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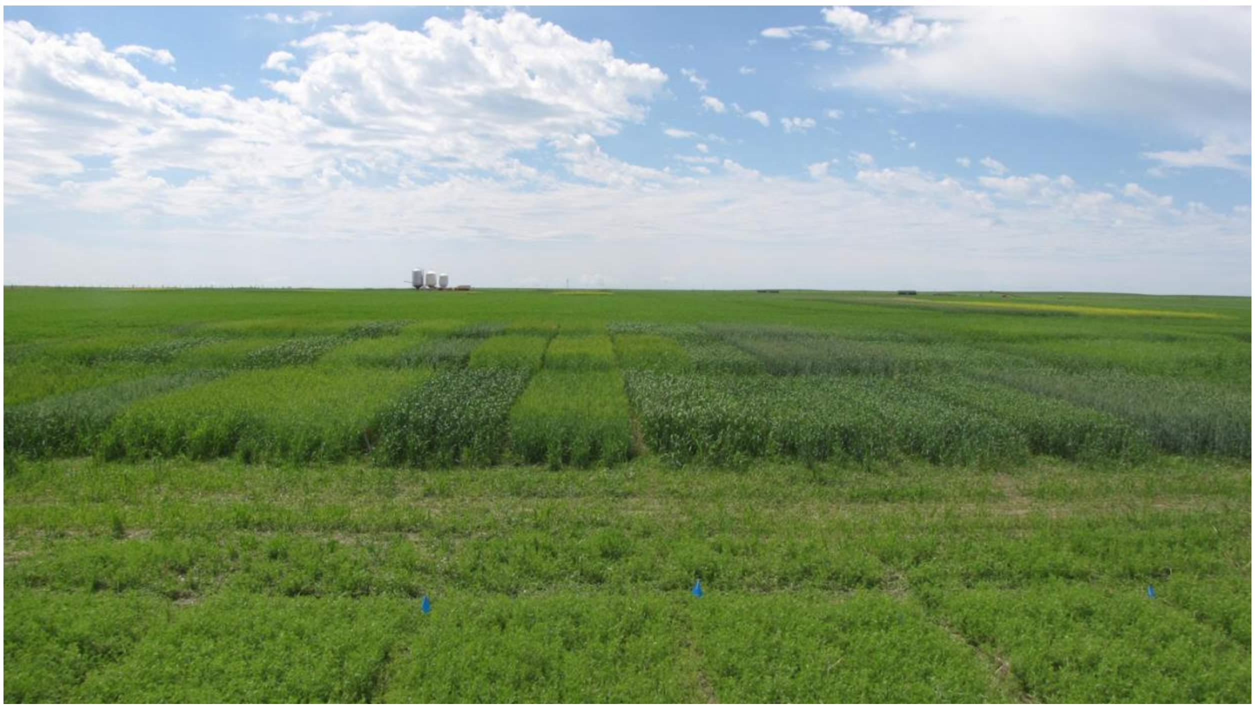
2022 Final Report

Strategic Field Program #20190400

Project Title: An Assessment of Annual Forage Varieties in Saskatchewan



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Project Identification

1. **Project Title:** An Assessment of Annual Forage Varieties in Saskatchewan

2. **Project Number:** #20190400
3. **Contractor Undertaking the Project:** Wheatland Conservation Area Inc.
4. **Project Location:** Swift Current, Clavet, Redvers and Prince Albert, SK
5. **Project start and end dates (month & year):** April 1, 2020 to March 31, 2023
6. **Project contact person & contact details:**

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Objectives and Rationale

7. **Project objectives:**

- The objective of this project was to evaluate and compare commonly grown and commonly available varieties of barley, oats, wheat, triticale and some mixtures for forage yield and quality along with newer crop varieties for their potential as annual forages.
- Recent shifts in spring weather patterns and extended periods of drought combined with increased year to year climatic variability has resulted in a more dual-purpose use (grain/green feed) of cereal crops in livestock production systems. This adaptation allows for greater flexibility and increases the overall economic resiliency of mixed farming operations while helping to ensure adequate feed supplies during dry periods when perennial forage yields are low.
- Although the Saskatchewan Variety Performance Group (SVPG) initiated an annual forage test in spring 2019 to test new varieties, there is still a knowledge gap with respect yield and quality measures for
    - i) some current popular annual forage varieties, and
    - ii) top grain varieties which have the potential to be used as annual forage but have not yet been widely used for that purpose.
- Data from this project will complement data collected in the SVPG trial.

8. **Project Rationale:**

- Perennial forages rely heavily on early spring precipitation. Frequent spring drought and increased climatic variability has led producers to increase their use of annual forages to supplement inconsistent perennial forage yields.
- Based on call logs at the Agriculture Knowledge Centre, from May 1, 2018 – May 1, 2019, 278 calls were related to annual forages/yellow feed/green feed/silage, 6 of which were specific to variety and 94 for corn/perennial/seed production.
- The data shows that producers are increasingly responding to potential reductions in hay supply in late spring by seeding an annual cereal as an insurance feed supply. In many cases they seed what is commonly available at the time. Depending on the year, these crops can be used as green feed or, if growing conditions for their perennial crops improve, the cereals can be harvest for grain.

- Additional information about the performance of common annual cereal varieties is required to help producers make more informed decisions about which cereals and which varieties can provide the best value for both grain and livestock feed in comparison to those that have been bred for forage production
- The use of annual forages is increasing due to uncertain feed supplies caused by increased climatic variability
- Having regional yield and quality data will support recommendations for the use of annual forages and help producers make more informed decisions about which varieties they can rely on for both grain and feed. This in turn will add resiliency to their overall operations by providing more flexibility for adaptation.

Methodology and Results

9. Methodology:

This project consists of 24 entries at 4 locations over 3 years. The plots are randomized by species and replicated 3 times. Plot size varied depending on the seeding equipment at each location, generally in the range of 4-12 m^2. Plots were harvested for forage yield using the biomass of a measured area (image 4-5), or the entire plot (image 1-3). The locations are targeted near cattle producing areas across a range of soil zones. Wheatland Conservation Area, Swift Current (Dry Brown), South East Research Farm, Redvers (long season Black), University of Saskatchewan, Clavet (Dark Brown) and Conservation Learning Centre, Prince Albert (short season Black). Ministry staff (cereal and forage specialists, livestock specialists and regional livestock and feed specialists), breeders and industry specialists were consulted for suggested entries. Suggestions have been narrowed down based on the following criteria:

- varieties that are not in the current SVPG trial,
- varieties that are a popular grain or forage type, and
- varieties that are expected to remain in the market for the foreseeable future.
- Check varieties will allow for linkage and direct comparison with varieties included within the SPVG.

Design: RCBD with three replicates

Treatments: Varieties listed below

Barley	Oats	Mixtures	Wheat	Triticale
AB Advantage (check)	**CDC Haymaker (check)**	**CDC Haymaker (check)**	**AAC Innova (check)**	**Taza (check)**
CDC Maverick	Ore3542M	KWS ProPower + CDC Baler	CDC Plentiful	Bunker
CDC Cowboy	CDC Ruffian	CDC Arborg + CDC Maverick	Pasteur	Proghorn
AAC Synergy	SO-1	CDC Austenson + CDC Haymaker	Sadash	
CDC Bow	CS Camden	CDC Haymaker + CDC Horizon		
CDC Fraser		CDC Haymaker + CDC Horizon + forage rape		

Crop Management: All sites and treatments were seeded in both 2020 and 2021, required data was collected and all treatments harvested. A list of operations is included below (table 1) including harvest stage and seeding rate (table 2).

Table 1. List of Operations at each site 2020-2022.

	Swift Current			Clavet			Redvers			Prince Albert		
Location	**2020**	**2021**	**2022**	**2020**	**2021**	**2022**	**2020**	**2021**	**2022**	**2020**	**2021**	**2022**
Seed Date	May 15	May 6	May 24	May 15	May 22	May 12	May 12	varied	varied	May 20	May 17	May 27
								April 29	May 5			
								May 1	May 12			
								May 6	May 18			
Seed Rates	Same seeding rate at all sites (based on seeds/m2)											
Fertility	Based on recommended rates for each region											
N		60-80			45			60			40	
P		30-40			0			23			30	
K		0			0			8			0	
S		10			0			0			0	
Weed control	Pre-seed burn-off prior to emergence to control any perennial weeds, winter annuals or variable natural populations											
Heading notes	At maturity											
Lodging ratings	Before harvest											
Stage at harvest	Oats used as an indicator crop											
Harvest Dates	July 30	July 22	Aug 3	July 30	July 3	July 27	July 23	July 19	--	Aug 11	Aug 3	Aug 10
	Aug 4		--	Aug 5	Aug 5	Aug 2	July 27	July 22	--	Aug 18		Aug 16
								July 27				Aug 22
Quality Analysis	Subsamples sent to Central Testing for feed analysis											

Table 2. Seeding rates and harvest stage of each crop.

Harvest Stage	Crop	Seed Rate
soft dough	Barley	@250 plants/m2
late milk	Oats	@250 plants/m2
early dough	Wheat	@250 plants/m2
soft dough	Triticale	@310 plants/m2
oats as indicator crop	Fall rye	@100 plants/m2
	Baler oat	@125 plants/m2
	Arborg Oat	@125 plants/m2
	Maverick Barley	@125 plants/m2
	Haymaker Oat	@125 plants/m2
	Austenson Barley	@125 plants/m2
	Haymaker Oat	@125 plants/m2
	Horizon Pea	@85 plants/m2
	Haymaker Oat	@95 plants/m2
	Horizon Pea	@31 plants/m2
	Gorilla forage rape	@32 plants/m2

Data Collected: All data required was collected at all sites (Appendices table 9).

- Moisture at harvest
- Days to Heading
- Lodging Ratings
- Actual stage at biomass
- Feed Analysis (CP, TDN, Ca, P, K, Mg, Na, ADF, NDF, ADI-CP, ADIN)
- Dry matter yield

Data Analyses:

- Data was analysed by WCA and the University of Saskatchewan.
- Tables were made to include all effects regardless of whether responses were significant.

<u>Results</u>

10. General Conditions at each location

Table 3. Mean monthly temperatures and precipitation compared to long-term averages.

Location	Year	May	June	July	August	Avg. / Total	
			Mean Temperature (°C)				% of normal
Swift Current	2020	10.9	16.6	18.2	19.5	16.3	105%
	2021	9.5	18.4	21.7	18	16.9	109%
	2022	10.9	15.9	19.8	20.9	16.9	109%
	Long-term	**10.9**	**15.3**	**18.2**	**17.6**	**15.5**	
Redvers	2020	10.5	16.8	19.2	18.5	16.2	100%
	2021	10.0	18.7	20.8	17.5	16.8	103%
	2022	10.2	16.3	19.2	18.9	16.2	99%
	Long-term	**12.0**	**16.0**	**19.0**	**18.0**	**16.3**	
Prince Albert	2020	9.2	13.4	17.6	16.1	14.1	86%
	2021	10.1	18.3	20.3	17.0	16.4	100%
	2022	10.5	15.5	18.3	18.5	15.7	96%
	Long-term	**10.6**	**16.7**	**19.5**	**18.6**	**16.4**	
Clavet	2020	11.4	15.3	18.8	18.6	16.0	98%
	2021	10.6	18.8	21.9	17.8	17.3	106%
	2022	11	15.7	19.3	19.6	16.4	101%
	Long-term	**11.8**	**16.1**	**19**	**18.2**	**16.3**	
			Precipitation (mm)				% of normal
Swift Current	2020	36.3	80	62.5	6.5	185	79%
	2021	35	29.6	38.9	55.8	159	68%
	2022	51.2	37.7	90.4	7.5	187	79%
	Long-term	**51.2**	**77.1**	**60.1**	**47.4**	**236**	
Redvers	2020	22.9	59.7	47.8	36.1	166	57%
	2021	42.2	107.3	58	57	265	90%
	2022	135.0	92.4	303.3	73.1	604	206%
	Long-term	**60.0**	**91.0**	**78.0**	**64.0**	**293**	
Prince Albert	2020	68.4	91.4	32.2	33.2	225	105%
	2021	30.1	80.3	8.6	59.9	179	109%
	2022	17.9	75.7	63.7	37.8	195	109%
	Long-term	**58.2**	**78.2**	**83.4**	**49.0**	**269**	
Clavet	2020	69.5	94.5	34.6	26.5	225	114%
	2021	41.2	39	8.5	42.2	131	66%
	2022	25.8	38	46.5	25.6	136	69%
	Long-term	**36.5**	**63.6**	**53.8**	**44.4**	**198**	

Mean monthly temperature and precipitation data for each location is listed in table 3. Swift Current was the hottest and driest and experienced 3 years of below average precipitation and above average temperature. However, each site year resulted in good stand establishment. Above average temperatures in July and August caused in the most damage as leaf drop resulted in lower yield potential. Redvers received scattered rain showers throughout seeding followed by cool and dry conditions, especially in 2020 and 2021 therefore emergence was delayed and soil moisture diminished very quickly. Although 2022 was very different receiving 206% of the normal precipitation from May to August, with majority of the rainfall coming from 2 rainfall events (one in May and one in July). Prince Albert was the latest seeded site as they were usually able to seed into good soil moisture by third week of May, followed by timely rains throughout the spring. Clavet also experienced cool May temperatures, which slightly delayed emergence. Above normal precipitation was received in 2020, but was followed by 2 drought years.

For the most part crops developed normally and were in good condition until June when limited to no rainfall, wind and warm temperatures began to slow growth. Meanwhile, the Northeast remained slightly behind other locations. Soil conditions also began to deteriorate at Prince Albert, but crops remained in fairly good condition. By the middle of June, soil conditions at Swift Current and Clavet had quickly deteriorated and experienced higher than average temperatures. Dry and windy weather for the remainder of June and July caused crops to rapidly advance, resulting in estimated yields to be below average as crops had experienced irreparable damage and biomass harvest was likely to be a low yielding, but fair quality as the crop continued to fill. In 2020 Clavet had cooler than normal temperatures and needed warmth to support the later seeded crop and that specific year, crops at Clavet were developmentally behind other sites. Harvest was often earlier than expected due to extreme drought and heat and seemed to affect yield more than quality, as feed analysis results varied very little year to year.

11. Field Results

Nutrient requirements for cattle change with age, stage of production, sex, breed, environmental conditions and basal diet quality and amount. For the purposes of this report, feed analyses are evaluated based on the Beef Cattle Research Council requirements and their feed value estimator (BCRC).[1] Variation in production management and cow type will affect nutrient requirements, therefore it is important to test feed annually and consult with your local livestock and feed extension specialists on what is best for a specific operation.

Barley

- Barley crude protein averaged 9.8%. The check variety (Advantage) had the highest crude protein (table 4). However, there were no significant differences in protein between varieties.
- Total digestible nutrients (68%) were well above the 55-60-65 rule of thumb suggesting a high energy feed
- Resulting NDF (48%) and ADF (29%) values suggest a feed source high in quality and intake.
- Of the barley varieties included in this test, the forage varieties (Advantage, Maverick, and Cowboy) all out-yielded the malt varieties (Synergy, Bow, Fraser), but were not significantly different.
- There were no significant differences in days to heading, or lodging.
- Barley varieties slightly varied in calcium and potassium.
- Barley did not meet the required calcium to phosphorus ratio and may need to be supplemented.
- Average barley yield was 7,858 kg/ha.
- Location did have an effect on barley yield and crude protein (table 5).
  Top yielding barley varieties did vary by site
    - Prince Albert: Cowboy (10,166 kg/ha)
    - Swift Current: Maverick (7,790 kg/ha)
    - Redvers: Advantage (9,904 kg/ha)
    - Clavet: Cowboy (6,936 kg/ha), Synergy (6,869 kg/ha)

Oat

- Oat crude protein averaged 9.9% (table 4). Camden had the highest crude protein, although not significantly different than SO-1, Ruffian, and Haymaker.
- TDN (65%) was well above the 55-60-65 rule of thumb suggesting a high energy feed
- NDF (52%) and ADF (32%) values suggest a feed source high in quality and intake/digestibility.
- There were no significant differences in lodging.
- Haymaker was a later maturing variety (1-2 days) compared to the other varieties.
- Oat varieties slightly varied in calcium, phosphorus, potassium, sodium and magnesium.

[1] https://www.beefresearch.ca/research/feed-value-estimator.cfm

- Oats did not meet the required calcium to phosphorus ratio and may need to be supplemented.
- Average oat yield was 8,063 kg/ha, slightly higher than the overall barley average.
- Location did have a slight effect on yield and crude protein (table 6).
  Top yielding oat varieties did vary by site:
  - Prince Albert: Haymaker (12,081 kg/ha), Ore3542M (12,104 kg/ha)
  - Swift Current: Haymaker (8,030 kg/ha), Ore3542M (7,623 kg/ha), Ruffian (7,605 kg/ha) and SO-1 (7,572 kg/ha)
  - Redvers: Haymaker (8,343 kg/ha)
  - Clavet: Haymaker (5,863 kg/ha)
- Haymaker likely has a forage or green feed yield advantage over other the other oat varieties due to characteristics like large plump seeds and larger, wider flag leaves compared to non-forage oat varieties.[2]

<u>Wheat</u>

- Wheat crude protein (10.4%) was the highest of the monoculture treatments (table 4).
- TDN (66%) was well above the 55-60-65 rule of thumb suggesting a high energy feed.
- NDF (50%) and ADF (31%) values suggest a feed source high in quality and intake.
- There were no significant differences in lodging, or days to heading.
- Wheat varieties slightly varied in potassium and magnesium.
- Wheat did not meet the required calcium to phosphorus ratio and may need to be supplemented.
- Average wheat yield was 7,034 kg/ha and was the lowest yielding species compared to other monocultures.
- Wheat was low in calcium and phosphorus and may need to be supplemented.
- Innova was the highest yielding wheat variety when averaged across the 12 site years (7,479 kg/ha) and is most commonly used for forage. Although yield was not significantly different than Pasteur and Sadash, Innova did result in the lowest protein (9.9%) of the wheat varieties.
- Location did have a slight effect on wheat yield and crude protein (table 7).
  Top yielding wheat varieties did vary by site:
  - Prince Albert: No significant difference in yield (8,348-9058 kg/ha)
  - Swift Current: Innova (6,132 kg/ha)
  - Redvers: Innova (8,260 kg/ha), Sadash (8,143 kg/ha), Pasteur (8,103 kg/ha)
  - Clavet: Innova (6,433 kg/ha), Sadash (6,129 kg/ha)

<u>Triticale</u>

- Triticale crude protein over 12-site years averaged 9.5% (table 4).
- TDN (65%) was above the 55-60-65 rule of thumb suggesting a high energy feed.
- NDF (50%) and ADF (31%) values suggest a feed source high in quality and intake.
- There were no significant differences in lodging, or days to heading.
- Triticale varieties slightly varied in calcium.
- Triticale did not meet the required calcium to phosphorus ratio and may need to be supplemented.

[2] https://www.secan.com/system/files/CDC%20Haymaker%20Jan%202016%20TB.pdf

- Average triticale yield was 7,740 kg/ha.
- Pronghorn was the highest yielding triticale variety when averaged over all 12 site years (8,056 kg/ha), likely due to being a fairly drought tolerant forage variety.
- Location did have a slight effect on triticale yield and crude protein (table 8).
  Top yielding triticale varieties did vary by site:
  - Prince Albert: Pronghorn (10,567 kg/ha)
  - Swift Current: Pronghorn (5,798 kg/ha), Taza (5,686 kg/ha)
  - Redvers: Pronghorn (8,891 kg/ha), Taza (8,176 kg/ha), Bunker (8,692 kg/ha)
  - Clavet: Pronghorn (6,969 kg/ha), Taza (6,668 kg/ha)

<u>Mixtures</u>

- Mixtures ranged in crude protein from 9.3% to 10.8% depending on what species were included in each mix (table 4).
- This group has the largest range in data due to having a pulse in two of the treatments as an attempt to provide a protein boost compared to the cereal mixtures,
- Total digestible nutrients (TDN) were particularly high for the barley-oat treatments, but all treatments were above 63% with little variation.
- ADF (32%) suggests feed would result in in good forage intake and NDF (52%) suggest high energy feed sources.
- The Haymaker oat (check) did out-yield the mixtures, but was not significantly different.

<u>Cereal mixtures</u> – were low in calcium and may need to be supplemented.

- **Fall rye (KWS ProPower) mixed with oats (CDC Baler)** is of interest to livestock producers as a spring seeded winter annual that will continue growing after the first cut and can then be grazed and/or overwintered for further forage. Other findings on this mixture:
  - Lowest yielding mixture when averaged over 12 site years, although not significantly different.
  - At Prince Albert, this treatment consistently yielded well compared to other mixes (table 9, figure 2) and resulted in only a few hundred kg/ha less than the check variety each year. Although, the rye-oat yield (9636 kg/ha) was not significantly different than Aborg oat-Maverick barley mix (9,855 kg/ha), protein was slightly higher for the rye-oat mix (7.7%).
- A mix of **Arborg oats (CDC Arborg) and barley (CDC Maverick)** was included to increase the overall protein content of the mix as a result of Arborg oats having improved protein compared to other oat varieties. Both species are tall plants and Arborg has good lodging resistance, which could be beneficial for Maverick barley, which is prone to lodging.
  - Crude protein (9.3%) was not significantly different than the check variety, Haymaker (9.9%) and not significantly higher than the Maverick barley monoculture (9.6%).
  - No lodging effects were observed in in this treatment.
  - There were very little differences in ADF and NDF compared to the other treatments, but this mixture did result in TDN (67%) 4.0% higher than the Haymaker check (63%).

  - This barley-oat mixture yielded well (8,261 kg/ha), not significantly different than the Haymaker oat check (8,461 kg/ha) and similar to the Maverick barley monoculture (8,145 kg/ha).
  - Barley and oat plants in this treatment appeared well balanced
  - This was the highest yielding mix at Clavet (table 9, figure 4), although not significantly different than the Austenson-Haymaker mix.

- The second **barley (CDC Austenson) and oat (CDC Haymaker) mixture** was included due to the difference in maturities between the two varieties and was thought to result in improved protein in the barley. Austenson barley also has improved lodging resistance and is mixed with a much taller variety of oat.
  - The mixture did not result in any lodging (table 4).
  - Crude protein (9.6%) was not significantly different than the Haymaker check, but 0.3% higher than the Arborg-Maverick mixture.
  - This mixture yielded 8,239 kg/ha, slightly less than the Haymaker oat check and more than the Arborg-Maverick mixture. However, treatments were not significantly different.
  - Barley-oat mixtures were very well-suited to Clavet and yielded higher than the check variety each year (table 9, figure 5).
  - Haymaker-Austenson was the highest yielding mixture in Redvers (9,525 kg/ha), and was higher than barley monocultures, but was not significantly different than the Haymaker oat check (9,387 kg/ha, table 9, figure 4).

<u>Pulse mixtures</u> – had adequate levels of calcium and the calcium to phosphorus ratio was acceptable (table 4).

- A **mixture of oats (CDC Haymaker) and peas (CDC Horizon)** as a forage blend that includes a pulse is a common recommendation to improve protein.
  - This mix resulted in increased protein (10.8%) by 0.9% compared to the check variety.
  - Higher calcium than the pea-oat-brassica mix.
- A second blend of **Haymaker oats, Horizon peas and a brassica (Gorilla forage rape)** was included to potentially further increase protein, as well as energy (NDF) and improve overall forage quality.
  - The 3-species blend increased crude protein by 0.6% compared to the check. Crude protein was not significantly different than the pea-oat mixture.
  - The additional brassica species did not result in differences to suggest it provided an increase in energy compared to the pea-oat mixture.
  - This mixture yielded slightly less than the pea-oat mixture, but was not significantly different. Overall it appeared the brassica was unable to compete in this mix.
- Resulting calcium levels were high in the pulse mixtures compared to other treatments.
- Swift Current was the most well-suited area for pulse mixtures (table 9, figure 3). These treatments yielded similar to the check variety, unlike the other locations where the pulse mixtures were lower than the oat check by 1000-3000 kg/ha.
- Location did have a slight effect on yield and crude protein (table 9).
  Top yielding mixtures did vary by site:

- Prince Albert: Haymaker oat (10,497 kg/ha).
- Swift Current: Pea-oat mix (9,658 kg/ha), Pea-oat-brassica mix (8,922 kg/ha), Haymaker oat (8,106 kg/ha).
- Redvers: Haymaker oat-Austenson barley mix (9,525 kg/ha), Haymaker oat (9,387 kg/ha).
- Clavet: Arborg oat-Maverick barley mix (6,863 kg/ha), Haymaker oat-Austenson barley mix (6,665 kg/ha).

12. Conclusions and Recommendations

Over the 3 years of this demonstration, producers had an opportunity to see how these crops established in their own region, specifically the cereal-cereal and cereal-pulse mixtures. They were also introduced to potential options for these varieties to be established as either grain, or livestock feed in comparison to those varieties that have specifically been bred for forage production. Based on the results of this project a number of varieties included would require supplementation in order to meet basic nutritional requirements. The resulting calcium to phosphorus ratio was often not adequate. Additionally, high potassium along with low calcium and magnesium can all predispose animals to winter tetany (death). Since forage quality is dependent on field conditions and differs from year to year and across species, it is important to test feed annually (BCRC) and ensure the feed source being used is appropriate for your specific operation. All varieties resulted in total digestible nutrient values well above 55% and suggest the potential to be high energy feed sources. Acid detergent fiber did not exceed 40% and suggests good digestibility and high forage intake. Neutral detergent fiber remained below 55% for all treatments, therefore no variety from this test is expected to be of low quality, nor restrict animal intake.

Although yield results varied by site, barley, oats and triticale as well as most forage mixtures often remained consistent in providing sufficient yield compared to wheat. Some specific varieties such as Haymaker oat and Pronghorn triticale were generally higher yielding than other varieties and have shown to perform well in terms of yield across various locations. Of the mixtures, the rye-oat mix tended to be lowest yielding compared to others, but offers other benefits, such as continuing to grow and be an available feed source after the first cut for further grazing. This mix was best suited to the Prince Albert region. Barley-oat mixtures performed well across most sites compared to other mixtures, particularly at Clavet, Redvers and Prince Albert followed by pulse-cereal mixtures, which were best suited for Swift Current. Some variation is seen between soil types and environments and it is important to choose the mix most suited to your region. There may also be advantages in considering the commodity price of each species, in the case that the crop is not needed for forage, but rather harvested and sold as grain. Many of these annual varieties have potential to be suitable feed sources and can provide high forage intake. Although environmental conditions were less than ideal most site years we were still able to obtain valuable information about each variety and location.

Supporting Information

13. Acknowledgements:

- This project was supported by the Strategic Field Program (SFP) initiative under the Canadian Agricultural Partnership bi-lateral agreement between the federal government and the Saskatchewan Ministry of Agriculture.

14. Extension Activities and Dissemination of Results

- This trial was featured each year on a weekly radio program called, “Walk the Plots” that airs weekly throughout the summer.
- Preliminary results were discussed by Amber Wall at the Ministry of Agriculture planning meeting September 22, 2020 in Humbodlt, SK (30+)
- Virtual Agronomy Research Update, Terry Kowalchuk (250+), December 2020
- Amber and Terry discussed results online at the Forage Advisory meeting on November 10, 2021
- Online Agri-ARM Research Update, Amber Wall (ARU 150+ participants), January 10, 2022
- Federated Coop (FCL) Forage Week, Amber Wall (85+ participants), February 16, 2022.
- Other small tours for of a total of approximately 30 producers and agronomists visiting the site throughout the season at Swift Current.
- Federated Coop (FCL) Forage Week, Amber Wall (100+ participants), February 14, 2024.
- Online Agri-ARM Research Update, Amber Wall (ARU 150+ participants), March 1, 2023

<u>Abstract</u>

15. Abstract/Summary:

- In the spring of 2020, 2021 and 2022, a trial was established in Swift Current, Clavet, Prince Albert and Redvers titled “An Assessment of Annual Forage Varieties in Saskatchewan.” This project consists of a 3-replicate demonstration with 24 different treatments all of which were seeded and harvested. The objective of this project is to evaluate and compare commonly grown and commonly available varieties of barley, oats, wheat, triticale and some mixtures for forage yield and quality along with newer crop varieties for their potential as annual forages. Since forage quality is dependent on field conditions, which differ from year to year according to species, stage of maturity at time of harvesting, weathering, storage conditions, plant disease and many other factors, it is important to test feed annually (BCRC). This project includes 12 site-years of data on the performance of common annual cereal varieties in order to help producers make more informed decisions. Based on the results of this project a number of varieties included would require supplementation in order to meet nutritional requirements. The resulting calcium to phosphorus levels were often low. Although yield results varied by site, barley, oats and triticale as well as most forage mixtures often remained consistent in providing sufficient yield compared to wheat. Some specific varieties such as Haymaker oat and Pronghorn triticale were generally higher yielding than other varieties and have shown to perform well in terms of yield across various locations. This trial was brought to the attention of multiple group tours and virtual webinars over the years. It was also promoted on a CKSW radio program titled, "Walk the Plots" which is broadcasted on a weekly basis throughout the summer.

17. Appendices

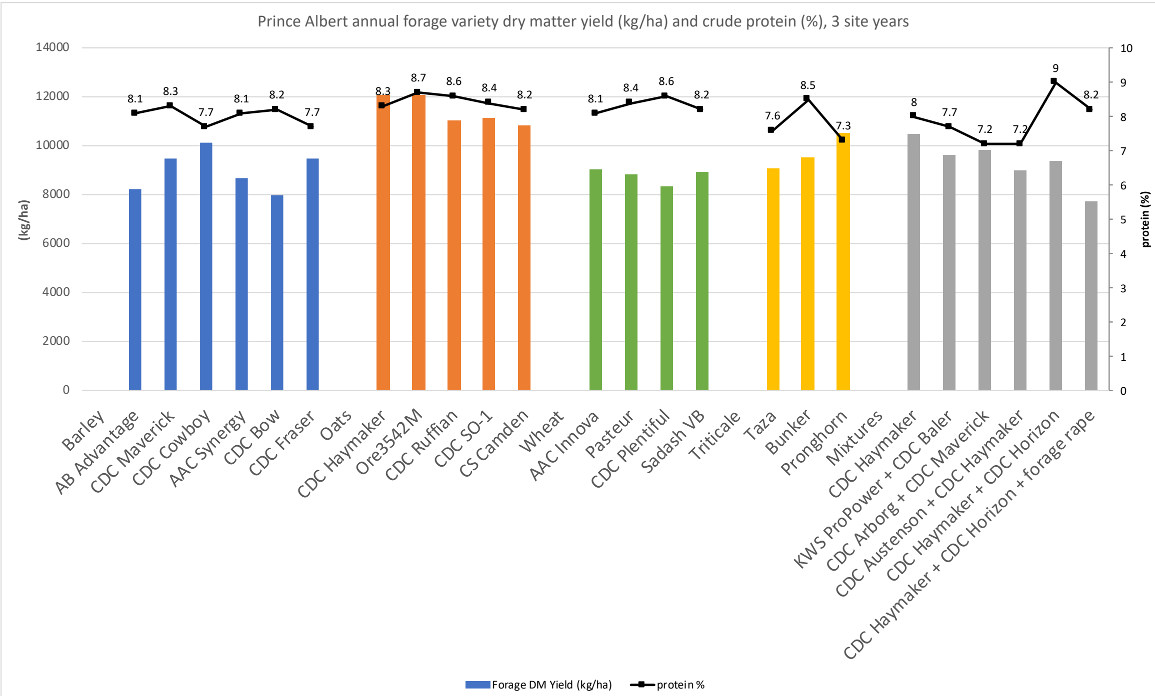

Figure 2. Forage mixture dry matter yields (kg/ha) and crude protein results from nutrient analysis at Prince Albert (3 site years).

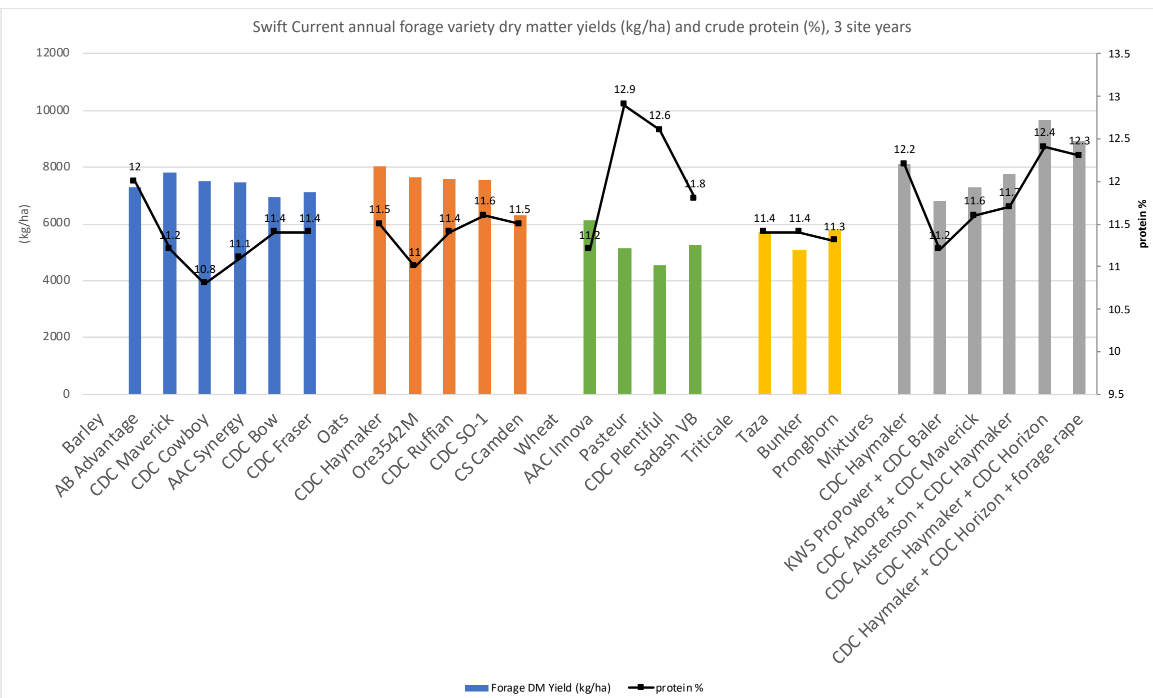

Figure 3. Forage mixture dry matter yields (kg/ha) and crude protein results from nutrient analysis at Swift Current (3 site years).

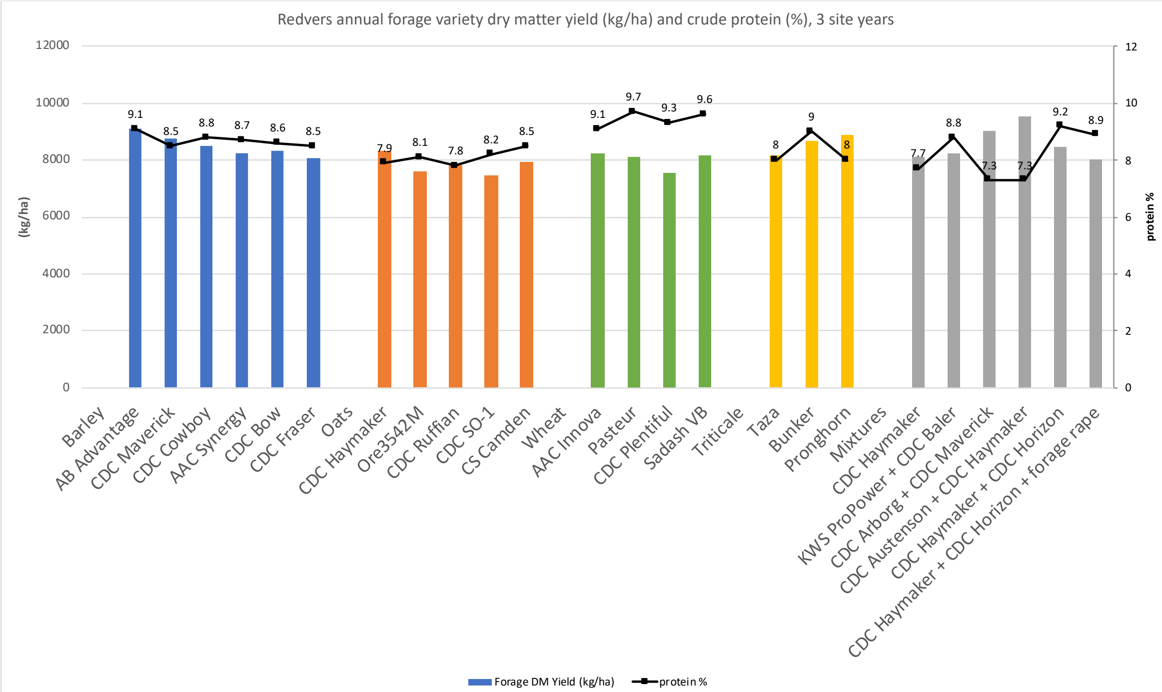

Figure 4. Forage mixture dry matter yields (kg/ha) and crude protein results from nutrient analysis at Redvers (3 site years).

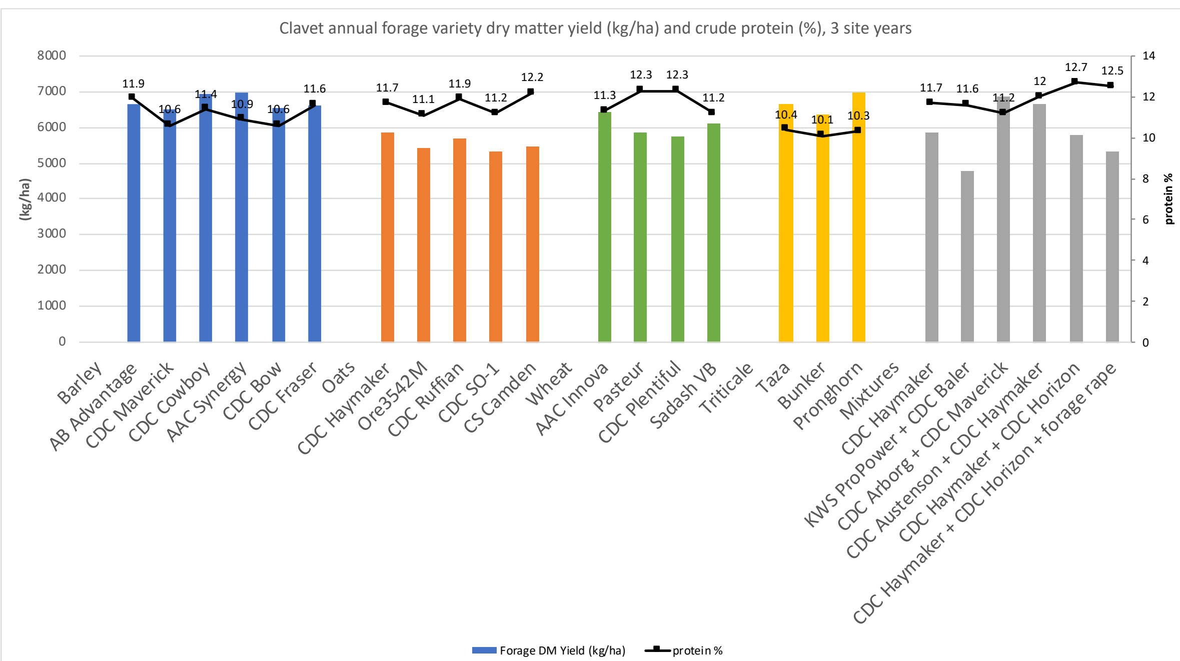

Figure 5. Forage mixture dry matter yields (kg/ha) and crude protein results from nutrient analysis at Clavet (3 site years).

Table 4. 12-site year means and overall averages per species (2020-2022, Swift Current, Redvers, Prince Albert, Clavet).

Site Years	Variety	Days to Heading	Lodging Score (1-9)	Forage DM Yield (kg/ha)	Feed Analysis											
					CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	ADI-CP (%)	ADIN (%)	K (%)	RFV	Na (%)	Mg (%)
12	Advantage (check)	61 a	1 a	7834 a	10.3 a	29 a	48 a	68 a	0.25 b	0.20 a	4.0 a	0.58 a	1.5 a	134 a	0.20 a	0.19 a
12	Maverick	61 a	1 a	8145 a	9.6 a	29 a	48 a	68 a	0.23 b	0.20 a	4.0 a	0.58 a	1.3 b	133 a	0.18 a	0.19 a
12	Cowboy	61 a	1 a	8276 a	9.7 a	30 a	49 a	67 a	0.23 b	0.20 a	3.9 a	0.58 a	1.5 a	130 a	0.19 a	0.19 a
12	Synergy	61 a	1 a	7561 a	9.7 a	29 a	47 a	68 a	0.28 a	0.18 a	4.0 a	0.55 a	1.3 b	137 a	0.15 a	0.18 a
12	Bow	62 a	1 a	7748 a	9.7 a	29 a	48 a	67 a	0.29 a	0.19 a	4.1 a	0.58 a	1.3 b	134 a	0.15 a	0.18 a
12	Fraser	62 a	1 a	7582 a	9.8 a	29 a	49 a	67 a	0.24 b	0.19 a	3.8 a	0.56 a	1.4 ab	130 a	0.16 a	0.17 a
	Average	**61**	**1**	**7858**	**9.8**	**29**	**48**	**68**	**0.25**	**0.19**	**3.9**	**0.57**	**1.4**	**133**	**0.17**	**0.18**
	CV%	1.0	4.3	3.4	2.3	1.3	1.2	0.6	9.4	3.6	1.9	1.8	6.5	1.7	9.7	3.6
	LSD	2	0	1670	0.89	2	3	2	0.03	0.02	0.70	0.09	0.12	9	0.04	0.02
12	Haymaker (check)	59 a	1 a	8579 a	9.8 ab	34 a	56 a	62 c	0.22 a	0.19 b	3.1 a	0.52 a	2.0 a	105 b	0.26 b	0.17 c
12	Ore3542M	57 c	1 a	8190 ab	9.7 b	31 bc	50 b	66 a	0.19 b	0.21 a	3.3 a	0.53 a	1.8 b	122 a	0.31 a	0.19 b
12	Ruffian	58 b	1 a	8036 abc	9.9 ab	32 b	51 b	64 b	0.20 b	0.20 ab	3.2 a	0.53 a	1.9 ab	120 a	0.26 b	0.17 c
12	SO-1	57 c	1 a	7871 bc	9.8 ab	30 c	51 b	66 a	0.23 a	0.19 b	3.1 a	0.52 a	1.9 ab	120 a	0.26 b	0.21 a
12	Camden	57 c	1 a	7640 c	10.1 a	32 b	51 b	65 ab	0.22 a	0.20 ab	3.2 a	0.52 a	1.9 ab	120 a	0.24 b	0.18 bc
	Average	**58**	**1**	**8063**	**9.9**	**32**	**52**	**65**	**0.21**	**0.20**	**3.2**	**0.52**	**1.9**	**118**	**0.27**	**0.18**
	CV%	2.0	18.9	14.9	8.6	7.0	5.1	3.7	13.3	12.1	21.2	19.1	14.3	7.6	40.0	18.0
	LSD	1	0	545	0.3	1	1	1	0.01	0.01	0.3	0.04	0.11	4	0.04	0.01
12	AAC Innova (check)	58 a	1 a	7479 a	9.9 b	31 a	51 a	66 a	0.14 a	0.18 a	2.7 a	0.44 a	1.4 ab	120 a	0.03 a	0.13 b
12	Pasteur	59 a	1 a	6997 ab	10.8 a	30 a	50 a	66 a	0.16 a	0.19 a	2.8 a	0.46 a	1.3 b	124 a	0.03 a	0.15 a
12	CDC Plentiful	57 a	1 a	6537 b	10.7 a	31 a	49 a	66 a	0.15 a	0.20 a	2.9 a	0.47 a	1.5 ab	127 a	0.02 a	0.12 b
12	Sadash VB	58 a	1 a	7124 ab	10.2 ab	30 a	50 a	66 a	0.14 a	0.18 a	2.8 a	0.45 a	1.5 ab	125 a	0.03 a	0.13 b
	Average	**58**	**1**	**7034**	**10.4**	**30**	**50**	**66**	**0.14**	**0.19**	**2.8**	**0.45**	**1.4**	**124**	**0.03**	**0.13**
	CV%	5.0	0.0	13.1	7.8	8.0	6.9	3.9	13.8	10.2	19.8	14.8	11.1	10.2	3.6	10.3
	LSD	2	0	664	0.6	2	3	2	0.01	0.02	0.4	0.05	0.1	9	0.01	0
12	Taza (check)	56 a	1 a	7407 b	9.5 a	32 a	51 a	65 a	0.15 b	0.20 a	2.9 a	0.46 a	1.4 a	119 b	0.02 a	0.12 a
12	Bunker	56 a	1 a	7425 b	9.7 a	32 a	51 a	65 a	0.22 a	0.23 a	2.9 a	0.46 a	1.5 a	118 b	0.02 a	0.17 a
12	Pronghorn	56 a	1 a	8056 a	9.3 a	30 b	49 a	66 a	0.22 a	0.22 a	2.8 a	0.45 a	1.7 a	126 a	0.04 a	0.18 a
	Average	**56**	**1**	**7740**	**9.5**	**31**	**50**	**65**	**0.22**	**0.23**	**2.9**	**0.45**	**1.6**	**122**	**0.03**	**0.17**
	CV%	1.1	21.6	14.8	10.7	8.5	7.5	4.3	130.8	78.8	16.5	15.7	88.1	10.7	177.5	120.9
	LSD	0	0	432	0.4	1	2	1	0.10	0.07	0.19	0.03	0.5	5	0.02	0.07
12	Haymaker (check)	58 b	1 b	8461 a	9.9 abc	33 a	55 a	63 c	0.23 c	0.20 a	3.2 a	0.49 a	2.0 ab	109 b	0.22 a	0.16 ab
12	Rye-Oat	60 a	1 b	7375 a	9.8 bc	32 ab	53 a	64 bc	0.25 c	0.20 a	3.1 a	0.50 a	2.1 a	113 b	0.16 ab	0.17 ab
12	Arborg-Maverick	58 b	1 b	8261 a	9.3 c	30 b	49 c	67 a	0.23 c	0.19 a	3.7 a	0.55 a	1.7 c	129 a	0.15 ab	0.17 ab
12	Haymaker-Austenson	59 ab	1 b	8239 a	9.6 b	31 ab	51 bc	66 ab	0.21 c	0.20 a	3.2 a	0.49 a	1.8 bc	122 a	0.13 b	0.15 b
12	Pea-Oat	59 ab	2 a	8322 a	10.8 a	33 a	52 b	63 c	0.39 a	0.21 a	3.6 a	0.55 a	2.1 a	114 b	0.16 ab	0.18 a
12	Pea-Oat-Brassica	59 ab	2 a	7505 a	10.5 ab	33 a	53 ab	63 c	0.33 b	0.21 a	3.4 a	0.52 a	2.0 ab	111 b	0.20 ab	0.17 ab
	Average	**59**	**1**	**8027**	**10.0**	**32**	**52**	**64**	**0.27**	**0.20**	**3.4**	**0.52**	**2.0**	**116**	**0.17**	**0.17**
	CV%	1.1	19.2	5.3	4.0	4.7	3.8	2.5	23.5	2.7	6.6	4.9	7.9	6.0	16.8	5.4
	LSD	1	0	1727	1	2	2	2	0.04	0.02	0.6	0.08	0.2	7	0.07	0.02

Table 5. 3-site year barley means and overall averages per variety at each individual site (2020-2022, Swift Current, Redvers, Prince Albert, Clavet).

Site Years	Variety	Days to Heading		Lodging Score (1-9)		Forage DM Yield (kg/ha)		Feed Analysis																							
								CP (%)		ADF (%)		NDF (%)		TDN (%)		Ca (%)		P (%)		ADI-CP (%)		ADIN (%)		K (%)		RFV		Na (%)		Mg (%)	
Prince Albert																															
3	Advantage (check)	58	e	1	b	8262	cd	8.1	a	26	b	44	cd	70	ab	0.21	bc	0.21	ab	4.9	a	0.70	a	1.4	a	145	bc	0.11	a	0.16	bc
3	Maverick	59	d	2	a	9500	b	8.3	a	28	a	45	bc	69	bc	0.20	cd	0.22	a	5.1	a	0.71	a	1.2	a	142	c	0.10	ab	0.15	cd
3	Cowboy	58	e	1	b	10166	a	7.7	b	28	a	47	a	68	c	0.20	cd	0.21	ab	4.6	b	0.69	a	1.3	a	133	d	0.11	a	0.18	a
3	Synergy	60	c	1	b	7984	d	8.1	a	26	b	43	d	71	a	0.22	ab	0.20	bc	4.1	c	0.60	b	1.2	a	149	ab	0.09	b	0.14	d
3	Bow	62	a	1	b	8716	c	8.2	a	26	b	43	d	71	a	0.23	a	0.20	bc	4.9	a	0.71	a	1.1	a	150	a	0.11	a	0.17	ab
3	Fraser	61	b	1	b	8522	cd	7.7	b	28	a	46	ab	69	bc	0.19	d	0.19	c	3.6	d	0.56	b	1.3	a	138	c	0.10	ab	0.15	cd
	CV %	2.0		41.0		20.0		10.0		8.0		6.0		3.0		14.0		12.0		27.0		24.0		13.0		8.0		36.0		27.0	
	LSD	0		0		561		0.3		1		1		1		0.01		0.01		0.4		0.05		0.1		4		0.01		0.01	
Swift Current																															
3	Advantage	65	b	1	a	7311	bc	12.0	a	29	ab	48	b	68	bc	0.33	b	0.24	ab	4.0	abc	0.61	ab	1.6	a	132	a	0.04	a	0.19	a
3	Maverick	65	b	1	a	7790	a	11.2	bc	27	c	47	b	70	a	0.29	c	0.25	a	3.7	c	0.59	b	1.4	bc	135	a	0.04	a	0.19	a
3	Cowboy	64	c	1	a	7495	b	10.8	d	29	ab	48	b	68	bc	0.27	d	0.25	a	3.8	bc	0.63	a	1.5	ab	132	a	0.04	a	0.19	a
3	Synergy	66	a	1	a	6870	d	11.1	c	28	bc	47	b	69	ab	0.35	a	0.22	c	4.3	a	0.60	ab	1.3	c	134	a	0.03	b	0.17	b
3	Bow	66	a	1	a	7476	b	11.4	b	30	a	51	a	67	c	0.35	a	0.23	bc	4.1	ab	0.60	ab	1.4	bc	123	b	0.04	a	0.17	b
3	Fraser	65	b	1	a	7105	cd	11.4	b	29	ab	50	a	67	c	0.30	c	0.23	bc	3.9	bc	0.60	ab	1.5	ab	123	b	0.04	a	0.17	b
	CV %	1.0		29.0		10.0		6.0		7.0		5.0		3.0		12.0		8.0		21.0		16.0		14.0		6.0		34.0		6.0	
	LSD	0		0		244		0.2		1		1		1		0.01		0.01		0.3		0.03		0.1		3		0.00		0.00	
Redvers																															
3	Advantage	62	c	2	a	9094	a	9.1	a	33	b	52	bc	64	a	0.23	bc	0.16	a	3.8	a	0.51	a	1.2	a	98	ab	0.28	ab	0.17	b
3	Maverick	63	b	1	b	8777	b	8.5	c	34	ab	53	b	62	bc	0.22	c	0.16	a	3.3	c	0.43	d	1.1	a	91	ab	0.27	bc	0.18	ab
3	Cowboy	63	b	1	b	8508	b	8.8	b	34	ab	53	b	63	ab	0.25	b	0.16	a	3.6	ab	0.48	bc	1.1	a	95	ab	0.32	a	0.18	ab
3	Synergy	63	b	1	b	8318	cd	8.7	bc	35	a	55	a	61	c	0.29	a	0.15	a	3.4	bc	0.47	c	1.1	a	89	b	0.26	bc	0.19	a
3	Bow	64	a	1	b	8246	cd	8.6	b	33	b	51	c	63	ab	0.29	a	0.16	a	3.6	ab	0.50	ab	1.1	a	100	a	0.21	d	0.17	b
3	Fraser	63	b	1	b	8072	d	8.5	c	34	ab	53	b	62	bc	0.25	b	0.15	a	3.7	a	0.48	bc	1.1	a	93	ab	0.23	c	0.17	b
	CV %	2.0		39.0		11.0		9.0		10.0		9.0		6.0		20.0		14.0		16.0		16.0		10.0		31.0		45.0		12.0	
	LSD	0		0		309		0.2		1		1		1		0.02		0.01		0.2		0.02		0.03		9		0.04		0.01	
Clavet																															
3	Advantage	57	c	1	a	6668	bc	11.9	a	28	a	47	a	69	c	0.23	c	0.18	a	3.2	d	0.49	c	1.9	a	133	c	0.37	a	0.22	a
3	Maverick	59	a	1	a	6512	c	10.6	d	27	ab	46	a	70	bc	0.22	cd	0.17	ab	3.8	bc	0.57	ab	1.7	b	138	b	0.31	b	0.22	a
3	Cowboy	57	c	1	a	6936	a	11.4	b	28	a	47	a	69	c	0.21	d	0.17	ab	3.5	cd	0.53	bc	1.9	a	133	c	0.29	bc	0.21	ab
3	Synergy	57	c	1	a	6869	ab	10.9	c	25	c	43	b	72	a	0.26	b	0.17	ab	4.1	ab	0.57	ab	1.5	c	150	a	0.22	d	0.20	b
3	Bow	59	a	1	a	6583	c	10.6	d	28	a	47	a	69	c	0.30	a	0.16	b	3.7	c	0.52	c	1.7	b	134	c	0.24	d	0.21	ab
3	Fraser	58	b	1	a	6630	c	11.6	b	26	bc	46	a	71	ab	0.21	d	0.17	ab	4.2	a	0.60	a	1.7	b	141	b	0.27	c	0.20	b
	CV %	2.0		0.0		11.0		6.0		7.0		5.0		3.0		10.0		10.0		24.0		23.0		8.0		7.0		18.0		10.0	
	LSD	0		0		236		0.2		1		1		1		0.01		0.01		0.3		0.04		0.0		3		0.02		0.01	

Table 6. 3-site year oat means and overall averages per variety at each individual site (2020-2022, Swift Current, Redvers, Prince Albert, Clavet).

Site Years	Variety	Days to Heading		Lodging Score (1-9)		Forage DM Yield (kg/ha)		Feed Analysis																									
								CP (%)		ADF (%)		NDF (%)		TDN (%)		Ca (%)		P (%)		ADI-CP (%)		ADIN (%)		K (%)		RFV		Na (%)		Mg (%)	
Prince Albert																																	
3	Haymaker (check)	60	a	1	a	12081	a	8.3	ab	32	a	53	a	64	c	0.20	a	0.19	b	3.0	ab	0.46	b	1.9	a	114	c	0.17	b	0.18	b
3	Ore3542M	57	b	1	a	12104	a	8.7	a	28	c	46	c	69	a	0.17	c	0.21	a	3.2	ab	0.48	b	1.6	b	138	a	0.21	a	0.26	a
3	Ruffian	58	b	1	a	11043	b	8.6	ab	28	c	44	d	68	ab	0.18	b	0.21	a	3.2	ab	0.48	b	1.6	b	141	a	0.15	b	0.18	b
3	SO-1	57	b	1	a	11124	b	8.4	ab	30	b	49	b	67	b	0.20	a	0.19	b	3.4	a	0.54	a	1.9	a	127	b	0.17	b	0.25	a
3	Camden	57	b	1	a	10837	b	8.2	b	30	b	48	b	67	b	0.20	a	0.20	ab	2.9	b	0.47	b	1.8	a	131	b	0.14	c	0.15	c
	CV%	2.4		20.5		13.8		12.4		9.3		6.1		4.4		9.1		14.1		22.0		22.5		17.7		9.0		26.6		27.8	
	LSD	1		0		565		0.4		1.0		1		1		0.01		0.01		0.3		0.04		0.1		4		0.02		0.02	
Swift Current																																	
3	Haymaker (check)	61	a	1	a	8030	a	11.5	a	34	a	56	a	63	d	0.27	b	0.27	b	3.3	c	0.57	a	2.2	a	104	c	0.08	bc	0.17	b
3	Ore3542M	58	b	1	a	7623	a	11.0	b	30	bc	50	b	67	ab	0.23	d	0.29	a	3.9	a	0.62	a	2.0	b	125	a	0.11	a	0.18	b
3	Ruffian	58	b	1	a	7605	a	11.4	a	31	b	50	b	65	c	0.25	c	0.28	a	3.5	bc	0.59	a	2.0	b	122	b	0.06	d	0.17	b
3	SO-1	57	b	1	a	7572	a	11.6	a	29	c	50	b	68	a	0.29	a	0.27	b	3.2	c	0.51	b	2.0	b	124	a	0.08	b	0.20	a
3	Camden	58	b	1	a	6288	b	11.5	a	30	bc	49	b	66	bc	0.26	bc	0.28	ab	3.7	a	0.62	a	2.1	ab	125	a	0.07	cd	0.17	b
	CV%	3.1		25.1		21.8		8.1		6.1		4.1		3.1		15.7		10.3		24.1		21.9		11.5		5.5		49.7		12.3	
	LSD	1		1		581		0.3		1		1		1		0.01		0.01		0.3		0.05		0.1		2		0.01		0.01	
Redvers																																	
3	Haymaker (check)	58	c	2	b	8343	a	7.9	bc	39	a	61	a	57	c	0.20		0.15	ab	2.3	a	0.49	a	1.7	b	89	c	0.39	b	0.15	b
3	Ore3542M	58	c	1	a	7605	c	8.1	bc	36	b	56	b	61	a	0.17		0.16	a	2.4	a	0.47	a	1.7	b	102	a	0.51	a	0.14	b
3	Ruffian	62	a	1	a	7799	bc	7.8	c	40	a	60	a	56	c	0.19		0.13	c	2.3	a	0.46	b	1.9	a	89	c	0.44	ab	0.14	b
3	SO-1	61	b	1	a	7472	c	8.2	ab	36	b	57	b	60	ab	0.20		0.15	b	2.4	a	0.47	ab	1.8	ab	100	a	0.43	ab	0.17	a
3	Camden	61	b	2	b	7958	b	8.5	a	37	b	57	b	59	b	0.21		0.14	bc	2.2	a	0.45	b	1.8	ab	96	b	0.39	b	0.17	a
	CV%	1.6		16.5		8.4		9.6		7		5		5		11.1		14.70		21.0		14.30		14.9		9		34.30		12.70	
	LSD	0		0		237		0.3		1		1		1		0.01		0.01		0.0		0.02		0.1		3		0.05		0.01	
Clavet																																	
3	Haymaker (check)	57	a	1	a	5863	a	11.7	a	31	a	53	a	65	c	0.21	b	0.17	b	3.7	ab	0.56	b	2.2	a	114	c	0.42	a	0.20	b
3	Ore3542M	53	c	1	a	5428	c	11.1	b	30	ab	50	b	67	b	0.18	c	0.19	a	3.5	b	0.53	c	2.0	b	123	b	0.42	a	0.18	c
3	Ruffian	54	b	1	a	5697	b	11.9	a	29	b	48	c	68	ab	0.19	c	0.19	a	3.9	a	0.59	a	2.1	ab	130	a	0.37	b	0.18	c
3	SO-1	54	b	1		5316	c	11.2	b	28	c	49	bc	69	a	0.23	a	0.18	ab	3.5	b	0.54	bc	2.1	ab	128	a	0.34	b	0.22	a
3	Camden	53	c	1	a	5477	c	12.2	b	29	bc	48	c	68	ab	0.22	ab	0.19	a	3.8	a	0.53	c	2.0	b	130	a	0.34	b	0.21	ab
	CV%	2		1		7		5.2		5		5		2		11.00		8.70		16.9		12.50		8.2		6		28.80		8.70	
	LSD	0		0		147		0.2		1		1		1		0.01		0.01		0.2		0.02		0.1		3		0.04		0.01	

Table 7. 3-site year wheat means and overall averages per variety at each individual site (2020-2022, Swift Current, Redvers, Prince Albert, Clavet).

Site Years	Variety	Days to Heading		Lodging Score (1-9)		Forage DM Yield (kg/ha)		Feed Analysis																									
								CP (%)		ADF (%)		NDF (%)		TDN (%)		Ca (%)		P (%)		ADI-CP (%)		ADIN (%)		K (%)		RFV		Na (%)		Mg (%)	
Prince Albert																																	
3	AAC Innova (check)	57	b	1	a	9058	a	8.1	a	28	a	46	a	68	a	0.11	a	0.18	a	$2.6	a	15.24	a	1.3	a	136	a	0.05	a	0.09	a
3	Pasteur	58	a	1	a	8859	a	8.4	a	28	a	46	a	69	a	0.12	a	0.18	a	$3.0	a	17.31	a	1.1	b	138	a	0.06	a	0.09	a
3	CDC Plentiful	57	b	1	a	8348	a	8.6	a	30	a	48	a	66	a	0.12	a	0.19	a	$2.9	a	14.91	a	1.3	a	129	a	0.05	a	0.08	a
3	Sadash VB	57	b	1	a	8965	a	8.2	a	28	a	46	a	69	a	0.11	a	0.17	a	$2.7	a	16.48	a	1.4	a	138	a	0.05	a	0.08	a
	CV%	0.8		0.0		16.6		14.1		13.6		11		6.1		20.5		13.8		18.9		38		14.9		15.2		19		13	
	LSD	0		0		1028		0.8		2.7		3.6		2.9		0.02		0.02		0.4		4.6		0.13		14.4		0.001		0	
Swift Current																																	
3	AAC Innova (check)	59	ab	1	a	6132	a	11.2	c	30	a	52	a	66	b	0.16	b	0.23	b	3.0	ab	0.46	a	1.4	a	118	b	0.01	a	0.13	b
3	Pasteur	60	a	1	a	5148	b	12.9	a	29	a	51	a	67	b	0.20	a	0.23	b	2.9	b	0.48	a	1.4	a	121	b	0.01	a	0.15	a
3	CDC Plentiful	58	b	1	a	4515	b	12.6	a	27	b	45	b	69	a	0.16	b	0.26	a	3.3	a	0.49	a	1.4	a	141	a	0.01	a	0.13	b
3	Sadash VB	59	ab	1	a	5259	b	11.8	b	30	a	52	a	66	b	0.15	b	0.22	b	2.9	b	0.47	a	1.5	a	119	b	0.01	a	0.13	b
	CV%	2.0		22.0		12.1		3.6		5.9		4.4		2.7		11.3		7.0		12.5		12.6		10.0		6.3		78.0		6.8	
	LSD	1		0		439		0.3		1		2		1		0.01		0.01		0.3		0.04		0.1		6		0.00		0.00	
Redvers																																	
3	AAC Innova (check)	63	b	1	a	8260	a	9.1	b	37	b	57	ab	59	b	0.15	b	0.15	ab	2.8	a	0.48	ab	1.4	a	99	ab	0.02	a	0.14	ab
3	Pasteur	65	a	1	a	8103	a	9.7	a	37	b	59	a	59	b	0.18	a	0.15	ab	2.6	a	0.47	b	1.4	a	95	b	0.01	a	0.15	a
3	CDC Plentiful	59	c	1	a	7537	b	9.3	a	39	a	57	ab	57	c	0.17	a	0.14	b	2.9	a	0.52	a	1.5	a	95	b	0.02	a	0.13	b
3	Sadash VB	62	b	1	a	8143	a	9.6	ab	36	b	56	b	61	a	0.15	b	0.16	a	2.9	a	0.49	ab	1.5	a	105	a	0.02	a	0.14	ab
	CV%	1.3		0.0		7.3		7.1		4.9		4.6		3.3		10.3		9.8		24.5		11.7		6.1		8.5		48.0		10.0	
	LSD	1		0		411		0.5		1		2		1		0.01		0.01		0.5		0.04		0.1		6		0.01		0.01	
Clavet																																	
3	AAC Innova (check)	54	a	1	a	6433	a	11.3	b	28	a	48	a	69	ab	0.13	a	0.17	b	2.6	a	0.43	a	1.6	a	131	b	0.03	a	0.18	b
3	Pasteur	55	a	1	a	5878	b	12.3	a	26	a	46	ab	71	a	0.14	a	0.18	ab	2.8	a	0.43	a	1.4	b	140	a	0.02	ab	0.20	a
3	CDC Plentiful	54	a	1	a	5749	b	12.3	a	27	ab	45	b	70	ab	0.13	a	0.19	a	2.7	a	0.43	a	1.6	a	140	a	0.01	b	0.15	c
3	Sadash VB	55	a	1	a	6129	ab	11.2	b	27	ab	46	ab	70	ab	0.13	a	0.17	b	2.8	a	0.42	a	1.6	a	137	a	0.03	a	0.18	b
	CV%	1.4		0.0		10.5		5.6		4.1		4.9		1.7		11.6		7.8		15.6		14.2		11.3		5.6		41.4		10.3	
	LSD	1		0		445		0.05		1		2		1		0.01		0.01		0.3		0.04		0.1		5		0.01		0.01	

Table 8. 3-site year triticale means and overall averages per variety at each individual site (2020-2022, Swift Current, Redvers, Prince Albert, Clavet).

Site Years	Variety	Days to Heading		Lodging Score (1-9)		Forage DM Yield (kg/ha)		Feed Analysis																							
								CP (%)		ADF (%)		NDF (%)		TDN (%)		Ca (%)		P (%)		ADI-CP (%)		ADIN (%)		K (%)		RFV		Na (%)		Mg (%)	
Prince Albert																															
3	Taza (check)	57	a	1	a	9099	b	7.6	b	31	a	51	a	65	a	0.12	a	0.19	a	2.7	a	0.42	a	1.3	a	120	b	0.05	a	0.07	b
3	Bunker	57	a	1	a	9544	b	8.5	a	30	ab	49	ab	66	a	0.12	a	0.20	a	2.8	a	0.42	a	1.0	a	124	ab	0.05	a	0.09	a
3	Pronghorn	57	a	1	a	10567	a	7.3	b	29	b	48	b	67	a	0.13	a	0.19	a	2.7	a	0.41	a	1.2	a	130	a	0.05	a	0.09	a
	CV%	2.4		26.0		17.8		12.4		10.0		8.8		10.4		20.9		14.9		17.5		19.5		10.8		12.1		11.1		11.8	
	LSD	0		0		784		0.4		1		2		5		0.01		0.01		0.2		0.04		0.1		7		0		0.00	
Swift Current																															
3	Taza (check)	58	a	1	a	5686	a	11.4	a	29	ab	48	b	68	ab	0.17	b	0.26	a	3.2	a	0.52	a	1.4	a	131	a	0.01	a	0.11	b
3	Bunker	58	a	1	a	5115	b	11.4	a	30	a	50	a	67	b	0.18	ab	0.25	a	3.1	a	0.50	a	1.2	b	123	b	0.00	b	0.13	a
3	Pronghorn	58	a	1	a	5798	a	11.3	a	28	b	48	b	69	a	0.20	a	0.25	a	3.0	a	0.50	a	1.4	a	132	a	0.01	a	0.14	a
	CV%	3.3		26.0		13.2		6.3		5.1		3.5		2.3		20.1		8.3		15.3		13.8		5.5		4.8		77.6		20.9	
	LSD	1		0		332		0.3		1		1		1		0.02		0.01		0.2		0.03		0.0		3		0.00		0.01	
Redvers																															
3	Taza (check)	56	a	1	a	8176	a	8	a	37	a	56	a	60	a	0.17	b	0.15	a	2.8	a	0.45	a	1.3	b	104	a	0.02	b	0.13	b
3	Bunker	56	a	1	a	8692	a	9	a	36	a	54	b	60	a	0.40	a	0.31	a	3.0	a	0.46	a	2.2	ab	106	a	0.02	b	0.29	ab
3	Pronghorn	55	b	1	a	8891	a	8	a	37	a	56	a	60	a	0.38	a	0.29	a	2.8	a	0.44	a	2.5	a	106	a	0.04	a	0.30	a
	CV%	1.4		0.0		5.5		11.4		6.2		7.0		4.0		57.5		72.0		15.0		12.7		124.0		11.8		115.0		149.0	
	LSD	0		0		1097		0		1		0		1		0.20		0.16		0.2		0.03		1.1		6		0.01		0.16	
Clavet																															
3	Taza (check)	53	a	1	a	6668	ab	10.4	a	30	ab	51	a	67	ab	0.16	a	0.17	a	2.9	a	0.47	a	1.7	a	122	b	0.02	a	0.16	b
3	Bunker	53	a	1	a	6348	b	10.1	a	31	a	51	a	66	b	0.16	a	0.16	a	2.8	a	0.45	ab	1.4	b	120	b	0.01	a	0.18	a
3	Pronghorn	53	a	1	a	6969	a	10.3	a	28	b	46	b	69	a	0.15	a	0.17	a	2.9	a	0.43	b	1.5	b	138	a	0.02	a	0.19	a
	CV%	1.1		0		10.9		11.6		11.1		7.7		5.2		11.70		19.70		15		14.5		9.2		11		75.7		11.60	
	LSD	0		0		328		0.5		2		2		2		0.01		0.01		0.2		0.03		0.1		7		0.01		0.01	

Table 9. 3-site year forage mixture means and overall averages per variety at each individual site (2020-2022, Swift Current, Redvers, Prince Albert, Clavet).

Site Years	Variety	Days to Heading		Lodging Score (1-9)		Forage DM Yield (kg/ha)		Feed Analysis																							
								CP (%)		ADF (%)		NDF (%)		TDN (%)		Ca (%)		P (%)		ADI-CP (%)		ADIN (%)		K (%)		RFV		Na (%)		Mg (%)	
Prince Albert																															
3	Haymaker (check)	59	c	1	c	10497	a	8.0	b	31	b	51	a	65	b	0.20	de	0.19	a	3.0	c	0.47	cd	1.7	c	118	c	0.15	a	0.14	a
3	Rye-Oat	61	a	1	c	9636	bc	7.7	c	32	ab	51	a	65	b	0.23	c	0.17	b	3.1	c	0.48	cd	2.2	a	117	c	0.15	a	0.13	ab
3	Arborg-Maverick	59	c	1	c	9855	b	7.2	d	28	c	47	b	69	a	0.21	cd	0.19	a	3.6	ab	0.55	ab	1.5	d	136	a	0.14	ab	0.14	a
3	Haymaker-Austenson	61	a	1	c	9001	d	7.2	d	29	c	48	b	68	a	0.18	e	0.19	a	3.3	bc	0.51	bc	1.6	cd	130	b	0.12	b	0.12	b
3	Pea-Oat	60	b	2	b	9376	cd	9.0	a	33	a	52	a	63	c	0.42	a	0.19	a	4.0	a	0.59	a	1.9	b	115	c	0.13	ab	0.14	a
3	Pea-Oat-Brassica	60	b	3	a	7757	e	8.2	b	32	ab	51	a	65	b	0.33	b	0.20	a	3.1	c	0.45	d	1.7	c	118	c	0.12	b	0.13	ab
	CV%	2.0		53.0		15.0		14.0		6.0		5.0		3.0		25.0		11.0		36.0		31.0		14.0		7.0		51.0		14.0	
	LSD	0		0		456		0.4		1		1		1		0.02		0.01		0.4		0.05		0.1		3		0		0	
Swift Current																															
3	Haymaker (check)	59	c	1	b	8106	ab	12.2	a	33	a	56	a	63	c	0.28	cd	0.26	a	3.2	b	0.52	bc	2.2	a	106	c	0.09	b	0.18	b
3	Rye-Oat	60	b	1	b	6826	c	11.2	c	31	b	55	ab	65	b	0.26	de	0.25	a	2.6	c	0.50	c	2.0	b	111	b	0.04	d	0.17	c
3	Arborg-Maverick	60	b	1	b	7309	b	11.6	b	29	c	49	c	68	a	0.28	cd	0.25	a	3.6	a	0.56	a	1.6	c	129	a	0.05	d	0.18	b
3	Haymaker-Austenson	61	a	1	b	7763	b	11.7	b	32	ab	55	ab	65	b	0.25	e	0.25	a	3.1	b	0.51	bc	2.0	b	111	b	0.04	d	0.17	c
3	Pea-Oat	59	c	1	b	9658	a	12.4	a	32	ab	54	b	64	bc	0.39	a	0.26	a	3.0	b	0.53	b	2.2	a	112	b	0.07	c	0.19	a
3	Pea-Oat-Brassica	59	c	2	a	8922	a	12.3	a	33	a	55	ab	64	bc	0.32	b	0.26	a	3.1	b	0.53	b	2.1	ab	110	b	0.11	a	0.18	b
	CV%	2.0		26.0		18.0		8.0		4.0		4.0		2.0		21.0		7.0		20.0		12.0		14.0		6.0		64.0		8.0	
	LSD	0		0		478		0.3		1		1		1		0.02		0.01		0.2		0.02		0.1		2		0.01		0.00	
Redvers																															
3	Haymaker (check)	58	b	1	b	9387	a	7.7	b	37	a	57	a	59	b	0.22	d	0.17	bc	3.1	c	0.46	d	1.9	b	87	bc	0.21	a	0.14	cd
3	Rye-Oat	61	a	1	b	8232	cd	8.8	a	37	a	57	a	59	b	0.28	c	0.18	ab	3.2	bc	0.50	b	2.1	a	88	bc	0.12	c	0.17	a
3	Arborg-Maverick	58	b	1	b	9018	b	7.3	b	34	b	53	b	62	a	0.22	d	0.16	c	3.4	ab	0.49	bc	1.7	c	89	ba	0.11	c	0.15	bc
3	Haymaker-Austenson	58	b	1	b	9525	a	7.3	b	34	b	53	b	63	a	0.20	d	0.17	bc	3.2	bc	0.47	cd	1.6	c	99	a	0.13	c	0.13	d
3	Pea-Oat	61	a	2	a	8453	c	9.2	a	37	a	54	b	59	b	0.38	a	0.19	a	3.4	a	0.49	bc	1.9	b	96	ab	0.17	b	0.16	ab
3	Pea-Oat-Brassica	61	a	2	a	8018	d	8.9	a	38	a	57	a	58	b	0.34	b	0.18	ab	3.5	a	0.53	a	1.9	b	85	c	0.21	a	0.17	a
	CV%	3.0		22.0		8.0		14.0		6.0		6.0		4.0		18.0		23.0		15.0		15.0		12.0		34.0		38.0		13.0	
	LSD	1		0		224		0.4		1		1		1		0.02		0.01		0.2		0.02		0.1		10		0.02		0.01	
Clavet																															
3	Haymaker (check)	57	c	1	a	5853	b	11.7	b	32	a	53	a	64	d	0.22	c	0.17	b	3.3	c	0.51	bc	2.3	ab	112	e	0.41	a	0.19	cd
3	Rye-Oat	59	a	1	a	4804	d	11.6	a	30	b	50	b	67	b	0.23	c	0.18	a	3.5	c	0.53	b	2.2	bc	122	c	0.33	b	0.20	bc
3	Arborg-Maverick	56	d	1	a	6863	a	11.2	c	27	c	46	c	69	a	0.21	cd	0.17	b	4.3	a	0.60	a	1.9	d	137	a	0.30	bc	0.20	bc
3	Haymaker-Austenson	58	b	1	a	6665	a	12.0	b	28	c	47	c	69	a	0.19	d	0.17	b	3.3	c	0.48	c	2.1	c	132	b	0.25	c	0.18	d
3	Pea-Oat	56	d	1	a	5799	b	12.7	a	31	ab	51	b	65	c	0.35	a	0.17	b	3.9	b	0.60	a	2.4	a	118	d	0.26	c	0.22	a
3	Pea-Oat-Brassica	56	d	1	a	5325	c	12.5	a	31	ab	51	b	65	c	0.32	b	0.18	a	4.0	b	0.57	a	2.2	bc	118	d	0.34	b	0.21	ab
	CV%	2		0		10		7.0		6		4		3		24.00		9.00		19.0		14.00		13.0		6		53.00		11.00	
	LSD	0		0		199		0.3		1		1		0		0.02		0.00		0.2		0.03		0.1		2		0.05		0.01	

Image 1-3. Whole plot forage harvest at Wheatland Conservation Area, Swift Current.

Image 4-5. Harvesting a known measured area from the forage plot for yield at South East Research Farm, Redvers.