.17
<i>CDC Nassar</i>	4.40	ab	107.27	101	1	11.57	35.14	50.25	61.52	0.26	0.18	1.90	0.12
<i>CDC Seabiscuit</i>	4.75	a	108.07	103	1	12.01	34.52	47.49	62.01	0.27	0.23	1.12	0.15
<i>CS Camden</i>	3.95	ab	83.17	92	1	11.86	35.88	49.63	60.95	0.33	0.21	1.69	0.17
<i>Murphy</i>	3.84	b	97.22	98	1	10.89	38.04	54.25	59.27	0.31	0.16	2.06	0.14
<i>ORE 3542 M</i>	4.21	ab	109.55	98	1	12.50	35.70	50.58	61.09	0.27	0.17	1.53	0.16
<i>Average</i>	<i>4.21</i>			<i>102</i>		<i>11.53</i>	<i>32.61</i>	<i>60.95</i>	<i>60.95</i>	<i>0.19</i>	<i>0.19</i>	<i>1.63</i>	<i>0.15</i>
<i>CV</i>	<i>8.87</i>												

*lodging rated on a 1-9 scale where 1 is erect and 9 is completely flat.

**average moisture content at the time of harvest was 58%.

Triticale and Wheat

The triticale and wheat trials are targeted to be harvested at the late milk stage. This year there were 3 soft white wheat varieties that were added to this trial, AAC Paramount, AAC Awesome, KWS Alderon. AAC Delight was also added to the trials this year as it is a forage triticale due to its short awns and its resistance to ergot. The results of the Fort Kent and St. Paul trials can be found in tables 6 and 7, respectively. The average moisture content at harvest for Fort Kent was at 60% and at St. Paul it was 58%. The Fort Kent trial was harvested 84 days after seeding and the St. Paul trial was 80 days after seeding.

The trials yielded higher in fort Kent trial at 4.67 tons/acre and 3.39 ton/acre in St. Paul. Bunker yielded the overall highest in both trials at 6.09 ton/acre for Fort Kent and 4.37 ton/acre in St. Paul. In Fort Kent AC Sadash yielded the highest for the soft white wheat at 4.38 tons/ac. In the St. Paul trial, KWS Alderon Yielded at 3.66 ton/acre which was slightly higher than the other soft white wheat varieties.

The quality in Fort Kent trial averaged CP at 13.13% while the St. Paul trial averaged at 11.59 % which still both meet the requirements for beef cattle nutrient requirements.

Table 6. RST Triticale Fort Kent, 2019 (ton/ac, 1 ton = 2000 lbs).

Variety	DM Yield (ton/ac)		DM Yield (% Taza)	Height (cm)	Lodging (1-9)	2019 Quality Results							
						CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
<i>Taza</i>	5.09	b	100.00	118	1	12.85	34.74	56.14	61.84	0.24	0.25	1.27	0.14
<i>AAC Awesome</i>	3.82	c	74.97	92	1	13.59	39.11	58.43	59.52	0.30	0.16	2.06	0.17
<i>AAC Delight</i>	5.26	b	103.30	117	1	11.55	35.12	57.14	61.54	0.17	0.20	0.78	0.17
<i>AAC Paramount</i>	4.28	c	84.04	91	3	13.26	37.55	57.49	59.65	0.27	0.18	1.55	0.19
<i>AC Andrew</i>	3.77	c	73.92	85	1	13.56	33.50	49.32	62.80	0.25	0.22	1.64	0.19
<i>AC Sadash</i>	4.38	c	86.06	83	1	13.10	34.53	51.51	62.00	0.24	0.21	1.38	0.17
<i>KWS Alderon</i>	4.10	c	80.50	80	1	15.15	36.16	57.65	60.73	0.21	0.23	1.72	0.20
<i>Bunker</i>	6.09	a	119.48	134	1	12.10	35.76	56.46	61.04	0.21	0.18	1.13	0.15
<i>Sunray</i>	5.47	b	107.40	109	1	13.04	33.06	51.79	62.15	0.31	0.22	1.17	0.17
<i>T256</i>	4.43	c	87.02	96	1	11.18	33.32	53.32	62.95	0.22	0.21	1.05	0.16
<i>Average</i>	4.67			100		13.13	35.29	54.93	61.52	0.24	0.21	1.38	0.17
<i>CV</i>	8.41												

*lodging rated on a 1-9 scale where 1 is erect and 9 is completely flat.

**average moisture content at the time of harvest was 60%.

Table 7. RST Triticale St. Paul, 2020 (ton/ac, 1 ton = 2000 lbs).

Variety	DM Yield (ton/ac)		DM Yield (% Taza)	Height (cm)	Lodging (1-9)	2020 Quality Results							
						CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
<i>Taza</i>	3.89	ab	100.00	104	1	11.24	36.26	55.37	60.65	0.14	0.25	1.11	0.09
<i>AAC Awesome</i>	3.09	bcd	79.32	89	1	11.68	34.32	55.39	62.18	0.17	0.24	1.56	0.10
<i>AAC Delight</i>	2.56	d	65.68	95	1	12.27	35.28	55.71	61.44	0.16	0.27	1.08	0.10
<i>AAC Paramount</i>	2.61	d	66.91	82	1	11.47	35.96	56.14	60.89	0.16	0.21	1.32	0.10
<i>AC Andrew</i>	3.64	abc	93.50	82	1	11.49	35.24	53.83	61.45	0.14	0.27	1.34	0.10
<i>AC Sadash</i>	3.63	abc	93.12	82	1	11.31	34.88	55.07	61.70	0.17	0.24	1.52	0.10
<i>KWS Alderon</i>	3.66	abc	93.91	74	1	12.44	35.13	54.73	61.51	0.11	0.28	1.40	0.12
<i>Bunker</i>	4.37	a	112.25	121	1	10.95	36.20	57.68	60.68	0.16	0.24	1.14	0.09
<i>Sunray</i>	2.77	cd	71.23	102	1	12.19	32.93	52.84	63.25	0.21	0.26	1.19	0.10
<i>T256</i>	3.65	abc	93.76	88	1	10.91	35.35	57.71	60.57	0.18	0.20	0.97	0.10
<i>Average</i>	3.39		86.97	92		11.59	35.15	55.45	61.43	0.16	0.25	1.26	0.10
<i>CV</i>	13.34												

*lodging rated on a 1-9 scale where 1 is erect and 9 is completely flat.

**average moisture content at the time of harvest was 58%.

Winter/Spring Cereal Intercrop

The winter/spring cereal intercrop trial was harvested at the recommended stage for the spring cereals. The trial was established in St. Paul (SW30-60-9-W4) and in Smoky Lake () and the following three 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.

The trial in St. Paul was harvested at the recommended stage for the spring cereals on September 8, 2020 at 89 days after seeding. Results of the trial can be found in table 8. The highest yielding mixture was Luoma/CDC Baler Yielding at 4.77 ton/acre. All three treatments with the winter cereals paired with CDC Baler all yielded in the top 5. CDC Baler still yielded higher than the other monoculture cereal varieties at 4.65 tons/acre as it is a known crop grown for forage productions.

Our Smoky Lake Site was unable to be harvested as there were high amounts of water declaring an agriculture natural disaster within that county. Therefore no data was collected from this trial.

Table 8. RST Winter/Spring Cereal Intercrop St. Paul, 2020 (ton/ac, 1 ton = 2000 lbs).

Treatments	DM Yield		DM Yield	Height (Spring)	Height (winter)	2020 Quality Data							
						CP	ADF	NDF	TDN	Ca	P	K	Mg
	(ton/ac)		(% Taza/CDC Austneson)	cm	cm	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Prima/CDC Austenson	3.81	bcd	100.00	80	60	10.14	34.87	49.90	61.73	0.28	0.17	1.26	0.12
Prima/CDC Baler	4.50	abc	118.25	132	50	9.85	34.10	48.32	62.34	0.37	0.17	1.26	0.16
Prima/Taza	3.68	cd	96.72	109	58	9.94	35.62	55.90	61.16	0.17	0.21	1.58	0.07
AAC Wildfire/CDC Austenson	3.70	cd	97.11	77	48	9.42	35.05	48.96	61.60	0.36	0.18	1.20	0.13
AAC Wildfire/CDC Baler	4.48	abc	117.73	128	46	9.75	35.40	51.24	61.33	0.28	0.15	1.20	0.12
AAC Wildfire/Taza	3.69	cd	96.80	106	50	10.34	34.43	52.91	62.08	0.22	0.16	1.14	0.10
Luoma/CDC Austenson	3.34	d	87.71	77	44	10.03	37.33	54.44	59.82	0.45	0.12	1.24	0.13
Luoma/CDC Baler	4.77	a	125.34	138	42	10.33	34.68	49.74	61.89	0.36	0.15	1.47	0.14
Luoma/Taza	3.87	bcd	101.63	108	43	10.64	35.09	53.60	61.57	0.24	0.20	1.36	0.09
CDC Austenson	4.21	abc	110.43	81	-	8.79	38.02	55.80	59.28	0.29	0.13	0.98	0.10
CDC Baler	4.65	ab	122.01	128	-	9.39	36.39	52.85	60.55	0.24	0.14	1.17	0.12
Taza	4.28	abc	112.47	110	-	10.14	34.39	49.56	62.11	0.12	0.20	0.88	0.09
Average	4.08			106	49	9.90	35.45	51.93	61.21	0.28	0.19	1.23	0.12
CV=	9.44												

*average moisture content at the time of harvest was 58%.

Regional Annual Silage Trial Pulse Mixtures

Partners: Alberta Agriculture and Forestry
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. 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. The use of 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 peas into the production of an annual cereal crop can provide multiple benefits over the use of a monoculture crop. Fertilizer costs could be reduced due to the ability of peas to fix nitrogen which could also impact overall soil fertility. Peas have a high protein content and will therefore add protein to the overall forage quality.

This year the pea/cereal trial expanded its pulse species and incorporated a Faba Bean treatment into the trial. Fertilizer costs can also be reduced as faba beans have the ability to fix nitrogen which could impact overall soil fertility. As well, faba beans have a high source of protein content which can add protein to your feed quality.

Method:

The trial was established at the LARA Fort Kent Research Site (NE25-61-5-W4) on May 22, 2019 and at our St. Paul site (NE15 59-9 W3) on June 12, 2020 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 Baler oats, Taza triticale and CDC Austenson barley were established as check treatments for comparison to the pea/cereal mixtures. The trial was seeded with 12 treatments and each cereal variety was seeded in a mixture with CDC Jasper peas, CDC Meadow peas and Snowbird faba beans.

Agronomic information on the trial can be found in table 1. 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 alfalfa-omega self-propelled forage harvester was used to harvest the plots at the recommended cereal harvest date + 10 days. The individual plot weights were recorded and samples were taken to assess dry matter content. An additional composite sample was taken from each variety, frozen and sent to A & L Canada Laboratories for wet chemistry analysis. Statistical analysis of the data was conducted using ARM 9, $p = 0.05$.

The following varieties were used in the pea/cereal trial in 2020:

- *CDC Austenson barley* - 2-row barley variety with semi-smooth awns, short and strong straw and high feed yield.
- *CDC Baler oats* - very leafy, forage oat variety.
- *Taza triticale* – reduced awn forage and grain triticale variety with good lodging resistance.
- *CDC Jasper peas* – forage pea variety with small seed size, good grain yield and high relative feed value.
- *CDC Meadow peas* – consistently high yielding, competitive yellow field pea variety with good lodging resistance.
- *AAC Peaceriver peas* – yellow pea, semi leafless field pea, early maturing, and is resistant to powdery mildew.
- *Snowbird faba beans* – zero tannin, medium size seed, resistant to root rot, good source of protein and energy.

Table 1. RST Pea/Cereal Mixture Agronomic Information, 2020.

	Date	Date	Rain			
Site	Seeded	Harvested	(mm)	Treatments	Seeding Rate	Fertility
Fort Kent	12- June-20	1-Sept-20		Austenson	300 plants/m ²	50% of recommended rate*
				CDC Baler	300 plants/m ²	50% of recommended rate*
				Taza	370 plants/m ²	50% of recommended rate*
				Austenson/Meadow	150 pl/m ² , 57 pl/m ²	50 lbs/acre of 11-52-0-0
				CDC Baler/Meadow	150 pl/m ² , 57 pl/m ²	50 lbs/acre of 11-52-0-0
				Taza/Meadow	185 pl/m ² , 57 pl/m ²	50 lbs/acre of 11-52-0-0
				Austenson/Jasper	150 pl/m ² , 57 pl/m ²	50 lbs/acre of 11-52-0-0
				CDC Baler/Jasper	150 pl/m ² , 57 pl/m ²	50 lbs/acre of 11-52-0-0
				Taza/Jasper	185 pl/m ² , 57 pl/m ²	50 lbs/acre of 11-52-0-0
				Austenson/Snowbird	150 pl/m ² , 57 pl/m ²	50 lbs/acre of 11-52-0-0
				Austenson/Snowbird	150 pl/m ² , 57 pl/m ²	50 lbs/acre of 11-52-0-0
				Austenson/Snowbird	185 pl/m ² , 57 pl/m ²	50 lbs/acre of 11-52-0-0

Table 2. RST Pea/Cereal Mixture Agronomic Information 2020.

St. Paul	12-June-20	8-Sept-20		Austenson	300 plants/m2	60-30-25-10 @239 lbs/acre
				CDC Baler	300 plants/m2	60-30-25-10 @239 lbs/acre
				Taza	370 plants/m2	60-30-25-10 @239 lbs/acre
				Austenson/AAC Peacriver	150 pl/m2, 57 pl/m2	60-30-25-10 @239 lbs/acre
				CDC Baler/AAC Peacriver	150 pl/m2, 57 pl/m2	60-30-25-10 @239 lbs/acre
				Taza/AAC Peacriver	185 pl/m2, 57 pl/m2	60-30-25-10 @239 lbs/acre
				Austenson/Jasper	150 pl/m2, 57 pl/m2	60-30-25-10 @239 lbs/acre
				CDC Baler/Jasper	150 pl/m2, 57 pl/m2	60-30-25-10 @239 lbs/acre
				Taza/Jasper	185 pl/m2, 57 pl/m2	60-30-25-10 @239 lbs/acre
				Austenson/Snowbird	150 pl/m2, 57 pl/m2	60-30-25-10 @239 lbs/acre
				Austenson/Snowbird	150 pl/m2, 57 pl/m2	60-30-25-10 @239 lbs/acre
				Austenson/Snowbird	185 pl/m2, 57 pl/m2	60-30-25-10 @239 lbs/acre

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 table 2 and table 3. The Fort Kent trial was harvested 81 days after harvest and the St. Paul trial was harvested 88 days after seeding.

The trial in St. Paul had a higher average yield of 4.45 tons/acre than Fort Kent trial at 3.99 tons/acre. In Fort Kent trial CDC Austenson/Snowbird yielded the second highest in the overall trial at 4.46 tons/acre. The traditional cereal trials paired with snowbird yield higher than the treatments with field peas. In the St. Paul trial Taza/snowbird yielded the second highest at 5.37 tons/acre. The highest yielding treatment was CDC Baler at 5.41 tons/acre.

Table 3. RST Pea/Cereal Mixture Fort Kent, 2020 (ton/ac, 1 ton = 2000 lbs).

* average moisture at the time of harvest for the pea-cereal treatments was 74% and the cereal treatments was 67%

Variety	DM Yield (ton/ac)		DM Yield (% CDC Austeson)	Pulse Height (cm)	Cereal Height (cm)	Lodging (1-9)	2020 Quality Results							
							CP	ADF	NDF	TDN	Ca	P	K	Mg
							(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
CDC Austenson	4.42	ab	100.00	-	86	1	11.35	34.52	62.01	62.01	0.24	0.12	1.27	0.20
CDC Baler	4.23	ab	95.59	-	134	1	11.50	38.42	57.97	58.97	0.21	0.17	1.24	0.17
Taza	4.81	a	108.66	-	95	1	12.28	31.94	43.31	4.02	0.29	0.18	1.32	0.18
CDC Austenson/CDC Meadow	3.80	ab	85.99	95	63	1	15.05	34.30	47.05	62.18	0.72	0.15	1.46	0.31
CDC Baler/CDC Meadow	3.90	ab	88.04	80	108	1	12.68	37.30	54.92	59.85	0.31	0.22	1.33	0.18
Taza/CDC Meadow	3.68	ab	83.14	87	83	1	13.73	37.25	54.83	59.90	0.44	0.23	1.81	0.22
CDC Austenson/CDC Jasper	3.86	ab	87.14	97	70	1	15.66	34.84	46.70	61.76	0.54	0.20	1.45	0.25
CDC Baler/CDC Jasper	3.60	ab	81.44	98	110	1	13.08	35.02	50.42	61.62	0.32	0.21	1.51	0.20
Taza/CDC Jasper	3.15	b	71.09	98	94	1	16.02	35.92	49.14	60.92	0.57	0.22	1.44	0.24
CDC Austenson/Snowbird	4.46	ab	100.84	99	82	1	14.27	34.70	45.55	61.87	0.49	0.22	1.37	0.30
CDC Baler/Snowbird	3.91	ab	88.27	93	126	1	14.44	33.85	44.80	62.53	0.42	0.23	1.21	0.26
Taza/Snowbird	4.07	ab	92.07	105	112	1	13.70	35.64	47.77	61.13	0.32	0.24	1.62	0.23
Average	3.99		90.19	71	97		13.65	35.31	49.57	61.40	0.41	0.20	1.42	0.23
CV	14.46													

Table 4. RST Pea/Cereal Mixture St. Paul, 2020 (ton/ac, 1 ton = 2000 lbs).

Variety	DM Yield (ton/ac)		DM Yield (% Murphy)	2019 Quality Results							
				CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
CDC Austenson	3.71	d	100.00	9.92	37.27	50.46	59.87	0.8	0.18	1.24	0.16
CDC Baler	5.41	a	145.71	9.37	38.54	52.89	58.86	0.25	0.15	1.44	0.14
Taza	5.12	a	138.09	9.39	36.36	51.41	60.58	0.35	0.15	1.21	0.12
CDC Austenson/CDC Meadow	3.92	cd	105.66	10.54	45.44	59.56	53.50	1.12	0.12	0.88	0.28
CDC Baler/CDC Meadow	4.69	abc	126.36	11.47	36.62	48.46	60.37	0.51	0.20	1.30	0.22
Taza/CDC Meadow	4.21	bcd	113.42	9.60	37.44	49.04	59.74	0.34	0.51	1.63	0.14
CDC Austenson/AAC Peacriver	3.63	d	97.84	9.93	45.08	57.83	53.79	0.80	0.34	0.94	0.19
CDC Baler/AAC Peacriver	5.02	ab	135.18	10.42	41.22	54.33	56.79	0.56	0.80	1.30	0.20
Taza/AAC Peacriver	4.15	bcd	11.81	9.87	46.65	60.71	52.56	0.73	0.56	0.93	0.24
CDC Austenson/Snowbird	3.27	d	88.14	10.52	41.59	57.60	56.50	0.45	0.73	1.20	0.18
CDC Baler/Snowbird	4.95	ab	133.42	9.46	37.52	51.79	59.67	0.33	0.45	0.99	0.18
Taza/Snowbird	5.37	a	144.82	9.21	35.12	50.16	61.54	0.21	0.33	0.91	0.12
<i>Average</i>	<i>4.45</i>		<i>120.04</i>	<i>9.97</i>	<i>39.90</i>	<i>53.69</i>	<i>57.81</i>	<i>0.50</i>	<i>0.21</i>	<i>1.16</i>	<i>0.19</i>
<i>CV</i>	<i>14.76</i>										

* average moisture at the time of harvest for the pea-cereal treatments was 52% and the cereal treatments was 54%

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

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 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 (Minnee et al. 2017). These results are supported by similar research on plantain-fed dairy heifers done by Cheng et al. (2017). A study by Edwards et al. (2014) showed high consumption of forage beet, kale and kale-oat mixtures by grazing dairy cows and almost complete consumption of 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 in order 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 June 18, 2020 and at our St. Paul site (SW30-60-9-W4) on June 18, 2020 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 (60-30-25-15) was side-banded during seeding at 239 lbs/ac. The trial was hand-weeded during the growing season when necessary. There was no in-crop herbicide application in these trials.

Total rainfall at the Fort Kent site was 132.3 mm and the St. Paul site received 165.8 mm of rain. 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 ARM 9, P = 0.05.

The following alternative crops were used for the trial in 2020:

- *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.
- *Forage Radish* – fast growing, drought tolerant forage radish that can be grazed multiple times due to its rapid regrowth. Highly digestible to livestock, with high energy levels and great persistence.
- *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 last 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.
- *Red Serbian Millet* – fast-growing, high yielding leafy warm-season grass that can be used for late season grazing systems. Creates a soft-palatable feed and is ideal for high temperature regions.

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 1. The trial at the Fort Kent Site (LARA) was harvested on Sept 4, 2020. The trial at the St. Paul site was harvested on September 8, 2020.

The Fort Kent trial had a higher yield of 1.42 ton/acre and the St. Paul site was 1.10 ton/acre. The highest yielding variety was the Japanese Millet at 3.03 tons/acre. In St. Paul, the Forage radish yielded the highest at 2.13 tons/acre.

Quality remained fairly consistent with an average CP content of 16.78% in the Fort Kent trial and 16.08% in the St. Paul trial. This will meet the CP requirements for beef cattle nutrient requirements.

Table 1. RST Alternative Crops Fort Kent Data, 2020 (ton/ac, 1 ton = 2000 lbs).

Treatment	DM Yield (ton/ac)		2020 Quality Results							
			CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
Chicory	0.69	d	19.97	33.48	44.06	62.78	1.55	0.35	3.86	0.54
Forage Brassica	1.18	c	18.45	34.21	44.33	62.25	2.90	0.32	4.24	0.83
Forage Kale	0.86	cd	19.11	32.41	40.32	63.67	3.18	0.30	2.66	0.87
Forage Radish	1.35	c	16.36	41.46	49.27	56.58	1.64	0.25	2.50	0.50
Forage Turnip	1.14	c	20.24	33.35	34.76	62.92	3.04	0.38	4.36	0.78
Japanese Millet	3.03	a	14.07	35.26	54.53	61.42	0.48	0.22	2.41	0.42
Millet	2.41	b	15.64	35.32	53.88	61.39	0.36	0.17	2.09	0.50
Phacelia	1.09	c	14.29	42.35	48.67	55.91	2.53	0.24	0.24	0.67
Plantain	1.17	c	15.80	36.15	41.91	60.73	1.85	0.28	2.28	0.56
Sorgum Sudan Grass	1.28	c	13.88	35.38	58.54	61.34	0.49	0.25	1.83	0.34
<i>Average</i>	<i>1.42</i>		<i>16.78</i>	<i>35.94</i>	<i>47.03</i>	<i>60.90</i>	<i>1.80</i>	<i>0.28</i>	<i>2.65</i>	<i>0.63</i>
<i>CV</i>	<i>15.44</i>									

* Average moisture at the time of harvest was 81%.

Table 2. RST Alternative Crops St. Paul Data, 2020 (ton/ac, 1 ton = 2000 lbs).

Treatment	DM Yield (ton/ac)		2020 Quality Results							
			CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
Chicory	1.05	cd	15.84	34.20	41.19	62.26	1.58	0.29	3.33	0.38
Forage Brassica	1.29	c	20.22	33.45	35.81	62.84	3.73	0.33	3.18	0.54
Forage Kale	0.54	de	16.42	35.26	40.05	61.44	2.77	0.34	2.53	0.39
Forage Radish	2.13	a	15.36	42.17	49.79	56.05	1.78	0.23	2.22	0.31
Forage Turnip	1.14	cd	19.39	33.04	41.17	63.16	1.18	0.35	1.82	0.41
Japanese Millet	0.86	cd	14.69	35.30	55.49	61.40	0.71	0.25	2.30	0.26
Millet	0.95	cd	11.49	37.28	57.24	59.86	0.31	0.29	1.57	0.24
Phacelia	1.72	b	16.15	56.66	41.38	47.82	3.44	0.28	2.51	0.46
Plantain	1.05	cd	15.5	33.52	42.39	62.79	2.07	0.25	2.05	0.25
Sorgum Sudan Grass	0.28	e	15.96	34.24	54.11	62.23	1.18	0.35	1.82	0.28
<i>Average</i>	<i>1.10</i>		<i>16.08</i>	<i>37.51</i>	<i>45.86</i>	<i>59.74</i>	<i>1.88</i>	<i>0.30</i>	<i>2.33</i>	<i>0.35</i>
<i>CV</i>	<i>25.39</i>									

* Average moisture at the time of harvest was 81%

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