2021 ANNUAL REPORT

West-Central Forage Association

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West-Central Forage Association (WCFA) is a non-profit, producer directed organization providing leading-edge applied, innovative and unbiased research as well as knowledge transfer and learning opportunities to the west-central region. Operating since 1978, we bring together a network of producers, industry and researchers to move the Agricultural industry forward.

We are pleased to make available this edition of our Annual Report.
It contains a description and summary of project results and extension activities carried out by WCFA in 2021.

Table of Contents

List of Tables

List of Figures

President's Message

Well, it's nice to get 2021 behind us although it won't be over until the grass greens up and judging by the amount of snow we have it will at least give us a start. As with any agricultural endeavour, the weather plays a major role. Between a lack of moisture and temperatures unheard of in this country, most crops really struggled. About 50% of normal yields are a number that I've heard quite often for forages and field crops. Of course, COVID restricted our extension activities but we all know what Zoom is now (what a great example of finding opportunity in a bad situation) and has become a pretty handy tool. Grain and feed prices were and continue to be at record highs; for some of us on the buying end we are going to have to make some major changes to adapt. For those of you on the production end, enjoy the seller's market- it doesn't come along all that often. Complacency is something to keep in mind at this point.

We had a busy year with projects and adjusting to another year of COVID as well as the challenges the weather brought. We had three different variety trials that actually did quite well this year, our silage variety trial, our perennial forage trial and our hemp variety trial. In comparison to last years' trials where we dealt with flooding, this year we dealt with drought – our hemp trial definitely showed the biggest change from year to year. We continued on with our DNA/Sire-Progeny project, Rancher Researcher, Soil Revitalization, Soil Moisture and Soil Benchmarking projects as well, which all were thanks to local producers helping make those happen.

On the HR side, our new manager Becky has settled in very nicely, she is dedicated, energetic and meticulous. After a lot of staff turnover and funding difficulties along with the previously mentioned challenges, she has set us up for success. Her efforts to secure long-term stable funding are most likely to pay off. We visited several MLAs including Ag. Minister Nate Horner and the Deputy Minister Shannon Marchand and we were very well received. With Alberta Agriculture, Forestry and Rural Economic Development greatly reduced they see us (ARA's) taking on some of their roles.

As far as the rest of the staff, Jessica has been the anchor through all of this; we are excited for her as she has had a big year with getting hitched this past July and now will be welcoming their first child in the summer of 2022. We have also welcomed two new staff members: Scott and Kennedy who are both passionate individuals and will do great things at WCFA. Scott will be

taking over on the research and operations side, and Kennedy will be taking over Jessica's role with communications, extension and conservation.

We did say Farewell to Melissa Howard this past year, as she has moved on to other opportunities and appreciate the work she did when she joined in July of 2020. We also had two amazing summer students, April and Savannah, who did an outstanding job getting our plots maintained as well as a plethora of other duties.

As far as myself, I've met a lot of good people that are passionate about our industry and continue to realize how complex and detailed it can be and yet is as simple as soil, water and photosynthesis which would happen with or without us. The board is a very diverse group of individuals and together form a whole that is greater than the sum of the parts. We went through a strategic planning process and developed a new vision statement and will continue the process of redefining ourselves and staying relevant in the most important industry in the world. Alongside feeding the world we are becoming the best solution for carbon sequestration.

I look forward to what the next few years bring and hope you will stay along for the ride.

Rod Nikkel

WCFA Board President

Manager's Message

When starting a new role there is always a learning curve involved and this position is no different. Fortunately, I have had an incredible support crew there to help me work through it, including our volunteer board of directors and the WCFA staff. There are also our partnering FarmRite associations that helped to provide context, experience and resources, as well as past members who I have chatted with over the year providing their support.

The 2021 year also had its own unique challenges which included the continued pandemic as well as drought. That being said, we had a pretty good field season, our summer staff that joined us for the year, April and Savannah, were great sports and kept our plots well maintained and were always lending a hand elsewhere such as with planning extension events. Our staff, Jessica and Melissa were definitely a tremendous help in getting me caught up to speed on the projects and keeping them on track and going.

Although not an ideal year, we had our fair share of challenges including equipment breakdowns and the usual challenges faced in the field. I still see it as a success as we met all our intended goals for our grants and we have a baseline from which we can work from to improve.

We saw quite a bit of transition on our board following our AGM held in August, with four members retiring after serving two, three-year terms which included the chair, Grant Chittick, treasurer Greg Malyk, and directors at large Frank Maddock and Brett Byers. We welcomed in four new directors at large: Jay Hagel, Shorty Fensky, Brian Koberstein, and Murray McLenaghan. A huge thank you to past and current members, as I know they all run busy lives outside of their volunteer role as a board member.

We also said farewell at the end of the year to Melissa Howard who was our Forage Research Coordinator and took care of all our field-based projects. She moved on to pursue her interests in a Ph.D. and we are very honoured to have spent the time we did with her and wish her all the best in her future endeavours.

In addition to project work we completed, we also moved our administrative offices to the old village office in Sangudo right on main street, which we share with the Sangudo fire department. We saw this as a great opportunity to have our own space that gives us flexibility to better serve our members, as well as to have greater opportunity in collaboration with our WCFA team. Our shop resides at the Quonset just across the highway from Sangudo and gives us plenty of room for our operations.

With wrapping up the 2021 year and looking on and forward to 2022, we will be finishing up much of the current projects in the 2022 year and will be applying for new projects, which is an exciting time. We encourage you to reach out to us if you have any comments regarding the organization, and I welcome them, as you as a member are the true leaders of WCFA.

Becky Doherty

General Manager

2021 Board of Directors

PRESIDENT	VICE-PRESIDENT	TREASURER	SECRETARY
Rod Nikkel	**Aren Skogstad**	**Melissa Freeman**	**Therese Tompkins**
Pickardville	Barrhead	Wildwood	Yellowhead County

DIRECTORS

Brian Dickson	**Larry Kidd**	**Duane Movald**	**Jay Hagel**
Niton Junction	Mayerthorpe	Breton	Sangudo
Murray McLenaghan	**Brian Koberstein**	**Shorty Fensky**	
Barrhead	Barrhead	Leduc	

Left to Right: Murray McLenaghan, Jay Hagel, Rod Nikkel, Duane Movald, Shorty Fensky, Larry Kidd, Melissa Freeman, Aren Skogstad, Therese Tompkins, Brian Koberstein (missing: Brian Dickson)

2021 Staff

General Manager
Becky Doherty
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Conservation Agriculture & Extension Program Coordinator
Jessica Rogerson (Watson)
conservationag@westcentralforage.com

Forage Research Coordinator
Melissa Howard
agronomy@westcentralforage.com

Summer Field Technicians
Savannah Mclean
April Kudera

Left to Right: Savannah McLean, Jessica Rogerson, Melissa Howard, April Kudera, Becky Doherty

Acknowledgements

The operation of West-Central Forage Association (WCFA) depends on support and cooperation from many groups and individuals. WCFA would like to extend our sincere appreciation to the many producer cooperators working with us to carry out our projects. You play a very important role in our demonstration and research activities and contribute greatly to the success of these projects. We would also like to thank our members, board of directors, project advisors, cooperators, sponsors, funders and everyone who has supported us throughout the year. Without the support and cooperation of so many, our programming would not be possible.

WCFA would like to acknowledge the following but not limited to, who have contributed to WCFA in a variety of ways by providing funding, donations, inputs, partnered on projects or extension events, lent a helping hand when we needed it or who have provided support in some other way. Our sincere apologies for anyone we may have missed.

A&L Canada Laboratories
Agriculture and Agri-Food Canada (AAFC)
Alberta Agriculture and Forestry
Alberta Beef Producers (ABP)
Alberta Environmental Farm Plan (EFP)
Alberta Forage Industry Network (AFIN)
ALUS
ALUS Brazeau
ALUS Lac Ste. Anne
ALUS Parkland
Applied Research & Extension Council of Alberta (ARECA)
Bart Guyon
Battle River Research Group (BRRG)
Beef Cattle Research Council (BCRC)
Blue Rock Animal Nutrition
Brazeau County
Canadian Agricultural Partnership (CAP)
Canadian Hemp Trade Alliance (CHTA)
Canadian Round Table for Sustainable Beef (CRSB)
CARA Soil Health Lab
Chelsea Pearce, Martin Deerline
Chinook Applied Research Association (CARA)
Churchill Land and Cattle
Corn Brothers Seed
Courtney O'Keefe, Blue Rock Animal Nutrition
Cows and Fish
Dale Kaliel
Dickson Farms
Dr. Kris Nichols
Duane Movald
Farming Smarter (FS)
FarmRite
Food Water Wellness
Foothills Forage and Grazing Association (FFGA)
Gateway Research Organization (GRO)
Graeme Finn
Grey Wooded Forage Association (GWFA)
Imperial Seed
Jan & Erin, Trailblazher Co.
Karen Anderson, Alberta Food Tours
Kidd Bros.
Kimberly Cornish
Kimberly Knull, Courageous Leadership
Lac Ste. Anne County
Lakeland Applied Research Association (LARA)
Lakeland College
Leduc County

Mackenzie Applied Research Association (MARA)
Martin Deerline
Melanie Villeneuve, Urtica Design
North Peace Applied Research Association (NPARA)
Nutrien Ag Solutions
Olds College
Parkland County
Peace Country Beef & Forage Association (PCBFA)
Quantum Genetix
Raymond Chittick
Results Driven Agriculture Research (RDAR)
Rob Jones
Shawn Elgert, Alberta Agriculture
Shorty Fensky
Smoky Applied Research & Demonstration Association (SARDA)
Stony Plain Seed Cleaning
Union Forage
Woodlands County
Yellowhead County

Trials & Demonstrations

Small Plot Trial Set-Up

Site Preparation

WCFA follows best management practices, when possible, which include crop rotation, soil testing and spraying for weed control.

Soil tests are carried out at each site to determine appropriate fertilization rates for each trial. Amount of seed for most trials is determined using seed germination, seed weight and target plant density, or industry recommended rates when this information is unavailable.

Plot sites are tilled prior to seeding, and a pre-seed application of herbicide is applied when possible/applicable. In most years tilling is conducted using a three-point hitch rototiller. Tilling is due to limitations with seeding equipment.

Seeding & Harvest

The majority of our small plots are seeded using WCFA's Fabro five-row small plot drill equipped with disc openers (Figure 1). When fertilizer is applied it is typically side-banded at time of seeding. Row spacing is set at 22.5 cm (8.9 inches).

Figure 1. WCFA Fabro five-row small plot drill

Harvest is typically conducted using a BCS tractor equipped with sickle mower bar. Harvest area is determined individually for each trial, making sure a representative sample is collected.

Following harvest representative samples (after drying for forages) are shipped to A&L Laboratories in Ontario for feed quality analysis. (Note: Hemp samples were sent to various labs for appropriate testing based on the protocol from the Canadian Hemp Trade Alliance in 2021).

Plot Layout

All small plots are seeded in a randomized block design, with four replicates to reduce error. Plots are typically 9 square metres in area (with a typical length of 8.0m for most trials). A typical block design is illustrated in Figure 2.

Guard	Rep 4. (Containing all varieties in trial)	Guard
3.0 m spacing for maintenance		
Guard	Rep. 3 (Containing all varieties in trial	Guard
3.0 m spacing for maintenance		
Guard	Rep 2. (Containing all varieties in trial)	Guard
3.0 m spacing for maintenance		
Guard	Rep. 1 (Containing all varieties in trial)	Guard

Figure 2. Typical block design for small plots at WCFA

Data Reporting

Yield, height, and lodging numbers reported throughout this Annual Report represent an average of measurements from the four replicates per variety. Feed quality numbers reported throughout this report represent an average for the two composite samples for each variety. Each composite sample is typically composed of representative samples from 2 of the 4 varieties (for example: Reps 1 and 3, and Reps 2 and 4).

2021 Weather Information

Daily Air Temperature, Precipitation and Growing Degree Days from Environment Canada from four weather stations in the WCFA area closest to research plots locations from May 1, 2021 to September 1, 2020 are displayed below. Greencourt weather station (Figure 3) is located near the Mayerthorpe trial sites, Evansburg (Figure 4) weather station is near the Wildwood plots, Tomahawk (Figure 5) weather station is near the Brazeau plots and the Paddle Dam (Figure 6) weather station is near the Lac Ste. Anne County plots.

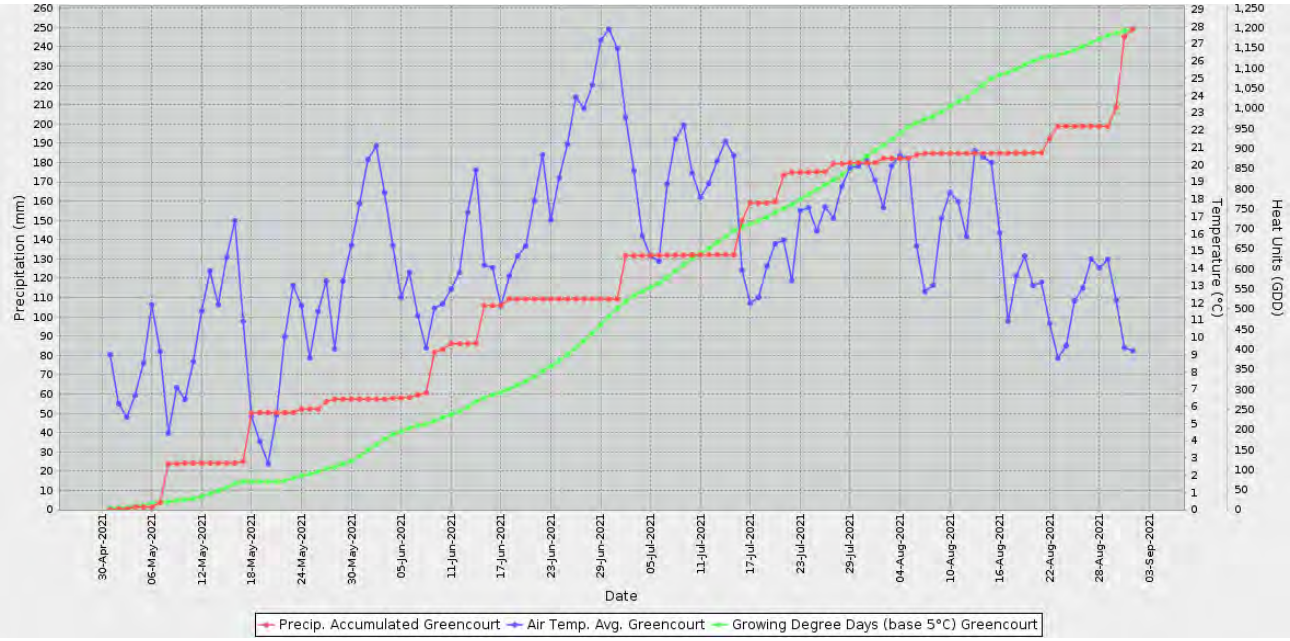


Figure 3. Weather information from Greencourt weather station

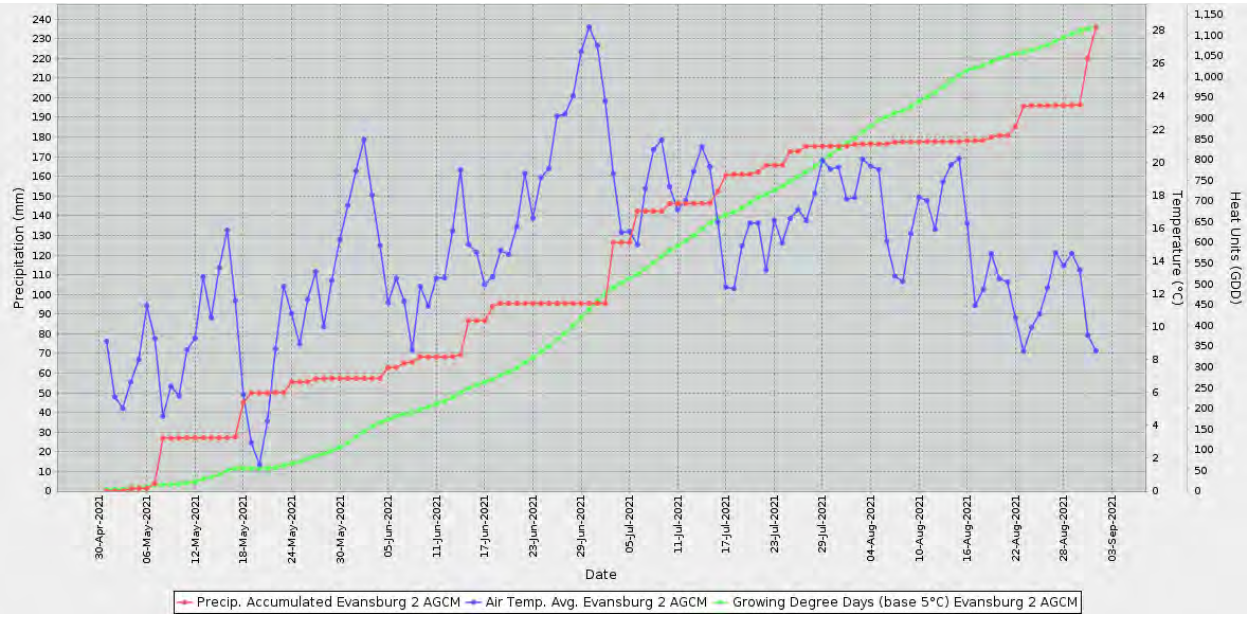


Figure 4. Weather information from Evansburg weather station

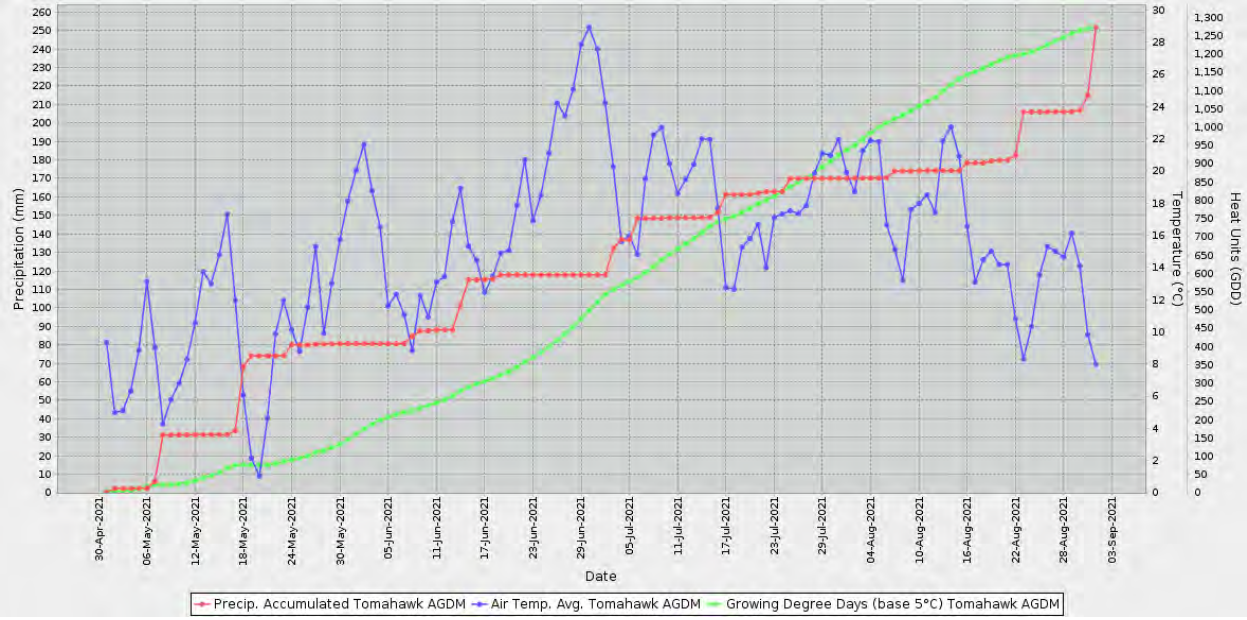


Figure 5. Weather information from Tomahawk weather station

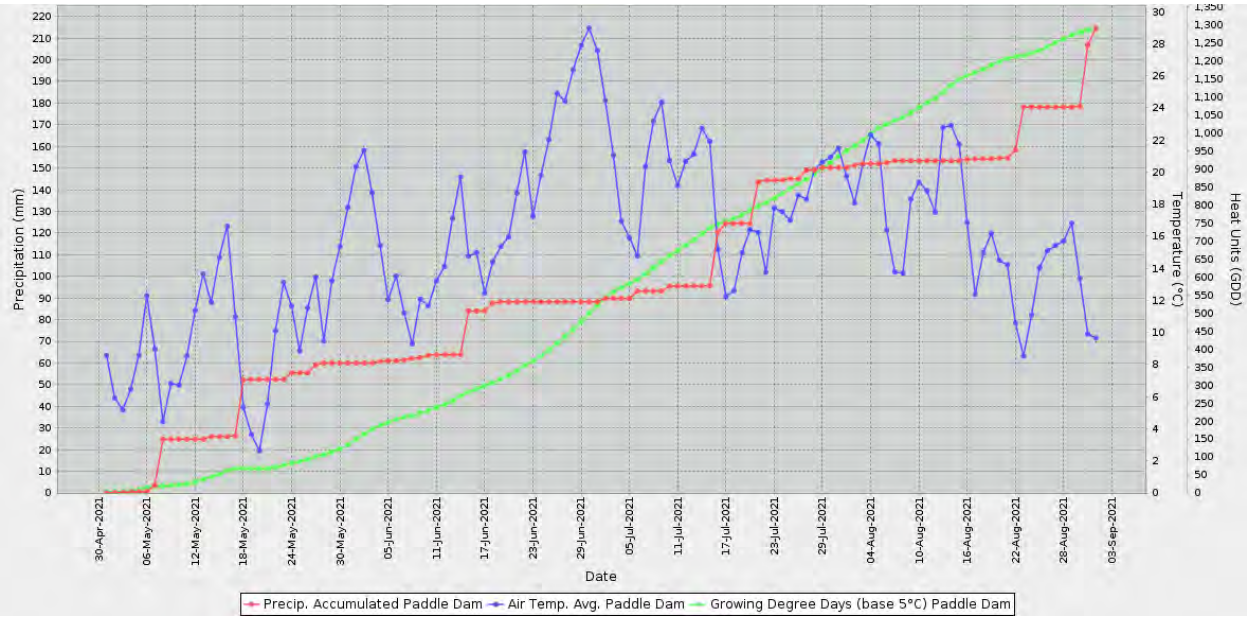


Figure 6. Weather Information from Paddle Dam Weather Station

Feed Result Metrics & What They Mean

Crude Protein (CP)

Beef Cow Rule of Thumb: 7-9-11. This means the average beef cow requires 7% protein in mid-gestation, 9% in late-gestation and 11% after calving.

Feeder Calf Rule of Thumb: 14-12-10. This means feeder calves from 550-800 lbs. require 14% protein, 12% for 800-1050 lbs. and 10% for 1050 lbs. to finish.

Total Digestible Nutrients (TDN)

Refers to the feed's energy value.

Beef Cow Rule of Thumb: 55-60-65. This means that for a mature beef cow to maintain her body condition score through the winter she will require 55% TDN in mid-gestation, 60% in late-gestation and 65% after calving.

Neutral Detergent Fibre (NDF)

This is an indication of the ration's fill. Lower NDF levels are preferred and anything starting to get above 60% is cause for concern.

Acid Detergent Fibre (ADF)

This is connected to forage digestibility; the lower the ADF value, the more digestible the forage.

Calcium (Ca) and Phosphorus (P)

These should be looked at as a ratio. The ideal range is 2:1 to 6:1. Anything outside this range may lead to metabolic issues.

Calcium (Ca), Potassium (K) & Magnesium (Mg) (Tetany Ratio)

Combinations of high K, and/or low Mg can lead to performance issues. The tetany ratio is expressed in K/(Ca +Mg) in milliequivalents (mEq). The ratio of K to the sum of Ca & Mg should be below 2.2 to avoid winter tetany.

**Note: to calculate, percentages reported must be converted to millequivalents per kg.*

Relative Feed Value (RFV)

An index that estimates intake and digestibility. It is only useful for evaluating 100% alfalfa hay or silage only. Full bloom alfalfa hay is used as the baseline with an RFV of 100; values below 80 typically do not meet animal requirements for energy. This value is not reliable for mixed hay, grass hay or cereal greenfeed. Often used as a benchmark for selling alfalfa hay, but is not used in ration formulation.

Alberta Agriculture's "Beef Ration Rules of Thumb" Agrifacts sheet can be found in the APPENDIX under Beef Ration Rules of Thumb Agri-facts.

2021 Regional Silage Trial

Yield and Quality of Annual Crop Mixtures and Alternative Annual Crops for Forage Production in Alberta

This project is supported by the Canadian Agriculture Partnership (CAP) Adapting Innovative Solutions in Agriculture Program (now managed by RDAR).

OVERVIEW

The ability to assess varieties and species regionally allows Alberta producers to make the most economic decisions for their farm's productivity and profitability. Selection of varieties that produce higher yield and/or nutritional quality regionally can be a significant factor in influencing productivity and profitability. Previous experience with variety trials has indicated that there can be a 15% increase in production from selecting the best variety for your environment, which can lead to an average increase of $25/acre.

'Alternative' crops (chicory, plantain, forage kale, etc.) are gaining popularity as a source of forage for livestock. Little work has been done to date evaluating individual species for these alternative crops. Yield and quality of these crops will be analyzed and allow comparison to commonly used annual cereal crops to provide producers with more information as they make annual forage variety decisions for feed use on their farms.

With new varieties continuing to become available to producers, it is important to evaluate forage yield and quality for these varieties at a regional level. The purpose of this trial is to supply producers with current data on annual forage variety yield and quality for silage, greenfeed or swath grazing in the west-central region, as well as across the province with cooperation from additional forage and applied research associations.

Partners

- Battle River Research Group (BRRG)
- Chinook Applied Research Association (CARA)
- Gateway Research Organization (GRO)
- Lakeland Agricultural Research Association (LARA)
- Mackenzie Applied Research Association (MARA)
- North Peace Applied Research Association (NPARA)
- Peace Country Beef and Forage Association (PCBFA)

METHODS

The cereal silage trials were grown in four blocks of plots: barley, oats, triticale/wheat and winter/spring mixtures near Sangudo (Lac Ste. Anne County Research Site –SE 1-57-07 W5). Trial blocks were seeded as a randomized block design, with four replicates to reduce error. Plot area was nine square metres.

The 'alternatives' trial was grown in a single block of plots near Sangudo (Lac Ste. Anne County Research Site –SE 1-57-07 W5) Trial blocks were seeded as a randomized block design, with four replicates to reduce error. Plot area was 9 square metres.

Agronomic information can be found in Table 1. Trials were seeded using the WCFA five-row Fabro small plot disc drill. Seeding rates for cereals were based on target plant density, thousand kernel weight (TKW) and germination for each variety; alternatives were seeded at industry recommended rates.

Cereal trials were sprayed once during the growing season. No in-crop herbicide application occurred on the alternatives trial. Trials were hand-weeded when necessary.

Prior to harvest crop height, lodging scores and stage of maturity were recorded for cereal varieties, but not for the alternative crops (these measurements were not applicable for these species). Following harvest, two composite samples per variety were sent to A&L Canada Laboratories for nutritional quality analysis.

Table 1. Agronomic information for 2021 regional silage trial.

Trial	Site	# of Varieties	Seeding Date	Fertility	Weed Control	Harvest Date
Barley	Sangudo	18	02-Jun-21	No Application	MCPA	17-Aug-21
Oats	Sangudo	12	02-Jun-21	No Application	MCPA	12-Aug-21
Triticale	Sangudo	11	02-Jun-21	No Application	MCPA	25-Aug-21
Winter/Spring Cereals	Sangudo	21	02-Jun-21	No Application	MCPA	17-Aug-21
Alternatives	Sangudo	10	02-Jun-21	No Application	N/A	16-Aug-21

Silage Varieties Tested in 2021

Barley

- *CDC Austenson*: 2 row, semi-smooth awns
- *AB Advantage:* 6 row, smooth awned
- *AB Cattlac:* 6 row, semi-smooth awned
- *AB Wrangler:* 2 row, rough awn, high yielding
- *Altorado:* 2 row, earlier maturing
- *Amisk:* 6 row, semi-dwarf, semi-smooth awns
- *Canmore:* 2 row, general purpose
- *CDC Bow:* 2 row, malting variety
- *CDC Churchill:* 2 row, malting variety
- *CDC Cowboy:* 2 row, high yielding
- *CDC Maverick:* 2 row, smooth awned
- *Claymore:* 2 row, high yielding
- *Esma:* 2 row, short, strong straw
- *SR17515 (AB Tofield):* 6 row, smooth awned
- *SR18645(AB Prime):* 2 row, feed barley
- *Stockford:* 2 row, forage barley
- *Sundre:* 6 row, smooth awned

- *TR18647 (AB Hague):* 2 row, high yielding

Oats

- *CDC Baler:* very leafy, forage oat variety
- *AC Juniper:* early maturing, general purpose variety
- *AC Morgan:* later maturing milling, high yielding
- *CDC Arborg:* early maturing milling, high yielding
- *CDC Endure:* early maturing milling, high yielding
- *CDC Haymaker:* forage oat, high yielding
- *CDC Nasser:* low lignin hull, high fat content
- *CDC Seabiscuit:* milling variety, high yielding
- *CS Camden:* milling variety, high yielding
- *Murphy:* forage oat, high silage yield
- *Ore3542M:* milling oat, high yielding

Triticale/Wheat

- *Taza:* reduced awn spring triticale, forage variety
- *AAC Awesome:* spring wheat variety, high yielding
- *AAC Delight:* reduced awn spring triticale
- *AAC Paramount:* soft white spring wheat
- *AC Andrew:* soft white spring wheat, high yielding
- *AC Sadash:* semi-dwarf soft white spring wheat, high yielding
- *Alderon:* red spring wheat, special purpose, high yielding
- *Bunker:* reduced awn spring triticale, high yielding
- *Sunray:* spring triticale, semi-dwarf variety
- *T256 (AB Stampeder):* reduced awn spring triticale
- *WPB Whistler:* special purpose wheat variety, short straw

Alternative Crops

- *Chicory:* short lived perennial with a strong deep fibrous tap root
- *Forage Brassica:* biennial leafy bush Brassica plant with a small tuber
- *Forage Kale:* Brassica plant, quick growing
- *Forage Radish:* Brassica plant, drought tolerant
- *Max Radish:* radish with taproot
- *Millet:* annual grass
- *Phacelia:* cool season annual, upright broadleaf forb, attractive flowers
- *Plantain:* cool season, perennial, low growing broadleaf forb, nutrient dense
- *Sorghum Sudan Grass:* warm season annual grass

PROGRESS TO DATE

Yield and feed quality results are detailed in the following tables for all varieties tested in 2021. Overall, yields across the board seemed to be significantly lower than in years past, likely due to the hot, dry growing season experienced in the region in 2021, and perhaps the absence of any fertilizer application to the trial.

Note about reported results: no statistical analysis was performed, therefore there is no indication as to whether or not differences between varieties are of significance.

Barley

Barley trials were aimed to be harvested at the soft dough stage, however not all plots were in this stage at time of harvest. Yield, height and lodging information for 2021 can be found in Table 2. All reported yield results are adjusted to 65% moisture. Yields are also represented as a percentage of a well-known variety, in this case Austenson, for ease of comparison. Feed quality results are reported in Table 3.

Table 2. Physical characteristics of Barley varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County

Variety	Yield (ton/ac)[1]	Yield (% Austenson)	Height (in)	Lodging (1-5)**
CDC Austenson	5.48	100.00	29	1.5
AB Advantage	4.74	86.46	33	1.5
AB Cattlelac	6.32	115.18	34	1
AB Wrangler	5.27	96.03	27	1
Altorado	6.33	115.39	29	1.5
Amisk	5.65	103.03	26	1.5
Canmore	4.92	89.69	26	1
CDC Bow	5.25	95.73	27	1
CDC Churchill	4.55	82.94	26	1.5
CDC Cowboy	7.04	128.44	39	1.5
CDC Maverick	6.29	114.63	38	1.5
Claymore	6.24	113.76	29	1
Esma	5.78	105.34	24	1
SR17515 (AB Tofield)	4.73	86.22	27	1
SR18645 (AB Prime)	5.91	107.69	29	1.5
Stockford	5.52	100.65	27	1.5
Sundre	7.03	128.21	32	1
TR18647 (AB Hauge)	5.45	99.34	28	1.5

[1] Yield adjusted to 65% Moisture (ton/ac, 1 ton = 2000 lbs.)
[2] Lodging assessed on 1-5 scale where 1 is erect and 5 is completely flat

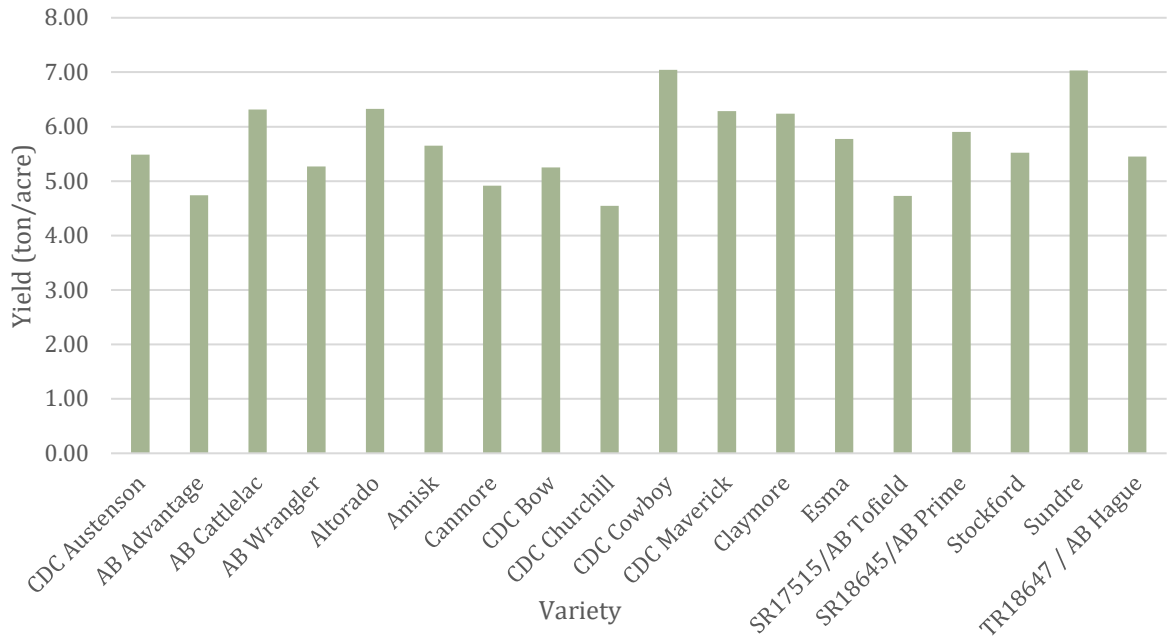


Figure 7. Yield at 65% moisture for Barley varieties in the 2021 Regional Silage Variety Trial in Lac Ste. Anne County

Table 3. Feed quality results for Barley varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County

Variety	CP (%)	ADF (%)	NDF (%)	TDN (%)	CA (%)	P (%)	K (%)	Mg (%)
CDC Austenson	8.88	35.50	57.28	64.96	0.56	0.16	1.51	0.18
AB Advantage	8.67	37.89	53.03	63.36	0.55	0.13	1.90	0.15
AB Cattlelac	9.63	33.06	51.74	64.76	0.68	0.14	1.78	0.21
AB Wrangler	6.57	35.65	58.90	59.79	0.58	0.11	1.42	0.14
Altorado	9.46	32.94	52.54	65.77	0.44	0.14	1.76	0.14
Amisk	10.62	25.78	40.04	68.63	0.43	0.16	1.30	0.16
Canmore	8.50	32.87	53.45	63.93	0.75	0.14	1.66	0.18
CDC Bow	7.56	34.07	54.94	63.10	0.60	0.12	1.33	0.14
CDC Churchill	8.82	32.23	52.42	64.70	0.76	0.14	1.60	0.19
CDC Cowboy	6.97	37.07	60.29	61.13	0.56	0.11	1.64	0.19
CDC Maverick	8.17	36.28	58.14	63.24	0.62	0.10	1.76	0.19
Claymore	8.99	36.78	59.67	62.19	0.73	0.11	1.84	0.16
Esma	7.41	35.08	56.82	59.09	0.54	0.13	1.24	0.18
SR17515 (AB Tofield)	9.08	30.50	47.66	65.83	0.62	0.14	1.51	0.19
SR18645 (AB Prime)	7.84	33.97	54.21	62.48	0.60	0.13	1.66	0.18

Variety	CP (%)	ADF (%)	NDF (%)	TDN (%)	CA (%)	P (%)	K (%)	Mg (%)
Stockford	9.26	31.06	48.01	66.50	0.56	0.17	1.49	0.18
Sundre	11.55	32.50	52.93	66.03	0.86	0.11	2.15	0.24
TR18647 (AB Hauge)	9.03	29.32	46.58	64.81	0.37	0.19	1.39	0.15

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 nutrient requirements for mid-gestation, fewer meet the requirements for late gestation, and there are very few (one to two) that would meet the requirements for after calving. Figure 8 shows the Crude Protein values in relation to the rule of thumb.

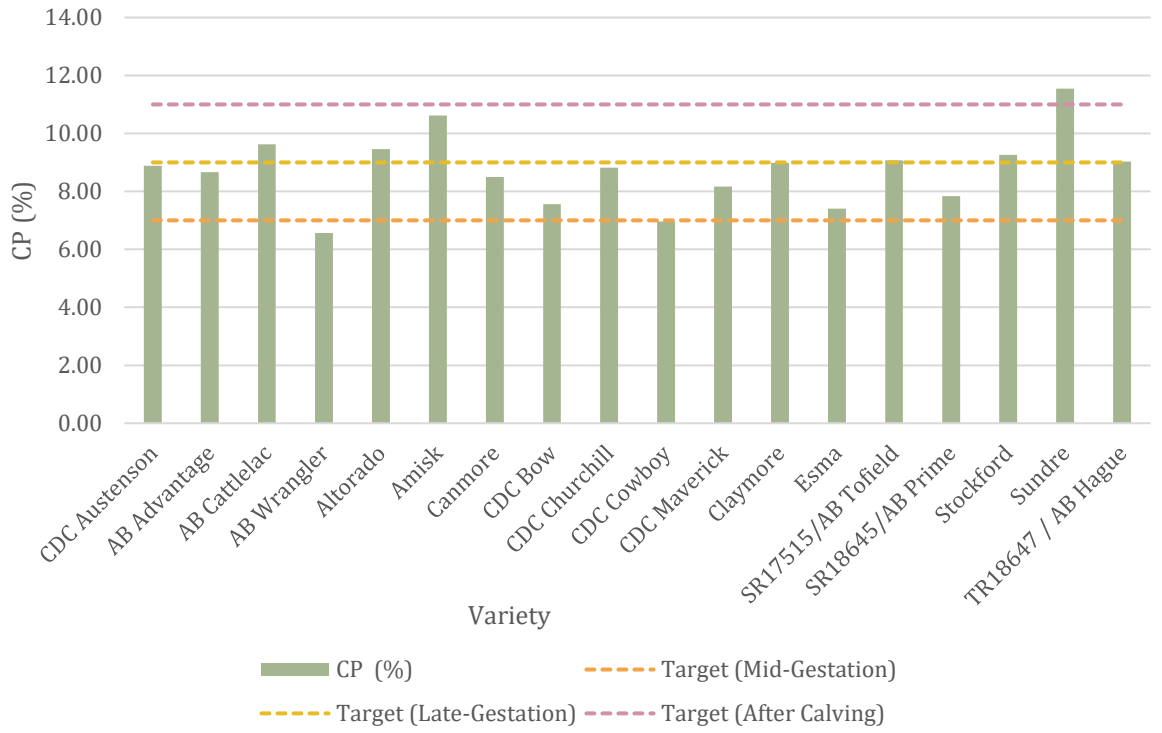


Figure 8. Crude Protein values for Barley varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County.

Looking at Total Digestible Nutrients (TDN), an estimate of the energy value of the feed, the general rule of thumb is 55-60-65 for mid-gestation, late-gestation and after calving. The majority of the varieties are adequate to meet the requirements for mid to late gestation, with fewer meeting the requirements for after calving. Figure 9 show the TDN values in relation to the rule of thumb.

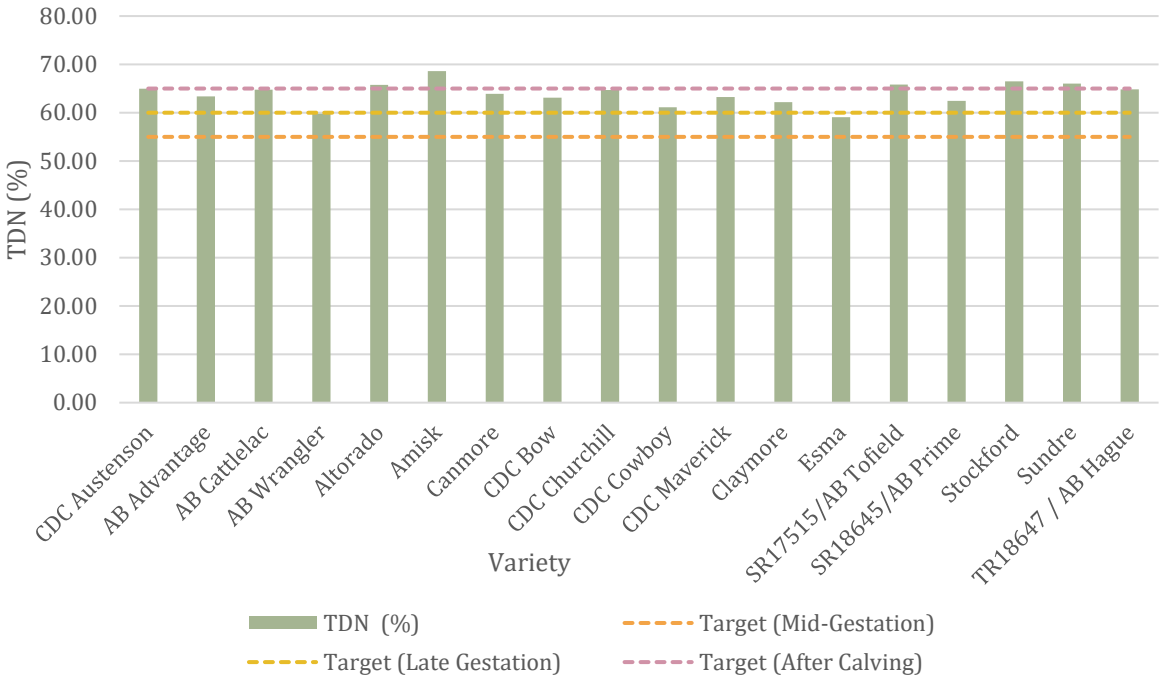


Figure 9. Total Digestible Nutrient values for Barley varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County

Oats

Oat trials were aimed to be harvested at the milk stage, however not all plots were in this stage at time of harvest. Yield, height and lodging information for 2021 can be found in Table 3. All reported yield results are adjusted to 65% moisture. Yields are also represented as a percentage of a well-known variety, in this case Baler, for ease of comparison. Feed quality results are reported in Table 5.

Table 4. Physical characteristics of Oat varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County

Variety	Yield (ton/ac)[1]	Yield (% Baler)	Height (in)	Lodging (1-5)[2]
CDC Baler	9.04	100.0	37	1.5
AC Juniper	5.14	56.8	32	1
AC Morgan	7.88	87.1	32	1
CDC Arborg	7.44	82.3	34	1
CDC Endure	5.47	60.5	32	1
CDC Haymaker	8.89	98.3	35	1.5
CDC Nasser	7.06	78.1	33	1
CDC S0-1	7.19	79.5	28	1
CDC Seabiscuit	6.46	71.4	29	1

Variety	Yield (ton/ac)[1]	Yield (% Baler)	Height (in)	Lodging (1-5)[2]
CS Camden	6.24	69.0	32	1
Murphy	8.19	90.6	41	1
ORe3542M	5.52	61.1	28	1

[1] Yield adjusted to 65% Moisture (ton/ac, 1 ton = 2000 lbs)
[2] Lodging assessed on 1-5 scale where 1 is erect and 5 is completely flat

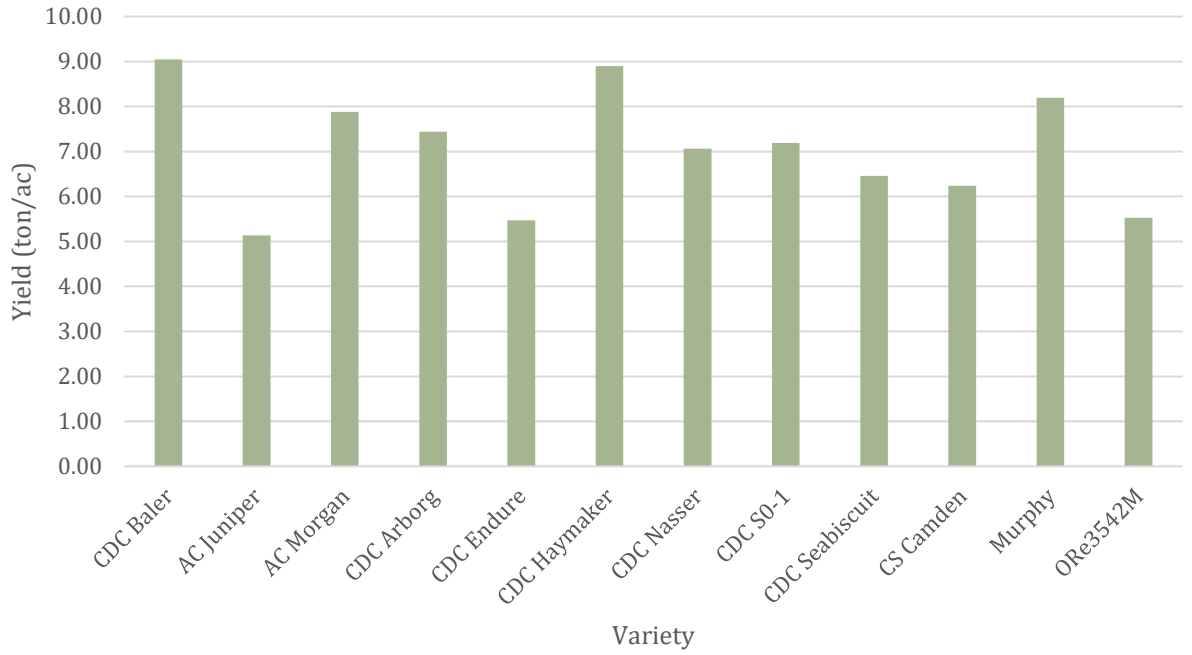


Figure 10. Yield at 65% moisture for Oat varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County

Table 5. Feed quality results for Oat varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County

Variety	CP (%)	ADF (%)	NDF (%)	TDN (%)	CA (%)	P (%)	K (%)	MG (%)
CDC Baler	9.95	35.79	56.52	63.41	0.47	0.17	2.29	0.19
AC Juniper	10.52	34.76	54.94	61.54	0.53	0.17	2.16	0.22
AC Morgan	10.51	34.87	53.35	62.40	0.52	0.20	2.17	0.19
CDC Arborg	9.04	36.49	57.85	60.09	0.49	0.14	2.06	0.19
CDC Endure	10.03	32.61	50.54	62.05	0.45	0.21	1.78	0.19
CDC Haymaker	9.95	37.94	56.71	60.28	0.48	0.16	2.18	0.18
CDC Nasser	9.86	34.34	55.09	63.08	0.44	0.17	1.93	0.17
CDC S0-1	9.41	34.37	55.16	62.19	0.44	0.18	1.96	0.19

Variety	CP (%)	ADF (%)	NDF (%)	TDN (%)	CA (%)	P (%)	K (%)	MG (%)
CDC Seabiscuit	11.39	32.53	51.56	64.12	0.42	0.16	1.74	0.16
CS Camden	10.95	30.79	48.78	63.00	0.47	0.22	1.71	0.20
Murphy	9.74	37.83	58.50	60.39	0.46	0.16	2.10	0.17
ORe3542M	10.64	33.47	52.98	62.48	0.41	0.19	1.85	0.17

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 for mid to late gestation, but almost none of the varieties have adequate CP to meet after calving requirements. Figure 11 shows the Crude Protein values in relation to the rule of thumb.

Figure 11. Crude Protein values for Oat varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County

Looking at Total Digestible Nutrients (TDN), an estimate of the energy value of the feed, the general rule of thumb is 55-60-65 for mid-gestation, late-gestation and after calving. The majority of the varieties are adequate to meet the requirements for mid to late gestation, but almost none of the varieties have adequate TDN to meet after calving requirements. Figure 12 show the TDN values in relation to the rule of thumb.

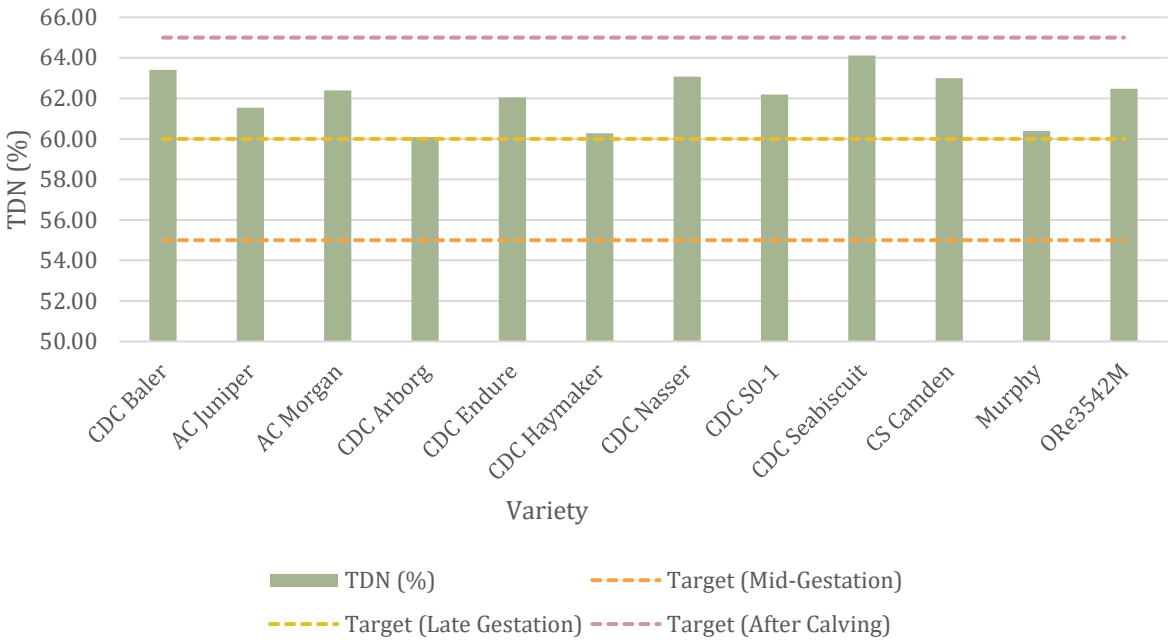


Figure 12. Total Digestible Nutrient (TDN) values for Oat varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County

Triticale/Wheat

Triticale/Wheat trials were targeted to be harvested at the late milk stage, however not all plots were in this stage at time of harvest. Yield, height and lodging information for 2021 can be found in Table 4. All reported yield results are adjusted to 65% moisture. Yields are also represented as a percentage of a well-known variety, in this case Taza, for ease of comparison. Feed quality results are reported in Table 7.

Table 6. Physical characteristics of Triticale/Wheat varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County

Variety	Yield (ton/ac)[1]	Yield (% Taza)	Height (in)	Lodging (1-5)[2]
Taza	3.03	100.0	37	1.5
AAC Awesome	4.52	149.5	32	1
AAC Delight	4.29	141.6	32	1.5
AAC Paramount	4.84	159.8	32	1
AC Andrew	4.79	158.3	31	1
AC Sadash	4.20	138.8	32	1.5
Alderon	5.63	186.1	24	1
Bunker	3.38	111.8	37	2.5
Sunray	3.47	114.8	36	2

Variety	Yield (ton/ac)[1]	Yield (% Taza)	Height (in)	Lodging (1-5)[2]
T256 (AB Stampeder)	3.66	121.0	31	1.5
WPB Whistler	4.84	160.1	26	1

[1] Yield adjusted to 65% Moisture (ton/ac, 1 ton = 2000 lbs.)
[2] Lodging assessed on 1-5 scale where 1 is erect and 5 is completely flat

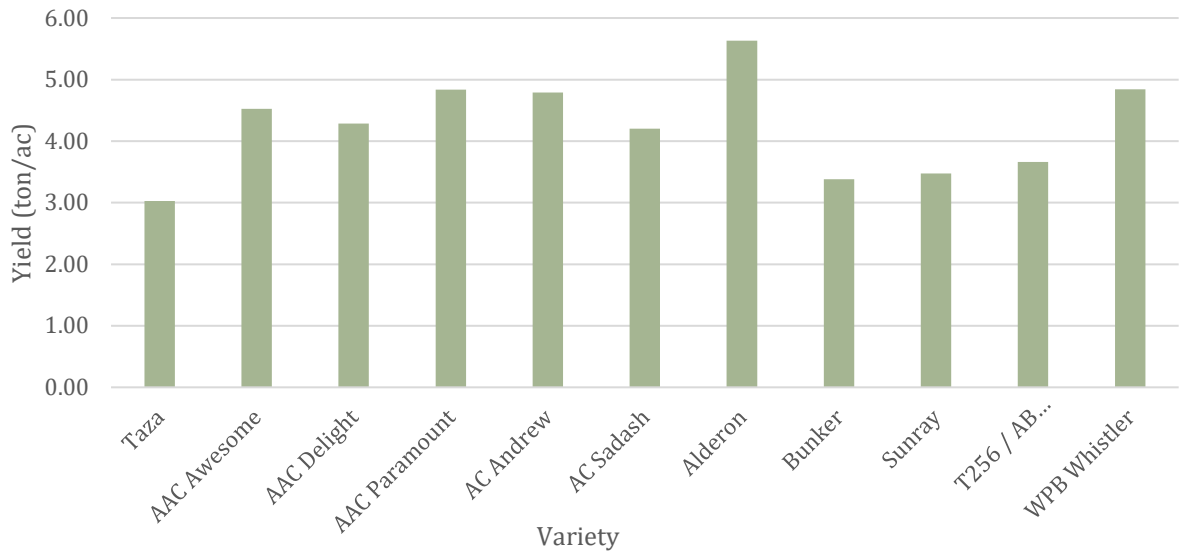


Figure 13. Yield at 65% moisture for Triticale/Wheat varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County

Table 7. Feed quality results for Triticale/Wheat varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County

Variety	CP (%)	ADF (%)	NDF (%)	TDN (%)	CA (%)	P (%)	K (%)	MG (%)
Taza	7.89	34.65	54.97	60.77	0.45	0.16	1.52	0.15
AAC Awesome	7.44	36.42	57.85	57.67	0.31	0.14	1.13	0.14
AAC Delight	8.33	32.03	52.06	61.93	0.26	0.15	1.13	0.10
AAC Paramount	6.94	39.65	64.78	54.03	0.27	0.11	1.35	0.12
AC Andrew	10.08	32.47	49.83	62.65	0.22	0.18	1.47	0.13
AC Sadash	7.44	37.18	59.99	58.20	0.26	0.13	1.28	0.12
Alderon	9.42	31.48	48.60	63.57	0.21	0.21	1.33	0.16
Bunker	8.29	32.98	50.77	63.34	0.26	0.16	1.16	0.12
Sunray	8.63	34.39	53.32	61.88	0.50	0.18	1.53	0.16
T256 (AB Stampeder)	7.47	34.67	58.41	59.10	0.29	0.13	1.11	0.13
WPB Whistler	9.20	33.66	53.06	60.20	0.24	0.16	1.23	0.14

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 nutrient requirements for mid to late gestation, but almost none of the varieties have adequate CP to meet after calving requirements. Figure 14 show the Crude Protein values in relation to the rule of thumb.

Figure 14. Crude Protein (CP) values for Triticale/Wheat varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County

Looking at Total Digestible Nutrients (TDN), an estimate of the energy value of the feed, the general rule of thumb is 55-60-65 for mid-gestation, late-gestation and after calving. The majority of the varieties are adequate to meet the requirements for mid to late gestation, but almost none of the varieties have adequate TDN to meet after calving requirements. Figure 15 shows the TDN values in relation to the rule of thumb.

Figure 15. Total Digestible Nutrient (TDN) values for Triticale/Wheat varieties in the 2021 Regional Silage Trial in Lac Ste. Anne County

Winter/Spring Cereal Mixtures

Winter/Spring Cereal trials were targeted to be harvested at the recommended stage for the spring cereals, however not all plots were in this stage at time of harvest. Yield and height information for 2021 can be found in Table 5. All reported yield results are adjusted to 65% moisture. Feed quality results are reported in Table 9.

Table 8. Physical characteristics of Winter/Spring cereal mixtures in the 2021 Regional Silage Trial in Lac Ste. Anne County

Variety	Crop Type	Yield (ton/ac)[1]	Height Spring (in)	Height Winter (in)
Austenson	Barley	4.74	27.58	-
Baler	Oats	5.00	39.42	-
Bobcat	Winter Triticale	2.35	-	22.67
Luoma	Winter Triticale	2.13	-	10.42
Metzger	Winter Triticale	2.27	-	10.22
Taza	Spring Triticale	3.58	41.33	-
Austenson/Bobcat	Barley/ Winter Triticale	3.62	24.67	12.50
Austenson/Luoma	Barley/Winter Triticale	5.49	26.78	15.33
Austenson/Metzger	Barley/Winter Triticale	5.01	27.17	12.25
Austenson/Prima	Barley/Fall Rye	4.49	27.33	12.11

Variety	Crop Type	Yield (ton/ac)[1]	Height Spring (in)	Height Winter (in)
Austenson/Wildfire	Barley/ Winter Wheat	5.02	27.42	16.83
Baler/Bobcat	Oats/Winter Triticale	4.34	38.83	20.22
Baler/Luoma	Oats/Winter Triticale	4.25	36.83	12.08
Baler/Metzger	Oats/Winter Triticale	3.98	38.78	11.11
Baler/Prima	Oats/Fall Rye	3.93	37.00	11.33
Baler/Wildfire	Oats/Winter Wheat	3.92	34.67	10.92
Taza/Bobcat	Spring Triticale/Winter Triticale	3.85	34.58	25.50
Taza/Luoma	Spring Triticale/Winter Triticale	4.59	31.78	17.67
Taza/Metzger	Spring Triticale/Winter Triticale	2.91	34.56	10.39
Taza/Prima	Spring Triticale/Fall Rye	2.97	33.83	11.67
Taza/Wildfire	Spring Triticale/Winter Wheat	3.21	33.33	11.67

[1] Yield adjusted to 65% Moisture (ton/ac, 1 ton = 2000 lbs.)

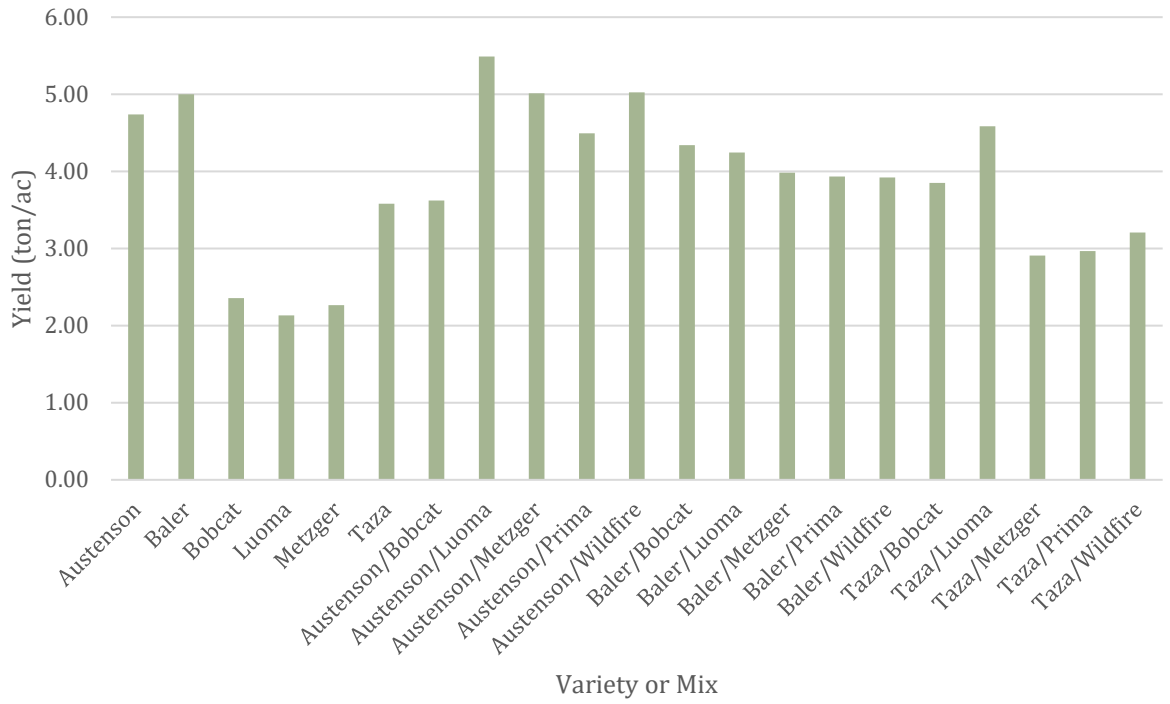


Figure 16. Yield at 65% moisture for Winter/Spring Cereal Mixtures in the 2021 Regional Silage Trial in Lac Ste. Anne County

Table 9. Feed quality results for Winter/Spring cereal mixtures in the 2021 Regional Silage Trial in Lac Ste. Anne County

Variety	Crop Type	CP (%)	ADF (%)	NDF (%)	TDN (%)	CA (%)	P (%)	K (%)	MG (%)
Austenson	Barley	7.04	34.30	53.58	63.26	0.45	0.13	1.44	0.14
Baler	Oats	6.11	35.97	57.06	59.42	0.46	0.12	1.32	0.17
Bobcat	Winter Triticale	14.23	30.66	49.22	74.11	0.59	0.26	2.55	0.17
Luoma	Winter Triticale	14.46	28.64	42.91	77.45	0.83	0.22	2.81	0.22
Metzger	Winter Triticale	16.01	26.85	40.86	78.69	0.75	0.24	2.99	0.22
Taza	Spring Triticale	10.79	32.31	49.77	67.06	0.63	0.20	2.08	0.20
Austenson/ Bobcat	Barley/ Winter Triticale	8.78	34.91	55.33	65.46	0.48	0.15	1.81	0.15
Austenson/ Luoma	Barley/Winter Triticale	9.67	31.30	51.52	68.00	0.47	0.14	1.73	0.15
Austenson/ Metzger	Barley/Winter Triticale	8.71	30.10	46.54	67.30	0.44	0.16	1.57	0.16
Austenson/ Prima	Barley/Fall Rye	7.95	31.78	51.40	65.43	0.42	0.16	1.63	0.15
Austenson/ Wildfire	Barley/ Winter Wheat	10.08	30.54	48.75	68.66	0.43	0.18	1.91	0.15
Baler/ Bobcat	Oats/Winter Triticale	10.29	31.03	50.53	67.00	0.55	0.19	1.89	0.18
Baler/ Luoma	Oats/Winter Triticale	8.90	32.26	50.79	64.81	0.60	0.18	1.67	0.20
Baler/ Metzger	Oats/Winter Triticale	9.77	32.73	51.02	69.32	0.41	0.18	2.17	0.15
Baler/ Prima	Oats/Fall Rye	7.71	33.66	53.34	61.97	0.43	0.15	1.53	0.16
Baler/ Wildfire	Oats/Winter Wheat	8.63	31.96	49.40	65.43	0.59	0.15	1.54	0.20
Taza/ Bobcat	Spring Triticale/Winter Triticale	14.44	29.37	47.98	73.96	0.52	0.23	2.39	0.17
Taza/ Luoma	Spring Triticale/Winter Triticale	14.51	31.36	49.38	75.29	0.58	0.23	3.05	0.17
Taza/ Metzger	Spring Triticale/Winter Triticale	12.02	27.55	43.07	72.26	0.66	0.20	2.14	0.19
Taza/ Prima	Spring Triticale/Fall Rye	10.61	29.20	46.14	70.80	0.50	0.19	1.98	0.17

Variety	Crop Type	CP (%)	ADF (%)	NDF (%)	TDN (%)	CA (%)	P (%)	K (%)	MG (%)
Taza/ Wildfire	Spring Triticale/ Winter wheat	12.56	29.27	43.71	73.43	0.56	0.21	2.10	0.20

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 nutrient requirements for mid to late gestation (Baler did not meet the requirements for mid gestation). A good number of varieties, but not all, are adequate to meet requirements following calving. Figure 17 shows the Crude Protein values in relation to the rule of thumb.

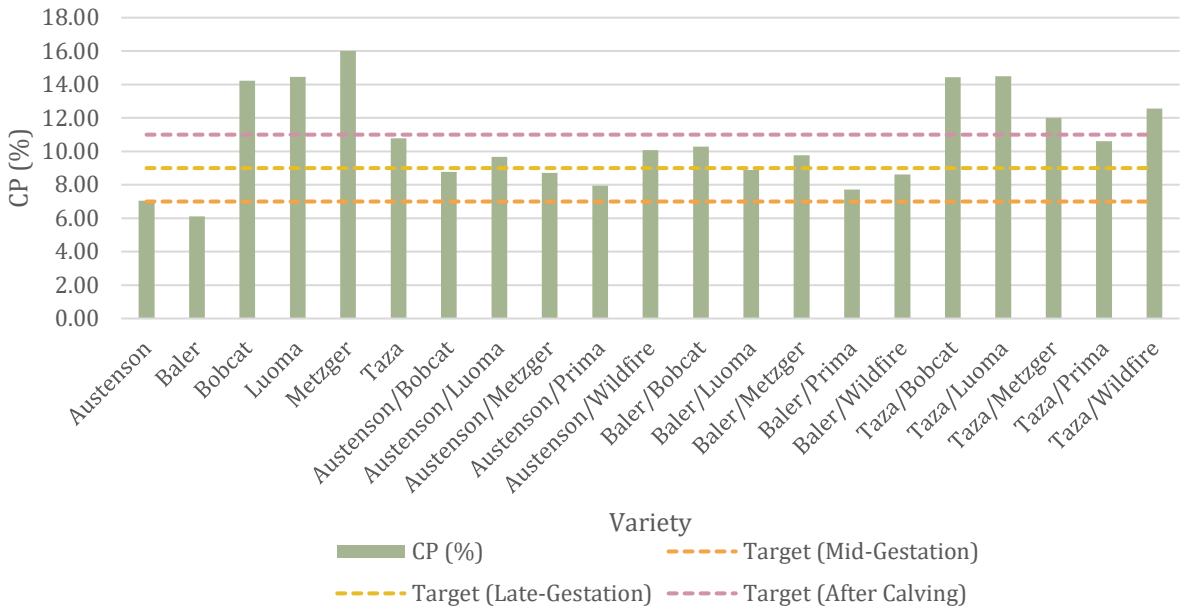


Figure 17. Crude Protein (CP) values for Winter/Spring Cereal Mixtures in the 2021 Regional Silage Variety Trial in Lac Ste. Anne County

Looking at Total Digestible Nutrients (TDN), an estimate of the energy value of the feed, the general rule of thumb is 55-60-65 for mid-gestation, late-gestation and after calving. The majority of the varieties are adequate to meet the requirements for mid gestation through to after calving. Figure 18 shows the TDN in relation to the rule of thumbs.

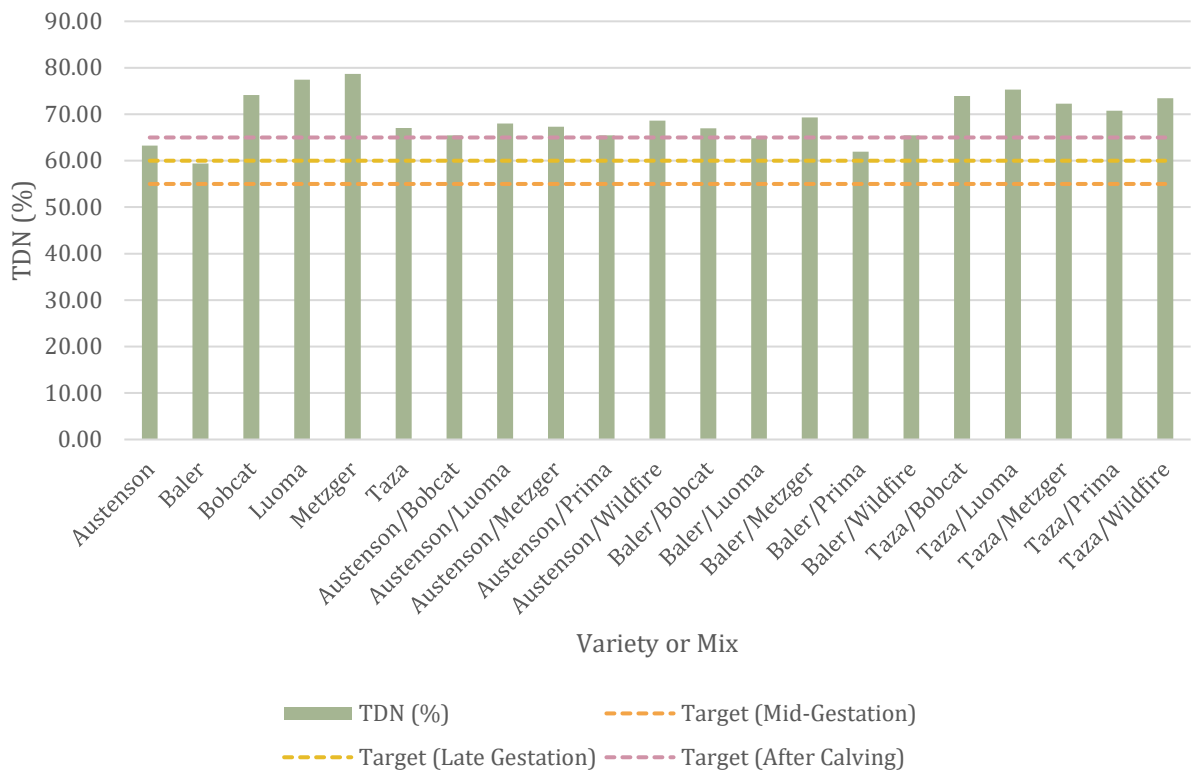


Figure 18. Total Digestible Nutrients (TDN) for Winter/Spring Cereal Mixtures in the 2021 Regional Silage Trial in Lac Ste. Anne County

Alternatives

Alternatives were harvested on Aug 16, 2021, at varying stages of maturity. Yield information, as well as moisture content at harvest, for 2021 can be found in Table 6. Feed quality results are reported in Table 11.

Table 10. Physical characteristics of Alternative crops in the 2021 Regional Silage Trial in Lac Ste. Anne County

Variety/Crop	Moisture @ Harvest (%)	Wet Yield (ton/ac)[1]	Yield @ 65% moisture (ton/ac)
Chicory	69.18	4.65	4.36
Forage Brassica	64.38	2.56	2.59
Forage kale	70.69	0.38	0.35
Forage radish	74.28	4.68	4.10
Forage Turnip	66.83	2.03	1.97
Max Radish	63.46	4.34	4.44
Millet	72.69	2.47	2.21
Phacelia	66.97	1.82	1.76
Plantain	70.82	2.32	2.13

Variety/Crop	Moisture @ Harvest (%)	Wet Yield (ton/ac)[1]	Yield @ 65% moisture (ton/ac)
Sorghum Sudan Grass	72.12	2.68	2.41

[1] This yield is the wet yield in the field at the moisture at harvest.

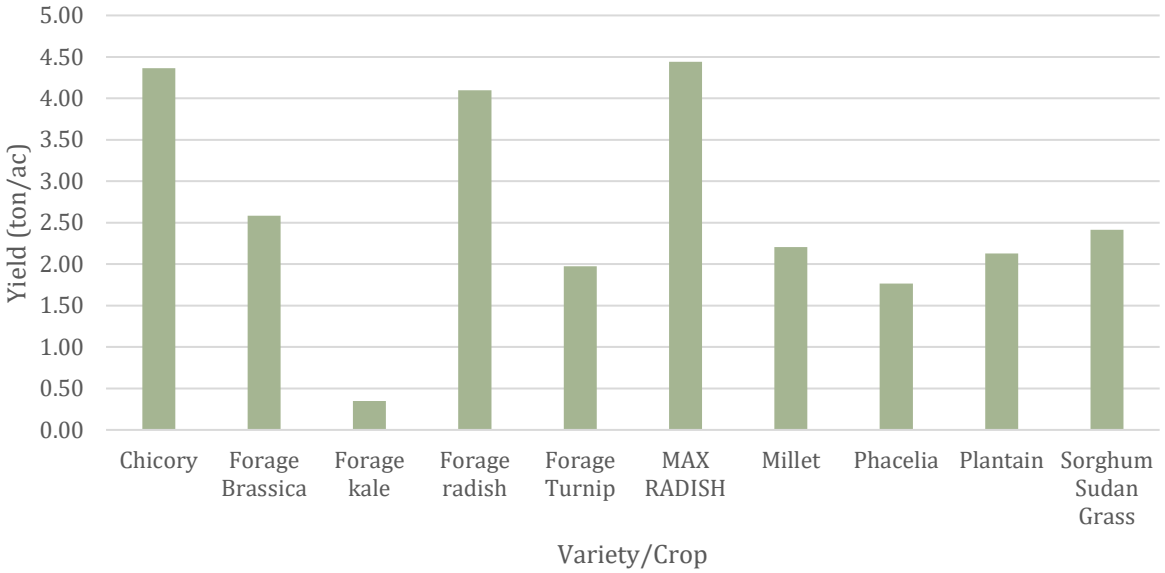


Figure 19. Yield at 65% moisture for Alternative Crops in the 2021 Regional Silage Trial in Lac Ste. Anne County

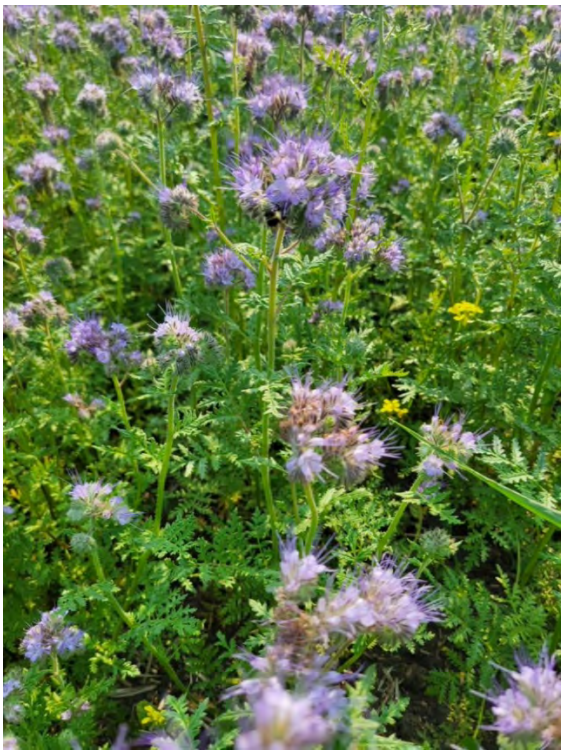


Figure 20. Phacelia in the 2021 Regional Silage Trial in Lac Ste. Anne County

Table 11. Feed quality results for Alternative crops in the 2021 Regional Silage Trial in Lac Ste. Anne County

Variety/Crop	CP (%)	ADF (%)	NDF (%)	TDN (%)	CA (%)	P (%)	K (%)	Mg (%)
Chicory	16.61	36.73	41.06	66.22	1.81	0.21	4.68	0.35
Forage Brassica	10.29	31.04	44.66	66.36	2.43	0.19	2.71	0.48
Forage kale	21.57	34.46	42.19	64.00	2.35	0.20	1.85	0.59
Forage radish	13.54	37.42	48.04	61.27	2.08	0.16	2.32	0.43
Forage Turnip	12.32	32.44	43.58	65.27	2.77	0.18	2.52	0.65
Max Radish	13.94	38.74	53.05	59.70	1.90	0.18	2.13	0.45
Millet	10.15	38.18	55.09	63.51	0.49	0.21	1.62	0.24
Phacelia	14.48	38.38	47.50	60.63	4.36	0.22	2.43	0.59
Plantain	13.28	36.63	51.87	60.11	2.43	0.19	2.39	0.29
Sorghum Sudan Grass	11.61	40.62	55.96	61.77	1.01	0.19	2.52	0.27

When considering Crude Protein (CP), the general rule of thumb is 7-9-11 percent for mid-gestation, late-gestation and after calving. All the alternative crops tested in 2021 are more than adequate to meet nutritional requirements through to after calving. Figure 20 shows the Crude Protein values in relation to the rule of thumb.

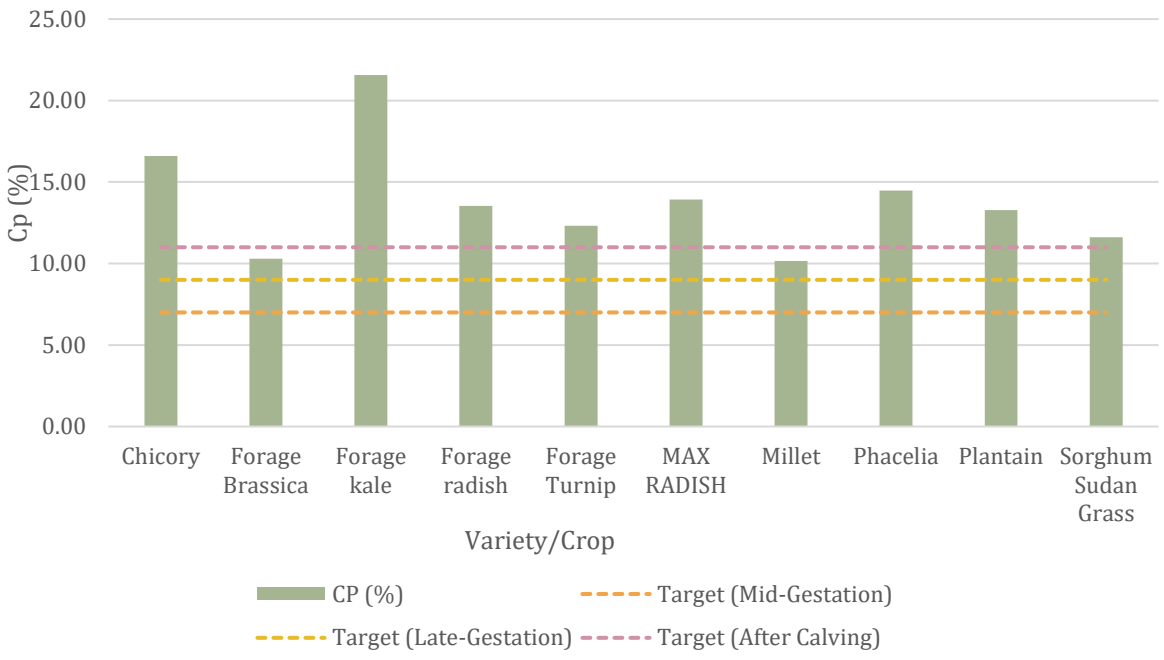


Figure 21. Crude Protein (CP) values for Alternative Crops in the 2021 Regional Silage Trial in Lac Ste. Anne County

Looking at Total Digestible Nutrients (TDN), an estimate of the energy value of the feed, the general rule of thumb is 55-60-65 for mid-gestation, late-gestation and after calving. The majority of the varieties are adequate to meet the requirements for mid gestation, but only Chicory and Forage Brassica would meet the requirements for after calving. Figure 21 shows the TDN values in relation to the rule of thumb.

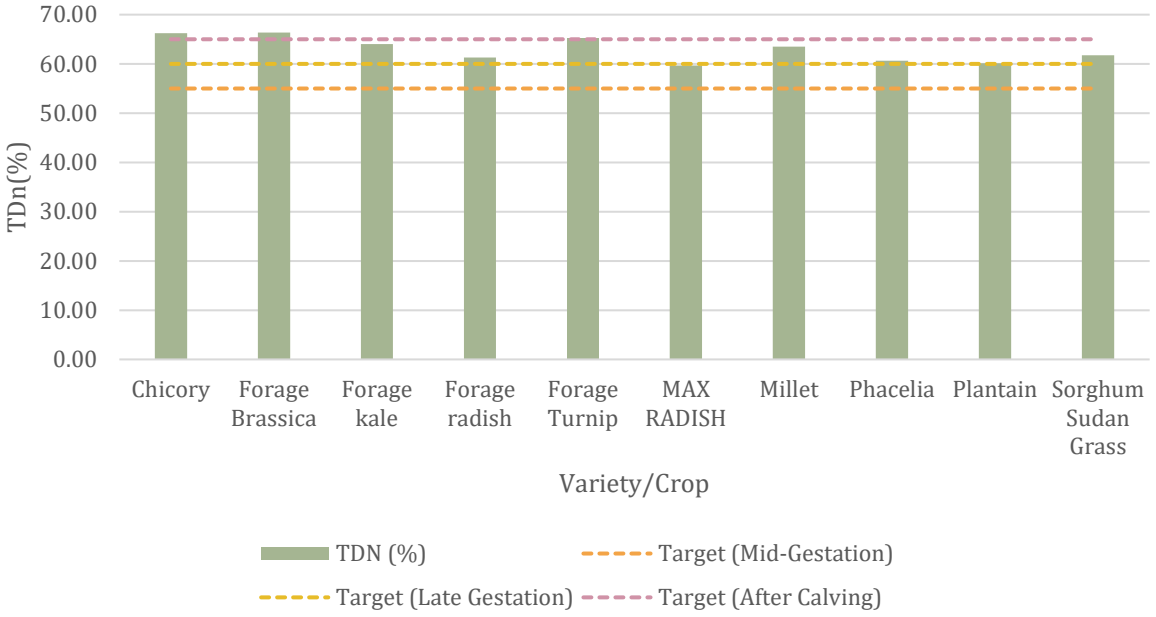


Figure 22. Total Digestible Nutrients (TDN) for Alternative Crops in the 2021 Regional Silage Trial in Lac Ste. Anne County

2021 CHTA National Industrial Hemp Variety Evaluation Trial

OVERVIEW

In order for Industrial hemp to be a profitable crop for Canadian farmers, it is important to understand which cultivars grow best in particular regions of Canada. Industrial hemp is highly regulated around the world. Limits to the amount of both THC and nonnarcotic cannabinoids (NNC) in hemp products require a constant understanding of the evolution of hemp cultivars being used by the hemp industry. To balance the regulations and the difficult task of growing Industrial hemp for profitable commercial purposes monitoring through scientific study and laboratory analysis is required. The Canadian Hemp Trade Alliance (CHTA) National Industrial Hemp Variety Evaluation Trials were designed to do exactly this. West-Central Forage Association has participated in the CHTA National Industrial Hemp Variety Evaluation Trial since 2018. By understanding which varieties have been cultivated to withstand growth conditions that are seen in our area, we can help producers to choose the best varieties for their fields. The CHTA National Industrial Hemp Variety Evaluation Trial is organized by James Frey of Manitoba Agriculture and Resource Development.

A  B 

Figure 23. A. Hemp seed head in 2021. B. Hemp at an earlier stage of maturity.

METHODS

Cultivars of industrial hemp in this study are separated into two types dependent upon their purposes. Grain hemp has been cultivated to provide a source of seed for use in the food industry and has the potential to be used in the forage industry, though this has yet to be permitted by the federal government. Dual purpose hemp has been cultivated to provide both grain and fiber for inclusion in products like pulp and textiles.

Table 12. Agronomic data for 2021 CHTA National Industrial Hemp Variety Evaluation Trial conducted in Brazeau County

Cultivar Type	# of Varieties	Seeding					Harvest Date		
		Date	Depth (in)	Soil Temp (°C)	Rate	Fertility	Grain	Fiber	NNC
Dual Purpose	6	22-Jun	1.5	11	150 lbs	None	N/A[1]	27-Sep	28-Sep
Grain [1]	3	22-Jun	1.5	11	150 lbs	None	N/A[1]	N/A[1]	N/A[1]

[1] Grain hemp was not harvested due to lack of plant maturation

For the 2021 research season nine varieties of dual-purpose hemp and three varieties of grain hemp were grown with the cooperation of Bart Guyon and Brazeau County. Plots were seeded on June 22nd and monitored for disease and weeds throughout the summer months. One week prior to harvest plants were measured for height and lodging. Lodging was assessed on a 1-5 scale with 1 being entirely erect and 5 laying on the ground. Yield and Nonnarcotic cannabinoids (NNC) samples were harvested from the dual-purpose hemp in late September 2021. Samples were not harvested from the grain hemp. It is common to wait until seeds have reached a moisture content of 10% before harvesting crops, however, the trial had been seeded later than expected; harvest did not occur before the grain hemp could reach the appropriate maturity. In addition, growing grain hemp to reach full maturity is difficult in the region, due to the temperatures, sunlight hours, and overall short growing season that Alberta has.

a  b 

Figure 24. (a) Hemp plots, June 2021. (b) Hemp plots, September 2021 in Brazeau County.

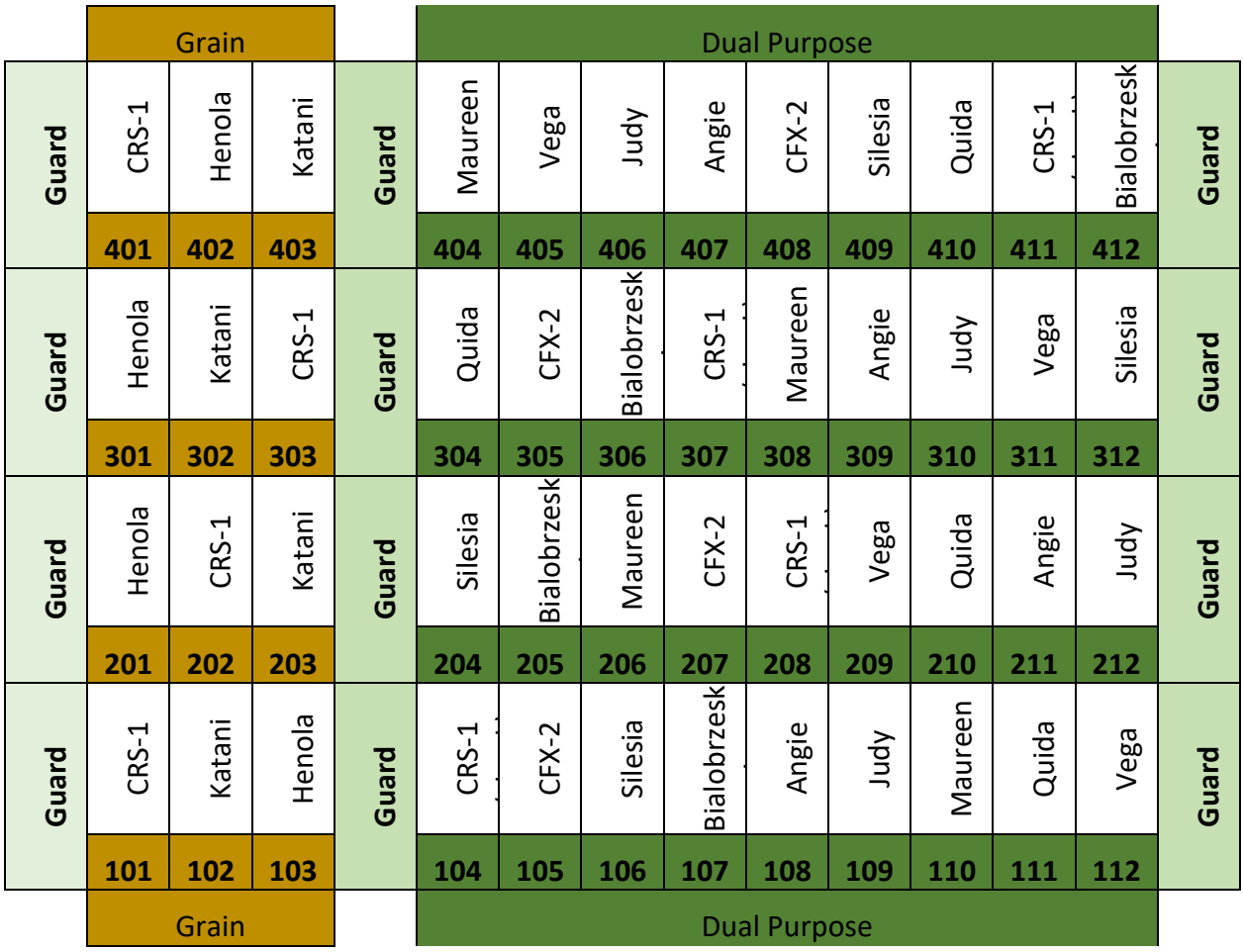


Figure 25. Plot arrangement for the 2021 CHTA National Industrial Hemp Variety Evaluation Trial in Brazeau County

PROGRESS TO DATE

2021 proved to be a challenging year for most producers in the West-Central region. Due to high temperatures and little precipitation through the majority of the growing season, soil moisture was considered low and the region's governing bodies declared drought. However, Industrial hemp does not tolerate water-logged conditions; the 2021 dry season may have provided some favorable conditions for growth when compared to the 2020 growing season. Air and soil temperatures and moisture readings were taken from the nearby Tomahawk weather station.

Variety Comparison

Due to late planting and Alberta's conditions, the grain varieties were unable to reach maturity and develop grain; no harvest samples were retrieved. It is also important to note that two rows of grain hemp were impacted by an aphid infestation and there were plot failures and some emergence issues in a few rows of the dual-purpose hemp. Dual-purpose varieties of industrial hemp scored higher in vigor and height than the grain varieties; indicating dual-purpose varieties perform better in the West-Central region. Average heights of the dual-purpose crop were nearing six feet and grain hemp averaged near five feet. Lodging occurred to some degree on

most dual-purpose varieties, most likely on account of their height, with the largest plant measurement reaching close to eight feet tall.

Table 13. Results for comparison of average growth metrics for Grain and Dual-purpose varieties in the 2021 CHTA National Industrial Hemp Variety Evaluation Trial in Brazeau County

Measured Parameter	Average Vigor Rating (1-10)	Average Plant height (in)	Average Lodging rating (1-5)[1]	Average Male to Female ratio (M:F)
Dual Purpose Varieties	8	70.65	1.51	0.66
Grain Varieties	6	57.64	1.42	0.78

[1] Lodging assessed on 1-5 scale where 1 is erect and 5 is completely flat

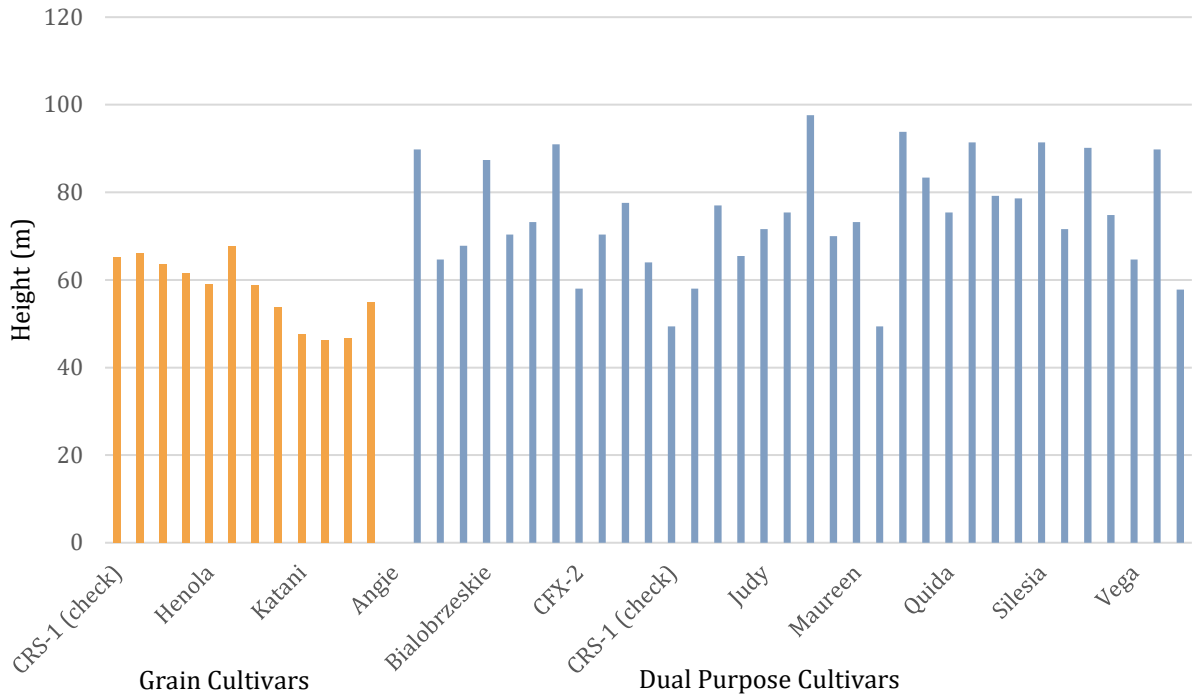


Figure 26. Comparison of heights between the 2021 Industrial Hemp varieties in the CHTA National Industrial Hemp Variety Evaluation Trial in Brazeau County

Grain

The establishment of the grain hemp was relatively similar among many varieties, with the exception of the plots affected by an aphid infestation. The 2021 crop of grain varieties was much smaller than that of the dual-purpose varieties; lodging was minimal on most varieties of grain hemp. The cultivars CRS-1 and Henola outperformed the Katani variety in height and vigour.

Table 14. Results for grain varieties in the CHTA National Industrial Hemp Variety Evaluation Trial conducted in Brazeau County

Variety	Lodging (1-5)[1]	Height (in)	Vigor rating (1-10)
CRS-1*Check	2	64	7
Henola	1	60	7
Katani	1	49	5

1 Lodging assessed on 1-5 scale where 1 is erect and 5 is completely flat

Dual Purpose

In the 2021 trial, above-ground biomass, stem biomass, and other materials such as leaves and seeds were measured for yield in dry weights. Between dual-purpose varieties; the highest yielding plants were from Bialobrzeskie, while the lowest yielding plants were from the CRS-1 cultivars. It was noted that there were great variances within the cultivars still which could be attributed to a range of soil conditions and fertility within the plots.

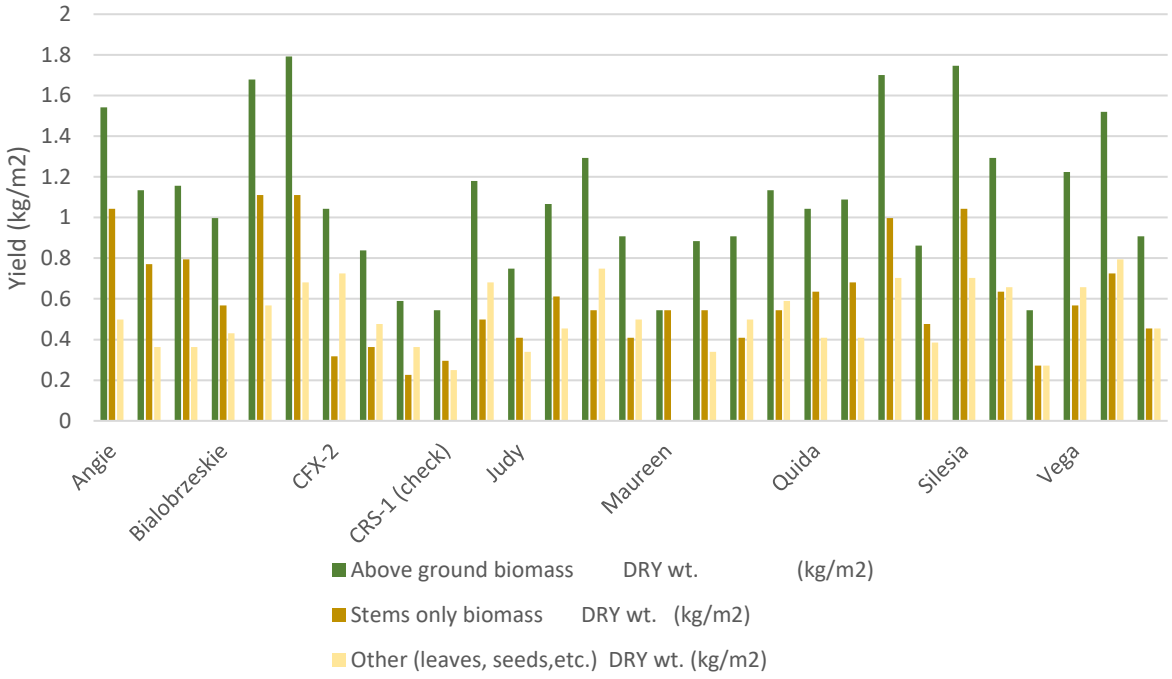


Figure 27. Comparison of yield for dual-purpose varieties in the CHTA National Industrial Hemp Variety Evaluation Trial in Brazeau County

FUTURE WORK

Though the purpose of each type of cultivar is different, the dual-purpose varieties outperformed the grain hemp varieties in height and establishment. The grain hemp varieties produced thinner smaller stalks, indicating it a more suitable crop for forage. If hemp's use as a forage crop is permitted in the future by regulatory bodies, grain hemp may be a worthwhile addition to forage

mixes. Establishment numbers were better for some varieties of the dual-purpose than for others but did well considering the hot and dry conditions that occurred in the season.

The Canadian Hemp Trade Alliance National Industrial Hemp Variety Evaluation trials will continue in 2022; WCFA members and producers indicated great interest in Industrial hemp trials and so there will be continued trialling of Industrial hemp in the West-Central region. While there was still limited ability to hold extension events in 2021 due to Covid-19 restrictions, West-Central Forage is hoping more of these events will be held in 2022. The CHTA research plots are open to the public for viewing regardless of planned events. Additional information on the CHTA Industrial Hemp Variety Trails can be made available upon request.

2021 Evaluation of Perennial Forage Mixes for Hay or Pasture

This project is supported by the Canadian Agriculture Partnership (CAP) Adapting Innovative Solutions in Agriculture Program (now managed by RDAR).

OVERVIEW

This project is intended to provide information on mixes of a number of perennial grass and legume species and varieties. Mixtures will be compared to select pure grass and legume stands.

Mixes have not traditionally been studied in past perennial forage trials, even though most hay and pasture stands throughout Alberta are a multi-species combination.

Establishment, yield and quality information collected during this trial will aid producers in selecting perennial forage stands with higher production and nutritional potential.

Partners

- Battle River Research Group (BRRG)
- Chinook Applied Research Association (CARA)
- Farming Smarter (FS)
- Gateway Research Organization (GRO)
- Lakeland Agricultural Research Association (LARA)
- Mackenzie Applied Research Association (MARA)
- North Peace Applied Research Association (NPARA)
- Peace Country Beef and Forage Association (PCBFA)
- SARDA Ag Research

METHODS

In 2020 sowing of 4 blocks of legumes (Alfalfa, Sainfoin, and Cicer milkvetch), grasses, and mixtures (legumes and grasses) at the Wildwood Plots donated by Yellowhead County occurred in late July. Emergence counts were done at 7-, 14-, and 21-days post seeding and 1st season mortality at 70 days. Counts are done by placing a 0.25m^2 frame at three spots on the plot and each plant or grass blade inside the square is counted. Technicians used flags to mark out the corners of each square so that the same sample area was counted throughout the growing season. The plant count for each in the report is an average of all 12 sample plots for each variety. For grasses, blades were counted rather than plants. Since several varieties of grass were used it is helpful to use density as a visualization tool.

Perennial Forage Varieties

Alfalfa

- *2010 Alfalfa*: highly adaptable, will perform well across variable land
- *AC Grazeland:* bloat reduced variety, very good quality
- *AC Yellowhead:* improved winter hardiness, adapted to prairie provinces
- *Assalt ST Alfalfa*: tolerant to high pH soils
- *AC Dalton:* good productivity and winter hardiness
- *Halo:* salt tolerant variety, good yield potential
- *Halo 2:* excellent salinity tolerance, high yield potential
- *Phabulous:* multifoliate variety
- *PV Parlour HG*: improved fibre digestibility, high leaf to stem ratio, more crude protein
- *PV Ultima:* top yielding, fast regrowth, winter hardiness
- *Rambler:* creeping rooted
- *Rangelander:* high forage yielding, productive under limited rainfall
- *Rugged:* very hardy, salt tolerant
- *Spyder Alfalfa*: strong dormancy, excellent winter hardiness
- *Spredor 4*: high yielding, creeping rooted
- *Spredor 5*: creeping variety, exceptional persistence

Sainfoin and Cicer Milkvetch

- AAC Glenview: sainfoin; non-bloating legume, higher yields than Nova
- *AC Mountainview:* sainfoin; non-bloating legume, persistent with rapid regrowth to keep up with alfalfa
- *AC Oxley II*: cicer milkvetch; non-bloating legume, ideal pasture legume
- *Veldt:* cicer milkvetch; non-bloating legume, well suited for pasture and hay production

Grass

- *AC Admiral:* meadow bromegrass, very winter hardy, good drought tolerance
- *AC Knowles*: meadow/smooth brome hybrid, suited for hay and pasture, good drought tolerance
- *AC Saltlander:* green wheatgrass, high salinity tolerance
- *AC Success:* hybrid bromegrass, good performance under drier conditions
- *Blizzard:* orchardgrass, suited for pasture, not very drought tolerant
- *Cache:* meadow bromegrass, suited for pasture, good drought tolerance
- *Courtney:* tall fescue, good flood and saline tolerance
- *Fleet:* meadow bromegrass, excellent pasture variety with good winter hardiness
- *Greenleaf:* pubescent wheatgrass, good seeding vigour and establishment
- *Grindstad:* timothy, reliable dual purpose for hay and pasture
- *AC Killarney:* orchardgrass, selected for persistence, productivity and winter hardiness
- *Kirk:* crested wheatgrass, good drought tolerance and winter hardiness

A number of mixtures utilizing various combinations of these varieties are also being evaluated.

PROGRESS TO DATE

For the 2020 season the seeding of the perennial forages trial was late and the conditions of the winter included low snow pack and significant temperature swings; this led trial coordinators to believe that the forages may not survive the winter leading into 2021. Despite these conditions, spring plant counts were promising with most forage types having high survival rates.

The 2021 growing season conditions throughout the area were dry with very low precipitation. The first cut for these forages was taken during a heatwave in late June. In an attempt to keep the forage plots alive no additional cuts were taken.

Despite the conditions, all forage plots were alive and had increased in plant density by late fall. All alfalfa, grasses, and mixed grass and legume plots had shown increases in density as well. Results were poor with regard to yield during the time of harvest. Weed coverage was fairly high for all plots. It is difficult to determine if feed and nutritional values are on account of varietal difference of each forage type or the high percentage of weeds on the plots.

Note about reported results: no statistical analysis was performed, therefore there is no indication as to whether or not differences between varieties are of significance.

Alfalfa

In 2021 the average establishment of alfalfa across varieties was 43 plants per sample plot; with the most established variety being AC Grazeland, while the lowest being Halo 2 (Figure 27).

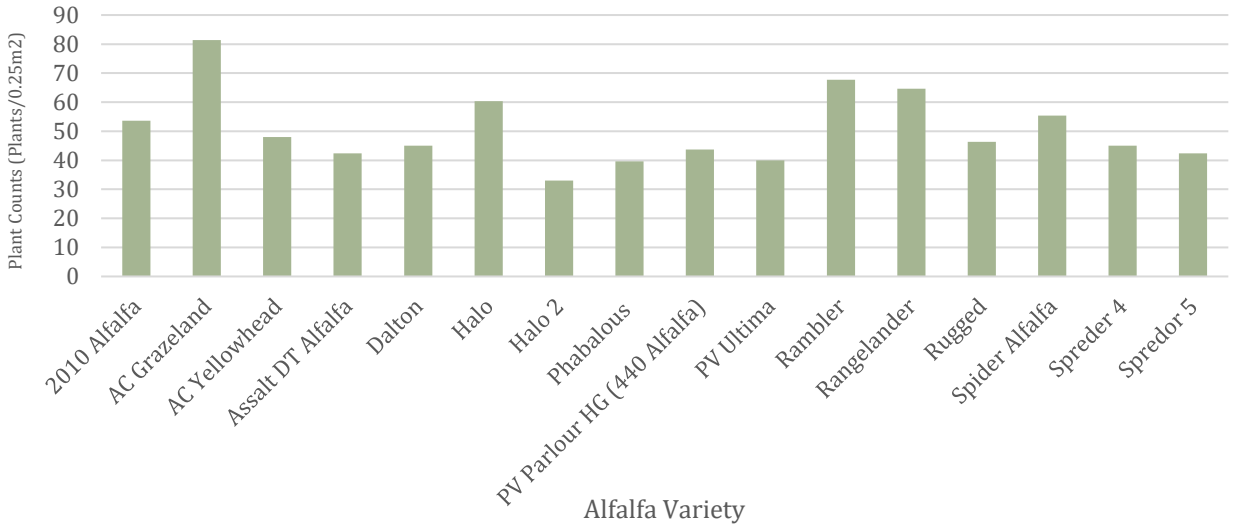


Figure 28. Alfalfa established plant counts in the 2021 Evaluation of Perennial Forages Mixes for Hay or Pasture Trial in Yellowhead County

The emergence plant count data shows no correlation between plant density per meter squared at emergence and the total yield of the plot. In 2021 for the Alfalfa plots the highest average yield was reached by the variety Rugged and the lowest by Spyder Alfalfa (Table 15).

Table 15. Alfalfa variety plant heights, growth stages, and dry weight yields in the 2021 Evaluation of Perennial Forages Mixes for Hay or Pasture Trial on June 28, 2021

Variety	Dry Yield (lbs/ac)	Height (cm)	Stage
2010 Alfalfa	792.99	18.70	Full
AC Grazeland	714.41	15.00	Full
AC Yellowhead	530.60	17.00	Mid bloom
Assalt ST Alfalfa	648.22	21.33	Full
Dalton	552.18	11.33	Mid bloom
Halo	924.62	17.00	Full
Halo 2	644.68	12.66	Mid
Phabulous	629.43	16.00	Full
PV Parlour HG (440 Alfalfa)	690.13	22.00	Full
PV Ultima	493.95	19.00	Full
Rambler	555.73	18.33	Full/mid. Equally half
Rangelander	678.68	22.66	Full
Rugged	943.48	12.00	Early
Spyder Alfalfa	420.42	14.00	Full
Spreder 4	603.19	16.66	Late
Spredor 5	624.34	16.00	Full

Relative feed values (RFV), which estimates intake and digestibility, ranged from 102 to 135, all of which are within normal and would meet animal requirements for energy. Poorer yields were achieved by varieties that had higher nutritional value (Table 16).

Table 16. Feed quality results for Alfalfa varieties in the 2021 Perennial Forage Trial in Yellowhead County

Variety	CP (%)	ADF (%)	NDF (%)	TDN (%)	CA (%)	P (%)	K (%)	MG (%)	RFV
2010 Alfalfa	15.9	36.8	50.5	62.3	1.1	0.1	1.9	0.2	112.3
AC Grazeland	14.9	38.1	50.3	60.9	1.2	0.1	1.8	0.3	109.9
AC Yellowhead	15.1	36.8	49.3	62.1	1.2	0.1	1.7	0.3	114.0
Assalt ST Alfalfa	17.3	36.3	47.2	62.6	1.4	0.2	2.4	0.3	119.6
Dalton	14.6	37.6	47.4	62.3	1.3	0.1	1.7	0.3	117.2
Halo	15.6	37.3	49.6	62.3	1.1	0.1	2.1	0.2	112.7
Halo 2	15.6	37.6	50.9	61.6	1.2	0.1	1.9	0.2	109.5

Variety	CP (%)	ADF (%)	NDF (%)	TDN (%)	CA (%)	P (%)	K (%)	MG (%)	RFV
Phabulous	16.1	36.6	48.1	62.0	1.4	0.2	1.6	0.3	117.7
PV Parlour HG (440 Alfalfa)	15.0	39.6	50.0	59.9	1.3	0.1	1.9	0.2	108.4
PV Ultima	15.8	37.4	48.1	61.0	1.2	0.2	1.7	0.3	115.8
Rambler	14.5	37.6	49.6	61.9	1.2	0.1	1.7	0.2	112.4
Rangelander	15.3	38.3	49.4	61.1	1.2	0.1	1.8	0.2	111.7
Rugged	14.5	38.4	49.2	61.3	1.1	0.1	1.7	0.2	111.8
Spyder Alfalfa	14.9	36.4	46.5	62.7	1.2	0.1	1.7	0.3	121.4
Spreder 4	15.3	37.1	49.7	61.9	1.1	0.1	1.7	0.2	112.9
Spredor 5	15.4	37.6	47.0	62.1	1.2	0.1	1.9	0.3	119.1

When considering Crude Protein (CP), the general rule of thumb is 7-9-11 percent for mid-gestation, late-gestation and after calving. All alfalfa varieties in 2021 have adequate Crude Protein to meet the nutrient requirements through to after calving. Figure 28 shows the Crude Protein values in relation to the rule of thumb.

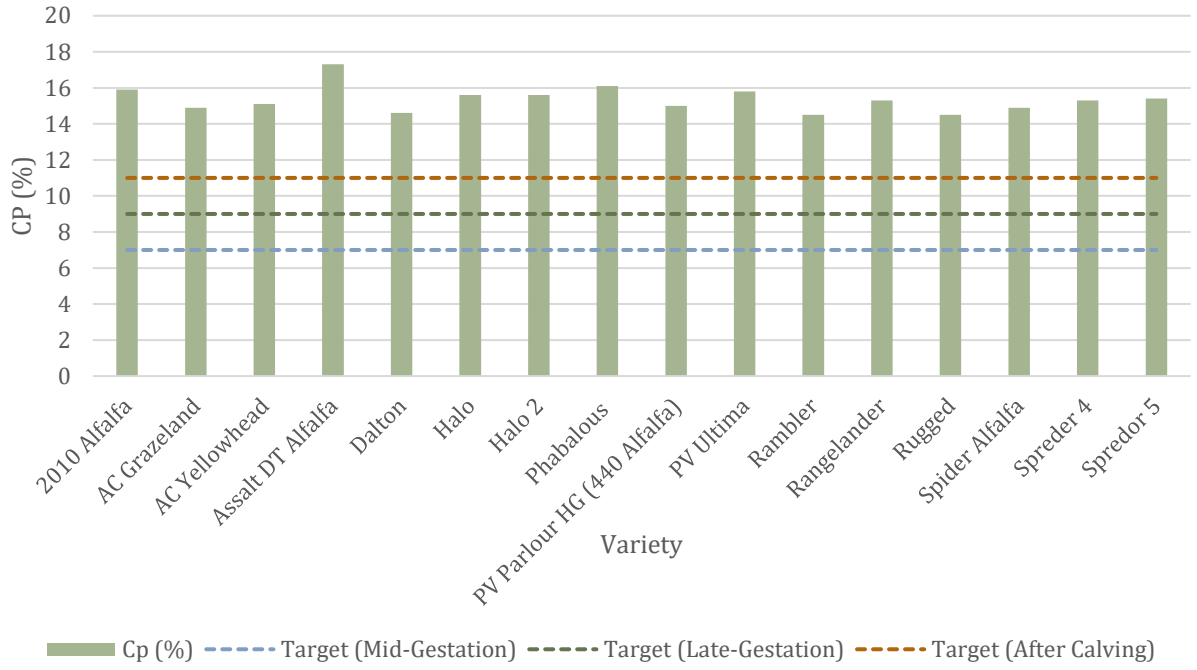


Figure 29. Crude Protein (CP) values for Alfalfa varieties in the 2021 Regional Silage Variety Trial in Yellowhead County

Looking at Total Digestible Nutrients (TDN), an estimate of the energy value of the feed, the general rule of thumb is 55-60-65 for mid-gestation, late-gestation and after calving. The majority of the varieties are adequate to meet the requirements for mid to late gestation, but almost none of the varieties have adequate TDN to meet after calving requirements. Figure 29 shows the TDN values in relation to the rule of thumb.

Figure 30. Total Digestible Nutrients (TDN) for Alfalfa varieties in the 2021 Perennial Forage Trial in Yellowhead County

Sainfoin and Cicer Milkvetch

In 2020 sainfoin and cicer milkvetch establishment occurred but was sparse overall. In early 2021 it was noted all sainfoin and cicer milkvetch plots had failed. Weed amounts varied from 50%-100%, with 11 plots out of 16 having 80% or higher weed coverage.

By the end of the season all plots had significantly increased in forage variety coverage. The AAC Glenview had decreased in establishment (Figure 30), while the other varieties had better establishment.

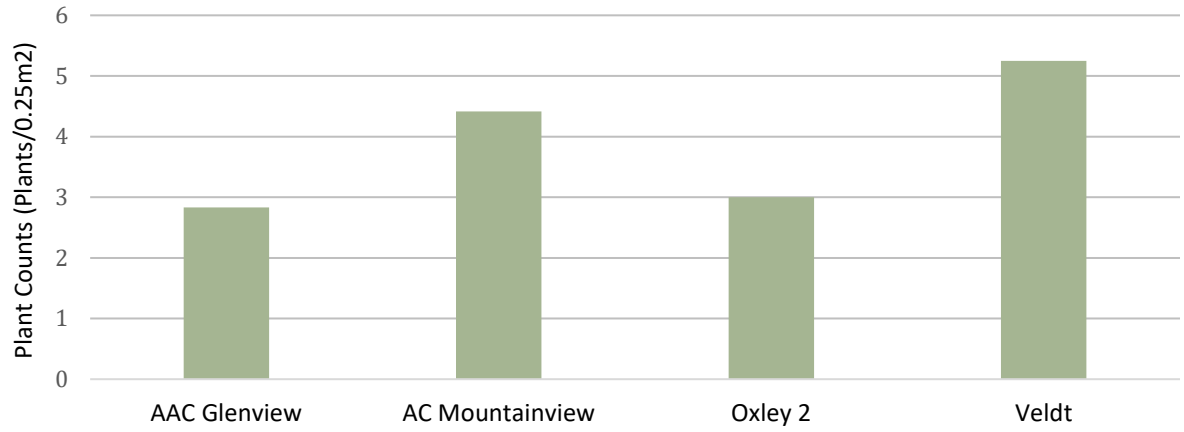


Figure 31. Sainfoin and Cicer Milkvetch established plant counts 2021 Evaluation of Perennial Forages Mixes for Hay or Pasture Trial in Yellowhead County

Table 17. Physical characterstics of Sainfoin and Cicer Milkvetch varieties in the 2021 Perennial Forage Trial in Yellowhead County

Variety	Dry Yield (lbs/ac)	Maturity	Height (cm)
AAC Glenview	163.75	Full Bloom	14.50
AC Mountainview	73.88	Full Bloom	22.58
Oxley 2	56.33	Full Bloom	10.67
Veldt	45.25	Full Bloom	14.92

Next field season it may be possible to take 2 cuts at higher yields, dependent upon environmental conditions.

Table 18. Feed quality results for Sainfoin and Cicer Milkvetch varieties in the 2021 Perennial Forage Trial in Yellowhead County

Variety	CP (%)	ADF (%)	NDF (%)	TDN (%)	CA (%)	P (%)	K (%)	MG (%)
AAC Glenview	13.02	36.62	47.95	61.91	1.04	0.11	1.52	0.35
AC Mountainview	14.87	36.72	46.31	62.59	1.09	0.14	2.16	0.32
Oxley 2	15.18	35.99	43.275	64.60	1.14	0.13	2.27	0.33
Veldt	14.99	35.51	46.89	62.93	1.09	0.13	2.18	0.33

When considering Crude Protein (CP), the general rule of thumb is 7-9-11 percent for mid-gestation, late-gestation and after calving. All Sainfoin and Cicer Milkvetch varieties have

adequate Crude Protein to meet the nutrient requirements through to after calving. Figure 31 shows the Crude Protein values in relation to the rule of thumb.

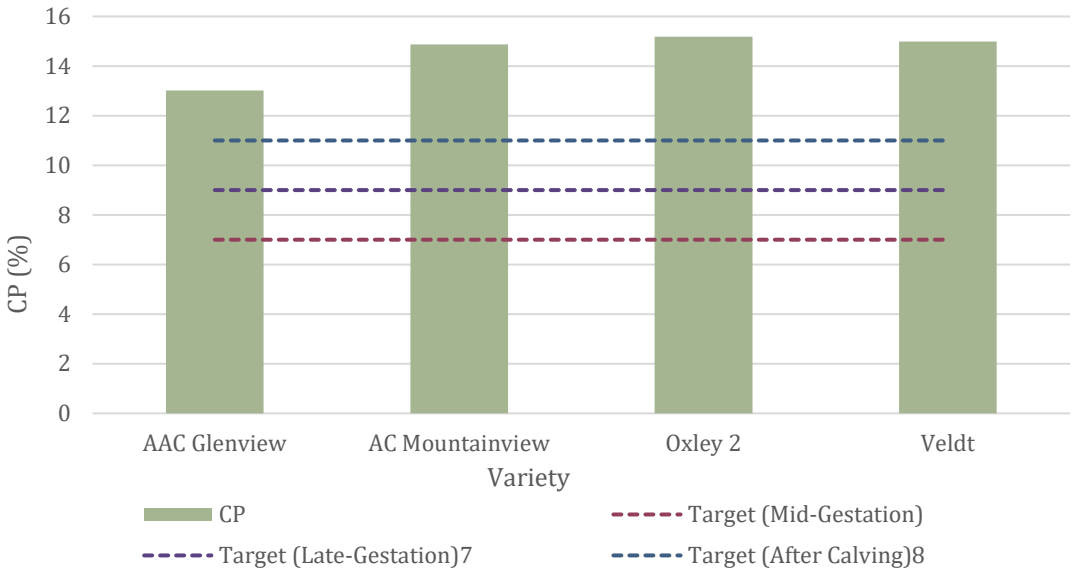


Figure 32. Crude Protein (CP) values for Sainfoin and Cicer Milkvetch Varieties in the 2021 Perennial Forage Trial in Yellowhead County

Looking at Total Digestible Nutrients (TDN), an estimate of the energy value of the feed, the general rule of thumb is 55-60-65 for mid-gestation, late-gestation and after calving. The majority of the varieties are adequate to meet the requirements for mid to late gestation, but almost none of the varieties have adequate TDN to meet after calving requirements, although Oxley comes close. Figure 32 shows the TDN values in relation to the rule of thumb.

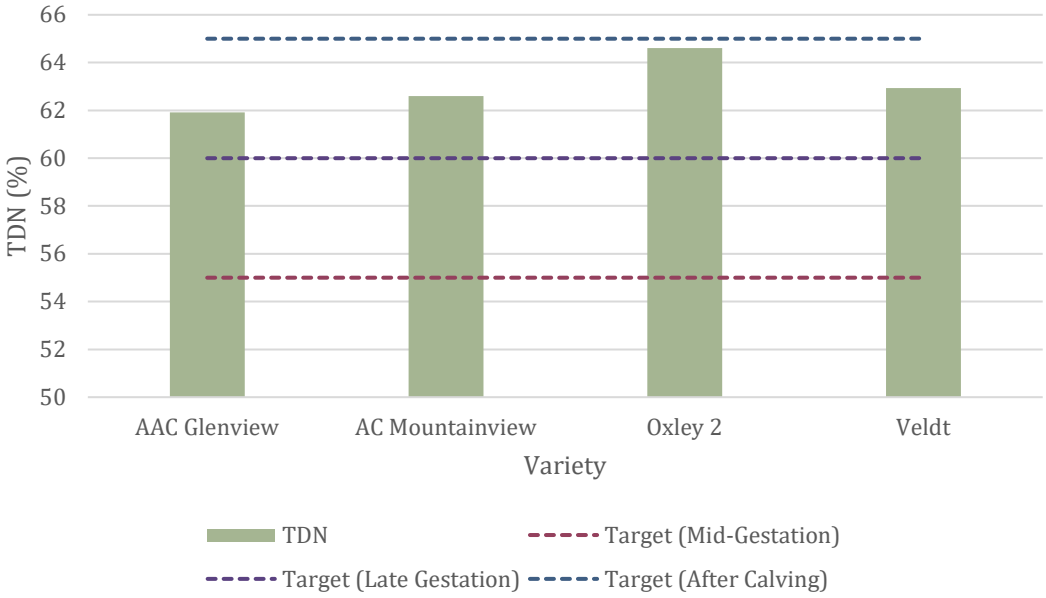


Figure 33. Total Digestible Nutrients for Sainfoin and Cicer Milkvetch Varieties in the 2021 Perennial Forage Trial in Yellowhead County

Mixes

In the 2020 season the mixes saw an average decrease in the amount of plants surviving throughout the early fall season. In 2021 there was progress made, and a successful harvest was completed. The mix highest average yield was Mix 12 and the lowest, Mix 8 (Table 19). There was some correlation between emergence plant counts and harvest yield of the Mixes. Mix 8 had the lowest average yield and the second lowest average number of plants per square meter at emergence counts, while Mix 12 had the 3rd highest average number of plants per square meter for emergence counts.

Table 19. Mixture composition and dry yield (lbs./ac) for Perennial Forage Mixtures in the 2021 Perennial Forage Variety Trial in Yellowhead County

Mix #	Variety in Mix Details				Dry Yield (lbs./ac)
Mix 1	Fleet Meadow Brome	AC Yellowhead			378.42
Mix 2	AC Success Hybrid Brome	AC Yellowhead			309.10
Mix 3	AC Knowles Hybrid Br	AC Yellowhead			422.43
Mix 4	Fleet Meadow Brome	Spredor 5			504.36
Mix 5	AC Success Hybrid Brome	Spredor 5			469.02
Mix 6	AC Knowles Hybrid Br	Spredor 5			10.60
Mix 7	Fleet Meadow Brome	AC Yellowhead Alfalfa	AC Mountainview Sainfoin		555.43
Mix 8	AC Success Hybrid Brome	AC Yellowhead Alfalfa	AC Mountainview Sainfoin		271.44
Mix 9	Fleet Meadow Brome	AC Yellowhead Alfalfa	AC Mountainview Sainfoin	Veldt Cicer Milk Vetch	424.84
Mix 10	AC Success Hybrid Brome	AC Yellowhead Alfalfa	AC Mountainview Sainfoin	Veldt Cicer Milk Vetch	563.09
Mix 11	Fleet Meadow	Greenleaf Pubescent WG	AC Yellowhead Alfalfa		601.09
Mix 12	AC Success Hybrid Brome	Greenleaf Pubescent WG	AC Yellowhead Alfalfa		949.37
Mix 13	Salinemaster				491.75
Mix 14	Legumeaster				635.93

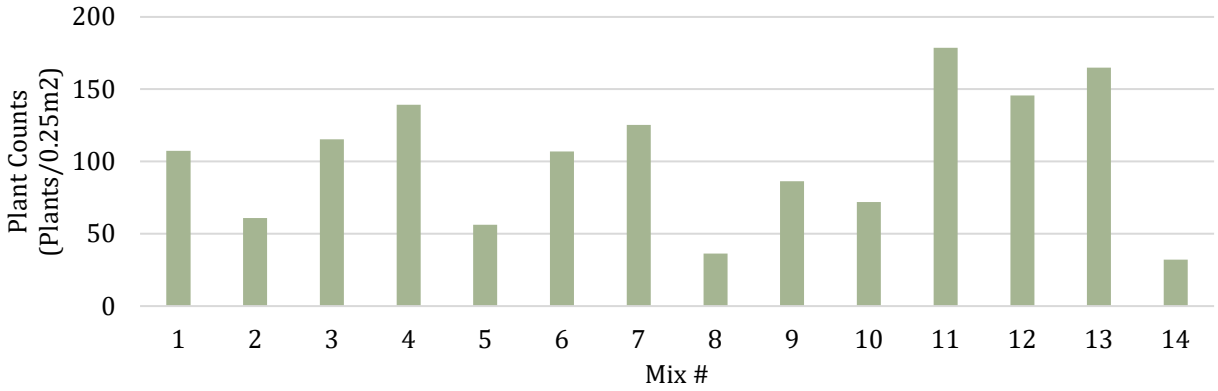


Figure 34. Mix variety established plant counts in the 2021 Evaluation of Perennial Forages Mixes for Hay or Pasture Trial in Yellowhead County

Table 20. Dry Yield Comparison for Mixes in the 2021 Evaluation of Perennial Forages Mixes for Hay or Pasture Trial

Mix Number	CP (%)	ADF (%)	NDF (%)	TDN (%)	CA (%)	P (%)	K (%)	MG (%)
Mix 1	16.47	35.83	51.24	65.25	0.79	0.11	2.08	0.23
Mix 2	17.25	36.09	50.19	62.58	0.90	0.10	1.60	0.22
Mix 3	15.75	35.68	51.99	64.48	0.70	0.10	1.74	0.19
Mix 4	15.77	35.66	49.69	64.67	0.86	0.09	1.94	0.21
Mix 5	18.43	36.51	49.10	62.02	1.32	0.12	2.05	0.26
Mix 6	15.78	36.66	50.81	62.81	1.08	0.11	2.01	0.22
Mix 7	16.58	36.30	49.05	64.00	0.77	0.10	2.12	0.22
Mix 8	16.38	38.30	51.61	60.87	0.83	0.11	1.75	0.24
Mix 9	16.77	34.89	49.34	65.10	0.76	0.09	2.02	0.22
Mix 10	14.13	39.12	53.08	61.43	0.76	0.12	1.83	0.21
Mix 11	14.03	37.73	53.13	62.57	0.63	0.11	1.99	0.16
Mix 12	15.07	38.00	53.33	61.34	0.66	0.14	1.99	0.17
Mix 13	14.08	36.88	53.49	63.89	0.44	0.09	1.89	0.12
Mix 14	19.59	35.24	47.30	61.69	1.57	0.12	1.85	0.30

When considering Crude Protein (CP), the general rule of thumb is 7-9-11 percent for mid-gestation, late-gestation and after calving. All of the perennial forage mixtures evaluated had Crude Protein levels that were more than adequate through to after calving. Crude Protein values for all mixes was significantly higher than in pure stands. Figure 34 shows the Crude Protein values in relation to the rule of thumb.

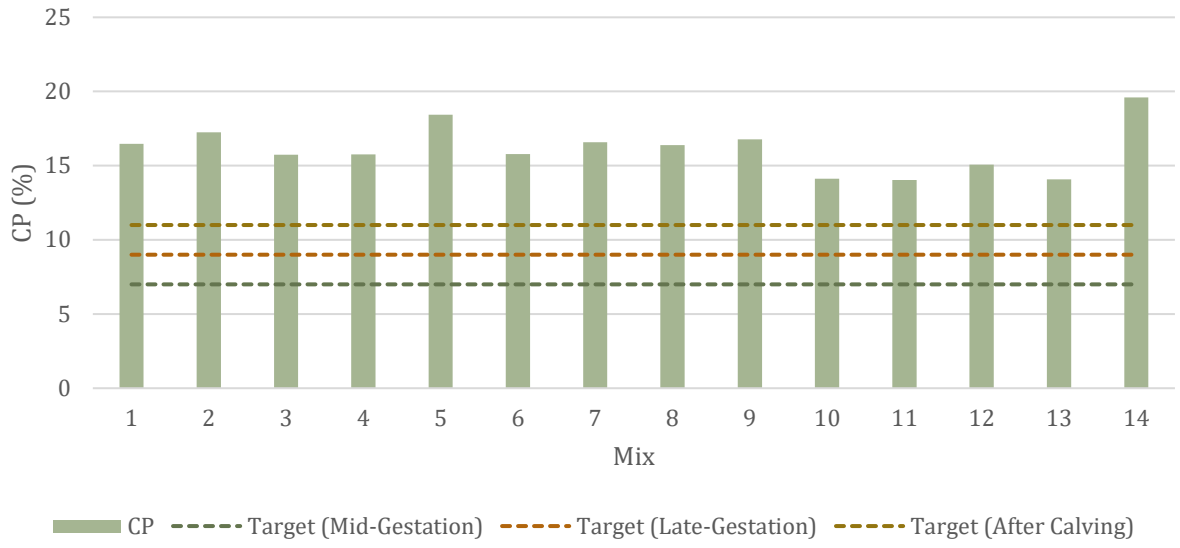


Figure 35. Crude Protein (CP) values for Perennial Forage Mixes in the 2021 Perennial Forage Trial in Yellowhead County

Looking at Total Digestible Nutrients (TDN), an estimate of the energy value of the feed, the general rule of thumb is 55-60-65 for mid-gestation, late-gestation and after calving. The majority of the mixes are adequate to meet the requirements for mid to late gestation, but very few have adequate TDN to meet after calving requirements. Figure 35 shows the TDN values in relation to the rule of thumb.

Figure 36. Total Digestible Nutrients (TDN) for Perennial Forage Mixes in the 2021 Perennial Forage Trial in Yellowhead County

Grasses

In 2020 most grasses did not show loss over the season but rather an increase in density. In 2021 For the Grass plots the highest average yield was reached by the variety AC Success and the

lowest by Killarney. There was a little correlation between plant density at spring emergence with Killarney also having the lowest density of plants per square meter, though AC Success was on the lower end of the density range for its spring emergence count despite showing the highest yield. The highest and lowest values being held by moderate yield producing varieties Greenleaf and Courtney respectively.

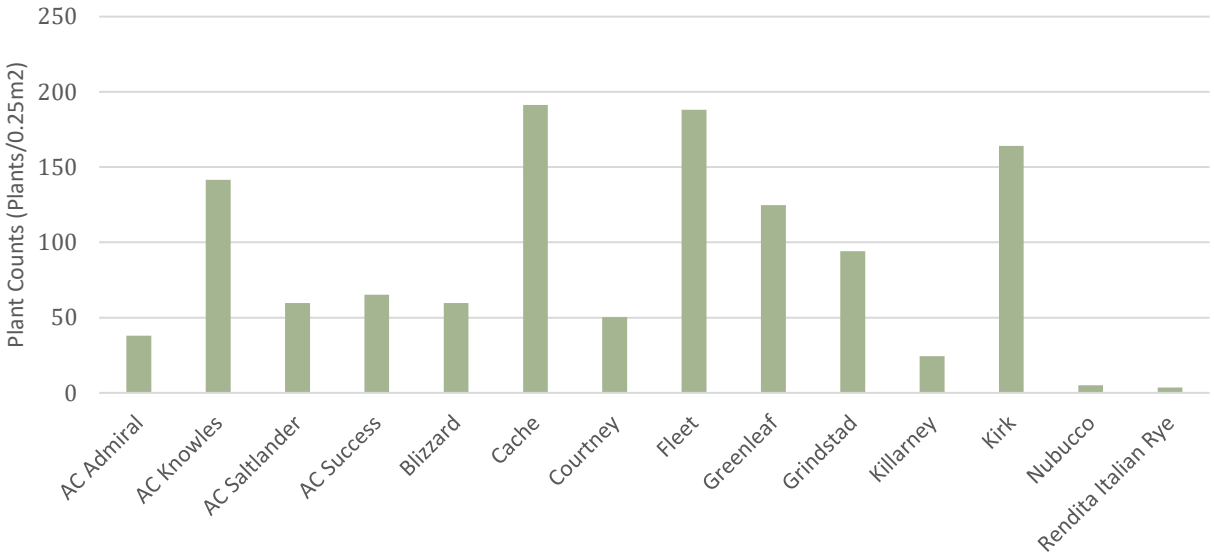


Figure 37. Established grass plant counts in the 2021 Evaluation of Perennial Forages Mixes for Hay or Pasture Trial in Yellowhead County

AC Success was on the lower end of the density range for its spring emergence count despite showing the highest yield. In 2021 For the grass plots the highest average yield was reached by the variety AC Success and the lowest by Killarney (Table 21).

Table 21. Plant heights, maturity and dry yield for Grass Varieties in the 2021 Perennial Forage Trial in Yellowhead County

Variety	Height (cm)	Maturity	Dry Yield (lbs/ac)
AC Admiral	29.04	No Bloom	555.71
AC Knowles	42.42	Full Bloom	955.35
AC Saltlander	32.29	Full Bloom	743.46
AC Success	37.96	Full Bloom	992.28
Blizzard	18.75	No Bloom	737.19
Cache	38.00	Full Bloom	853.05
Courtney	22.13	Early Bloom	683.35
Fleet	39.25	Full Bloom	943.60
Greenleaf	34.04	Early Bloom	704.49

Variety	Height (cm)	Maturity	Dry Yield (lbs/ac)
Grindstad	28.21	Full Bloom	982.45
Killarney	13.42	No Bloom	405.26
Kirk	33.92	No Bloom	809.74
Nubucco	N/A*	N/A*	N/A*
Rendita Italian Rye	N/A*	N/A*	N/A*

*indicates plot failure

Table 22. Feed quality results for Grass varieties in the 2021 Perennial Forage Trial in Yellowhead County

Variety	CP (%)	ADF (%)	NDF (%)	TDN (%)	CA (%)	P (%)	K (%)	MG (%)
AC Admiral	12.70	39.83	51.72	59.46	0.92	0.14	1.75	0.24
AC Knowles	13.87	38.09	54.11	62.10	0.61	0.13	1.98	0.17
AC Saltlander	14.13	37.83	52.02	61.21	0.71	0.13	1.88	0.19
AC Success	13.56	39.42	52.64	59.58	0.70	0.14	1.79	0.20
Blizzard	13.44	39.74	52.29	61.08	0.69	0.14	2.26	0.22
Cache	13.32	37.08	52.58	63.69	0.63	0.12	1.94	0.17
Courtney	12.96	39.23	48.55	61.39	0.80	0.14	1.87	0.22
Fleet	13.23	38.99	52.08	60.56	0.81	0.12	1.76	0.21
Greenleaf	13.01	38.36	54.38	61.58	0.50	0.14	1.91	0.14
Grindstad	13.34	38.27	52.59	61.06	0.73	0.15	1.84	0.21
Killarney	15.09	38.06	49.26	61.07	0.88	0.18	1.85	0.27
Kirk	13.23	37.69	52.15	62.30	0.64	0.13	1.73	0.19

When considering Crude Protein (CP), the general rule of thumb is 7-9-11 percent for mid-gestation, late-gestation and after calving. All of the grass varieties evaluated had Crude Protein levels that were more than adequate through to after calving. Figure 39 shows the Crude Protein values in relation to the rule of thumb.

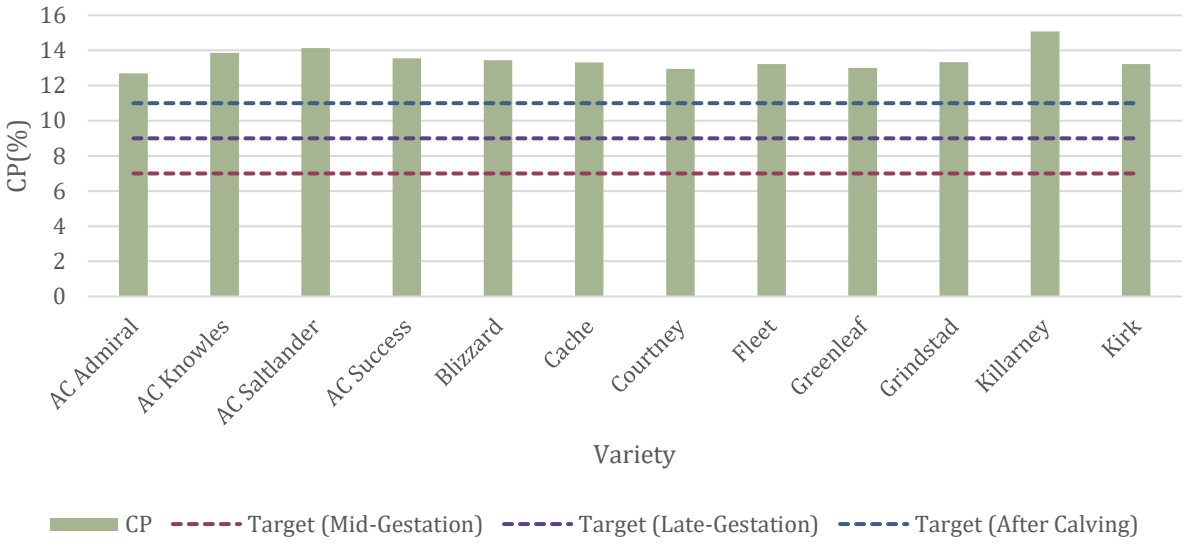


Figure 38. Crude Protein (CP) values for Grass Varieties in the 2021 Perennial Forage Trial in Yellowhead County

Looking at Total Digestible Nutrients (TDN), an estimate of the energy value of the feed, the general rule of thumb is 55-60-65 for mid-gestation, late-gestation and after calving. The majority of the mixes are adequate to meet the requirements for mid-gestation, fewer meet the requirements for late-gestation, and almost none have adequate TDN to meet after calving requirements. Figure 40 shows the TDN values in relation to the rule of thumb.

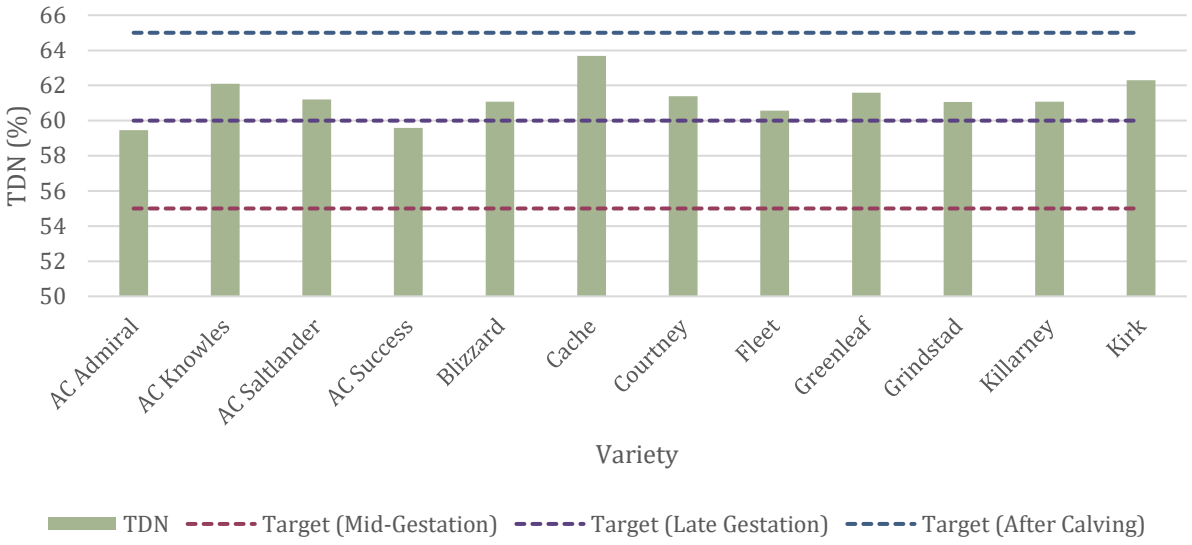


Figure 39. Total Digestible Nutrients for Grass varieties in the 2021 Perennial Forage Trial in Yellowhead County

FUTURE WORK

The most notable outcome of the 2021 trial is the gradual increase in health and yield of the plots despite undergoing adverse conditions. It may prove that regardless of late start and poor conditions, perennial forages may increase in vitality if given the appropriate amount of time. The extreme weather conditions of the last few years have highlighted the importance of understanding how forage and grain crops and methods of growing those crops can be changed to increase resilience. Although late planting and harvesting at a less than ideal time, the results provide producers insights into how these forages perform under adverse conditions.

2021 Soil Moisture in Forage Systems Update

This project is supported by the Canadian Agriculture Partnership (CAP) Environmental Stewardship and Climate Change Program.

OVERVIEW

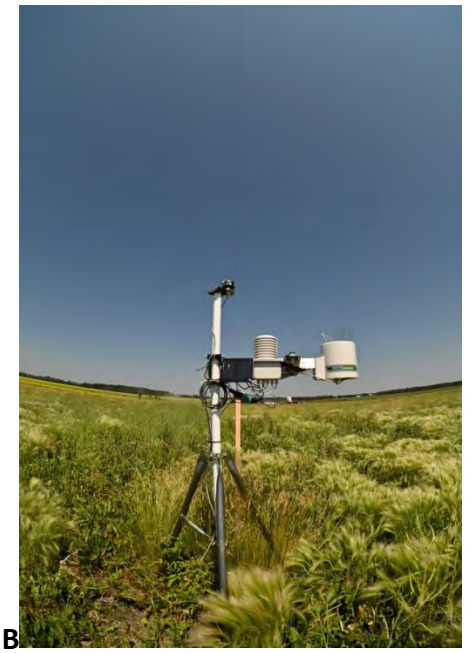
The soil moisture in forage systems project is focused on several aspects including: determining the differences in soil moisture profiles amongst forage and crop production systems, the usefulness of soil moisture probe technology for WCFA producers, the effect of soil moisture on crop productivity, as well as the accuracy of Alberta Government soil moisture maps as compared to WCFA's moisture probes/weather station data. The project was initially proposed to begin in the spring of 2020; due to many challenges and the requirement of spring installation, the project began spring of 2021.

METHODS

The project utilizes weather stations provided by Martin Deerline to show changes in soil moisture at six different depths to 100cm. Each weather station is equipped to log the temperature, wind, precipitation and leaf wetness at its location. Weather stations are installed in one of each of the following forage or crop types: an annual silage, a perennial silage, a permanent pasture, and an annual cropland site. Each cooperator is given access to weather data updated hourly via app. Our partners at Martin Deerline served as intermediaries between app and information processors and the producer to ensure producers can have access to the data whenever possible.

Four cooperators in each of Woodlands, Leduc, Lac Ste. Anne, and Brazeau counties provided testing locations. Each producer received infographics at year end that shows the spring and autumn soil moisture profile, crop potential for the next season, and other pertinent weather data. The installation of weather stations, soil probes, and leaf sensors occurred in spring of 2021 after cooperating producers were finished seeding. Soil moisture and precipitation data from each weather station is compared to soil moisture and precipitation maps provided by the government for the same period of use - these serve to demonstrate accuracy of the map information provided to producers.

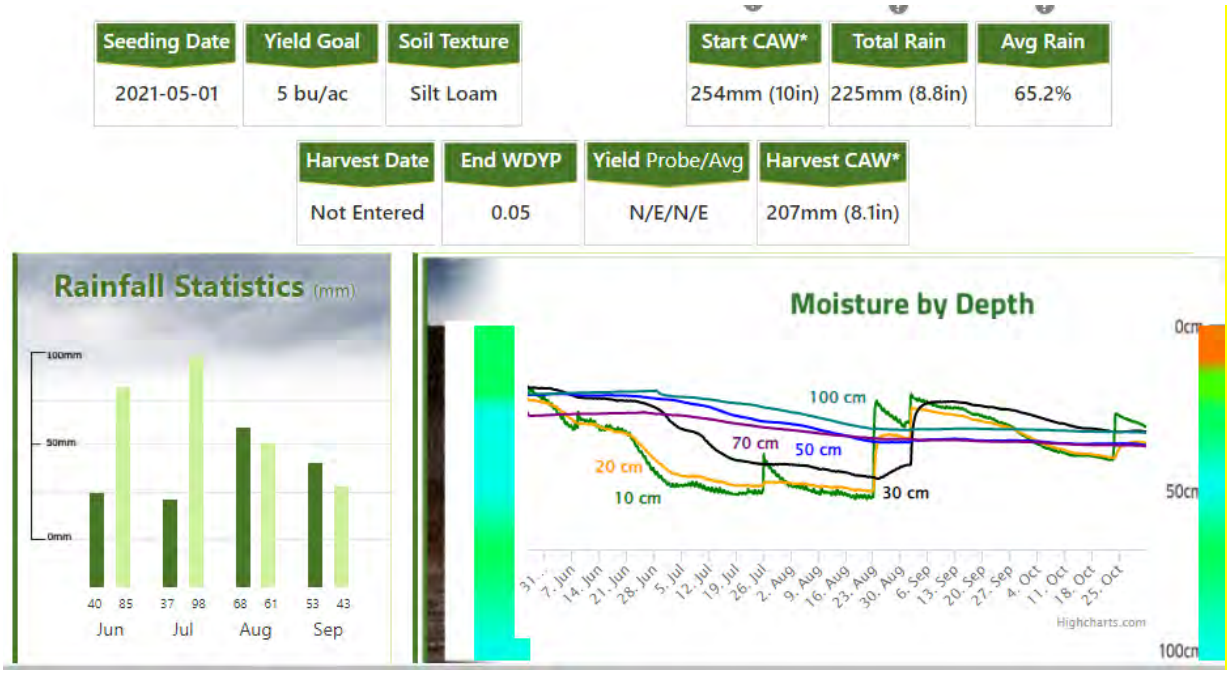
A

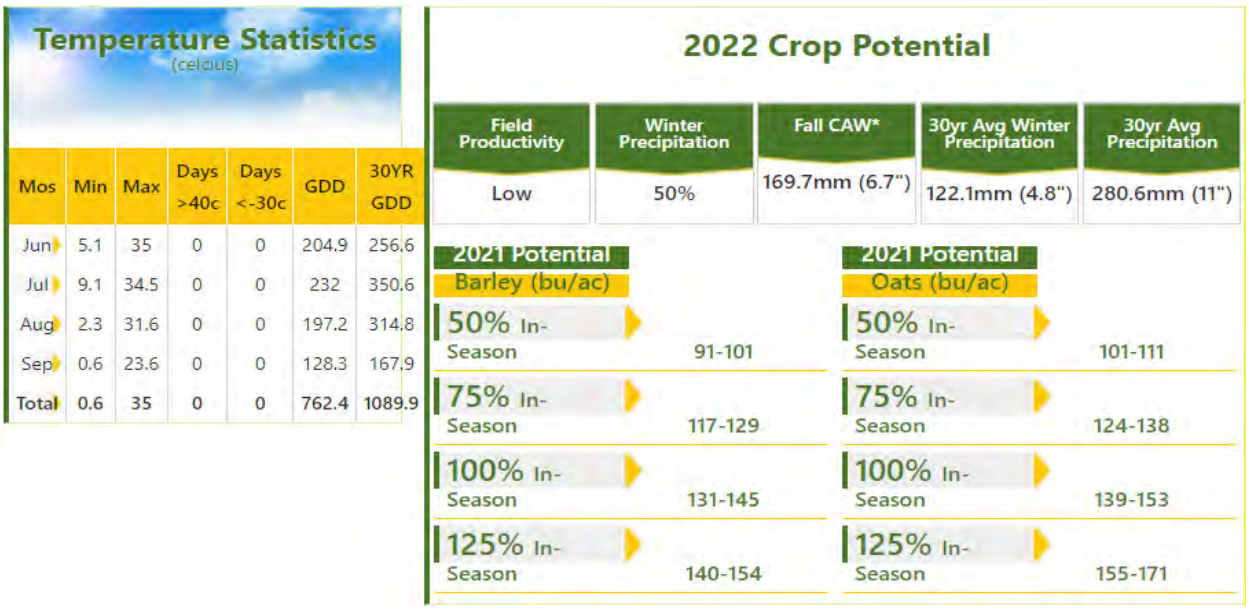


B

Figure 40. A. Photo of a Martin Deerline leaf wetness sensor from 2021 Soil Moisture in Forage Systems trial B.

Four cooperators in each of Woodlands (Blue Ridge), Leduc (Thorsby), Lac Ste. Anne (Mayerthorpe), and Brazeau (Breton) counties provided testing locations; each producer received infographics at year end that shows the spring and autumn soil moisture profile, crop potential for the next season, and other pertinent weather data (Figure 43).





Temperature Statistics (celcius)

Mos	Min	Max	Days >40c	Days <-30c	GDD	30YR GDD
Jun	5.1	35	0	0	204.9	256.6
Jul	9.1	34.5	0	0	232	350.6
Aug	2.3	31.6	0	0	197.2	314.8
Sep	0.6	23.6	0	0	128.3	167.9
Total	0.6	35	0	0	762.4	1089.9

2022 Crop Potential

Field Productivity	Winter Precipitation	Fall CAW*	30yr Avg Winter Precipitation	30yr Avg Precipitation
Low	50%	169.7mm (6.7")	122.1mm (4.8")	280.6mm (11")

2021 Potential Barley (bu/ac)		2021 Potential Oats (bu/ac)	
50% In-Season	91-101	50% In-Season	101-111
75% In-Season	117-129	75% In-Season	124-138
100% In-Season	131-145	100% In-Season	139-153
125% In-Season	140-154	125% In-Season	155-171

Figure 41. Growing Season Report Data Summary page provided by the Crop Intelligence desktop program installed in the 2021 Soil Moisture in Forage Systems trial

Martin Deerline has detailed weather data, including precipitation and humidity (Figure 44), yield potential data with correlation to weather conditions (Figure 45), soil capacity potential (Figure 46), and spray conditions (Figure 47).

Figure 42. Precipitation and Humidity trend data provided by the Crop Intelligence desktop program and probes installed in the 2021 Soil Moisture in Forage Systems trial

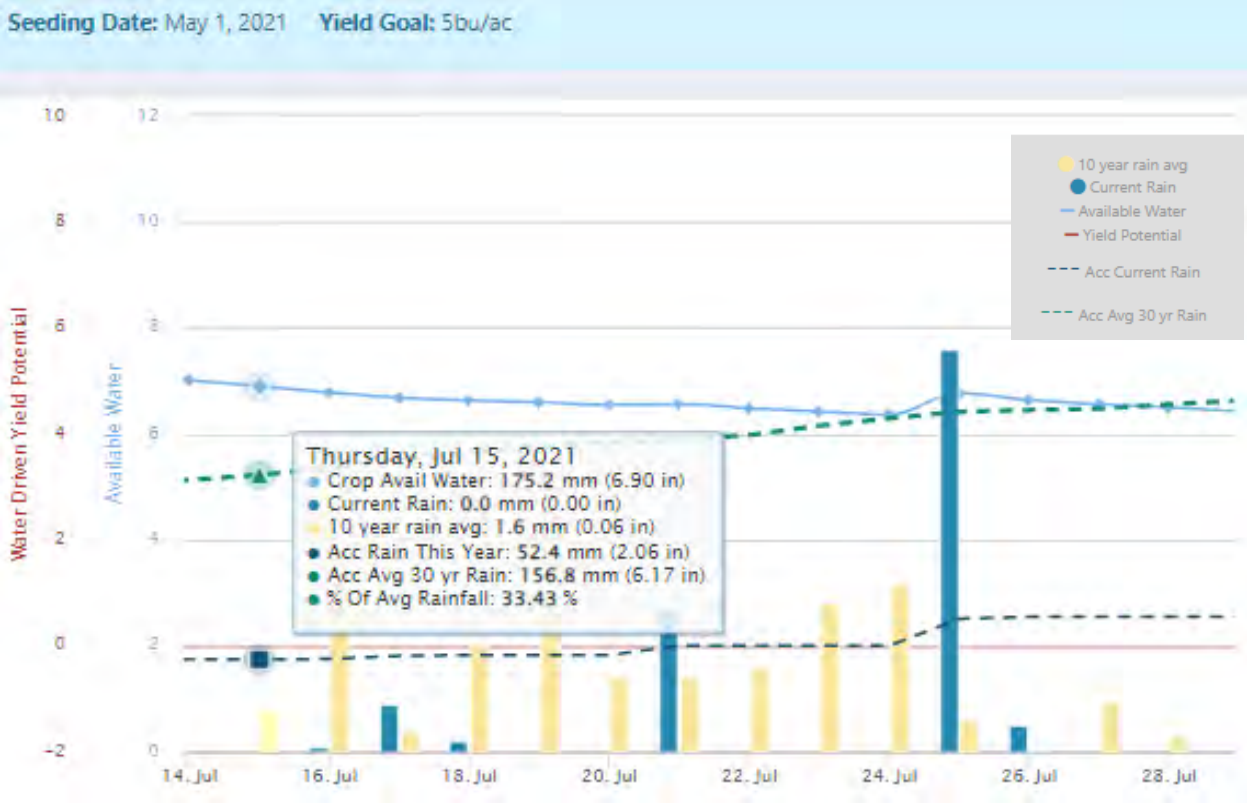


Figure 43. Yield Potential data with correlation to weather conditions provided to cooperators by the Crop Intelligence desktop program and probes installed in the 2021 Soil Moisture in Forage Systems trial

Figure 44. Soil Capacity Potential data retrieved from the desktop program and probes installed in the 2021 Soil Moisture in Forage Systems trial

Figure 45. Spray Conditions data from the desktop program and probes installed in the 2021 Soil Moisture in Forage Systems trial

The data in the Martin Deerline Crop Intelligence program has soil moisture level thresholds (Figure 48) indicated with lines in red; while the Government of Alberta database does not indicate a threshold (Figure 49). The app also has notification capabilities, these features may be a helpful tool for farmers undergoing adverse weather conditions and can aid them with early intervention. The Soil Moisture probes provided by Martin Deerline have more soil depth readings, in addition to leaf sensors providing humidity readings that may be useful for producers determining timing of certain applications (e.g., fungicide) while government weather data does not deliver this type of information useful to growers.

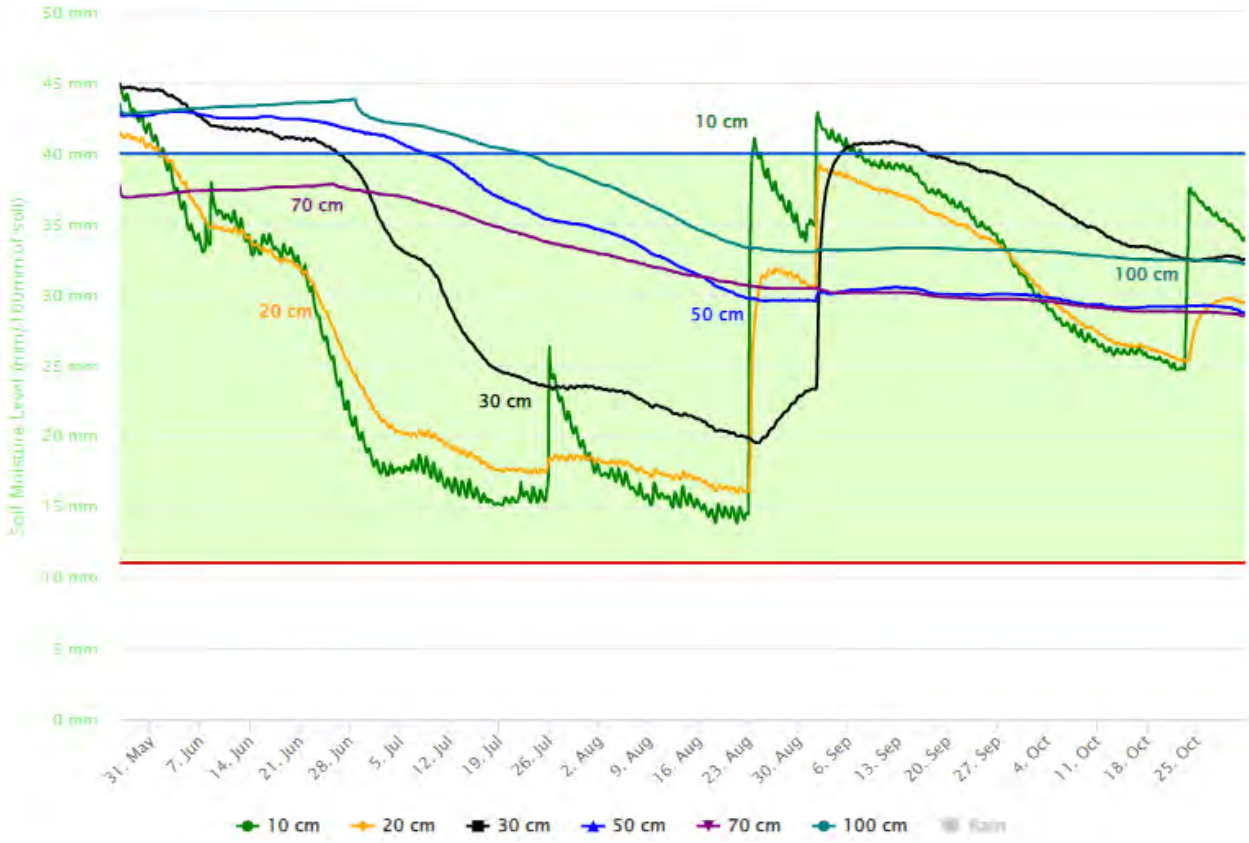


Figure 46. Soil Moisture data in the 2021 growing season at the Breton location provided by the Crop Intelligence Soil Moisture Probes

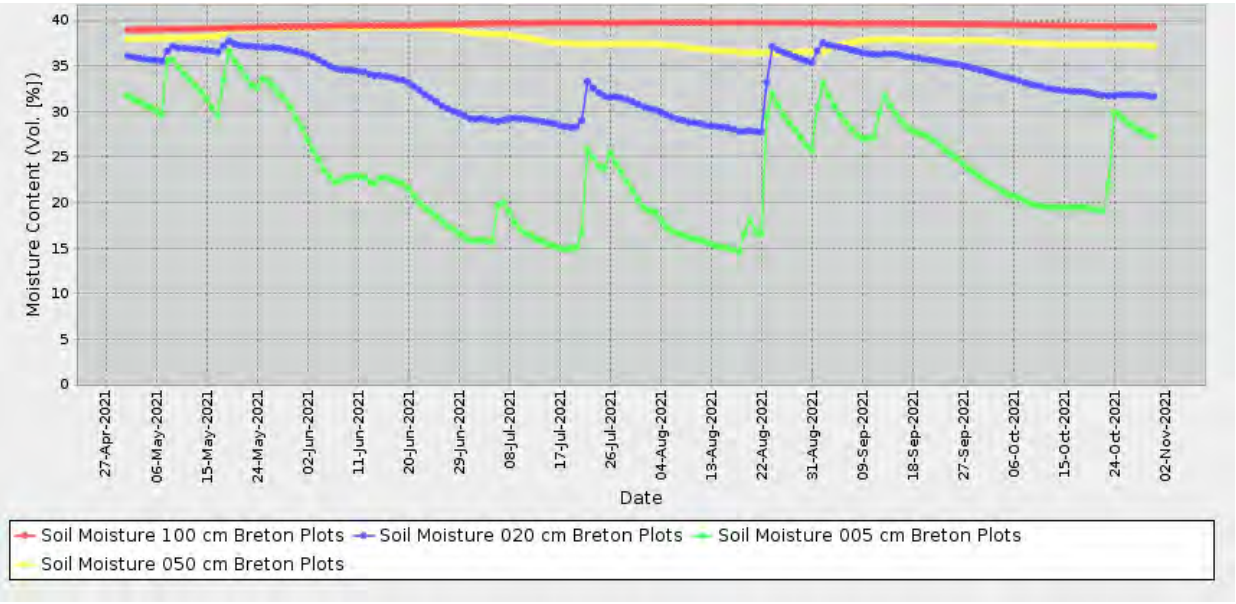


Figure 47. Soil Moisture data in the 2021 growing season from the Government of Alberta weather database at the Breton weather station

Soil moisture and precipitation data from each weather station compared to soil moisture and precipitation maps provided by the government for the same period of use serves to demonstrate accuracy of the map information provided to producers as well as to show to locality of weather systems.

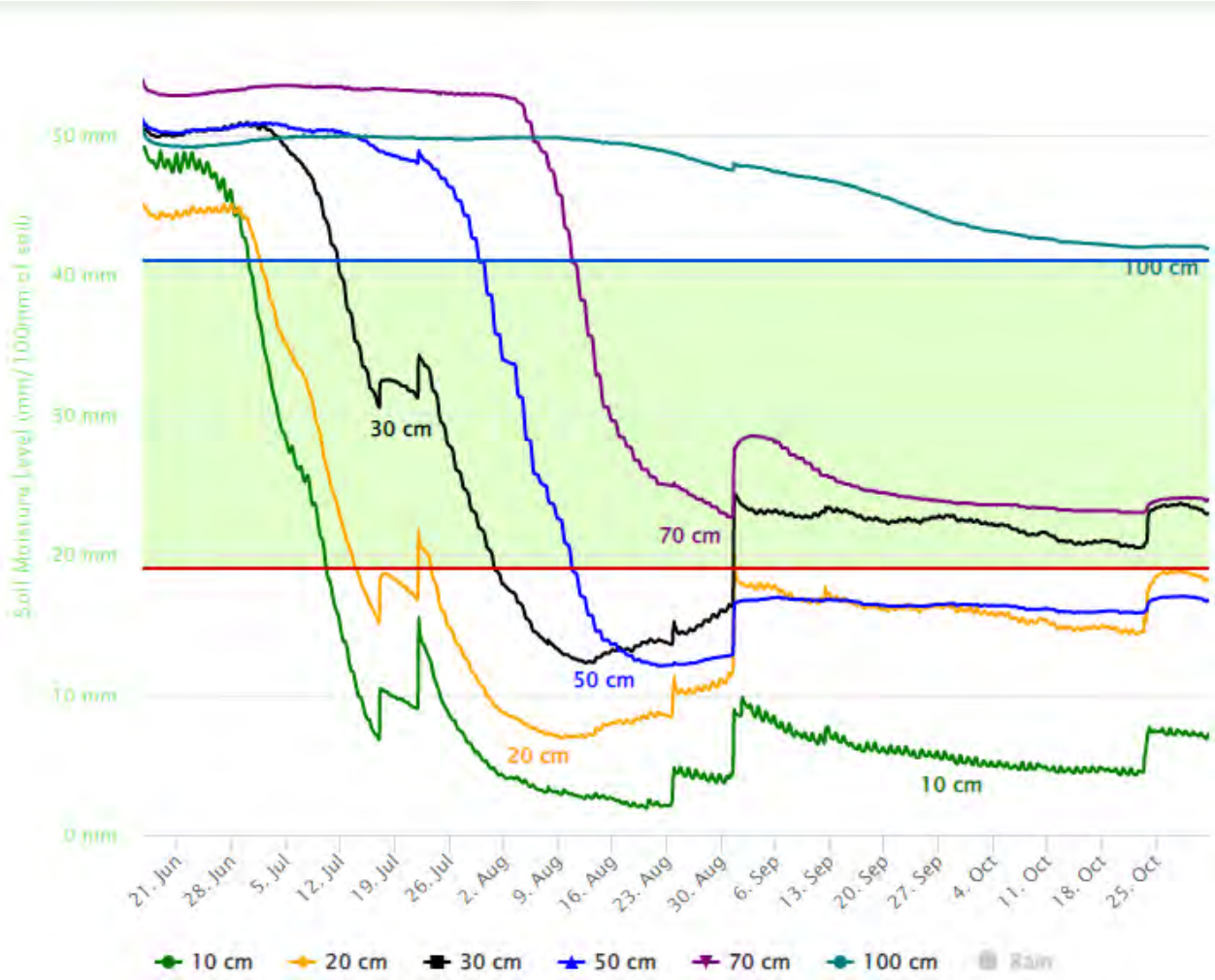


Figure 48. Soil Moisture data in the 2021 growing season at the Mayerthorpe location provided by the Crop Intelligence Soil Moisture Probes

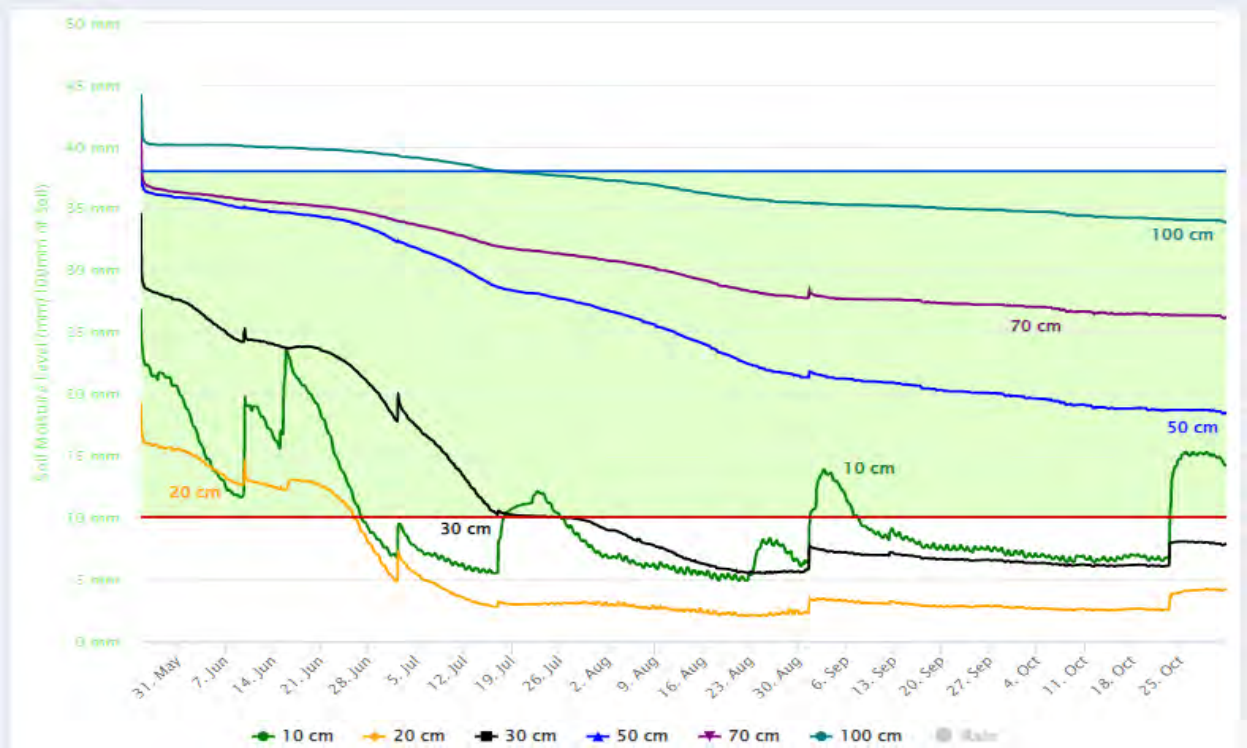


Figure 49. Soil Moisture data in the 2021 growing season at the Blue Ridge Location provided by the Crop Intelligence Soil Moisture Probes

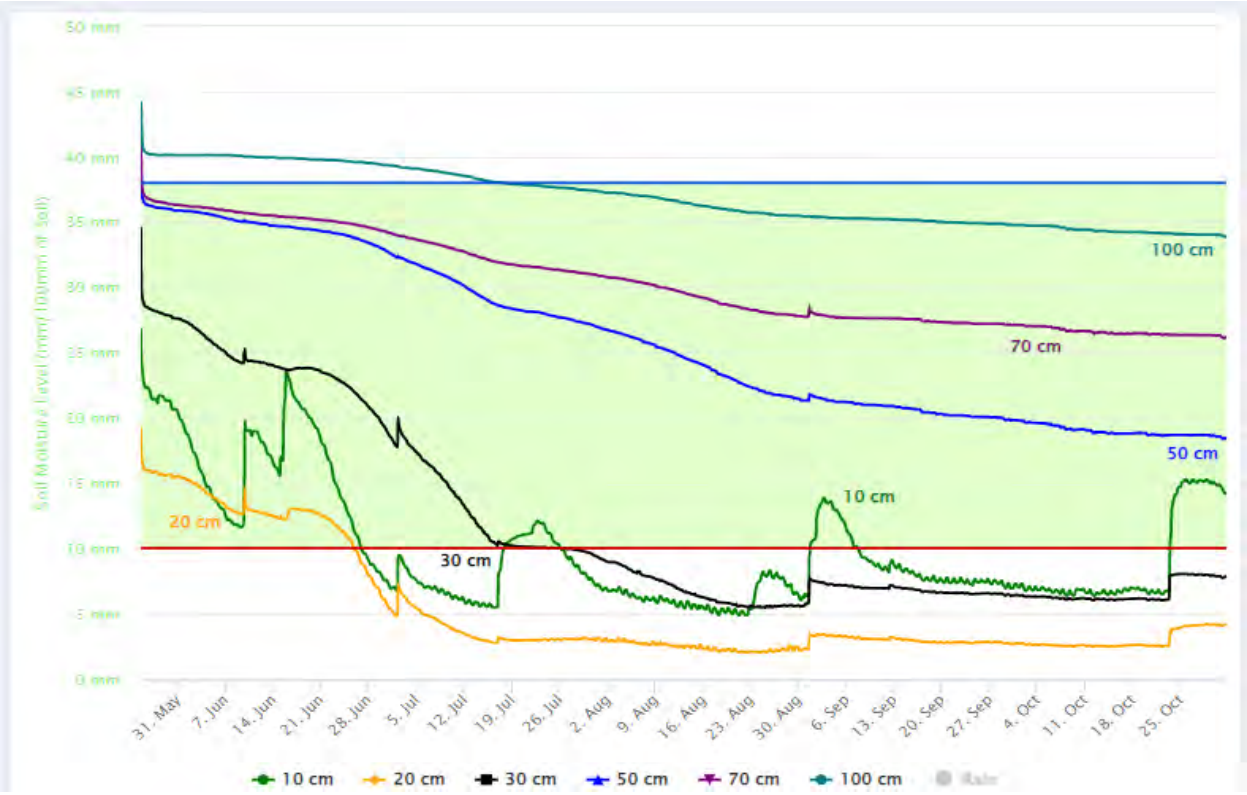


Figure 50. Soil Moisture data in the 2021 growing season at the Thorsby Location provided by the Crop Intelligence Soil Moisture Probes

PROGRESS TO DATE

All regions in the province, including all our test locations experienced very little precipitation with the regional governing bodies declaring drought. One of the cooperators indicated to WCFA staff that the weather data found on the Crop Intelligence app relaying information from the installed probes was the most accurate system to observed real time and predictive weather conditions on site.

FUTURE WORK

WCFA obtained and will continue to obtain the weather data, feed quality analysis, and yield data, provided by the cooperators for each field in use, in addition to soil analysis being done at the CARA Soil Health Lab in Oyen. Year-by-year comparison of all the sites weather data and forage yields will occur in 2022. All cooperators will be surveyed on the usefulness of the technology near the end of the project term. The project will continue until February of 2023, when a final report will be generated to summarize all the data received in each year and provide an overview of the degree of usefulness that WCFA cooperators found the technology to have.

2021 Soil Revitalization Project Update

This project is supported by the Canadian Agriculture Partnership (CAP) Environmental Stewardship and Climate Change Program.

OVERVIEW

The soil revitalization project is concerned with how and if different forage systems or rotations build soil health. The project was designed to use four treatments and one check to determine how different forage regimes affect soil properties, more specifically if these forage treatments can help to increase carbon storage, soil nutrients, and soil microbial biomass.

The project was initially slated to get underway in the spring of 2020. Unfortunately, due to issues with the plots at Wildwood in Yellowhead County it was impossible to get the treatments seeded in 2020. In 2021, producer Raymond Chittick offered the use of his fields so that this trial could be seeded in a manner befitting its original intention.

METHODS

In the spring of 2021 five treatments were seeded on five-acre parcels in Lac Ste. Anne County. The five treatments were: 1) a three-crop rotation of triticale or oats, millet, followed by either triticale or winter wheat 2) a multi species mix comprised of at least 20-30% berseem clover 3) the 2nd year of a three-year rotation of a broad leaf (brassica) and grass (brome) 4) a perennial pasture blend and 5) a conventional cereal monocrop. Seed providers include Union Forage, Corn Brothers, Imperial, and Nutrien.

In the original project proposal green manure, in the form of trimming the forage, was to be performed in order to simulate grazing. In the new project protocol, each forage treatment was to be grazed. The three-crop rotation is to be grazed between forage crops. Each forage was sampled for yield, by method of using a test strip, feed samples taken from the test strip were to sent to A&L Laboratories for feed quality analysis (Table 16).

Table 23. Agronomic information for different treatments for the Soil Revitalization Trial in Lac Ste. Anne County

Seed Description	Seed Provider	Moisture (%)	Yield (lbs/acre)	Relative feed value	Seeding rate
Dryland Annual with Peas and Triticale	Union forage	82.2	1166.68	215.68	45 lbs/acre?
Rocket Fuel	Union forage	73.5	685.15	171.41	14 lbs/acre?
Oats and Millet	Various seed cleaners, Corns	77.85	62.00	97.06	80 lbs/acre
Triticale, Chicory and yellow clover	Corns	58.1	551.15	174.96	150 lbs/acre
Soil Rejuvenation Mix (30% Berseem)	Imperial	82.2	1267.60	191.05	10 lbs/acre
Turnip and Brome (onto turf)	Nutrien Ag	65.4	1208.45	175.12	15 lbs/acre

PROGRESS TO DATE

In late summer of the 2021 season soil samples were sent to the CARA soil lab in Oyen; no results or report had been provided at time of reporting as soils data are still in the process of being analyzed. The analysis will be for nutrients, microbial community, bulk density, and infiltration prior to seeding and before grazing.

Figure 51. Photos throughout the 2021 season for the Soil Revitalization project conducted in Lac Ste. Anne County

FUTURE WORK

This project is expected to continue until the winter of 2023. Updates will be provided regularly through annual reports, update articles in our newsletters, on the website and social media, and in the coming year extension events will be held once again. WCFA will perform a full analysis on how the different forage systems or rotations impacted the soil health over the span of the project cycle; and potentially continue similar trials over a longer period of time to determine best management practices that impact our local soil health.

Alberta Soil Health Benchmark Monitoring Project Update

Provided by: Dianne Westerlund, Chinook Applied Research Association, February 2022

This project is supported by the Canadian Agriculture Partnership (CAP) Environmental Stewardship and Climate Change Program.

OVERVIEW

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

METHODS

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

The CARASHLab generates a comprehensive report (to see an example see Sample Soil Health Lab Report from CARA on page 92) for each site sampled, which is compiled and shared with the local association and landowners. The report captures a picture of the soil health and is a point of reference for comparison to future sampling or following management changes. It includes measurements of the individual soil indicators as well as a ranking of whether the measurement is an area of concern or constraint for over-all soil productivity. Suggestions for mitigation or improvement of problem soil components may also be added to the soil score card. Discussion of the soil health report cards have been the focus of several extension activities held by participating producer associations.

PROGRESS TO DATE

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

FUTURE WORK

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

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

Note from WCFA: to date (2019-2021) we have collected samples from 67 fields managed by 42 producers, for a total of approximately 102 samples.

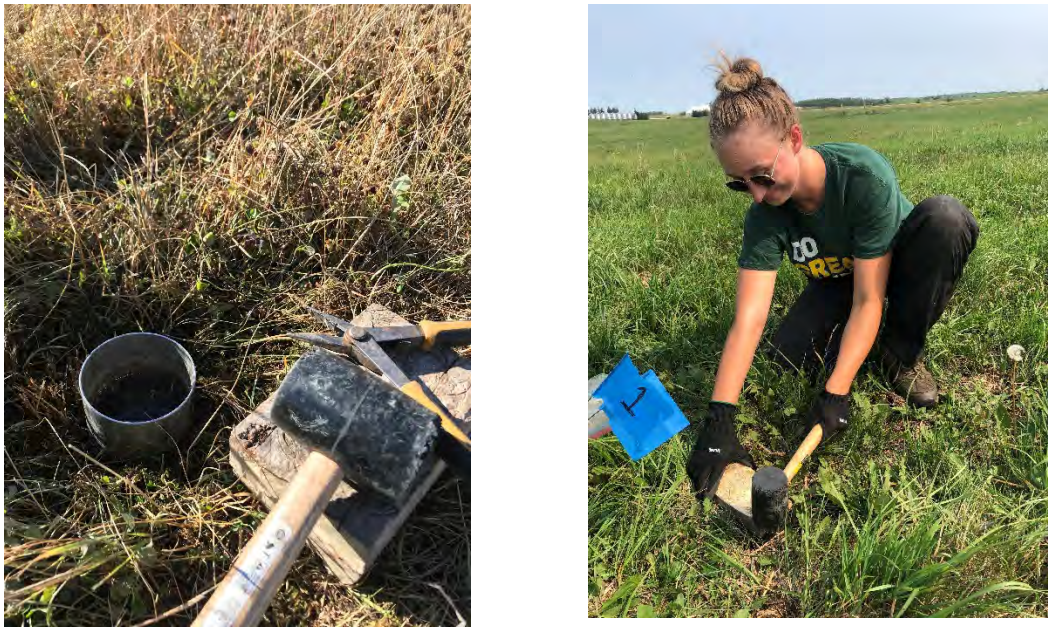


Figure 52. A. Infiltration test in field. B. Savannah taking a core sample.

Sire-Progeny Links in Commercial Herds Project Update

Evaluating Sire-Progeny Links, Breeding Plans and Information Management in Multi-Sire Breeding Scenarios on Commercial Herds

This project is supported by the Canadian Agriculture Partnership (CAP) Adapting Innovative Solutions in Agriculture Program (now managed by RDAR)

OVERVIEW

One of the more commonly used natural breeding systems in commercial herds is the multi-sire system. One of the major disadvantages to this system, however, is that producers are often unaware of which bulls are siring calves. The use of genetic technology to assign parentage may allow producers to determine which bulls have sired calves and in turn better evaluate if they are achieving their breeding and genetic improvement goals.

The assumption in these systems is that each bull is breeding an equal number of cows. However, without identifying which bulls are siring calves, it is impossible to know with certainty if this is the case. The introduction of desirable genetic traits in commercial herds is typically achieved through purchase of bulls. By linking bulls to their offspring, producers can better evaluate if they are achieving the desired outcomes of their breeding plans while using multi-sire systems.

This multi-year project will demonstrate the benefits of a systematic approach to breeding and how sire-progeny and other herd performance information can be used to generate measurable productivity and profitability improvements.

Partners

- Lakeland College
- Olds College
- Quantum Genetix
- Local Producers

METHODS

A number of herds are evaluating the use of the Q-link bull performance and herd improvement tool from Quantum Genetix, which assigns parentage to calves through DNA sampling.

Each year, ranchers are asked to provide at least 100 calves (if possible) for parentage verification through DNA testing. All bulls in the test groups must pass a yearly breeding soundness exam, which includes testing negative for venereal disease. Ranchers are asked to provide additional production information to be used to fully analyze the use of genetic testing for parentage on farm. Additional herd information requested includes:

- Birth weights
- Birthdates of calves (if this is not possible calving start and end dates are asked for)

- Calving ease scores
- Calf weaning weights
- Weight and Body Condition Scores of cows at weaning
- Any losses (calves, cows, etc.)
- Length of breeding season
- Number of open cows in the test group
- Number of cows in the test group
- EPDs for all bulls, along with bull age

Sires are to have DNA collected once in their lifetime, and any new bulls added during the project must have their DNA collected and submitted to the lab. DNA for sires is collected using a hair sampling procedure.

Calves are to have DNA collected through an ear tissue sampling procedure. These samples are often collected during other management procedures (branding, weaning, when tagging at birth).

Figure 53. Photos of tools used; tissue collection tool with sample collection tags (left); ready to collect tissue sample (right)

PROGRESS TO DATE

Four herds in the west-central region began using the Q-link tool in 2019 to identify parentage of calves. The number of calves sampled from each of the WCFA cooperator herds from 2019 to 2021 is presented in Table 16.

Note: it was originally anticipated that five cooperator herds would participate in the project. Due to a variety of factors, only four began testing in 2019, and as of 2021 there were three herds continuing to collect data. There still remains a significant number of calves being tested each year when the number of animals associated with the herds from Lakeland and Olds Colleges are considered.

Table 24. Number of calves sampled for each WCFA cooperator herd from 2019-2021.

Herd	2019	2020	2021
A	134	141	112
B	40	70	None
C	72	83	76
D	95	79	74

As we were waiting on there to be multiple years worth of parentage and production information to analyze, a detailed in-depth analysis of data has yet to be conducted, but will begin as soon as all the 2021 parentage information is received (at time of reporting some results had yet to come back from the lab).

The importance of record keeping has already become apparent throughout this process. Parentage information can be more effectively utilized when detailed records are kept, and more production information is captured (weaning weights as one example). As the project has progressed, we have continued to work on more effective systems to ensure all relevant information is captured for each herd. We have, however, run into a few bumps along the road, as is to be expected in projects of this nature. It was discovered, for example, following the beginning of the project that the scale used to capture weaning weights, does not fit in all the handling systems used by cooperators, thus limiting our ability to collect some of the important production data (weights).

One of the primary assumptions being tested as part of this project is that each bull in a multi-sire breeding system will sire the same number of calves. We have not statistically analyzed parentage results to confidently conclude that this is not the case, but an initial look at the raw data would begin to suggest that not all bulls are contributing equally to the calf crop. Thus, the genetic improvements may not be occurring as expected. Table 17 shows an overview of the number of calves sired by each participating bull for the years 2019 and 2020 (2021 data was not fully available at time of reporting). Unidentified refers to samples that were unable to be matched to a sire. Some of these unidentified samples are due to degradation of samples prior to reaching the lab (lack of tissue) and due to timing of sampling we were unable to collect additional samples for retesting. Other samples have come back as unidentified due to other factors, including: lack of DNA sample from the bull (this was common in 2019 as the calf crop sampled was from the 2018 breeding year and not all producers had the 2018 bull battery available for sampling in the spring of 2019), or the lab not being confident in assigning parentage from sample results. Efforts have been made by cooperators to use the same bulls for multiple years whenever possible, but as is evident when looking at the overview, this was not always possible due to a number of factors (injury, for example).

Table 25. Summary of calves sired by each bull for each of the WCFA cooperator herds for 2019 and 2020

Herd	Sire Name	2019	2020
Herd A			
	Challenger	29	47
	Endevour	20	14
	Fireman	25	20
	Pinebank	10	13
	Platinum	1	16
	Stanley	21	25
	No Name	13	-
	Lemur	-	4
	Unidentified	15	2
Herd A Total		**134**	**141**
Herd B			
	68E	11	11
	69E	25	17
	78F	-	23
	Unidentified	4	19
Herd B Total		**40**	**70**
Herd C			
	202D	3	1
	713F	2	4
	9E HH	-	6
	Herb	20	21
	Percy	10	17
	Poncho	-	3
	Unidentified	37	31
Herd C Total		**72**	**83**
Herd D			
	159C	36	16
	15E	8	4
	190E	6	9
	222E	-	19
	28E	9	6
	42D	14	9
	448A	6	-
	8D	12	13
	8F	-	1
	Unidentified	4	2
Herd D Total		**95**	**79**

Note: not all 2021 results had been received at time of reporting.

In relation to knowledge transfer and translation (extension) for this project, Jessica was invited to provide an overview of the project work at the annual AgSmart event hosted by Olds College in August. It was evident following the presentation that there is interest from many producers in potentially using more genetic technology tools within their operations to enhance productivity and profitability.

FUTURE WORK

2022 will be the final year of data collection for this project, for any cooperators who are still wishing to participate (they were originally asked for a three-year commitment only). A detailed review of the data and results will be complete by the end of 2023. Analysis will include testing the assumption that each bull sires the same number of calves within a breeding group, as well as looking at how to link parentage information to the production information to better understand economics associated with using these genetic tools.

The intent is to use information gathered, and results from a detailed analysis to equip cooperators (and ultimately producers at large) with strategies that could be implemented on farm to ensure they are capturing the most value from the genetics they are introducing through purchase of bulls.

Figure 54. Data collection photos. A. Scale indicator for weaning weight collection. B. DNA sample collection, ear tissue. (Photo courtesy of Olds College)

Rancher Researcher Enhancing Technology Adoption Project Update

This project is supported by the Canadian Agriculture Partnership (CAP) Adapting Innovative Solutions in Agriculture Program.

OVERVIEW

The Rancher Researcher Enhancing Technology Adoption Project is an expansion of a Rancher/Researcher Pilot project which monitored the adoption of up to three innovations by eight ranchers in south central Alberta under the guidance of Dr. Susan Markus.

Through the pilot project, it was demonstrated that an enhanced understanding of the operation prior to, during and following the implementation of a new innovation can improve the outcomes when adopting practice changes or new technologies. The goal of this project is to work on providing a framework for enhancing the success and adoption of innovations on Alberta ranches. This project is an expansion of the pilot project and works to implement some of the learnings from the pilot project to further advance adoption rates on ranches in Alberta.

By demonstrating a process for implementing a variety of innovations on Alberta ranches, and a subsequent process for systematically evaluating their success on-farm (as it relates to the specific ranch), ranchers and producers throughout Alberta will be better equipped to select and evaluate appropriate innovations for their specific situations.

Partners

- Foothills Forage and Grazing Association (FFGA)
- Peace Country Beef and Forage Association (PCBFA)
- North Peace Applied Research Association (NPARA)
- MacKenzie Applied Research Association (MARA)
- Gateway Research Association (GRO)
- Battle River Research Group (BRRG)
- Lakeland Agricultural Research Association (LARA)
- Grey Wooded Forage Association (GWFA)
- Chinook Applied Research Association (CARA)

METHODS

Producer associations in the province are each working with up to two local ranchers to provide guidance and context in order to select appropriate technologies or management practices new to that operation which should provide maximum return on investment. A large part of this project was the ability for producers to be connected to a number of experts and additional resources to aid them in the implementation of the selected innovation.

Participating ranchers are asked to provide financial, economic and production benchmarks (GOLD indicators). As part of the project, ranchers were able to access assistance and resources to aid in collection of this information.

PROGRESS TO DATE

Two ranchers within the west-central region are currently working closely with WCFA and a number of stakeholders to develop customized software to quickly analyze/interpret information they are collecting on farm. The intent is that this software will allow these producers to quickly and effectively analyze information they are collecting to aid in decision-making within their operations. One of these producers has enrolled in our in-depth CowProfit$ program, and will be utilizing his learnings from this to provide the insight into the economic aspects of his operation and how adoption of this new innovation may contribute to this.

In cooperation with all the groups involved in the project and a few willing producers involved in both the pilot project and expansion project, two videos were filmed by Storybrokers Media to highlight innovation on farm. One video focused on the experiences of the pilot producers, and the second focused on the expansion project producers. Participating producers were asked to focus on their 'why' instead of their individual innovations. These videos are available on our website (www.westcentralforage.com)

FUTURE WORK

2022 will serve as the final year of funding for this project. Both producers will continue to provide input on the development of the customized software in early 2022, with the intent that they are able to utilize this software and provide feedback on the effectiveness by early 2023.

An additional goal of this software development is to potentially make it available to a larger producer audience in the future, following development and testing by these pilot producers.

Extension

2021 Extension Highlights

Once again, our extension activities were hindered by restrictions in place due to COVID-19. We were limited in our ability to host many in-person events, and for the first time since it's inception in 2018 we had to cancel our annual Ladies' Ranching Retreat event.

On a more positive note, however, we were able to host a number of virtual events throughout the year, which gave us the opportunity to interact with many new faces from near and far. We were able to sneak in a highly successful field tour, along with our AGM, in August while restrictions were temporarily lifted.

We kept in touch with everyone through our newsletter publications, both printed and e-versions, as well as through regular email updates and our social media channels.

EVENTS HOSTED BY WCFA IN 2021

Rural Dugout Webinar Series

MARCH 4 AND 11, 2021

Hosted in partnership with Yellowhead County, Woodlands County and Brazeau County. Shawn Elgert, Agricultural Water Engineer with Alberta Agriculture and Forestry, covered dugout planning, designing, construction, operation, protection, water quality issues, treatment solutions and stocking fish in dugouts. Both sessions were extremely well attended, and an abundance of information was shared over the two webinars.

Field Tour & AGM

AUGUST 5, 2021

A day of networking for producers and industry. Attendees were given the opportunity to walk through all of the Soil Revitalization project sites at cooperator Raymond Chittick's. As everyone was rotating through the sites, they were able to take in three in-field presentations. Graeme Finn, with Union Forage, was on hand with his shovel to discuss and demonstrate soil health in the field. Graeme also discussed drought preparation prior to the meeting portion of the day. Chelsea Pearce and Chris Huolt of Martin Deerline were available to discuss the weather station, equipped with soil moisture probe, at the site (as part of our Soil Moisture in Forage Systems project). This was one of the more popular stops, even in the extreme heat! Our own Melissa Howard, and cooperator Raymond Chittick were in-field to discuss the projects, and how everything was seeded, etc. in-depth with tour participants. We closed out the day with our AGM, and a wonderful supper, along with plenty of time for networking (and cold beverages—it was hot!). Following our AGM we welcomed four new members to our Board of Directors.

Nitrates, Straw & Alternative Feeds…Oh My!

September 13, 2021

The dry, hot weather had many concerned about feed supplies for the winter, and considering using 'alternative' feeds to cope with short feed inventories. Courtney O'Keefe, with Blue Rock Animal Nutrition spent the evening covering things to be aware of when building rations, concerns and things to watch for when considering using a less-than-normal alternative within the ration, and general nutrition tips and tricks.

Dare to Lead with Kimberly Knull

November 4, 2021

Kimberly Knull, a Registered Psychologist, motivational speaker and trained Dare to Lead™ facilitator joined us for an evening looking at the four skill sets of courage identified through Brené Brown's research.

Dare to Lead™ is an empirically based courage-building program based on the research of Dr. Brené Brown, research professor and author of five #1 New York Times bestsellers

You can watch the recording of this presentation on our website!

Building Soil Resilience Through Regenerative Agriculture

November 8, 2021

Dr. Kris Nichols spent the day with local producers covering soil health and how to utilize the principles of regenerative agriculture to build soil resilience. Attendees were also given the opportunity to provide input on a potential Living Lab in province following the workshop.

CowProfit$: Profit-Based Decision Making (Guided Program)

November, 2021-Early 2022

Starting in the fall of 2021, in partnership with Dale Kaliel, we offered an in-depth opportunity for local producers to learn how to use CowProfit$ software to strategically guide business decisions, using their own farm information. The first session

was held in November, and participants will be supported throughout the process, with more guided sessions scheduled for the Spring of 2022.

Jim Gerrish Webinar

December 1, 2021

Renowned grazing expert, Jim Gerrish shared his knowledge on how to work to build a drought resilient farm or ranch.

We were joined online by producers from all over, including Quebec!

Jim's knowledge is second-to-none, and as such this was a very well attended session.

Food, Farming & Telling Your Story

December 9, 2021

The first virtual panel presentation, in lieu of Ladies' Ranching Retreat. Melanie Villeneuve, from Urtica Design, Jan & Erin from Trailblazher Co., and Karen Anderson of Alberta Food Tours discussed goal setting for your website, connecting with your community, telling your story online, local food and a whole lot more!

You can watch the recording of this panel discussion on our website!

Conservation

Stewardship Alliance for Conservation Agriculture (SACA)

Enhancing Stewardship and Conservation within Agriculture

What is the Stewardship Alliance for Conservation Agriculture (SACA)?

The Stewardship Alliance for Conservation Agriculture (SACA) is a partnership between WCFA, Yellowhead County and Woodlands County. This partnership has been in place since 2012, following a restructuring of the previous group known as the West-Central Conservation Group (WCCG).

Through this partnership, our goal is to assist the agricultural community to find practical, environmentally sustainable practices and raise awareness through workshops, information sessions, demonstrations and projects.

Through this partnership we are able to deliver programming to support local producers in achieving their stewardship goals, which includes:

- Supporting producers with the Alberta Environmental Farm Plan (EFP) program
- Providing information and support to producers in accessing funding through programs such as the Canadian Agricultural Partnership (CAP) program
- Supporting integrated weed control through delivery of biological control agents for Canada thistle.
- Supporting youth education through initiatives such as Pond Days and the Classroom Agriculture Program.
- Developing projects and initiatives to support environmental stewardship in our local agricultural communities
- Providing learning opportunities to local producers on a variety of stewardship related topics

To connect with SACA contact:
Conservation and Communications Coordinator
conservationag@westcentralforage.com
780-621-8670

SACA Programs- 2021

CANADA THISTLE BIOCONTROL AGENT PROGRAM

OVERVIEW

Each year WCFA/SACA works with a large number of individuals throughout the province to tackle Canada thistle infestations through the use of biological controls.

Canada thistle is listed as 'noxious' on Alberta's weed control act, meaning it must be controlled. The use of biological control agents to do so has become increasingly popular in recent years. Interest in our program has continued to grow, often putting a strain on our suppliers to meet the high demands.

We currently facilitate the importation and delivery of two biological control agents for Canada thistle: stem-mining weevils and stem-gall flies.

Why Biocontrol?

It is a method of control that is specific to the target plant, i.e. Canada thistle, and will not move to economically important crops (pasture, etc.). It has the ability to infest plants in inaccessible areas. Once established the agents are self-perpetuating, and have the potential to migrate to other locations (thistle patches). Once established it is also a very cost-effective method that is often less expensive and labour intensive than chemical or mechanical methods of control. The goal of Canada thistle biocontrol is to reduce plant vigor and its dominance in the landscape. It is not to completely eradicate the thistle, as it is very unlikely that the use of biocontrol agents alone will be able to achieve this.

Notes about Biocontrol

In the most successful examples of biological control there are always a small number of plants that do not fully succumb to the attack of the beneficial insect. This is good. It allows the insect population to sustain itself during years of low weed density. Once the weevils have exhausted a thistle patch, they will migrate to look for more food, for example.

Biological control insects alone are not the answer. Without healthy stands of desirable vegetation to take the place of undesirable weeds, bio-control cannot be successful. As the insects reduce the weed population, useful plants take their places and gain a competitive advantage. Together, bio-control agents and competing vegetation will reduce weed infestations. Encouraging desirable plants, by re-seeding or reducing grazing pressure, will greatly help the insects do their job.

Stem-Mining Weevils

The Canada thistle stem-mining weevil (*Hadroplontus litura*) occurs naturally in France, Switzerland, Austria, Germany, Britain, and southern Scandinavia. It was first introduced into Canada as a biological pest control agent in 1965 and into the US in the early 1970s. WCFA has been importing these agents from Montana for producers for over ten years.

Stem-mining weevils are intended to act as a permanent, self-perpetuating control mechanism for Canada thistle. These insects restrict their feeding to Canada thistle only.

How do they work?

Eggs are laid in the mid-vein of the rosette leaves in early spring, and hatch after five to nine days. Larvae internally mine the inside of the stem of the thistle plant as the shoot elongates during the summer. Fully developed larvae will exit the plant at the root and enter the soil to pupate. They will emerge again in their adult form later in the summer, and feed on thistle leaves before winter. Adults will over winter in the soil, ready to attack the emerging thistle the following spring.

2021 Weevil Program

Due to the difficulty associated with crossing the border, we were unable to bring in weevils in 2021.

Stem-Gall Flies

The Canada thistle stem-gall fly (*Urophora cardui*) is native to Europe, but has been used in Canada for control of Canada thistle since around the 1970s. WCFA has been importing these agents from Montana for producers since 2017.

How do they work?

The stem-gall fly attacks the stem of the thistle plant, boring in and causing the plant to form gall tissue. Females lay their eggs on the apical meristem (tip) of developing shoots in the early summer, and larvae burrow into the shoots. Larval feeding triggers gall formation, which stresses the plant. The gall becomes a nutrient sink, directing nutrients away from the plant's normal metabolic & reproductive functions, lowering normal plant function and reproduction. Abnormally developed flower heads frequently occur above the gall, resulting in fewer flowers and lowered seed production. Galls vary in size, depending on the number of larvae present within. Galls may range in size from small (marble) to large (walnut/plum), containing anywhere from three or four larvae to upwards of 25 larvae. The flies overwinter in the gall as mature larvae and emerge as adults in the spring (around June) when the gall tissue deteriorates.

2021 Gall Fly Program

Due to border closures, we were unable to bring in gall flies in 2021.

ALBERTA ENVIRONMENTAL FARM PLAN

As part of the SACA partnership, WCFA employs a trained EFP Technician to assist with the delivery of the Alberta Environmental (EFP) program.

Why Do an EFP?

Maintaining a healthy environment is essential to the success of Alberta's agricultural producers. The Environmental Farm Plan (EFP) program helps you identify and address environmental risks in your operation. It will also increase your understanding of legal requirements related to

environmental issues. Protecting water, air and soil quality is key to the sustainable production of crops and livestock and to leaving a healthy and productive farm for the next generation. An EFP will identify what you are already doing well and pinpoint where improvements can be made. By addressing these risks, you increase operational efficiency while reducing farm costs, which results in increased profit for you. With your EFP completion certificate, you become eligible for some funding under the Canadian Agricultural Partnership. Pairing environmental stewardship with agricultural production is also crucial in the marketing of your products. Consumers are increasingly concerned about the safety and quality of the food they eat and how that food is grown/raised. Sustainable sourcing is becoming a requirement of many major food purchasers, from manufacturers to restaurants. Having an EFP demonstrates to the public, government, lenders and/or investors that you are managing your environmental risks.

The EFP Process

1. Register online at www.albertaefp.com or contact the WCFA technician directly to set up your account.
2. Your EFP technician will be available throughout the process to help complete your EFP workbook (online)
3. Once you have finished your EFP, your technician will review it. Once complete you will receive a Certificate of Completion. If, during the review process, more work is required the technician will offer advice and assistance to ensure approval.
4. You are encouraged to begin implementing the actions you identified in your Action Plan as part of competing your EFP, as well as continuously update your EFP as you make changes on-farm.

EFPs in the WCFA Region

In 2021, we assisted with 12 new EFPs throughout the region, along with continuing support for a number of producers who began their EFPs in previous years.

Often, as we work through the EFP process with producers, we are able to provide information on available funding through the Canadian Agricultural Partnership (CAP) program. As part of our mission to support producers with sustainability initiatives we are able to offer some assistance with applications to these programs as well. For the latest information on available funding through CAP, visit www.cap.alberta.ca

YOUTH EDUCATION PROGRAMS

Typically, each year we work with local schools and our SACA partners to host a number of Pond Days in the region. This program offers an interactive opportunity for students in Gr. 4/5 to learn more about a variety of stewardship topics, including aquatic and soil health, wildlife, water quality, invasive species, riparian health and more. Unfortunately, due to COVID, we have been unable to host these events over the last two years, but are looking forward to the possibility of hosting them once again in 2022.

In years past we have also volunteered with the Classroom Agriculture Program, to deliver presentations related to Agricultural topics to Gr. 4/5 students at a number of local schools. In 2020 the Classroom Agriculture Program took a bit of hiatus. The program has since been acquired by Ag in the Classroom and we are looking forward to being able to continue our support for this program in the future.

Additional Programs Supported by WCFA & SACA

ALUS PARTNERSHIP ADVISORY COMMITTEES

The ALUS program works with farmers to produce valuable ecological services on Canadian farmland. More specifically, ALUS helps farmers and ranchers restore wetlands, reforest, plant windbreaks, install riparian buffers, manage sustainable drainage systems, create pollinator habitat and establish other ecologically beneficial projects on their properties. What's more, ALUS provides per-acre annual payments to ALUS participants to recognize their dedication to managing and maintaining all the ALUS projects on their land.

As ALUS is a community driven program, each active ALUS community establishes a local Partnership Advisory Committee (PAC) to direct local programming. The PAC includes a broad spectrum of community members, such as representatives from local environmental groups, local government agencies and local industry. Approximately 50 percent of each PAC is made up of farmers.

WCFA has been a member of the ALUS Brazeau PAC since 2016 and will continue to support this program moving forward. In 2020 we joined Parkland County's ALUS PAC as well. We appreciate the opportunity to support these local programs.

We would also like to note that although we are not members of their PACs, we work closely with and are strong supporters of the other ALUS programs in our area, which include ALUS Lac Ste. Anne and ALUS Leduc-Wetaskiwin.

If you are interested in the ALUS program we encourage you to contact your local ALUS coordinator (alus.ca/communities).

CANADIAN ROUNDTABLE FOR SUSTAINABLE BEEF (CRSB)

The CRSB was established in 2014 by a community of stakeholders devoted to fostering continuous improvement and sustainable practices across the Canadian beef value chain.

The CRSB's objective is to promote sustainability throughout the Canadian beef industry through three pillars of focus:

1. Sustainability Benchmarking
2. A voluntary Certification Framework
3. Sustainability Projects

WCFA is proud to be a member of the CRSB. In 2021 we were active participants in the Certified Sustainable Beef Framework Committee, which oversees the delivery of CRSB's Certified Sustainable Beef Framework (an operation-level certification program developed by the CRSB), as well at the Communications Committee.

APPENDIX

BEEF RATION RULES OF THUMB AGRI-FACTS

October 2004 Agdex 420/52-4

Beef Ration Rules of Thumb

This factsheet can both guide producers through a feed test and help them understand the results.

With a feed test in front of you, look at the following rules and compare them to the feed test. Remember, these are rules of thumb, which means they hold true most of the time, but variations in management and cow type will affect the end result.

These rules of thumb should not be considered a replacement for balancing rations with proven software, but rather an aid to understand the feed and where it fits in the management.

Rules of Thumb

Dry matter

Always refer to the "dry matter" numbers. These numbers have the moisture factored out and allow the comparison of all feeds, from silage to grains.

Crude protein

Protein is a building block. The Beef Cow Rule of Thumb with protein is 7-9-11, which means an average mature beef cow requires a ration with crude protein of 7 per cent in mid pregnancy, 9 per cent in late pregnancy and 11 per cent after calving. The method to monitor protein in terms of cow performance is to look at the manure – high levels of undigested fibre in the manure indicate low protein.

Crude protein with feeder calves

The Feeder Calf Rule of Thumb is 14-12-10. A feeder calf from 550 to 800 lbs needs a ration of 14 per cent protein, from 800 to 1,050 lbs needs 12 per cent protein and from 1,050 lbs to finish needs 10 per cent protein. An implant program will create variations to this rule, so check with the implant manufacturer.

Rules of Thumb are not a replacement for balancing rations with proven software

Energy

Energy gives the ability to use the building blocks for growth and other productive purposes. Learn one of the six measures for energy and stick with it. Using Total Digestible Nutrients (TDN) per cent, the Rule of Thumb is 55-60-65. This rule says that for a mature beef cow to maintain her body condition score (BCS) through the winter, the ration must have a TDN energy reading of 55 per cent in mid pregnancy, 60 per cent in late pregnancy and 65 per cent after calving.

Energy can be monitored in the beef cow by watching BCS; low energy rations result in a loss of BCS. Other energy units of measure include Digestible Energy (DE), Metabolizable Energy (ME), Net Energy for lactation (NEl), Net Energy for maintenance (NEm), and Net Energy for gain (NEg), and producers can develop their own rules for these measures if the need arises.

Calcium to phosphorous ratio

The calcium to phosphorous ratio (Ca:P) for a mature beef cow should be within the range of 2:1 and 7:1, assuming actual required grams of each are adequate. Using a feed test, the ratio is calculated by dividing the dry matter Ca (%) by the dry matter P (%). Ratios outside this range need to be addressed using feed blends or commercial minerals.

Minerals

On an average feed analysis sheet, two other related minerals are reported: magnesium (Mg) and potassium (K). These two minerals, in combination with calcium (Ca), make up the tetany ratio, which is K/(Mg + Ca). Cowbytes, which is a ration balancing software program available through Alberta Agriculture, Food and Rural Development, indicates that this ratio should not exceed 2.2:1.

Alberta
AGRICULTURE, FOOD AND RURAL DEVELOPMENT

The combination of high K (**Rule of Thumb – over 1.75%**), and/or low Ca (**Rule of Thumb – under 0.6%**) and low Mg (**Rule of Thumb – under 0.3%**) can lead to animal performance issues. Because this ratio involves three different numbers, producers are encouraged to look at the three figures both individually and as a ratio to determine if the need for caution exists.

With respect to commercial minerals, an average **25 kg bag of minerals will last about 1 week for 50 cows.** Read the label for specific feeding rates.

Salt

On many feed analysis sheets, only Sodium (Na) is reported. **Rule of Thumb** says that **Na x 2.5 equals NaCl (salt).**

Salt Rule of Thumb: if the feed analysis shows that Na is over 0.1 per cent, which equates to salt over 0.25 per cent, livestock will receive all their salt requirements from the feed and therefore will not consume commercial minerals with added salt. High salt levels are very prevalent in cereal greenfeed and their associated feed analysis.

The next step

Once producers understand the quality of their individual feeds, the next step is to determine the quantity of feed required, both for individual animals per day and for the herd for the winter. Several Rules of Thumb apply to feed quantity.

Rule of Thumb for consumption

All beef cattle will consume approx **2.5** per cent dry matter (DM) of their body weight per day of average quality feed. For example, a **1,000** pound cow will eat **25** lbs of dry matter feed per day. Moisture and feed waste must be factored in on top of this number.

The following table, taken from Cowbytes, shows different consumption levels based on forage quality (Table 1).

Cold stress

Under **cold stress**, for every **10** degrees Celsius (C) below minus **20** degrees C, feed **3** kg of hay or **6** kg of silage or **2** kg of grain AS FED to cows.

Rule of Seven: for quick calculation purposes, this rules says that in an average operation, a combination of tons of silage, average size round bales of hay and average size round bales of straw all need to add up to **seven per mother cow.** For example, you may need three tons of silage, two bales of hay and two bales of straw per cow per winter. Cow size, length of winter-feeding season and feed wastage contribute to variations in this rule.

Backgrounding feeders calves require, as a **Rule of Thumb**, an additional **3** tons of silage or **1** ton of hay per **90** days of feeding.

Feed wastage

With respect to feed wastage, the **Rule of Thumb** says that if you see feed on the ground, you have **15** per cent waste. Many operations have over **20** per cent feed waste every winter, and the producers may not realize that this waste costs in excess of **$40**/cow.

Prepared by:

Trevor Yurchak – Alberta Agriculture, Food and Rural Development

Dr. Erasmus Okine – University of Alberta

Table 1. Forage intake guidelines [as per cent of body weight (BW)]

	Straw and poor forage	Medium quality forage	Excellent quality forage
Growing and finishing cattle	1.0%	1.8 to 2.0%	2.5 to 3.0%
Dry mature cows and bulls	1.4 to 1.6%	1.8 to 2.0%	2.3 to 2.6%
Suckled cows	1.6 to 1.8%	2.0 to 2.4%	2.5 to 3.0%

R.01/05/18M

SAMPLE SOIL HEALTH LAB REPORT FROM CARA

CARA SHLab

SOIL HEALTH LAB REPORT

XXXXX
XXXXXXXXX
xxxxxxxx

Lab Submission : 1-002111

LAB #	SAMPLE NAME	DEPTH (inches)	LAND LOCATION	ASSESSMENT	OBSERVATIONS
505	B1	0-3	NE S$-44 67 W5	Benchmark	
506	B1	3-6			
507	B2	0-6	NE XX-9-77-W5		
508	B3	0-6			
509	B4	0-6			

Highway 41E, Oyen, Alberta T0J 2J0
E-mail: carashl@telus.net
Phone: (403) 664 3777
Fax: (403) 664 3000

Submission N/Land Location	Farmer Id No.	Sample No.	Depth (cm)
1-002111	B1	505	0-7.5
1-002111	B1	506	7.5-15

% Sand	% Silt	% Clay	Textural Class:	
26	51	24	Medium	Loam
19	56	24	Medium	Silt loam

Soil Health Analysis: Biophysical & Others

	Indicator	Results 505	Results 506	Score 505	Score 506	Constraint(s)
Physical	Wet Aggregate Stability (%)	41	38	70	64	
	Water Infiltration (min)	63	63	12	12	Water retention and availability, potential for limited plant growth, drought resistance, leaching losses
	Bulk Density (g/cm3)	0.60	0.60	100	100	
	Compaction Depth/cm (200psi)	4	4	0	0	Germination, surface rooting, water infiltration, water storage, erosion
	Compaction Depth/cm (300psi)	5	5	0	0	Deep rooting, drought resistance, water availability, nutrient uptake, plant growth and yield, subsurface pan/deep compaction/restrictive layer
	Mean Physical Health:			36	35	36
Biological	Organic Matter (%)	3.8	3.8	74	74	
	Active Carbon (ppm)	326	229	17	7	Water infiltration, microbial biomass growth and activity, nutrient cycling, carbon storage, aggregate stability, bulk density, nutrient availability, supply of labile carbon
	C:N Ratio	12	12	98	97	
	Microbial Respiration (mg CO_2/g)	0.72	0.38	66	23	
	Mean Biological Health:			64	50	57
Chemical	pH	5.4	5.4	21	21	Slight acidity
	EC (mmhos/cm)	0.29	0.29	92	92	
	Extractable P (ppm)	21	21	0	0	P Deficiency
	Extractable K (ppm)	94	94	100	100	
	Magnesium (ppm)	451	451	0	0	Mg High
	Iron (ppm)	73	73	0	0	Excessive Fe
	Manganese (ppm)	25	25	1	1	
	Zinc (ppm)	3.1	3.1	1	1	
	Other nutrient Rating (0-4)			2	2	2
	Mean Chemical Health:			45	45	45
Overall Soil Health Score:				46		**Low**

Add-On Tests

Physical and Biological Indicator Scores are calculated using the cumulative normal distribution function for Coarse, Medium, and Fine textural classes. Depending on the measured soil texture distribution, this worksheet identifies the appropriate soil textural class and uses the corresponding Scoring Function. Each Indicator Score represents the percentage of all samples scoring at or below the measured value when compared across the complete sample database. Chemical Indicator Scores are not based upon the normal distribution. Soil pH, Extractable P, and Extractable K are scored as follows: a) pH Score of 100 for pH 6.25-7.25, Score of 0 for pH >= 7.7 and <= 5.4, b) P Scores were base on 25 + 5 ppm optimum P levels c) K Score of 100 for >=74.5 ppm, Score of 0 for <= 20 or 200 ppm. Other Nutrients Rating are determined on a scale of 0-4, representing the sum of Scores for Mg, Fe, Mn, and Zn and follows: a) Mg Score of 1 for > 33 ppm, 0 for <= 33 ppm, and 0 for > 200ppm, b) Fe Score of 1 for < 25 ppm, 0 for >= 25 ppm, c) Mn Score of 1 for < 50 ppm, 0 for >= 50 ppm, d) Zn Score of 1 for > 3ppm, 0 for <= 3 ppm and 0 for > 10ppm. Indicator Scores are assigned a color grade using the follows system: Very High, Score of 80-100 (Blue), High, Score of 60-80 (Green), Medium, Score of 40-60 (Yellow), Low, Score of 20-40 (Orange), Very Low, Score of 0-20 (Red). For Other Nutrients Ratings, a Score of 1 is best (blue) and 0 is worst (red). The Other Nutrients Rating is then converted to a 1-100 scale as follows (4, 100), (3, 56), (2, 11), (1, 4), and (0, 0). The Mean Physical, Biological, and Chemical Health Scores are calculated as the average of the Indicator Scores within each category. The average of the Mean Physical, Biological, and Chemical Health Scores is the Overall Soil Health Score. The Overall Soil Health Score is categorized using the following scale: Very High, >= 85, High, >= 70, Medium, >= 55, Low, >=40, Very Low, < 40.

Submission N/Land Location	Farmer Id No.	Sample No.	Depth (cm)
1-002111	B1	505	0-7.5
1-002111	B1	506	7.5-15

% Sand	% Silt	% Clay	Textural Class	
26	51	24	Medium	Loam
19	56	24	Medium	Silt loam

Soil Health Analysis: Biophysical & Others

	Indicator	Results 505	Results 506	Score 505	Score 506	Suggestion(s)
Physical	Wet Aggregate Stability (%)	41	38	70	64	
	Water Infiltration (min)	63	63	12	12	Short: Add stable organic materials, mulch, compost • Incorporate crop rotation with cover (cocktail) crops. Long: Reduce tillage, increase soil microbial diversity • Rotate with cover crops • Incorporate high biomass cover crop,.
	Bulk Density (g/cm3)	0.60	0.60	100	100	
	Compaction Depth/cm (200psi)	4	4	0	0	Short: Mechanical soil loosening (strip till, aerators, broadfork, spader) • deep & shallow-rooted cover crops •Living mulch, cocktail cover crop. Long term: Avoid traffic on wet soils /tillage/loads. Use controlled traffic patterns/lanes
	Compaction Depth/cm (300psi)	5	5	0	0	Short: Mechanical soil loosening (strip till, aerators, broadfork, spader) • deep & shallow-rooted cover crops •Living mulch or interseed cover crop. Long term: Avoid traffic on wet soils, tillage/loads. Use controlled traffic patterns/lanes.
	Mean Physical Health:			36	35	36
Biological	Organic Matter (%)	3.8	3.8	74	74	
	Active Carbon (ppm)	326	229	17	7	Short: Add fresh organic materials • Use shallow & deep-rooted cover/rotation crops • Add manure, green manure, mulch. Long: Reduce tillage • Rotate with sod crop • Cocktail Cover crop •Improve soil biological diversity
	C:N Ratio	12	12	98	97	
	Microbial Respiration (mg CO_2/g)	0.72	0.38	66	23	
	Mean Biological Health:			64	50	57
Chemical	pH	5.4	5.4	21	21	Base on Soil Rec: Add lime or wood ash, •Calcium sulfate (gypsum) + lime if high Al • Use less ammonium or urea, Long: Increase OM to improve buffering capacity
	Soluble Salts (EC)	0.29	0.29	92	92	
	Extractable P (ppm)	21	21	0	0	Add P soil test rec. • Use cover crops to recycle fixed P & promote Mycorrhizae colonization • Adjust pH to 6.2-6.5 to free up fixed P.
	Extractable K (ppm)	94	94	100	100	
	Magnesium (ppm)	451	451	0	0	Mg High
	Iron (ppm)	73	73	0	0	Excessive Fe
	Manganese (ppm)	25	25	1	1	
	Zinc (ppm)	3.1	3.1	1	1	
	Other nutrient Rating (0-4)			2	2	2
	Mean Chemical Health:			45	45	45
Overall Soil Health Score:				46		**Low**

Submission N / Land Location	Farmer Id No.	Sample No.	Depth (cm)
NW 32-90-23-W5M	B2	507	0-15

% Sand	% Silt	% Clay	Textural Class:	
28	41	31	Fine	Clay loam

Soil Health Analysis: Biophysical & Others

		Results	Score	
	Indicator	507	507	Constraint(s)
Physical	Wet Aggregate Stability (%)	59	90	
	Water Infiltration (min)	9	99	
	Bulk Density (g/cm3)	0.85	95	
	Compaction Depth/cm (200psi)	15	100	
	Compaction Depth/cm (300psi)	25	17	Deep rooting, drought resistance, water availability, nutrient uptake, plant growth and yield, subsurface pan/deep compaction/restrictive layer
	Mean Physical Health:		80	80
Biological	Organic Matter (%)	5.7	97	
	Active Carbon (ppm)	239	5	Water infiltration, microbial biomass growth and activity, nutrient cycling, carbon storage, aggregate stability, bulk density, nutrient availability, supply of labile carbon
	C:N Ratio	11	99	
	Microbial Respiration (mg CO_2/g)	0.98	90	
	Mean Biological Health:		72	72
Chemical	pH	5.6	33	Slight acidity
	Soluble Salts (EC)	0.32	91	
	Extractable P (ppm)	39	85	
	Extractable K (ppm)	240	0	K High
	Magnesium (ppm)	698	0	Mg High
	Iron (ppm)	143	0	Excessive Fe
	Manganese (ppm)	17	1	
	Zinc (ppm)	7.1	1	
	Other nutrient Rating (0-4)		2	2
	Mean Chemical Health:		44	44
Overall Soil Health Score:			66	Medium

Add-On Tests

Physical and Biological Indicator Scores are calculated using the cumulative normal distribution function for Coarse, Medium, and Fine textural classes. Depending on the measured soil texture distribution, this worksheet identifies the appropriate soil textural class and uses the corresponding Scoring Function. Each Indicator Score represents the percentage of all samples scoring at or below the measured value when compared across the complete sample database. Chemical Indicator Scores are not based upon the normal distribution. Soil pH, Extractable P, and Extractable K are scored as follows: a) pH Score of 100 for pH 6.25-7.25, Score of 0 for pH >= 7.7 and <=5.4, b) P Scores were base on 25 + 5 ppm optimum P levels c) K Score of 100 for >=74.5 ppm, Score of 0 for <= 20 or 200 ppm. Other Nutrients Rating are determined on a scale of 0-4, representing the sum of Scores for Mg, Fe, Mn, and Zn and follows: a) Mg Score of 1 for > 33 ppm, 0 for <= 33 ppm, and 0 for > 200ppm, b) Fe Score of 1 for < 25 ppm, 0 for >= 25 ppm, c) Mn Score of 1 for < 50 ppm, 0 for >= 50 ppm, d) Zn Score of 1 for > 3ppm, 0 for <= 3 ppm and 0 for > 10ppm. Indicator Scores are assigned a color grade using the follows system: Very High, Score of 80-100 (Blue); High, Score of 60-80 (Green); Medium, Score of 40-60 (Yellow); Low, Score of 20-40 (Orange); Very Low, Score of 0-20 (Red). For Other Nutrients Ratings, a Score of 1 is best (blue) and 0 is worst (red). The Other Nutrients Rating is then converted to a 1-100 scale as follows (4, 100), (3, 36), (2, 11), (1, 4), and (0, 0). The Mean Physical, Biological, and Chemical Health Scores are calculated as the average of the Indicator Scores within each category. The average of the Mean Physical, Biological, and Chemical Health Scores is the Overall Soil Health Score. The Overall Soil Health Score is categorized using the following scale: Very High, >= 85; High, >= 70; Medium, >= 55; Low, >=40; Very Low, < 40.

Submission N / Land Location	Farmer Id No.	Sample No.	Depth (cm)
NW 32-90-23-W5M	B2	507	0-15

% Sand	% Silt	% Clay	Textural Class:	
28	41	31	Fine	Clay loam

Soil Health Analysis: Biophysical & Others

		Results	Score	
	Indicator	507	507	Suggestion(s)
Physical	Wet Aggregate Stability (%)	59	90	
	Water Infiltration (min)	9	99	
	Bulk Density (g/cm3)	0.85	95	
	Compaction Depth/cm (200psi)	15	100	
	Compaction Depth/cm (300psi)	25	17	Short: Mechanical soil loosening (strip till, aerators, broadfork, spader) • deep & shallow-rooted cover crops •Living mulch or interseed cover crop. Long term: Avoid traffic on wet soils, tillage/loads. Use controlled traffic patterns/lanes.
	Mean Physical Health:		80	80
Biological	Organic Matter (%)	5.7	97	
	Active Carbon (ppm)	239	5	Short: Add fresh organic materials • Use shallow & deep-rooted cover/rotation crops • Add manure, green manure, mulch. Long: Reduce tillage • Rotate with sod crop • Cocktail Cover crop •Improve soil biological diversity
	C:N Ratio	11	99	
	Microbial Respiration (mg CO_2/g)	0.98	90	
	Mean Biological Health:		72	72
Chemical	pH	5.6	33	Base on Soil Rec: Add lime or wood ash, •Calcium sulfate (gypsum) + lime if high Al • Use less ammonium or urea, Long: Increase OM to improve buffering capacity
	Soluble Salts (EC)	0.32	91	
	Extractable P (ppm)	39	85	Add P soil test rec. • Use cover crops to recycle fixed P & promote Mycorrhizae colonization • Adjust pH to 6.2-6.5 to free up fixed P.
	Extractable K (ppm)	240	0	NO need for K application. Incorporate high demand K crop for balancing K
	Magnesium (ppm)	698	0	Mg High
	Iron (ppm)	143	0	Excessive Fe
	Manganese (ppm)	17	1	
	Zinc (ppm)	7.1	1	
	Other nutrient Rating (0-4)		2	2
	Mean Chemical Health:		44	44
Overall Soil Health Score:			66	Medium

Submission N / Land Location	Farmer Id No.	Sample No.	Depth (cm)
NW 32-90-23-W5M	B3	508	0-15

% Sand	% Silt	% Clay	Textural Class:	
29	45	25	Medium	Loam

Soil Health Analysis: Biophysical & Others

		Results	Score	
	Indicator	508	508	Constraint(s)
Physical	Wet Aggregate Stability (%)	57	92	
	Water Infiltration (min)	44	52	
	Bulk Density (g/cm3)	0.75	100	
	Compaction Depth/cm (200psi)	32	100	
	Compaction Depth/cm (300psi)	51	100	
	Mean Physical Health:		89	89
Biological	Organic Matter (%)	6.6	100	
	Active Carbon (ppm)	335	19	Water infiltration, microbial biomass growth and activity, nutrient cycling, carbon storage, aggregate stability, bulk density, nutrient availability, supply of labile carbon
	C:N Ratio	11	99	
	Microbial Respiration (mg CO_2/g)	0.71	64	
	Mean Biological Health:		70	70
Chemical	pH	5.3	16	Slight acidity
	Soluble Salts (EC)	0.53	83	
	Extractable P (ppm)	55	60	
	Extractable K (ppm)	189	100	
	Magnesium (ppm)	688	0	Mg High
	Iron (ppm)	124	0	Excessive Fe
	Manganese (ppm)	15	1	
	Zinc (ppm)	9.9	1	
	Other nutrient Rating (0-4)		2	2
	Mean Chemical Health:		54	54
Overall Soil Health Score:			71	High

Add-On Tests

Physical and Biological Indicator Scores are calculated using the cumulative normal distribution function for Coarse, Medium, and Fine textural classes. Depending on the measured soil texture distribution, this worksheet identifies the appropriate soil textural class and uses the corresponding Scoring Function. Each Indicator Score represents the percentage of all samples scoring at or below the measured value when compared across the complete sample database. Chemical Indicator Scores are not based upon the normal distribution. Soil pH, Extractable P, and Extractable K are scored as follows: a) pH Score of 100 for pH 6.25-7.25, Score of 0 for pH >= 7.7 and <=5.4, b) P Scores were base on 25 + 5 ppm optimun P levels c) K Score of 100 for >=74.5 ppm, Score of 0 for <= 20 or 200 ppm. Other Nutrients Rating are determined on a scale of 0-4, representing the sum of Scores for Mg, Fe, Mn, and Zn and follows: a) Mg Score of 1 for > 33 ppm, 0 for <= 33 ppm, and 0 for > 200ppm, b) Fe Score of 1 for < 25 ppm, 0 for >= 25 ppm, c) Mn Score of 1 for < 50 ppm, 0 for >= 50 ppm, d) Zn Score of 1 for > 3ppm, 0 for <= 3 ppm and 0 for > 10ppm. Indicator Scores are assigned a color grade using the follows system: Very High, Score of 80-100 (Blue); High, Score of 60-80 (Green); Medium, Score of 40-60 (Yellow); Low, Score of 20-40 (Orange); Very Low, Score of 0-20 (Red). For Other Nutrients Ratings, a Score of 1 is best (blue) and 0 is worst (red). The Other Nutrients Rating is then converted to a 1-100 scale as follows: (4, 100), (3, 56), (2, 11), (1, 4), and (0, 0). The Mean Physical, Biological, and Chemical Health Scores are calculated as the average of the Indicator Scores within each category. The average of the Mean Physical, Biological, and Chemical Health Scores is the Overall Soil Health Score. The Overall Soil Health Score is categorized using the following scale: Very High, >= 85; High, >= 70; Medium, >= 55; Low, >=40; Very Low, < 40.

Submission N / Land Location	Farmer Id No.	Sample No.	Depth (cm)
NW 32-90-23-W5M	B3	508	0-15

% Sand	% Silt	% Clay	Textural Class:	
29	45	25	Medium	Loam

Soil Health Analysis: Biophysical & Others

		Results	Score	
	Indicator	508	508	Suggestion(s)
Physical	Wet Aggregate Stability (%)	57	92	
	Water Infiltration (min)	44	52	
	Bulk Density (g/cm3)	0.75	100	
	Compaction Depth/cm (200psi)	32	100	
	Compaction Depth/cm (300psi)	51	100	
	Mean Physical Health:		89	89
Biological	Organic Matter (%)	6.6	100	
	Active Carbon (ppm)	335	19	Short: Add fresh organic materials • Use shallow & deep-rooted cover/rotation crops • Add manure, green manure, mulch. Long: Reduce tillage • Rotate with sod crop • Cocktail Cover crop •Improve soil biological diversity
	C:N Ratio	11	99	
	Microbial Respiration (mg CO_2/g)	0.71	64	
	Mean Biological Health:		70	70
Chemical	pH	5.3	16	Base on Soil Rec: Add lime or wood ash, •Calcium sulfate (gypsum) + lime if high Al • Use less ammonium or urea, Long: Increase OM to improve buffering capacity
	Soluble Salts (EC)	0.53	83	
	Extractable P (ppm)	55	60	
	Extractable K (ppm)	189	100	NO need for K application. Incorporate high demand K crop for balancing K
	Magnesium (ppm)	688	0	Mg High
	Iron (ppm)	124	0	Excessive Fe
	Manganese (ppm)	15	1	
	Zinc (ppm)	9.9	1	
	Other nutrient Rating (0-4)		2	2
	Mean Chemical Health:		54	54
Overall Soil Health Score:			71	High

Submission N / Land Location	Farmer Id No.	Sample No.	Depth (cm)
NW 32-90-23-W5M	B4	509	0-15

% Sand	% Silt	% Clay	Textural Class:	
32	46	22	Medium	Loam

Soil Health Analysis: Biophysical & Others

		Results	Score	
	Indicator	509	509	Constraint(s)
Physical	Wet Aggregate Stability (%)	59	94	
	Water Infiltration (min)	21	94	
	Bulk Density (g/cm3)	0.88	100	
	Compaction Depth/cm (200psi)	16.51	100	
	Compaction Depth/cm (300psi)	24.384	16	Deep rooting, drought resistance, water availability, nutrient uptake, plant growth and yield, subsurface pan/deep compaction/restrictive layer
	Mean Physical Health:		81	81
Biological	Organic Matter (%)	6.6	100	
	Active Carbon (ppm)	389	27	Water infiltration, microbial biomass growth and activity, nutrient cycling, carbon storage, aggregate stability, bulk density, nutrient availability, supply of labile carbon
	C:N Ratio	11	99	
	Microbial Respiration (mg CO_2/g)	0.75	69	
	Mean Biological Health:		74	74
Chemical	pH	5.3	16	Slight acidity
	Soluble Salts (EC)	0.53	83	
	Extractable P (ppm)	55	60	
	Extractable K (ppm)	189	100	
	Magnesium (ppm)	688	0	Mg High
	Iron (ppm)	124	0	Excessive Fe
	Manganese (ppm)	15	1	
	Zinc (ppm)	9.9	1	
	Other nutrient Rating (0-4)		2	2
	Mean Chemical Health:		54	54
Overall Soil Health Score:			69	Medium

Add-On Tests

Physical and Biological Indicator Scores are calculated using the cumulative normal distribution function for Coarse, Medium, and Fine textural classes. Depending on the measured soil texture distribution, this worksheet identifies the appropriate soil textural class and uses the corresponding Scoring Function. Each Indicator Score represents the percentage of all samples scoring at or below the measured value when compared across the complete sample database. Chemical Indicator Scores are not based upon the normal distribution. Soil pH, Extractable P, and Extractable K are scored as follows: a) pH Score of 100 for pH 6.25-7.25, Score of 0 for pH >= 7.7 and <=5.4, b) P Scores were base on 25 + 5 ppm optimum P levels c) K Score of 100 for >=74.5 ppm, Score of 0 for <= 20 or 200 ppm. Other Nutrients Rating are determined on a scale of 0-4, representing the sum of Scores for Mg, Fe, Mn, and Zn and follows: a) Mg Score of 1 for > 33 ppm, 0 for <= 33 ppm, and 0 for > 200ppm, b) Fe Score of 1 for < 25 ppm, 0 for >= 25 ppm, c) Mn Score of 1 for < 50 ppm, 0 for >= 50 ppm, d) Zn Score of 1 for > 3ppm, 0 for <= 3 ppm and 0 for > 10ppm. Indicator Scores are assigned a color grade using the follows system: Very High, Score of 80-100 (Blue), High, Score of 60-80 (Green), Medium, Score of 40-60 (Yellow), Low, Score of 20-40 (Orange), Very Low, Score of 0-20 (Red). For Other Nutrients Ratings, a Score of 1 is best (blue) and 0 is worst (red). The Other Nutrients Rating is then converted to a 1-100 scale as follows (4, 100), (3, 56), (2, 11), (1, 4), and (0, 0). The Mean Physical, Biological, and Chemical Health Scores are calculated as the average of the Indicator Scores within each category. The average of the Mean Physical, Biological, and Chemical Health Scores is the Overall Soil Health Score. The Overall Soil Health Score is categorized using the following scale: Very High, >= 85; High, >= 70; Medium, >= 55; Low, >=40; Very Low, < 40.

Submission N / Land Location	Farmer Id No.	Sample No.	Depth (cm)
NW 32-90-23-W5M	B4	509	0-15

% Sand	% Silt	% Clay	Textural Class:	
32	46	22	Medium	Loam

Soil Health Analysis: Biophysical & Others

		Results	Score	
	Indicator	509	509	Suggestion(s)
Physical	Wet Aggregate Stability (%)	59	94	
	Water Infiltration (min)	21	94	
	Bulk Density (g/cm3)	0.88	100	
	Compaction Depth/cm (200psi)	17	100	
	Compaction Depth/cm (300psi)	24	16	Short: Mechanical soil loosening (strip till, aerators, broadfork, spader) • deep & shallow-rooted cover crops •Living mulch or interseed cover crop. Long term: Avoid traffic on wet soils, tillage/loads. Use controlled traffic
	Mean Physical Health:		81	81
Biological	Organic Matter (%)	6.6	100	
	Active Carbon (ppm)	389	27	Short: Add fresh organic materials • Use shallow & deep-rooted cover/rotation crops • Add manure, green manure, mulch. Long: Reduce tillage • Rotate with sod crop • Cocktail Cover crop •Improve soil biological diversity
	C:N Ratio	11	99	
	Microbial Respiration (mg CO_2/g)	0.75	69	
	Mean Biological Health:		74	74
Chemical	pH	5.3	16	Base on Soil Rec: Add lime or wood ash, •Calcium sulfate (gypsum) + lime if high Al • Use less ammonium or urea, Long: Increase OM to improve buffering capacity
	Soluble Salts (EC)	0.53	83	
	Extractable P (ppm)	55	60	
	Extractable K (ppm)	189	100	NO need for K application. Incorporate high demand K crop for balancing K
	Magnesium (ppm)	688	0	Mg High
	Iron (ppm)	124	0	Excessive Fe
	Manganese (ppm)	15	1	
	Zinc (ppm)	9.9	1	
	Other nutrient Rating (0-4)		2	2
	Mean Chemical Health:		54	54
Overall Soil Health Score:			69	Medium

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Soil Foodweb Analysis
NPARA
Jolene Noble
Main Street
Manning, Alberta T0H2M0
Fax:

Lab Submission # 1-002111

Plants: Wheat, grass, Annuals
Sample Received: 7/9/2019
Invoice Numb 1-002111

Organism Biomass Data

Sample #	Unique ID	Depth Inches	Active Bacterial Biomass (µg/g)	Total Bacterial Biomass (µg/g)	Active Fungal Biomass (µg/g)	Total Fungal Biomass (µg/g)	Average Hyphal Diameter (µm)	Protozoa Numbers/g Flagellates	Amoebae	Ciliates	Total Nematode (Dry Weight) #/g
505	B1	0-3	1610	1,660	32	655	3.8	4,720	307	85	8.1
506	B1	3-6	597	914	0	402	3.6	1,554	156	0	1.3
507	B2	0-6	147	3,189	39	508	3.7	2,553	5,085	0	0.7
508	B3	0-6	3147	4,390	15	951	4.7	5,850	10,564	74	1.1
509	B4	0-6	1335	5,182	53	858	3.7	5,134	3,339	43	6.8
Desired Range			1 - 5	175 - 300	1 - 5	175 - 300	(A)	5000 +	5000 +	50 - 100	10 - 20

(A) Hyphal diameter of 2.0 indicates mostly actinobacteria hyphae, 2.5 indicates community is mainly ascomycete, typical soil fungi for grasslands, diameters of 3.0 or higher indicate community is dominated by highly beneficial fungi, a Basidiomycete community.

Notes: Protozoa numbers and types are an estimate of their appearance when counting them base on shapes, movements, sizes, colors, etc

Sample	Protozoa Types Numbers (At Least) Flagellates	Ciliates	Amoeba	Fungal Hyphae Colors*	Diam (um)	Other Comments
505	6	1	1	Burg, C	2.3-6.3	Large Ciliate
506	6	0	1	C	2.3-6.3	
507	7	0	1	C	2.3-10	white little worms, large Ciliates in fresh sample
508	8	2	1	C	2.3-10	large ciliate, two types of rotifers
509	7	3	2	B,C	2.3-4	Large round and flat ciliates

*Color: Burgandy (Burg) Ligh Brown (LB), Brown (B), Clear (C), Tan (T)

Organism Ratios

Sample #	Unique ID	Depth Inches	Total Fungal To Total Bacterial Biomass	Active to Total Fungal Biomass	Active to Total Bacterial Biomass	Active Fungal to Active Bacterial Biomass	Nematode Feeding Habit Identified #/g (Wet Soil) BactF	FungF	RootF	Pred
505	B1	0-3	0.394	0.050	0.969	0.020	2.65	1.42	2.84	0.38
506	B1	3-6	0.440	0.000	0.653	0.000	0.39	0.06	0.69	0.00
507	B2	0-6	0.159	0.077	0.046	0.269	0.08	0.24	0.21	0.03
508	B3	0-6	0.217	0.016	0.717	0.005	0.38	0.15	0.23	0.08
509	B4	0-6	0.127	0.080	0.258	0.039	3.58	0.26	1.79	0.00

Desired Range	*(1)	*(2)	*(2)	*(3)	*(4)

(1) Brassica: 0.2-0.5; Row crops: 0.6 to 1.2; Early successional grass: 0.5-0.75; Late successional grass: 0.8 to 1.5; Berries, shrubs, vines: 2-5; Deciduous Trees: 5-10; Conifer: 10-100.

(2) Warm spring, early summer: 0.25 to 0.95; Early spring, late winter & mid-summer: 0.10 to 0.15; Fall rain: 0.15 to 0.20; Drought/frozen soil/heavy metal/many pesticides: 0.05 or lower. Values greater than indicated mean the organisms are recovering from a negative impact. Values lower mean organisms are not recovering and help is needed, typically addition of their food resource is required.

(3) Generally 1:1 results in good soil aggregate structure in crop soil; 2 to 5 for deciduous trees; 5 for conifers. Values above 1:1 mean negative impact. Values lower mean organisms are not recovering and help is needed, typically addition of their food resource is required.

(4) Identification of Todes feeding groups: (BactF) Bacteria, (FungF) Fungal, (Pred) Predatory, (RootF) Plant/Root,

Season, moisture, soil and organic matter must be considered in determining optimal foodweb structure.
All submissions receive free 15 minute consultation, call +1 403 664 3777

Report Number: C19205-10017
Account Number: 01207

To: CHINOOK APPLIED RESEARCH ASSOC
BOX 690
HIGHWAY 41 EAST
OYEN, AB T0J 2J0

A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5
Telephone: (519) 457-2575 Fax: (519) 457-2664

C19205-10017

For: CARA SHL

Grower Code: 1-002111

SOIL TEST REPORT

Reported Date:2019-07-26 **Printed Date:**Aug 12, 2019 **Page:** 1 / 1

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	Buffer	CEC meq/100g	Percent Base Saturations % K	% Mg	% Ca	% H	% Na
505-506	B1	0	48481	3.8	14 L	21 L	94 M	451 H	1400 VL	5.4	6.5	17.1	1.4	22.0	40.9	34.8	1.0
507	B2	0	48482	5.7	20 M	39 M	240 H	698 VH	930 VL	5.6	6.2	21.7	2.8	26.7	21.4	43.8	5.3
508-509	B3	0	48483	6.6	32 G	55 G	189 H	688 H	1220 VL	5.3	5.9	26.6	1.8	21.5	22.9	49.3	4.5

Sample Number	Sulfur S ppm	Sulfur S lbs/ac	Nitrate Nitrogen NO3-N ppm	Nitrate Nitrogen NO3-N lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts mmhos/cm	Saturation %P	Aluminum Al ppm	Saturation %Al	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm
505-506	9 VL		16 M		3.1 M	25 M	73 VH	2.7 H	0.4 L	0.3 VL	4 M	756	1.0 G	0.06	50	13	38 M
507	17 VL		2 VL		7.1 H	17 M	143 VH	4.4 VH	0.6 M	0.3 VL	5 M	1054	0.8 G	0.10	70	9	263 VH
508-509	17 VL		28 H		9.9 H	15 M	124 VH	1.3 H	0.4 L	0.5 L	7 H	1007	1.0 G	0.08	79	10	277 VH

W VL = VERY LOW, L = LOW, M = MEDIUM, H = HIGH, VH = VERY HIGH, G = GOOD, MA = MARGINAL, MT = MODERATE PHYTO-TOXIC, T = PHYTO-TOXIC, ST = SEVERE PHYTO-TOXIC

SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B
505-506		Pasture	2 tons	3.5	140	40	100	0	0	30	0.0	0	0	0	0.0
507		Rye	40 bu	6.5	50	35	20	0	0	30	0.0	0	0	0	0.0
508-509		Rye	40 bu	9.0	45	0	20	0	0	25	0.0	0	0	0	0.0