Lakeland Agricultural Research Association

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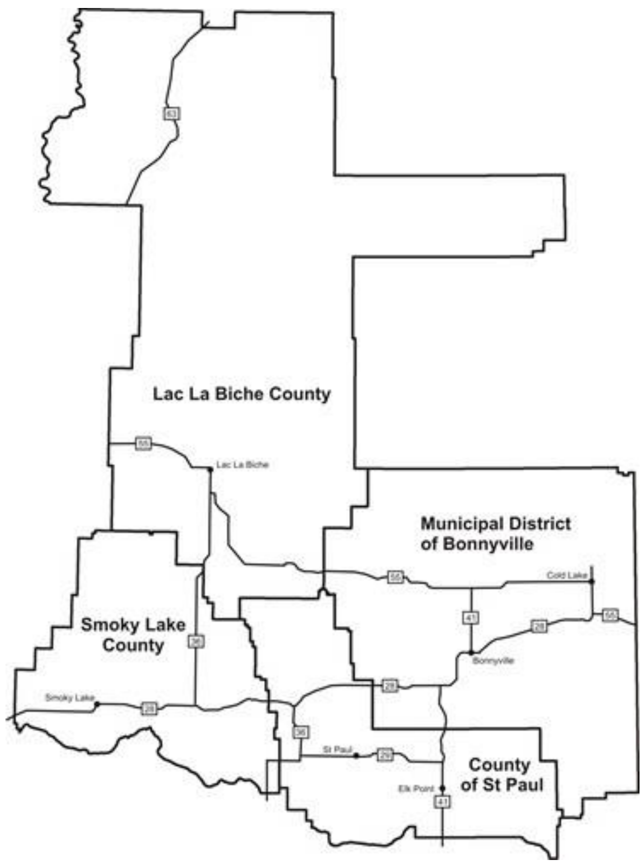
LAKELAND AGRICULTURAL RESEARCH ASSOCIATION

Vision Statement:
To be a leader in applied research and extension in Alberta

Mission Statement:
Lakeland Agricultural Research Association conducts innovative, unbiased, applied research and extension, supporting sustainable agriculture

What is the Lakeland Agricultural Research Association?

Lakeland Agricultural Research Association (LARA) is a producer-run organization conducting leading edge applied agricultural research and extension in Northeastern Alberta. Our vision is to make Alberta's agricultural producers profitable and sustainable through applied research, demonstration and extension in the areas of forages, livestock, annual crops, specialty crops, environmental conservation and regenerative agriculture.



LARA is located ½ mile west of Fort Kent, Alberta on Township Road 615.

LARA is open Monday to Friday, 8:00 am to 4:30 pm

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Message from the Chair

Those of us in agriculture are an optimistic bunch! The old saying "Next year will be better has never been more evident.

2021 once again put us to the test as we faced the record setting heat wave. It was hard on the pasture land, hay crops and cereal crops. Cattle had to be brought home from the pastures earlier than normal, hay was selling at a premium and the crops were sparse.

Winter has been a tough one! Record setting cold in temperatures and the length of the cold snap. Now we are dealing with huge amounts of snow!

We are still dealing with the Covid 19 Pandemic so many of our events were once again virtual although we were able to host our field days and a couple of in person special events.

Despite the curves Mother Nature threw at us, our amazing staff at LARA continued to do a good job and I want to take this time to express the LARA board's heartfelt thanks for all that they do to keep LARA moving forward and for always being there for our producers.

The board would also like to extend a huge thank you to the County of Smoky Lake, County of St. Paul, Lac La Biche County and the MD of Bonnyville for supporting LARA.

Thank you to the LARA board of directors for your commitment and knowledge. It is a pleasure working with you all.

Wanda Austin

Forage and Livestock Program Report

This past year has presented the agriculture industry in Alberta and across Western Canada with many, many challenges. From record setting high temperatures in the summer to weeks on end of well below -30 through the winter, the environment has had a huge impact on grain, forage and livestock producers alike.

The hot and dry conditions in the summer, led to a significant negative impact on hay and pasture land with many hay crops yielding at 25%-50% of average. This has led to a shortage in stored feed supplies. To help producers cope, we hosted a very successful webinar with Yaremcio Ag Consulting to discuss ways our local livestock producers can feed through the winter on limited feed supplies.

Not only were hay crops negatively impacted, but cattle had to be removed from pasture earlier than anticipated due to poor pasture regrowth. Focus will need to be on pasture and hayland rejuvenation as we move into 2022.

On the research side, we have completed the third year of our project assessing the impact of four winter grazing strategies on long-term soil health. The results are coming in and will become available in 2022. The regional silage trials continue to be a key project for our Forage and Livestock Program as we grew over 30 varieties of barley, wheat, triticale and oats. In addition, this project has been assessing individual cover crop species for productivity and quality as a feed option for livestock producers.

I want to say a huge thank you to everyone who participated in our research and extension programming at LARA this past year. A huge thank you to all of the hard-working and dedicated staff and board of directors and to the many local producers who continue to support our programming. It has been a challenging one, but your continued support ensures that regional research and extension can continue in the Lakeland. I am looking forward to another successful year in 2022.

Sincerely,

Alyssa Krawchuk

Cropping Program Report

The close of 2021 saw the complement of my second year as a full-time employee of LARA! This year's plot was grown in the MD of Bonnyville, County of St. Paul, County of Lac La Biche, and Smoky Lake County.

To say the least, 2020 and 2021 were rocky aside from being in a pandemic. 2020 was a growing season of extreme moisture causing flooded fields and unharvested crops and forages. To drought conditions in 2021, which started as a dry spring and turned into an even drier summer and fall. These conditions caused poor emergence, early maturity, and low yields in both crops and forages.

Some of the highlights for the 2021 research plots were the RVT in Fort Kent. These trials did extremely well, considering the year that it had been and produced stable data to be used by producers. This year was also my first year growing hemp at LARA, it was a learning curve as I didn’t have much experience with hemp. But I look forward to growing hemp again in 2022.

I would like to say a huge thank you to everyone who participated in our research and extension program at LARA this past year. Our board of directors and producers are fantastic to work with throughout the year and we greatly appreciate your input. Our exceptional staff here at LARA and our summer students, your hard work and dedication truly do not go unnoticed. I am looking forward to another successful year in 2022.

Sincerely,

Amanda Mathiot
Cropping Program Manager

Environmental Program Report

Although there might have been fewer workshops, there were still plenty of learning opportunities this year. 2021 definitely was a challenge with the heat dome and drought. Personally, I picked the worst year to plant a bunch of trees in my yard. With the weather extreme, it did show the benefit of cover crops on my own property, as where they had been planted the year before, the soil had a supply of moisture and better aggregation compared to my monoculture lawn, that was like dust. The benefits of biodiversity really shined, and provided a refuge for my bees.

This year I also was able to finish my Masters Degree in Water Security from the University of Saskatchewan. This multidisciplinary degree provided a great challenge trying to recall my calculus skills, and create new computer programming skills (that are still shameful).

2021 still was busy with Environmental Farm Plans, as well as assisting producers with funding applications to Canadian Agricultural Partnerships and the LARAWRRP.

Work towards a local food initiative (Connect For Food) was kick started, and will continue into 2022. Along with planning for the next Western Canada Conference for Soil Health and Grazing. In lieu of the conference being postponed, a webinar series with Joel Williams was held in 2021 that had amazing attendance and great takeaways. This year I look forward towards many more sessions about soil health to continue area producers' journey on regenerative agriculture.

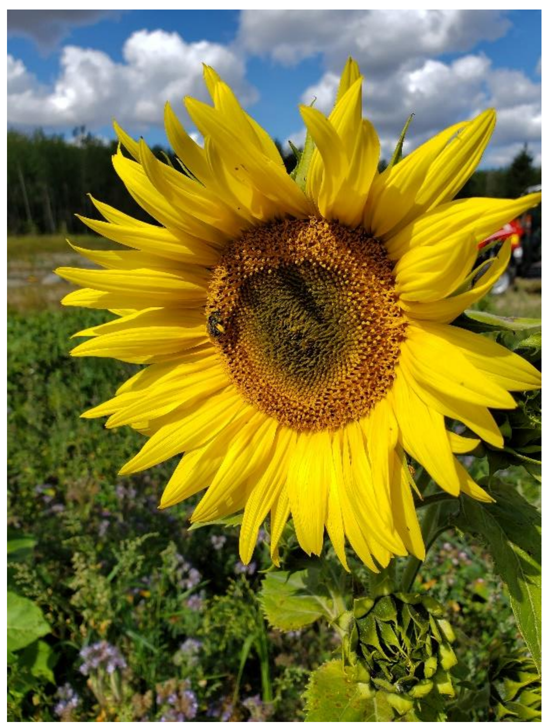
As the pandemic continued on last year, school programs were cancelled, which I missed dearly. I am so happy to announce that the Classroom Agriculture Program is coming back for 2022. After 35 years, this program is much loved and a great way for grade 4s to learn about where their food comes from.

As we start the new year with optimism for a great growing season, along with possibilities of extension events, it will be interesting to see if 2022 will bring with it the 'new normal'.

I want to thank those who have attended our webinars and workshops, and those that have shown interest in environmental stewardship.

Cheers to a great 2022!

Kellie Nichiporik MWS P.Ag.



2021 Board of Directors

Chair:	Wanda Austin
St. Paul County Rep:	Kevin Wirsta Louis Dechaine (alternate)
Lac La Biche County Rep:	Sterling Johnson Colette Borgun (alternate)
MD of Bonnyville Rep:	Don Slipchuk Josh Crick (alternate)
Smoky Lake County Rep:	Danny Gawalko
Producer Reps:	Murray Scott – MD of Bonnyville Ulf Herde – MD of Bonnyville Phil Amyotte – County of St. Paul Patrick Elsen – County of St. Paul Wanda Austin – Lac La Biche County Laurier Bourassa – Lac La Biche County Charlie Leskiw – County of Smoky Lake Barb Shapka – County of Smoky Lake
Lakeland Forage Association Rep:	Jay Cory Chairman, LFA

2021 Staff

Executive Director **Forage and Livestock Program Manager:**	Alyssa Krawchuk
Cropping Program Manager:	Amanda Mathiot
Environmental Program Manager:	Kellie Nichiporik
Agronomy Technician:	Stephanie Bilodeau
Administration/Horticulture:	Charlene Rachynski
Full Time Staff:	Vic Sadlowski Dustin Roth
Summer Staff	Haley Dechaine Hailey Romonowics Amelle Tizzard
LFA Pasture Managers:	Bob and Wanda Austin

Acknowledgements

The success of LARA's programs is a testament to the support and partnerships we have with a number of organizations and individuals within our operational area. LARA would like to thank the following contributors and partners in making 2021 another successful year.

Alberta Agriculture and Forestry (AF)
Canadian Agricultural Partnership (CAP)
Agriculture and Agri-Food Canada (AAFC)
Alberta Environment and Parks (AEP)

Municipalities & Counties
MD of Bonnyville
County of St. Paul
Lac La Biche County
Smoky Lake County

Associations & Societies
North Peace Applied Research Association
McKenzie Applied Research Association
Gateway Research Organization
Battle River Research Group
Grey Wooded Forage Association
West-Central Forage Association
Foothills Forage and Grazing Association
Peace County Beef and Forage Association
Chinook Applied Research Association
FarmRite
Craigend Agriculture Society
Alberta Lake Management Society
St. Paul Agriculture Society
Moose Lake Watershed Society
Agriculture Research and Extension Council of Alberta

Producers
Philip Amyotte
Todd Tessolin
Darrell Ketsa
Luc Tellier
Todd Brodziak

Industry and Producer Commissions
Alberta Beef Producers
Alberta Pulse Growers Commission
Alberta Wheat Commission
Alberta Barley Producers Commission
Alberta Canola Producers Commission
Canola Council of Canada

Agri-Businesses & Collaborators
AFSC Insurance
Agland St. Paul
Canadian Seed Growers Association, AB
Western Committee on Crop Pests
UFA – St. Paul and Vermilion
St. Paul Municipal Seed Cleaning Plant
FP Genetics
Nutrien Ag Solutions
HGI Hemp Genetics International
Canterra Seeds
Bonnyville Municipal Seed Cleaning Pl.
Association of AB Seed Cleaning Plants
Caouette & Sons
Solio Ag
Imperial Seed
Mistol Seeds
SeCan
UniSeeds
Union Forage
Cover Crops Canada
Alliance Seed
A & L Canada Laboratories
Top Gro Agro Ltd.
Greymont Western Canada Inc.
Innotech Alberta

And the many, many other suppliers and producers who gave us a great deal of assistance!

Lakeland Agricultural Research Association Projects and Activities – 2021

Research and Demonstration Projects

Cropping Program
Regional Variety Trials – Cereals
- CWRS Wheat
- CPRS Wheat
- Oats
- Triticale
- Barley

Regional Variety Trials – Pulses
- Green Field Peas
- Yellow Field Peas
- Faba Beans

LARA Regional Variety Trial
Impact of Seeding Date on Spring Wheat
Use of ESN in Spring Cereals
- Wheat and Barley

Canola Performance Trial
Top Dressing N on Spring Wheat
Canola Seed Size and Depth trial
Liming and Crop Rotations
Pest Monitoring

Forage and Livestock Program
Regional Silage Trials
- Barley
- Triticale
- Pea-Cereal Mixture
- Alternatives
- Winter-Spring Cereals
- Oats

Perennial Forage Projects
- Grass/Legume Mixture
- Grasses
- Legumes

Winter Grazing Strategies and Soil Health
Northern Range Enhancement Project
- Heifer Project

Environmental Program
Canada Thistle Stem Mining Weevils
Riparian Health Assessments
Cyanobacteria Monitoring Project
Alberta Soil Health Benchmarking Project
Cover Crops and Soil Health Project

Extension Activities

Workshops, Seminars and Webinars
Designing Cover Crop Blends
Soil Health Webinar Series with Joel Williams
LARA Research Update and AGM
Talk*Ask*Listen
Moose Lake Nutrient Budget Release
Succession Planning
Grazing Planning
Working Well Workshop
Smoky Lake Summer Field Day
Fort Kent Summer Field Day
St. Paul Summer Field Day
Dugout Webinar Series
Healthy Waters Lac La Biche
Hemp Workshop
Septic Sense: Solutions for Rural Living
In The Know
Building Soil Resilience Through Regenerative Agriculture
Living Labs Opportunity
Cultivating Resilience on the Farm: How to Get Unstuck
Feeding Through the Drought

Education Events
Grade Seven Wetland Education
Lac La Biche Mad About Science
Alberta Open Farm Days

Demonstrations
Solar Watering System
Flax Variety Demonstration
Hemp Variety Demonstration

A Short Explanation of Various Statistical Terms Used in this Report

Least Significant Difference (LSD):

- Once the data from a test plot has been collected it can be used to calculate the Least Significant Difference (LSD). The LSD tells if one variety (or bushel weight, etc.) is significantly different than the other varieties in a test plot (same environment and soil conditions).

- Example: The LSD for a test plot has been calculated to be 2 bu/acre. If a test variety Ava differs from the other varieties by more than 2 bu/acre then there is a significant yield difference. We can say one variety yields higher than another. If the varieties are within 2 bu/acre then we cannot say the varieties yield differently.

Yield Grouping:

- Once the LSD is determined, each variety is assigned a yield grouping letter (A, B, C, etc.). By using yield grouping letters, we can easily determine which varieties are significantly different. Varieties that share a letter will **NOT** be significantly different, but varieties that **DO NOT** share a letter **WILL** be considered significantly different.

- Example: In this example Bob, and Cora are **not** considered to be significantly different from Ava because they share the Yield Grouping letter A…but David, Evan, Frank and Gary **are** considered to be significantly different from Ava, because they do not have Yield Grouping letter A and therefore, it could be said that Ava has a higher yield than David, Evan, Frank and Gary.

Variety	Yield Grouping
Ava	A
Bob	AB
Cora	AB
David	BC
Evan	CD
Frank	CD
Gary	D

Coefficient of Variability (CV):

- The coefficient of variability (CV) is a measure of the consistency of the data from a plot. A lower CV value means that the data collected from the plot was consistent, which implies that the data collected is reliable and that accurate conclusions/recommendations can be made from these findings. A CV value of less than 20 is considered to be acceptable. The data from any plots that have a CV value of greater than 20 will be discarded to ensure the statistical accuracy of the tests. Discarding plot data that has a CV value of greater than 20 will prevent any skewing of the test results due to inconsistencies in soil quality or unexpected events like droughts or floods.

Bushel Calculation

- All bushels were calculated using 35.2L for volume, and test weight (0.5L) as measured

Smoky Lake County Agricultural Service Board 2021 Overview

Agricultural Pest Act

- 3 Agricultural Pest Inspectors Appointed
- 75 Clubroot Fields Inspected
- 4 Fields Inspected for Virulent Blackleg in Canola
- 3 Bertha armyworms locations Monitored throughout County for AB Ag
- 12 Grasshoppers monitored for AB Ag
- 2 Fields Sampled for Fusarium Head Blight in Wheat
- 52 Beaver tails brought in
- 4 New Water Stabilizers Installed
- 7 repaired/upgraded water stabilizers
- 0 Bottles of strychnine sold
- 457 Pocket Gopher Tails brought in
- 0 1080 pills distributed

Weed Control Act

- 3 Weed Inspectors Appointed
- 0 Weed Enforcements
- 50% of Municipal Rights of way's were sprayed for control of Weeds
- 2 Locations sprayed for Prohibited noxious weeds
- 336 Introduction Letters Sent
- 312 Inspections Completed
- All County roads mowed once

Soil Conservation Act

- 2 Soil Conservation Inspectors Appointed
- Monitoring for different types of Soil erosion occurs throughout growing season

M.D. of Bonnyville 2021 – A Year in Review

Another year has come gone and more than just Covid challenges came with it. Hot and dry temperatures skyrocketing into the 40's posed many challenges for producers. Producers faced feed shortages and diminished crop yields leading the Municipality to declare a State of Agricultural Disaster in our area. This step can bring awareness to a developing situation, inform residents, industry, provincial and federal governments and enable collaboration with impacted producer groups.

In 2021 we inspected a total of 434 fields for clubroot, yielding only one additional positive field. In 2015 we found our first positive clubroot field. Since that time, we have verified 13 positive fields over the previous 7 years. Our eastward trend continues putting clubroot north of HI way 55 between La Corey and Cold Lake. Please check out our Areas of Concern map that is posted on our MD website.

Scentless Chamomile, Oxeye Daisy and White Cockle continue to be prolific noxious weeds in our area. Weather conditions delayed our spraying efforts in 2021 allowing these weeds to establish and set seed. Our inspectors will be out in full force once again to prevent or eliminate any infestations that may affect our fields. Good news, we will be implementing a new fenceline spraying program to assist farmers with the establishment of weeds in their headlands adjacent to municipal rights-of-way.

Last years Shelterbelt program was once again a huge success, selling nearly 9000 shelterbelt and ornamental trees.

Insect survey results for last year were well below the economic thresholds. The pea leaf weevil, cabbage seedpod weevil and wheat midge are not favored by the hot, dry conditions. We noted some grasshopper damage in select areas; however, the Alberta grasshopper forecast for 2022 is low. The Coyote and Wolf Reduction Incentive Program is up and running and residents will have until March 31, 2022 to bring them. This year we did have an MD resident bring in a deceased Norway Rat that was found in the Goodridge area while combining. Our staff completed the inspection of a 5 km radius around where the rat was located. In total there were 76 inspections done and no other rat signs were found. As a precautionary measure the 76 completed inspections were offered rat bait for placement on private property.

We received a 50/50 cost sharing grant to build an area specific Emergency Livestock Plan. With the assistance of Jennifer Woods Livestock, we have designed a Livestock Emergency Response Guide and Livestock Emergency Resource Guide. We hosted a two-day hands-on training for MD employees, local RCMP members (both Cold Lake and Bonnyville Detachments) as well as local stakeholders. Distribution of Livestock Preparedness magnets were sent out to all livestock producers within the MD. We will continue to do hands on mock training with responders annually. A copy of our Livestock Response Guide can be found on our MD of Bonnyville website.

Overall, we a very successful and productive year throughout all the challenges we went up against. Here is goodbye to 2021 and best wishes to producers for a successful and prosperous 2022 growing season.

Matt and Janice

Lac La Biche County Agriculture Review 2021

Lac La Biche County Agricultural Service Board considers its partnership with Lakeland Agricultural Research Association as highly beneficial to the region's agricultural community.

In 2021, the County inspected 70 brassica fields for Clubroot, with no field testing positive. That is more than the 28 fields inspected in 2020. Six sites were inspected for Fusarium Head blight. The ASB also completed five grasshopper surveys were completed.

Lac La Biche County also made significant enhancements to the Alexander Hamilton Community Garden in 2021. The improvements include the addition of peat and gypsum to the soil and the installation of additional water tanks. In 2022, raised beds will be added to the garden to improve gardener's experience. About 5,367 km of County roads, ditches and right of ways were mowed, with some areas getting a second pass. This was 20.7 % higher than in 2020 mowed areas.

Lac La Biche County completed more than 750 weed inspections on public and private lands, that's 33 % higher than in 2020, with 8 weed notices issued. ASB equipment were rented out to 52 ratepayers for a combined total of 194 days.

The County's Agricultural Service Board provided two bursaries to two post-secondary students in natural resource management programs. The County's Agricultural Service Board partnered with Portage College to host the 2021 Agricultural Appreciation & Symposium.

The Agricultural Service Board is excited about LARA's new long-term research site in Craigend and looks forward to working with the research organization to deliver quality research and extension services to producers in the County and beyond.

Jacob Marfo (PhD, PAg)
Agricultural Fieldman, Lac La Biche County

County of St. Paul Agricultural Service Board 2021

The County of St. Paul Agricultural Service Board would like to thank LARA for its work to provide local and relevant information to our area farmers since 1991. LARA brings together 4 Municipalities and Counties providing important research and programming to the producers in the Lakeland.

2021 was the weirdest year I have ever lived through. Everything from 2020 continued to display itself in 2021 and we had to deal with some weird weather along the way. The County of St. Paul declared an Agricultural Disaster in July of this year along with 42 other Counties and Municipalities in the province. This prompted the provincial government to come up with new supports for farmers to hopefully get them through to next year.

During June and July of this year the County went through a time where we did not see significant rainfall for a month and a half! Average temperatures soared with us hitting temperatures of 40C on some days. Many County employees switched to working earlier hours to avoid the heat of midday. Potential bumper crops turned into below average crops as sloughs and water ways around the County dried up.

Checking for clubroot became easier as our staff could easily walk into crops and check plants. We only found 4 new positive fields in 2021. Grass was quicker to cut and it became a lot easier to deal with beaver problems because there was no water. Our weed control was completed quickly with less rain delays. It became very easy to find a hornet's nest or a thistle patch this year as well. Hay yield and crop yield were down about 25-50% this year due to the drought and heat.

Although the difficult situations persisted for such a long time the current snow levels should give us hope for this coming summer. With the winter we are also hearing that mandates and restrictions may be coming to an end. There is indeed hope for the future and hope for plenty of rain in 2022!

The County of St. Paul Agricultural Service Board thanks all of our producers for feeding the world and our little part of that world!

Keith Kornelsen
Agricultural Fieldman
County of St. Paul

Cropping Program

Regional Variety Trials

Partners: Alberta Agriculture, Forestry and Rural Economic Development
Alberta Wheat Commission
Alberta Pulse Growers
St. Paul Municipal Seed Cleaning Plant
County of St. Paul
Smoky Lake County
MD of Bonnyville
Agriculture and Agri-Food Canada
Nutrien Ag Solutions
FP Genetics
SeCan
Canterra Seeds
Alliance Seeds
Philip Amyotte
Darrell Ketsa
Todd Brodziak

Objectives:

1. To detail agronomic characteristics of new varieties and proven varieties in a specific geographic area.
2. To provide information about new varieties to local producers.
3. To conduct these tests yearly to produce long term data.

Background:

Regional Variety Trials (RVTs) have been used as a means of testing superior varieties under different environmental conditions. One of the goals of the RVTs is to help researchers and producers identify varieties that are suitable for each particular environment. Multi-location trials often show genotype x environment interaction due to differential response of genotypes to different environmental conditions. Information on the genotype x environment response obtained through RVT's may be helpful in identifying and selecting high-yielding varieties with specific or broad adaptations to their environmental conditions.

Efficiency in the RVT's depends on selecting a large number of locations within a region with varying environmental conditions and assigning to each location the variety most likely to succeed. It is also essential to assess varieties in the trial in terms of their productivity and quality, and to assess stability in yields across years.

The regional variety trials (RVTs) have been grown in the Lakeland since 1991. Each variety is tested for three years against a common check variety that is kept in the trial long-term. Each year, new varieties are added and older ones are removed from the trial. How a variety does relative to the check variety can be used as a comparison between varieties that are not grown in the trial at the same time.

The information gathered from these trials is important for producers first, to aid in crop variety selection and, second, to improve economic returns. Determining the cereal varieties that are best suited to production in the LARA area will aid producers in making the most economical decisions for their operations.

The data presented in the following tables is a useful tool for comparing varieties to each other. Information should not be used to determine how much a variety will yield, but **rather as a comparison of how one variety will yield in relation to another.** The tables will tell how a certain variety yields statistically compared to another variety.

Methods:

The cereal plots for the Regional Variety Trials were seeded at the LARA Fort Kent Research Site (NE25-61-5-W4), the County of St. Paul (SE 13-60-10-W4) and Smoky Lake County (NW 59-16-30 W4). Agronomic information about the RVTs grown by LARA in 2021 is listed in Table 1. The trials were seeded using the LARA five-row Fabro zero-till small plot seeder. The plots were 1.15m x 6m in area with a 9" row spacing. All trials were seeded to a randomized complete block design with four replications for pulses and three replications for cereals to reduce error.

Soil samples were taken in spring prior to seeding to check soil fertility and a blend fertilizer was side-banded at seeding for optimum yields. Pre-seeding burn-off and in-crop herbicides were utilized for weed control. Notes on lodging and height were taken during the growing season. The plots were harvested using a Wintersteiger small plot combine and information on yield, bushel weight, 1000 kernel weight and protein were recorded.

Although the varieties in the trials are set by the ABCGAC and seed companies, there is opportunity for local input.

Lodging is rated on a scale of 1-9 where 1 is perfectly erect and 9 is completely flat.

Table 1. Regional Variety Trial Agronomic Information, 2021.

Test	Site	# of Variety	Seeding Date	Fertility	Seeding Rate	Harvest Date	Rain (mm)
Barley	Fort Kent	22	13-May-21	284 lbs/ac 90-30-20-5	270 pl/m2	21-Sep-21	189.7
CPSR Wheat	Fort Kent	12	13-May-21	284 lbs/ac 90-30-20-5	330 pl/m2	07-Sep-21	189.7
CWRS Wheat	Fort Kent	26	13-May-21	284 lbs/ac 90-30-20-5	330 pl/m2	07-Sep-21	189.7
Oats	Fort Kent	10	14-May-21	284 lbs/ac 90-30-20-5	300 pl/m2	21-Sep-21	196.9
Oats	Smoky Lake	10	27-May-21	284 lbs/ac 90-30-20-5	300 pl/my	28-Sep-21	184.4
Triticale	Fort Kent	2	13-May-21	284 lbs/ac 90-30-20-5	310 pl/m2	09-Sep-21	189.7
Yellow Peas	St. Paul	15	12-May-21	50 lbs/ac 11-52-0-0	88 pl/m2	23-Sep-21	178.2
Green Peas	St. Paul	5	12-May-21	50 lbs/ac 11-52-0-0	88 pl/m2	23-Sep-21	178.2
Faba Bean	St. Paul	6	12-May-21	50 lbs/ac 11-52-0-0	44 pl/m2	23-Sep-21	178.2

Barley

The RVT barley trials were established at two locations, one in the County of St. Paul (SE-13-60-10-W4) and one at the LARA Fort Kent Research Site (NE 25-61-5-W4). Unfortunately, due to the St. Paul site not passing the ARVAC inspection, the data collected from this site cannot be published.

The RVT Barley trials had 14 varieties that were tested in 2021. The highest yielding variety in Fort Kent was TR19758 was yielding 118 bu/ac followed by Esma, AAC Synergy, and AC Metcalfe which yielded 114 bu/ac. There was a 31 bu/ac difference between the top-yielding variety and the lowest variety. Observations made during the summer were that there was almost no lodging in the Fort Kent Barley in 2021. The average height of the barley plots was 67cm.

The yield data for Fort Kent is shown in the table below.

Table 2. RVT Barley Data Fort Kent, 2021.

Variety	Yeild (bu/ac)	% of AC Metcalfe	TWT (lbs/bu)	TKW (g)	Height (cm)
TR19758	118	104	316.63	54	71
Esma	114	100	303.97	54	64
AAC Synergy	114	100	304.57	53	67
AC Metcalfe	114	100	304.87	51	67
CDC Copeland	111	97	315.76	56	68
KWS Kellie	111	97	305.6	56	57
TR18748	110	97	317.63	56	75
KWS Coralie	110	96	296.9	55	61
AB Wrangler	110	96	313.37	55	75
AB Brewnet	109	96	305.9	53	66
CDC Anderson	109	95	318.43	55	63
CDC Renegade	108	95	313.63	59	82
TR18749	106	93	322	60	79
AB Hauge	105	92	305.41	52	64
AB Prime	105	92	305.5	52	67
TR18747	104	92	311.83	56	72
AB Tofield	103	90	308.23	50	67
RGT Planet	103	90	315.47	55	68
TR17255	102	89	305.83	49	56
AB Cattlelac	100	88	306.63	47	73
Torbellino	98	86	306.47	57	54
TR19175	87	76	314.68	53	60
CV 9.09					

CPSR & CCHNR Wheat

The Canadian Prairie Spring Red (CPSR Wheat) and Canada Northern Hard Red (CCNHR Wheat) were also grown in both Fort Kent (NE-25-61-5-W4) and St. Paul (SE 13-60-10-W4). Unfortunately, due to the site not passing inspection from ARVAC, the data collected from the St. Paul site cannot be published.

Pasteur was the top-yielding variety in Fort Kent yielding 91bu/ac, which is 30% higher than AAC Brandon and 51% higher than Carberry. The lowest yielding variety in the trial was Carberry yielding 60 bu/ac, this was a 31bu/ac difference between the top-yielding variety Pasteur and lowest yielding variety Carberry. The highest protein content from this trial was from AAC Brandon which was 12.6%, the average protein in this trial was 10.6%

The yield data from CPSR & CCHNR wheat from Fort Kent can be shown in the table below.

Table 3. CPSR & CCHNR Wheat Data Fort Kent, 2021.

Variety	Yeild (bu/ac)	% of AAC Brandon	% of Carberry	TWT (lbs/bu)	TKW (g)	Height (cm)	Protien (%)
Pasteur	91	130	151	388.2	36	73	9.5
Accelerate	80	114	132	388.77	32	64	10.8
AC Andrew	76	109	126	384.3	36	67	9.6
AAC Penhold	76	108	126	385.2	40	59	11.1
HY2095	73	104	121	385.67	45	70	10.2
WPB Whistler	73	104	121	397.1	40	65	9.0
HY2082	71	102	118	395.27	41	63	11.2
SY Rorke	71	101	117	401.87	33	70	10.1
LNR15-1741	70	100	116	398.1	35	69	10.6
AAC Brandon	70	100	116	393.53	36	69	12.6
HY2074	69	99	115	397.57	39	74	10.5
HY2090	66	94	109	387.17	45	70	10.7
CDC Reign	64	92	106	403.72	36	76	11.2
Carberry	60	86	100	399.43	39	69	11.8
CV 10.84							

CWRS & CWHWS Wheat

The Canadian Western Red Spring (CWRS) and Canadian Western Hard White Spring (CWHWS) were grown in Fort Kent (NE-25-61-5 W4) and St. Paul (SE 13-60-10 W4). The CWRS and CWHWS wheat trial is the largest trial that LARA manages with 26 varieties in this class. Unfortunately, the County of St. Paul Research site did not pass the ARVAC site inspection. Due to this, the RVT CWRS & CWHWS data collected from the site cannot be published.

The highest yielding variety in the Fort Kent site was AAC Brandon yielding 80 bu/ac followed by CS Resolve at 76 bu/ac. The average height on the wheat was 72 cm tall and the average protein content on the trial was 11.44%. Overall, the trial did well and we are looking forward to growing this trial again in 2022.

The yield data for the CWRS and the CWHWS for Fort Kent are shown in the table below.

Table 4. CWRS & CWHWS Wheat Data Fort Kent 2021.

Variety	Yeild	abc	% of AAC Brandon	% of Carberry	TWT (lbs/bu)	TKW (g)	Height (cm)	Protien
AAC Brandon	80	a	100	113	400.53	39	74	11.81
CS Resolve	76	ab	96	108	391.9	43	74	10.82
BW1093	76	ab	95	108	387.3	32	67	10.7
SY Torach	75	ab	95	107	395.49	31	64	11.29
AAC Hodge VB	75	ab	95	107	398.93	37	71	10.99
SY Cast	75	ab	94	107	390.33	39	70	11.97
CDC Skrush	75	ab	94	106	389.77	33	75	11.7
AAC Whitehead VB	74	ab	93	106	389.6	43	72	11.34
AAC Broadacres VB	74	abc	93	106	401.07	43	80	10.86
BW5045	74	abc	93	105	393.13	39	75	11.4
PT598 CL	73	a-d	92	104	390.3	38	61	11.52
BW5055	72	a-d	91	103	389.47	33	73	11.67
SY Brawn	72	a-d	91	103	388.43	34	73	11.99
AAC Russell VB	71	bcd	89	101	400.7	40	66	11.47
AAC Redstar	71	b-e	89	101	384.17	36	66	11.62
Carberry	70	b-e	88	100	399.1	39	72	11.4
AAC Viewfield	70	b-e	88	100	404.24	38	69	11.33
Rednet	70	b-e	88	99	404.6	40	86	12.02
SY Crossite	70	b-e	88	99	396.1	42	76	12.18
Ellerslie	70	b-e	88	99	376.3	33	69	10.65
SY Gabro	69	b-e	87	99	394.27	41	77	11.59
AAC Tomkins	69	b-e	87	98	395.07	39	73	11.5
AAC Leroy VB	69	b-e	86	98	399.23	40	78	11.34
AAC Hockley	68	cde	85	96	401.4	36	69	11.43
BW5031 CL VB	67	de	84	95	392.93	43	71	12.15
Sheba	64	e	81	91	393.97	34	72	10.7
CV 5.75								

Triticale

The Triticale trial this year was grown in Fort Kent (NE-25-61-5-W4) and in the County of St. Paul (SE 13-60-10 W4). The RVT triticale is the smallest trial held at LARA consisting of two different varieties. This year the highest yielding variety of Triticale was Brevis yielding 86bu/ac, which is 12 bu/ac higher than AB Stampeder.

Overall, the triticale did well this year and we hope to continue having success growing triticale in the future. The yield from the triticale trial can be seen in table 5.

Table 5. Triticale Data Fort Kent, 2021.

Treatment	Yeild (bu/ac)	% Brevis	TWT (lbs/bu)	TKW (g)	Height (cm)
AB Stampeder	74	86	343.2	51	67
Brevis	86	100	366.33	46	72
CV 3.13					

Oats

The Oats trials this year were grown in Fort Kent (NE 25-61-5-W4) and Smoky Lake (NW 59-16-30-W4). This is the first year that the Regional Variety Trial Oats was in Smoky Lake previously the oats always grew in the MD of Bonnyville and Lac La Biche County. Due to not being able to find a site in Lac La Biche County the RVT Oat was moved to Smoky Lake in 2021.

CS Camden was one of the highest-yielding oat varieties at both the Fort Kent and the Smoky Lake research sites. As seen below, in Fort Kent CS Camden yielded 129 bu/ac, which was 13 bu/ac more than AAC Douglas which was the second-highest yielding variety. In Smoky Lake, CS Camden was one of the top-yielding varieties along with Kallio both yielding 97 bu/ac. There was very little lodge in both oat trials in 2021. The average height of the oat plots was 81 cm at Fort Kent and 70 cm at Smoky Lake.

Table 6. RVT Oats Data Fort Kent, 2021.

Variety	Yeild (bu/ac)	% of OT2129	TWT (lbs/bu)	TKW (g)	Height (cm)
CS Camden	129	176	232.39	46	83
AAC Douglas	116	159	236.77	48	79
Kyron	110	151	243.5	46	93
AC Morgan	109	149	246.8	47	85
CDC Arborg	105	144	243.8	46	88
Kalio	98	135	240.47	44	76
ORE Level 48	93	127	245.13	46	77
CDC Skye	85	116	246.83	45	80
ORE Level 5	85	116	251.23	50	78
OT2129	73	100	287.75	44	69
CV 5.93					

Table 7. RVT Oats Data Smoky Lake, 2021.

Variety	Yeild (bu/ac)	% of OT2129	TWT (lbs/bu)	TKW (g)	Height (cm)
CS Camden	97	116	226.65	45	74
Kalio	97	116	229.33	43	77
AAC Douglas	96	116	220.87	44	72
CDC Arborg	93	112	222.2	45	86
OT2129	83	100	217.2	43	68
ORE Level 48	81	97	217.07	41	74
CDC Skye	78	94	205.17	41	73
Kyron	76	92	229.41	46	71
ORE Level 5	60	72	220.96	46	72
AC Morgan	38	46	245.7	46	38
CV 10.95					

Green and Yellow Field Peas

The field peas were grown in the County of St. Paul with both green and yellow peas being assessed. There were 5 green pea varieties and 15 yellow pea varieties grown. Both the green and yellow field pea trials were seeded on May 12th, 2021 with 50 lbs/ac of 11-52-0-0 side banded at seeding. Both of the pea trials were harvested on September 23rd, 2021. There was difficulty harvesting the yellow peas this year due to poor standability. Looking at the tables below the highest yielding yellow pea variety was CDC Lewochko at 34 bu/ac which yielded 25% higher than the check variety CDC Amarillo at 27bu/ac. The average height of the yellow pea was 58cm.

Blueman was the highest yielding variety in the green pea varieties at 23bu/ac and had an average height of 50 cm; however, the data that is shown in the green peas is not statistically sound due to the high variability as indicated by the CV of 26.4.

Table 8. RVT Yellow Peas, 2021**.**

Variety	Yield (bu/ac)	% of CDC Amarillo	TWT (lbs/bu)	TKW (g)	Height (cm)
CDC Lewochko	34	125	412.45	273	62
AAC Profit	32	118	415.45	268	55
CDC Spectrum	29	105	410.88	223	62
AAC Barrhead	28	104	410.68	262	58
AAC Beyond	28	101	405.64	233	47
AAC Carver	27	101	409.09	273	61
CDC Inca	27	100	416.66	270	67
CDC Amarillo	27	100	409.28	270	61
AAC Delhi	27	98	399.95	316	47
AAC Ardill	26	98	414.68	289	61
AAC Julius	26	96	410.68	257	56
AAC Aberdeen	24	88	410.5	286	61
CDC Canary	23	84	413.35	256	60
AAC Lacombe	17	62	415.23	292	57
LN4228	14	50	408.75	316	55
CV 19.4					

Table 9. RVT Green Peas Data, 2021.

Variety	Yield (bu/ac)	% of CDC Limerick	TWT (lbs/bu)	TKW (g)	Height (cm)
Blueman	23	169	305.28	264	49
CDC Forest	18	133	305.95	265	46
Garde	18	132	243.41	259	51
CDC Rider	16	119	408	239	54
CDC Limerick	14	100	251.21	232	52
CV 26.45					

Faba Beans

Faba Beans were seeded in the county of St. Paul on May 12th, 2021, side banded with a 11-52-0-0 fertilizer at a rate of 50lbs/ac. The faba bean trial was harvested on September 28th, 2021. There were 6 varieties of faba beans grown in 2021. The highest yielding varieties were 219-16 and Fabelle at 23bu/ac. The average height of the faba beans was 55 cm in height which was impressive considering the lack of moisture seen during the growing season. Overall, we were very impressed with the results from the faba beans and look forward to growing them again in 2022.

Table 10. RVT Faba Beans Data 2021.

Variety	Yield (bu/ac)	% of Snowbird	% of Malik	TWT (g)	TKW (g)	Height (cm)
219-16	23	114	166	405.26	395	51
Fabelle	23	114	165	406.43	550	60
Snowbird	20	100	145	389.45	463	53
DL Tresoro	18	93	136	403.35	580	58
Malik	14	69	100	380.39	608	54
DL 18.7602	10	52	75	400.66	483	58
CV 13.16						

Image 1. Faba Beans, June 30, 2021

Canola Performance Trial

Partners: Canola Council of Canada
Alberta Canola Producers Commission
Saskatchewan Canola Development Commission
Manitoba Canola Growers Association
County of St. Paul
Philip Amyotte

Objectives:

1. To detail agronomic characteristics of new varieties and proven varieties in a specific geographic area.
2. To provide information on new varieties to local producers.

Background:
The canola performance trials (CPT) represent the next generation in variety evaluations for Western Canadian canola growers. The three Prairie canola grower groups – Alberta Canola Producers Commission, Saskatchewan Canola Development Commission and the Manitoba Canola Growers Association – fund the program. The Canola Council of Canada delivers the program on their behalf. Trials provide relevant and unbiased performance data that reflects actual production practices, and comparative data on leading varieties and newly introduced varieties.

The CPT trial test canola varieties in both small plot and field scale trials. In 2021 there were 27 small plots which showcased 12 standard canola varieties and 15 straight cut varieties. There were also 64 field scale trials in 2021 seeded in Western Canada. The complete results of the different varieties can be found can be found https://www.canolaperformancetrials.ca/.

Method:
The trial was seeded on May 22, 2021, in the County of St. Paul in a randomized complete block design (RCBD) with four replications to reduce error. Before seeding, soil tests were taken and a fertilizer blend (90-30-20-20) was side banded on at the time of seeding. The seeding rate for the CPT trial is dependent on the thousand kernel weight of the seed and is adjusted accordingly. The trial was seeded using the LARA Fabro five-row, zero-till small plot drill. Each plot is measured 1.15 m x 6.5 m in area.

Results:
Unfortunately, due to environmental conditions, this trial was terminated as it would not achieve statistically sound data due to damage of the canola because of excessive heat and lack of moisture. We are looking forward to growing the CPT trials again in 2022.

Impact of varying rates of Environmentally Smart Nitrogen (ESN) on the performance Spring Wheat and Spring Barley in Northeastern Alberta

Partners: Philip Amyotte
Darrell Ketsa
County of Smoky Lake
County of St. Paul
Top Gro Agro Ltd.
Canadian Agricultural Partnership
St. Paul Municipal Seed Cleaning Plant
Alberta Agriculture, Forestry and Rural Economic Development

Objectives:

1. To determine the impact of utilizing varying rates of Environmentally Smart Nitrogen (ESN) on spring wheat production in Northeastern Alberta.
2. To determine the impact of utilizing varying rates of Environmentally Smart Nitrogen (ESN) on spring barley production in Northeastern Alberta
3. To determine the economic feasibility of utilizing Environmentally Smart Nitrogen (ESN) in spring wheat production in Northeastern Alberta.
4. To determine the economic feasibility of utilizing Environmentally Smart Nitrogen (ESN) in spring barley production Northeastern Alberta.

Background:
Growth in grain crop yields has been declining in recent years while it is estimated that annual grain crop production will need to increase to around 3 billion tones by 2050 to feed a fast-growing human population (FAO 2009). According to the Food and Agriculture Organization (2009), this increase in crop yield will not come from land expansion in developed countries, but ninety percent will be from higher yields and increased cropping intensity.

A large portion of today's current food production numbers is due to the use of commercial fertilizers which consists of Nitrogen (N), Phosphorous (P) and Potassium (K) and Sulphur (S). However, actual N uptake from fertilizer applied to a grain crop is estimated at only around 50%, with the rest lost through environmental events such as volatilization and denitrification. It can be determined that the use of commercial fertilizers will increase in order to meet production demands. The development of effective nutrient (N, P, K and S) management strategies will be key in maintaining and enhancing current grain crop production in Alberta.

The use of enhanced efficiency fertilizers, such as environmentally smart nitrogen or ESN, is one method of reducing N loss during grain crop production. Environmentally smart N is the most widely used slow-release N product on the market for agricultural crops (Walsh and Christiaens 2014). It is produced through the use of a flexible polymer coating or membrane that protects against loss mechanisms such as volatilization, denitrification or leaching. This coating allows water to imbibe into the granule to create a liquid solution that can then move out of the membrane based on crop N demands and soil temperature. The ability to match fertilizer use to crop requirements could translate into increased yield and overall cost savings to Alberta producers.

Method:
The trials were conducted in the County of St. Paul and Smoky Lake County using a randomized complete block design (RCBD) with four replications to reduce error. Prior to seeding, a soil sample was collected to determine fertility recommendations and a blend fertilizer was side-banded during seeding.

The wheat variety used was Stettler and the barley variety used was CDC Metcalfe. Five different inclusion rates of ESN as a percent of the total nitrogen in the fertilizer were used: 30%, 50%, 70% and 90%. Additionally, a check plot with no ESN was included for comparison.

Results:
The results in table 11 and 12 indicate that the treatments including 50% ESN were the highest yielding treatments at both the Fort Kent and Smoky Lake sites. In Smoky Lake, only the check yielded higher.

The ESN Wheat trial showed that at both the Fort Kent and Smoky Lake plot site the plots with the treatment of 90% ESN were the highest yielding plots of the trial. The Fort Kent 90% ESN yielded 73 bu/ac followed by 50% ESN which was the second-highest yielding at the site. The Smoky Lake 90% ESN yielded 39 bu/ac followed by the 30% ESN at 35 bu/ac. Looking at the protein from each site shows that the treatment that had the highest protein was the treatment that had the 90% ESN.

We are looking forward to conducting this trial again in 2022!

Table 11. ESN Barley Fort Kent, 2021.

Treatment	Yeild (bu/ac)	% of Check	TWT (lbs/bu)	TKW(g)	Height (cm)
ESN 50%	109.35	103	315.53	51	60
ESN 30%	107.15	101	319.5	51	65
Check	105.66	100	312.95	51	65
ESN 70%	101.02	96	311.22	52	67
ESN 90%	100.73	95	317.25	52	59
CV 8.74					

Table 12. ESN Barley Smoky Lake, 2021.

Treatment	Yeild (bu/ac)	% of Check	TWT (lbs/bu)	TKW(g)	Height (cm)
Check	83.76	100	316.33	52	59
ESN 50%	81.95	98	316.68	50	52
ESN 70%	80.82	96	309.05	49	60
ESN 30%	78.75	94	314.33	51	61
ESN 90%	76.15	91	312.36	51	61
CV 8.18					

Table 13. ESN Wheat Fort Kent, 2021.

Treatment	Yeild (bu/ac)	% of Check	TWT (lbs/bu)	TKW(g)	Protien (%)	Height (cm)
ESN 90%	73.43	107	388.98	38	12.68	60
ESN 50%	72.97	107	388.95	37	12.67	59
ESN 30%	72.46	106	388.53	38	12.7	63
ESN 70%	69.74	102	387.95	37	12.64	65
Check	68.42	100	390.83	37	12.46	68
CV 4.32						

Table 14. ESN Wheat Smoky Lake, 2021.

Treatment	Yeild (bu/ac)	% of Check	TWT (lbs/bu)	TKW(g)	Protien (%)	Height (cm)
ESN 90%	39.45	115	400.84	38	14.36	38
ESN 30%	34.98	102	398.45	38	13.82	38
Check	34.4	100	397.24	37	14.18	37
ESN 70%	33.25	97	398.28	39	14.26	39
ESN 50%	32.97	96	400.65	38	14.18	38
CV 6.71						

LARA RVT

Partners:

Smoky Lake County
St. Paul Municipal Seed Cleaning Plant
Canterra
Secan
Alliance Seeds
Luc Tellier
Jacque Plante
Darrell Ketsa

Objectives:

1. To provide regional data on Oats, Barley and Wheat varieties to local producers
2. To produce long term data for producers

Background:

This trial was based off of the Regional Variety Trials. One drawback to the RVT trials is that a majority of the varieties are in the testing stage and are not registered or available for producers to purchase and grow on their own operations. LARA started the LARA RVT in Smoky Lake this year, the varieties chosen were selected based on previous trials grown at LARA and from the input of local producers.

Methods:

The varieties were seeded in a complete randomized block design (RCBD) with four replications to provide accuracy throughout at the Smoky Lake site. Prior to seeding, a pre-burn had taken place and a soil test had been taken in the spring and a custom blend for fertilizer was created. The fertilizer blend was side banded during seeding to create the total blend of (90-30-20-5). The trial was seeded on May 27th, 2021, using the LARA Fabro five-row, zero till small plot drill and seeded plots measured at 1.15m x 6.5 m in area. Notes on lodging and height were taken during the growing season and the trial was harvested on October 5th, 2021.

Results:

The LARA RVT is grown to give producers a comparison between the regional variety trial varieties and commonly grown varieties that may not be seen in the trial. This allows producers to see the difference in yield and height between different varieties. The LARA RVT did well this year considering the environmental conditions seen in 2021.

The top two highest-yielding varieties were oat varieties. Nassar was the highest yielding at 114 bu/ac followed by CS Camden a102 bu/ac. The highest yielding varieties were Canmore and

Coalition barley yielding 77 bu/ac. CS Tracker was the highest yielding wheat at 32 bu/ac followed by Redberry at 30 bu/ac.

If you grow a different variety of cereals than the ones in the table below and would like to see it grown in this trial, please feel free to contact the office at 780-826-7260 or 780-812-1037 and ask for Amanda.

Table 15. Performance data of LARA RVT Trial, 2021.

Cereal	Variety	Yield (bu/ac)	TWT (lbs/bu)	TKW (g)	Height (cm)	Protein (%)
Oats	Nassar	114	224.78	39.58	77	
Oats	CS Camden	102	225.94	41.54	70	
Barley	Canmore	77	306.63	51.05	60	
Barley	Coalition	77	299.8	49.7	59	
Barley	Cowboy	67	307.3	61.16	73	
Wheat	CS Tracker	32	376.4	36.39	55	14.4
Wheat	Redberry	30	393.5	37.48	56	15.2
Wheat	AAC Crossfield	28	372.38	48.72	58	15.0
Wheat	CS Jake	27	390.28	38.99	60	15.8
CV 8.01						

Impact of Soil Temperature and Seeding Rate on Spring Wheat Performance

Partners: Alberta Wheat Commission
Alberta Agriculture, Forestry and Rural Economic Development
Canadian Agriculture Partnership
MD of Bonnyville

Objectives:

1. To determine the impact on the performance and protein content of two varieties of spring wheat when using varying soil temperatures instead of calendar date to determine time of seeding.
2. To determine the impact on the performance and protein content of two varieties of spring wheat when using three different seeding rates on two different seeding dates (ultra-early and normal).

Background:

Current research has been focusing on the opportunity to seed wheat at an earlier date based on soil temperature than typically considered normal. Research let by Brian Beres of Agriculture and Agri-Food Canada (AAFC) has shown that there is no yield drag observed when planting into soil temperatures of 2-6 degrees Celsius as long as the soil surface is not frozen. These trials indicate that seeding early may require a higher seeding rate for the greatest benefit.

One of the primary risks of seeding early is the threat of early frost. However, wheat seedlings up to about the 5-6 leaf stage can survive short periods of cold temperatures as low as -8 degrees Celsius. At these temperatures, some leaves may be damaged but the whole plant will recover.

Despite the frost risk, there are many positive benefits of seeding wheat early, including the ability to harvest crops earlier than wheat seeded at higher soil temperatures. This could be particularly important in years similar to 2019 which saw a delay in crop development and harvest stretching well into November.

Although there has been plenty of research looking into the possibility of seeding wheat early, there has been a lack of assessment on the impact on protein content. To help investigate this concept further, LARA partnered with other Applied Research and Forage Associations across the province, Alberta Agriculture and Forestry and the Alberta Wheat Commission to seed two varieties of wheat at two different seeding dates. The two varieties chosen were: AAC Connery (considered an early maturing variety) and AAC Brandon. (although earlier maturing than some varieties, is later maturing than AAC Connery).

The two seeding dates were:

1. Ultra-Early: when the ground is first able to carry equipment and soil temperatures are between 2-6 degrees Celsius.
2. Normal: seeded at least 10-14 days later or when 'normal' seeding window occurs for the area (soil temperature between 10-12 degrees Celsius).

Method:

The trial was established at the LARA Fort Kent Research Farm (NE 25-61-5-W4) in a randomized complete block design with four replications to reduce error. The "Ultra-Early" seeding date was seeded on April 26, 2021, with snow still on the ground and soil temperatures at +4 degrees Celsius. No pre-seed herbicide was applied due to minimal weed germination before seeding. The "regular" seeding date was seeded on May 13, 2021, using the same RCBD as the first seeding date. Soil temperatures were around +11 degrees Celsius at the time of seeding.

The treatments seeded are outlined below:

1. AAC Connery Light Rate = 71.1 g/plot
2. AAC Connery Medium Rate = 106.7 g/plot
3. AAC Connery High Rate = 142.3/plot
4. AAC Brandon Light Rate = 79.4 g/plot
5. AAC Brandon Medium Rate = 119.1 g/plot
6. AAC Brandon High Rate = 158.8g/plot

In-crop herbicide applications were applied in both blocks of plots based on weed pressure and any weeds not controlled by the application were hand-pulled when necessary.

Results:

The ultra-early seeding date trial yielded the highest with AAC Brandon at 80 bu/ac which is 5 bu/ac more than the top-yielding treatment in the regular seeding date trial. In both trials, the Brandon high and medium seeding rate treatments were the highest yielding treatments. AAC Connery, which is considered an early maturing variety, yielded lower than AAC Brandon in the regular and ultra-early trial.

The final protein content between both the regular and ultra-early seeding trial was fairly close, as the regular seeding trial averaged 12.52% and the ultra-early seeding trial averaged 12.47% which was a 0.05% difference in average.

2021 marked the completion of the ultra-early vs regular seeding date trial. We are looking forward to compiling all of the data from all three years and comparing the data.

Table 16. Regular seeding date harvest data, 2021.

Treatment	Yield (bu/ac)	TWT (lbs/bu)	TKW (g)	Height (cm)	Protien (%)
Brandon High	75	395	41.44.	65	12.35
Brandon Medium	72	394.63	41.19	71	12.61
Brandon Low	72	395.45	40.57	67	13.41
Connery High	66	388.13	37.77	69	12.5
Connery Low	64	389	39.46	65	12.38
Connery Medium	64	388.18	38.72	69	11.88
CV 6.9					

Table 17. Ultra-Early seeding date harvest data, 2021.

Treatment	Yield (bu/ac)	TWT (lbs/bu)	TKW (g)	Height (cm)	Protien (%)
Brandon Medium	80	401.5	40.67	65	12.66
Brandon High	74	402.53	39.88	66	12.48
Connery High	73	390.68	40.8	71	12.4
Brandon Low	69	402.53	42.6	62	12.53
Connery Medium	64	386.85	40.33	65	12.4
Connery Low	60	389.08	40.29	63	12.36
CV 7.59					

Image 1. Ultra-Early Wheat. May 19, 2021

Image 2. Ultra-Early Wheat May 25, 2021

Impact of Soil pH > 7.2 on Crop Yields (Wheat, Yellow Pea's and Canola)

Partners: Canadian Agricultural Partnership
Alberta Agriculture, Forestry and Rural Economic Development
Gateway Research Organization
University of Guelph
Canola Council of Canada
Graymont Western Canada Inc

Objectives:

1. To determine the annual impact on yield on plots treated with lime to a soil pH >7.2 vs none limed plots for a typical Alberta crop rotation of Canola, HR Wheat and Yellow peas over a three-year period.
2. Evaluate the effectiveness of different liming products.
3. Evaluate the effectiveness of increased soil pH (>7.2) on clubroot disease spore and disease occurrence on the roots (Gro site only)
4. Assessment of soil health at start of trial year 1 and at the end of trial year 3.

Background:

The number of fields infected with clubroot disease in Alberta, are still growing. Clubroot has been diagnosed in fields as far north as the Northern Sunrise County and as far south as Newell County and continues to spread. It has been found over all the prairie provinces.

Clubroot resistant varieties have been developed, launched and some have failed within a few years of becoming available on the market. The resistant has been overcome in close to 200 fields in Alberta (Nicole Fox M.Sc.)

Canola is Canada's most important agricultural sources of revenue generating about 25% of all farm cash receipts. Clubroot disease was first found in canola and can be considered the largest economic threat. Research done by Nicole Fox M.Sc. (The Evaluation of Lime Products as a Clubroot (*Plasmodiophora brassicae*) Management Tool) indicates that a soil pH >7.2 may be a viable tool for disease management. "Different lime products, and hydrated lime in particular, may represent an effective tool to manage *P. brassicae* in highly infested patches in a field, at field entrances and in acidic soils, by reducing clubroot severity on susceptible and resistant hosts. As such, the application of lime may help to supplement the use of genetic resistance, by reducing disease pressure and the potential for pathotype shifts."

In field trials where hydrated lime was used on a clubroot infected field (2018 - Edberg location, Keith Gabert) are showing some promising initial results.

This proposed project seeks to test different liming products, their effectiveness on clubroot disease management, and the impact of a soil pH (>7.2) on yield of HRS wheat, yellow peas and canola over a 3-year time period.

Increasing the soil pH to > 7.2 is not a common practice. Most of the research that has been done in Alberta or Norther British Columbia on soil pH amelioration has been done in the 1970 to early 1990. Since then many new varieties for wheat and peas have been developed and canola has replaced the production of rapeseed.

Most, if not all, of the research done at the time was focused on increasing soil pH by 1 pH unit to about 6 – 6.5. No information is available on crop yield when soil pH is increased to >7.2.

It is unclear what the impact is, if any, of raising the soil pH to >7.2 level on the productivity of other crops. For most crops it seems that the higher pH is just outside their optimum.

Farming practices and disease management tools have changed and greatly impacted the overall productivity of the crops over the last 30 years. Application of chemical fertilizer and sprays continues to have an acidifying effect on the topsoil with, in 2019 about 50% of Alberta soils having a pH of 6.0 and lower (with 15-20% being <5.5pH). In 1970 this was estimated to be 21% of Alberta soils or 2.1 million acres, with 4% having a pH of 5.5 and lower. (source: Doug Penney, Lacombe June 26 2019)

Application of lime has been suggested to also improve the soil health (Plant-Soil Interactions at Low pH: Principles and Management pp 703-710) as yield improvement have been recorded even as soil pH has returned to initial pre-treatment levels.

Method:
Production and yield measurements are gathered for a three-year crop rotation using Canola, Hard Red Wheat, and Yellow Field Peas grown on soil with adjusted pH to >7.2. Soil pH is amended to >72 using the following treatments:

1. Check (none applied)
2. 100% hydrated lime
3. 75% hydrated lime & 25% zero grind limestone
4. 50% hydrated lime & 50% zero grind limestone
5. 25% hydrated lime & 75% zero grind limestone
6. 100% zero grind limestone

This trial was seeded using a randomized complete block design (RCBD). Prior to seeding, a pre-burn had taken place and a soil test had been taken in the spring and a custom blend for fertilizer was created. The fertilizer blend was side banded during seeding to create the total blend of (90-30-20-20) at 319 lbs/ac for canola, (90-30-20-5) at 284 lbs/ac for hard red wheat, and (11-52-0-0) at 50 lbs/ac for the peas. The trials were seed as follows: yellow pea's on May 14th, 2021, Canola on May 25th, 2021, and the Red Hard Spring Wheat on May 26th, 2021. Throughout the growing season, notes were taken on emergence, height, lodging, disease pressure, and yield. The yellow peas were harvested on September 3rd, 2021, The hard red wheat was harvested on September 22nd, 2021, and the canola was harvested on October 18th, 2021.

Results:

The results from the trial had a high degree of variability, likely due to the severe drought seen throughout the growing season. The canola had a second growth, which created uneven emergence and greens.

Looking at the data from the hard red spring wheat trial shows that the plots that have been applied with lime to change the soil pH to >7.2 did not overall affect the yield from the wheat as a majority of the plots yielded higher than the check treatment which had no lime applied. Another interesting observation looking at the data below is that the plots that had lime have a higher protein content than the check that had no lime.

We are looking forward to comparing data with GRO to see how changing soil pH to >7.2 not only affects the plant growth and performance but the effect that it has on clubroot.

Table 18. Liming Canola Plots, 2021.

Treatment	Yeild (bu/ac)	% of Check	TWT (lbs/bu)	TKW(g)
25% Hydrated Lime 75% 0-Grind Limestone	24.93	143	294.14	5.6
100% 0-Grind Limestone	23.44	135	294.1	5.43
100% Hydrated Lime	23.3	134	297.2	5.41
75% Hydrated Lime 25% 0-Grind Limestone	21.13	121	296.35	5.3
50% Hydrated Lime 50% 0-Grind Limestone	20.28	117	293.55	5.3
Check	17.4	100	290.8	5.08
CV 34.48				

Table 19. Liming Pea Plots, 2021.

Treatment	Yeild (bu/ac)	% of Check	TWT (lbs/bu)	TKW(g)	Height (cm)
50% Hydrated Lime 50% 0-Grind Limestone	22.69	111	414.03	231	47
Check	20.4	100	414.95	226.97	43.7
100% 0-Grind Limestone	19.49	96	413.1	216.84	47.7
100% Hydrated Lime	19.38	95	415.43	222.25	45.8
75% Hydrated Lime 25% 0-Grind Limestone	15.63	77	404.73	216.07	42.4
25% Hydrated Lime 75% 0-Grind Limestone	14.5	71	407.3	212.5	45.3
CV 22.81					

Table 20. Liming Hard Red Wheat Plots, 2021.

Treatment	Yeild (bu/ac)	% of Check	TWT (lbs/bu)	TKW(g)	Protien (%)	Height (cm)
75% Hydrated Lime 25% 0-Grind Limestone	57.88	110	391.91	42	13.85	65
100% Hydrated Lime	56.05	106	393.48	43	13.95	65
25% Hydrated Lime 75% 0-Grind Limestone	54.63	104	392.13	43	13.56	63
100% 0-Grind Limestone	53.83	102	392.37	42	13.96	64
Check	52.66	100	394.58	43	13	66
50% Hydrated Lime 50% 0-Grind Limestone	50.2	95	393.06	42	13.2	66
CV 13.12						

Impact of Top-Dressing Nitrogen on the Yield and Protein Content of Spring Wheat

Partners: M.D of Bonnyville
Smoky Lake County
St. Paul Municipal Seed Cleaning Plant
Nutrien Ag Solution
Canadian Agricultural Partnership
Alberta Agriculture, Forestry and Rural Economic Development
Darrell Ketsa

Objectives:

•To demonstrate the impact of topdressing nitrogen fertilizer on the agronomic performance and yield of spring wheat in Alberta.

•To demonstrate the impact of topdressing nitrogen timing on the agronomic performance and yield of spring wheat in Alberta.

•To demonstrate the impact of topdressing nitrogen rate on the agronomic performance and yield of spring wheat in Alberta.

Background:

The use of topdressing fertilizer treatments in wheat throughout Alberta can improve the agronomic performance and yield by supplying extra, necessary nutrients. Several producers in the Lakeland region of Alberta are aware of the option to top-dress and are set up to do it (with sprayers) however, are shy to try it because of the cost, and the fact that it is not proven to a point where profitability can be achieved. As technology advances, producers are always looking for new ways to make their crops more profitable.

Current studies have shown the beneficial impact that top-dressing nitrogen on spring wheat can have on both yield and protein depending on the stage of the crop at the time of application. Applying earlier in the growing season could improve overall yields while applying after heading can have a significant impact on final protein content of the harvested grain.

To help showcase the impacts of topdressing nitrogen fertilizers on the performance of agronomic, yield and protein of spring wheat, LARA established two sites to test the application of 28-0-03 at various crops stages.

Method:

The treatments were seeded on May 17th, 2021 in Fort Kent (NE-25-61-5 W4) and May 27th, 2021 in Smoky Lake County (NW-59-16-30 W4) in a randomized complete block design (RCBD) with four replications in Fort Kent and Smoky Lake to reduce error. Before seeding, soil tests were taken and fertilizer blends (90-30-20-5) were side banded at 284 lbs/ac at the time of seeding. The trial was seeded using LARA Fabro five-row zero-till small plot drill and the individual plots measured 1.15m x 6.5m in area.

The appropriate plots were hand sprayed with nitrogen at the different stages with rates at 3-5 leaf, flag leaf, flowering stage, and milk stage. An in-crop herbicide was applied to control secondary growth of weeds and, overall, the site was very clean. Notes on lodging and height were taken during the growing season and the trial in Fort Kent was harvested on September 10th, 2021, and September 28th, 2021 in Smoky Lake.

The treatments applied during the trial are listed below. All treatments were applied with a nitrogen stabilizer.

1. Check
2. Topdressing 28-0-0-3 blend at 5 gal/ac at 3.5 leaf
3. Topdressing 28-0-0-3 blend at 10 gal/ac at 3-5 leaf
4. Topdressing 28-0-0-3 blend at 15 gal/ac at 3-5 leaf
5. Topdressing 28-0-0-3 blend at 20 gal/ac at 305 leaf
6. Topdressing 28-0-0-3 blend at recommended 10 gal/ac at flag leaf
7. Topdressing 28-0-0-3 blend at recommended 10 gal/ac at flowering stage
8. Topdressing 28-0-03 blend at recommended 10 gal/ac at milk stage

Results:

As a results of the dry environmental conditions throughout the growing season, the data collected from the harvested trials was highly variable and we have, therefore, not included it in the report. We were hoping to see from the trial was by topdressing at the 3-5 leaf stage at various rates, would be an increase in yield. Topdressing from flag leaf to the milk stage we were hoping to see an increase in protein. Unfortunately, that was not the case. We are looking forward to conducting this trial again in 2022 and hope to see better results.

Demonstrations

In 2021, LARA conducted two demonstration in Smoky Lake County. The first demonstration included five different varieties of dual hemp, which are made for both fiber and grain. The following varieties were seeded. Altair, Anka, Katani, Slesesia and Vega. The hemp was seeded on June 22nd 2021 and had good emergence among all five varieties. We are looking forward to growing hemp again in the future.

Hemp seed was sourced and provided by: Dr. Jan Slaski with Innotech Alberta, UniSeeds and HGI Hemp Genetics International.

Image 4. Hemp, July 5, 2021

Image 5. Hemp, September 15, 2021

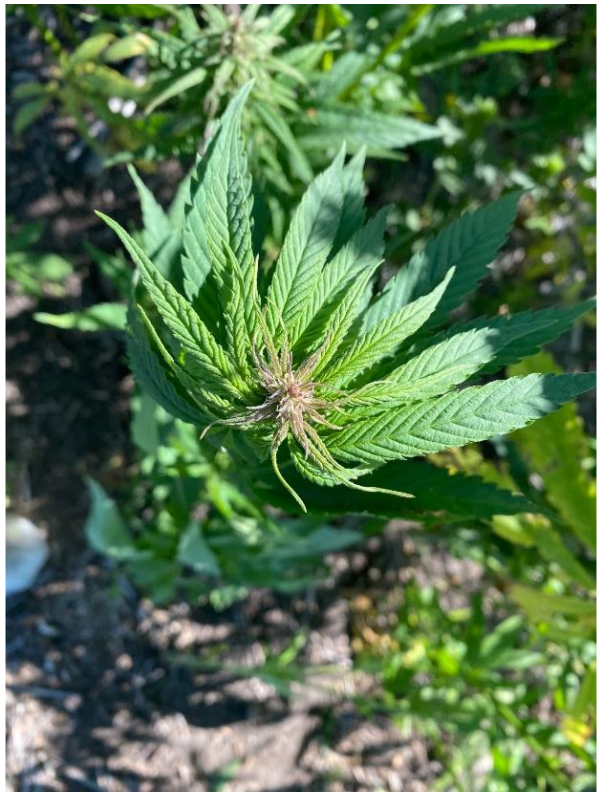


Image 6. Hemp, October 7, 2021

Figure 1. Amount of CBD per variety

Variety	% CBD	10% Moisture Calculated
Anka	**0.63**	**0.60**
Altair	**1.04**	**0.99**
Silesia	**0.53**	**0.50**
Vega	**0.41**	**0.29**
Katani	**0.30**	**0.38**

Pest Surveys

Partners: Alberta Agriculture, Forestry and Rural Economic Development
Lac La Biche County
County of St. Paul
MD of Bonnyville
Canadian Agricultural Partnership
SARDA Ag Research
Alberta Wheat Commission
Alberta Pulse Growers
Alberta Canola Producers Commission
Alberta Barley Commission

Objectives:

1. To participate in a complete pest monitoring program for Alberta.
2. To ensure the best, most current pest information is extended in a timely, appropriate manner for Northeastern Alberta producers.
3. To participate in a coordinated network of survey gatherers providing up-to-the-minutes information for Alberta crop producers, media, industry and professionals.

Introduction (Portions of this article are taken directly from the "Alberta Pest Monitoring Network Manual").

The goal of using Integrated Pest Management (IPM) surveys is to be able to provide enough information for these surveys so that early warnings of an increase in pest population are sent out in Alberta. Some of the pests surveyed in Alberta are Bertha Armyworm, Diamondback Moth, Cabbage Seedpod Weevil, Orange Blossom Wheat Midge, Grasshoppers, Wheat Stem Sawfly, Cutworms, Fusarium Headlight, Fusarium Wilt, Clubroot and Blackleg. For pests that have a short amount of lead-time, the Prairie Pest Monitoring Network provides a dynamic web-based system that updates the risk information on a daily basis. As the surveys are completed and the information is entered, the pest risk map changes to reflect the new information. Being forewarned allows producers and agronomists to be informed about certain pests they should be looking out for so that timely scouting and control tactics can be implemented before crop losses occur. The dynamic nature and timeliness of the information available to the agriculture industry would be a valuable asset to enhance decision making for producers, agronomists, and researchers.

In 2021 LARA participated in the pest surveys which included, Diamondback Moth, Bertha Armyworms, the Orange Blossom Wheat Midge and our new pest survey the Pea Leaf Weevil. The regional data that we collected was sent to the provincial authorities. The information collected is compiled and can be found on the Alberta Agricultural and Forestry website Pest Monitoring Network. Producers can see if there are any insect outbreaks that they should be informed about in their area so that a plan for appropriate action can take place in a timely matter.

Bertha Armyworm:
Bertha Army worms are one of the most significant pests of canola in Canada. Their impact on crops occurs throughout Manitoba, Saskatchewan, Alberta, and the interior of British Columbia. Severe moth infestations may occur throughout most of this area but are usually limited to the parkland area of the Prairies and the Peace River region of British Columbia and Alberta. Within our partnering Counties and Municipal Districts including the M.D of Bonnyville, Lac La Biche County and the County of St. Paul, all trap sites had numbers well below the first warning level of 300 moths. It is important to continue to monitor Bertha Armyworms in order to catch any population build up that may occur.

In most years, the population of Berthas have been kept low due to unfavourable weather conditions such as cold winters, cool growing seasons, higher amounts of precipitation, and disease. These weather conditions can fail in some dry years with mild winters that might allow population to increase dramatically creating potential for widespread outbreaks. In extreme situations, population more than 1,000 larvae per square metre have been reported, but most commonly you would see populations that can fall between 50-200 larvae per square metre.

Infestation outbreaks can be localized or widespread over a number of acres. In the case of widespread outbreaks, crop losses can be minimized by applying an insecticide but only if the infestation was detected early enough. Failure to detect this insect early can lead to incorrect timing of insecticide application resulting in the possibility of severe damage to your crop. Also, high outbreaks may lead to a shortage of pesticide if suppliers are not aware of the potential infestation.

Bertha Armyworm populations are monitored with the use of pheromone baited traps that are used to attract the adult male moths. Two traps are placed a little way in from the edge of a canola crop and are 50 m apart from each other. The traps are checked once a week and a moth count done each time. The traps are put out in the fields from June-August. Each bertha moth (adult) counted is considered one armyworm larvae.

Diamondback Moth:
Diamondback Moths first migrated into North America from Europe over 150 years ago. The insect now occurs throughout North America or wherever the host plant is grown. The diamondback moth larvae typically feed on most plants found in the Brassicaceae family and, in Alberta, canola and mustard are its primary targeted plants. Within our partnering Municipal District of Bonnyville we only had one site for Diamondback Moths and the numbers were well below the economic threshold of 100 to 150 larvae per square metre. This insect is hard to predict what the population could be like for 2022 as it varies on population size in the spring. As well, timing, larvae size, and plant size can contribute to this variable infestation.

The adult moths may overwinter in the prairies but they typically arrive on wind currents in the spring that come from southern or western United States or northern Mexico. Although the Diamondback Moths occur each year throughout the Canadian prairies and north central states, the severity of the infestation varies from year to year due to the arrival time and population size of the spring migrants.

Infestation of Diamondback moths can be very severe when spring conditions are suitable to the population. The insect damage is typically done by the larvae stage as they feed on the canola plants. They prefer to feed on plant tissues such as stems, leaves, flowers, and developing pods. In some years, millions of dollars in damage can be done so prevention tactics should be considered with drier seeding conditions.

The diamondback moth traps contain pheromones that attract the male moths. These traps are typically placed out during the last week of April (1 week prior to seeding). 2 traps are placed at opposite ends of the field approximately 100 metres apart from each other. They are checked weekly by removing the fly paper from the trap and counting the moths. The traps are left out for six weeks but if population increases at a later time the traps may be left out past that time duration.

Orange Blossom Wheat Midge:

Orange Blossom Wheat Midge is found in most acres around the world wherever the host plant is grown. In recent years, there has been cases of population outbreaks reported in Alberta, Saskatchewan, Manitoba, and several regions of British Columbia.

Infestations of wheat midge can be damaging towards your crop yield and the grade of harvested grain. Wheat midge populations can exist in a low population and begin to build up rapidly in some years when favorable conditions are met. Wheat midge damage can be easily mistaken for frost or drought damage if not properly scouted for at the correct timing.

Damage is typically done by the larval stage as they feed on the developing wheat kernels causing them to shrivel, crack, and become disfigured. This damage is not easily seen as there is no physical external change in discoloration, size, or misshapen seed heads. Analyzing the developing kernels in the glumes is the easiest way to asses' damage. Damage to the seed kernels can vary within a single wheat head. There may be a few kernels that might not be fully developed and may be too small and light and they will pass through the combine and be disposed with the chaff. And in other cases, a few kernels may be aborted from the plant entirely. Scouting timing is most critical to be done in the time period between heading and flowering stage because if damage is spotted then proper control actions could be put into place.

During the fall of 2021, LARA sent in 1 composite soil samples taken at a depth of 6 inches throughout our operational area. In total, 4 samples were taken from the MD of Bonnyville, 5 samples from the County of St. Paul and 2 samples from Lac La Biche County. Soil samples taken in the MD of Bonnyville, County of St. Paul and Lac La Biche County showed no infestation. Even though there was no wheat midge found, midge could reappear as they have the ability to stay dormant an extra growing season if ground conditions are not favorable conditions to develop with spring moisture. It is recommended that producers and agronomist plan to monitor fields in 2022 as the wheat heads out especially if there is late seeding or if wet conditions appear in 2022.

Pea Leaf Weevil:
The Pea leaf Weevil is a native insect to Europe. Its attacks were first recorded in Alberta in 2000 near Lethbridge, Alberta. This insect mainly targets pulse crops and has been a problem insect in Faba beans since 2014. In 2020, the Pea Leaf Weevil population migrated to more northwestern portions of central Alberta and southern Alberta has now seen lower populations of the insect. Within the MD of Bonnyville, Pea Leaf Weevil damage from the surveys conducted in late May-early June resulted in increase in the presence of insects in 2020. This is something for producers to keep an eye on. Producers who have seen similar trends on their operation, might want to consider using a seed treatment.

Spring weather conditions have a huge impact on timing and severity of Pea Leaf Weevil damage. With warm weather reaching a temperature around 20 degrees Celsius during the time of late April or early May can cause a spike in early arrival within fields. Early arrival can correspond with early insect damage which can decrease yields. Cooler spring conditions can delay arrival of the insect which can lower the risk of yield damage especially if the plant surpasses the six-node stage before the weevil arrives.

The adult Pea Leaf Weevil feeds on the leaves and growing points of the seedlings of legumes/pulses. This feeding leaves notches in a scalloped pattern along the leaf margins. As for the Pea Leaf Weevil larvae, they are root feeders. They target the nitrogen fixing nodules on the roots of the legume plants resulting in partial or complete inhibition of nitrogen fixation by the plant. A good prevention tool to consider when growing pules is the use of a seed treatment with your seed.

In 2021 LARA conducted 9 pea leaf weevil surveys, 2 surveys in the Lac La Biche County, 3 surveys in the MD of Bonnyville and 4 surveys in the County of St. Paul. In the Lac La Biche County, there was no pea leaf weevil damage found. In the MD of Bonnyville the pea leaf weevil feeding damage was found at low levels and are still not at a level of concern to producers. In the County of St. Paul pea leaf weevil was present in our surveys that we conducted in late May – early June. It will be important for producers to watch for the pea leaf weevil over the next few years to determine if it will be a problem in the County of St. Paul. At this time producers do not need to be using an insecticide seed treatment.

Methods: Canola Sweeps
In 2021 LARA also participated in a regional survey where canola sweeps were taken to identify any unidentified insects. We sampled 4 sites in the M.D of Bonnyville, 2 Sites in Lac La Bice County, and 3 sites in the County of St. Paul. These sites were spread out through each county to get better results and the sweeps were taken at the early bloom stage (25% flower). At each site, 10 sweeps were taken and then placed in a sample bag. From the sweeps taken, there were no new alarming insects found in the crop.

Comments:
Pest surveys are an important tool to use as it allows you to be notified of any insect outbreak that may occur within the growing season. They allow producers to be aware of insect outbreak potential and purchase seed treatments or another chemical beforehand. They are also useful for chemical representatives as they can estimate how much product they should have on hand for producers to purchase if needed. Regarding 2021 pest surveys, it has been overall a very good year for low insect pressure. All of the results from the surveys have been well below the economic thresholds. The forecast for 2022 in Lakeland should be a relatively good year for low insect pressure. However, it should be in your best practice to continue to monitor the pest surveys as weather conditions may change and be suitable for an insect outbreak of some sort.

Forage and Livestock Program

The producer's resource for forage production, feeding and grazing

The single most variable cost in livestock production is feed! From grazing in summer on tame and native pastures to feeding in the winter through conventional or extended grazing systems to animal marketing, cost effective production begins and ends with forage/feed. This program aims to aid producers in decreasing their cost of production while increasing their value of production.

The goals of this program are to:

Demonstrate effective winter feeding systems in Northeastern Alberta

Reduce costs associated with winter feeding systems

Improve crop production efficiency through feed testing, ration-balancing, pasture/grazing management etc.

Determine the highest yielding and quality annual crops for whole-plant forage production

Aid producers in annual and perennial forage selection

Provide producers with current marketing options and risk management strategies

Lakeland Forage Association

The Lakeland Forage Association (LFA) was formed in 1972 to promote the management and use of forage crops, and to identify and pursue the forage crop research needs of Northeastern Alberta. The LFA provides forage demonstrations, extension activities and coordination of forage research. The governing board of directors currently has 13 members who are elected for staggered three-year terms at the LFA annual general meeting. They are responsible for the management of the Olympic Lake Grazing Lease.

The Olympic Lake Lease was obtained by LFA in 1985, has grown to 2000 acres and has been used for two main projects: the Northern Range Enhancement Project (NREP) and the Olympic Lake Heifer Project.

Under the NREP, this lease was used as a demonstration for turning boreal forest land into an enhanced, sustainable rangeland. Range improvements have included clearing and breaking the land, windrowing, and spraying and burning. This pasture has been rotationally grazed for 20 years (currently there are 12 paddocks) and so fencing was also involved in the range improvements. Grazing capacity has almost doubled in the past 20 years. Now that the pasture has been developed the focus has changed from development to increasing pasture longevity and rejuvenating older pastures. Projects with this goal have included yearly rotation of fertilizer application, spraying weeds (trials have included Grazon, Remedy, and Restore) and introducing legumes into the pastures.

The Heifer Project has been tracing the effect of body weight and body condition on heifer fertility for over ten years. The heifers are weighed at the beginning and the end of the grazing season. These measurements are then compared to the fall pregnancy test results. From 2010 to 2013, the heifers were weighed two additional times, when they are switched from tame pasture to native brush pastures around the end of July and then when they switch from these native pastures back to the tame pastures around mid-September.

LFA would like to thank Bob and Wanda Austin who have been managing the Olympic Lake Lease for the past eleven seasons and doing a great job!

In addition to managing the Olympic Lake Lease the LFA acts as the forage and livestock advisory board for Lakeland Agricultural Research Association (LARA).

Northern Range Enhancement Project

Partners: Lakeland Forage Association
Lac La Biche County
Bob and Wanda Austin

Objectives:

1. To monitor the weight of heifers entering and exiting the pasture.
2. To evaluate methods of pasture rejuvenation.
3. To develop a complimentary grazing system, allowing for maximum utilization of tame and native species.

Background:

The Lakeland Forage Association (LFA) obtained Grazing Lease N. 840055 from the provincial government in 1985. The lease is located in Lac La Biche County near Olympic Lake (NE17-64-14) and was originally 1500 acres. A second lease was obtained by LFA to increase the pasture to 2000 acres. At the time the lease was obtained, the pasture had not been grazed for 15 years and no formal range improvement had taken place.

The LFA has used the Olympic Lake Grazing Lease as a demonstration for turning boreal forest land into an enhanced sustainable rangeland. Four different treatments have been used to increase carrying capacity: 1) clear and break, 2) spray and burn, 3) windrowing and 4) fertilizing. Rotational grazing has been practiced for the past 20 years and management improvements, such as cross-fencing, fertilizing and spraying, have been utilized to increase carrying capacity. The pasture has gone from carrying 998 Animal Unit Months (AUMs) in 1990 to 1607 in 2006. In 2010 1130 AUM's were grazed on the pasture, allowing some recovery from the drought in 2009. The cattle are rotated through the paddocks in a high intensity, low frequency grazing system.

Now that the pasture has been developed the focus has changed to increasing pasture longevity and pasture rejuvenation. Similar to other pastures in Northeastern Alberta, aspen encroachment and old pastures are a problem.

Every year approximately 15 patrons are given allotments for up to 30 heifers and one bull. The grazing season typically runs from mid-June to early-mid October.

In 2021, there was one project at the Olympic Lake Grazing Lease.

1. Heifer project

Heifer Project

Methods:

The heifers were weighed when they entered the pasture on June 3rd, 2021. The Bulls were pulled on July 29th, 2021, allowing for a 60-day breeding period. At this time the heifers were weighed for a second time. The heifers were removed from the pasture on September 10th, 2021 allowing for adequate grass carryover for the 2022 grazing season. The heifers were weighed for a third and final time during the heifer take-out day in September. Similar to previous years, the heifers were not pregnancy checked. The pasture received a total of 7 inches of rain over the grazing season.

Results:

There was a total of 99 days in the grazing season at Olympic Lake Grazing Lease (table 1, Figure 1). The average daily gain (ADG) over the grazing season was 1.44 lbs/day (table 2), which is 0.11 lbs lower than the ADG seen in 2020 of 1.55lbs/day.

Table 1. Grazing rotation for the 2021 grazing season at Olympic Lake Grazing Lease.

First Graze						***Second/Third Graze***				
Paddock Name				**# of head**					**# of head**	
	Date In	**Date Out**	**# of days**	**heifers**	**bulls**	**Date In**	**Date Out**	**# of days**	**heifers**	**bulls**
Headquarters	03-Jun-21	04-Jun-21	1	387	12	28-Jul-21	29-Jul-21	1	386	13
Headquarters						09-sept-21	10-Sep-21	1	386	0
W3	04-Jun-21	08-Jun-21	4	387	12	24-Jul-21	28-Jul-21	4	386	13
W5	08-Jun-21	15-Jun-21	7	387	13	29-Aug-21	01-Sep-21	4	386	0
Pipeline	15-Jun-21	16-Jun-21	1	387	13	06-Sep-21	07-Sep-21	1	386	0
W4	16-Jun-21	19-Jun-21	3	387	13	04-Sep-21	06-Sep-21	2	386	0
W1	19-Jun-21	24-Jun-21	5	387	13	01-Sep-21	04-Sep-21	3	386	0
W2	24-Jun-21	28-Jun-21	4	386	13					
C1	28-Jun-21	05-Jul-21	9	386	13	07-Sep-21	09-Sep-21	2	386	0
C4	05-Jul-21	07-Jul-21	2	386	13					
C3	07-Jul-21	16-Jul-21	9	386	13					
C2	16-Jul-21	24-Jul-21	8	386	13					
S1	29-Jul-21	15-Aug-21	14	386	0					
E1	15-Aug-21	29-Aug-21	14	386	0					
Home	10-Sept-21			386	0					
		Total:	**81**				**Total:**	**18**		

Table 2. Heifer data by herd for the 2021 grazing season.

	2021 Heifer Weights			Heifer Average Daily Gain (ADG)					
	June	**July**	**September**	**June 3 – July 29**	**56 days**	**July 29- September 10**	**43 days**	**June 3 - September 10**	**99 days**
Herd	**lbs**	**lbs**	**lbs**	**lbs gained**	**lbs/day**	**lbs gained**	**lbs/day**	**lbs gained**	**lbs/day**
1	855	902	959	47	0.84	57	1.33	104	**1.05**
2	762	863	946	101	1.80	83	1.93	184	**1.86**
3	852	962	1037	110	1.96	75	1.74	185	**1.87**
4	759	835	918	76	1.36	83	1.93	159	**1.61**
5	761	823	889	62	1.11	66	1.53	128	**1.29**
6	861	891	969	30	0.54	78	1.81	108	**1.09**
7	792	893	962	101	1.80	69	1.60	170	**1.72**
8	856	887	973	31	0.55	86	2.00	117	**1.18**
9	861	891	969	30	0.54	78	1.81	108	**1.09**
10	902	980	1048	78	1.39	68	1.58	146	**1.47**
11	704	784	858	80	1.43	74	1.72	154	**1.56**
Average	**815**	**883**	**957**	**68**	**1.21**	**74**	**1.73**	**142**	**1.44**

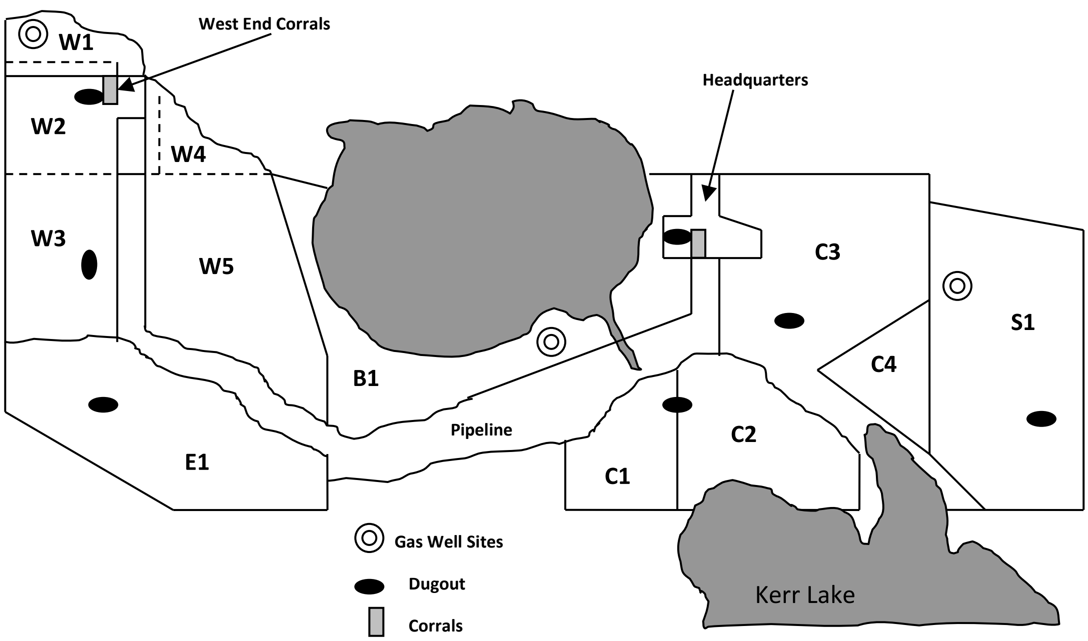


Figure 1. Map of the Northern Range Enhancement Project (NREP) pasture system.

Discussion:

There was a total of 11 patrons grazing cattle at Olympic Lake in 2021 with herd size ranging from 30 heifers and 1 bull to 60 heifers and 2 bulls in partnerships. All red or black angus heifer bulls were used for breeding between June 3rd and July 29th.

The average herd entry weight at 815 lbs was 33 lbs higher than in 2020 at 782lbs which is likely the results of the breed and age of heifers. The average daily gain (ADG) increased from

1.21lbs/day in June/July period to 1.73lbs/day from July – September. This is unusual when compared to other years – typically there has been a drop in ADG in the later part of the season, but this can vary. The length of this grazing season was shorter than 2020 due to very low precipitation.

The stocking rate at the Olympic Lake Lease has slowly declined since 2009, which has allowed for significant recovery and improvement of the pasture. The historical data for the pasture is summarized in table 3.

The poor amount of precipitation seen the grazing year resulted it for slow pasture regrowth.

Table 3. Historical data from Olympic Lake Grazing Lease. 2003-2021.

Year	Grazing Season (days)	# of Head	Weight Gain	ADG	% Open
2021	99	386	142	1.44	N/A
2020	117	399	181	1.55	N/A
2019	113	390	152	1.24	N/A
2018	105	410	123	1.17	N/A
2017	123	388	158	1.29	N/A
2016	121	350	141	1.16	N/A
2015	102	280	-	-	N/A
2014	133	271	266	2.00	28
2013	120	336	205	1.71	17
2012	126	343	139	1.1	9
2011	121	350	223	1.86	14
2010	120	350	170	1.43	14
2009	111	410	124	1.13	19
2008	128	369	224	1.76	14
2007	126	435	130	1.03	18
2006	127	462	-	-	18
2005	127	439	156	1.22	13
2004	127	427	163	1.35	10
2003	131	410	116	0.9	10
Average	124.63	373.71	171.42	1.41	14.5

Regional Annual Silage Trials

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

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

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

In 2021, the LARA Regional Annual Silage Trial included six blocks: barley (18 varieties), oats (11 varieties), triticale and wheat (12 varieties), winter/spring intercrop (17 treatments), pulse (12 treatments) and alternative (10 varieties).

In partnership with the Association of Alberta Co-op Seed Cleaning Plants and the Alberta Seed Growers Association, the Regional Annual Silage Trial information are annual printed in the Alberta's Seed Guide (seed.ab.ca). Unfortunately, due to a delay in results in 2021, the Regional Silage Trial data will not be printed in the 2021 guide but will be available on the website at a later date.

Regional Annual Silage Trial
Cereals

Partners: Canadian Agriculture Partnership
Alberta Agriculture, Forestry and Rural development
Battle River Research Group
Chinook Applied Research Association
Gateway Research Organization
West-Central Forage Association
Peace Country Beef and Forage Association
Philip Amyotte
Darrel Ketsa

Objectives:

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

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

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

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

Method:
The cereal trials were grown in three blocks of plots: barley, oats and triticale/wheat, in three location: St. Paul (SE13-60-10-W4) and Fort Kent (NE25-61-5-W4) and Smoky Lake (NW59-16-30-W4). The trial blocks were seeded as a randomized complete block design (RCBD) with four replicates to reduce error. The plots measured 1.15 m by 6 m in area.

Agronomic information on the trials can be found in table 1. The trials were seeded using the LARA five-row zero-till small plot drill and blend fertilizer was side-banded at the time of seeding.

The trials in Fort Kent were seeded on May 17, 2021 (barley, oats and triticale/wheat) and the trials in St. Paul were seeded on June 2, 2021 (oats, barley and triticale/wheat, winter/spring). The winter/spring cereal trial was seeded Smoky Lake on May 27, 2021. The trials were sprayed with a 3-point hitch sprayer once during the growing season.

Crop height and stage of maturity was recorded prior to harvest with the LARA alfalfa-Omega self-propelled forage harvester. The total plot weight was recorded and samples were taken to assess dry matter content. Additional composite samples were taken from each variety, frozen and sent to A & L Canada Laboratories for wet chemistry analysis. Statistical analysis was conducted using ARM 9, $p = 0.05$.

The following varieties were grown in the Regional Annual Silage Trials in 2021:

Barley

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

- *AB Tofield* - 6-row, awned forage and feed barley wit high yields and good lodging resistance.

Oats

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

Triticale and Wheat

- *Taza* – reduced awn forage and grain triticale variety with good lodging resistance.
- *Bunker* – early maturing, reduced awn forage variety with great digestibility, high fat content and high silage yields.
- *Sunray* – early maturing, spring triticale variety with improve ergot resistance. Short statured for increased resistance to lodging.
- *AAC Paramount* – soft white spring wheat, midge tolerant, high grain protein, good fit for silage production
- *AAC Awesome* – soft white spring wheat, midge tolerant, high yield, and excellent straw strength, good for silage production.
- *AAC Delight* – spring triticale, reduced awn forage variety with low ergot susceptibility and quality high tonnage.
- *AB Stampeder* – new spring forage triticale variety with reduced awns, shorter stature and increased digestibility.
- *AC Andrew* – soft white spring wheat variety with high yields and short, strong straw.
- *AC Sadash* – semi-dwarf soft white spring wheat variety with high yields, high quality and short, strong straw.
- *KWS Alderon* – high yielding special purpose red spring wheat, short stature, strong straw, late maturing, does well in cooler growing seasons.
- *CS Tracker* – early maturing variety with excellent disease protection and improved protein content. Broad adaptability with high yield potential.

- *WPB Whistler* – high- yielding special purpose wheat with a short strong straw – targeted at the feed/forage and ethanol markets.

Table 1. Agronomic Information 2021.

Trial	Site	# of Varieties	Seeding Date	Seeding Rate	Fertility (lbs/ac)	Weed Control	Harvest Date
Barley	Fort Kent	18	17-May-21	250 lbs/ac	90-30-20-5 @ 284 lbs/ac	Curtail M	10-Aug-21
	St. Paul	18	2-June-21	250 lbs/ac	90-30-20-5 @ 284 lbs/ac	Curtail M	25-Aug-21
Oats	Fort Kent	11	17-May-21	250 lbs/ac	90-30-20-5 @ 284 lbs/ac	Curtail M	9-Aug-21
	St. Paul	11	2-June-21	250 lbs/ac	90-30-20-5 @ 284 lbs/ac	Curtail M	19-Aug-21
Triticale/Wheat	Fort Kent	12	17-May-21	250 lbs/ac	90-30-20-5 @ 284 lbs/ac	Curtail M	11-Aug-21
	St. Paul	12	2-June-21	250 lbs/ac	90-30-20-5 @ 284 lbs/ac	Curtail M	25-Aug-21
Winter/spring	St. Paul	12	2-June-21	125 lbs/ac	90-30-20-5 @ 284 lbs/ac	Curtail M	30-Aug-21
	Smoky Lake	12	27-May-21	125 lbs/ac	90-30-20-5 @ 284 lbs/ac	Curtail M	-

Results:

Barley

The barley trials are aimed to be harvested at the soft dough stage. There were 18 barley varieties grown in the trials this year at both locations. There were 5 new varieties added to the trial in 2021 including tow recently registered varieties SR18645 or AB Prime and SR17515 or AB Tofield. Two new 2-row barley varieties were added (Esma and Stockford) and one new 6-row barley variety in AB Tofield.

The yield and quality results of the Fort Kent and St. Paul trials can be found in tables 2 and table 3, respectively. The Fort Kent trial was harvested 85 days after seeding and the St. Paul trial was harvested 84 days after seeding. Average moisture content of the Fort Kent trial was 48% and the St. Paul trial was 48%.

As many producers across the province experienced this year with the dry conditions, we saw lower yields at all sites compared to previous years. This year we saw higher average yields in our Fort Kent location of 4.52 ton/acre compared to an average yield in St. Paul at 1.84 ton/acre. The highest yielding variety at both locations was Claymore at 5.31 ton/ac in Fort Kent and 2.25 ton/ac in St. Paul.

In contract to previous years, we saw significant variability between varieties and sites when considering nutritional quality. When considering Crude Protein (CP), the general rule of thumb is 7-9-11 percent for mid-gestation, late-gestation and after calving. The majority of the varieties are adequate to meet the nutrients requirements through mid-gestation to late-gestation at the Fort Kent site, while the majority of varieties show nutritional quality to meet only mid-gestation at the St. Paul site. Total digestible nutrients (TDN), which is the easiest method to estimate the amount of energy in the feed, was fairly consistent between both sites and was adequate to meet the nutritional requirements through mid-gestation to late-gestation but lacks for after calving following the rules of 55-60-65.

Table 2. RST Barley Fort Kent, 2021 (ton/acre, 1 ton = 2000 lbs).

Variety:	Yield (ton/ac)		% of Check CDC Austenson	Height (cm)	Moisture (%)	2021 Quality Results CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
Claymore	5.31	ab	134.40	77.66	50.48	9.66	33.10	46.26	63.12	0.21	0.16	0.80	12.75
CDC Cowyboy	5.06	ab	127.99	105.80	52.51	9.90	32.81	46.11	63.34	0.20	0.17	0.73	15.67
CDC Maverick	4.98	ab	125.92	94.00	51.66	10.34	34.02	50.03	62.40	0.22	0.17	0.72	17.98
CDC Churchill	4.91	ab	124.35	70.70	45.14	9.14	32.19	43.73	63.82	0.20	0.20	0.74	13.28
CDC Bow	4.81	ab	121.69	68.42	47.58	9.97	34.42	48.00	62.09	0.26	0.16	0.67	12.67
TR18647/ AB Hauge	4.64	ab	117.39	75.84	45.16	9.58	36.99	55.06	60.08	0.17	0.12	0.85	19.00
AB Advantage	4.63	ab	117.26	77.09	50.58	10.40	32.69	45.82	63.43	0.22	0.14	0.95	12.51
AB Wrangler	4.63	ab	117.26	69.83	48.02	9.13	42.89	64.34	55.49	0.32	0.08	0.81	10.38
SR18647/AB Prime	4.56	ab	115.41	77.92	48.24	9.87	33.65	49.21	62.69	0.19	0.16	0.86	10.67
Altorado	4.35	ab	110.10	65.17	44.81	9.07	39.33	53.99	58.26	0.16	0.11	0.55	12.09
Esma	4.35	ab	110.10	67.09	43.15	9.58	35.66	49.68	61.12	0.21	0.10	0.73	12.06
Canmore	4.35	ab	109.97	67.75	47.98	9.30	38.11	54.52	59.21	0.32	0.12	0.81	12.81
Sundre	4.32	ab	109.29	70.17	47.68	10.00	38.20	55.22	59.14	0.24	0.09	1.15	14.04
Stockford	4.29	ab	108.66	70.34	52.24	9.78	37.87	54.32	59.40	0.29	0.12	0.83	14.53
AB Cattlelac	4.16	b	108.66	77.42	47.70	9.84	37.20	51.36	59.92	0.31	0.12	1.16	18.79
Amisk	4.09	b	103.39	62.83	44.67	10.43	35.48	50.59	61.26	0.28	0.10	0.80	15.70
SR 17515/ AB Tofield	3.99	b	100.86	66.34	49.38	9.96	34.46	48.02	62.06	0.27	0.16	0.76	14.33
CDC Austenson	3.95	b	100.00	63.91	49.55	10.99	34.83	51.42	61.77	0.21	0.15	0.91	12.31
Average	**4.52**			**73.79**	**48.14**	**9.83**	**35.77**	**50.98**	**61.03**	**0.24**	**0.14**	**0.82**	**13.98**
CV	**9.96**												

Table 3. RST Barley St. Paul, 2021 (ton/acre, 1 ton = 2000 lbs).

Variety:	Yield (ton/ac)	% of Check CDC Austenson	Height (cm)	Moisture (%)	CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
Claymore	2.25	115	54.50	47.39	6.81	28.07	49.41	67.03	0.34	0.1	1.46	35.24
CDC Cowboy	2.24	114	73.42	52.36	7.19	25.76	46.51	68.83	0.25	0.12	1.13	31.13
TR18647/AB Hauge	2.14	109	56.09	45.90	7.5	28..58	66.64	0.42	0.42	0.1	1.62	53.35
CDC Churchill	2.10	107	48.58	43.14	7.12	30.13	47.89	65.43	0.31	0.1	1.15	29.9
CDC Austenson	1.97	100	52.00	49.30	6.62	29.23	50.42	66.13	0.29	0.09	1.13	31.9
SR18645/AB Prime	1.94	99	52.83	46.34	7.12	29.88	51.61	65.62	0.38	0.1	1.34	35.93
Esma	1.92	98	42.92	39.03	6.56	32.03	55.77	63.95	0.36	0.09	1.12	45.86
AB Wrangler	1.82	92	52.08	43.28	4.71	37.38	60.29	59.78	0.3	0.09	1.3	34.08
CDC Maverick	1.81	92	66.92	57.86	6.94	27.37	45.42	67.58	0.32	0.11	1.45	33.08
Canmore	1.81	92	53.17	46.34	7.12	25.84	45..24	68.77	0.3	0.1	1.22	29.85
Stockford	1.79	91	48.17	61.28	7.56	30.02	51.07	65.51	0.27	0.1	1.07	37.84
CDC Bow	1.74	89	55.42	45.25	8.38	30.37	52.29	65.24	0.5	0.15	1.17	37.52
AB Cattlelac	1.68	86	58.50	44.26	6.31	31.7	52.59	64.21	0.37	0.11	1.37	52.25
Altorado	1.65	84	50.58	47.94	5.96	30.51	49.14	65.13	0.28	0.1	1.4	26.66
Sundre	1.60	81	58.67	53.98	6.31	30.11	50.97	65.44	0.47	0.13	1.8	53.3
AB Advantage	1.59	81	67.67	51.60	7.19	29.76	50.87	65.72	0.36	0.08	1.87	36.69
SR17515/AB Tofield	1.56	80	52.08	50.38	8.75	30.36	50.82	65.25	0.42	0.15	1.22	54.06
Amisk	1.45	74	39.58	47.28	6.07	35.59	60.68	61.18	0.43	0.09	1.67	39.64
Average	**1.84**		**54.62**	**48.49**	**6.90**	**30.24**	**52.49**	**61.73**	**0.35**	**0.11**	**1.36**	**38.79**
CV	**17.66**											

Oats

The oat trials are aimed to be harvested at the milk stage. There were 11 oat varieties grown in the trial this year in Fort Kent (NE25-61-5-W4) and St. Paul (SE13-60-10-W4). The results of Fort Kent trial can be found in table 4 and the results of the St. Paul trial can be found in Table 5. The average moisture content at the time of harvest in Fort Kent was 56% and in St. Paul it was 54%. This is the fourth year that the experimental variety ORE3542 M has been included in this trial, which is not yet available to commercial producers. A new variety that was added to our trial this year was CDC Endure.

The Fort Kent trial was harvested at 84 days after seeding and the St. Paul trial was harvested at 78 days after seeding.

Similar to the barley trials, all varieties at both sites yielded lower than average years likely due to the dry environmental conditions experienced during the growing season. The varieties yielded slightly higher at the Fort Kent location with an average of 2.73 tons/acre compared to an average of 2.15 tons/acre at the St. Paul site. The highest yielding variety in Fort Kent was CDC Baler at 4.01 ton/acre followed by CDC Haymaker at 3.49 ton/acre. In contrast, Murphy yielded the highest in St. Paul at 2.58 ton/acre although this was not significantly higher than the other varieties in the trial.

Table 4. RST Oats Fort Kent, 2021 (ton/acre, 1 ton = 2000 lbs).

						2021 Quality Data							
Variety	**Yield (ton/ac)**		**% of Check CDC Baler**	**Height (cm)**	**Moisture (%)**	**CP (%)**	**ADF (%)**	**NDF (%)**	**TDN (%)**	**Ca (%)**	**P (%)**	**K (%)**	**Mg (%)**
CDC Baler	4.01	a	100	103.92	58.71	8.19	32.28	54	63.75	0.29	0.13	0.92	59.65
CDC Haymaker	3.49	b	87	94.17	56.72	8.62	34.2	52.79	62.26	0.25	0.15	0.91	56.1
Murphy	3.4	b	85	106.09	56.79	7.12	35.05	59.48	61.6	0.38	0.11	1.5	63
CDC Nassar	3.21	b	80	88.92	56.74	8	30.94	54.81	64.8	0.23	0.12	0.95	49.01
CDC Endure	2.77	c	69	85.67	54.91	8.31	30.95	52.41	64.79	0.18	0.14	0.82	46.46
CDC Arborg	2.68	c	67	88.17	54.94	7.12	35.04	60.15	61.6	0.28	0.12	1.88	65.09
AC Morgan	2.45	cd	61	82.92	56.8	6.69	38.62	62.49	58.82	0.3	0.08	1	56.55
CDC S0-1	2.16	de	54	71.84	52.76	8	33.5	58.71	62.8	0.28	0.12	1.47	58.3
CS Camden	2.09	de	52	75.42	53.41	9.25	29.22	49.45	66.14	0.36	0.18	1.36	59.8
AC Juniper	2.06	de	51	81.25	56.25	6.81	37.5	59.1	59.69	0.39	0.09	1.88	71.66
ORE 3542M	1.71	e	43	75.17	59.51	8.69	31.81	54.66	64.12	0.18	0.14	0.72	48.34
Average	**2.73**			**86.69**	**56.14**	**7.89**	**33.56**	**56.19**	**62.76**	**0.28**	**0.13**	**1.22**	**57.63**
CV	**10.7**												

Table 5. RST Oats St. Paul, 2021 (ton/acre, 1 ton = 2000 lbs).

Variety	Yield (ton/ac)		% of Check CDC Baler	Height (cm)	Moisture (%)	2021 Quality Data CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
Murphy	2.58	a	122	100.49	54.35	5.33	38.04	64.15	59.27	0.28	0.08	1.34	63.8
ORE 3542M	2.44	a	116	77.70	53.56	5.29	35.12	54.88	61.54	0.25	0.12	1.29	65.7
CDC Haymaker	2.44	a	116	88.92	58.45	6.5	34.05	59.68	62.38	0.41	0.08	1.35	89.8
CDC Endure	2.43	a	115	83.35	52.21	5.64	34.35	53.77	62.14	0.26	0.15	1.31	14.9
CDC Arborg	2.36	a	112	80.25	52.81	6.24	32.37	55.36	63.4	0.27	0.12	1.26	49.35
CDC Nassar	2.21	a	105	79.24	55.15	6.25	37.26	60.24	59.87	0.35	0.12	1.54	44.1
AC Juniper	2.13	a	101	79.33	45.28	4.11	37.21	60.68	59.91	0.31	0.09	1.52	91.51
CDC Baler	2.11	a	100	85.00	56.64	4.86	32.83	53.52	63.33	0.33	0.13	1.13	75.64
AC Morgan	2.08	a	99	80.84	52.47	4.1	39.81	62.59	57.89	0.44	0.07	1.78	61.64
CS Camden	1.90	a	90	75.00	52.24	5.43	37.64	57.98	59.58	0.36	0.09	1.27	78.9
CDC SO-1	1.05	b	50	64.00	57.79	5.08	35.27	63.04	61.42	0.42	0.08	1.4	114.26
Average	**2.15**			**81.28**	**53.72**	**5.35**	**35.81**	**58.72**	**60.98**	**0.33**	**0.10**	**1.38**	**68.15**
CV	**22.32**												

Triticale and Wheat

The triticale and wheat trials are targeted to be harvested at the late milk stage. This year there were 7 wheat varieties and 5 spring triticale varieties in the trials. The results of the Fort Kent and St. Paul trials can be found in tables 6 and 7, respectively. The Fort Kent trial was harvested 85 days after seeding and the St. Paul trial was 86 days after seeding.

The trials yielded higher in the Fort Kent trial at an average of 4.33 tons/acre and compared to an average of 2.16 ton/acre in St. Paul. Bunker was the highest yielding variety in Fort Kent at 4.95 ton/acre while Sunray was the highest yielding variety in St. Paul at 2.76 ton/acre.

The quality in Fort Kent trial averaged CP at 8.16% while the St. Paul trial averaged at 6.40% while TDN was 65.95% in Fort Kent and 63.18% in St. Paul.

Table 6. RST Triticale Fort Kent, 2021 (ton/ac, 1 ton = 2000 lbs).

Variety	Yield (ton/ac)	% of Check Taza	Height (cm)	Moisture (%)	2021 Quality Data CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
Bunker	4.95	119	79.72	38.50	9.1	30.85	54.29	64.87	0.18	0.15	0.85	24.95
AAC Delight	4.91	119	79.82	40.79	6.93	35.42	55.59	61.31	0.14	0.11	0.74	20.38
CS Tracker	4.76	115	83.75	50.44	8.15	27.69	44.9	67.33	0.16	0.15	0.87	21.19
AAC Paramount	4.67	113	82.58	48.16	7.16	27.58	49.17	67.42	0.14	0.16	0.77	19.64
AC Sadash	4.64	112	92.04	44.04	7.2	32.29	53.1	63.75	0.17	0.13	0.87	29.3
AAC Awesome	4.53	109	75.00	43.60	8.63	28.07	52.14	67.03	0.13	0.17	0.82	19.05
Sunray	4.21	101	79.67	41.84	8.6	31.49	52.06	64.37	0.12	0.15	0.64	14.27
WPB Whistler	4.16	100	78.00	52.22	8.77	29.35	48.56	66.04	0.19	0.17	0.96	21.97
Taza	4.15	100	82.82	50.12	8.27	26.91	46.81	67.94	0.14	0.15	0.73	20.41
Alderon	4.05	98	72.33	38.61	8.46	28.36	48.36	66.81	0.15	0.15	0.87	0.18
AC Andrew	3.51	85	79.09	50.22	8.56	25.4	46.49	69.11	0.12	0.19	0.64	14.02
T256/ AB Stampeder	3.44	83	74.75	48.75	8.05	30.1	51.31	65.45	0.14	0.14	0.88	21.69
Average	**4.33**		**79.96**	**45.61**	**8.16**	**29.46**	**50.23**	**65.95**	**0.15**	**0.15**	**0.80**	**18.92**
CV	**16.22**											

Table 7. RST Triticale St. Paul, 2021 (ton/ac, 1 ton = 2000 lbs).

Variety	Yield (ton/ac)	% of Check Taza	Height (cm)	Moisture (%)	2021 Quality Data							
					CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
Sunray	2.76	155	85.34	55.11	7.25	25.67	46.94	68.9	0.16	0.12	1.05	39.79
AAC Paramount	2.58	145	74.75	48.50	4.88	41.56	64.58	56.52	0.22	0.07	1.02	42
AAC Awesome	2.57	144	74.35	53.23	4.22	36.3	53.25	60.62	0.16	0.14	1.12	22.16
AC Andrew	2.42	136	66.00	50.62	6.75	36.69	59.4	60.32	0.26	0.09	1.27	56.45
T256/ AB Stampeder	2.39	134	75.25	53.00	6.25	34.37	57.12	62.13	0.19	0.1	0.88	55.25
AAC Delight	2.25	93	72.66	54.74	6.56	28.97	49.36	66.33	0.17	0.14	0.82	38.18
AC Sadash	2.01	113	69.00	48.26	5.41	35.02	60.45	61.62	0.19	0.13	1.17	31.58
Alderon	1.96	110	60.17	55.63	6.11	32.68	54.26	63.44	0.17	0.11	1.15	42.8
Bunker	1.88	105	80.92	63.19	6.09	32.85	53.39	63.31	0.2	0.12	1.06	53.75
Taza	1.79	100	82.58	59.43	8.12	28.48	52.52	66.71	0.23	0.14	0.97	56
WPB Whistler	1.74	98	65.77	57.21	6.05	36.58	54.94	60.4	0.21	0.09	1.37	68.49
CS Tracker	1.57	88	60.35	45.44	9.06	27.03	46.53	67.84	0.2	0.14	0.84	57.25
Average	**2.16**		**72.26**	**53.70**	**6.40**	**33.02**	**54.395**	**63.178**	**0.197**	**0.1158**	**1.06**	**46.975**
CV	**22.9**											

Winter/Spring Cereal Intercrop

The winter/spring cereal intercrop trial was harvested at the recommended stage for the spring cereals. The trial was established in St. Paul and Smoky Lake County and the following four winter cereal varieties were used in mixtures with Taza triticale, CDC Austenson Barley and CDC Baler oats:

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

The trial in Fort Kent was harvested at the recommended stage for the spring cereals on September 8th, 2020 at 89 days after seeding. Results of the Fort Kent trial can be found in table 8. The highest yielding mixture was Bobcat/CDC Austenson at 2.76 ton/acre. Overall, the mixtures with CDC Baler were among the top yielding varieties while the mixtures with Taza triticale were among the lower yielding. Unfortunately, due to weather, the Smoky Lake site was unable to be harvested with usable data.

Table 8. RST Winter/Spring Cereal Intercrop Fort Kent, 2021 (ton/ac, 1 ton = 2000 lbs).

Variety	Yield (ton/acre)		% of Check CDC Austenson	S Height (cm)	W Height (cm)	Moisture (%)	Quality Results 2021 CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
CDC Austenson	3.36	a	100.00	63.50	-	38.68	8.16	34.98	46.72	61.65	0.24	0.12	1.04	35.62
CDC Baler	3.27	a	97.18	95.17	-	52.04	8.22	37.78	52.79	59.47	0.33	0.24	1.14	45.41
Bobcat/CDC Austenson	2.76	ab	82.07	57.99	24.69	52.04	10.73	34.69	48.44	61.88	0.38	0.17	1.87	66.45
Prima/CDC Baler	2.58	bc	76.72	91.09	22.08	55.87	7.73	37.72	50.61	59.52	0.38	0.25	1.30	71.95
AAC Wildfire/CDC Baler	2.54	bc	75.47	90.33	20.08	55.63	8.14	37.77	50.82	59.48	0.38	0.21	1.21	54.00
Bobcat/CDC Baler	2.44	bc	72.41	89.50	19.59	55.89	9.37	35.81	49.51	61.00	0.25	0.24	1.00	61.55
Luoma/CDC Baler	2.32	bc	68.99	91.08	20.92	53.78	7.85	38.28	51.15	59.08	0.37	0.20	1.16	59.75
Taza	2.30	bc	68.39	84.58	-	53.90	9.35	38.28	55.93	59.08	0.23	0.17	1.12	0.09
Prima/CDC Austenson	2.13	bcd	63.34	72.41	22.95	56.97	8.35	34.87	47.85	61.74	0.37	0.21	168.00	25.09
Luoma/CDC Austenson	2.11	bcd	62.74	67.77	23.66	55.50	9.31	35.02	47.23	61.62	0.46	0.23	1.83	44.24
AAC Wildfire/CDC Austenson	1.88	cde	56.02	60.08	19.06	48.28	8.32	37.49	50.75	59.70	0.30	0.14	1.29	37.33
Bobcat/Taza	1.44	def	42.76	77.00	24.83	69.14	11.42	38.39	56.50	58.99	0.29	0.28	1.88	45.47
Wildfire/Taza	1.40	def	41.75	84.66	22.66	60.08	11.99	38.25	57.51	59.10	0.45	0.14	1.71	115.60
Luoma/Taza	1.25	efg	37.17	78.42	25.84	63.32	10.74	36.07	51.02	60.80	0.35	0.16	1.41	85.20
Prima/Taza	1.20	efg	35.68	60.08	19.06	48.28	10.45	39.45	55.99	58.17	0.41	0.17	1.88	72.70
Bobcat	0.91	fg	26.91	-	73.17	80.34	12.94	35.54	54.01	61.21	0.33	0.34	2.37	42.85
Luoma	0.57	g	16.95	-	21.75	71.83	14.65	33.70	48.12	62.65	0.89	0.28	3.05	183.56
Average	**2.03**			**77.58**	**25.74**	**57.15**	**9.87**	**36.71**	**51.47**	**60.30**	**0.38**	**0.21**	**11.37**	**61.58**
CV	**18**													

Regional Annual Silage Trial
Pulse Mixtures

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

Objectives:

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

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

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

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

Method:
The trial was established at the LARA Fort Kent Research Site (NE25-61-5-W4) June 1st, 2021 and at our St. Paul site (Se13-60-10-W4) on May 12th, 2021 in a randomized complete block design (RCBD) with four replicates to reduce error. The plots were seeded with the LARA five-row zero-till small plot drill to a depth of 1.5 – 2" to try and reach an intermediate between cereal and pea recommendations. The peas were inoculated prior to seeding.

Cereal monocultures of CDC Baler oats, Taza triticale and CDC Austenson barley were established as check treatments for comparison to the pea/cereal mixtures. The trial was seeded with 15 treatments and each cereal variety was seeded in a mixture with Aberdeen Field Peas, DL Delicious Field Peas, Snowbird Faba beans and DL Tesoro Faba beans.

Agronomic information on the trial can be found in table 1. No in-crop herbicide applications were performed for weed control due to the mixture of broadleaf and grassy plants. Therefore, hand-weeding was done where necessary.

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

The following varieties were used in the pea/cereal trial in 2021:

- *CDC Austenson barley* - 2-row barley variety with semi-smooth awns, short and strong straw and high feed yield.
- *CDC Baler oats* - very leafy, forage oat variety.
- *Taza triticale* – reduced awn forage and grain triticale variety with good lodging resistance.
- *Aberdeen Peas* – semi leafless yellow pea variety with high yield and excellent standability.
- *DL Delicious Peas* – new semi leafless forage pea with high yields, good standability and early maturity.
- *DL Tesoro faba beans* - high yielding, zero tannin faba bean variety with great agronomic traits.
- *Snowbird faba beans* – zero tannin, medium size seed, resistant to root rot, good source of protein and energy.

Table 1. RST Pea/Cereal Mixture Agronomic Information, 2021.

Site	Date Seeded	Date Harvested	Rain (mm)	Treatments	Seeding Rate	Fertility
Fort Kent	1-June-21	17-Aug-21		Austenson	300 plants/m2	50% of recommended cereal rate
St. Paul	12-May-21	12-Aug-21		CDC Baler	300 plants/m2	50% of recommended cereal rate
				Taza	370 plants/m2	50% of recommended cereal rate
				Austenson/Aberdeen	150 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
				Austenson/DL Delicious	150 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
				Austenson/DL Tesoro	150 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
				Austenson/Snowbird	150 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
				CDC Baler/Aberdeen	150 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
				CDC Baler/DL Delicious	150 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
				CDC Baler/DL Tesoro	150 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
				CDC Baler/Snowbird	150 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
				Taza/Aberdeen	185 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
				Taza/DL Delicious	185 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
				Taza/DL Tesoro	185 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0
				Taza/Snowbird	185 pl/m2, 57 pl/m2	50 lbs/acre of 11-52-0-0

Results:

The trial is aimed to be harvested at the recommended cereal stage plus 10 days to try and account for the increased moisture content of the forage with the inclusion of peas. In previous years, the trial was harvested at the recommended cereal stage. However, the Forage Pea trials conducted at LARA for four years found that optimal yields and quality could be achieved if harvest was delayed by at least 10 days. The results of the pea-cereal trial are summarized in table 2.

Unfortunately, there was a mix-up in data collection for the St. Paul site and, as a result, the data has not been reported. The highest yielding mixtures at the Fort Kent site was CDC Austenson/Aberdeen at 3.35 ton/ac. Two other mixtures including CDC Austenson (with DL Delicious and DL Tesoro) were among the top yielding as well.

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

Table 2. RST Pea/Cereal Mixture Fort Kent, 2021 (ton/ac, 1 ton = 2000 lbs).

Variety	Yield (ton/acre)		% of Check CDC Austenson	P Height (cm)	C Height (cm)	Moisture (%)	Quality Results 2021 CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
CDC Austenson	3.69	a	100	-	81.186	59.535	9.33	33.76	53.31	62.6	0.82	0.12	0.65	23.95
CDC Baler	3.35	ab	91	-	104.7	64.962	9.52	25.59	40.12	68.97	0.36	0.73	0.11	18.41
CDC Austenson + Aberdeen	3.29	ab	89	73.892	85.065	63.141	7.84	29.17	47.34	66.18	0.25	0.18	0.8	36.73
CDC Austenson + DL Delicious	2.75	abc	75	68.915	73.25	61.308	8.21	33.78	55.76	62.59	0.25	1.01	0.17	28.25
CDC Austenson + DL Tesoro	2.66	abc	72	60.226	74.619	68.821	8.79	34	51.61	62.41	0.56	0.13	0.76	19.92
CDC Baler + Dl Delicious	2.66	abc	72	59.58	88.668	61.365	8.83	31.23	45.78	64.57	0.5	0.81	0.15	33.39
Taza	2.63	abc	71	-	94.065	59.638	7.53	27.78	45.86	67.26	0.15	0.83	0.14	32.12
CDC Baler + Aberdeen	2.59	abc	70	71.583	94.083	64.288	7.03	42.8	58.24	55.56	0.78	0.1	0.52	21.8
Taza + Aberdeen	2.52	abc	68	71.668	86.085	66.53	7.75	29.2	47.9	66.15	0.34	0.88	0.11	21.33
Taza + DL Delicous	2.41	abc	65	70.75	85.833	64.965	9.91	31.53	50.48	64.34	0.49	0.82	0.16	46.56
CDC Baler + Snowbird	2.34	abc	63	56.583	97.503	65.478	10.42	27.47	37.65	67.5	0.76	0.13	0.67	15.13
Taza + DL Tesoro	2.19	bc	59	63.418	88.253	69.715	6.6	30.3	52.16	65.3	0.26	0.11	0.91	39.87
CDC Austenson + Snowbird	2.15	bc	58	62.583	74.753	68.99	9.4	33.25	50.99	63	0.67	0.74	0.18	32.75
Taza + Snowbird	1.89	c	51	65.083	89.668	69.913	8.54	29.56	52.52	65.87	0.38	0.14	1.01	38.64
CDC Baler + DL Tesoro	1.69	c	46	42.424	73.48	62.595	7.61	34.78	54.69	61.81	0.5	0.11	0.83	33.95
Average	**2.59**			**63.89**	**86.08**	**64.75**	**8.49**	**31.61**	**49.63**	**64.27**	**0.47**	**0.46**	**0.48**	**29.52**
CV	**21.2**													

Regional Annual Silage Trial
Alternative Crops

Partners: West-Central Forage Association
Chinook Applied Research Association
Peace Country Beef and Forage Association
Battle River Research Group
North Peace Applied Research Association
Alberta Agriculture, Forestry and Rural Economic Development

Objectives:

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

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

Recent research from New Zealand on the use of 'alternative' crops in sheep and cattle diets is showing promising results in feed intake and environmental impacts. A study on chicory and plantain has shown the potential of reduced environmental impacts of these forages through decreased rumen ammonia and urine nitrogen in dairy cattle (Minnee et al. 2017). These results are supported by similar research on plantain-fed dairy heifers done by Cheng et al. (2017). A study by Edwards et al. (2014) showed high consumption of forage beet, kale and kale-oat mixtures by grazing dairy cows and almost complete consumption of beet.

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

Method:
The trial was established at the LARA Fort Kent Research Site (NE25-61-5-W4) on June 1st, 2021and at our St. Paul site (SE13-60-10-W4) on June 2nd, 2021 in a randomized complete block design (RCBD) with four replicates to reduce error. The plots were seeded using the LARA five-row Fabro zero-till drill to a depth of ½ inch.

Soil tests were taken in the spring at both sites and a blend fertilizer (90-30-20-5) was side-banded during seeding at 284 lbs/ac. The trial was hand-weeded during the growing season when necessary. There was no in-crop herbicide application in these trials.

Crop height and stage of maturity was recorded prior to harvest with the LARA alfalfa-omega self-propelled forage harvester. The total plot weight was recorded and samples were taken to assess dry matter content. Additional composite samples were taken from each treatment, frozen and sent to A & L Canada Laboratories for wet chemistry analysis. Statistical analysis of the data was conducted ARM 9, P = 0.05.

The following alternative crops were used for the trial in 2021:

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

Results:

The trial was harvested at the industry recommended stage for each individual crop. The yield and quality results from the trial are summarized in table 1. The trial at the Fort Kent Site (LARA) was harvested on August 5, 2021. Unfortunately, due to weather, the St. Paul site was not harvested.

Similar to the other Regional Silage Trials, the alternative trial yielded much lower than in previous years and the drought stress was obvious throughout the growing season. The highest yielding alternative species was Red Serbian Millet at 1.84 ton/acre and the lowest yielding species was forage kale at 0.35 ton/acre.

As expected, the species with the highest CP content was Chicory at 18.52%. Alternative forage species are well known for their high nutritive quality, which has led to their use in cocktail mixtures to boost nutritional content of cattle feed. All of the variety's, except for Forage Brassica and Forage Radish, are adequate to meet cattle CP requirements through gestation and into lactation. Due to these species high nutritional quality, it is recommended to include them in cattle rations in combination with at least one cereal crop.

Table 1. RST Alternative Crops Fort Kent Data, 2021 (ton/ac, 1 ton = 2000 lbs).

Variety:	Yield (ton/ac)		% of Check CDC Austenson	Height (cm)	Moisture (%)	2021 Quality Results CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
Millet	1.84	a	316.38	92.94	68.10	12.16	35.75	56.55	61.05	0.32	4.73	0.17	26.05
Max Radish	1.43	b	246.38	97.18	82.50	14.3	39.32	45.58	58.27	1.09	2.74	0.17	38.21
Phacelia	1.21	b	207.76	64.39	80.38	11.98	41.8	47.23	56.34	2.74	4.84	0.17	69.69
Forage Radish	0.86	cde	148.28	90.67	86.05	9.72	44.78	55.44	54.02	0.32	2.81	0.17	58.3
Sorghum Sudan Grass	0.76	cde	130.69	104.05	75.60	10.24	48.04	51.33	51.48	0.47	3.21	0.17	8.39
Plantain	0.68	cde	116.38	33.67	79.83	11.09	47.26	50.21	52.08	0.4	3.03	0.17	0.32
Chicory	0.58	cde	100.00	34.42	84.28	18.52	30.91	40.81	64.82	1.15	5.93	0.17	49.58
Forage Brassica	0.45	de	76.72	23.15	75.67	8.55	41.86	54.2	56.29	0.25	3.74	0.14	98.55
Forage Turnip	0.39	de	67.76	25.67	78.20	12.68	32.28	36.59	63.75	0	3.11	0.15	0.01
Forage Kale	0.35	e	60.00	33.67	78.95	10.65	44.85	54.66	53.96	0.37	4.04	0.16	131.6
Average	**0.85**			**59.98**	**78.95**	**11.99**	**40.69**	**49.26**	**57.21**	**0.71**	**3.82**	**0.16**	**48.07**
CV													

References

Cheng, L., Judson, H.G., Bryant, R.H., Mowar, H., Guinot, L., Hague, H., Taylor, S. and Edwards, G.R. 2017. The effects of feeding cut plantain and perennial ryegrass-white clover pasture on dairy heifer feed intake and water intake, apparent nutrient digestibility and nitrogen excretion in urine. *Animal Feed Science and Technology 229:* 43-46.

Edwards, G.R., de Ruitter, J,M., Dalley, D.E., Pinxterhuis, J.B., Cameron, K.C., Bryant, R.H., Di, H.J., Malcolm, B.J. and Chapman, D.F. 2014. Dry matter intake and body condition score change of dairy cows grazing fodder beet, kale and kale-oat forage systems in winter. *Proceedings of the New Zealand Grassland Association 76:* 81-88.

Minnee, E.M.K., Waghorn, G.C., Lee, J.M. and Clark, C.E.F. 2017. Including chicory or plantain in a perennial ryegrass/white clover-based diet of dairy cattle late in lactation: Feed intake, milk production and rumen digestion. *Animal Feed Science and Technology 227:* 52-61.

Longevity of Perennial Forage Varieties and Mixes Evaluation Trial

Partners: Alberta Beef Producers
Canadian Agriculture Partnership
Alberta Agriculture, Forestry and Rural Economic Development
Chinook Applied Research Association
Foothills Forage and Grazing Association
North Peace Applied Research Association
Gateway Research Organization
Battle River Research Group
West-Central Forage Association
Mackenzie Applied Research Association
SARDA Crop Research
Peace Country Beef and Forage Association

Objectives:

1. To provide unbiased, current and comprehensive regional data regarding the establishment, winter survival, yield and economics of specific species and varieties of perennial forage crops.
2. To identify perennial crop species/varieties that demonstrate superior establishment, hardiness, forage yield and nutritional quality characteristics in different eco-regions of Alberta.
3. To assess any benefits from growing mixtures of selected species.

Background:

Perennial forages include a diverse range of grasses and legumes that are utilized by livestock producers for a wide variety of purposes – from hay and greenfeed to summer pasture and winter grazing through stockpiled forage. They make up one of the largest sources of livestock feed on the prairies and the wide diversity in growth characteristics makes them ideal for many purposes.

According to Alberta Agriculture's Agriprofits Benchmarks, two thirds the cost of maintaining a cow is comprising pasture, stored feed and bedding. Consequently, managing the perennial forage supply and having access to high quality and high yielding forage varieties is extremely important to producers.

Historically there has been a gap in perennial forage production knowledge in Alberta and, in particular, regionally specific variety information. There is significant variation in Alberta's ecoregions and varieties that are developed and tested in one location or region will likely not perform the same in another region such as those experienced in Northeastern Alberta.

To help bridge this gap in perennial forage information, the perennial forage trial was developed to test cultivars that have been recently developed but have had limited regional evaluation to provide producers with valuable, region specific data. The province wide project data will be available to all producers in Alberta.

Method:
The trial was seeded as three blocks of plots: legumes, grasses and grass/legume mixtures at the LARA Fort Kent Research Site (NE25-61-5-W4) in a randomized complete block designs (RCBD) with four replicates to reduce error. The legume and legume mixture trials were seeded on June 7, 2016 and the grass trial was seeded on June 2, 2016. Unfortunately, due to slow and patchy establishment, the grass and grass/legume trials were reseeded on June 19, 2017. Table 1 illustrates the forage varieties seeded in each trial.

Table 1. Perennial Forage Trial Varieties seeded, 2016-2017.

Grasses	Legumes	Grass/Legume Mixtures
Fleet Meadow Brome	20-10 Alfalfa	Fleet/Yellowhead
AC Admiral Hybrid Brome	44-44 Alfalfa	AC Knowles/Yellowhead
Success Hybrid Brome	Assalt ST Alfalfa	Success/Yellowhead
Knowles Hybrid Brome	Dalton Alfalfa	Fleet/Spredor 5
Greenleaf Pubsecent Wheatgrass	Halo Alfalfa	AC Knowles/Spredor 5
Kirk Crested Wheat Grass	PV Ultima Alfalfa	Success/Spredor 5
AC Saltlander Green Wheatgrass	Rangelander Alfalfa	Fleet/AC Mountainview
Tom Russian Wilde Rye	Rugged Alfalfa	AC Knowles/AC Mountainview
Killarney Orchard Grass	Spreder 4 Alfalfa	Success/AC Mountainview
Grinstad Timothy	Spredor 5 Alfalfa	
Fojtan Festulolium	Yellowhead Alfalfa	
Courtney Tall Fescue	AC Mountainview Sainfoin	
	Nova Sainfoin	
	Oxley 2 Cicer Milkvetch	
	Veldt Cicer Milkvetch	

Prior to seeding, soil tests were taken and a blend fertilizer was developed (30-22-10-12) and side-banded with the grass trial at seeding. Due to the nitrogen fixing ability of legumes, the legume and grass/legume trial was seeded with 50 lbs/ac of 11-52-0-0 side-banded at seeding. All legumes were inoculated prior to seeding and seeding took place with the LARA Fabro five-row zero-till small plot drill with 9” row spacing. Plots measured 1.15m x 6m in area.

To determine percent emergence and establishment, plant counts were conducted 7, 14 and 21 days after seeding as the number of plants in 3 separate ¼ m squared areas in each plot. Another count was taken 70 days after seeding.

No yield or quality data was taken on the trial in the year of establishment. Since the legume trial was established in 2016, yield and quality data were taken in 2017. Yield and quality data was taken on all three trials in 2018 and 2019. Yield and quality data have been taken for the year 2020.

The seeding rates of each variety are shown in table 2.

Table 2. Perennial Forage Trial Seeding Rates, 2016-2017.

Species	Variety	Seeding Rate (lbs/ac)
Meadow Brome	AC Armada	14
	Fleet	14
Hybrid Brome	Success	12
	Knowles	12
Wheatgrasses		
Pubescent	Greenleaf	10
Crested	Kirk	6
Green	Saltlander	9
Russian Wildrye	Tom	8
Fojtan Festulolium		20
Orchard Grass	Killarney	10
Tall Fescue	Courtney	9
Timothy	Grinstad	4
Alfalfa	AC Grazeland	8
	Dalton	8
	20-10	8
	Halo	8
	Rangelander	8
	Rugged	8
	Spredor 4	8
	Spredor 5	8
	Yellowhead	8
	PV Ultima	8
	44-44	8
Sainfoin	AC Mountainview	30
	Nova	30
Cicer Milk Vetch	Veldt	13
	Oxley 2	13

The emergence counts and plant count results for the legume, grass and grass/legume mixture trials can be found in table 3, table 4 and table 5, respectively. The higher moisture experienced in 2017 allowed for excellent establishment of the grass and grass/legume trials. However, excessive moisture sitting on the legume site resulting in plots 113 and 114 dying out (Nova Sainfoin and AC Mountainview Sainfoin).

To assess winter survival, plant counts were taken on the legume trial on June 26, 2017 and the results are illustrated in table 3. The alfalfa variety Assalt ST showed the greatest impact of winter on plant survivability with a 56% decrease in plant stand from August of 2016 to June of 2017.

Rangelander alfalfa showed a 35% decrease in plant stand while Yellowhead alfalfa and Oxley Cicer Milkvetch only showed a 6% and 8% decrease, respectively. The rest of the varieties showed an increase from 2016 to 2017.

Historically, sainfoin has shown poor survivability in central and northern climates but showed an 18% increase for the new AC Mountainview and a 76% increase for the older variety Nova.

Table 3. Perennial Forage Project Legume Emergence and Plant Counts, 2016-2017.

	Emergence Counts (plants per 1/4 m)			Plant Count	Plant Count	Change
Variety	21-Jun-16	28-Jun-16	05-Jul-16	26-Aug-16	26-Jun-17	(%)
20 - 10	0.00	1.45	3.99	4.92	5.83	18
44 - 44	0.09	1.15	4.32	4.67	7.17	54
Assalt ST	0.00	0.65	2.68	4.58	2.00	-56
Dalton	0.00	0.33	3.09	4.67	5.50	18
Halo	0.00	0.69	4.44	5.33	6.50	22
PV Ultima	0.00	1.02	4.38	5.83	6.42	10
Rangelander	0.10	1.50	3.74	5.50	3.58	-35
Rugged	0.04	0.99	2.97	4.67	6.17	32
Spreder 4	0.00	0.68	3.48	4.83	5.92	23
Spredor 5	0.00	0.43	5.02	5.25	5.58	6
Yellowhead	0.00	1.07	3.57	5.92	5.58	-6
AC Mountainview	0.00	0.79	4.61	5.50	6.50	18
Nova	0.00	1.12	2.72	3.50	6.17	76
Oxley 2	0.00	1.03	3.86	4.33	4.00	-8
Veldt	0.00	0.54	4.15	4.75	5.67	19

The emergence counts of the grass and grass/legume mixture trial are illustrated in table 3 and table 4, respectively.

Table 4. Perennial Forage Project Grasses Emergence Counts, 2017-2018.

	Emergence Counts (pls per 1/4 m)		
Variety	Day 7	Day 14	Day 21
Fleet MB	0.00	8.41	7.50
AC Admiral HB	0.00	5.58	5.50
Success HB	0.00	9.00	6.75
Knowles HB	0.00	7.33	4.58
Greenleaf PWG	0.00	10.50	7.58
Kirk CWG	0.00	4.85	1.50
AC Saltlander GWG	0.00	8.41	6.83
Tom RWR	0.00	9.00	13.08
Killarney OG	0.00	15.83	10.25
Grinstad Tim.	0.00	15.92	15.33
Fojtan Festulolium	0.00	28.83	26.58
Courtney TF	0.00	13.00	10.33

Table 5. Perennial Forage Project Grass/Legume Emergence, 2017-2018.

Treatment	Emergence Counts (plants per 1/4 m)					
	Day 7		Day 14		Day 21	
	Grasses	Legumes	Grasses	Legumes	Grasses	Legumes
Fleet MB/Yellowhead	0.00	0.00	3.08	3.17	5.83	2.08
AC Knowles/Yellowhead	0.00	0.00	2.67	3.33	3.75	3.50
Success HB/Yellowhead	0.00	0.00	4.58	4.00	4.67	3.42
Fleet MB/Spredor 5	0.00	0.00	4.67	2.67	4.50	2.50
AC Knowles MB/Spredor 5	0.00	0.00	3.67	2.08	3.42	3.75
Success HB/Spredor 5	0.00	0.00	3.75	3.17	3.58	3.17
Fleet MB/AC Mountainview	0.00	0.00	3.00	2.75	2.58	4.17
AC Knowles HB/AC Mountainview	0.00	0.00	4.16	1.66	2.58	3.08
Success HB/AC Mountainview	0.00	0.00	3.00	2.88	2.67	3.58

The legume trial was harvested on August 6th, 2021 at an average moisture content of 74%. The yield and quality results can be found in table 6. The third and fourth rep were only able to be harvested due to the first 2 reps experiencing winter kill and severe drought in the first few years after seeding.

Table 6. Perennial Forage Project Legumes Data, 2021 (ton/acre, 1 ton = 2000 lbs).

Variety	Plot Yield (ton/ac)	2021 Quality Data								
		CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)	Moisture (%)
20-10	1.71	16.29	38.63	48.6	58.81	1.57	0.12	1.6	0.22	71.34
Spreder 4	2.75	15.05	41.19	49.52	56.81	1.46	0.11	1.38	0.21	74.86
Dalton	2.71	14.03	45.2	52.8	53.69	1.48	0.14	1.81	0.21	72.1
Oxley CMV	2.69	15.81	42.94	44.73	55.45	1.12	0.16	2.3	0.23	77.75
PV Ultima	2.66	15.46	39.91	47.55	57.81	2.01	0.13	1.66	0.25	71.58
Rangelander	2.33	17.51	37.24	46.12	59.89	1.62	0.12	1.55	0.25	76.21
Yellowhead	2.078	16.81	40.35	48.72	57.47	1.34	0.15	1.76	0.21	80.78
Spredor 5	1.98	15.93	43.06	51.42	55.36	1.72	0.14	1.67	0.24	76.17
Halo	1.91	18.05	34.15	46.79	62.3	2.01	0.11	1.08	0.23	70.04
44-44	1.81	17.06	37.9	47.75	59.38	1.59	0.13	1.55	0.18	72.96
Veldt CMV	1.75	14.73	41.14	50.31	56.85	1.53	0.12	1.73	0.27	72.58
Average	2.22	16.07	40.16	48.57	57.62	1.59	0.13	1.64	0.23	74.22

The grass trial was harvested on July 30th, 2021. The yield and quality results can be found in table 7. The average yield of the trial was 2.19 ton/acre, which was lower than the average in 2020, likely due to the dry conditions during the growing season. The highest yielding variety was Success Hybrid Brome at 3.83 ton/acre followed closely by Fleet Meadow Brome at 3.53 ton/acre. The lowest yielding variety was AC Saltlander Wheatgrass as 1.27 ton/acre. Unfortunately, Fojtan

Festulolium died out completely within the first two years of the original trial so was removed from the data tables.

Table 7. Perennial Forage Project Grasses Data, 2021 (ton/acre, 1 ton = 2000 lbs).

Variety	Yield (ton/ac)	2021 Quality Date							
		CP (%)	TDN (%)	ADF (%)	NDF (%)	Ca (%)	P (%)	K (%)	Mg (%)
Success Hybrid Brome	3.83	8.07	57.00	40.95	51.32	0.28	0.12	1.26	0.20
Fleet Meadow Brome	3.53	9.53	49.94	50.01	58.93	0.44	0.17	1.61	0.29
AC Admiral Hybrid Brome	2.67	10.71	51.62	47.85	49.73	0.44	0.18	1.51	0.28
Grinstad Timothy	2.28	9.15	58.35	39.22	54.48	0.25	0.08	0.91	0.21
Courtney Tall Fescue	2.12	10.28	54.72	48.88	52.09	0.41	0.13	1.35	0.33
Knowles Hybrid Brome	2.08	8.97	59.41	37.86	55.46	0.34	0.13	1.30	0.25
Greenleaf Pubescen Wheatgrass	1.86	8.89	56.91	41.07	60.06	0.36	0.15	0.99	0.21
Killarney Orchard Grass	1.63	9.50	55.33	43.09	54.89	0.26	0.17	1.34	0.24
Kirk Creasted Wheatgrass	1.44	9.83	55.06	43.44	51.90	0.39	0.17	1.08	0.27
Tom Russian Wild Ryegrass	1.42	11.00	51.41	48.13	53.32	0.41	0.13	1.70	0.35
AC Saltlander Green Wheatgrass	1.27	10.22	56.70	41.34	57.90	0.36	0.16	1.31	0.20
Average	**2.19**	**9.65**	**55.13**	**43.80**	**54.55**	**0.36**	**0.14**	**1.31**	**0.26**

The grass/legume mixture trial was harvested on August 13th, 2021. The highest yielding mixture was Success Hybrid Brome/Spredor 5 alfalfa at 2.46 ton/acre, although this was not significantly higher than Fleet Meadow Brome/Yellowhead alfalfa at 2.45 ton/acre. The lowest yielding mixtures included AC Mountainview sainfoin with an average of 1.48 ton/acre. This is likely due to the poor stand longevity seen with the AC Mountainview, with percent composition significantly decreasing over the years since trial establishment.

Table 8. Perennial Forage Project Grass/Legume Mixture Data, 2020 (ton/acre, 1 ton = 2000 lbs).

Variety	Yield (ton/ac)	2021 Quality Data							
		CP (%)	TDN (%)	ADF (%)	NDF (%)	Ca (%)	P (%)	K (%)	Mg (%)
Success HB/Spredor 5	2.46	13.44	58.39	39.16	53.68	0.64	0.13	1.01	0.36
Fleet MD/Yellowhead	2.45	3.33	54.97	43.56	52.84	0.50	0.14	1.19	0.40
Fleet MB/Spredor 5	2.36	12.02	52.77	46.38	54.52	0.66	0.12	1.39	0.46
AC Knowles/Spredor 5	2.36	9.93	57.49	40.21	54.49	0.43	0.11	1.09	0.30
Success HB/Yellowhead	2.32	12.71	57.19	40.71	54.22	0.61	0.14	1.18	0.42
AC Knowles/Yellowhead	2.24	11.78	55.36	43.05	53.84	0.57	0.12	1.15	0.34
Success HB/AC Mountainview	2.04	8.40	58.19	39.42	57.98	0.27	0.10	1.09	0.20
AC Knowles/AC Mountainview	1.92	11.88	57.47	40.35	52.64	0.48	0.12	1.10	0.33
Fleet MB/AC Mountainview	1.47	10.44	55.36	43.05	54.02	0.45	0.13	1.24	0.29
Average	**2.15**	**10.06**	**56.10**	**42.09**	**54.32**	**0.50**	**0.12**	**1.18**	**0.34**

Table 9 illustrates the change in botanical composition of the mixture trial from 2018 to 2021. No significant change in composition was seen in the alfalfa/grass mixtures. However, the sainfoin/grass mixtures have changed significantly as the majority of the sainfoin has died out over the past 3 years.

The trials have consistently been harvested in July or August of each growing season, allowing sufficient time for regrowth before the first killing frost. It is recommended for sainfoin to allow at least 50 growing days between the last cut and first killing frost to promote stand longevity.

Another recommendation to promote stand longevity in sainfoin is to allow seed set every two years, which has not been done with this trial.

Table 9. Percent Composition of Mixture Trial, 2018-2021.

Mixture	% Composition			
	2018		2021	
	Legumes	Grasses	Legumes	Grasses
Fleet MD/Yellowhead	27	73	46	54
AC Knowles/Yellowhead	53	47	34	66
Success HB/Yellowhead	44	56	44	56
Fleet MB/Spredor 5	27	73	30	70
AC Knowles/Spredor 5	34	66	21	84
Success HB/Spredor 5	48	52	40	60
Fleet MB/AC Mountainview	80	20	0	100
AC Knowles/AC Mountainview	86	14	0	100
Success HB/AC Mountainview	66	34	5	95

Evaluation of Perennial Forage Mixtures for Hay or Pasture

Partners: Canadian Agriculture Partnership
Alberta Agriculture, Forestry and Rural Economic Development
Chinook Applied Research Association
Foothills Forage and Grazing Association
North Peace Applied Research Association
Gateway Research Organization
Battle River Research Group
West-Central Forage Association
Mackenzie Applied Research Association
SARDA Crop Research
Peace Country Beef and Forage Association

Objectives:

1. To provide unbiased, current and comprehensive regional data regarding the establishment of, persistence, dry matter, yield, nutrition quality and economics of a number of perennial grasses and legume combinations when compared to pure stands of selected species intended for grazing and hay-land.
2. To deliver comprehensive information related to regional establishment, persistence, dry matter yield, quantity and economics of a number of perennial grasses and legume mixtures.

Background:

The recent survey on the economic, productive and financial performance of the Alberta cow-calf operation indicate that two thirds of the total cost of maintaining Alberta's cow herd is comprised of pasture (both native and seeded), stored feed and bedding (Oginsky and Boyda, 2018) The majority of the annual feed requirement comes from mixed stands of perennial grasses and legumes, therefore managing these forage resources is very important. Across Alberta most questions Agricultural Research Associations (ARA's) have received from producers wishing to improve their pastures and hayland are related to combinations of grass and legume species. Very few requests are for pure stands.

Most perennial seed sold by fame supply companies is sold either as a custom or stock blend. Unfortunately, the majority of perennial forages research to date has focused on pure stands instead of mixes. The recent concerted program of research/demonstrations on high legume pastures by AFF, ARA's and Ag Canada, which was devoted to improving producers understanding of the roles played by legumes in forage production systems, has helped initiate producer's interest in optimizing the use of legumes in forage and livestock systems. Producers are now aware that grass-legume mixes are key to increase yield and profit/acre. Of great importance is the availability of newer non-bloating legume varieties, in particular sainfoin and cicer milkvetch.

The importance of legumes in grass mixtures cannot be overemphasized. In addition to nitrogen benefits, potential yield and quality improvements, legume/grass combinations may also provide benefits in soil structure and carbons storage. A mixture of species more closely mimics natural forages than pure stands. There can be symbiotic benefits from differences in root structures, water and mineral use efficiencies, regrowth and snow trap potential.

Establishing and maintaining a successful hayland and grazing stand requires significant investment and good management. Selecting varieties which are easy to establish and are resilient while providing high yield and quality can improve net returns for agricultural producers. Results from this project will help tailor appropriate blends of perennial forage species to a particular regional and improve cattlemen's ability to make a good management decision.

Generation of information at points across the project will complement the Perennial Forage Variety Evaluation and Demonstration at multiple sites in Alberta (ABP/ALMA File No. FRG 19.15) project completed in 2018. It will also contribute directly to three goals of the Alberta Beef Forage and Grazing Center (ABFGC), including reducing winter feeding cost, reducing backgrounding cost and improving late summer/fall pasture.

Regional knowledge generated in the project will be shared with local cattlemen through a variety of means, ensuring management decisions contribute to a strong future for individual operations and agricultural industry in general.

Reference:

- *AgriProfit$ 2013-2017 Economic, Production and Financial Performance of Alberta Cow/Calf Operations.*
- *https://open.alberta.ca/dataset/78f2072-bdb5-40be-a7df-a0a44a760017/resource/c19ad19f-22a8-46c0-b05a-0a604c4b0814/download/cowcalfbenchmarks2017.pdf*
- *Alberta Agriculture and Forestry Alberta Forage Manual (Agdex 120/20-1)*
- *18 Schelllenberg, Michael P. 2013. http://www.beefresearch.ca/factsheet.cfm/drought-tolerant-forage-mixtures-55*
- *Beef Cattle Research Council Research. 2015. Determining Optimal Forage Species Mixtures. http://www.beefrearch.ca/factsheet.cfm/determining-optimal-forage-species-mixtures-152*
- *Beef Cattle Research Council 2015. Breeding Forage Varieties, http://www.beefresearch.ca/research-topic.cfm/breeding-forage-varieties -13*
- *ABP File No.FRG 19.15 Perennial Forage*

Method:

The trial was seeded as three blocks of plots: legumes, grasses and grass/legume mixtures at the LARA Fort Kent Research Site (NE25-61-5-W4) in a randomized complete block designs (RCBD) with four replicates to reduce error. The legume and legume mixture trials were seeded on August 26th, 2021. The grass trial was not established in 2021, but will be established in spring of 2022. Table 1 illustrates the forage varieties seeded in each trial.

No harvest data was taken in the year of establishment to allow for adequate establishment of all varieties, particularly due to the dry conditions. The first harvest will be taken in the summer of 2022.

Table 1. Perennial Forages seeded, 2021.

Mixtures	Legumes
Fleet/AC Yellowhead	Spyder
AC Success/Yellowhead/AC Mountainview/Veldt	PV Ultima
Legumeaster	Rugged
AC Knowles/Yellowhead	Phabalous
AC Success/Spredor 5	Rambler
Fleet/Greenleaf/AC Yellowhead	44-40
Salinemaster	AC Yellowhead
Fleet/AC Yellowhead/AC Mountainview/Veldt	AAC Glenview
Fleet/AC Yellowhead/AC Mountainview	20--10
Fleet/Spredor 5	Halo
AC Knowles/Spredor 5	Veldt
AC Success/Yellowhead	Rangelander
AC Success/Greenleaf/AC Yellowhead	Spreder 4
AC Success/AC Yellowhead/AC Mountainview	AC Mountainview
	AC Grazeland
	Spredor 5
	Dalton
	Halo 2
	Oxley 2
	Assalt

Table 2. Perennial Forage Mixtures Emergence Counts, 2021.

Variety	Emergence Counts (plants per 1/4m)					
	7 Days		14 Days		21 Days	
	Legumes	Grasses	Legumes	Grasses	Legumes	Grasses
Fleet/AC Yellowhead	0	0	2	13	6	20
AC Success/Yellowhead/AC Mountainview/Veldt	0	0	4	6	6	5
Legumeaster	0	0	5	2	13	10
AC Knowles/Yellowhead	0	0	3	4	8	11
AC Success/Spredor 5	0	0	2	2	6	8
Fleet/Greenleaf/AC Yellowhead	0	0	3	11	4	22
Salinemaster	0	0	1	7	5	15
Fleet/AC Yellowhead/AC Mountainview/Veldt	0	0	3	4	9	17
Fleet/AC Yellowhead/AC Mountainview	0	0	3	7	8	15
Fleet/Spredor 5	0	0	2	8	4	14
AC Knowles/Spredor 5	0	0	4	11	7	15
AC Success/Yellowhead	0	0	5	2	5	7
AC Success/Greenleaf/AC Yellowhead	0	0	3	6	4	16
AC Success/AC Yellowhead/AC Mountainview	0	0	1	1	8	10

Table 3. Perennial Forage Legumes Emergence Counts, 2021.

Variety	Emergence Counts		
	7 Days	14 Days	21 Days
Spyder	0	17	20
PV Ultima	0	23	21
Rugged	0	31	32
Phabalous	0	18	15
Rambler	0	29	31
44-40	0	18	19
AC Yellowhead	0	18	19
AAC Glenview	0	18	17
20--10	0	19	30
Halo	0	18	22
Veldt	0	18	18
Rangelander	0	27	28
Spreder 4	0	28	33
AC Mountainview	0	13	18
AC Grazeland	0	26	26
Spredor 5	0	21	23
Dalton	0	36	34
Halo 2	0	19	28
Oxley 2	0	8	14
Assalt	0	13	18

Long-Term Impact on Soil Biological, Physical and Chemical Health of Four Extended Grazing Strategies in Northeastern Alberta

Partners: Bar LD Ranch
Canadian Agriculture Partnership
Chinook Applied Research Association
Peace Country Beef and Forage Association
Alberta Agriculture, Forestry and Rural Economic Development

Objectives:

1. To determine the long-term impact of four winter grazing strategies on soil physical, chemical and biological health.
2. To determine the long-term impact of four winter grazing strategies on plant productivity and nutritive quality.
3. To determine the economic feasibility of four winter grazing strategies.
4. To compare the environmental impact (soil and forage) and economics of four winter grazing strategies.

Background:

Overwintering beef cows is a major cost in cow-calf production systems across the western Canadian prairies. Producers are looking to decrease winter feeding costs by utilizing extensive feeding systems including bale grazing, swath grazing, stockpiled forage and corn grazing. These systems can utilize both annual and perennial forage crops. Not only do extensive grazing systems reduce winter feeding costs through lower machinery use, fuel consumption and manure handling costs, but these systems can also have a beneficial impact on soil nutrients and plant productivity (Jungnitsh et al. 2011; Kelln et al. 2012).

Jungnitsh et al. (2011) showed a marked gain in nutrient cycling efficiencies and pasture growth using in-field feeding systems when compared to drylot feeding systems. The study also showed higher protein content in forages with in-field feeding compared to hauled manure or compost with a total of 34% of original feed N and 22% of original feed P imported into the fields with extended grazing systems. Similar results were found by Kelln et al. (2012) comparing nitrogen and phosphorous amounts and distribution in swath grazing, straw-chaff bunch grazing and bale grazing. This study also assessed subsequent crop biomass and found a greater positive impact in the extended feeding systems when compared to raw manure and compost manure application.

With the higher concentration of nutrients accumulated in winter feeding sites, care needs to be taken to avoid nutrient overloading. Gburek and Sharpley (1998) stressed the potential environmental risk of exceeding the soil and vegetations phosphorous capacity leading to dissolved phosphorous runoff with precipitation. King et al. (2017) showed a significant increase in nitrate export from applications of solid cattle manure during spring melt when compared to a non-manured control. Extended feeding systems show a greater accumulation on nutrients from excreta at feeding sites (Kelln et al. 2012; Jungnitsh et al. 2011).

Although current studies provide a detailed look into the short-term impact of winter grazing systems on soil nutrients and plant biomass, there is a lack of data assessing the long-term impacts (3+ years) of winter grazing systems on soil health and plant biomass.

In recent years, there has become an increased focus on soil health. Soil health can be defined as "the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals and humans" (USDA). Recent research into extended grazing strategies and their impact on soil has focused on nutrient cycling, particularly Nitrogen (N) and Phosphorous (P). Although this is an important part of soil health, very little has been investigated into the impact on soil biological health. Much of this has been due to a lack of laboratory testing capabilities in North America to determine soil biology including soil microorganisms. With the opening of Chinook Applied Research Association's (CARA) Soil Health Lab, Alberta now has the ability to determine soil biological health.

References:

Gburek, W.J. and Sharpley, A.N. 1998. Hydrologic controls on phosphorous loss from upland agricultural watersheds. *J. Environ. Qual.* 27.

Jungnitsh, P.F., Schoenau, J.J., Lardner, H.A. and Jefferson, P. 2011. Winter feeding beef cattle on the western Canadian prairies: impacts on soil nitrogen and phosphorous cycling and forage growth. *Agric. Ecosyst. Environ.* 141 (1-2): 143-152.

Kelln, B. and Lardner, H.A. 2012. Effects of beef cow winter feeding systems, pen manure and compost on soil nitrogen and phosphorous amounts and distribution, soil density and crop biomass. *Nutr. Cycl. Agroecosyst.* 92: 183-194.

King, T., Schoenau, J. and Elliott, J. 2017. Relationship between manure management application practices and phosphorous and nitrogen export in snowmelt run-off water from black chernozem Saskatchewan soil. *Sust. Agric. Res.* 6: 03-114.

Method:

The following four extended grazing strategies will be assessed:

1. Bale grazing
2. Swath grazing cereals
3. Grazing stockpiled forage
4. Corn grazing

A detailed historical record of each field used for the treatments was compiled prior to confirming project sites. Similar records will be kept throughout the duration of the project including, seeding costs, fertility costs, baling costs, number of head grazed, days grazed etc. Anecdotal summaries from each participating producer will be kept to demonstrate how each producer felt the system performed on their operation.

Soil Sampling

Soil sampling for the project will utilize CARA's Soil Health Sampling Protocol. Physical soil health parameters will be assessed on site, biological parameters assessed at the CARA Soil Health Lab and soil samples will be sent to an accredited laboratory for analysis of chemical soil health parameters.

Soil health parameters tested will include:

1. Physical analysis
    a. Compaction
    b. Bulk density
    c. Texture
    d. Water infiltration
2. Biological analysis
    a. Active carbon
    b. Soil microbial respiration
    c. Active and total bacteria
    d. Active and total fungi
    e. Nematode functional groups
    f. Protozoa functional group
3. Chemical Analysis
    a. Organic matter
    b. N,P,K
    c. Micro Nutrients

Over the next three years, each site will be sampled in the fall and spring of each grazing season with sampling beginning in the fall of 2019.

Forage Sampling

Forage samples will be collected, frozen and sent to an accredited laboratory for wet chemistry analysis utilizing best management practices for sampling.

Discussion:

The project began with fall sampling of all four strategies for soil health parameters at Bar LD Ranch located in Bonnyville, Alberta.

Forage Crop Guidelines and Forage Analysis Summary

The single largest variable cost in maintaining a cow herd is feed. Understanding cow nutrient requirements and ration balancing can help to reduce costs associated with over and under feeding (tables 1 and 2). Previous studies estimate that feeding a balanced ration can save as much as $0.25/hd/day. Consequently, feed tests are critical to ensuring that rations are based on the actual feed being fed.

This year was an interesting and frustrating year for making good quality feed for overwintering your cattle. The dry weather made it difficult to time the proper crop staging making it a shorter growing season as well as there being a shortage on feed.

Every year LARA sends in multiple feed samples for quality analysis on our trials and demonstrations. In addition, we offer two free feed tests for each producer in our operational area and results from those tests are also included this summary in table 3, 4 and 5.

Available to all producers is a forage probe that can be borrowed at any time. Contact LARA to see when it is available: 780.826.7260.

Table 1. Forage intake guidelines (as percent of body weight).

	Straw and Poor Quality Forage (%)	Medium Quality Forage (%)	Excellent Quality Forage (%)
Growing and Finishing Cattle	1.0	1.8 - 2.0	2.5 - 3.0
Dry Mature Cows and Bulls	1.4 - 1.6	1.8 - 2.0	2.3 - 2.6
Lactating Cows	1.6 - 1.8	2 - 2.4	2.5 - 3.0

* as taken from CowBytes

Table 2. Minimum Energy and Crude Protein Requirements for Beef Cattle.

Animal	CP (%)	ADF (%)	TDN (%)
Cows			
Mid-Pregnancy	8	59	50
Late Pregnancy	9	50	55
Lactation	10-12	31.5 - 45.7	56 - 63
Growing Cattle			
400 - 600 lbs - low ADG	11-12	24-39	60-65
400 - 600 lbs - high ADG	12-14	<31	68-75
600 - 800 lbs - low ADG	10-11	<31	60-65
600 - 800 lbs - high ADG	12-13	<31	68-75
>800 lbs	9-12	<31	68-75
Finishing Cattle			
900 - 1000 lbs	10-11	<31	68-75
>1000 lbs	9-10	<31	68-75
Wintering Bulls	9	37-53.5	53-60

Table 3. Quality Analysis Summary of Dry Hay Samples, 2021.

Crop Type	CP	ADF	NDF	TDN	Ca	P	K	Mg
Dry Hay	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Hay	11.68	38.95	57.69	58.56	0.51	0.09	1.26	0.12
Grass Hay	9.97	38.27	57.17	59.09	0.33	0.2	1.56	0.1
Hay	11.31	41.81	57.22	56.33	0.45	0.09	0.88	0.21
Hay	13.31	40.07	53.53	57.69	0.68	0.09	0.99	0.28
hay	11.25	45.26	56.81	53.64	0.49	0.09	1.11	0.2
Hay	13.4	39.98	54.18	57.76	0.87	0.14	1.51	0.19
Hay	13.04	39.97	55.05	57.76	0.93	0.11	1.48	0.28
Alfalfa / Grass Hay	14.25	31.27	32.3	64.54	0.98	2.3	0.18	0.24
Alfalfa / Grass Hay	11.56	31.61	46.34	64.28	1.49	1.79	0.2	0.37
Alfalfa / Grass Hay	8.31	34.5	58.07	62.02	0.45	1.57	0.13	0.17
Grass Hay	9.25	35.43	60.68	61.3	0.43	2.26	0.13	0.13
Grass Hay	7	35.95	62.11	60.89	0.29	2.16	0.12	0.1
Alfalfa / Grass Mix hay	8.12	34.94	56.47	61.68	0.5	1.57	0.12	0.17
2nd cut Hay	15.4	47.09	55.01	52.22	2.16	0.16	1.37	0.29
Hay	11.13	44.37	61.18	54.34	0.87	0.15	1.56	0.22
Hay	10.64	40.91	62.63	57.03	0.43	0.19	1.88	0.11
Hay	12.16	39.24	57.16	58.33	0.95	0.16	1.64	0.2
Hay	12.31	40.54	58.3	57.32	1.12	0.15	1.37	0.2
2nd cut hay	14.39	34.52	48.75	62.01	2.13	0.15	1.63	0.35
hay	7.72	50.25	71.81	49.76	0.46	0.04	1.19	0.14
Hay	13.1	39.69	54.2	57.98	1.29	0.15	1.92	0.28
Hay	9.12	41.32	58.11	56.71	0.58	0.12	1.34	0.19
Hay	10.66	41.59	57.76	56.5	0.49	0.23	1.9	0.26
Hay	11.89	39.04	59.78	58.49	0.48	0.24	1.54	0.25
Hay	15.58	31.46	46.68	64.39	1.26	0.22	2.15	0.3
hay	15.37	31.96	47.34	64	1.17	0.18	2.09	0.27
Hay	11.36	40	59.07	57.74	0.57	0.17	1.62	0.16
Hay	12.06	43.26	60.6	55.2	0.24	0.16	1.38	0.11
Hay	13.04	39.97	55.05	57.76	0.93	0.11	1.48	0.28
Hay	11.67	41.7	61.18	56.42	0.72	0.14	1.67	0.22
Hay	8.26	51.66	70.37	48.66	0.36	0.07	1.14	0.13
Hay	9.54	43.22	64.42	55.23	0.55	0.18	1.28	0.15
Hay	13.17	43.93	63.02	54.68	0.35	0.12	0.88	0.42
Hay	10.19	40.95	59	57	0.58	0.15	1.33	0.17
Hay	17.05	36.22	52.03	60.69	1.46	0.27	1.69	0.22
Hay	6.56	36.73	63.11	60.29	0.42	1.1	0.08	0.12
Hay	7.1	55.07	65.43	46	1.51	0.06	0.47	0.36
Grass/Hay	10.54	43.73	62.16	54.83	0.64	0.12	1.48	0.17
Hay / Grass	13.26	41.7	55.37	56.41	1.16	0.16	1.88	0.27
Grass/Hay	13.94	41.65	51.02	56.45	1	0.32	4.34	0.55
Hay	13.71	36.52	49.94	60.45	0.35	0.26	3.63	0.22
Hay	11.36	40	59.07	57.74	0.57	0.17	1.62	0.16
Hay	10.83	43.06	59.67	55.36	0.87	0.16	1.41	0.18
Hay	10.4	43.3	61.89	55.17	0.56	0.21	1.68	0.14
hay	12.45	42.23	59.46	56	1.38	0.17	1.43	0.3

Hay	11.24	40.8	58.05	57.12	1.08	0.16	1.42	0.21
Hay	11.24	37.99	53.53	59.31	1.19	0.15	1.44	0.24
Hay	15.58	31.46	46.68	64.39	1.26	0.22	2.15	0.3
Hay	15.37	31.96	47.34	64	1.17	0.18	2.09	0.27
Hay	11.23	37.67	55.6	59.56	0.48	0.14	1.68	0.19
Hay	12.46	38.26	53.32	59.1	1.32	0.12	1.23	0.48
Hay	10.26	40.51	56.79	57.34	0.83	0.11	1.55	0.18
hay	12.33	40.24	56.31	57.55	0.57	0.23	2.03	0.15
Hay	13.56	38.51	51.91	58.9	0.94	0.13	2	0.16
hay	10.42	42.56	57.84	55.75	0.99	0.17	1.66	0.19
hay	11.35	44.02	56.54	54.61	0.81	0.17	1.72	0.16
Hay	9.19	45.05	62.44	53.81	0.56	0.1	0.84	0.12
Hay	12.59	39.63	57.49	58.03	0.67	0.19	1.87	0.16
hay	7.08	41.45	66.51	0	0.2	1.29	0.08	0.09
Hay	11.54	38.45	56.98	58.95	0.58	0.14	1.47	0.17
Slough hay	9.38	42.48	59.58	55.81	0.52	0.07	0.77	0.22
Hay	12.29	40.37	57.67	57.45	0.66	0.14	1.46	0.25
Hay	10.97	44.16	55.83	54.5	1.46	0.13	2.24	0.75
Hay	9.09	34.7	53.72	61.87	0.91	0.25	1.59	0.38
Hay	7.84	35.91	56.09	60.93	0.75	0.26	1.46	0.31
Hay	11.96	42.53	56.74	55.77	0.85	0.2	1.58	0.22
Hay	10.89	39.92	56.24	57.8	0.68	0.12	1.23	0.26
Hay	12.68	43.57	64.4	54.96	0.4	0.19	1.15	0.13
Hay	12.86	37.95	54.56	59.34	1.11	0.17	1.49	0.23
Hay	9.29	31.33	48.42	64.49	0.4	0.24	1.85	0.16

Table 4. Quality Analysis Summary of Annual Crop Samples, 2021.

Crop Type Annual crops	CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
barley silage	10.51	28.26	45.93	66.89	0.48	0.27	1.31	0.28
grain silage	10.54	29.95	45.19	65.57	0.37	0.29	1.22	0.19
grain silage	10.76	2830	49.26	66.85	0.39	0.37	1.87	0.19
grain silage	10.76	28.3	49.26	66.85	0.39	0.37	1.87	0.19
grain silage	11.7	27.71	48.59	67.31	0.37	0.24	1.2	0.21
Greenfeed	12.57	31.83	48.36	64.1	0.72	0.26	1.94	0.32
Oat greenfeed	10.18	33.32	58.09	62.94	0.46	0.23	2.04	0.2
oat silage	10.05	32.09	50.83	63.9	0.75	0.19	1.12	0.29
oat silage	8.1	31.21	53.3	64.59	0.4	0.21	1.28	0.21
oat Straw	9.89	43.92	62.46	54.69	0.4	0.16	2.31	0.2
oat Straw	6.07	50.23	78.75	49.77	0.15	0.06	0.54	0.09
oat/barley greenfeed	12.37	29.86	50.29	65.64	0.39	0.2	1.18	0.17
oat/barley greenfeed	12.18	28.28	44.36	66.87	0.57	0.18	2.07	0.17
Oats grain silage	9.78	33.94	62.24	62.46	0.62	0.12	1.08	0.14
oats/peas/barley silage	10.74	30.03	47.59	65.51	0.75	0.17	0.98	0.33
oats/peas/barley silage	12.69	29.9	47.61	65.61	0.48	0.15	1	0.34
wheat silage	6.82	29.04	43.21	66.28	0.17	0.29	1.56	0.14
Con Silage	8.41	23.62	44.77	70.5	0.25	0.15	0.84	0.36
corn Silage	8	20.63	39.44	72.83	0.14	0.26	1.05	0.12
corn Silage	7.1	27.3	47.27	67.63	0.19	0.21	1.12	0.24
corn Silage	9.21	15.3	31	76.98	0.11	0.27	0.84	0.13
Canola regrowth	19.44	28.86	37.33	66.42	1.61	0.48	2.15	0.4
Canola Regrowth	21.03	36.3	47.66	60.62	1.78	0.37	2.45	0.39
canola regrowth	19.49	42	52.65	56.18	1.19	0.44	2.42	0.49
Canola Silage	15.54	35.13	52.05	61.53	1.54	0.26	1.1	0.39
Canola silage	14.02	37.74	54.21	59.5	1.49	0.34	1.53	0.53
Pea straw	5.06	43.64	61.99	54.9	0.98	0.05	0.78	0.39
Pea straw	7.1	55.07	65.43	46	1.51	0.06	0.47	0.36
Pea straw	6.26	51.31	65.85	48.93	1.62	0.08	0.84	0.34
Rye hay	13.38	32.91	52.03	63.26	0.37	0.25	1.43	0.16
Rye hay	11.63	31.98	56.48	63.99	0.36	0.25	1.12	0.11
Sorghum Sudan Grass hay	8.27	35.27	57.26	61.42	0.62	0.11	1.33	0.51
Straw	6.79	48.91	69.87	50.8	0.32	0.06	0.93	0.15
straw	6.05	47.87	71.78	51.61	0.37	0.04	1.24	0.21
wheat straw	5.58	49.18	73.36	50.59	0	0	0	0
wheat straw	5.58	52.66	72.61	47.88	0.24	0.03	1.09	0.18
wheat straw	6.13	47.02	65.77	52.27	0.26	0.1	0.19	0.16
barley straw	6.02	47.7	75.88	51.74	0.25	0.12	0.96	0.16
barley straw	5.6	49.35	69.89	50.46	0.55	0.08	0.36	0.22
Barley straw	5.06	47.56	70.77	51.85	0.49	0.08	0.97	0.15
canola straw	9.27	48.22	62.32	51.34	1.27	0.16	1.21	0.29
canola straw	9.93	44.33	58.33	54.37	1.34	0.2	1.8	0.26
canola straw	7.3	52.63	66.59	47.9	1.21	0.09	1.55	0.46
Canola straw	7.18	55.61	66.66	45.58	0.9	0.06	0.51	0.18
Canola straw	6.25	55.87	69.9	45.38	0.96	0.04	0.66	0.2
Canola straw	6.46	55.04	66.78	46.02	1.02	0.07	0.79	0.3

canola straw	7.04	53.15	65.06	47.5	0.9	0.09	0.9	0.33
canola straw	8.78	55.11	66.63	45.97	1.55	0.08	1.94	0.4

Table 5. Quality Analysis Summary of Silage Silage and Baleage, 2021.

Crop Type silage and baleage	CP (%)	ADF (%)	NDF (%)	TDN (%)	Ca (%)	P (%)	K (%)	Mg (%)
greenfeed	10.65	33.43	52.77	62.86	0.48	0.21	1.68	0.28
haylage	12.9	42.4	59.22	55.87	1.15	0.16	1.64	0.26
greenfeed	10.28	45.54	70.38	53.42	0.56	0.28	1.5	0.23
haylage	13.4	33.39	53.35	62.89	0.34	0.26	2.03	0.18
haylage	16.38	31.1	45.53	64.67	0.79	0.27	2.29	0.36
haylage	18.79	29.56	39.4	65.87	2.14	0.16	1.08	0.5
haylage	18.6	29.98	38.17	65.55	1.93	0.12	1.48	0.64
haylage	17.09	32.28	41.71	63.75	0.98	0.16	1.7	0.37
Small Grain /Hay	21.2	22.91	38.22	71.05	1.25	0.22	3.8	0.67
haylage	15.79	32.07	45.82	63.92	1.11	0.19	2.29	0.28
Greenfeed	14.16	28.56	44.07	66.65	0.99	0.22	3.92	0.41
Greenfeed	8.54	29.79	48.9	65.69	0.43	0.19	1.55	0.18
haylage	13.4	33.39	53.35	62.89	0.34	0.26	2.03	0.18
haylage	19.66	31.74	37.52	64.17	1.92	0.17	1.85	0.44
greenfeed	9.71	35.34	56.43	61.37	0.27	0.12	1.48	0.19
haylage	15.34	33.33	46.31	62.94	0.71	0.19	2.19	0.23
haylage	14.46	32.4	48.66	63.66	0.35	0.2	1.06	0.24
haylage	13.57	27.85	42.21	67.2	0.2	0.16	0.92	0.12
greenfeed	9.98	32.05	51.24	63.93	0.38	0.17	1.73	0.2
Greenfeed	12.25	27.23	51.3	67.69	0.4	0.2	1.17	0.22
greenfeed	10.42	36.97	57.19	60.1	0.27	0.24	1.54	0.27
haylage	16.66	32.29	46.55	63.75	0.63	0.14	1.45	0.38
haylage	16.63	34.06	47.09	62.37	2.7	0.18	1.24	0.56
haylage	10.19	39.3	55.77	58.29	0.38	0.09	0.71	0.26
haylage	14.66	34.38	46.03	62.12	1.04	0.16	1.43	0.27

Rancher Researcher Project

Partners: Canadian Agriculture Partnership
Chinook Applied Research Association
Foothills Forage and Grazing Association
North Peace Applied Research Association
Gateway Research Organization
Battle River Research Group
West-Central Forage Association
Mackenzie Applied Research Association
Grey Wooded Forage Association
Peace Country Beef and Forage Association
Alberta Beef Forage and Grazing Centre (Alberta Beef Producers, Alberta Agriculture and Forestry, Agriculture and Agri-Food Canada)

Objectives:

1. Provide a framework and process to assist in the adoption of technologies which provide benefit to cattle operations in Alberta.
2. Assess the impact of adoption of specific technologies on 20 operations utilizing financial and production data.
3. Enhance the adoption process of technologies which benefit ranch operations.

Background:

The uptake of new technologies has typically been slow within ranching operations. There are many reasons why this happens including but not limited to, a lack of awareness of specific innovations, lack of knowledge of how and what impacts the practice change may have or perhaps a lack of financial and/or manpower resources to put the tools to use. Despite the data which already exists related to productivity and profitability many ranchers have not been motivated to utilize the tools for making decisions within their operations.

This is an expansion of a Rancher/Researcher Pilot project which monitored the adoption of up to 3 innovations by 8 ranchers in south central Alberta. Selection of specific innovations was determined by the individual ranchers. Several targeted areas were evaluated, including soil, forage and economic parameters, for assessment of the impact the innovations made to the individual ranch operations. The ranchers were provided with the opportunity to consult with various scientists to further their understanding of the new technologies. They were encouraged to participate in Alberta Agriculture's Agriprofits program, which although onerous, provided enlightening results for their operations.

The pilot project demonstrated that an enhanced understanding of the ranch operation (eg. GOLD indicators, long term goals, available resources, etc.) can improve and how an innovation will have a positive impact. Ranch participants also acknowledged the importance of collecting and utilizing production and financial data when making decisions on management change.

While the information gleaned from the pilot was valuable, there was an identification of gaps which can impede consideration of the number of innovations available to the ranching community. This project builds on the experience from the pilot and will improve the successful adoption of various technologies by including a detailed initial interview with the ranchers to help determine selection of technologies relevant to their operation (rather than self-selected innovations), facilitated linkage with appropriate topic specialist as well as require a financial investment for the new technology. Ranchers will be made aware of the benefits of detailed monitoring of both production and financial ranch metrics. They will be encouraged to participate in Agriprofits. Ranchers from both the pilot and expansion projects will be expected to support the adoption process by providing testimonials and mentorship related to their experience, enhancing peer to peer KTT.

Discussion:
Two ranches were selected to take part in this program; K-Cow Ranch and Tower Farms Ltd. Each ranch was interviewed and their technology was selected.

K-Cow Ranch is located near Stony Lake, in the County of St. Paul, will be implementing a solar powered watering system that can be utilized year-round off of a dugout watering source. In addition to existing expertise they have found within industry, LARA staff have and will continue to provide links to expertise as needed. The project will be installed in 2022.

Tower Farms Ltd. is located near Smoky Lake and have installed a weigh scale on their feed wagon to improve rations. Previously they were using a feed truck to finish off/background their steers for direct marketing. Originally, they fed without a scale, and relied on timing an auger, filling the truck and counting how many pails were filled during that timeframe. This gives them a “rough” estimate as to how much grain the cattle are being fed. The amount of the grain augured out during that timeframe can vary based on moisture of the grain, the type of grain, and the weather conditions. All these variables can cause variations in the amount or total lbs. of grain augers out. By putting a scale on their feed truck, they can accurately feed out the amount of grain needed for the animals. It also gives them the ability to adjust the cattle feed intake accurately depending on where they are in the finishing cycle, what the weather conditions are and what type of grain is being fed. They are hoping that this advancement in technology will allow them to be more efficient when feeding these animals, as they will have the ability to adjust the feed, and measure accurately. The system was installed December 22, 2020, and was calibrated in 2021. They also added an offsite watering system to expand their grazing season as a second part to their innovation.

Environment and Regenerative Agriculture

Impact of Stem Mining Weevil (*Hadropontus litura*) population density on Canada Thistle Suppression

Canada thistle (*Cirsium arvense*) is an aggressive, colony-forming perennial weed which reproduces by both seeds and horizontal creeping root systems. It is listed under the Alberta Weed Control Act as noxious. Canada thistle has a high tolerance to many different environmental conditions and is highly competitive with other vegetation. It is prevalent in many locations such as riparian areas that do not allow for chemical or mechanical control methods.

The adult lifespan of the Stem Mining Weevil, *Hadropontus litura,* is approximately 10 months as they overwinter in the soil and leaf litter, and emerge in the spring to feed on rosette leaf foliage and stem tissue. Eggs are laid in May and June in the mid vein of the leaf and eggs hatch 9 days later. The larva mine down the stem into the root collar consuming plant tissues.

The majority of previous research on *Hadropontus litura* has been dependant on geographic location. On the west coast of British Columbia and California the weevils have not been very successful compared to the Midwest including Montana. Montana has similar climate to Alberta; therefore, weevils may be effective across the region.

Hadropontus litura offers a viable option for Canada thistle suppression in sensitive areas or in conjunction with other control options. The success of *Hadropontus litura* on suppression of Canada thistle will demonstrate:

- Use of a biological control as an alternate means of pest control;
- A possible reduction in chemical use; and
- Weed control in sensitive areas where other traditional methods are not able to be utilized

In 2012, as part of the provincial ARECA Environmental Team protocol, LARA released 1260 adult weevils across 4 sites at various population levels. Each site had a Canada thistle population density of 5 – 10 plants per square meter. Sites were revisited in 2013 to 2017 to monitor for plant damage and presence of weevils. Adults were found this past year and notable damage to the plants was observed.

Demonstration Solar Watering System

In 2006 LARA constructed a portable solar watering system with funding from the Alberta Stewardship Network. The unit, on a pull trailer, contains solar panels, trough, pump, batteries, float and hoses. It can water 150 head of cattle with a 15-foot lift, or 200 head with a 10-foot lift. It can be used for any surface body of water such as a dugout or creek.

This system is available for a free trial and allows the producer a chance to see if an alternative watering system will work for their situation. Call the LARA office to book the system if you are interested.

LARA Watershed Resiliency and Restoration Program

Watersheds are unique, come in many shapes and sizes and can cross many different land uses. The simple definition of a watershed is the area of land that catches precipitation, and drains into a wetland, stream, river or groundwater. The riparian zone is the interface between the upland and a water course. This area is heavily influenced by water, how and where it flows and is reflected in the plants, soil characteristics and wildlife that are found there. Riparian areas have a large role in water quality, quantity and biodiversity. They provide eight key functions to: trap and store sediment; build and maintain banks and shorelines; store water; recharge aquifers; filter and buffer water; reduce and dissipate energy; create primary production; and maintain biodiversity by providing habitat for plants, wildlife and fish. These Ecological Services benefit people, other living organisms, and the overall functioning of interconnected natural systems within watersheds. Conservation and restoration of wetlands and riparian areas in Alberta are needed for sustainably functioning watersheds. The accomplishments of the funding that ran from 2018-2021 can be seen in the infographic to the right.

This program received additional funding and is being continued until December 2022.

Environmental Farm Plans

The environment is becoming a more prominent issue. It is a large factor in marketing agriculture and food products in today's global markets. Consumers are demanding more transparency and are demanding high quality and safe products. Reputation of food safety is critical to retain and gain access to domestic and international markets.

Environmental Farm Plans (EFP) provide a tool for producers to assess their own operation and identify environmental risks, current standards, areas for improvement and also highlight what they are doing well.

Having a completed EFP allows producers to access different funding opportunities, such as the Growing Forward Stewardship Program. It is also useful in product branding that demonstrates specific environmental standards. There is a ten-year mandatory renewal period for all EFPs. If your EFP is older than 10 years old you will have to renew it to be eligible for funding opportunities.

The EFP Process

An EFP can be completed with one-on-one session(s). The EFP first identifies the soil and farm site characteristics. Following this, the producer completes only the relevant chapters that apply to their operation; such as wintering sites, fertilizer, pesticides, crop management etc.

Upon completion the EFP is submitted to a Technical Assistant for review. Once reviewed, the EFP will be returned along with a letter of completion.

The EFP is a living document and should be reviewed and updated periodically. As of April 1, 2018, there is a mandatory 10-year renewal period for an EFP.

If you wish to complete an EFP or have any questions regarding EFP please contact the LARA office at 780-826-7260.

Riparian Health Assessments

The riparian zone is the interface between the upland and a water course. This area is heavily influenced by water, how and where it flows and is reflected in the plants, soil characteristics and wildlife that are found there. Riparian areas have a large role in water quality, quantity and biodiversity. They provide eight key functions to: trap and store sediment; build and maintain banks and shorelines; store water; recharge aquifers; filter and buffer water; reduce and dissipate energy; create primary production; and maintain biodiversity by providing habitat for plants, wildlife and fish.

This Riparian Health Assessment is a tool designed to evaluate the selected site. It can provide a foundation to build an action plan and identify priorities. The assessment provides a snapshot in time and to be an effective tool for monitoring should be done on the same riparian area several years apart.

If you are interested in having a riparian health assessment completed on your land, please contact the LARA office.

Moose Lake Watershed Society

The Moose Lake Watershed Society (MLWS) is a Watershed Stewardship Group. It was founded in 2002 as the Moose Lake Water for Life committee, and became a society in 2008. This group was formed to address the health of Moose Lake, increase public knowledge and interest, and improve water quality as well as fish and wildlife habitat. This group is made up of volunteers. If you want to get involved with the MLWS please contact the Moose Lake Watershed Society or the LARA office.

Due to COVID, this year all Walking with Moose dates were cancelled. This field trip takes grade fives on an experiential field trip to learn about the watershed, forest ecology, water quality and riparian health and functions.

This was the third year that the MLWS partnered with LICA Environmental Stewards for the Keep Our Lake Blue (KOLB) Campaign. KOLB encouraged people to take action to reduce runoff and pollutants, such as phosphorus, from entering the lake. It consists of residents committing to taking at least one action from a list of a possible 52 actions, to help reduce runoff and pollutants from entering their watershed, and helping to protect and improve water quality of the lake.

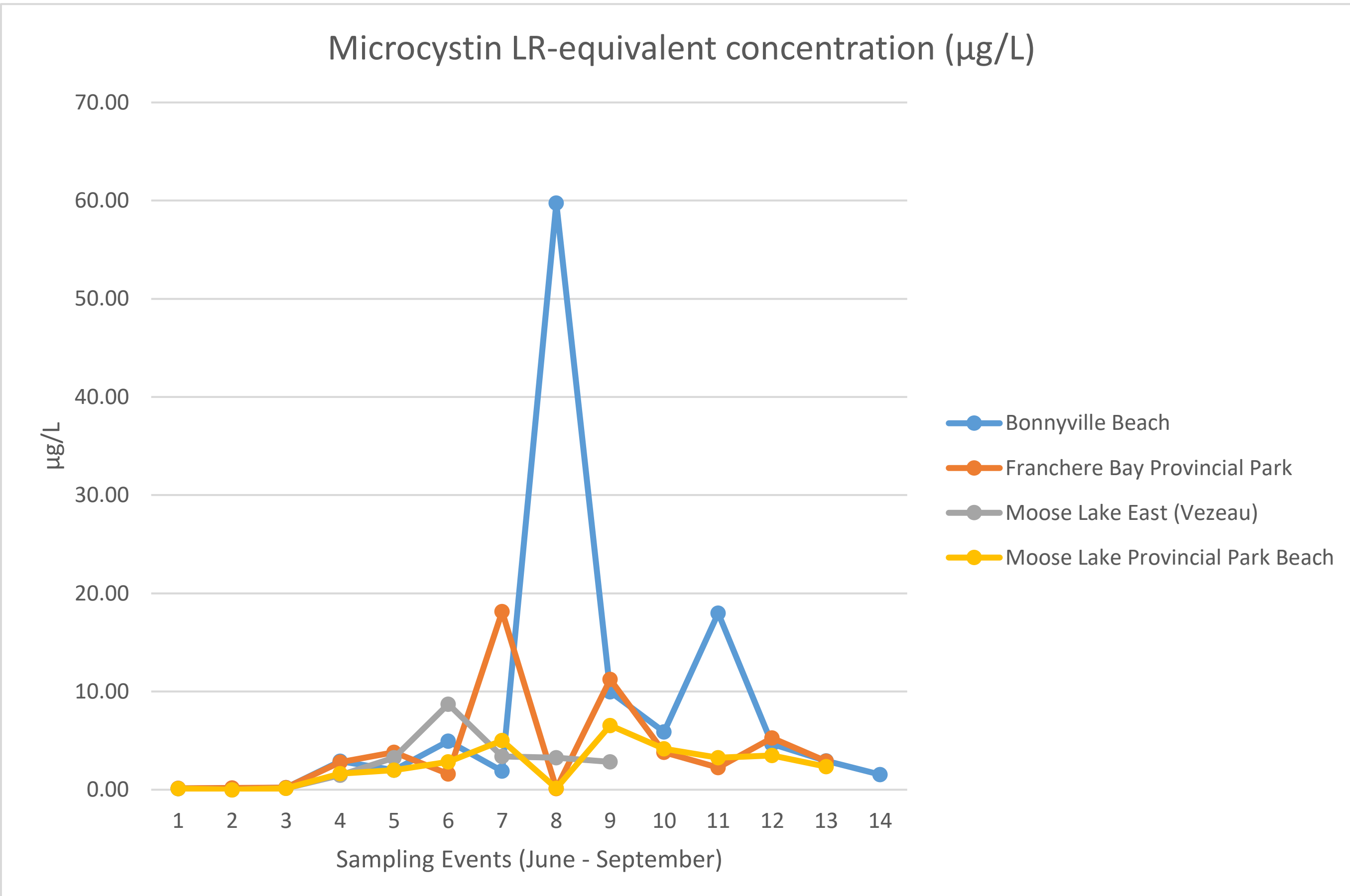
What we do in the watershed has compounding impacts on the health of our lakes and rivers. Impermeable surfaces don't allow water to soak into the ground. Instead, this water runs off of the surface, carrying sediments, salts, chemicals, and excess nutrients like phosphorous into the lake. Excess nutrients, like phosphorus, can also result in the formation of cyanobacteria, also known as blue-green algae, which are a unique group of bacteria that photosynthesize. When cyanobacteria decompose, they produce nerve and liver toxins that can pose a serious health risk to humans and animals. You can help prevent algae blooms by reducing runoff, phosphorus, and other pollutants on your property.

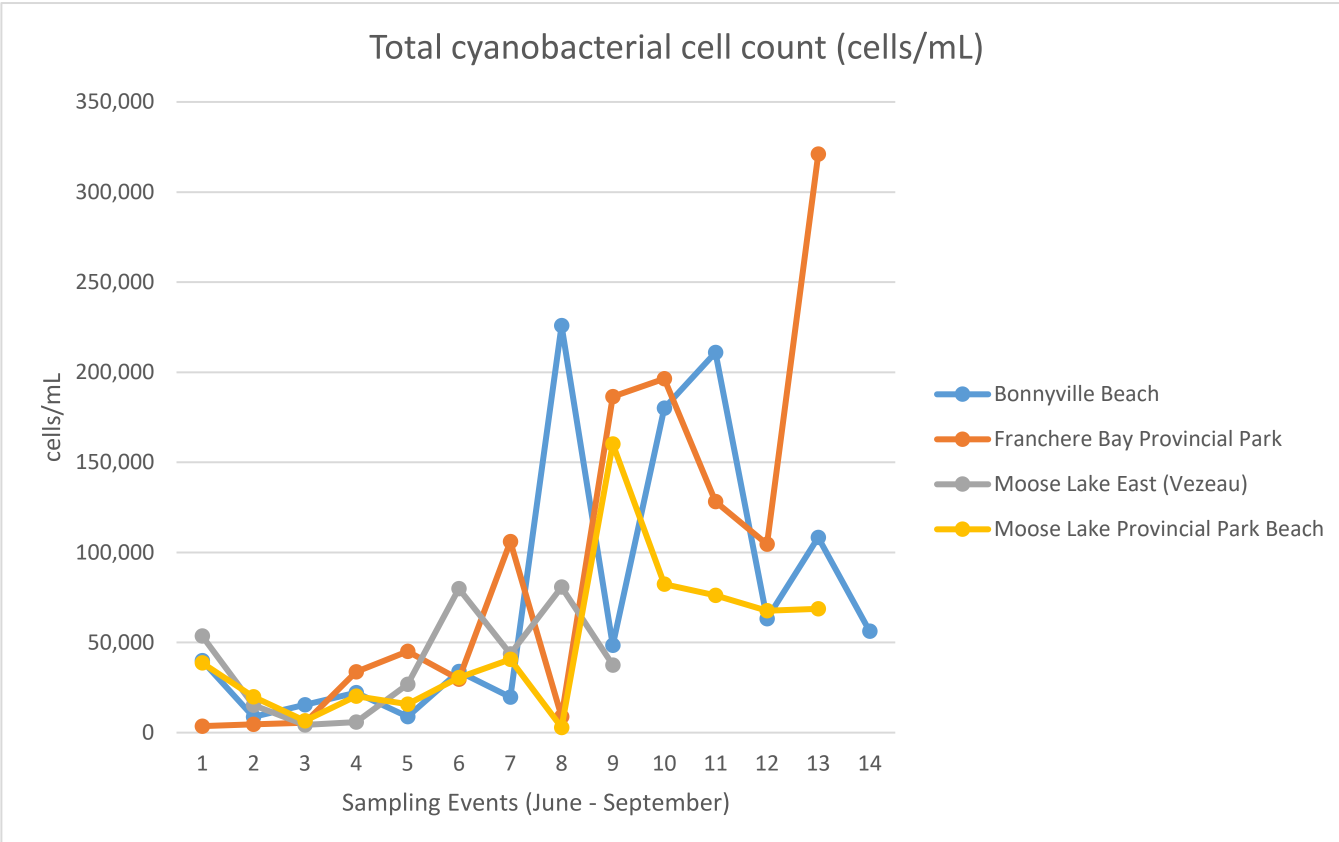
In early 2021, the Moose Lake Nutrient Budget was completed and released. It is the culmination of multiyear tributary, in lake, individual basin water quality sampling, as well as the phosphorous flux and core sampling that was completed in 2019. The nutrient budget assesses the legacy phosphorous and internal and external loading of nutrients. It will be used to focus restoration and projects in the future.

Moose Lake Cyanobacterial Monitoring

Moose Lake Watershed Society, Lakeland Agricultural Research Association and Alberta Health Services, partnered to complete enhanced cyanobacteria monitoring weekly from June to September long weekend. Vezeau was sampled by the Municipal District of Bonnyville. This was the second year that this monitoring was conducted.

The sampling was collected by LARA staff and volunteers, following AHS procedures.




Total cyanobacterial cell count (cells/mL)
cells/mL
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Sampling Events (June - September)
Bonnyville Beach
Franchere Bay Provincial Park
Moose Lake East (Vezeau)
Moose Lake Provincial Park Beach

The Predictive Effect of Regenerative Agricultural Practices on Overall Water Balance in the Prairie Pothole Till Region of the Canadian Prairies

In 2021, Kellie Nichiporik completed her Masters of Water Security. For her thesis she looked at the predictive effect of regenerative agricultural practices on overall water balance in the Prairie pothole till region of the Canadian Prairies.

Agriculture is the predominant land use in the Canadian Prairies, and every year the region undergoes a new widespread change in vegetation cover with spring seeding and so is arguably the most heavily managed landscape in Canada. Agricultural practices evolve with climate, market conditions, social norms and technology. It can be difficult to disentangle both climate and landscape effects on Prairie catchment water budgets. Hydrological models, such as the Cold Regions Hydrologic Model (CRHM), that represent the processes of the water budget are one possible tool to do so.

The first portion of this project was to create a two crop Macro to simulate intercropping to represent regenerative agriculture in CRHM. The second portion of the project compared and contrasted the field and catchment water budget sensitivity to adopting widespread regenerative agricultural practices compared to a conventional baseline in the largest catchment type in the Canadian Prairie (Pothole Till; 25%).

The Cold Regions Hydrological Model (CRHM) is a powerful modular model that permits appropriate hydrological processes for a selected prairie region/basin, selected from a library of process modules, to be linked to simulate the hydrological cycle of hydrological response units (HRUs) (Pomeroy et al., 2007). An HRU is a spatial unit of mass and energy balance calculations that correspond to bio-physical landscape units, within which process and states can be adequately described for the calculation by single sets of parameters, state variables and fluxes. HRUs have bio-physical states such as vegetation cover, state variables such as soil moisture, and fluxes in vertical and horizontal directions such as evaporation and runoff (Pomeroy et al., 2007).

CRHM can incorporate Macros, permitting rapid experimentation within the model structure, and is intended for variable and parameter transformations (such as crop heights, changes to start, maturity and harvest dates) between existing modules. In essence, Macros can be developed to overcome the shortfalls of the model. Below (Figure 2) is the flowchart of the two crop Macro that was developed to simulate intercropping into CRHM.

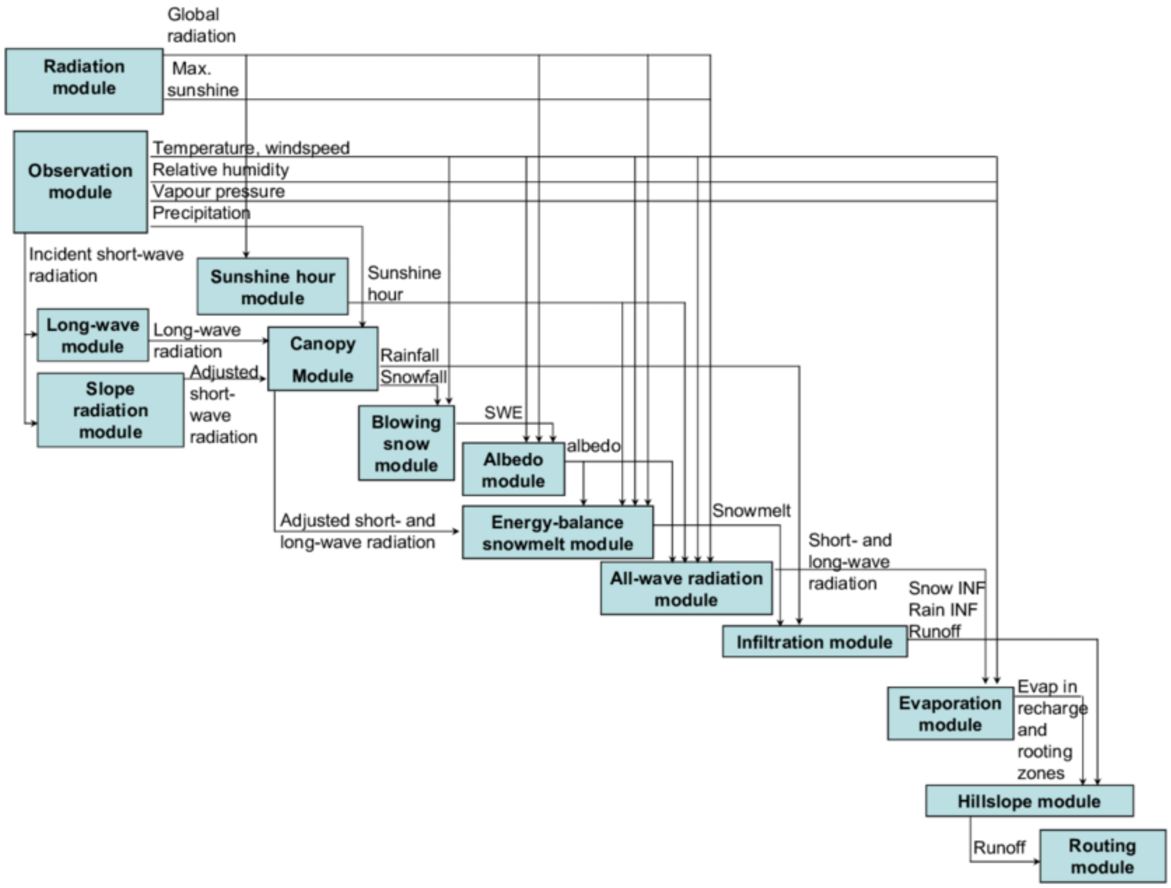
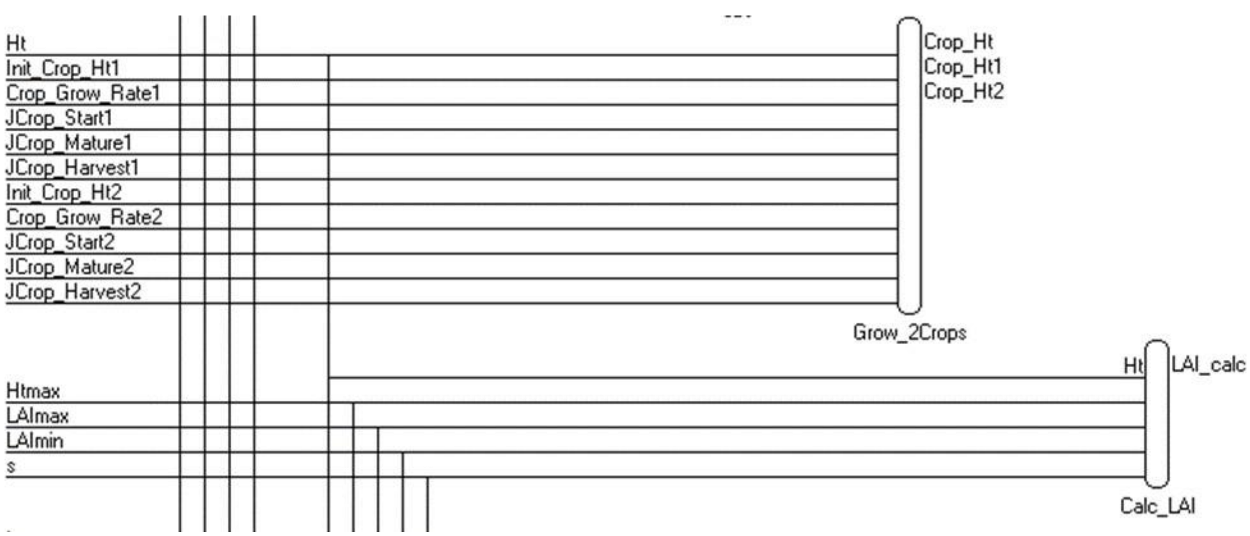


Figure 1. Flowchart depicting the configuration of physically based hydrological modules in CRHM for simulating hydrological processes. This setup is repeated for each HRU to develop a model to understand the water balance for PHT and Regenerative Agriculture. The Regenerative scenario has a macro that is incorporated after the Observation module. (Fang et al., 2013)

Figure 2 Flowchart of the two crop Macro



Typically, HRUs correspond to fallow, cultivated, grassland, shrub-land, woodland, wetlands to open water and channels; from highest elevation to lower elevations. This represents conventional agriculture and the Prairie landscape adequately. HRUs do not need to be spatially continuous, but rather must have approximate geographical location or hydrologic flow sequence. In CRHM, modern regenerative agricultural practices are not reflected accurately to demonstrate the adoption of no-till and the reduction of fallow practices. Presently organic operations, which have relied heavily on cultivation for weed control, have moved away from fallow practices and now incorporate cover crops for weed control and added nutrient cycling. Currently fallow practices are limited to areas that have seen extreme flooding or drought where crops could not be seeded or terminated due to climatic stress during the growing season, and are not a regular part of rotation for agricultural producers. In modelling regenerative agriculture, the fallow and cultivated HRUs are redistributed in area and are replaced with the two different intercrop blend HRUs.

There are seven classes of sub-regional watersheds that are defined by climatic, physiographic, wetland and land-cover variables (Wolfe et al., 2019). The Prairie Pothole Till (PHT) represents the largest class of watersheds; spanning from the northern part of the Alberta Prairie to the southeastern part of Saskatchewan. PHT is characterized with a large fraction of cropland cover, and low amounts of unmanaged grasslands. Typically, there is a high wetland density due to hummocky landforms (Wolfe et al., 2019).

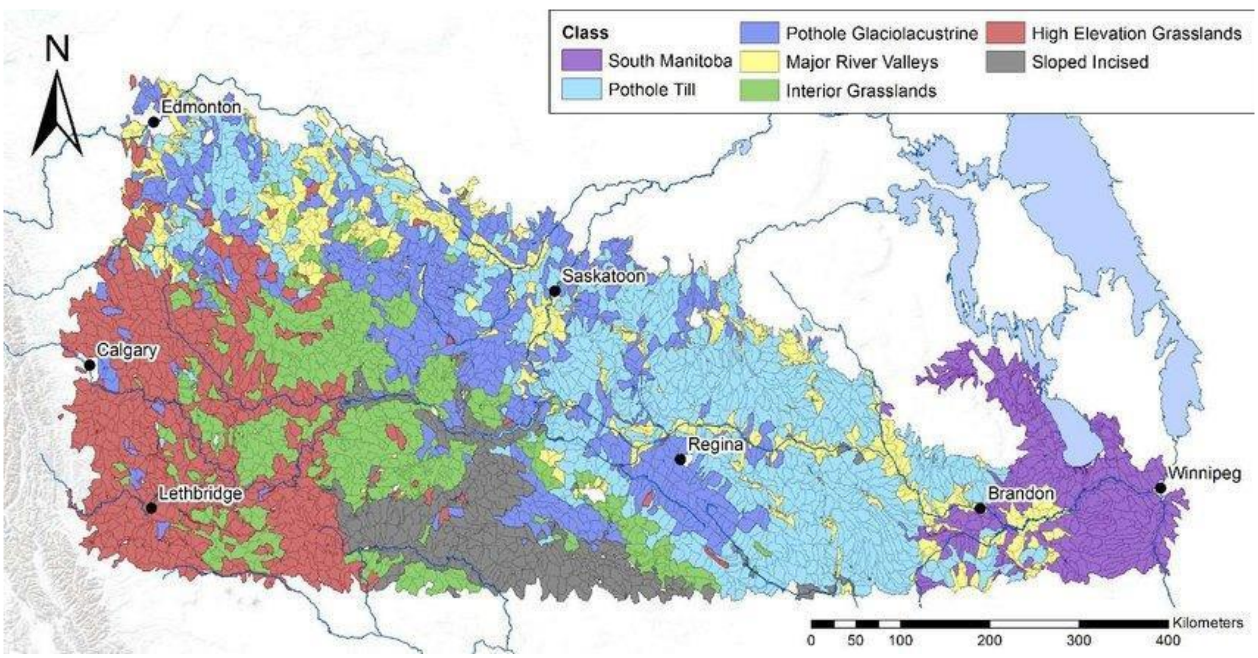


Figure 3. Classification of Prairie ecozone watersheds. The seven classifications include: Southern Manitoba, Pothole Till, Pothole Glaciolacustrine, Major River Valleys, Interior Grasslands, High Elevation Grasslands and Sloped Incised (Wolfe et al., 2019)

CRHM was run for both the regenerative agriculture scenario using the two crop Macro and for the conventional baseline for the PHT watershed class to output SWE, evapotranspiration, soil moisture, runoff, depression storage and basin flow to compare and contrast water budget sensitivities.

Monoculture production systems compromise biodiversity, utilize resources inefficiently, and are susceptible to pest outbreaks. Continuous production of annual crops requires constant disturbance (either mechanical or chemical) to maintain the system in the earliest successional state (Martens et al., 2015). Adopting practices such as cover cropping or intercropping, composting or organic amendments and integrating livestock has water budget implications. Trapping of snow, infiltration, evapotranspiration and runoff generation could all be substantially different in fields and hillslopes under regenerative than conventional agriculture practices.

Intercropping is the growing of two different species together. Intercropping has many benefits in that the diversity allows for different rooting depths (and therefore access to water), growth rates, heights, and provision of nutrients to the other plant. Interspecies specific interactions are generally regarded as drivers of plant productivity in multispecies agroecosystems.

Complementary use of resources in diverse communities can enhance community productivity through optimal use of plant-available resources and positive interactions such as facilitation can reduce water stress and ameliorate high abiotic stress conditions (Franco et al., 2017).

It was found that with incorporating regenerative agriculture in the form of intercropping that the snow water equivalent (SWE) increases, sublimation decreases, evaporation decreases, evapotranspiration increases, there is greater depression storage and less runoff.

Alberta Soil Health Benchmark Monitoring Project

Partners: Chinook Applied Research Association
Battle River Research Group
Farming Smarter
Foothills Forage and Grazing Association
Gateway Research Organization
Grey Wooded Forage Association
Mackenzie Applied Research Association
North Peace Applied Research Association
Peace Country Beef and Forage Association
West Central Forage Association
Food Water Wellness Foundation
Canadian Agriculture Partnership
Alberta Agriculture and Forestry

Objectives:

1. Improve the understanding of soil health parameters amongst Alberta producers.
2. Establish a soil health benchmark database representing points across Alberta.
3. Monitor how management practices affect soil health parameters during a 3-year time frame.

Background:

There is an increasing interest in the link between soil health, plant health and ultimately food quality. Society is also concerned with carbon both in the air and soil. Since carbon and soil health are very closely connected, management practices which improve carbon sequestration may result in a healthy soil and nutritious food products.

The status and functionality of a soil should be measured not only by its chemical (fertility) properties but also for its physical and biological properties. Chemical components of soil have been intensively evaluated by commercial soil testing labs in Canada. Chemical fertility recommendations have been based on this knowledge. The role of soil biology, however, is not well understood and physical characteristics have not been monitored. Evaluation of biological soil characteristics has only become available during the past few years in laboratories in the United States and more recently eastern Canada. Existing biological tests have not been calibrated and monitored specifically for Alberta soils. CARA's Soil Health Lab, under the direction of Dr. Yamily Zavala, provides a unique service in evaluating soil health constraint indicators. A biological and physical baseline developed within the province will provide a framework which can help define strategies for managing and improving the productive capacity, and sustainability, of our soils. A diverse micro-biological underground community may contribute to an overall healthier soil by improving soil aggregation, soil water infiltration and storage as well as improved

carbon sequestration. The improved aggregation stability will also contribute to enhanced carbon sequestration levels in the soil. Healthy soils produce healthy plants resulting in a higher quality food product.
Understanding soil health will give Alberta producers a valuable tool for use in making strategic management decisions on their farms and ranches. Sustainable productivity of a soil is a function of physical, chemical and biological soil functions. While chemical (mineral) characteristics are well documented through traditional soil testing, physical and biological components are not.

This project will assess and document soil health indicators at a minimum 220 locations per year across Alberta. Information from soil samples collected for various other projects, including the Rancher Researcher Pilot (8 Alberta Ranches), the Carbon Pasture Management Project (9 sites in Alberta) and Strategies to Reduce Fertility Inputs and Improve Soil Health and C-Sequestration in Mixed Crop/Livestock Systems (Fairview and Sedalia) will added to the data base. Individual farmer submissions to CARA's Soil Health Lab will also be included in the benchmark inventory. This will result in a base of information from points all across the province which will be a new tool for our agricultural industry.

In addition to the collection and evaluation of soil samples, land owners will be coached in the understanding of soil health in general as well as the analysis related to his/her location. The benchmarks will enable these producers to evaluate their management practices with respect to soil health. Farmers will also have the unique opportunity to be trained and have access to some of the lab equipment within CARA's Soil Health Lab for use in the evaluation of their own soil.

Method:

- 20 soil samples will be collected by each participating group in each of 2018 through 2022; the project will allow for farmers to include additional samples in the benchmark inventory if they wish at their own expense
- No specific land use criteria will be used for site selection other than a willing and interested landowner who has good records of management history for the site; it is anticipated the 1210 samples will be a cross-section of crop, forage and native pasture under various management regimes
- CARA's Soil Health Sampling Protocol will be utilized in the collection of all samples
- Staff from all associations will be trained for collection of samples and site information
- Each association will have a Soil Health Sampling Kit
- GPS coordinates will be recorded for each site
- Site history will be documented
- Parameters that will be analyzed:
- Physical (on-site or at CARA Lab):
    - wet aggregation stability (Cornell University protocol)
    - compaction (penetrometer on site)

    - bulk density (by weight/volume measurement)
    - texture (Bouyoucos hydrometer method)
- Biological (CARA Lab Food Soil Web protocol except as noted)
    - active carbon (Cornell University protocol)
    - C:N ratio (will be done in collaboration with U of A)
    - soil microbial respiration (Cornell University protocol)
    - active & total bacteria
    - active & total fungi
    - nematode functional groups
    - protozoa functional groups
- Chemical (commercial labs)
    - organic matter, pH, EC, etc.
    - N, P, K
    - Micro nutrients
- All information will be entered into a data base
- Information related to specific sites will be shared with the cooperating producers by association staff
- In addition to 220 new sites per year for years 2018-2020, sites will be re-visited 3 years after the benchmark and sampled again in 2021 and 2022 to monitor the impact of management activities

Discussion:

Soil sampling began in 2019 and will continue into 2022. If you are interested in being a part of the Soil Health Benchmarking Project, please contact the LARA office at 780.826.7260.

Extension

2021 Lakeland Agricultural Research Association Extension Activities

Designing Cover Crop Blends

On February 2nd, fifty-four producers attended the designing cover crop blends webinar with Kevin Elmy. The webinar featured how adding diversity can improve feed values, soil health, weed control, increased infiltration and so much more.

Soil Health Webinar Series

Four webinars were held featuring Joel Williams, an independent plant and soil health educator. February 11th was attended by 171 producers on the topic of what's new in soil health and plant nutrition. February 16th had 209 producers to learn about transitioning to low input production systems. February 23rd featured strategies for regenerating forage stands and using perennial and annual forages in crop rotations that 133 producers attended. March 2nd was a question and answer period that 52 producers took advantage of.

LARA Research Update and AGM

The Annual Research Update and AGM was held on March 2nd via zoom. LARA staff presented information on the 2020 research and extension programs such as the variety trials, fertility trials, forage peas and forage variety trials.

Talk * Ask * Listen

Talk * Ask * Listen is a mental health first aid workshop tailored to agricultural producers. Fifteen participants took part in this webinar over March 16 and 17th.

Moose Lake Nutrient Budget Release

March 18th, Dörte Köster from Associated Environmental Consultants Inc. presented the nutrient budget for Moose Lake. This study compiled many years of research, core sampling, tributary monitoring and in-lake sampling to look at the phosphorous in the lake, which is the main driver of cyanobacteria (blue-green algae) blooms.

Succession Planning

On April 13th, participants took a deeper look into insights and experiences on beginning and continuing on conversations about succession planning with Kelly Sidoryk.

Grazing Planning

On April 27th a grazing planning webinar was held with Kelly Sidoryk to review the principles of planned adaptive grazing, and talk about the factors to consider when planning and monitoring throughout the grazing season.

Working Well Workshop
On April 29th 22 producers attended the working well webinar. Here they learned about their wells, and to increase their understanding of groundwater and driller's reports, common water well problems, rural water treatments, and proper well maintenance. Attendees also learned how to shock chlorinate their wells.

Smoky Lake Summer Field Day
On July 22nd the Smoky Lake Summer Field Day was held in Smoky Lake. Twenty-one producers attended the presentations and plot tour.

Fort Kent Summer Field Day
On July 28th LARA hosted its Fork Kent summer field day at the LARA office. It featured our regional cereal variety trials, flax, cover crops, liming and crop rotation trial, and ultra-early wheat trial. Thirty-five producers attended the day.

St. Paul Summer Field Day
On August 5th near Mallaig, LARA hosted its summer field day. Fourteen producers attended to tour our regional variety trials, ESN wheat and barley trials, regional silage trials and alternative pea/cereal silage trial.

Dugout Webinar Series
The dugout webinar series was held on July 20th and 27th featuring Shawn Elgert from Alberta Agriculture and Forestry. The webinar series covered: planning considerations; design and construction; dugout operations, protection and maintenance; water quality issues and treatment solutions; and dugouts as fish habitats.

Healthy Waters Lac La Biche Speaker Series
Kellie presented for Healthy Waters Lac La Biche on watershed and agricultural stewardship. She also presented on funding available for producers to access to complete projects that protect water quality and riparian areas.

Hemp Workshop
Thirteen producers attended the hemp workshop in Smoky Lake. Producers got the chance to look at our hemp demonstration featuring several different varieties. Dr. Jan Slaski was on hand to answer questions and present on growing hemp. Representatives from Canadian Rockies Hemp Corporation were on hand to discuss the process of producer contracts and growing requirements for those interested in growing hemp.

Septic Sense: Solutions for Rural Living
Septic sense webinars were offered on September 20, 21 and 22nd for participants to learn how to understand and maintain their septic systems.

In The Know
Six producers participated in the workshop In The Know on October 12th in Mallaig. This workshop is designed specifically for agricultural producers to promote wellbeing, help them learn

about mental health and illness, teach them to recognize when someone is struggling and how to respond.

Building Soil Resilience Through Regenerative Agriculture
Twenty producers took part in this hands-on workshop featuring Dr. Kris Nichols and Kevin Elmy. The day focused on soil health and cocktail mixes; using soil health principles to build soil carbon and resiliency on farms and ranches.

Living Labs Opportunity
Eighteen producers joined in on October 20th on the exploration of living labs, and he potential to develop beneficial management practices within regenerative agriculture principles.

Cultivating Resilience on the Farm: How to Get Unstuck
Twenty producers braved the blizzard to hear Lesley Kelly from High Heels and Canola Fields present on cultivating resiliency on the farm. In this presentation Lesly shared strategies of what resilient people do during hard times and everyday strategies that not only helped Lesley overcome tragedy, but helped her farm bounce back, from being stuck to unstuck.

Classroom Agriculture Program (CAPs)
Kellie Nichiporik is the zone 8 Classroom Agriculture Program Coordinator. Due to COVID this program was suspended for the year but will return in 2022.

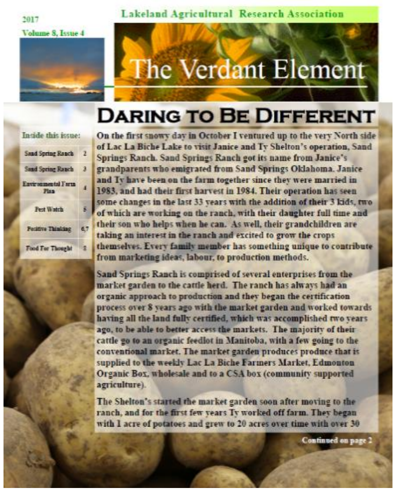
Lac La Biche Mad About Science
The Mad About Science Program was established in 2002 by the Lac La Biche Watershed Project. It is an energetic, up-beat program aimed at educating and encouraging youth to become involved with current environmental issues. This year Kellie presented on invasive species and watersheds.

Alberta Open Farm Days
On August 15th LARA staff Kellie Nichiporik had a booth at the Alberta Open Farm Day that was held at Charlotte Lake Ranch. There were around 1000 people in attendance at this all day event to learn about agriculture, local products and where food comes from.

Feeding Through the Drought
On December 15th the Feeding Through the Drought webinar was held with 76 producers in attendance. This webinar featured Barry Yaremcio and covered: impacts on grain quality; grazing crop regrowth; various forms of supplemental protein; concerns using canola; nitrate concerns; bale processor impacts on feed quality and waste; and using liquid molasses on straw bales.

Social Media
LARA is very active on Facebook, Twitter, and Instagram. We also have a YouTube channel where many of our webinars can be found, as well as other recommended videos.

Newsletter
Along with articles in LARA's bimonthly *Grow With Us* newsletter, this year four editions of *The Verdant Element* were produced and distributed to 2100 farm mailboxes in the MD of Bonnyville, County of St. Paul, Smoky Lake County and Lac La Biche County.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Lakeland Agricultural Research Association
The Verdant Element

DARING TO BE DIFFERENT

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On the first snowy day in October I ventured up to the very North side of Lac La Biche Lake to visit Janice and Ty Shelton's operation, Sand Springs Ranch. Sand Springs Ranch got its name from Janice's grandparents who emigrated from Sand Springs Oklahoma. Janice and Ty have been on the farm together since they were married in 1983, and had their first harvest in 1984. Their operation has seen some changes in the last 33 years with the addition of their 3 kids, two of which are working on the ranch, with their daughter full time and their son who helps when he can. As well, their grandchildren are taking an interest in the ranch and excited to grow the crops themselves. Every family member has something unique to contribute from marketing ideas, labour, to production methods.

Sand Springs Ranch is comprised of several enterprises from the market garden to the cattle herd. The ranch has always had an organic approach to production and they began the certification process over 8 years ago with the market garden and worked towards having all the land fully certified, which was accomplished two years ago, to be able to better access the markets. The majority of their cattle go to an organic feedlot in Manitoba, with a few going to the conventional market. The market garden produces produce that is supplied to the weekly Lac La Biche Farmers Market, Edmonton Organic Box, wholesale and to a CSA box (community supported agriculture).

The Shelton's started the market garden soon after moving to the ranch, and for the first few years Ty worked off farm. They began with 1 acre of potatoes and grew to 20 acres over time with over 30

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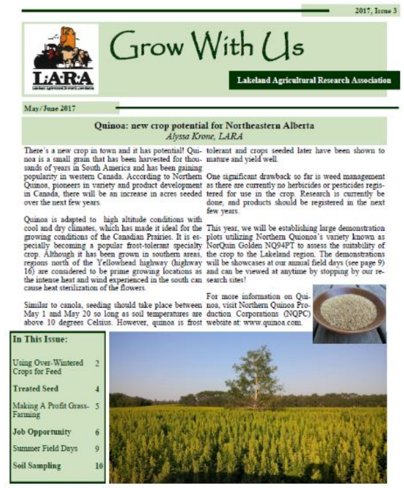
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May/June 2017

Quinoa: new crop potential for Northeastern Alberta
Alyssa Krone, LARA

There's a new crop in town and it has potential! Quinoa is a small grain that has been harvested for thousands of years in South America and has been gaining popularity in western Canada. According to Northern Quinoa, pioneers in variety and product development in Canada, there will be an increase in acres seeded over the next few years.

Quinoa is adapted to high altitude conditions with cool and dry climates, which has made it ideal for the growing conditions of the Canadian Prairies. It is especially becoming a popular frost-tolerant specialty crop. Although it has been grown in southern areas, regions north of the Yellowhead highway (highway 16) are considered to be prime growing locations as the intense heat and wind experienced in the south can cause heat sterilization of the flowers.

Similar to canola, seeding should take place between May 1 and May 20 so long as soil temperatures are above 10 degrees Celsius. However, quinoa is frost tolerant and crops seeded later have been shown to mature and yield well.

One significant drawback so far is weed management as there are currently no herbicides or pesticides registered for use in the crop. Research is currently be done, and products should be registered in the next few years.

This year, we will be establishing large demonstration plots utilizing Northern Quionoa's variety known as NorQuin Golden NQ94PT to assess the suitability of the crop to the Lakeland region. The demonstrations will be showcases at our annual field days (see page 9) and can be viewed at anytime by stopping by our research sites!

For more information on Quinoa, visit Northern Quinoa Production Corporations (NQPC) website at: www.quinoa.com.

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Horticulture Program

LARA Garden

The past couple years have been challenging for our garden. Weather has been the biggest factor, giving that we have either had an abundance or decided lack of moisture. We have also been battling tree roots that find our tilled soil an excellent patch to encroach upon. Due to age and poor health we removed many of these trees which hopefully will improve our garden this coming year.

Cucumbers and carrots produced exceptionally well last year as the pictures show.

Pepperoncini - abundant yielding pepper plant. Grew well and produced through to frost. Very tasty fresh or pickled.

In the greenhouse: Celtuce (bottom left) made its maiden debut as well as Navajo Tea (below) and Sunset Yellow Mint (bottom right)

In the garden this year

Aunt Molly's Ground Cherry
Fruits can be eaten raw or preserved in variety of ways.

Potatoes are always an interesting addition.
This year we are trying:
Satina—a smooth, yellow-skinned potato with a mild buttery flavor
Jennifer—a mid-season white skin and flesh
Prince of Orange—dark red skin with yellow flesh and creamy, buttery taste
Soraya—new yellow variety with good resistance to scab and dry rot that also stores well.
Red Thumb—red skin fingerling with shallow eyes and marbled pink and white flesh
German Butterball—mid season large, yellow fleshed tuber with superb taste

Rapunzel

Mad Hatter Pepper
Unique shape and rich, sweet flavour

Birdhouse Gourd

Tomatoes
Varieties for 2022

Bobcat—early beefsteak variety
Primo Red—early beefsteak, disease resistant
Tough Boy—smaller, gold variety
Celebrity—large red fruit, disease resistant
Cherry Falls—cherry tomato ideal for containers
Lemon Boy—large bright yellow fruit
Rapunzel—abundant cherry tomato

Appendices

Definition of Common Feed Nutrient Terms

ADF Acid Detergent Fibre – the least digestible portion of roughage. ADF content is used to determine digestibility and energies.

AIP Available Insoluble Protein – the portion of the total available protein which is not soluble in the rumen fluid, but is still available to the cow.

AP Available Protein – the portion of the total protein which is available to the animal if the animal could completely digest the feed.

BP Bypass Protein – ingested protein that is not degraded in the rumen.

CP Crude Protein – the total protein contained in feeds as determined by measuring nitrogen content.

DE Digestible Energy – the amount of energy consumed minus the amount of energy lost in feces.

GE Gross Energy – measure of total caloric energy of a feedstuff.

IP Insoluble Protein – the portion of protein which digestive juices or similar solutions cannot dissolve.

ME Metabolizable Energy – equal to DE minus energy lost in urine, feces and in methane for ruminants.

NDF Neutral Detergent Fibre – measures cellulose, hemi-cellulose, lignin, silica, tannin and cutin; used as an indicator of feed intake.

NEG Net Energy for Gain – amount of energy for gain above that which is required for maintenance; used for balancing rations for ruminants.

NEM Net Energy for Maintenance – amount of energy required to maintain an animal with no change in body weight or composition.

RFV Relative Feed Value – an index for assessing quality based on the ADF and NDF levels of a feed. As fibre values increase the RFV of forages decreases.

SP Soluble Protein – the portion of protein which digestive juices of ruminant can dissolve.

TDN Total Digestible Nutrients – a term which is estimated from the ADF content and is used to describe the digestible value of a feed.

Forages and Cattle Nutrient Requirements

Table 1. Composition of Some Common Feedstuffs.

	Percent of DM Basis								
Feedstuff	**DM**	**CP**	**ADF**	**NDF**	**TDN**	**Ca**	**P**	**K**	**Mg**
Alfalfa Hay Early	90.5	19.9	31.9	39.3	60	1.63	0.21	2.56	0.34
Alfalfa Hay Late	90.9	17	38.7	48.8	55	1.19	0.24	1.56	0.27
Alfalfa Silage	44.1	19.5	37.5	47.5	63	1.32	0.31	2.85	0.26
Barley Grain	88.1	13.2	5.77	18.1	88	0.05	0.35	0.57	0.12
Barley Straw	91.2	4.4	48.8	72.5	40	0.3	0.07	2.36	0.23
Barley Silage	37.2	11.9	33.9	56.8	60	0.52	0.29	2.57	0.19
Corn Silage Mature	34.6	8.65	26.6	46	72	0.25	0.22	1.14	0.18
Oat Grain	89.2	13.6	14	29.3	77	0.01	0.41	0.51	0.16
Oat Straw	92.2	4.4	47.9	74.4	50	0.23	0.06	2.53	0.17
Oat Silage	36.4	12.7	38.6	58.1	59	0.58	0.31	2.88	0.21
Oat Hay	90.7	9.5	38.4	63	53	0.32	0.25	1.49	0.29
Smooth Brome Early Pasture	26.1	21.3	31	47.9	74	0.55	0.45	3.16	0.32
Smooth Brome Hay Mid-bloom	87.6	14.4	36.8	57.7	56	0.29	0.28	1.99	0.1
Rye Grass Pasture	22.6	17.9	38	61	84	0.65	0.41	2	0.35
Orchard Grass Hay Early Bloom	89.1	12.8	33.8	59.6	65	0.27	0.34	2.91	0.11
Orchard Grass Early Pasture	27.4	10.1	35.6	57.6	57	0.23	0.17	2.09	0.33
Timothy Hay	89.1	10.8	35.2	61.4	59	0.51	0.29	2.41	0.13

Source: NRC 1996. Nutrient Requirements of Beef Cattle (7th Ed.) National Academy Press, Washington D.C.

Note: The values that are presented in the above table are intended for producers to determine if the results of their own feed tests are within normal ranges. The most accurate way to determine if feeds are meeting nutrient requirements of specific groups of cattle is to feed test.

Table 2. Tolerance Information for Some Perennial Legumes.

	Acidity	Alkalinity	Salt	Drought	Winter
Legumes	**Tolerance**	**Tolerance**	**Tolerance**	**Tolerance**	**Hardiness**
Alfalfa	Moderate	High	Moderate	Very High	Moderate-High
Cicer Milkvetch	Low	Moderate	Low-Moderate	Moderate-High	Very High
Alsike Clover	Moderate	Moderate	Low-Moderate	Low-Moderate	High
Red Clover	Low	Moderate	Low	Low-Moderate	Moderate-High
Sainfoin	Low	Low	Low-Moderate	Moderate	Moderate
Birdsfeet Trefoil	High	Moderate	High	Moderate	Low-Moderate
Sweetclover	Low	High	Moderate	Moderate-High	Moderate

Table 3. Tolerance Information for Some Perennial Grasses.

Grasses	Acidity Tolerance	Alkalinity Tolerance	Salt Tolerance	Drought Tolerance	Winter Hardiness
Meadow Bromegrass	Moderate	Moderate	Low-Moderate	Moderate-High	Moderate
Smooth Bromegrass	Moderate	Moderate	Low-Moderate	Moderate-High	Moderate-High
Reed Canarygrass	High	Moderate	Moderate-High	Moderate-High	Low-Moderate
Creeping Red Fescue	High	Moderate	Moderate-High	Moderate-High	High-Very High
Meadow Fescue			Moderate	Low	Moderate
Tall Fesue	High	Moderate	Moderate-High	Moderate	Moderate
Creeping Foxtail	High	Low	Low	Low-Moderate	High-Very High
Meadow Foxtail	Moderate		Low	Low	High
Orchardgrass	Moderate	Low	Low-Moderate	Moderate	Moderate
Italian Ryegrass	High	Low	Moderate	Low	Low
Perennial Ryegrass	High	Low	Moderate	Low	Low
Timothy	Very High	Low	Low	Low	Moderate
Crested Wheatgrass		Moderate	Moderate	Very High	Very High
Intermediate Wheatgrass	Low	Moderate	Moderate	Moderate	Moderate
Northern Wheatgrass	Moderate	High	Moderate	Very High	Moderate
Slender Wheatgrass		High	Moderate-High	Moderate	High
Tall Wheatgrass		Very High	Very High	High	Moderate
Western Wheatgrass	Moderate	Moderate	Very High	Moderate - High	Moderate
Russian Wildrye	Low	Moderate	High	Very High	High
Altia Wildrye			High	Very High	High
Dahurian Wildrye			High	Moderate-High	Moderate-High

Table 4. Nutrient Requirements for Beef Cattle.

	Daily Gain (lbs)	Dry Matter Intake (lbs)	Crud Protein lbs/day	% of DM	TDN lbs/day	% of DM	Ca (%)	P (%)
600 lb Calves	1.5	1308	1.32	9.5	9.4	68.5	0.32	0.21
950 lb Bred Heifers	0.9	19	1.5	8	10.3	54.1	0.27	0.02
1200 lb Cows Mid Pregnancy	-	20.8	1.4	6.9	10.1	48.8	0.19	0.19
1200 lb Cows Late Pregnancy	0.9	22.3	1.7	7.8	11.8	52.9	0.26	0.21
1000 lb 2 yr. Heifer With Calf	0.5	20.8	2.1	10.2	12.9	61.9	0.31	0.23
1200 lb Cow Nursing Calf (1st 3-4 months)	-	23	2.1	9.3	12.1	55.5	0.27	0.22

Source: NRC 1984. Nutrition Requirements of Beef Cattle (6th Ed.) National Academy Press, Washington, D.C.