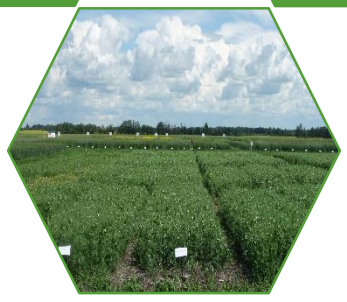
Gateway Research Organization

2020 ANNUAL REPORT

Cropping

Forage & Livestock

Environment



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Chairperson's Report

Rusty Bellamy

Greetings on behalf of the board of directors at Gateway Research Organization. This past year has been trying with all the craziness, but great things were able to happen with GRO.

At GRO we have an extra amazing staff lead by Sandeep, our manager who plans events, projects and finds funding to get the work done. Rick, who keeps the equipment maintenance up to sniff, and gets the plots in and keeps the summer staff on track with the plots. Amber is our Outreach Officer and plans extension events. New edition Jay Byer (Soil Conservation Analyst) and Kabal Singh will further add to our research and demonstration capability.

My name is Rusty Bellamy a regenerative protein producer that's real meat protein from Athabasca.

GRO is an important unbiased research group that is directed by farmers who set on the board. This makes GRO's work in our region so important to all of us in the region. I would like to thank all our fellow board members for their commitment to GRO.

So with that our hats are off to the great staff at GRO without them, the great work and research is not possible, and the plot quality wouldn't be as good as it is. **GRO is here with localized practical, unbiased, research for the farmer.**

Thanks for your interest and active membership in our events in the past year and in the upcoming year.

Manager's Report

Sandeep Nain

Welcome to our 2020 Annual Report. GRO had been able to continue the success of completing small plot research and demonstration projects despite all hurdles. The highlight of the year was GRO's growing presence on social and digital media with **Amber Kenyon** taking a big step in keeping our extension effort to the changing times. This year's Annual Report is the culmination of a lot of hard work by **Rick Tarasiuk, Jay Byer** and **Kabal Singh** along with our summer students. The work we do truly would not be possible without the support of our Board of Directors and local producers who believe in the value that farmer-led applied research associations provide to the industry.

We attempt to locate our research sites in locations throughout our membership area and are very thankful for the generosity of our co-operating producers in achieving this. A special thanks to Jubilee Feedlot, Pibroch Colony, Randy Pidsadowski, Kieth Wiart, Tom Macmillan, and Dean Wigand, who provided support with our trials in Westlock County, and County of Barrhead. We are always searching for fresh ideas to put into action. Any suggestions for demonstrations or research trials are always welcome.

There have been several discussions with our Provincial Government and Ag Minister Devin Dreeshen, over the past year, and their support is so very much appreciated. I would also like to thank our co-operators, municipal governments (Barrhead, Lac Ste. Anne, Woodlands, and Parkland Counties) and agri-businesses whose continued support has added tremendously to the success of our organization.

I would like to thank the outgoing directors, **Rusty Bellamy** and **Steve Kenyon** for their outstanding commitment to GRO and its board over the years.

We look forward to the upcoming season. No doubt it will be filled with a new set of challenges, but I believe with our joint efforts we will accomplish the mission for our organization. We will reinforce our efforts to meet regularly with the provincial and municipal governments to ensure that we receive the necessary financial support to continue serving the regional farming community. We will continue to keep our members informed of GRO's activities and the benefits of our organization.

Agricultural Research and Extension Council of Alberta (ARECA)
Executive Director Report

Alan Hall

Reflecting on the past year, it has been a bit of a whirl! My compliments to Gateway Research Organization **(GRO)** for your excellent efforts and services to your members and others during these unusual times. It is a privilege to be associated with and be able to support you in the excellent work you do. Having a top-notch Board and high performing people like Sandeep Nain make it seem easy. A lot of careful thinking and hard work goes in behind the scenes that continues to result in benefits and good value to the ranchers and farmers you serve.

These past couple of years have been challenging for Associations like yours, both in terms of financial uncertainty and having to operate in different ways as we battle COVID. I suspect some of the new approaches like webinars and video messaging will continue to be a key part of your services after COVID is in our rear view mirror.

Historically, Associations have had annual core funding support from the Province. However, with the tight budget times of the past few years, maintaining this core financial support has had it's ups and downs. Full kudo's to Minister Dreeshen for his strong support in making sure this core funding continued uninterrupted in 2020 and to RDAR, the new farmer led agriculture research and extension funding not for profit company that has been set up, for their taking on this commitment for 2021 and 2022. We very much look forward to a strong relationship with RDAR over the coming years.

Further RDAR has made it clear to forage and applied research associations around the Province, that they see these groups as key in provision of local and regional extension efforts important to ranchers and farmers. Hence RDAR has provided stable core funding support to all associations for this year and next year, and has clearly indicated their willingness to work with Associations with an eye to improving financing longer term.

These discussions are already underway and I am convinced that there is a great opportunity here for GRO and other Associations to secure longer term stable core funding from RDAR that will enable growth and expansion of your capacity to expand existing or take on new services important to your members and others in the communities you serve.

A strong organization with excellent leadership and people, being financially stable, being strong in forming partnerships with others, and having a superb track record of bringing value to ranchers and farmers does generate interest in others to get involved.

GRO has been a very valuable partner in the various provincial scale projects dealing with management practices leading to productivity gains while sustaining and improving our soil, water and ecosystem base. They have also been helpful in assisting individual ranchers and farmers in accessing some of the specific grants available from the provincial government. Here at ARECA, we really need and appreciate working with groups like GRO in this effort.

In the past year, our journey took us into the reclamation of orphan wells efforts that are underway. In our discussions with Orphan Well Association, we ended up helping them reach out to individual landowners around the province in improving landowner awareness and understanding of how the orphan well reclamation efforts work. GRO has been a key partner in this effort as part of an overall approach with Associations and Commissions. These groups have a direct pipeline to individual farmers and ranchers who may be affected – an excellent way to get important information into produces hands. These efforts are continuing over the coming year.

There are other things being done, but let me wrap up where I began with a heartfelt compliment and thank you to GRO for the excellent work you do, and for being a great group to support and work with. We look forward to a continued strong relationship as we move ahead.

2020-Board of Directors & Committee

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Rusty Bellamy
Steve Kenyon
Kenleigh Pasay

HR Committee - Rusty Bellamy- Chair, Janine Paly, Steve Kenyon

Equipment - Justin Nanninga-Chair, Tom McMillan, Randy Pidsadowski

Acknowledgement to Sponsor

The Board of Directors and staff extends their sincere appreciation for the active support for our research programs

Program Funding

Alberta Government

County of Barrhead

parkland county

Woodlands County

Project and Extension Sponsorship

Alberta Wheat Commission

Alberta Barley

Alberta Canola Producers Commission

Prairie Oat Growers Association

Alberta Pulse Growers

Canterra Seeds

Nutrien Ag Solutions

SeCan Canada's Seed Partner

FP Genetics

Crop Maxx Innovative Ag Solutions

FBC We make life less taxing

Co-op Neerlandia

YYA Young Agrarians

The Land Institute

Food Water Wellness Foundation

McEwen's

In-Kind Contributors

(Including a combination of goods, land, equipment, product, services, percentage markdowns, etc.)

Special thanks to "Jubilee Feedlot, Pibroch Colony, Tom McMillan, and Randy Pidsadowski" for their support.

- WESTLOCK SEED CLEANING CO-OP LTD
- Agriculture and Agri-Food Canada
- **Greener Pastures Ranching**
- **Anderson Seed Growers**

Greener Pastures Ranching

Westlock Seed Cleaning Co-op

Gateway Research Organization

Gateway Research Organization

Our History

Gateway Research Organization was formed from consolidation with the Pembina Forage Association in 1994. The Pembina Forage Association was started in 1975 by local producers interested in pasture management and forage & livestock research. While maintaining its interest in forage & livestock issues, the new organization became more involved in applied research and demonstrations in crops and environmental sustainability.

Our Vision

Gateway Research Organization will be a renowned and respected agriculture research and extension organization that is the preferred source of unbiased farm production information.

Our Mission

Gateway Research Organization provides cost-effective applied agricultural research, demonstration, and extension for producers in order to facilitate greater returns to farms by providing economically and scientifically sound information that enables our clients to make informed decisions.

The Goals of our Organization

1. To increase the profitability of our members.
2. To encourage active participation by local producers.
3. To provide a valuable resource for information transfer and extension to producers.
4. To produce high quality, unbiased, and scientifically sound research.
5. To produce research based on local growing conditions and soil properties.
6. To collaborate with specialists from the agricultural industry, government, and educational institutions.

2020 Extension Activities

Amber Kenyon

As most of us can probably agree, 2020 was a year that hit us with the need to adapt hard and fast. Until March our extension activities at Gateway Research Organization were quite run of the mill. When we went into our first shutdown, I was up north promoting the CAP program at the Peace Country Classic Agri-Show. If on the way up there someone had told me that it would be cancelled after the first day, I wouldn't have believed them! Once we were all home, reality sunk in and most people in extension realized that we would have to change the way that we were reaching people. Here at GRO we were no exception. In April we decided that it was time to change things up. Using Sandeep's DSLR we started to take videos and began our YouTube channel.

GROing with YouTube

We quickly realized that this was an incredibly engaging way of bringing information to people and started some video series to continue with our extension events that had previously been held in person. One of the two series that we have been working on are the **Coffee Shop Talk videos**, in which we have a producer speaking with an 'expert' in agriculture. We have been working on filming these on location at local coffee shops. The idea is to have the viewer be a 'fly on the wall' for the conversation. The Coffee Shop Talk videos have been incredibly popular and have addressed topics such as; Cover Crops with Gabe Brown, Regenerative Potato Farming with Brendon Rockey, and Carbon Credits and Sequestration with Stuart Austin.

The other series that has been really engaging is our "**GRO -Feature Farm" videos.** Here we get the chance to meet with a local farmer and their family while learning about some of the practices that make their operation unique. Not only have we had the chance to introduce some amazing people in these videos, but we've also been able to address some hot topics such as; succession planning, transitioning to full time on the farm, elk farming, and on farm slaughter licensing.

These two series are only a small portion of the information that is now accessible on our YouTube channel, with new videos coming out regularly. **We have launched about 25 videos at our YouTube channel**. Check them out on **YouTube at:** Gateway Research Organization

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GRO also started hosting **Wednesday Night Networking sessions** in conjunction with Greener Pastures Ranching in December. Each week we have a special guest speaker come on and chat with people about agriculture, while attendees get a chance to ask questions and engage in discussion about the chosen topic of the night. These have been more popular than we could have guessed. When we first embarked on this adventure with between 100-200 people attending each night, and the demand for a recording was incredible.

GROing with Podcasts

We heard from many of our producers that they wanted access to recordings of Wednesday Virtual Networking Sessions and access to the audio of many of our videos! We thought that the easiest way to bring these to producers was through podcast!

Click on the link below to head over to our podcast site:
Gateway Research Organization (podbean.com)
Don't forget to subscribe to our feed while you're there! Our podcast is also available by searching Gateway Research Organization on iTunes/Spotify and Google Podcasts!
We have 5,270 Downloads from 14 Episodes posted.

GROing together Blog

At GRO we work for our farmers and bring producers to provide unbiased research that help facilitate greater returns based on scientific information. A large part of that is being open and accessible, which is why we decided that a blog would be a great way to keep you informed about what we are up to.
Overall, it has been a terrific year for extension and we are planning on integrating our current virtual methods of reaching people with in person events in the 2021, COVID allowing!

To stay connected with producers we are active on social media.

- Our website is: **www.gatewayresearchorganization.com**
- On Twitter at: **@GatewayResearch**
- Find us on Facebook at: **Gateway Research Organization**

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Regional Cereal Variety Trials

Co-operators: Pibroch Colony – SW-16-61-26-W4

Objectives: To provide yield and agronomic information of current cereal varieties as well as newer varieties to producers in central Alberta.

Introduction

Variety selection plays an important role in production management due to the impact that yield, maturity, and other agronomic characteristics can have on producer profitability. Variety testing continues to be important in providing producers with information on the performance of newly registered and established varieties.

Table: 1 The yield and characteristics of cereals grown in our region are presented below.

	RVT - Project Description
Seeding Date	Wheat/Barley/Oat/Flax on May 11 & May 12; Triticale on May 13
Seeding Specifics	Fabro zero-till drill Seeding depth: 1" for Cereals and 3/4th inch for Flax **Seeding Rates:** 26 plants/ft^2 - 2-Row & 6-Row Barley 31 plants/ft^2 - HRS & CPS Wheat, 29 plants/ft^2 - Triticale 28 plants/ft^2 - Oats 75 plants/ft^2 - Flax Seed treatment: Raxil
	RVT - Project Description
Fertilizer/acre	**Fall Applied:** 90 lbs/ac Actual N from 82-0-0 • 26 lbs/ac Actual N; 30 lbs/ac Actual P; 40 lbs/ac Actual K; 24 lbs/ac Actual S **Spring Applied:** Side banded: 13.8-0-42 @ 100 lbs/ac (13.8 lbs/ac Actual N; 42 lbs/ac Actual K) $^{\#\#}$ For oats only: 0-0-60 @ 100lbs/ac side banded instead of 13.8-0-42 blend. **Seed Placed:** 11-52-0 @58 lbs/ac (6.38 lbs/ac Actual N30.16 lbs/ac Actual P.

Herbicide	Glyphosate (Preburn): 1L/acre May 6 Curtail M 750ml/acre June 16 Axial **(Wheat and Barley)** 500 ml/ac June 16 Poast 300ml/acre & Curtail M 750ml/ac June 16 (Flax only) 2nd application of Poast @300 ml/acre on June 26 (Flax only) Roundup @ 360gai/ac Sept 4 Reglone @ 750ml/ac Sept. 4 (Flax)
Rainfall	Recorded from May 1 to Sept 15, 2020: **374.1mm**
Harvest Date	Sept. 21 (2-Row & 6-Row Barley) Sept. 22 (Wheat) Sept. 29 (Oat) Sept. 29 (Flax)

2-Row Barley – The majority of malt-grade barley produced is two-row. Two-row barley is characterized by having only one fertile spikelet at each node. Six-row barley has three fertile spikelets at each node. This lack of crowding in two-row barley allows for straight, symmetrical kernels with low dormancy; key characteristics essential for malting. The malting process begins by soaking the grain and causing it to germinate. The low dormancy and high seed viability in two-row barley are important for this process.

6-Row Barley- This barley is world's most important crop for feeding livestock. As feed, it is nearly equal in nutritive value to corn, which is very high in energy. This leads it to be valuable in feedlots and as hog feed. Six-row barley allows for desirable portions of firm fat and lean meat.

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Table 2: Barley: 2020

Name		Height cm		Lodging 1-9		Protein %		Yield kg/ha		% of AC Metcalf	Yield bu/ac		Bushel Weight lbs/bu		Test Weight kg/HL		TKW g	
AC METCALFE	TWO Row	85	b-e	2.1	-	11.8	-	6124	-	**100**	113	-	55.8	abc	68.9	abc	42.5	ab
AAC SYNERGY	TWO Row	99	ab	1.3	-	11.7	-	7448	-	**122**	138	-	56.2	abc	69.3	abc	45.7	a
AB BREWNET	TWO Row	105	a	1.9	-	11.7	-	7531	-	**123**	140	-	55.8	abc	68.9	abc	42.7	ab
AB WRANGLER	TWO Row	84	b-e	1.9	-	10.9	-	6862	-	**112**	127	-	57.3	ab	70.7	ab	45.4	a
CDC AUSTENSON	TWO Row	91	a-d	1.9	-	10.4	-	7739	-	**126**	144	-	58.6	a	72.2	a	46.0	a
CDC CHURCHILL	TWO Row	87	b-e	1.3	-	11.2	-	7083	-	**116**	132	-	55.6	abc	68.6	abc	40.9	ab
CDC COPELAND	TWO Row	97	abc	2.1	-	10.2	-	6754	-	**111**	126	-	56.7	abc	70.0	abc	45.7	a
CDC COPPER	TWO Row	83	c-f	1.9	-	11.1	-	7699	-	**126**	143	-	55.6	abc	68.6	abc	44.3	ab
ESMA	TWO Row	74	efg	1.0	-	9.9	-	7848	-	**128**	146	-	55.4	abc	68.4	abc	48.7	a
FB209	TWO Row	96	abc	2.0	-	11.1	-	7256	-	**119**	135	-	55.0	abc	67.8	abc	48.7	a
KWS KELLIE	TWO Row	71	fg	1.0	-	9.4	-	8186	-	**134**	152	-	53.9	bc	66.5	bc	46.6	a
SIRISH	TWO Row	75	efg	1.0	-	10.6	-	7527	-	**123**	140	-	56.7	abc	70.0	abc	46.2	a
TR16742	TWO Row	86	b-e	1.0	-	11.1	-	7152	-	**117**	133	-	55.4	abc	68.4	abc	42.9	ab
TR18647	TWO Row	89	bcd	1.3	-	10.8	-	7420	-	**121**	138	-	56.4	abc	69.6	abc	42.6	ab

TR18747	TWO Row	93	abc	1.3	-	10.8	-	7734	-	**126**	143	-	57.8	ab	71.3	a	47.2	a
TR18748	TWO Row	92	abc	1.9	-	10.0	-	6388	-	**104**	119	-	58.3	a	72.0	a	47.9	a
TR18749	TWO Row	94	abc	1.6	-	10.4	-	7559	-	**123**	140	-	58.5	a	72.2	a	48.2	a
KWS CORALIE	TWO Row	66	g	1.5	-	9.2	-	7995	-	**130**	148	-	53.2	c	65.6	c	47.6	a
TORBELLINO	TWO Row	78	d-g	2.1	-	10.2	-	7026	-	**115**	131	-	54.9	abc	67.7	abc	46.8	a
AB ADVANTAGE	SIX Row	96	abc	1.3	-	10.9	-	7608	-	**124**	141	-	56.1	abc	69.2	abc	48.8	a
AB TOFIELD	SIX Row	99	ab	3.6	-	10.6	-	7043	-	**115**	131	-	55.1	abc	68.0	abc	38.1	b
LSD P=.05		8.55		1.99		1.809		1203.46			22.2		2.122		2.615		4.244	
Standard Deviation		5.18		0.15t		1.096		729.279			13.45		1.286		1.585		2.572	
CV		5.92		36.08t		10.29		9.95			9.88		2.29		2.29		5.66	

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

**Lodging: 1 = erect; 9 = flat

**TKW: Thousand Kernels Weight

Highlighted row = Among the top performing variety for the year 2020 at Westlock site.

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Hard Red Spring (HRS) Wheat – The Canadian Grain Commission currently classes 56 varieties under the Canadian Western Red Spring (CWRS) class. HRS is known for its hard texture, high protein, and high gluten content. These attributes contribute to making superior bread-making flour. The top two grades, No. 1 and No. 2, are segregated by protein level, with guaranteed minimum protein contents.

Utility Wheat – The Western Canadian wheat classes consist of eight individual descriptions. This trial consisted of two classes: Canadian Prairie Spring Red (CPSR) and Canadian Wheat Soft White Spring (CWSWS).

Canada Prairie Spring Red (**CPSR**) has medium to hard kernels and medium to hard dough strength. It has two milling grades and is used for the hearth, flat, and steamed bread, and noodles.

Canada Western Soft White Spring (CWSWS) is soft white wheat with low protein. It has three milling grades used for cookies, cakes, and pastry. CWSWS is also highly sought after by the industrial ethanol industry on account of its low protein content (i.e. high starch content).

Canada Western Special Purpose (CWSP): is a special-purpose wheat class of varieties for ethanol or livestock feed markets.

Canada Northern Hard Red (CNHR) is the red spring wheat with medium to hard kernels, very good milling quality and medium gluten strength (lower than both the CWRS and CPSR classes). Introduced on August 1, 2016, the target quality of this class is for it to have sound kernels. There are three milling grades available. Depending on protein content, CNHR will be suitable for the production of pan bread, hearth bread, flatbread and noodle.

Table 3: CWRS & CWHWS Wheat: 2020

Name	Height		Protein		Yield					Bushel Weight		Test Weight		TKW	
	cm		%		kg/ha		% of Carberry		bu/ac	lb/bu		kg/HL		g	
CARBERRY	83	e-h	12.9	ab	5001	-	**100**	-	74	65.7	bc	81.3	bcd	36.7	c-h
AAC BRANDON*	83	e-h	12.4	abc	5696	-	**115**	-	85	66.7	ab	82.7	b	38.7	bcd
AAC BROADACRES	85	d-h	11.4	bc	5442	-	**109**	-	81	65.3	bc	80.7	bcd	38	b-f
AAC ELIE	82	fgh	12.4	abc	5467	-	**109**	-	81	65.7	bc	81.3	bcd	41.8	ab
AAC MAGNET	92	b-g	12.1	abc	6104	-	**123**	-	91	64.3	bc	79.3	cd	37.7	b-g
AAC REDSTAR	91	b-g	12.6	abc	5479	-	**109**	-	81	65.7	bc	81.3	bcd	36	c-h
AAC RUSSELL	89	b-h	12.5	abc	5790	-	**116**	-	86	65.7	bc	81.3	bcd	38.7	bcd
AAC STARBUCK VB	82	e-h	11.8	abc	5723	-	**115**	-	85	66.3	ab	81.7	bcd	38.6	bcd
AAC WARMAN VB	99	B	12	abc	5472	-	**109**	-	81	66	ab	81.7	bcd	35.3	d-h
AAC WHEATLAND VB	86	c-h	12	abc	6351	-	**127**	-	94	66.3	ab	82.3	bc	38.3	b-e
BW1069	93	b-f	12.2	abc	6228	-	**124**	-	92	65.3	bc	80.7	bcd	36.3	c-h
BW1093	83	e-h	11.7	abc	5810	-	**116**	-	86	66	ab	81.3	bcd	34	fgh
BW5031 CL	88	b-h	11.9	abc	5488	-	**111**	-	82	66.3	ab	81.7	bcd	39	bcd
BW5044	89	b-h	12.6	abc	5738	-	**115**	-	85	65	bc	80	bcd	33.3	h
BW5045	87	b-h	10.9	c	5561	-	**111**	-	82	65.7	bc	81.3	bcd	37.7	b-g
CDC EVOLVE	116	A	12.8	ab	5222	-	**105**	-	78	61	d	75.7	e	38.3	b-e
CDC ORTONA	97	Bcd	12.3	abc	5997	-	**120**	-	89	65	bc	80	bcd	34.3	e-h
CS JAKE	**95**	**b-e**	**13.5**	**a**	**5725**	**-**	**115**	**-**	**85**	**65.3**	**bc**	**80.3**	**bcd**	**36**	**c-h**
CS TRACKER	93	b-f	12.7	abc	5630	-	**114**	-	84	65.3	bc	80.7	bcd	33.7	gh
CS11200212-17	88	b-h	11.4	bc	4798	-	**96**	-	71	64.3	bc	79.3	cd	36	c-h

DAYBREAK	90	b-h	12.4	abc	5680	-	**114**	84	-	65	bc	80.3	bcd	40.3	abc
ELLERSLIE	92	b-g	12.2	abc	5487	-	**111**	82	-	65.3	bc	80.3	bcd	35.3	d-h
LNR15-1405	91	b-h	11.9	abc	5437	-	**109**	81	-	63.3	c	78.7	d	43.7	a
PT598 CL	80	Gh	11.8	abc	5751	-	**115**	85	-	66	ab	81.7	bcd	36.7	c-h
PT599	92	b-g	11.7	abc	5777	-	**116**	86	-	65.7	bc	81	bcd	34.7	d-h
PT652	93	b-f	11.7	abc	5812	-	**116**	86	-	65.7	bc	81.3	bcd	34	fgh
REDNET	98	Bc	12	abc	5329	-	**107**	79	-	68	a	84.3	a	38.3	b-e
SHEBA	95	b-e	12.3	abc	5602	-	**112**	83	-	65.7	bc	80.7	bcd	35	d-h
STETTLER	89	b-h	12.3	abc	5008	-	**100**	74	-	66.7	ab	82	bc	37.7	b-g
SY GABBRO	92	b-g	12.2	abc	5812	-	**116**	86	-	64.3	bc	79.7	bcd	41.6	ab
SY STEEL	84	e-h	12.1	abc	5443	-	**109**	81	-	65.7	bc	81	bcd	36.3	c-h
SY TORACH	79	H	12.2	abc	5494	-	**111**	82	-	65.7	bc	81	bcd	30	i
LSD P=.05	6.86		0.977		1042.27			15.5		1.27		1.64		1.95 - 2.65	
Standard Deviation	4.2		0.598		638.58			9.5		0.78		1		0.02t	
CV	4.68		4.92		11.39			11.41		1.19		1.24		1.03t	

AAC Brandon is new check for wheat trials.;

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

Highlighted row = Among the top performing variety for the year 2020 at Westlock site.

Gateway Research Organization

Table 4: CPSR & CWSP Wheat: 2020

Name	Height cm		Protein %		Yield kg/ha		Yield % of Carberry	Yield bu/ac		Bushel Weight lb/bu		Test Weight kg/HL		TKW g	
CARBERRY	94	-	13.8	a	6088	c	**100**	90	c	66.7	ab	82.3	ab	39.3	bcd
AAC BRANDON*	89	-	13.6	a	6586	bc	**108**	98	bc	67.7	a	83.3	a	42.3	ab
AAC CASTLE	92	-	12.8	abc	7139	bc	**117**	106	bc	67.0		83.0		41.0	ab
AAC PENHOLD	82	-	13.2	ab	7205	bc	**118**	107	bc	67.0	ab	83.0	a	43.3	a
AC ANDREW	92	-	11.4	cd	8696	a	**143**	129	a	65.7	ab	81.3	ab	41.7	ab
CDC REIGN	88	-	13.2	ab	6963	bc	**114**	103	bc	64.0	bc	79.0	bc	40.0	abc
CS ACCELERATE	86	-	12.9	abc	7345	bc	**121**	109	bc	67.7	a	83.3	a	36.7	cd
HY2068	92	-	12.6	abc	7158	bc	**118**	107	bc	64.3	abc	79.3	bc	36.3	d
LNR15-1741	89	-	12.8	abc	7317	bc	**120**	109	bc	67.0	ab	82.3	ab	36.7	cd
PASTEUR	93	-	11.0	d	7874	ab	**130**	117	ab	66.0	ab	81.3	ab	41.3	ab
WPB WHISTLER	85	-	11.6	bcd	8025	ab	**132**	119	ab	62.7	c	77.0	c	43.7	a
LSD P=.05	7.51		1.076		883.25			13.27		2.1		2.33		2.49	
Standard Deviation	4.41		0.632		518.59			7.79		1.22		1.36		1.46	
CV	4.93		5.01		7.1			7.18		1.86		1.67		3.64	

AAC Brandon is new check for wheat trials. **Highlighted row = Among the top performing variety for the year 2020 at Westlock site.**

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

Gateway Research Organization

Oats are a valuable part of crop rotation. They provide disease and insect breaks from wheat, barley, and canola. Their rapid establishment and growth provide excellent weed suppression. Oats also work well as a "catch crop" for taking up and storing excess nitrogen, and the straw provides a nutrient source for the following year's crop. The straw also protects against soil erosion and contributes to an increase in the soils organic matter content.

Table 5: Oats: 2020

Name	Height		Lodging		Yield			Bushel Weight	Test Weight	TKW	Protein
	cm		1-9		kg/ha	% of CDC Dancer	bu/ac	lb/bu	kg/HL	g	%
CDC Dancer	113	ab	3.7	ab	6269	100	164	47.0	57.9	35.0	11.6
AAC Douglas	118	ab	2.9	ab	8535	136	224	46.1	56.9	40.0	11.4
AC Morgan	114	ab	1.8	b	7975	127	209	47.4	58.5	41.0	11.5
CDC Endure	119	a	1.8	b	7966	127	209	45.1	55.6	38.7	11.6
CDC Skye	123	a	2.9	ab	8015	128	210	46.6	57.6	37.7	11.7
CFA1502	106	b	7.3	a	8647	138	227	46.2	57.0	36.9	11.9
CS Camden	106	b	1.3	b	7383	118	194	45.4	56.1	39.5	11.7
LSD P=.05	8.12		2.62 - 3.79		2168.47		56.67	3.18	3.888	4.531	0.655
Standard Deviation	4.56		2.74t		1218.93		31.85	1.788	2.185	2.547	0.3682
CV	4.01		28.05t		15.57		15.52	3.86	3.83	6.64	3.17

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls). **Lodging score low = better standability**

Gateway Research Organization

Triticale is the first man-made crop species, initially produced by crossing wheat (genus Triticum) with rye (Secale). When crossing wheat and rye, wheat is used as the female parent and rye as the male parent (pollen donor). The development of triticale as a cereal crop in Canada first began in 1954 at the University of Manitoba, Winnipeg. Triticale is still a minor crop in Canada. Triticale is grown mostly for forage or fodder, although some triticale-based foods can be purchased at health food stores and can be found in some breakfast cereals.

Table 6: Triticale: 2020

Name	Height		Yield			Bushel Weight		Test Weight		TKW		Protein	
	cm		kg/ha		bu/ac	lb/bu		kg/HL		g		%	
BREVIS	106	b	8740	-	130 -	62.7	-	77.3	-	40.7	-	9.5	
T256	105	b	9051	-	134 -	61.0	-	75.2	-	44.1	-	10.1	-
T267	101	b	8948	-	133 -	60.4	-	74.5	-	44.5	-	10.1	-
TYNDAL	123	a	8157	-	121 -	63.1	-	77.8	-	45.5	-	10.4	-
LSD P=.05	6.15		1041.254		15.442	1.927		2.381		4.203		1.125	
Standard Deviation	3.08		521.176		7.729	0.964		1.192		2.104		0.496	
CV	2.83		5.97		5.96	1.56		1.56		4.82		4.87	

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

**TKW: Thousand Kernels Weight

Highlighted row = Among the top performing variety for the year 2020 at Westlock site.

Gateway Research Organization

Flax is grown mainly in cool northern climates. High omega-3 fatty acid and fiber in flax are some of the health benefits. It is used in livestock feeding, human consumption, and many other industrial purposes.

Table 7: Flax: 2020

Name	Height		Yield				Bushel Weight		Test Weight		TKW	
	cm		kg/ha		bu/ac		lb/bu		kg/HL		g	
CDC Bethune	65	-	3028.7	b	48.2	b	62.4		77.0		8.2	-
CDC Glas	66	-	3648.4	a	58.1	a	62.1	a	76.7	a	8.1	-
AAC Bright	64	-	2131.5	c	33.9	c	54.7	b	67.5	b	8.0	-
CDC Dorado	63	-	3006.2	b	47.8	b	60.3	a	74.4	a	7.9	-
FP2573	65		3506.1	a	55.8	a	62.3	a	76.9	a	8.4	-
LSD P=.05	3.18		342.61		5.45		2.12		2.62		0.75	
Standard Deviation	1.59		181.96		2.897		1.06		1.31		0.40	
CV	2.47		5.94		5.94		1.77		1.78		4.96	

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

Highlighted row = Among the top performing variety for the year 2020 at Westlock site.

Gateway Research Organization

Regional Pulse Variety Trial

Co-operators: Keith Wiart- SW-31-61-2-W5

Objectives:

- To provide yield and agronomic information of Green pea, Yellow pea and Fababean commercial varieties and experimental lines for adaptability and yield potential to producers in west central Alberta.
- To promote crop diversification and increase pulse production acres in our area.

Introduction:

Variety selection plays an important role in production management due to the impact that yield, maturity, and other agronomic characteristics, such as standability or harvestability for pulses crops that can affect a producer's profitability. Variety testing continues to be important in providing producers with information on the performance of newly registered and established varieties.

Table 8: Agronomic details:

Trial	Date Seeded Soil Temp	Seed Depth (in)	Fertilizer Seed Placed	Fertilizer Side Banded	Herbicides Fungicides Insecticides	Rate	Date
RVT Peas	May 6 7.5 C	1.5	11-52-0 58 lbs/ac	5.74-7.4-39.3-4.9 204 lbs/ac	Viper ADV	404ml/acre	June 11
RVT Fababean	May 6 7.5 C	1.5	11-52-0 58 lbs/ac	5.74-7.4-39.3-4.9 204 lbs/ac	Viper ADV	404ml/acre	June 11
Soybean	May 6 7.5 C	1.5	11-52-0 58 lbs/ac	5.74-7.4-39.3-4.9 204 lbs/ac	Viper ADV	404ml/acre	June 11
Lentils	May 6 7.5 C	1.5	11-52-0 58 lbs/ac	5.74-7.4-39.3-4.9 204 lbs/ac	Solo	325ml/acre	June 11

Gateway Research Organization
Soil Test at site

Nitrogen (lbs/ac)	Phosphorus (lbs/ac)	Potassium (lbs/ac)	Sulphur (lbs/ac)	pH (0-14)	CEC (meq/100g)	Organic Matter (%)
7	32	156	28	5.9	16.9	4.8

Note: Except Fababean, all other trials were affected by excessive rainfall. Therefore, the site was mowed down on August 26. No other data was available in 2020 for green and yellow peas performance.

Harvest Fababean: October 20

Variety Name	Maturity Rating	Height (cm)		Yield (bu/ac)	TKW	
Snowbird	Early	123	b	125	460	c
CDC219-16	Early	127	b	119	336	d
DL Tesoro	Medium	141	a	116	500	bc
Fabelle	Medium	144	a	132	507	bc
Malik	Medium	112	c	102	614	ab
NPZ 16.7601	Early	140	a	108	694	a
NPZ 16.7610	Medium	137	a	112	532	bc
LSD P=.05		7.58			81.3	
Standard Deviation		5.1			54	
CV		3.87			10.4	

Gateway Research Organization

Demonstration trial 1

- Demonstration/Applied research trial of comparing different inoculants for growing peas

Treatment	Inoculant
1	Liquid
2	Peat
3	Granular
4	Double Inoculant

Pea Variety: AAC Barrhead

Seed treatment: Cruiser Maxx Vibrance

Agronomic detail is same as all **RVT Pulse trials. The trial was flooded, no further information is available for year 2020.

Demonstration trial 2

- Demonstration/Applied research trial of comparing the phosphorus rate at seeding

Treatment	P (lbs/acre)
1	0
2	15
3	30
4	15 + No Insecticide

Pea Variety: AAC Barrhead

Seed treatment: Cruiser Maxx Vibrance

Agronomic detail is same for above mentioned demonstration trials.

Trial was seeded on May 6. Seeding depth was 1.5". Viper ADV was sprayed @ 404ml/acre on June 11 ***except treatment 4*.

The trial was flooded, no further information is available for year 2020

Gateway Research Organization

Trials Funded by Alberta Wheat Commission 2020

Co-operators: Pibroch Colony – SW-16-61-26-W4

GRO - Local wheat varieties comparison trial

Problem: The Gateway Research Organization has been involved in the regional variety trials (RVTs) organized by the Government of Alberta and contributed to datasheets for the Alberta Seed Guide since 1988. However not all locally grown varieties of wheat are included in the RVTs. The producers in our region want to see a close comparison of the newer varieties grown in the RVT program with most popular varieties grown in our region.

Justification: Prior to planting each year, wheat producers have to make the important and difficult decision of selecting wheat seed varieties from a long list of choices. Since public and private wheat breeders continue to develop higher-yielding wheat varieties over time, wheat producers are confronted with a difficult question about whether to purchase new certified seed or go with older proven choices. As a producer run applied research organization, it is mandated for GRO to provide an unbiased source of information to aid in the decision-making process. If producers can choose from the information suited close to their individual set of growing conditions, including average rainfall, soil type, and agronomic practices, they would most likely be able to maximize performance for their selected wheat variety and profitability,

Objective: Side by side comparison of all the locally popular wheat varieties in our area (surrounding Westlock County) to analyze yield and other agronomic characteristics.

Table: List of varieties used in the trial 2020

CWRS		**CPSR & CWSP**
AAC BRANDON	CDC LANDMARK VB	CS ACCELERATE
CARBERRY	PARATA	KWS ALDERON
AAC CONNERY	AAC REDBERRY	AAC CROSSFIELD
AAC ELIE	AAC REDWATER	AAC GOODWIN
AAC VIEWFIELD		AAC PENHOLD

Gateway Research Organization

Agronomic Information for Trial - 2020

Seeded	**May 11, 2020**	
Harvested	**Sept. 22,2020**	
Rainfall recorded from May 1 to Sept. 15, 2020	374.1 mm	
Fertilizers		
Fall Applied	90 lbs/ac Actual N From 82-0-0	
	26 lbs/ac Actual N	30 lbs/ac Actual P
	40 lbs/ac Actual K	24 lbs/ac Actual S
Seed Placed	11-52-0 58 lbs/ac	
	30.16 lbs/ac Actual P	6.38 lbs/ac Actual N
Side Banded	13.8-0-42 100 lbs/ac	
	13.8 lbs/ac Actual N	42 lbs/ac Actual K
Pesticide	Glyphosate(Preburn) @ 1L/ac	May 06, 2020
	Curtail M @ 750ml/ac	June 16, 2020
	Axial @ 500ml/ac	June 16, 2020
	Prosaro 250EC @320 ml/ac	July 13, 2020

Gateway Research Organization

Table: GRO Local Varieties 2020

Variety	Height	Falling number	Gluten	Protein	Yield		Bushel Weight	Test Weight	TKW	DTM
					% of AAC Brandon	bu/ac				
Name			%	%			lb/bu	kg/HL	gm	days
CWRS										
AAC Brandon	86	408	35 ab	14.2 ab	100	102 b-e	67.6 a	83.4 a	41.5 ab	112 b
Carberry	92	401	35 ab	14.4 ab	87	89 e	66.4 a-d	81.9 a-d	38.2 bcd	110 bc
AAC Connery	95	418	35 ab	14.0 ab	95	97 cde	67.3 ab	83.1 ab	39.8 abc	108 bcd
AAC Elie	87	430	33 bcd	13.2 bcd	94	96 cde	67.0 abc	82.7 abc	42.3 a	105 cd
CDC Landmark VB	94	492	34 cd	13.1 bcd	98	100 b-e	67.4 ab	83.1 ab	41.3 ab	106 cd
PARATA	90	475	37 a	15.0 a	98	100 b-e	65.6 cde	80.9 cde	37.4 cd	105 cd
AAC Redberry	91	460	33 bcd	13.1 bcd	90	92 de	66.5 a-d	82.1 a-d	39.7 abc	106 cd
AAC Redwater	93	425	35 abc	13.8 abc	97	99 b-e	65.7 cde	81.1 cde	36.6 cd	103 d
AAC Viewfield	84	425	31 d	12.5 cd	99	101 b-e	67.5 a	83.3 ab	35.8 d	106 cd
CPSR & CWSP										
Accelerate	88	391	29 e	11.9 d	117	119 bc	66.0 b-e	81.4 b-e	36.5 cd	107 bcd
KWS Alderon	84	413	27 f	11.0 e	141	144 a	51.7	63.8	39.7 abc	116 a

AAC Crossfield	93	420	33	bcd	13.3	bc	114	116	bcd	64.6	e	79.7	e	41.2	ab	107	bcd
AAC Goodwin	88	418	33	bcd	13.5	bc	121	123	b	65.0	de	80.2	de	42.2	a	112	b
AAC Penhold	82	462	32	cd	13.2	bcd	111	113	b-e	65.9	b-e	81.3	b-e	43.4	a	107	cd
LSD P=.06			1.8		0.87			14.6		1.01		1.24		2.26		3.16 - 3.31	
Standard Deviation			1.0		0.518			8.7		0.6		0.74		1.35		0.09t	
CV			3.16		3.9			8.19		0.9		0.9		3.39		0.88t	

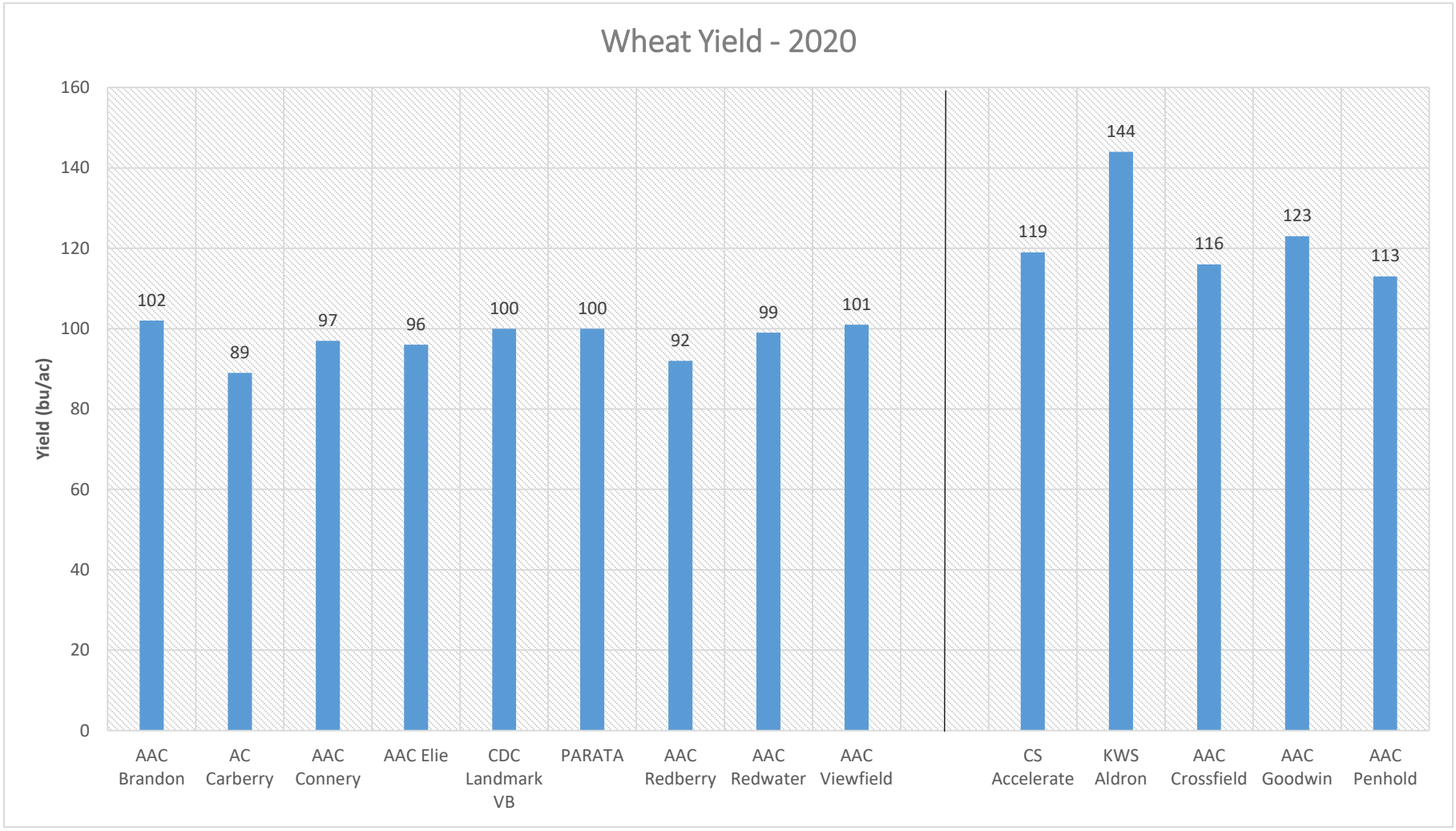
Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

AAC Brandon is new check for wheat trials

Highlighted row = Among the top performing variety for the year 2020 at Westlock site.

Gateway Research Organization

Graph 1: Yield Comparison of Local Wheat Varieties – 2020



Gateway Research Organization

AWC funded trial: GRO - Malting Barley Varieties Comparison

Problem: The Gateway Research Organization has been involved in the regional variety trials (RVTs) organized by the Government of Alberta and contributed to datasheets for the Alberta Seed Guide since 1988. However, malt barley production in our area has not been a popular choice among growers. Good management can deliver a solid return on growing malt barley, but obtaining the desired quality standard and grade needed for malt barley is often hard and that risk can affect the producer's decision. The RVT trial includes some of the locally grown and a few of newer malting barley varieties. The fertilizer recommendation in RVT trails is usually higher than what good malt barley agronomy would recommend. Producers in our region would benefit if they can see a close comparison of all the malt barley varieties available in our region. This give grower's local results to assist in choosing between varieties and showcase what best management practices they need to follow to be able to have their barley accepted for malting.

Justification: Before planting each year, barley producers have to make an important and interesting decision of selecting barley seed varieties from a long list of choices. Since public and private barley breeders continue develop higher-yielding malt barley varieties over time, barley producers are confronted with a difficult question about whether to purchase new certified seed or go with older proven choices. As a producer-run applied research organization, it is mandated for GRO to provide an unbiased source of information regarding the decision-making process for each of these available barley varieties. If producers can choose from the information suited close to their set of growing conditions, including average rainfall, soil type, and agronomic practices, they would most likely maximize the yield, quality and acceptance of their malt barley variety and its profitability as a result.

Objective: Side by side comparison of all the malt barley varieties available for producers (about 8-10) in north-central Alberta to analyze yield and other needed agronomic characteristics.

Project Design, Methodology, and Experimental Approach:

Agronomic best management practices will be followed. After consultations with many successful malt growers in the area, agrologists, and agri-extension staff we come with a standard protocol that will be followed and will be showcased to the local producer as the recipe for success.

To produce the best malt barley an early seeding date (before mid-May), seeding rate in the range of 280-300 plants/m2. It is always better to use an appropriate seed treatment on the most resistant varieties to reduce the likelihood of genetic resistance breakdown. The fertilizer rate was maximized for an actual application of 70-30-25-10 lb/acre. Lastly, proper application of fungicide was conducted at the correct stage.

Table 11: List of Varieties for trial

#	Variety Name	
1	AAC SYNERGY	CDC CHURCHILL
2	AAC METCALFE	CDC BOW
3	CDC COPELAND	CDC FRASER
4	AAC CONNECT	LOWE

	Project Description
Seeding Date	Early Seeded - May 7, 2020 Regular Seeded - May 20, 2020
Seeding	Seeding depth: 1.5” Seed treatment: Raxil
	Project Description
Fertilizer/acre	**Fall Applied:** 90 lbs/ac Actual N from 82-0-0 26 lbs/ac Actual N; 30 lbs/ac Actual P; 40 lbs/ac Actual K; 24 lbs/ac Actual S **Spring Applied:** Side banded: 13.8-0-42 @ 100 lbs/ac (13.8 lbs/ac Actual N; 42 lbs/ac Actual K) **Seed Placed:** 11-52-0 @58 lbs/ac (6.38 lbs/ac Actual N 30.16 lbs/ac Actual P.
Herbicide	Preburn: Glyphosate May 6, 2020 Curtail M 750 ml/ac, Axial 500 ml/ac June 16, 2020 Fungicide: Prosaro 250 320 ml/ac July 13, 2020
Rainfall	Recorded from May 1 to Sept 15, 2020: **374.1mm**
Harvest Date	Sept. 21

Gateway Research Organization

Table 12: **Malting Barley Varieties Comparison – GRO – 2020**

Variety Name	Height cm	Yield kg/ha	Yield bu/ac	Bushel Weight lb/bu	Test Weight kg/HL	TKW g	Protein %
AAC SYNERGY -ES	72 -	5364 -	100 -	56.7 -	70.0	48.0 -	8.8 -
AAC METCALFE -ES	75 -	6335 -	118 -	57.3	71.0 -	49.5 -	9.5 -
CDC COPELAND -ES	77 -	5676 -	105 -	58.3 -	72.0 -	48.5 -	9.3 -
AAC CONNECT - ES	74 -	4837 -	90 -	56.0 -	69.3 -	49.5 -	9.7 -
CDC CHURCHILL - ES	79 -	5878 -	109 -	56.0 -	69.3 -	48.5 -	9.3 -
CDC BOW-ES	73 -	4729 -	88 -	55.3 -	68.3 -	49.0 -	9.4 -
CDC FRASER- ES	73 -	5198 -	97 -	54.3 -	67.3 -	45.0 -	9.4 -
LOWE - ES	75 -	4473 -	83 -	55.7 -	69.0 -	50.5 -	9.3 -
AAC SYNERGY –Regular	75 -	5665 -	105 -	57.3 -	70.7 -	49.5 -	9.5 -
AAC METCALFE – Regular	72 -	4509 -	84 -	55.0 -	68.0 -	47.0 -	10.7 -
CDC COPELAND – Regular	75 -	5784 -	108 -	57.0 -	70.3 -	51.0 -	10.1 -
AAC CONNECT – Regular	68 -	4824 -	90 -	57.3 -	71.0 -	48.0 -	9.8 -
CDC CHURCHILL – Regular	72 -	5011 -	93 -	55.7 -	68.7 -	49.0 -	10.4 -
CDC BOW – Regular	70 -	4326 -	80 -	56.3 -	69.7 -	48.0 -	10.7 -

CDC FRASER – Regular	73 -	4439 -	82 -	55.0 -	68.0 -	49.5 -	10.4 -
LOWE - Regular	71 -	4773 -	89 -	55.7 -	68.7 -	48.0 -	10.5 -
LSD P=.05	18.24	2398.11	44.42	3.74	4.7	6.33	1.138 - 1.215
Standard Deviation	10.94	1438.14	26.64	2.24	2.81	2.97	0.029t
CV	14.91	28.12	28.04	3.98	4.05	6.1	2.77t

Note: The CV is very high for the trial as the early seeded trial was hit by excessive rain and water logging occurred at the site in mid June.

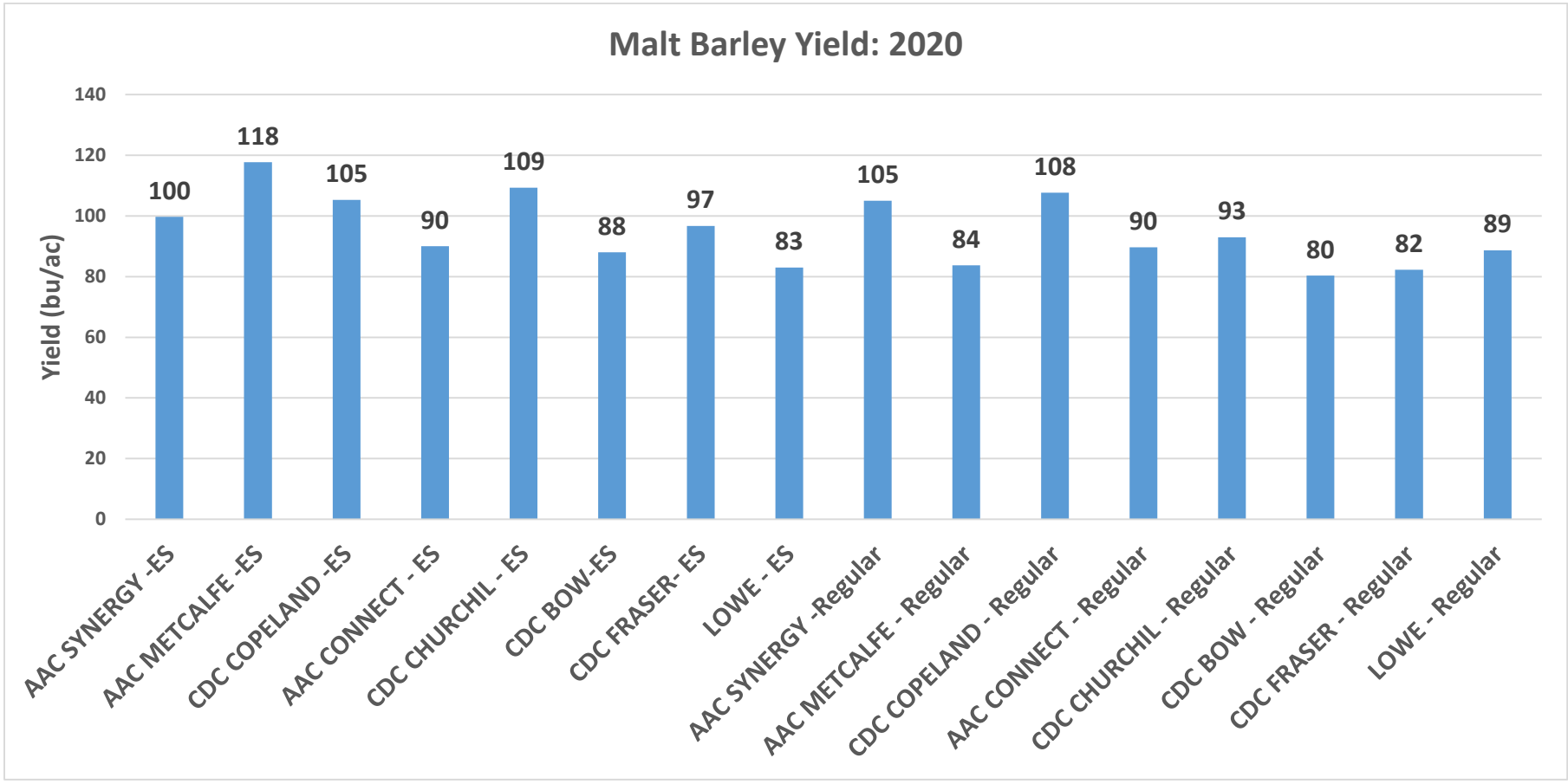
ES = Early seeded May 7, 2020

Regular Seeded May 20, 2020

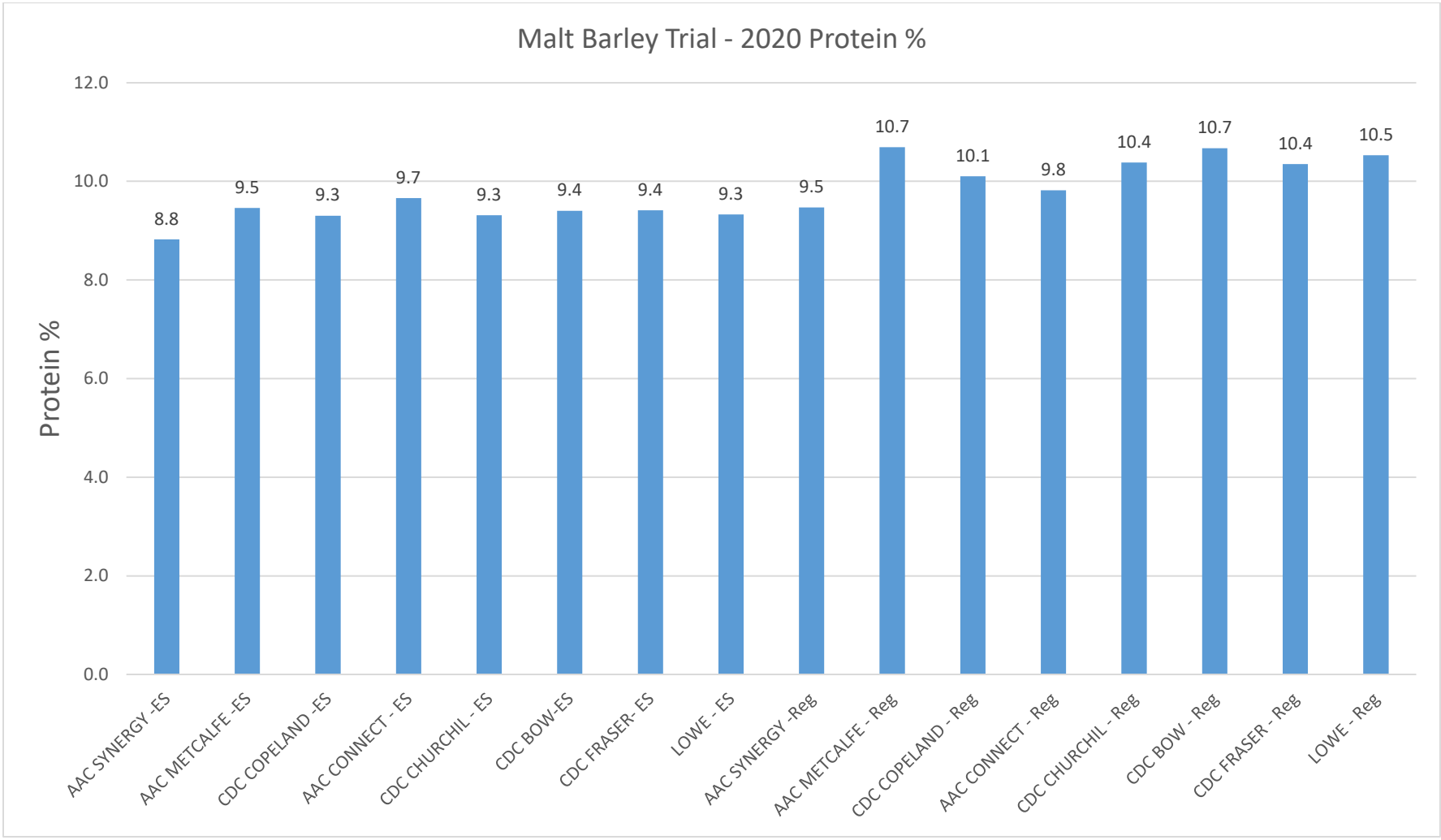
Highlighted row = Among the top performing variety for the year 2020 at Westlock site.

Gateway Research Organization

Graph 2: Malting Barley Yield – GRO - 2020



Graph 3: Malting Barley Protein (%) – GRO – 2020



Gateway Research Organization

AWC funded trial: Ultra early vs Regular seeding dates and its effect on maturity, yield and quality.

Ultra-early seeding of spring wheat is accomplished by planting at soil temperatures of 2 - 6 degree Celsius. This is much earlier than traditional seeding temperatures (10 - 12 degrees C). It has the potential to increase yield, improve grain quality and result in earlier maturity. Ultra-Early seeding should allow the crop to miss damage caused by Wheat Midge (*Sitodiplosis mosellana*) and *Fusarium graminearum*. It could also lower the cost of herbicides as the crop closes its canopy sooner and reduces weed competition. Another benefit is there is enough time for the crop to ripen naturally, thus potentially reducing the use of pre-harvest herbicides.

Need and Potential Outcomes:

There is a need in the province for spring wheat to mature sooner in order to reduce the impacts of frost and damp weather at harvest, causing downgrading of the grain. There is a need for the grain to escape damage caused by Wheat Midge and *Fusarium graminearum* by seeding early to avoid these pests at crop heading. This way, spring wheat could require less pesticide and potentially reduce the risk of their residues.

The potential benefits and outcomes include a higher quality crop (grade protection), potentially reduced pesticide use and earlier harvest date (spreads harvest workload and reduces stress).

Treatments were: The trial was seeded as 3 factorials randomized block design

2 varieties (*AAC Brandon*, medium-late maturity and *AAC Connery*, early maturity)

2 planting dates (ultra-early date, 2 - 6 C soil temp and normal seeding date, 8 – 10 C soil temp, (approximately 12-14 days apart))

3 seeding rates (Low: 200, Medium: 300 and High: 400 viable seeds/m2),

Acknowledgment: Thanks for support from the Canadian Agricultural Partnership (CAP) and Alberta Wheat Commission (AWC) for the three years of funding (2020 – 2022) for the project.

Gateway Research Organization

Table 13: Agronomic details for the trial:

	Project Description
Seeding Date	Early Seeded - May 5, 2020 (Soil temp 8.5 ° C) Regular Seeded - May 20, 2020 (Soil temp 10.0 ° C)
Seeding	Seeding depth: 1.5” Seed treatment: Raxil
	Project Description
Fertilizer/acre	**Fall Applied:** 90 lbs/ac Actual N from 82-0-0 26 lbs/ac Actual N; 30 lbs/ac Actual P; 40 lbs/ac Actual K; 24 lbs/ac Actual S **Spring Applied:** 28-4-28-7.5 @125 lbs/ac (35 lbs/ac Actual N; 5 lbs/ac Actual P; 35 lbs/ac Actual K; 9.4 lbs/ac Actual S) **Seed Placed:** 11-52-0 @58 lbs/ac (6.38 lbs/ac Actual N 30.16 lbs/ac Actual P.
Herbicide	Preburn: Glyphosate May 6, 2020 Curtail M 750 ml/ac, Axial 500 ml/ac June 16, 2020 Fungicide: Prosaro 250 320 ml/ac July 13, 2020
Rainfall	Recorded from May 1 to Sept 15, 2020: **374.1mm**
Harvest Date	Early Sept. 17 and Late seeded Sept. 29 respectively

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Table 14: Yield Data for the trial: 2020

Variety	Seeding Rate	Seeding Time	Height (cm)	Protein %		Yield kg/ha		Yield bu/acre		Test weight Kg/HL		TKW (g)	
AAC Brandon	Low	Ultra Early	82.3	13.0	ab	5759	ab	85.8	ab	79.0	-	41.5	-
AAC Brandon	Medium	Ultra Early	82.5	13.0	ab	6019	ab	89.5	ab	79.3	-	41.0	-
AAC Brandon	High	Ultra Early	77.5	12.7	ab	5340	b	79.5	b	79.5	-	40.8	-
AAC Connery	Low	Ultra Early	84.8	14.0	a	5770	ab	85.8	ab	78.5		41.3	-
AAC Connery	Medium	Ultra Early	85.5	12.9	ab	5487	ab	81.5	ab	78.3	-	40.8	-
AAC Connery	High	Ultra Early	80.8	12.3	b	5179	b	77.0	b	79.8	-	40.0	-
AAC Brandon	Low	Regular	82.5	12.4	ab	5659	ab	84.0	ab	79.0	-	40.3	-
AAC Brandon	Medium	Regular	85.5	13.4	ab	5963	ab	88.8	ab	79.3	-	42.5	-
AAC Brandon	High	Regular	82	12.2	b	5531	ab	82.0	ab	79.5	-	39.5	-
AAC Connery	Low	Regular	87.8	14.0	a	6498	a	96.8	a	78.5	-	42.8	-
AAC Connery	Medium	Regular	83.5	12.9	ab	6092	ab	90.5	ab	79.0	-	40.5	-
AAC Connery	High	Regular	85	12.6	ab	6187	ab	91.8	ab	80.8	-	41.0	-
LSD P=.05			5.37	0.973		654.26		9.75		2.57		3.19	
Standard Deviation			3.73	0.676		454.78		6.78		1.78		2.21	
CV			4.48	5.23		7.85		7.87		2.78		2.79	

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).

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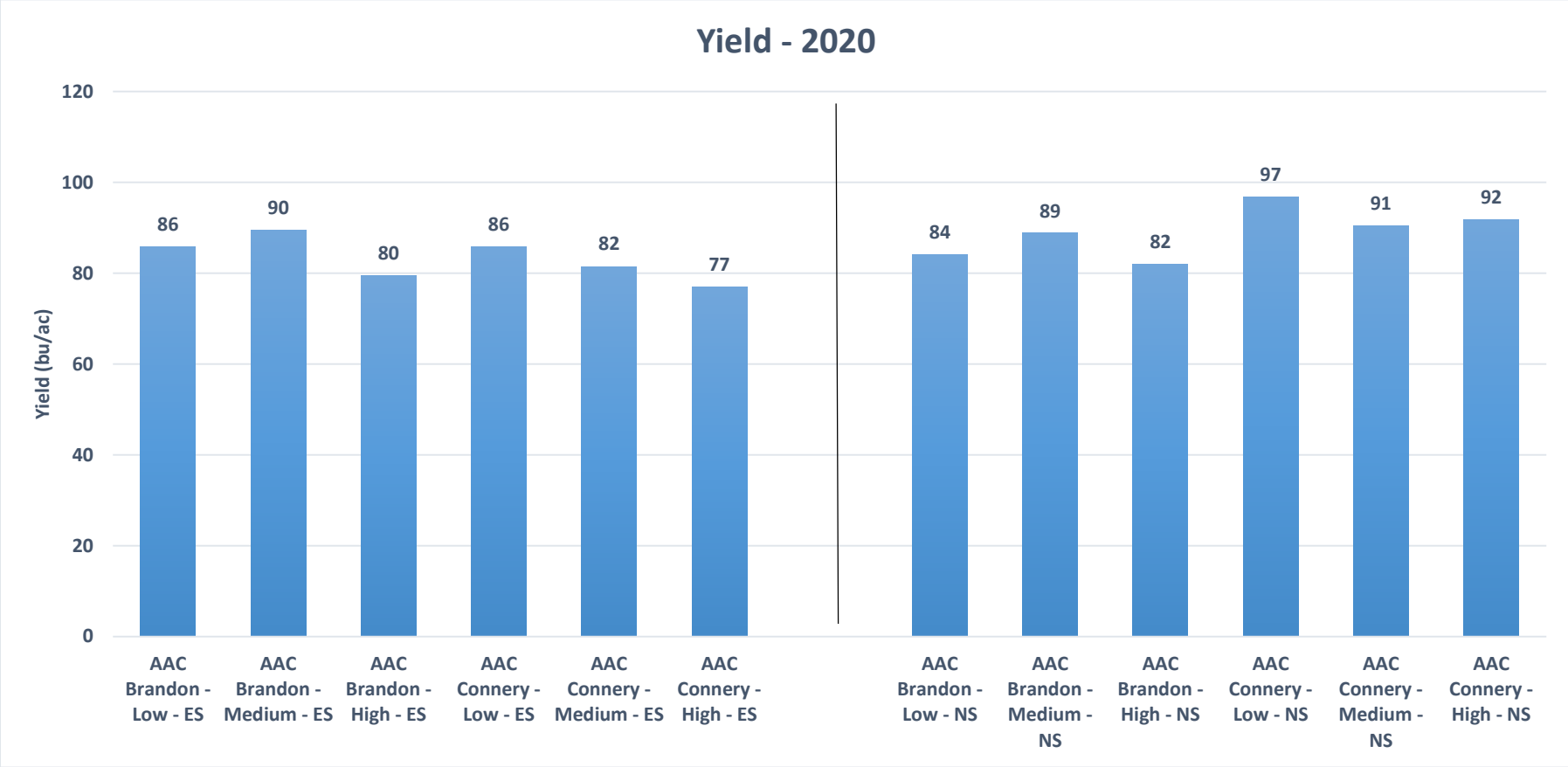
Chart 1: Yield Comparison of Wheat – GRO - 2020



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GRO Plant Growth Regulator Trial

Co-operators: Pibroch Colony – SW-16-61-26-W4

Background: Manipulator™ from Engage AGRO is a plant growth regulator as a tool to prevent crop lodging in wheat. The U.S. Environmental Protection Agency published the regulation establishing a maximum residue limit for **chlormequat chloride** — the active ingredient in Manipulator last year in April. This product is registered for application between the two-leaf stage (Zadoks stage 12) to the flag leaf collar visible stage (Zadoks stage 39). According to Sheri Strydhorst, Alberta Agriculture and Forestry, the most effective application time for consistent height reductions is between Zadoks GS 30-32 (the beginning of stem elongation, when the first internode begins to elongate and the top of the inflorescence is at least 1 cm above the tillering node, to the time when the second node is at least 2 cm above node one).

Objectives

1. To compare yield and height reduction of Manipulator correctly staged cereals.
2. If cutting the rate of Manipulator will have any impact on the product efficacy.

Agronomics: The four spring wheat varieties and three oat varieties were selected for the trial. A full rate of Manipulator was also compared to a reduced rate and a no treatment control (See table below for treatment details). The trial was seeded in a randomized block design with three replications in a split-plot arrangement. Plots were seeded 15 m in length. One-third of the plot was sprayed with Manipulator at half rate and one-third of plot was sprayed at full rate with the middle third left untreated. The Manipulator was applied at Zadoks GS 37-39. This timing was a bit later than the best management practices, but still within the range as mentioned on the product labels. The crop was combined on September 22.

Treatments	Wheat	Oats
Varieties	AAC Elie AAC Redberry AAC Redwater AAC Starbuck VB	CDC Arborg CS Camden CDC Ruffian
Manipulator Application Rates	Untreated 1.24 L/ha 1.8 L/ha	Untreated 1.24 L/ha 1.8 L/ha 2.3 L/ha

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Table: Agronomic Information for trials

Parameter	Wheat	Oats
Seeding Date	May 12, 2020	May 12, 2020
Seeding Depth	1.0 inch	1.0 inch
Soil Temperature	9 degree Celsius	9 degree Celsius
Harvest Date	September 22, 2020	September 23, 2020
Rainfall Recorded (From May 1 to Sept. 15, 2020)	374.1 mm	374.1 mm
Fertilizer		
Fall Applied:	90 lbs/ac Actual N from 82-0-0	90 lbs/ac Actual N from 82-0-1
From Blend	26 lbs/ac Actual N 30 lbs/ac Actual P 40 lbs/ac Actual K 24 lbs/ac Actual S	27 lbs/ac Actual N 30 lbs/ac Actual P 41 lbs/ac Actual K 24 lbs/ac Actual S
Spring Applied		
Side banded (13.8-0-42) @ 100lbs/ac	13.8 lbs/ac Actual N 42 lbs/ac Actual K	13.8 lbs/ac Actual N 42 lbs/ac Actual K
Seed placed (11-52-0) @ 58lbs/ac	6.38 lbs/ac Actual N 30.16 lbs/ac Actual P	6.38 lbs/ac Actual N 30.16 lbs/ac Actual P
Herbicide		
Glyphosate (Pre burn) @ 1L/ac	May 06,2020	May 06,2020
Curtail M @ 750ml/ac	June 16,2020	June 16,2021
Axial @ 500ml/ac (Only on Wheat)	June 16,2020	N/A
Manipulator Applied	July 06,2020	July 06,2020

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Table: Results of Wheat- 2020

NAME	TREATMENT	HEIGHT cm	PROTEIN %	YIELD kg/ha	YIELD bu/ac	TKW g
AAC Elie	Untreated	89 -	12.57 -	5912 -	87.8 -	40.9 -
AAC Elie	1.24 L/ha	78 -	13.47 -	6259 -	93.0 -	40.4 -
AAC Elie	1.8 L/ha	75 -	12.37 -	5752 -	85.4 -	39.8 -
AAC Redberry	Untreated	96 -	12.17 -	5629 -	83.6 -	34.2 -
AAC Redberry	1.24 L/ha	83 -	12.6 -	5969 -	88.7 -	33.7 -
AAC Redberry	1.8 L/ha	82 -	12.30 -	5852 -	87.0 -	32.67 -
AAC Redwater	Untreated	93 -	12.57 -	5584 -	83.0 -	38.97 -
AAC Redwater	1.24 L/ha	82 -	12.37 -	5891 -	87.5 -	36.9 -
AAC Redwater	1.8 L/ha	84 -	12.37 -	5591 -	83.1 -	36.97 -
AAC Starbuck	Untreated	89 -	12.73 -	6746 -	100.2 -	38.07 -
AAC Starbuck	1.24 L/ha	80 -	13.6 -	6583 -	97.8 -	37.43 -
AAC Starbuck	1.8 L/ha	80 -	12.47 -	6202 -	92.1 -	37.87 -
Tukey's HSD P=.05		8.26	2.63	1098.32	16.34	1.92
Standard Deviation		2.78	0.88	369.79	5.50	0.64
CV		3.3	7.01	6.16	6.17	1.73

Highlighted row = Among the top performing treatment for the year 2020 at Westlock site. **Red colored was the worst performing treatment.**

None of the treatments had statistical significantly differences; so the highlighted results are the trends from year 2020.

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Table: Results of Oat- 2020

Name	Treatment	Height cm	DTM Days	Protein %	Yield kg/ha	Yield bu/ac	Test Weight kg/HL	TKW g
CDC Arborg	Untreated	125.3 -	109 -	10.03 -	8531 -	223.7 -	56.17 -	44.117 -
CDC Arborg	1.24 L/ha	112 -	110 -	9.00 -	7640 -	200.3 -	56.73 -	45.137 -
CDC Arborg	1.8 L/ha	109 -	110 -	9.93 -	8788 -	230.3 -	56.07 -	45.637 -
CDC Arborg	2.3 L/ha	114.7 -	110 -	10.1 -	8433 -	221.0 -	56.4 -	46.23 -
CS Camden	Untreated	110.7 -	109 -	10.33 -	7431 -	194.7 -	56.13 -	43.927 -
CS Camden	1.24 L/ha	100.3 -	110 -	9.77 -	7388 -	193.7 -	54.87 -	44.68 -
CS Camden	1.8 L/ha	95.7 -	110 -	10.47 -	8020 -	210.0 -	53.83 -	43.033 -
CS Camden	2.3 L/ha	92.7 -	110 -	9.97 -	7665 -	201.0 -	55.2 -	43.303 -
CDC Ruffian	Untreated	101.7 -	108 -	9.50 -	7875 -	206.7 -	58 -	44.297 -
CDC Ruffian	1.24 L/ha	92.7 -	109 -	9.00 -	7434 -	194.7 -	57.4 -	43.61 -
CDC Ruffian	1.8 L/ha	90.7 -	109 -	9.73 -	7963 -	208.7 -	56.07 -	42.55 -
CDC Ruffian	2.3 L/ha	88.3 -	109 -	9.53 -	7677 -	201.0 -	55.33 -	43.73 -
Tukey's P=.05		18.72	2.76	1.703	2539.1	66.49	3.36	4.2319
Standard Deviation		6.3	0.93	0.574	854.9	22.39	1.131	1.4249
CV		6.13	0.85	5.864	10.82	10.81	2.019	3.2246

Highlighted row = Among the top performing treatment for the year 2020 at Westlock site. **Red colored was the worst performing treatment.**

None of the treatments had statistical significantly differences; so the highlighted results are the trends from year 2020.

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Chart 5: Wheat Yield – GRO – 2020

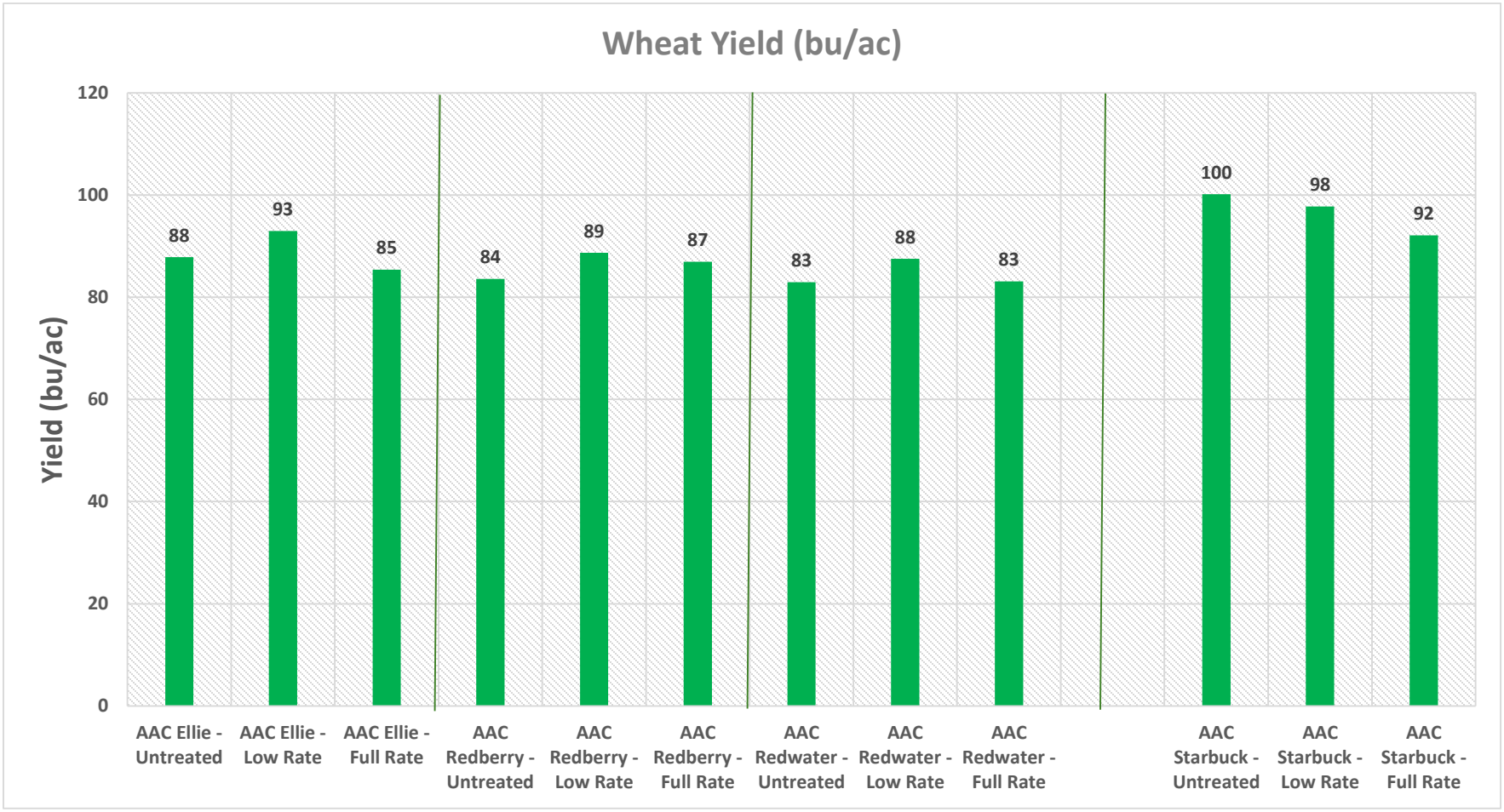

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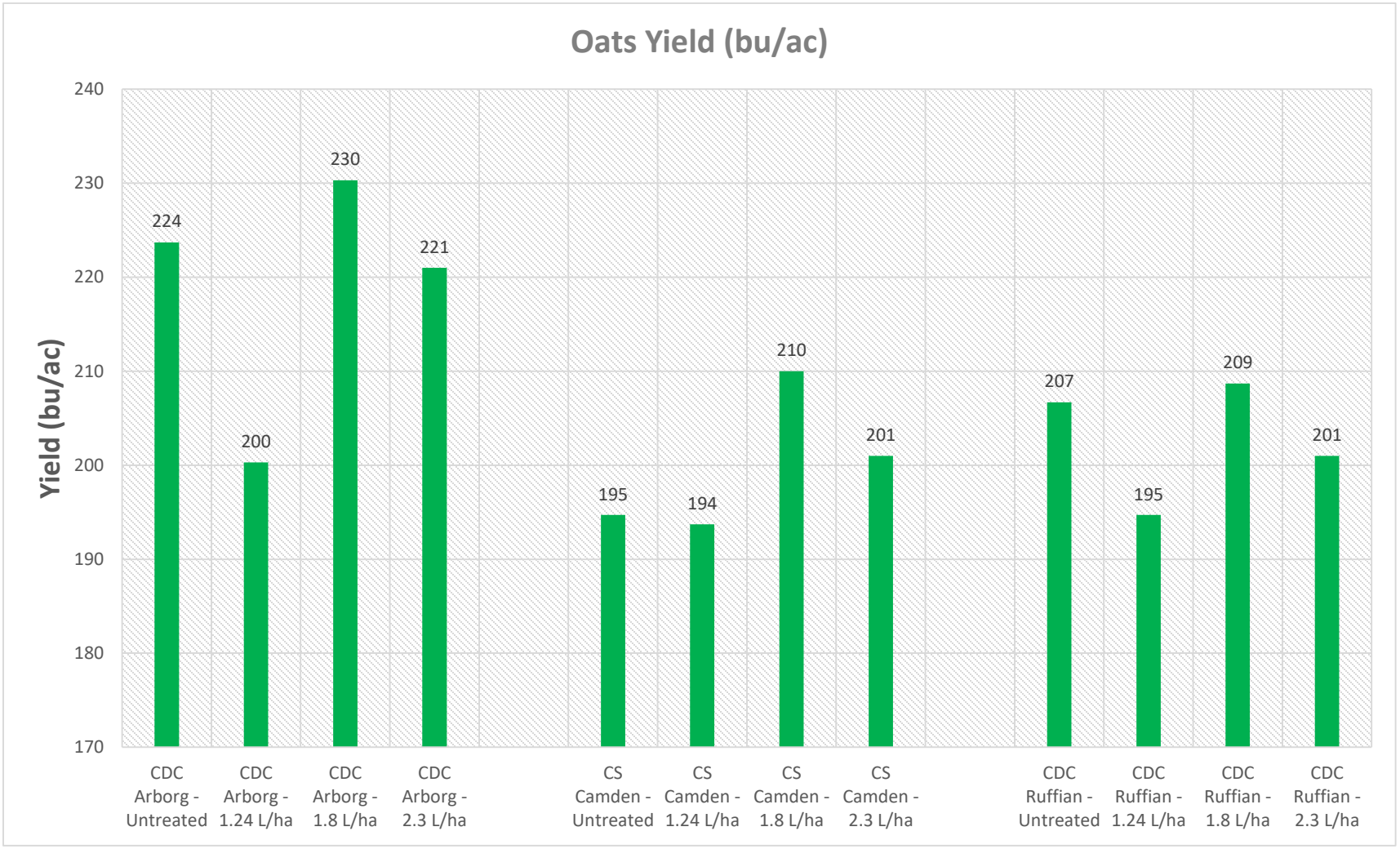
Chart 6: Oats Yield – GRO – 2020



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Canola Performance Trial 2020

Co-operator: Randy Pidsadowski – SW-17-61-26-W4

Introduction: Canola Performance Trials (CPT) are independent trials for Western Canadian canola growers to evaluate (current) commercially available varieties. The funding for these trials comes from Alberta Canola, MCGA and SaskCanola. The current version of the CPT program dates back to 2011. However, 2018 was the first year for GRO to host the site for the trial again. In 2020, the trial includes a total of 16 standard varieties from three herbicide-tolerant systems (Liberty Link, Roundup Ready and TruFlex).

Objectives: to evaluate commercial canola seed varieties currently available to farmers. Yield differences should be due to genetic differences only, not due to high weed, disease or insect pressure.

- To compare the agronomic characteristics of new varieties and proven varieties in our localized growing condition.
- To provide information on newer varieties to local producers

	CPT - Project Description
Seeding Date	May 15
Seeding Specifics	Fabro zero-till drill Seeding Depth: ¾ inch **Seeding Rates:**14 plants/square foot
	CPT - Project Description
Fertilizer/ac	**Deep Banded: 23-5-12-5 = 502 lbs/ac** • 115.46lbs/ac Actual N • 25.1lbs/ac Actual P • 60.24lbs/ac Actual K • 25.1lbs/ac Actual S **Side Placed: 11-52-0 = 48.07lbs/ac** • 5.29 lbs/ac Actual N ; 25 lbs/ac Actual P
Herbicide	• Roundup (RR entries) 270 gai/ac June 18, 2020 • Liberty (LL entries) 1.6 l/ac June 18, 2020 • Centurion 50 ml/ac June 18, 2020
Harvest Date	September 25

The trial was sprayed at the 3-6 leaf stage. 2020's poor growing conditions, primarily excessive moisture early in the season, resulted in a bit low yield. Comparing the yield data from 2019 to 2020, we noticed a reduction of about 25% yield at our small plot trials.

Summary:

The results of the CPT trial grown at Westlock are summarized in the table. The average yield in the trial for LL entries, RR entries, and TruFlex was 60.2, 60.1 and 67 bu/ac. The highest yielding canola variety was **L352C** at 66 bu/ac (Liberty Link system) and **45CS49** at 78 bu/ac (Roundup Ready system). The **L234PC** at 64 bu/ac **45CM39** at 62 bu/ac were also good yielding varieties in LL and Roundup Ready systems.

DKTF 98 CR yielded quite well **72 bu/ac** for the TruFlex varieties.

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Canola Performance Trial 2020: Westlock

Variety	Herbicide Tolerant	Height cm	Maturity # of days	Yield bu/ac
L234PC	LL	104	110	**64**
L241C	LL	94	108	**61**
L352C	LL	92	110	**66**
P501L	LL	100	106	**60**
PV 680 LC	LL	97	108	**57**
PV 681 LC	LL	98	106	**53**
1028RR	RR	101	109	**61**
45CM39	RR	104	109	**62**
45CS40	RR	102	107	**78**
45H37	RR	95	107	**53**
6076 CR	RR	95	111	**57**
CP20R3C	RR	102	113	**58**
CS2300	RR	89	112	**50**
D3155C	RR	104	109	**62**
BY 6204TF	TF	95	110	**62**
DKTF 98 CR	TF	92	108	**72**

Highlighted row = Among the top performing treatment for the year 2020 at Westlock site.

Summary: Overall the yield for Canola at GRO plot in year 2020 was about 25% less than 2019.

The average yield for Liberty Link and Roundup Ready varieties was very similar at about 60.2 bu/acre.

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POGA Milling Oats Trial-2020

Summary: This study is a ongoing effort to collect data on 11 milling oats variety in Central and Northern Alberta. The goal was to determine how variety and growing location will influence the **yield** and functional property attributes linked to **beta-glucan** levels of the oats. Similar to what's been recorded, there were noticeable varietal differences between the two locations for the yields as well as beta-glucan content. This year the average yield was higher for the Westlock location compared to the Peace location, but the beta-glucan content averaged higher for the Peace site. Most of the milling oat varieties surpassed the 4% mark for the total beta-glucan content. Both Westlock and Peace sites had ample to a little too much moisture during the season.

Background: Oat production in Alberta has been on a relatively steady decline since 2011. Oats has earned the status of a major Canadian export crop from a domestic crop status. According to Prairie Oat Grower's Association (POGA), an estimate of 3.1 million acres of oats was seeded in the year 2015-16 but there is a decline in Alberta due to lack of markets and non-competitive pricing with other crops. Many major millers will not accept oats from Alberta or look to Alberta only after Manitoba and Saskatchewan's supply is gone, because the main two oat varieties grown in Alberta, Morgan and Derby contain low amounts of Beta Glucan (β-glucan). **A minimum of 4% β-glucan is required for companies to be able to label their products with the Heart Healthy Claim** and both Morgan and Derby are consistently below that amount. Therefore, oat producers in Alberta need an oat variety that can consistently beat the yields of Morgan and Derby but has the higher β-glucan amounts that the oat miller desire. To emphasize this fact, since 2015 two millers are helping to fund this variety trial hoping to identify oat varieties that will help Alberta producers access the milling market more consistently.

Oats are a valuable part of crop rotation and are therefore beneficial to producers. They provide disease and insect breaks for wheat, barley, and canola. Their rapid establishment and growth provide excellent weed suppression. Oats also work well as a "catch crop" for taking up and storing excess nitrogen, and the straw provides a nutrient source for the following year's crop. The straw also protects against soil erosion and contributes to an increase in the soil's organic matter content (Campbell et al., 1991). Well-planned management and appropriate variety selection make oats a profitable crop due to their low input requirements and favorable effects on succeeding crops in a rotation.

Test weight is the most commonly used indicator of grain quality. High test-weight varieties should be chosen by growers who intend to market oat grain. However, the functional attribute such as β-glucan solubility and viscosity are the main criteria for the

processing industry. Many studies have shown that oat β-glucan can lower blood cholesterol levels, glucose and insulin response and therefore decrease the risk of cardiovascular diseases and prevention of diabetes (Wang and Ellis, 2014).

Oats are regularly affected by crown rust in other parts of Western Canada, but this issue is moving west, towards Alberta. Neither Morgan nor Derby varieties have crown rust resistance but selecting a new disease resistant variety can overcome the problem. The information for a producer to choose the newer and higher-yielding varieties specific to their region is, therefore, a very important step to stay profitable in the oat production. The β-glucan content in oat may vary with change in growing conditions (Perez Herrera et al., 2016). The current trial will provide valuable agronomic information for the producers in Alberta to grow oat varieties with a higher yield and increased functional properties (β-glucan) attribute.

Objective:

- Increase the Oat Acres in Alberta by Finding a High Yielding Oat Variety that maximizes Producer Income and Meets the Demands of the Millers.
- To investigate the impact of genotype and growing condition on the yield and β-glucan content of milling oat varieties in Alberta.

Methodology

Eleven milling oat varieties and four forage oat varieties were tested in 2020 (Table 1). Based on the soil fertility recommendations, fertilizers were added to maintain the optimal levels of growing condition. Seeding rates were calculated based on 1000 kernel weight of each variety with a seed counter, desired plant density and germination percentage. A clean composite sample (500g) was collected and sent to the laboratory analysis for the β-glucan estimation.

Soil Information – GRO – Westlock - 2020

Nitrogen (lbs/ac)	Phosphorus (lbs/ac)	Potassium (lbs/ac)	Sulphur (lbs/ac)	pH	CEC (meq/100g)	Organic Matter (%)
101	64	294	58	6.4	21.9	5.7

Table 1: Agronomic details for the POGA Trail 2020

Location:	Peace Region	Westlock
Seeding Date:	May 30th, 2020	May 12th, 2020

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Harvest Date:	Sept 23th, 2020	September 29, 2020
Soil Temp:	13.4 Celsius	9 Celsius
Soil Moisture:	Adequate	Very good
Seeding Depth:	¾ inch	1 inch
Fertility total Nutrients (Actual lb/acre)	120N-20P-15K-15S	107N-30P-90K-24S
Herbicides	Pre-burn Paradigm(granular) @ 7.5g/acre	Pre-burn Roundup 1L/Ac
Herbicides	In crop Stellar XL @405 ml/ac	In crop Broad leaf: Curtail M (600 ml/ Acre) on 16 June
Fungicides	None	None
Rainfall (mm)	190.5 mm	374.1 mm

The decision for applying fertilizer at a higher level was made to allow all varieties to express their best performance potential based on the soil test at both locations.

Results and Discussion: The overall yield averaged at Westlock site was 200 Bu/acre compared to an average of 195 Bu/Acre in the Peace area. At the Westlock site, OT 3112, CS Camden and CDC Skye oat varieties had more yield as compared to AC Morgan in 2020. At the Peace site, AC Morgan was highest yielding oat variety.

Table.2: Yield - 2020 Comparison

		Westlock			Peace Region		
	Variety	% of	Yield		% of	Yield	
		AC Morgan	bu/ac		AC Morgan	bu/ac	
1	**AC Morgan**	100	203	-	100	211	a
2	**CS Camden**	104	211	-	87	183	c
3	**CDC Seabiscuit**	101	205	-	93	196	abc
4	**OT3112**	105	213	-	85	180	c
5	**CDC Ruffian**	101	206	-	98	207	ab
6	**AC Summit**	87	178	-	86	181	c
7	**AC Arborg**	102	208	-	94	199	abc
8	**CDC Endure**	96	194	-	97	206	ab
9	**CDC Skye**	104	211	-	93	196	abc
10	**ORE3542M**	90	183	-	93	197	abc
11	**CDC Norseman**	93	190	-	90	190	bc

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Table.3: Other results from the POGA trial 2020 Westlock Site.

		Height cm		Lodging 1-9		Test Weight kg/HL		TKW G		Maturity Days	
1	**AC Morgan**	110	ab	1.2	ab	57.7	-	41.9	a	111	abc
2	**CS Camden**	111	ab	1.2	ab	55.6	-	39.8	ab	107	bcd
3	**CDC Seabiscuit**	112	ab	1.9	ab	52.3	-	40.7	ab	106	bcd
4	**OT3112**	94	c	1.0	b	55.1	-	37.3	bc	107	bcd
5	**CDC Ruffian**	100	bc	1.4	ab	54.2	-	37.3	bc	104	cd
6	**AC Summit**	83	d	1.0	b	54.8	-	35.5	c	115	a
7	**AC Arborg**	115	ab	1.0	b	56.2	-	40.9	ab	107	bcd
8	**CDC Endure**	109	ab	1.4	ab	54.9	-	39.8	ab	**102**	**d**
9	**CDC Skye**	118	a	1.5	ab	56.3	-	37.4	bc	107	bcd
10	**ORE3542M**	103	abc	1.2	ab	54.1	-	39.5	ab	112	ab
11	**CDC Norseman**	114	ab	2.6	a	53.6	-	37.3	bc	107	bcd
LSD P=.05		9.16		0.74 - 0.96		3.134		2.27		4.64	
Standard Deviation		5.38		0.09t		1.84		1.564		3.2	
CV		5.06		25.95t		3.35		4.05		2.97	

Lodging score (1 to 9) where 1 = Straight and 9 is flat; **CDC Norseman lodging was noticed to bit higher degree in 2020.**

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Table.4: Other results from the POGA trial 2020 Peace Site.

		Height cm		Lodging 1-9		Test Wt kg/HL		TKW g	
1	**AC Morgan**	96	a	1	-	50.7	a	42.8	ab
2	**CS Camden**	88	b	1	-	50.1	ab	39.8	b
3	**CDC Seabiscuit**	94	a	1	-	47.3	d	44.5	a
4	**OT3112**	76	d	1	-	49.5	b	41.2	ab
5	**CDC Ruffian**	83	c	1	-	49.4	bc	41.9	ab
6	**AC Summit**	84	c	1	-	50.9	a	40.9	ab
7	**AC Arborg**	96	a	1	-	51.0	a	40.7	ab
8	**CDC Endure**	95	a	1	-	50.2	ab	42.9	ab
9	**CDC Skye**	95	a	1	-	49.4	bc	41.8	ab
10	**ORE3542M**	88	b	1	-	48.5	c	43.0	ab
11	**CDC Norseman**	94	a	1	-	47.7	d	39.7	b
LSD P=.05		3.322		.		0.75		2.627	
Standard Deviation		2.3		0		0.519		1.819	
CV		2.56		0		1.05		4.36	

Test weight is an important indicator of grain milling quality. **CDC Seabiscuit, ORE3542M and CDC Norseman** were among the three lowest oat varieties for the test weight at peace region At Westlock site the test weight were not significantly different among varieties.

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Table 5: The Beta-Glucan results from the POGA trial of 2020.

	Variety	Westlock - 2020			Peace Area – 2020		
		Hull percentage (%)	Flour Moisture (%)	Beta Glucan (%, db)	Hull percentage (%)	Flour Moisture (%)	Beta Glucan (%, db)
1	AC Morgan	21.18	4.07	3.86	23.32	5.13	3.82
2	CS Camden	15.80	4.39	4.67	23.68	4.94	4.34
3	CDC Seabiscuit	17.63	4.28	4.62	19.11	5.05	3.98
4	OT 3112	21.94	4.60	6.10	16.64	5.35	4.81
5	CDC Ruffian	18.58	4.62	4.29	19.85	5.21	3.46
6	AC Summit	19.82	4.39	4.80	19.34	5.06	4.53
7	CDC Arborg	23.29	4.83	4.58	16.94	5.21	3.58
8	CDC Endure	14.89	4.49	5.24	25.10	5.24	4.61
9	CDC Skye	21.35	4.18	4.85	26.83	5.11	4.95
10	ORE3542M	18.91	4.60	4.39	29.06	5.13	3.83
11	CDC Norseman	15.96	4.17	4.78	22.73	5.54	4.55

Beta Glucan results: The beta-glucan content of the 11 different milling varieties ranged between 3.46% and 6.10%, with the lowest reported for AC Morgan and CDC Ruffian at Westlock and Peace region respectively. **OT3112, CDC ENDURE and CDC SKYE were the highest beta-glucan varieties** at both locations.

Highlighted row = Among the top performing variety for the year 2020 at Westlock site.

Conclusion: There were significant effect of location and varietal difference for the oat yields as well as beta-glucan levels in all 5 years (2016-2020). In 2020, oat yield overall was great with higher level of Beta-glucan levels in most oat varieties at Westlock. The environmental conditions effect yield capacity of a variety to a higher degree than the effect on beta-glucan levels. For example, the higher beta glucan varieties were same at both location Westlock and Peace but the same oat variety yield was different for both locations.

Since the year 2018, we added a few newer entries to the trial. The newer varieties are performing better for the yield as well as the beta-glucan content. In 2020 OT3112 had shown to be a great milling oat variety with **highest yield, specifically in Westlock,** and **highest beta-glucan** and **good test weight,** which are preferred characteristics for the grain millers.

	Top 3 Varieties at Westlock		
2020	OT3112	CDC Endure	CDC Skye
2019	CDC Endure	CDC Arborg	AC Morgan
2018	CDC Endure	CDC Arborg	Triactor
2017	CS Camden	Akina	CDC Ruffian
2016	CDC Seabiscuit	CDC Ruffian	CDC Orin
	Top 3 Varieties at Peace Region		
2020	CDC Skye	OT3112	CDC Endure
2019	CDC Seabiscuit	CDC Arborg	CS Camden
2018	Triactor	AC Morgan	CDC Endure
2017	CDC Ruffian	CS Camden	CDC Orin
2016	CDC Ruffian	AC Morgan	CDC Seabiscuit

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Table 6: **Overall Summary of the trial: Yields from 2016 to 2020**

	Yield	Overall Average	2020	2019	2018	2017	2016
Milling oats	% of AC Morgan	Yield (Bu/Ac)	Yield (Bushel/Acre)				
AC Morgan	100	212	203	243	226	212	178
CS Camden	99	210	211	241	206	226	167
CDC Seabiscuit	99	211	205	239	212	208	189
OT3112	100	213	213				
CDC Ruffian	101	214	206	219	207	245	193
AC Summit	95	202	178	245	203	217	167
CDC Arborg	106	224	208	244	221	-	-
ORE3542M	94	199	183	214	201	-	-
CDC Norseman	98	208	190	222	213	-	-
CDC Endure	105	223	194	249	226	-	-
CDC SKYE	105	224	211	237	-	-	-
CDC Orrin	95	202		-	218	221	168
Souris	82	175		-	-	194	155
Kara	93	199		-	-	222	175
CDC Minstrel	89	188		-	-	202	174
Triactor	100	212		238	229	208	172
Akina	97	206		-	221	222	176

Highlighted row = Among the top performing variety for the year 2020 at Westlock site.

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Table 7: Beta glucan (%) contents in milling oats from 2016 to 2020

Milling oats		2016		2017		2018		2019		2020	
	Average	Westlock	Peace	Westlock	Peace	Westlock	Peace	Westlock	Peace	Westlock	Peace
AC Morgan	3.9	3.9	4.1	3.8	4.2	3.9	3.4	3.9	3.7	3.9	3.8
CS Camden	4.3	3.7	3.9	4.4	4.6	4.4	3.8	4.4	5.2	4.7	4.3
CDC Seabiscuit	4.2	3.7	3.7	4.6	4.6	4.4	3.7	4.5	4.2	4.6	4.0
OT3112	5.5									6.1	4.8
CDC Ruffian	3.5	2.7	3.3	3.8	3.9	3.6	2.7	3.6	3.7	4.3	3.5
AC Summit	4.2	3.6	3.7	4.3	4.4	4.3	3.7	4.3	4.6	4.8	4.5
CDC Arborg	4.1					4.4	3.8	4.2	4.3	4.6	3.6
ORE3542M	4.0					4	3.5	3.8	4.2	4.4	3.8
CDC Norseman	4.5					4.5	3.8	4.7	4.4	4.8	4.6
CDC Endure	4.7					4.7	4.2	4.5	4.7	5.2	4.6
CDC SKYE	4.8							4.5	5	4.9	5.0
CDC Orrin	3.8	3.2	3.7	4.4	4	4.1	3.4				
Souris	4.3	3.6	4.4	4.9	4.4						
Kara	4.2	3.6	3.7	4.3	5						
CDC Minstrel	3.7	2.9	3.5	3.9	4.3						
Triactor	4.1	3.5	3.7	4.4	4.5	4.4	4	4.1	4.3		
Akina	4.4	3.8	3.7	5	4.9	4.8	4				

Acknowledgments: We would like to thank **Prairie Oat Growers Association (POGA) and Grain Millers Canada** for their full financial assistance. We would also like to thank Canterra seeds, Canada Seed depot, alliance seed and FP Genetics for their generous seed donation with this trial. This information is presented with the understanding that no product discrimination is intended and neither endorsement of any variety/product mentioned, nor criticism of named variety/products is implied.

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Regional Silage Trial

Co-operators: Jubilee Feedlot- SW-9-59-26-4

Objectives

- Compare silage yield and nutritional value of new and commonly used barley, oat and triticale silage varieties.
- To provide yield and agronomic data for use in the Alberta Agriculture publication "Silage Varieties for Alberta."

Background

A randomized complete block with 4 replicates of each treatment was used. Plot size was 1.37 meters wide (6 rows with 9-inch spacing) by 10 meters long. Silage was harvested, samples were weighed and sent for wet chemistry analysis to obtain moisture and feed quality. Seeding rates were based on 1000 kernel weight and germination % in order to achieve 300 seeds/m^2, 300 seeds/m^2, and 370 seeds/m^2 that translates to about 28, 28, and 34 plants per square foot for barley, oat and triticale respectively. It is important to calculate seeding rates using 1000 kernel weight and germination % to prevent under or overseeding. Crops with larger seed size have fewer seeds per pound/bushel. They need to have more pounds/bushel seeded per acre to keep viable seed counts the same as crops with small seed size.

	Project Description
Seeding specifics	Barley, Triticale, Oats, Spring/Winter Cereal: June12, 2020
	1-inch depth
Fertilizer/acre	Side banded: 27.5-2.5-15-5 363lbs/ac 100 lbs/ac Actual N 9.1 lbs/ac Actual P 54.54 lbs/ac Actual K 18.18 lbs/ac Actual S Seed placed: 11-52-0 40 lbs/ac 4.4 lbs/ac Actual N 21 lbs/ac Actual P
Herbicide	Glyphosate 250ga/ac June 10, 2020 Curtail M 700 ml/ac July 23, 2020
Rainfall	Recorded from May 1 to Sept 15, 2020: **374.1mm**
Harvest Date	Barley: September 09, 2020 Oats: September 11, 2020 Triticale: September 09, 2020 Spring/Winter Cereal: September 14, 2020

Barley Varieties Used in the Trial

- **CDC Austenson** is a two-row, rough-awned hulled feed barley with very high grain yield and short, strong straw. Large plump kernels. A top-yielding two-row with improved, performance over Xena. Resistant to stem rust and covered and false loose smut. Medium maturity. Susceptible to scald and true loose smut.
- **AB Advantage** is a six-row smooth-awned feed and forage barley with high grain yield and good agronomic performance.
- **AB Cattlelac** is asix row semi-smooth awned barley, coupled with good lodging resistance, good grain yield, and excellent disease resistance.
- **AB Wrangler** is a two-row feed, grain and variety with high grain and forage yield potential. Early to medium maturing, moderate resistance to smut, stem rust and fusarium head blight and low DON (deoxynivalenol) accumulation.
- **Altorado** is a two-row feed barley with good resistance to lodging and a fair to good resistance to drought conditions.
- **Amisk** is a rough awned, six-row, semi-dwarf general-purpose barley with increased feed efficiency, strong straw for decreased lodging.
- **Canmore** is a two-row, medium height, and general-purpose barley. This variety fits in the feed market with the added food-grade opportunities in the pearling and Shochu markets (Shochu is an alcoholic beverage that is replacing Sake in Japan). Canmore barley has excellent pearling qualities, starch content and alcohol yields. Other features include: high yield, improved disease resistance, increased percentage of plump seed and improved lodging resistance.
- **CDC Bow** is a two-row, malting barley. It combines good agronomic performance and physical grain quality with resistance to covered smut and stem rust.
- **CDC Cowboy** is a two-row-forage type barley with very high forage and grain yield. It is susceptible to scald, spot blotch, Barley Yellow Dwarf Virus and loose smut.
- **CDC Maverick** is a two-row forage barley with smooth awns, good for swath grazing as well as baling.
- **Claymore** is a two-row, spring feed barley, with a semi-erect growth habit at tillering. good resistance to lodging and shattering, good tolerance to straw breakage, and fair to good tolerance to drought.
- **Sundre** is a high yielding 6-row barley variety with good disease resistance.

NOTE: Cereal Silage trial results are sent to the Alberta Seed Guide every year. We rely on municipal funding to continue these trials so if producers feel the data is relevant and important please talk to your municipal councillor to support GRO's effort in applied research close to your field.

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Barley Variety	Height	Yield	Check	Crude Protein	TDN	Calcium	Phosphorus	Potassium	Magnesium	RFV
	cm	tonne/acre	%	%	%	%	%	%	%	%
CDC AUSTENSON	72	7.6	100%	10.0	61.5	0.30	0.12	1.15	0.12	120
AB ADVANTAGE	92	9.8	129%	9.9	62.2	0.33	0.11	1.22	0.10	115
AB CATTLELAC	77	8.3	109%	10.5	58.1	0.46	0.08	1.60	0.14	94
AB WRANGLER	67	6.6	87%	10.5	64.2	0.38	0.13	1.04	0.12	143
ALTORADO	60	8.0	105%	11.1	61.9	0.29	0.16	1.15	0.13	125
AMISK	61	6.9	91%	9.8	61.1	0.38	0.07	1.57	0.11	97
CANMORE	66	6.2	82%	9.8	60.2	0.37	0.10	1.31	0.10	105
CDC BOW	80	7.0	92%	10.4	63.2	0.42	0.11	1.11	0.12	108
CDC COWBOY	98	7.3	96%	9.7	59.8	0.35	0.14	0.96	0.12	107
CDC MAVERICK	104	6.9	91%	11.3	62.7	0.34	0.15	0.97	0.14	104
CLAYMORE	77	7.6	100%	11.5	63.1	0.31	0.18	1.13	0.12	112
SR 18524	63	6.5	86%	11.1	64.3	0.28	0.17	1.29	0.13	138
SUNDRE	75	7.5	99%	11.5	63.9	0.38	0.16	1.27	0.14	117
TR 18647	79	7.3	96%	10.9	66.3	0.22	0.14	1.07	0.11	116

Harvested at Soft dough stage TDN: Total Digestible Nutrients Yield: Adjusted to 65% Moisture RFV: Relative Feed Value

Check: CDC AUSTENSON

Highlighted row = Among the top performing variety for the year 2020 at Westlock site.

Gateway Research Organization

Triticale Varieties Used in the Trial

- **Taza** is an awnletted (reduced awn expression) standard height spring triticale line, intended for use as a feed grain conserved forage, swath grazing crop and potentially for industrial use. It is adapted to the Canadian prairie provinces and has good lodging resistance, good test weight, and high kernel weight
- **AAC Delight** is a spring triticale, that is moderately resistant to ergot, a hexaploid, and the awns are only at the tips.
- **Bunker** is an early maturing, reduced awn forage variety with great digestibility, high-fat content and high silage yields.
- **Sunray** is adapted to the Canadian prairies and represents an improvement in ergot resistance for Canadian triticale. This early maturing, spring triticale variety has a short-stature for increased resistance to lodging. It is resistant to the prevalent races of leaf rust, stem rust, common bunt, root rot and is moderately resistant to sprouting.
- **T256** is a spring triticale, forage-type line, and is more digestible because it has reduced awns, is shorter, and has lower lignin content. It is also favorable for swath grazing.

Regional Triticale Silage Variety Trial - 2020

Triticale Variety	Height	Yield	Check	Crude Protein	TDN	Calcium	Phosphorus	Potassium	Magnesium	RFV
	cm	tonne/acre	%	%	%	%	%	%	%	%
TAZA	114	12.9	100%	9.3	64.1	0.14	0.10	1.08	0.09	101
AAC DELIGHT	100	11.5	89%	10.0	65.1	0.13	0.08	0.84	0.06	107
BUNKER	124	13.7	106%	10.3	66.1	0.14	0.09	0.95	0.08	111
SUNRAY	106	13.8	107%	9.7	66.8	0.14	0.08	1.10	0.07	111
T256	98	12.8	99%	9.4	64.4	0.14	0.08	0.97	0.09	102

Harvested at Hard dough stage TDN: Total Digestible Nutrients Yield: Adjusted @65% Moisture RFV: Relative Feed Value

Check: TAZA; **Highlighted row = Among the top performing variety for the year 2020 at Westlock site.**

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Oat Varieties Used in the Trial

- **CDC Baler** is a forage oat with very long wide leaves, slightly taller than the standard forage variety, excellent lodging resistance, and exceptional forage yield. It generally has higher energy and protein values than other forage oats.
- **AC Morgan** is a high yielding, later maturing milling oat with good lodging resistance and is commonly used for silage or green feed. It is susceptible to crown and stem rust, moderately susceptible to smuts, and adapted to black and grey wooded soil zones of Alberta.
- **AC Juniper** is an early maturing oat, well adapted to rust free area of Western Canada.
- **CDC Arborg** is a high yielding, early maturing, variety, high in beta-glucan, with a strong straw and excellent standability.
- **CDC Haymaker** is a spring oat with high forage yield potential and forage quality, good grain quality and improved grain yield over CDC Baler. It has plump grain with high seed weight, and grain yield better than CDC Baler. Its crown rust resistance is similar to CDC Dancer, and it is susceptible to smut.
- **CDC Seabiscuit** is a high yielding milling oat variety with good straw strength for reduced lodging.
- **CS Camden** has a high yield, shorter stature, and better lodging resistance, high leaf biomass & high beta-glucan.
- **AC Murphy** is a widely adapted forage oat, with high yields, improved lodging resistance and is well suited for silage, swath grazing, and green feed.
- **ORe3542M** is a high yielding, high quality, white-hulled milling oat. It is medium maturing with strong straw and crown rust resistance.

Oat Variety	Height cm	Yield tonne/acre	Check %	Crude Protein %	TDN %	Calcium %	Phosphorus %	Potassium %	Magnesium %	RFV %
CDC Baler	115	16.3	100%	9.9	60.4	0.19	0.09	1.53	0.10	97
AC Morgan	106	14.2	87%	9.7	62.1	0.19	0.13	1.49	0.09	109
AC Juniper	109	12.3	75%	9.4	64.9	0.21	0.08	1.56	0.13	119
CDC Arborg	109	13.8	85%	9.7	63.0	0.15	0.10	1.23	0.09	112
CDC Haymaker	112	13.9	85%	10.3	62.5	0.18	0.10	1.26	0.10	105

CDC Nasser	112	12.4	76%	9.6	62.2	0.15	0.11	1.01	0.11	106
CDC Seabiscuit	98	14.2	87%	8.7	64.6	0.17	0.11	1.09	0.09	129
CS Camden	96	12.1	74%	9.5	63.7	0.20	0.11	1.44	0.11	116
AC Murphy	98	11.3	69%	9.6	62.2	0.19	0.10	1.39	0.12	109
ORe3542M	98	12.9	79%	9.2	66.3	0.14	0.13	1.10	0.09	136

Harvested at milk stage TDN: Total Digestible Nutrients Yield: Adjusted @65% Moisture RFV: Relative Feed Value

Check: CDC Baler; **Highlighted row = Among the top performing variety for the year 2020 at Westlock site.**

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Variety	Crop Type	Height		Yield	CP	TDN	Calcium	Phosphorus	Potassium	Magnesium	RFV
		cm	cm	tonne/acre	%	%	%	%	%	%	%
PRIMA / CDC AUSTENSON	**Fall Rye** / Barley	44	67	7.9	12.4	63.3	0.34	0.15	1.51	0.13	120
PRIMA / CDC BALER	**Fall Rye** / Oat	35	123	15.8	9.9	61.7	0.27	0.11	1.24	0.11	122
PRIMA / TAZA	**Fall Rye** / Spring Triticale	39	107	12.0	11.8	61.8	0.26	0.12	1.31	0.11	103
AAC WILDFIRE / CDC AUSTENSON	**Winter Wheat** / Barley	42	60	8.0	12.8	61.6	0.27	0.15	1.67	0.13	111
AAC WILDFIRE / CDC BALER	**Winter Wheat** / Oat	44	120	13.5	9.9	61.3	0.24	0.12	1.17	0.10	121
AAC WILDFIRE / TAZA	**Winter Wheat** / Spring Triticale	45	110	12.3	11.4	62.1	0.20	0.10	1.29	0.07	106
BOBCAT / CDC AUSTENSON	**Fall Triticale** / Barley	39	65	8.5	12.1	64.4	0.29	0.13	1.53	0.11	126
BOBCAT / CDC BALER	**Fall Triticale** / Oat	40	116	14.3	10.5	59.7	0.25	0.12	1.37	0.11	109
BOBCAT / TAZA	**Fall Triticale** / Spring Triticale	38	110	12.0	9.3	62.0	0.15	0.13	0.95	0.07	108
CDC AUSTENSON	**Barley**	74		8.1	10.2	62.5	0.26	0.13	0.98	0.11	121
CDC BALER	**Oat**	121		16.2	8.5	62.0	0.20	0.09	0.87	0.10	122
TAZA	**Spring Triticale**	111		14.0	9.1	65.2	0.13	0.14	0.84	0.09	132

Harvested at soft dough stage; TDN: Total Digestible Nutrients; Yield: Adjusted @65% Moisture; RFV: Relative Feed Value **Highlighted row = Among the top performing variety for the year 2020 at Westlock site.**

Gateway Research Organization

Regional Silage Pea Mix and Alternative Silage Trial

Project Description	
Seeding specifics	June 12, 2020
	1-inch peas & cereal mix
Fertilizer/acre	Side banded: 0-0-60 100 lbs/ac 60 lbs/ac Actual K Seed placed: 11-52-0 58 lbs/ac 6.38 lbs/ac Actual N 30.16 lbs/ac Actual P
Herbicide	Glyphosate 1l/ac June 10, 2020 Basagran Forte 910 ml/ac July 27, 2020
Rainfall	Recorded from May 1 to Sept 15, 2020: **374.1mm**
Harvest Date	September 14, 2020

Alternative Silage

Project Description	
Seeding specifics	June 19, 2020
	½" to ¾" inch depth
Fertilizer/acre	Side banded: 27.5-2.5-15-5 363lbs/ac 100 lbs/ac Actual N 9.1 lbs/ac Actual P 54.54 lbs/ac Actual K 18.18 lbs/ac Actual S Seed placed: 11-52-0 50 lbs/ac 5.5 lbs/ac Actual N 26 lbs/ac Actual P
Herbicide	Glyphosate 1l/ac June 10, 2020 Roguing (Hand Weeding): 2 to 3 times
Rainfall	Recorded from May 1 to Sept 15, 2020: **374.1mm**
Harvest Date	September 16, 2020

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Pea Cereal Silage Variety	Crop Type	Height cm		Yield tonne/acre	CP %	TDN %	Calcium %	Phosphorus %	Potassium %	Magnesium %	RFV %
CDC AUSTENSON	Barley	65		3.9	7.7	51.3	0.53	0.18	1.44	0.27	78
CDC BALER	Oat	83		5.3	9.0	60.1	0.24	0.18	1.29	0.12	93
TAZA	Spring Triticale	69		4.9	10.5	65.0	0.20	0.23	1.23	0.09	114
CDC AUSTENSON / CDC MEADOW	**Barley** / Field Pea	65	48	4.2	12.1	68.5	0.50	0.22	0.92	0.15	144
CDC BALER / CDC MEADOW	**Oat** / Field Pea	96	47	6.9	10.9	64.8	0.68	0.13	0.91	0.17	120
TAZA / CDC MEADOW	**Spring Triticale** / Field Pea	75	51	5.6	10.6	64.6	0.55	0.22	0.94	0.15	120
CDC AUSTENSON CDC JASPER	**Barley** / Forage Pea	72	48	4.7	11.0	57.1	0.51	0.17	1.38	0.16	96
CDC BALER / CDC JASPER	**Oat** / Forage Pea	87	52	7.3	11.2	63.3	0.67	0.17	0.93	0.16	119
TAZA/ CDC JASPER	**Spring Triticale** / Forage Pea	76	49	5.0	12.9	67.1	0.59	0.22	1.09	0.16	138
CDC AUSTENSON / SNOWBIRD	**Barley** / Fababean	64	65	5.9	10.3	59.4	0.32	0.17	1.42	0.12	99
CDC BALER / SNOWBIRD	**Oat** / Fababean	89	65	6.6	10.4	60.1	0.42	0.20	1.55	0.17	107
TAZA / SNOWBIRD	**Spring Triticale** / Fababean	84	67	6.6	11.1	63.4	0.35	0.17	1.05	0.13	111

Yield: Adjusted @65% Moisture; TDN: Total Digestible Nutrients; CP: Crude Protein; RFV: Relative Feed Value. Trial effected by excessive rainfall and; **Highlighted row = Among the top performing variety for the year 2020 at Westlock site.**

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Alternative Silage Options

1. Chicory

Seeding Rate: 3 – 4 pounds/acre

3-4 weeks for sprouting requires 80-100 days to become ready for grazing.

Chicory production is optimized under rotational grazing management. Depending on time of year, a rest period of 25-30 days between grazing is best for chicory persistence and performance. A stubble height of 1.5 to 2 inches should remain after grazing.

2. Plantain

Seeding rate 3.5 – 7 lbs/ac

Plantain should be first grazed no earlier than the six-leaf stage, i.e. the plants have six fully grown leaves, and this is normally 7-8 weeks after sowing. This ensures plants have well-developed root systems to improve survival.

3. Proso Millet

Seeding rate: 20 – 25 pounds per acre

Good for stockpiled or swath grazing.

Ready to cut for hay 60-70 days after emergence.

Proso millet cut for hay should be harvested when the crop is in the boot to milk stage. It rarely provides sufficient regrowth to economically justify another hay harvest, and the regrowth should be utilized by grazing.

4. Kale

Seeding Rate: 4.5 lbs/ac

Ready for grazing in 55-75 days after seeding.

Kale has good salinity tolerance. Plants are high protein, high relative feed value, and low fiber.

Strip grazing will utilize the crop most efficiently. Due to its slow early establishment, flea beetle can be a potential pest of kale. Clubroot can be an issue in brassica rotations. Caledonian kale is a club root resistant variety.

5. Forage Radish

Seeding rate: 4 – 6 pounds of seed per acre

A forage radish cover crop is sown late in the growing season; the seed needs 60 days to become ready for forage. The radish captures and stores nutrients while alive, and then releases them back into the soil during decomposition.

6. Forage Brassica

Seeding Rate: 4.5 lbs/ac

Forage brassica are a biennial leafy bush brassica plant with a small tuber. There are numerous forage brassica hybrids in the market, usually crossed turnips with kale or forage rape. Maximum production levels in 80-90 days.

7. Sorghum Sudan Grass

Seeding Rate: 13.5 lbs/ac

The first cut will be ready for harvest about 60 days from planting. For a faster recovery of aftermath growth, leave at least 10-18 cm (4-7 inches) of stubble when harvesting. Optimum growth of these plants occurs under hot, moist conditions. A second cut should be ready 30-35 days later.

8. Phacelia

Seeding Rate: 8 – 15 lbs. per acre

This is a "pollinator attracter", which starts flowering 45-60 days after emergence. It has a slow regrowth rate, so it is not very good for grazing, but better for hay as it dries down nicely.

9. Japanese Millet

Seeding Rate: 20 – 25 lbs. per acre

Seeds can reach maturity in 45-60 days.

Excellent for grazing and hay both purposes.

10. Turnip

Seeding Rate: 2 – 5 lbs/acre

Require 30-60 *days for first grazing*

Some varieties are better than others for grazing purpose. Turnip has good growth and it is a tool to remove soil compaction.

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Alternate Silage Variety Trial - Westlock, AB 2020

Alternative Silage option	Establishment %	Height cm	Yield tonne/acre	CP %	TDN %	Calcium %	Phosphorus %	Potassium %	Magnesium %	RFV %
CHICORY	**100**	47	0.34	14.1	54.5	1.35	0.19	3.10	0.30	150
FORAGE BRASSICA	**50**	45	0.38	12.3	63.2	3.11	0.19	2.68	0.46	162
FORAGE KALE	**50**	49	0.19	9.6	40.8	1.43	0.10	1.08	0.24	107
FORAGE RADISH #	**60**	108	0.13	13.0	54.4	1.94	0.19	1.70	0.32	116
FORAGE TURNIP #	**60**	41	0.15	13.9	64.2	3.16	0.19	2.47	0.43	172
JAPANESE MILLET	**70**	97	0.20	9.1	52.6	0.66	0.14	1.63	0.40	91
MILLET*	**20**	52	0.05	9.2	58.2	0.41	0.16	1.60	0.23	98
PHACELIA*	**10**	58	0.04	9.2	53.2	3.25	0.15	1.65	0.46	104
PLANTAIN	**80**	43	0.31	10.7	62.0	1.69	0.12	1.35	0.23	145
SORGUM SUDAN GRASS*	**10**	87	0.02	7.4	52.4	0.40	0.16	1.37	0.23	86

Yield: Adjusted @65% Moisture; CP: Crude Protein; TDN: Total Digestible Nutrients RFV: Relative Feed Value

*Establishment was very poor, may be due to slow growth and high weed pressure at site # Just above the ground yield

Acknowledgement: The current project is funded by Canadian Agricultural Partnership Program under The Adaptive Innovation Stream. The project will collect data in 2021 and 2022 as well.

Crude Protein (CP, % of dry matter)

Crude protein is the proportion of the feed estimated to be protein (amino acids). There is no lab method for directly measuring the amount of protein in a sample, but an approximation can be calculated using the nitrogen content of the feed. Crude protein may be an overestimation of the actual protein levels, since there may be some non-protein nitrogen in the feed (such as urea), however this is usually a very small proportion of the feed. Generally, higher protein indicates a higher quality feed.

Total Digestible Nutrients (TDN, % of dry matter)

The total digestible nutrient (TDN) is the proportion (%) of dry matter that is digestible to the animal. The TDN can be calculated by using the acid detergent fibre (ADF) measurement, or with another calculation that sums the measurements of various digestible components (fat, digestible carbohydrates, digestible protein, digestible fibre).

Relative Feed Values (RFV)

The relative feed value (RFV) is an index that represents forage quality and used to compare the potential energy intake (how much energy an animal will consume) of forages of the same type. The RFV is a unitless value, and its equation uses the ADF as a measure of digestibility and the NDF (neutral detergent fibre) as a measure of intake. An RFV value greater than 100 represents a feed of higher quality than alfalfa hay at full bloom.

Mineral Abbreviations

Abbreviation	Full Mineral Name	Unit
Ca	Calcium	%
P	Phosphorus	%
K	Potassium	%
Mg	Magnesium	%

Gateway Research Organization

Perennial Forage Trials – 2020-22

Objectives:

1. Provide unbiased, current and comprehensive regional data regarding the establishment, persistence, dry matter yield, nutritional quality and economics of several perennial grass and legume combinations when compared to a pure stand of selected species and varieties intended for hayland or grazing.
2. Deliver comprehensive information related to regional establishment, persistence, dry matter yield, quality and economics of several perennial grass and legume mixes.

Background:

The recent survey on the economic, productive and financial performance of Alberta cow/calf operations indicates 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 (Oginskyy 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 ARAs have received from producers wishing to improve their pasture or hayland, are related to combinations of grass and legume species. Very few requests are for information on pure stands. Most perennial seed sold by farm supply companies is sold as either a custom or stock blend. Unfortunately, most perennial forage research to date has focused on pure stands rather than mixes. The recent concerted program of research/demonstration on high legume pastures by AFF, ARAs and AgCanada, which was devoted to improving producers' understanding of the roles played by legumes in forage production systems, has helped initiate producers' interest in optimizing the use of legumes in forage-livestock systems. Producers are now aware that grass-legume mixes are a key to increased 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 carbon 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, re-growth and snow trap potential.

Establishing and maintaining a successful hayland or 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 region and improve cattlemen's ability to make good management decisions. Generation of information at points across the province from this project will compliment 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 costs, reducing backgrounding costs 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 the agricultural industry in general.

Grasses, Legumes, & Grasses-Legume Mix

	Project Description	
Seeding specifics	July 28, 2020	
	½" inch depth	
Fertilizer/acre	Broadcast: 11.28-14.44-19.26-9.63	310 lbs/ac (Grasses)
	35 lbs/ac Actual N	45lbs/ac Actual P
	60 lbs/ac Actual K	30lbs/ac Actual S
	Broadcast: 11.28-14.44-19.26-9.63	208 lbs/ac (Legumes + Mixes)
	23.5 lbs/ac Actual N	30 lbs/ac Actual P
	40 lbs/ac Actual K	20 lbs/ac Actual S
Herbicide	Glyphosate @1L/ac + Heat @20g/ac	June 19, 2020
	Basagran @800ml/ac (Grasses, Legumes & Mixes)	September 3, 2020
	Assure @150ml/ac	September 3, 2020
Rainfall	Recorded from May 1 to Sept 15, 2020: **374.1mm**	
Harvest Date	September 14, 2020	

Seeding Information:

Table 1: Grass Species

Species	**Variety**	**Seeding Rate (lb/A)**
Meadow Brome	Fleet	14
	AC Admiral	14
Hybrid Brome	AC Success	12
	AC Knowles	12
Wheatgrasses		
Pubescent	Greenleaf	12
Crested	Kirk	7
Green Wheatgrass	AC Saltlander	11

Orchardgrass	Killarney	10
	Blizzard	10
Italian Ryegrass	Nabucco or Randita	10
Tall Fescue	Courtney	8
Timothy	Grindstad	5

Table 2: Legumes

Species	Variety	Seeding Rate (lb/A)
Alfalfa	AC Grazeland	8
	Dalton	8
	Halo	8
	Rambler	8
	Rangelander	8
	Rugged	8
	Spredor 4	8
	Spredor 5	8
	AC Yellowhead	8
	PV Ultima	8
	Spyder	8
	Assalt	8
	44-40	8
	Phabulous	8
	20-10	8
Sainfoin	AC Mountainview	35
	AAC Glenview	35
Cicer Milk Vetch	Veldt	14
	Oxley 2	14

Table 3: Grasses + Legumes Mix

Species	Variety	Seeding Rate (lb/A)
Mix 1	Fleet Meadow Brome	7
	AC Yellowhead	4
Mix 2	AC Success Hybrid Brome	6

	AC Yellowhead	4
Mix 3	AC Knowles Hybrid Brome	6
	AC Yellowhead	4
Mix 4	Fleet Meadow Brome	7
	Spredor 5	4
Mix 5	AC Success Hybrid Brome	6
	Spredor 5	4
Mix 6	AC Knowles Hybrid Brome	6
	Spredor 5	4
Mix 7	Fleet Meadow Brome	5
	AC Yellowhead Alfalfa	3
	AC Mountainview Sainfoin	10
Mix 8	AC Success Hybrid Brome	4
	AC Yellowhead Alfalfa	3
	AC Mountainview Sainfoin	10
Mix 9	Fleet Meadow Brome	5
	AC Yellowhead Alfalfa	2
	AC Mountainview Sainfoin	8
	Veldt Cicer Milk Vetch	4
Mix 10	AC Success Hybrid Brome	5
	AC Yellowhead Alfalfa	2
	AC Mountainview Sainfoin	8
	Veldt Cicer Milk Vetch	4
Mix 11	Fleet Meadow	5
	Greenleaf Pubescent WG	4
	AC Yellowhead Alfalfa	3
Mix 12	AC Success Hybrid Brome	4
	Greenleaf Pubescent WG	4
	AC Yellowhead Alfalfa	3
Mix 13	Salinemaster	11
Mix 14	Legumemaster	24

Observation & Results:

This was the establishment year, so only emergence data is available. The harvest yields from first cut and quality data will be available in subsequent years.

Table 1: Grasses Emergence

Emergence Assessment		
	Variety	**Plants per square feet**
Meadow Brome	Fleet	8.7
	AC Admiral	4.4
Hybrid Brome	AC Success	3.8
	AC Knowles	10.9
Wheatgrasses		
Pubescent	Greenleaf	11.6
Crested	Kirk	9.2
Green Wheatgrass	AC Saltlander	3.7
Italian Ryegrass	Randita	10.3
Orchardgrass	Blizzard	15.3
	Killarney	4.0
Tall Fescue	Courtney	9.1
Timothy	Grindstad	2.6

Table 2: Legumes Emergence

Emergence Assessment		
	Variety	**Plants per square feet**
Alfalfa	AC Grazeland	6.8
	20-10,	5.1
	Halo	6.2
	Rangelander	6.7
	Rugged	5.8
	Spredor 4	5.0
	Spredor 5	5.1
	AC Yellowhead	3.5
	44-40	3.9
	PV Ultima	8.3
	Rambler	5.7
	Spyder	5.9

	Assalt	4.6
	Dalton	6.3
	Phabulous	7.3
Sainfoin	AC Mountainview	3.1
	AAC Glenview	3.0
Cicer Milk Vetch	Veldt	1.4
	Oxley 2	1.2

Table 3: Grasses & Legume Mixes

Emergence Assessment		
	Variety	**Plants per square feet**
Mix 1	Fleet Meadow Brome AC Yellowhead	8.5
Mix 2	AC Success Hybrid Brome AC Yellowhead	9.6
Mix 3	AC Knowles Hybrid Brome AC Yellowhead	7.9
Mix 4	Fleet Meadow Brome Spredor 5	10.2
Mix 5	AC Success Hybrid Brome Spredor 5	9.7
Mix 6	AC Knowles Hybrid Brome Spredor 5	10.7
Mix 7	Fleet Meadow Brome AC Yellowhead Alfalfa AC Mountainview Sainfoin	6.8
Mix 8	AC Success Hybrid Brome AC Yellowhead Alfalfa AC Mountainview Sainfoin	8.2
Mix 9	Fleet Meadow Brome AC Yellowhead Alfalfa AC Mountainview Sainfoin Veldt Cicer Milk Vetch	9.5

Mix 10	AC Success Hybrid Brome Another AC Yellowhead Alfalfa AC Mountainview Sainfoin Veldt Cicer Milk Vetch	8.0
Mix 11	Fleet Meadow Greenleaf Pubescent WG AC Yellowhead Alfalfa	9.8
Mix 12	AC Success Hybrid Brome Greenleaf Pubescent WG AC Yellowhead Alfalfa	10.4
Mix 13	Salinemaster	9.0
Mix 14	Legumemaster	10.9

The yield data will be collected in year two of the trial and will be shared by members by 2021.

Acknowledgement: The current project is funded by Canadian Agricultural Partnership Program under the Adaptive Innovation Stream. The project will collect data in 2021 and 2022.

Gateway Research Organization

Intercropping Grain Trials – 2020-2022

Cooperator Name: Tom McMillian

Objective:

1. To provide unbiased, current and comprehensive regional data regarding the yield, nutritional quality and economics of annual crops alone or in mixtures in Alberta.
2. To provide unbiased, current and comprehensive regional production data regarding the establishment, dry matter yield, nutritional quality and economics of forage type crops seeded along with cash crop for grazing post-harvest.
3. To identify soil health parameters when a crop is grown as monocrop versus more diverse system and how the introduction of livestock helps the soil health of land using various feed mixtures for livestock production.

Background:

Longer crop rotation for growers is proven to be a helpful strategy for the overall profitability and the sustainability benefits linked with improved soil health and decreased diseases and pest pressure. However, in reality there are plenty of growers in our area who are still staying with a typical wheat-canola-wheat-canola rotation. This type of tight rotation is detrimental to long term agriculture. Most producers are rotating the types of canola (herbicide systems) and types of wheat (CPS vs HRS), with very few going with a legume in their crop rotation. The introduction of the economical option of legume will help the overall cropping system and will diversify rotation. In addition, grasses such as our cereal crops seeded in intercropping with legumes contain a higher percentage of protein, an important quality factor, especially in wheat. With increased diversity of plant species underground and above ground intercropping also increases the biological microbial diversity that is a key factor when considering strategies for maintenance of soil health and land fertility.

One of the aims for sustainable and profitable agriculture is to have an increased output per unit area of the available arable land in a growing season. The greater efficiency of intercrops than that of the sole crops in converting absorbed nutrients to seeds/grains is contributing to the yield advantage (Chowdhury and Rosario, 1994). In addition, the web of root mass systems provides an expanded root surface area to which non-mobile nutrients (P and K) are diffused (Dong et al., 2008). Intercropping is advantageous over mono-cropping in providing the following benefits:

- Greater land-use efficiency
- Greater yield stability
- Increased competitive ability against weeds
- Improved nutrient efficiency with favorable exudates from the component legumes

Grain-legume intercrops are better at exploiting natural resources as compared to the sole crops of different plant species (Hauggaard-Nielsen et al., 2003, 2006). Grain- leguminous can cover their nitrogen demand from atmospheric nitrogen and therefore in intercropping with cereals compete less for soil mineral nitrogen (Hauggaard-Nielsen et al., 2006). On the other hand, legumes or pea plants from monoculture may often lodge heavily, making harvesting them difficult and increase yield losses. When intercropping pea with cereals like wheat/oat as a standing support culture, lodging can be avoided (Lauk et al., 2006).

Most current recommendations on intercropping are coming from anecdotal sources or from countries where shrinking arable land use has forced producers to go with the multi-crop option to enhance land-use efficiency. The ability to assess economics and feasibility of growing two or more crops together will educate Alberta producers to enhance their farm's productivity and profitability. This information on yield, quality and economics will be directly compared to select harvestable single cash crops (oats and wheat) with legume/pulse crops that are most commonly grown by grain producers and can also be used by livestock producers as an annual feed source. The inclusion of 'high nutritive value' annual forages, including chicory and plantain that is known for increased energy and protein content and reduced neutral detergent fiber (NDF), in the rations of beef cattle could have an environmental, economic and production benefit to Alberta producers. Currently, there has been limited research focusing on replicated trials to establish baseline information on these cropping systems. Understanding the regional adaptability of these new mixtures will be key for Alberta producers to make the most economic decisions for their operations.

Original Plan:

A total of eleven (11) treatments seeded in a block design, replicated 3 times.

- 3 monocrops seeded alone: peas, oats and wheat.
- 3 companion crop (pea) and wheat or oat (pea-oat; pea-Canola; fababean-wheat).

Eg: Barrhead peas and Camden or earlier maturing oats seeded together and in-crop herbicide, like MCPA, sprayed before seeding the other treatments of the trial.

- 3 treatments of four mixtures with pea-oat; pea-wheat; fababean-wheat along with clover and soil amendments. *

Eg: 4 – Mixture includes seeding monocrop (oats), companion crop (peas) with under seeded later, (probably after first herbicide spray) one legume (clover) and one forb (chicory, plantain, turnip, radish or whatever is recommended as a soil amendment to fix an issue such as compaction, low organic matter etc. in soil).

- 2 treatments with #8 mixture with peas/fababean/lentil/oats; peas/fababean/lentil/wheat

#8 Mixture includes the same principle as above with a mix of 8 different species (1 cereal, 3 pulses, 2 clovers, and 2 soil amendments).

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Adjusted Plan 2020

Trial: Comparison of monocrop wheat and wheat with four, eight and sixteen species mixes.

Field: Tom McMillian: 150 Acres

Seeding Date: June 26th, 2020

1. Monocrop

Wheat sprayed for broadleaf herbicide on June 26th, 2020. 10 acres of the field was kept as a monocrop to check and compare with end result. Seeding rate was 130lbs/ac (adjusted for 33 plants/ft2 with TKW 40gm)

2. Wheat with Four Species Mix

Inter-seeding has been done with a four species mix. Seeding rate was 10 lbs/ac. Seeded areas were 110 acres.

Crop	Percentage in Mix (%)
Italian Ryegrass	50
Forage Turnip	10
White Clover	30
Berseem Clover	10
Total	100

3. Wheat with Eight Species Mix

Inter-seeding with eight species has been done. Seeding rate was 15 lbs/ac. Seeded areas were 10 acres.

Crop	Percentage in Mix (%)
Crimson Clover	15
Berseem Clover	15
White Clover	10
Italian Ryegrass	20
Japanese Millet	15
Purple Top Turnip	10
Vivant Forage Brassica	10
Forage Kale	5

4. Wheat with Sixteen Species Mix

Interseeding has been done with a sixteen species mix. Seeding rate was 23 lbs/ac. Seeded areas were 10 acres.

Crop	Percentage in Mix (%)
Crimson Clover	15
White Clover	10
Italian Ryegrass	15
Japanese Millet	10

Purple Top Turnip	5
Vivant Forage Brassica	5
Forage Kale	5
Berseem Clover	10
Forage peas	4.5
Red Clover	2.5
Lentils	1.5
Sunflower	4
Common Oats	5
Soybean	4
Triticale (Sunray)	1
Hairy Vetch	2.5

Observations:

The wheat yield in sole crop vs the intercrop was not significantly different although marginally lower. That shows seeding companion intercrop is not a bad approach to overall improve the soil health or economic advantage from the land usage.

The timing of seeding was impacted by heavy rainfall at end of June and early July 2020. The plan is to seed the small scale replicated trial in small plots instead of field scale for 2021. This will help narrow down the choices of mixture in intercropping combination.

Acknowledgement: The current project is funded by Canadian Agricultural Partnership Program under the Adaptive Innovation Stream. The project will collect data in 2021 and 2022.

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Demonstration Pasture Setup for Showcasing Continuous vs. Specialized Grazing Cell Designs, Fencing, and Various Watering Systems

Abstract

One of the biggest challenges for Alberta ranchers is to manage the ever shrinking land base available to them in such a way that both pastures and the land remain healthy, productive and sustainable for future generations. Despite the considerable amount of research and scientific proof available relating to land and herd management, the adoption of improved management is still limited by an inability to foresee the impact that new changes in practices would have on cattle production, grass production for overall economic returns and resource management on the ranch. Producers can read about a lot of management strategies that are already proven to be helpful in increasing the bottom line (profit) for their operation; however, it is almost impossible to believe in the applicability to their own operation unless they see it beforehand and can analyze the pros and cons of each grazing system, water systems, styles of fencing, and their impact on overall grass production.

History & Field Design

The pasture was established in 1979 and was originally used for steers. In 1988, the first heifers were put into the pasture and have remained ever since. The 160-acre pasture is split into 16 paddocks; approximately 10 acres each. There is a central watering/ loafing area as well as a handling facility. The perimeter is fenced with 4 double strand barbed wire, and cross fencing is done with 2 single strand barbed wire that is powered with a solar electric fence. Each paddock is rotationally grazed to allow alternate periods of grazing and rest. If managed properly, these rest periods allow the grass a chance to replenish nutrients after defoliation and, therefore, increase grass production. In a continuous grazing situation some forage resources are continually stressed (no rest); while others may be underutilized as the animals will repeatedly graze the most palatable species. In this situation the preferred species will begin to decline and less palatable species or weeds will begin to dominate the pasture. The existing pasture layout is single alley system. (See schematic diagram on next page).

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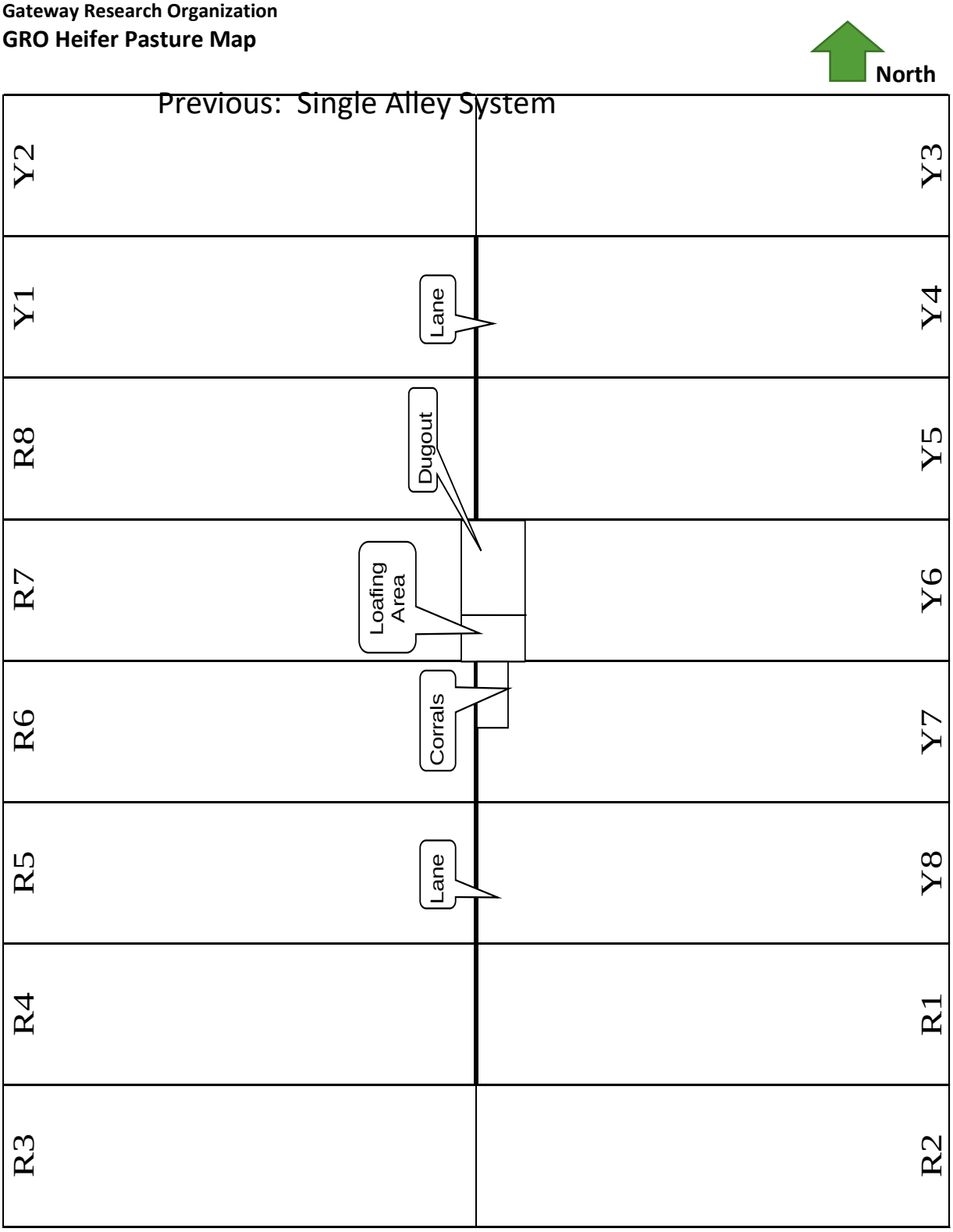
GRO Heifer Pasture Map



Objectives

- Demonstration of practical applicability of different types of cell design strategies used in rotational grazing systems.

- Demonstration of different types of fencing materials and watering system site locations and types to best fit with different types of cell design patterns used in rotational grazing systems.

Methodology

We aim to develop the current Heifer Pasture into a site for future research and as a demonstration center for producer learning activities. With the "GRO Educational Pasture Demonstration" project we aim to showcase how to make sustainable grazing choices for producers not only in our community, but with an applicability to the entire north central Alberta region. The different types of cell designs will prepare producers to tackle drought situations as well as higher moisture situations, which have been two of the most common challenges in the last 10 years for producers. (See schematic diagram of the proposed upgraded changes on next Page).

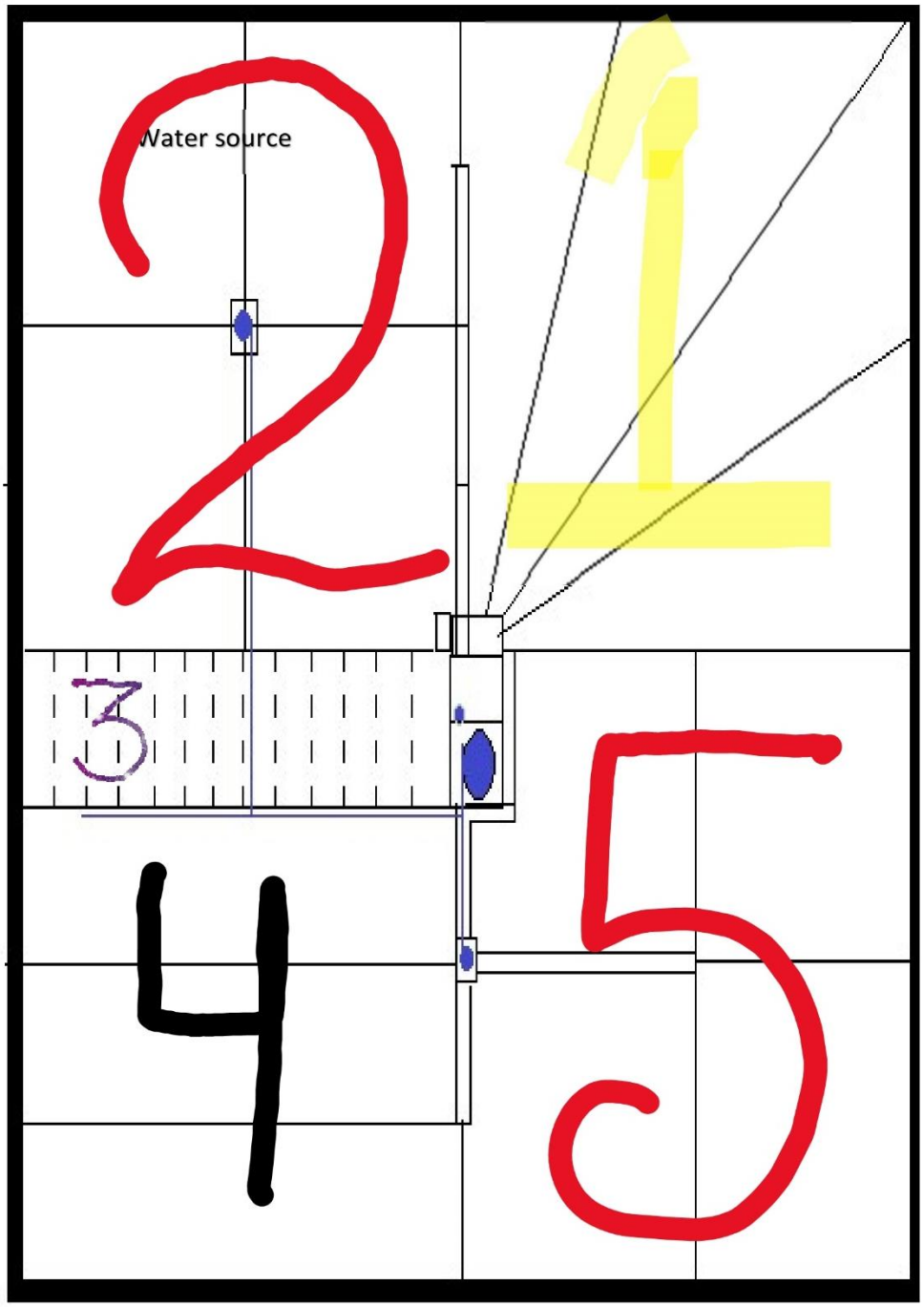
When water holding capacity in pasture lands is enhanced, a producer's ability to mitigate severe weather patterns increases, either by retaining effective rainfall, or by having enough ground cover to avoid erosion from large rainfall events. By seeing first hand the different effects that differing cell designs have on the land, producers will be able to make informed decisions on their own operations.

The Heifer Pasture was previously set up to showcase just one type of cell grazing system. It used a common alley as a walkway to access different paddocks and a central water system. This system is great except in situations of higher rainfall. With low lands, the continuous use of the alley by the animals created problems for the animals (hoof rot, difficulty accessing water, more time spent near the water and less out grazing), as well as the land (compaction in the alleyway).

Based on different topographical situations, a producer may have to make use of more than one type of grazing cell design and subsequently would need to change their current fencing arrangement in order to minimize the damage caused by the formation of livestock walking trails.

North

Proposed Cell design systems for demonstration at GRO: Five different Cell Design Demonstration and three different watering systems.



We want to set up this demonstration of different grazing cell designs to showcase different possible situations so that producers can easily see the pro and cons of each system and what would work best on their own operation without taking a financial risk that would be involved with upgrading the whole farm, based solely on theory.

1. **Wagon-Wheel or Pie System:** The benefit to this system is that it is very cost effective and less laborious to operate. Flexibility of movement is pretty good with this system as all of the paddocks funnel nicely to the central watering area. The paddocks end up being long and narrow, which again tends to cause uneven utilization and bit of overutilization at the hub, or center of the system.
2. **The Square Cell Center System:** The square paddocks allow for more even utilization of the forage and provide good manure distribution. In some cases, where there is no existing water pressure system, it can be costlier to put in. Installation of a more permanent system keeps the fencing cost low and requires little labour in cattle movement.
3. **Portable or Strip Grazing Method for Mob Grazing/High Intensity Grazing**: Grazing for a very short duration with high stock density followed by recovery periods mimics the historic prairie grazing patterns of American bison. This system facilitates uniformity of the pasture for grass utilization, manure spread and a very effective way to control weed species. In this system, there are three permanent fences, and one moving portable fence which creates multiple long rectangles across the pasture. The portable fences give you flexibility on the size of each paddock based on number of animals and allows access to new grass each time that you move the fence. A disadvantage of this system is that it is very labor intensive and producers need to invest time in order to train animals to electric fencing.
4. **Continuous Grazing System:** Continuous grazing has been the traditional way to graze cattle throughout generations. In this system the cattle graze a pasture for an extended amount of time with no, or infrequent rest to the plants from grazing. The biggest advantages to this method are low fencing cost, low daily management requirements, and when stocking rate is correct, acceptable animal gains. This method is unfortunately the most common currently practiced and through current research studies is showing to negatively impact soil health. It also promotes the growth of weed species over time, as the animals pick their favorite plants to graze and leave the weed species to become prolific. Continually grazing a pasture with too many animals, or in year with slow forage growth, will lead to reduced forage availability, quality and animal growth.
5. **The Rectangular One Alley System:** This system is quite common and is relatively inexpensive to set up. A benefit to having rectangular paddocks is that the shape of the paddock makes a bale grazing setup easy. One of the downsides to the alley system is

the excess manure and urine that ends up in the alleyway. Also, based on how intensely you manage the long rectangular paddocks, they will usually become over utilized closest to the water and underutilized at the far end.

Water systems

Proper use of fencing and water systems to manipulate the grazing requirement and efficient distribution of manure. Our demonstration pasture will have different types of temporary and permanent watering systems that can be used as per the producer's requirements, keeping land constraints in mind. Using resourcefulness and creativity, these water systems can be custom designed to best fit long or short term profitability of the ranching operation. Some examples that we would be showcasing are:

- Turkey's Nest: Elevated earthen reservoir with woven polyethylene liner
- Gravity-flow systems
- Solar-powered or gas-powered pumping systems
- Well based system
- Above ground pipeline

This demonstration will be showcasing economically and environmentally feasible grazing management practices to promote health, safety and welfare of animals, as well as the lands that they live on for future generations.

Possible Outcomes

- Increased productivity of pasture will increase the beef production which in turn will reduce the cost of production per kilogram of beef.
- Reduction of the labor required for handling more livestock will increase the carrying capacity and increase the labor efficiency in term of production of the same amount of beef.
- Healthy productive pasture with proper grazing management will have less weed pressure, more biodiversity above and below the pasture land (i.e microbes, insects, earthworms etc.).
- To demonstrate that grazing cattle has the potential to be both economically and environmentally sustainable.

Regenerative Rotational Versus Continuously Grazed Pasture Soil Samples

One of the expected benefits of a regenerative rotationally grazed pasture management system (Paddock 5) versus a continuously grazed pasture (Paddock4) is said to be the improvement in the soil structure, chemistry and biology. While it is early days yet to see differences in these parameters, soil sampling occurred in October 2020 to determine if there were some early observable changes and to create a base line from which to observe future amendments in these soils. The table below show these results and some potential interpretations of what was seen.

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Table 1: Comparison of soil test results from the two side by side pasture (**Pasture 4 and Pasture 5 from schematic diagram).**

Identifiers	Continuously Grazed	Rotationally Grazed (2019-20)	Interpretation
Lab	A&L	A&L	Soils were sent to A & L Labs in London, Ontario, for a detailed chemical and biological analysis
Legal Land Description	SE-23-61-26-W4		
GPS N	54.283333	54.28583	
GPS W	113.781111	113.782333	
Penetrometer 200 lbs	n/a	n/a	There is deep soil penetration in both fields. Neither field reached 200 pounds of pressure to full depth, let alone 300 lbs. Likely in these cases there would be adequate soil infiltration of moisture to minimize runoff, despite a long infiltration timing. Most species, particularly grassy forage species, cannot penetrate soils to a depth that requires 300 pounds' pressure to penetrate but soils in both these paddocks will have adequate root penetration for all species, legumes or grasses.
Penetrometer 300 lbs	n/a	n/a	
Bulk Density (gms/cm-3)	0.74973555	0.659905	***There is relatively low bulk density indicating good soil absorption of moisture and potentially high organic matter.*** Graphs exist that show a relationship between bulk density and organic matter, and these two samples approximate points on this curve.
Infiltration, minutes for 210 ml in 3"	>35 min	>35 min	While standard water infiltration timing is long in both cases, it is suspected that runoff would not be excessive, but would likely instead get captured in the turf and infiltrate in time. More research is needed in order

			to determine how infiltration rates impact water acceptance and holding capacity.
2018-20 crop	Pasture	Pasture	
Organic Matter %	6.6	5.8	Both samples have excellent organic matter, which speaks well for the regeneration of the soil, with adequate ongoing supply of nutrients. While these were only single benchmark sample sets, there was adequate site sampling for us to provide confidence in these organic matter levels which may be increasing faster in the rotationally grazed pasture.
pH	7.0	7.1	Both pastures have optimum pHs. This will generally provide adequate accessibility of nutrients.
Buffer pH	n/a	n/a	When pHs are low, a buffer pH is calculated to determine the amount of lime required to bring them to neutral. This is the ability of the soil to withstand changes in pH, based on the cations, etc. in the soil. This calculation is not required in cases when the pH is optimal.
CEC	23.3	21.9	Cation Exchange Capacity (CEC) measures the ability to hold nutrients such as potassium and magnesium. The value ranges from 2 to 35 meq/100 gms, and is dependent on clay minerals and organic matter in the soil. In these cases, neither sample is out of range & should be okay.
Nitrate Nitrogen N ppmx2=lbs/ac	2-VL	1-VL	PPM (parts per million) of nitrogen multiplied by 2 roughly equals pounds per acre. Current available N is low, but refill from organic matter breakdown is adequate for the pastures.
Season long available N lbs/ac	81	72	Total season long nitrogen with release from organic matter is sufficient for pasture growth for the year. Additions would be needed for annual crops.
Phosphorous-Bicarb P ppm	11-L	14-L	Phosphorous Bicarb indicates phosphorous availability in basic soils. This equates to the amount that can be removed by plants in the soil in the

			current year. Both samples are categorized as low and if no replacement is occurring, there may be shortages occurring in the future.
Phosphorous-Bray- P ppm	18-VL	24-L	Phosphorous Bray tests indicate the readily available P in the soil for plants in total. Most fields require about 20-30 ppm. Phosphorous levels are low, and inherent replacement is not obvious for either paddock.
Potassium K ppm	109-M	112-M	Ideal ranges for potassium are 90 to 150 ppm for light soils and 120-240 ppm for heavier ones. The K content appear to be adequate in both paddocks.
Sulfur S ppm	272 VH	72-VH	Optimum levels of sulfur depend on drainage, CEC, OM, pH, and fertilizer use. These levels of sulfur appear to be more than adequate in both cases. Toxicity of sulfur is not considered likely at any level, certainly not the levels present in the soil of both paddocks.
Magnesium Mg ppm	589 H	426 H	Mg and Ca are closely related to pH, with higher pH soils displaying higher available Mg and Ca in the soil. Adequate levels of Mg usually range from 50-70 ppm. Both of these figures are high but not excessive. This is further determined by its base saturation, which should be above 10%.
Calcium Ca ppm	2860 H	3040 M	Calcium deficiencies are rare when pH is adequate. The comparative analysis of these two soils is inverse, with higher figures indicating a lower level of soil health, so a higher figure being listed as medium instead of high is not a surprise.
Sodium Na ppm	119 VH	214 VH	Sodium may have an impact on the physical structure of the soil, with high sodium soils such as these causing adverse physical and chemical conditions. Both samples appear to be unreasonably, unexplainably high, and may be indicative of potential soil structural issues.
Percent Base Saturations			Percent base saturations refer to the level of the cation exchange capacity that is occupied by a given cation (an element with a positive charge such

			as calcium, magnesium or potassium). Optimum ranges for each are listed below:
% K	1.2	1.3	Optimum range of potassium saturation is 2-5%. These levels are low in both cases and may cause concern for future replacement of K.
% Mg	21	16.2	Optimum range of magnesium is 10-40% These values appear to be within that wide range and should be sufficient for replacement of this valuable micronutrient.
% Ca	61.3	69.4	Optimum range of calcium base saturation is 40-80%. These values both appear to be well within range.
% H	12.6	8.9	Optimum range for hydrogen base saturation is 5-15%. Both are well within range, likely indicating a stability of the favorable pHs in these soils.
% Na	3.7	4.2	Optimum range for sodium saturation is less than 1%. Both paddocks appear to be high here but does not appear to currently have an impact on soil structure, plant growth or fertility, however it may be indicative of potential problems in the future.
Zinc Zn ppm	5.7 H	5.4 H	3-5 ppm is normally adequate for zinc saturation, taking into consideration yield goals, etc. Both samples here appear to be more than adequate, perhaps a bit on the high side but not so much that any potential for toxicity does not currently exist.
Manganese Mn ppm	35 H	35 H	5-10 ppm is considered adequate levels of manganese for most crops. These levels are high in both cases, but not into an excessive range.
Iron Fe ppm	127 VH	162 VH	5-10 ppm is considered adequate for iron. Out-of-range pH is often a consideration for adequate iron availability. These are both listed as very high but iron toxicity is not usually a consideration.

Copper Cu ppm	1.0 M	.9 M	0.3 ppm of copper is considered adequate with the extraction method used here. Low copper levels can cause physical deformities in wheat crops. Both of these samples are well within range.
Boron	1.1 M	1.0 M	Adequate levels of boron usually range from 1-3 ppm, with a variety of factors including pH and organic matter impacting available B through the growing season. Low boron levels have been known to cause deficiency symptoms in canola. These ranges on both paddocks appear to be borderline but not an issue for grass and legume production.
Soluble Salts ms/cm	0.8 L	0.5 L	There is minimal effect of soluble salts below 1 ppm. High soluble salt levels, including sodium, can arise naturally or by overuse of irrigation, fertilizer or wastes, so the high sodium readings, listed above, may not be a large concern.
Saturation %P	6 G	9 H	If this figure is understood correctly, the percentage of bonded P in the soil compared to the total potential saturation of phosphorous, with high levels of P potentially leading to soluble phosphorus leaching away through ground or melt water. Levels over 25-40% are said to be a problem, so while the rotationally grazed figure of 9 is listed as high, it has not reached a problem level as yet.
Aluminum Al ppm	404	363	Aluminum is a common part of the soil crust, largely tied up in compounds. It is not needed in crop production, and can cause harm in higher levels of availability, which increases as the pH drops below 5.5. Aluminum toxicity is possible in low pH soils, but is not likely in these cases. Research reports indicate levels up to 2000 ppm are still acceptable.
Saturation % Al	0.0 G	0.0 G	Very low percentages of aluminum saturation in the soil are required for optimum plant growth and phosphorous availability. Al saturation levels

			above 1% are considered problematic, but neither paddock has a high aluminum saturation level.
K/Mg ratio	0.06	0.08	The ideal K/Mg ratio is .25- .35. Levels outside of this range may indicate a high level of K fertility and possibly reduced Mg availability, required for the production of chlorophyll, necessary for photosynthesis. That is not the explanation for these unusually low ratios. The Mg is particularly high, which makes for a low K/Mg ratio and the potential for Mg to be interfering with K uptake in both fields. More research on this will follow.
ENR	79	71	ENR is the estimated nitrogen release in lbs/ac. This is the amount of N that is expected to be released from the breakdown of organic matter over the nest growing season. This is impacted by environmental conditions and physical conditions. So, despite the low levels of available nitrogen in these soils, the ENR more than makes up for that shortage in both cases.
Chloride CL ppm	133 -H	84 H	Chloride is important in disease prevention, Mg uptake, and N conversion. Ranges below 15 are considered low and may require supplementation in some crops. Most soils are below this figure but these two samples are well above that and provide no impediment to nutrient availability.
Microbial analysis			
Anaerobes-soil	1569 -M	2152 - G	Anaerobes are bacteria that function in oxygen limited conditions, and are often pathogenic. High levels of anaerobes indicate soil problems. Levels below 2000 are best for soil health. *The continuously grazed soil is fine, but the rotational one is higher than that level. Paradoxically the ratings on the graphical depiction of these numbers, the higher number is rated better. This is being investigated.*
Total Gram negative-soil	5209 M	6019 – M	Gram negative bacteria use plant derived carbon sources and are susceptible to population fluctuations if proper agronomic practices are

			not followed. This index should be over 7000 with higher indexes being better for the soil, so these ratings indicate that while Gram negatives are not low, there is room for improvement in both cases.
Nitrogen Fixers soil	2189 M	2133 – M	This is an assessment of free-living nitrogen fixing bacteria in the soil. The optimum index is over 3000. This also indicates how future nitrogen application should be handled, with a lower value implying an excess of nitrogen amendments which would indicate some concerns for changing fertility practices. In these cases, there may be so much N being derived from the organic matter there is not a great need for N fixers to flourish.
Total Microbial activity - soil	14478 - G	17448 – H	This is an index of all the bacteriological and fungal activity in the soil. The majority are beneficial for all necessary soil functions. This index should be over 10,000 for a healthy soil, and both of these soils appear to be more than healthy, with the rotationally grazed field showing a higher level of microbial activity.
Biological Quality Rating	5	5	
General bacteria	2395-M	2437 – M	This is an indication of all bacteria that can metabolize standard carbon sources. Summer ranges for ideal soils is 2500-5000, with lower values in the fall and spring (1200-2500). These fall numbers appear to be adequate in both samples.
Pseudomonas -soil	2862 - M	2803 – M	Pseudomonas is generally a good, gram negative soil bacteria. They quickly colonize roots, help with growth stimulation, enhance plant immunity and improve nutrient cycling Their presence indicate optimum phosphorous saturation levels which support high crop productivity. They also help to balance boron and iron availability in the soil and disease suppression.

			Indexes over 3500 are considered optimal. While these are not bad, neither are in the optimal range at this point.
Trichoderma - soil	181 - L	393 – M	Trichoderma are opportunist soil fungi that have many beneficial soil impacts, including biological control of pathogenic fungi, plant growth promotion and beneficial nutrient solubilization. 500 or more indicate a strong contribution to soil function. While not optimal at this point in time they are approaching that value, with the rotationally grazed soil currently and apparently at a higher level.
Active Carbon ppm	940	939	In medium textured soils, which the soils at the heifer pasture appears to be, reactive carbon ranges are very low from 0-400, low at 401-500, medium from 501 to 600, high from 601-700, and very high over 700. According to an A & L Lab technical bulletin, this is composed of all the dead and actively decomposing organic matter, plus all the living soil microbes that will eventually die and decompose. Both of these soil tests fall into the very high range, which appears to indicate that, given the right conditions, there might be significant volatilization of carbon dioxide.
CO2 Respiration ppm	108	128	Most soil microbes take in oxygen and release carbon dioxide. This in another indication of soil microbial activity, where soil is remoistened and respiration is measured for 24 hours. These levels indicate there appears to be adequate microbial activity in both of these soils.
General Fungi-soil	1138 – M	2331 – M	Soil fungi play an important role in nutrient cycling. It should be 2500-4000 in the growing season, with peak activity in the spring and fall of 4000-6000.Both values could be better at this time of year, but the rotationally grazed soil appears to be at a higher level.
Rhizobium - soil	150 - VL	1084 - M	Rhizobium in soils is an index shows the levels of symbiotic nitrogen fixing bacteria in this family for both legume and non legume crops. 1500 or

			more is considered good. This level would also imply optimum boron levels, which need to be at 2 ppm for optimum ranges of microbial populations. The rotationally grazed soil appears to be approaching this optimal range of rhizobia in the soil.
Actinomycetes	2764 - G	2684 - G	Actinomycetes are hardy bacteria and should have an index below 2500 in highly productive soils with a good physical and chemical balance. These values should be about 1/3 to 2/3 the Gram positive index, ¼ the total Gram negative index, and can be equivalent or lower than the fungal index in productive soils. These soils both have an index above the 2500 threshold and could be a concern.
Gram positives - soil	1222 - L	1433 - L	Gram positive bacteria adapt to extreme soil and environmental conditions better than gram negative ones. Too high a level of this index (over 4000) with low levels of nitrogen fixers indicate a microbial imbalance Whether an imbalance is an indication of poor soil conditions or a result of soil depletion is not yet known. Levels of 2000-4000 are considered beneficial. These are below that but should not be a concern at this point in time.
Mineralizable Nitrogen ppm	49	52	Mineralizable Nitrogen is the amount of N that will become available to plants over the next growing season or more. Multiply this number by roughly 2 to get pounds of N per acre. It is good in both cases.
Total bacteria	11590 - G	12573 - G	Total bacteria measures total bacterial activity. A good balance between bacteria and fungi is required for a properly functioning soil ecosystem. This index should be above 7000, and it is in both cases.
Gram +/Gram -	.77 - L	.68 - L	A number of factors affect this ratio, with Gram positive (a staining technique, used to put all bacteria into two broad classifications) bacteria are a hardier microbe that survive in a wide range of soil and environmental conditions. Gram negative bacterial are smaller and

			sensitive to extreme conditions, and can only survive at near neutral pH. This ratio should be less than 1 to maintain the diversified functional activity of the soil. We are there in both cases, and the L or low graphic indication may be a positive one in this case.
Gram +/ Actinomycetes	.44 - VL	.53 - VL	Actinomycetes are a subgroup of Gram positive bacteria which can indicate problems in the soil. An ideal figure for this ratio is greater than 3, which has not been achieved in either sample, possibly due to high levels of actinomycetes.
Fungi/Bacteria	.11 - L	.22 - L	An ideal ratio for fungi to bacteria is .3-.6, with variations in the spring and fall as fungal numbers increase due to crop residue degradation. Numbers outside of this range may indicate issues, which we could investigate, but the rotationally grazed paddock appears to be improving and approaching the ideal level.
Fungi / Trichoderma	6.31 VL	5.93 - VL	Trichoderma indicate the presence of a good class of soil fungi. A number of this ratio below 50 indicates a stable Trichoderma population, which we have more than achieved in both paddocks.
Aerobe/Anaerobe	1 - L	1 - L	This is a comparison to oxygen using bacteria compared to those which function in low oxygen levels. If this ratio is greater than 5, it indicates average to good quality soils. A ratio below 4 indicates that attention should be paid to improve the physical condition of these soils. We see that in both paddocks here, so we may need to investigate this further.
Soil Health Pseudomonas Pop	24 L	40 – M	In general term, these indices are calculated figures or ratios compared to standards of soil health. In general term the ratings are on a 1-100 scale, with 0-20 considered very low, 21-40 low, 41-60 medium, 61-80 good, and 81-100 high. Specific information on these ratings, where available, are below.

Soil Health Index Total Gram Negs	84- H	56 - M	The population of Pseudomonas species, one of the major groups of Gram-negative soil bacteria. While the number of Pseudomonas in the calculated number, above, is virtually identical for the two paddocks samples, other factors appear to impact the 1-100 soil health Pseudomonas population rating, indicating the possibility that the rotationally grazed paddock has greater soil health from this perspective.
Soil Health Index Gram Positive	61 G	83 - H	These beneficial Gram negative bacteria have a positive impact on soil health, as they actively make nutrients available to plants. While the actual estimated number of Gram negative bacteria appears to be higher in the rotationally grazed pasture, other factors appear to make the soil health index higher in the conventional category for this category. As in all cases, as we are comparing only single soil samples, these results are not truly statistically significant, but rather an indication of what might be the case when a sufficient number of samples were taken for us to have full confidence in these results.
Soil Health Index Gram +/ Gram-_	61 - G	63 - G	In the case of Gram positive bacteria, the lower the population, the higher the soil health index. This appears to be contra indicated by the ratings of these two samples, where the higher population of Gram positives is also rated higher in the soil health index, likely indicating other factors impacting the health index and negating the negative impact of the Gram positive bacteria.
Soil Health Index Fungi: Bacteria	34 - L	49 - M	This index is a indication of the ratio between the ratio between Gram positive and negative bacteria, where when the ratio is below 1, the soil is considered more healthy than soils where the numbers of harmful Gram positive bacteria is greater than the beneficial Gram negative population. Both of these paddocks appear to have healthy ratios of these bacteria.

pH _ Total Gram negatives	45 - M	43 - M	This ratio, as mentioned above is generally considered positive when it falls into the ratio of .3-.6. This impact is magnified when both fungi and bacteria are considered to be in the normal range. The rotationally grazed paddock appears to progressing towards a complete, favorable over all rating.
pH - Fungi: Bacteria	43 - M	51 - M	Soil pH has a major impact on its biology. Both paddocks have near neutral pH and is generally in the range for favorable growth of all soil biota, especially Gram negative bacteria where the appropriate range is generally pH 5-9. As the Gram negative functional index increases over the recommended range of 6000, this rating should also increase. The rotational paddock does appear to be at or above this index, and so the difference in the figures between this rating is not considered significant at this time.
OM - Fungi: Bacteria	52- M	51 - M	Similarly, the comparison of pH to the ratio of fungi to bacteria shows a medium relationship between the two figures, so no flags are raised by this number, but there could be room for improvement. And again, more research is needed to fully understand the importance of this relationship.
PERP - Pseudomonas Population	38- L	52 - M	According to A & L Labs, organic matter plays a strong role in keeping microbial populations healthy and active. Organic matter in soils of both paddocks appears to be adequate, at or near the benchmark of 6% or better and as the soil biology improves, this rating is likely to improve over time, possibly in both paddocks.
CEC - Total Gram negatives	19 - VL	18 - VL	PERP stands for saturation percent of phosphorous. This figure is compared against pseudomonas population. It appears as if this ratio follows the standard range of 0-20 very low, 21-40 low, 40-60 medium, 61-

			80 good, and 81-100 high. More research is required to fully understand why this ratio is important to regenerative soils.
CEC - Total microbial activity	35 - L	14 - VL	Cation Exchange Capacity (CEC) is a main factor affecting biological community shifts. CEC levels of 10-20 in the presence of low organic matter would apparently be adequate to support required microbial diversity. In levels of higher organic matter such as what we have here in both cases, these ratios may be skewed somewhat. Further investigation into these ratios may need to be undertaken to understand and explain whether anything need to be done to improve these figures.
KMg - Total Gram negatives	38 - L	46 - M	An optimum range of a K to Mg ratio is .2 to .35 for a favorable growth environment for beneficial Gram negative bacteria. When this ratio is compared to the current Gram negative community, a 1-100 rating is calculated. This rating may indicate that the Gram negative community in the rotationally grazed pasture is improving, compared to the continuously grazed pasture. More samples would have to be taken to statistically prove the potential for this improvement, but it is an interesting comparison, nonetheless.
B - Rhizobium Related	4 - VL	64 - G	An optimum range of a K to Mg ratio is .2 to .35 for a favorable growth environment for beneficial Gram negative bacteria. When this ratio is compared to the current Gram negative community, a 1-100 rating is calculated. This rating may indicate that the Gram negative community in the rotationally grazed pasture is improving, compared to the continuously grazed pasture. More samples would have to be taken to statistically prove the potential for this improvement, but it is an interesting comparison, nonetheless.

Overall biological index	42 M	52 - M	Studies have shown that Rhizobium and related nitrogen fixing organisms rely on a moderate but not excessive amount of boron to enhance their growth and the fixation of atmospheric nitrogen, reducing the need for N supplementation. Again, if this rating is significant, it would appear as if the microbial population of the rotationally grazed pasture is already more regenerative than the continuously grazed one.
Overall microbial sustainability index	49 M	55 - M	Single benchmark samples do not create a statistically significant analysis, but with the multiple observations going into this index, there might be a trend towards considering the rotationally grazed paddock to have made more progress towards long term sustainability.

VL=Very low, L=low, M=Medium, G=Good and H=High

Highlighted row = Rotational grazed paddock had significant advantage over continuous grazed one.

The above table is full explanation guide for producers to interpret the soil analysis. Please refer to each parameter and see the remarks. As both the paddocks in GRO leased pasture were managed as similar rotational management until 2018, after which one paddock was changed to as continuous grazing purpose. The chemical and physical parameter did not differ much in two paddocks. However, within two years grazing management changes it appears that rotationally grazed paddock have made more positive results for overall microbial and biological index as compared to continuous paddock. .

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Effect of Liming Application on Crop Rotation and Clubroot

Background:

The number of fields infested 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. It continues to spread throughout 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 resistance has been overcome in close to 200 fields in Alberta (Nicole Fox M.Sc.). The biggest reason is linked to close rotation of canola crop.

Canola is Canada's most important agricultural source of revenue, generating about 25% of all farm cash receipts. The first infestation of clubroot on canola was discovered in 2003 in central Alberta. Clubroot disease in canola can be considered the largest economic threat. Research done by Nicole Fox for M.Sc thesis (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."

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 the yield of HRS wheat, yellow peas and canola over a 3 year time period.

Increasing the soil pH to > 7.2 is not common practice. Most of the research that has been done in Alberta or northern British Columbia on soil pH amelioration was done from 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 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 topsoil. In 2019 about 50% of Alberta soils have 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. (source: Doug Penney, Lacombe June 26, 2019)

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

Objectives:

1. Determine the annual impact on the yield on plots treated with lime to a soil pH ≥7.2 vs Control (not limed) plots for a typical Alberta crop rotation of canola, HR wheat and Yellow peas over three years.
2. Evaluate the effectiveness of different liming products alone or in combination.
3. Evaluate the effectiveness of increased soil pH (≥7.2) on clubroot disease spore and disease occurrence on the roots (clubroot trial).
4. Assessment of soil health at the start of trial year 1 and the end of trial year 3.

Project Plan:

The project started in the fall of 2019 to provide enough time to have soil sampling done so lime requirement curves could be developed.

Yield Trial:

The three crops (canola, Hard Red Wheat and Yellow peas) are grown on soil with adjusted pH to >7.2. Soil pH is amended to >7.2 by using the following treatments:

- Check (no lime applied)
- 100% hydrated lime
- 75% hydrated lime & 25% crushed limestone
- 50% hydrated lime & 50% crushed limestone
- 25% hydrated lime & 75% crushed limestone
- 100% crushed limestone

Trial Design:

Suggested rotation:	/; .,'n,mii,	Block 2	Block 3
Year 2020	Canola	Hard Red Wheat	Yellow Field Peas
Year 2021	Hard Red Wheat	Yellow Field Peas	Canola
Year 2022	Yellow Field Peas	Canola	Hard Red Wheat

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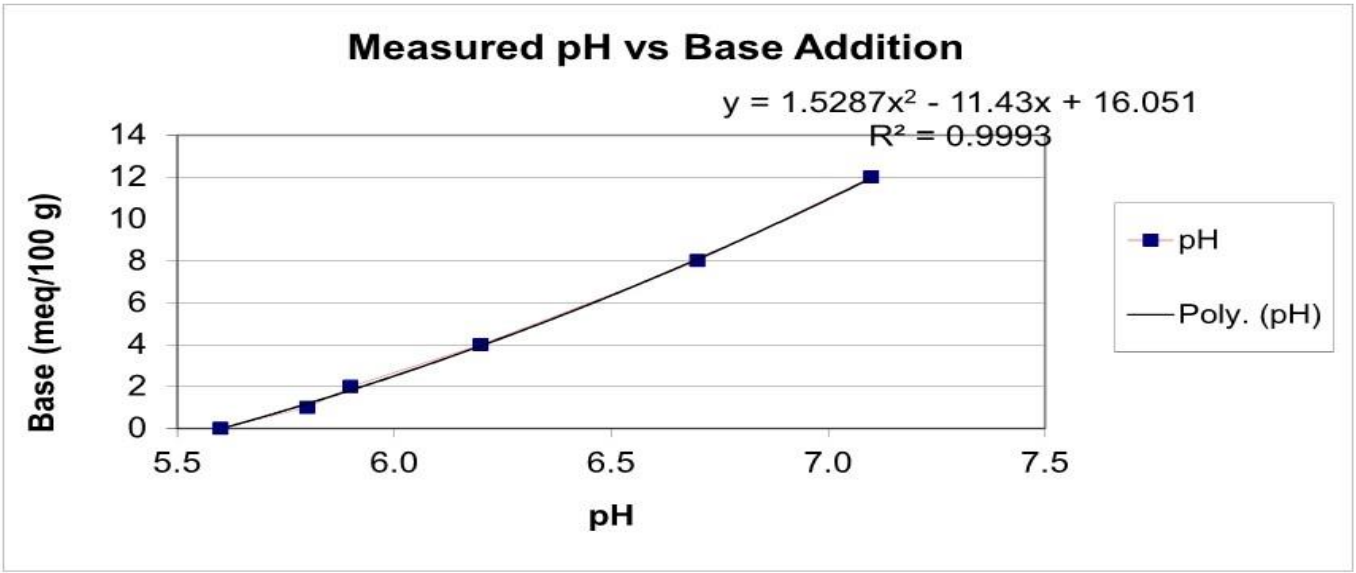
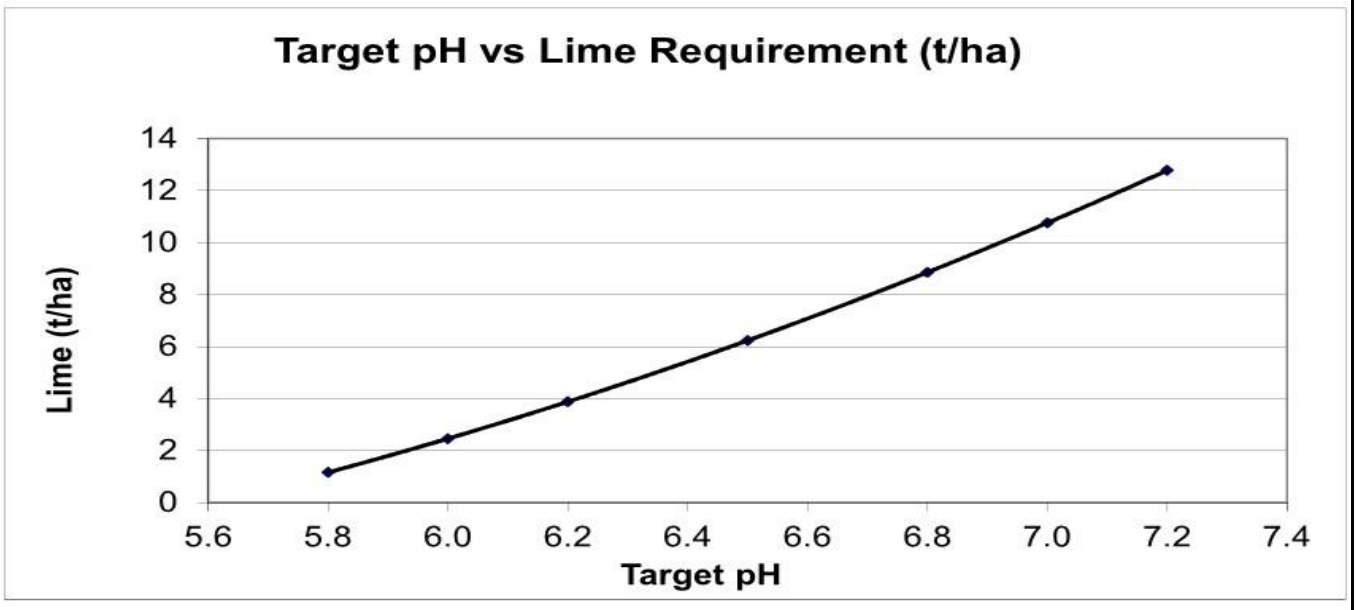
Soil pH Curve of Topsoil (0-3”)

Base Addition	meq/100 g	0	1	2	4	8	12
Resulting pH	pH	5.6	5.8	5.9	6.2	6.7	7.1



Theoretical Lime Requirement

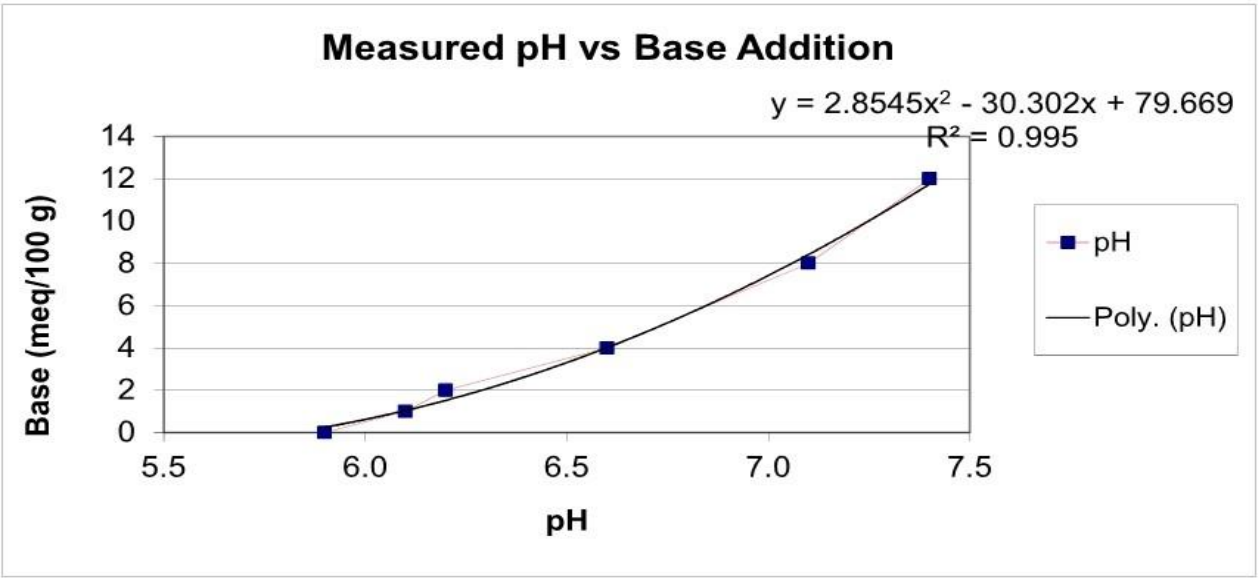
Target pH	5.8	6.0	6.2	6.5	6.8	7.0	7.2
Base Required (me/100g)	1.2	2.5	3.9	6.3	9.0	10.9	13.0
CaCO3 (mg/kg)	596	1262	1990	3197	4543	5517	6553
Lime Required (t/ha)	**1.2**	**2.5**	**3.9**	**6.2**	**8.9**	**10.8**	**12.8**



Note: Only valid within pH range measured

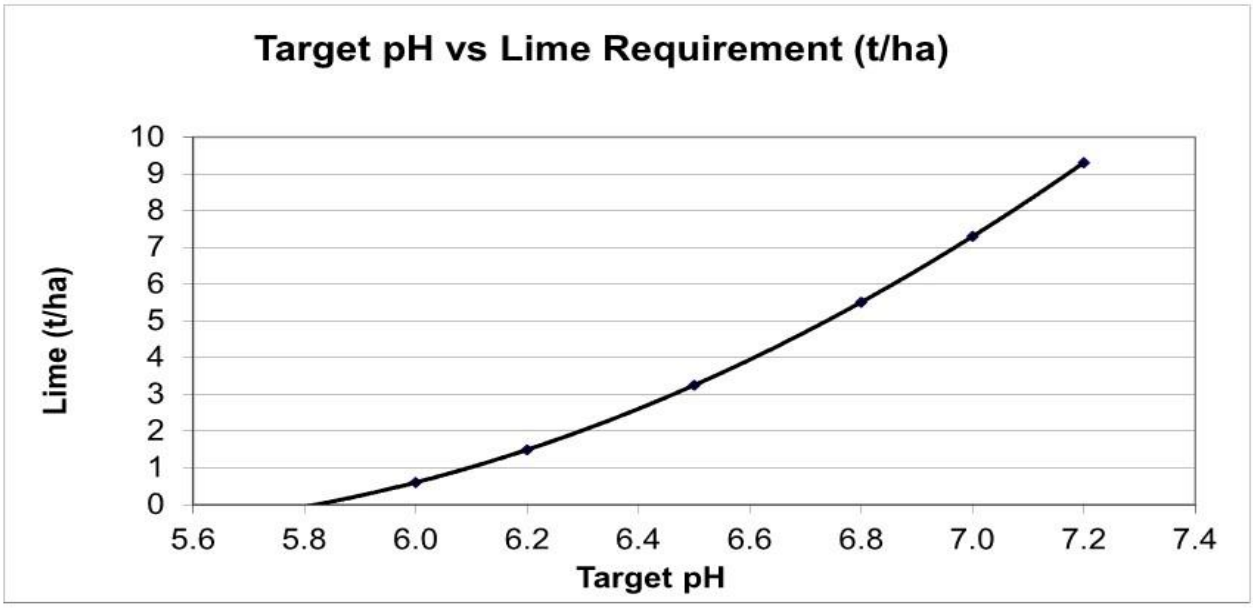
Picture: Soil pH Curve of Lower Soil (3-6”)

Base Addition	meq/100 g	0	1	2	4	8	12
Resulting pH	pH	5.9	6.1	6.2	6.6	7.1	7.4



Theoretical Lime Requirement

Target pH	5.8	6.0	6.2	6.5	6.8	7.0	7.2
Base Required (me/100g)	-0.1	0.6	1.5	3.3	5.6	7.4	9.5
CaCO3 (mg/kg)	-29	312	768	1668	2826	3742	4774
Lime Required (t/ha)	**-0.1**	**0.6**	**1.5**	**3.3**	**5.5**	**7.3**	**9.3**



Note: Only valid within pH range measured

Based on the above soil pH curve and the lime equivalency factor, the following lime calculation were made for each treatment.

	Treatment	Crushed lime (ton/acre)	Hydrated lime (ton/acre)
1	Control	0.0000	0.0000
2	100% Hydrated lime	0.0000	1.4855
3	75% Hydrated lime +25% Crushed lime	0.3904	1.1712
4	50% Hydrated lime +50% Crushed lime	0.8188	0.8188
5	25% Hydrated lime +75% Crushed lime	1.2853	0.4284
6	100% Crushed lime	1.7898	0.0000

Lime Application: Lime was applied in each plot using Scott's lime applicator. It was tedious work, and a strong wind was a big hurdle in controlling the application. Our target was 5% more than the calculated numbers above (minimize loss). After each plot, the exact amount of lime was measured. The whole site was rototilled to a 4-inch depth after the lime application.

Agronomic information:

	Project Description
Seeding specifics	June 4 & 5, 2020
	1-inch peas & wheat, ½ inch canola
	Project Description
Fertilizer/acre	• Peas – Side banded: 5.74-7.4-39.3-4.9 204 lbs/ac Seed placed: 11-52-0 58 lbs/ac • Wheat – Side banded: 27.5-2.5-15-5 363 lbs/ac Seed placed: 11-52-0 58 lbs/ac • Canola – Deep banded: 24-0-12-14 506 lbs/ac Side banded: 11-52-0 80 lbs/ac
Herbicide	Glyphosate 250ga/ac June 25, 2020 (canola) Viper 404 ml/ac June 25, 2020 (Peas) Curtail M 700 ml/ac June 25, 2020 (Wheat) Axial 500 ml/ac June 25, 2020 (Wheat)
Rainfall	Recorded from May 1 to Sept 15, 2020: **374.1mm**
Harvest Date (peas, wheat & canola)	September 28, 2020

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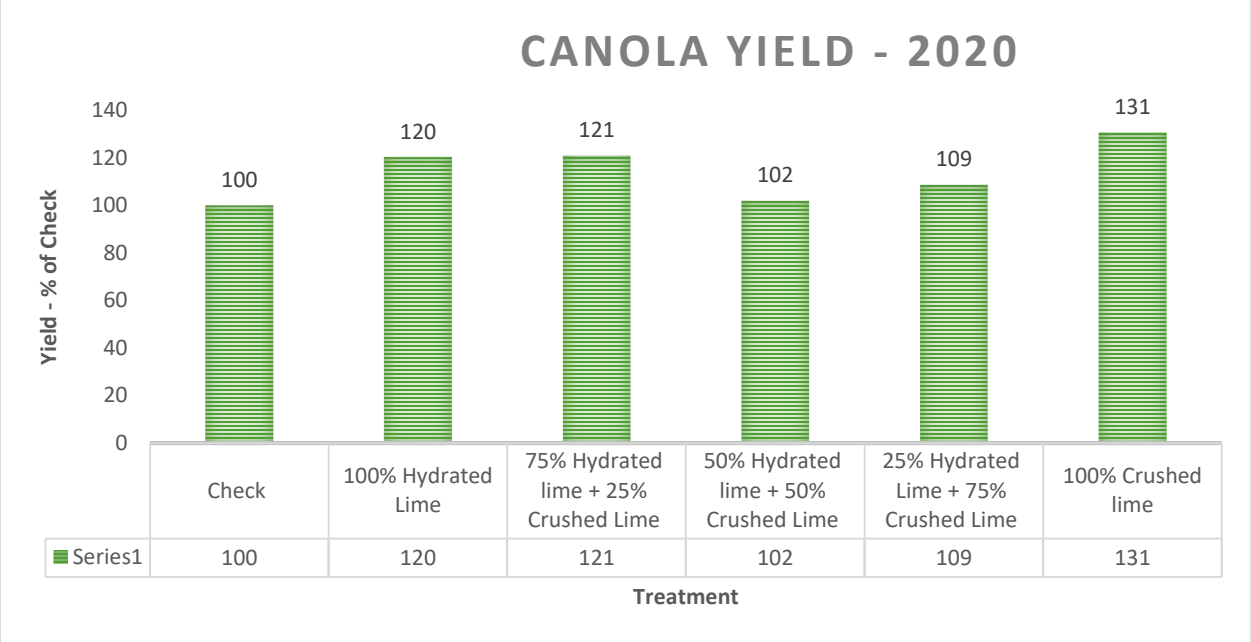
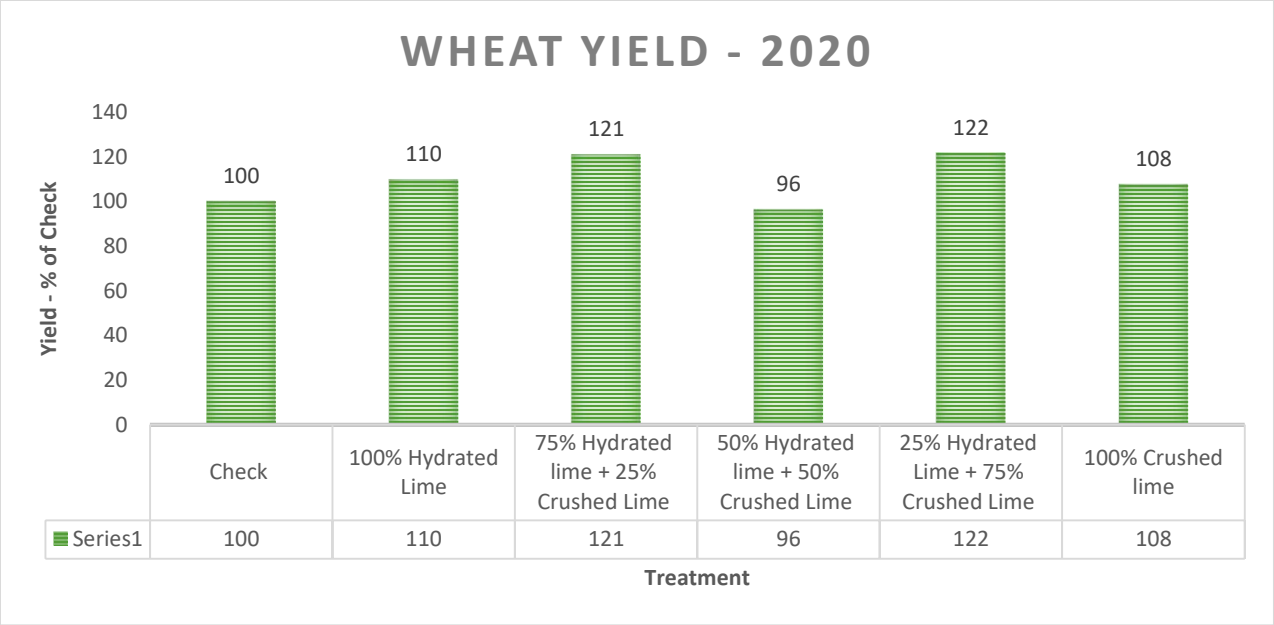
Results: Canola:



	Treatment	Height cm		Oil %		Yield bu/ac		% of Check
1	Check	98.5	-	49.6	-	41.3	-	**100**
2	100% Hydrated lime	101.8	-	51.4	-	49.8	-	**120**
3	75% Hydrated lime + 25% Crushed lime	104.3	-	52.7	-	49.9	-	**121**
4	50% Hydrated lime + 50% Crushed lime	100.5	-	52.1	-	42.1	-	**102**
5	25% Hydrated lime + 75% Crushed lime	98.8	-	52.5	-	44.9	-	**109**
6	100% Crushed lime	112.3	-	50.5	-	54.0	-	**131**
	LSD P=.05	19.29		2.58		12.52		
	Standard Deviation	12.80		1.71		8.20		
	CV	12.46		3.33		17.53		

Overall yield was lower in 2020 in the area in general due to excessive moisture early in the season. The canola results show that the check had less yield than all the liming treatments. The range was up to an increase of 31% in yield.

- **Wheat**



	Treatment	Height cm	Protein %	Test Wt kg/HL	TKW g	Yield bu/ac	% of Check
1	Check	75 -	11.6 -	84.8 -	36.4 -	51.4 -	**100**
2	100% Hydrated lime	82 -	12.0 -	83.6 -	35.5 -	56.4 -	**110**
3	75% Hydrated lime + 25% Crushed lime	83 -	11.4 -	84.0 -	37.1 -	62.2 -	**121**
4	50% Hydrated lime + 50% Crushed lime	79 -	11.0 -	85.5 -	37.4	49.5 -	**96**
5	25% Hydrated lime + 75% Crushed lime	82 -	11.4 -	84.4 -	36.3 -	62.5 -	**122**
6	100% Crushed lime	78 -	10.8 -	83.1 -	34.5 -	55.3 -	**108**
	LSD P=.05	6.51	1.13	3.24	3.65	23.51	
	Standard Deviation	4.32	0.75	2.15	2.37	14.92	
	CV	5.41	6.6	2.55	6.59	25.76	

Lime application had a variable effect on the wheat crop. The range was a 26% increase to even a loss of -15% in yield. More data needs to be collected for establishing a clear trend on the liming impact on wheat yield and quality.

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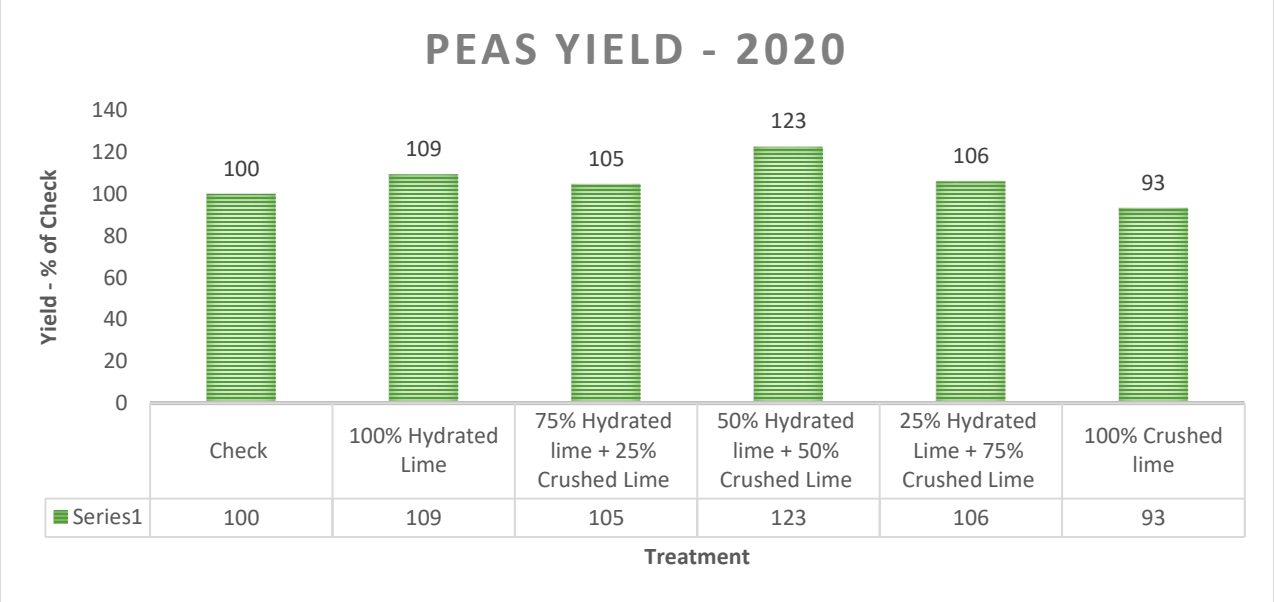
Peas



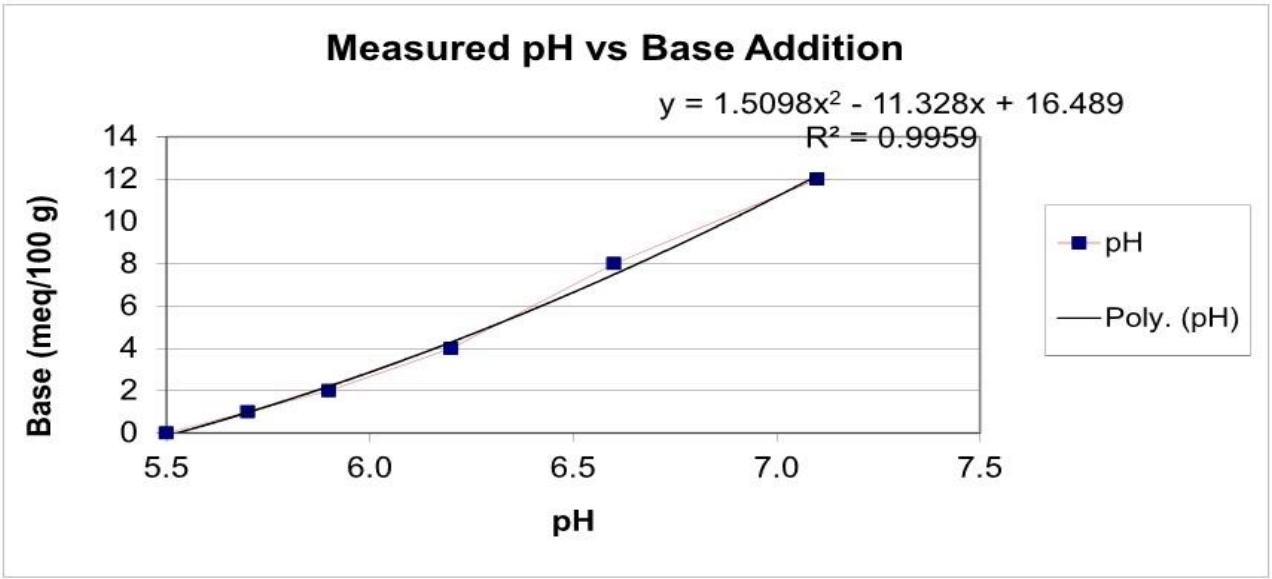
	Treatment	Height cm		TKW g		Yield bu/ac		% of Check
1	Check	84.3	-	259.65	-	64.3	-	**100**
2	100% Hydrated lime	92.1	-	283.6	-	70.32	-	**109**
3	75% Hydrated lime + 25% Crushed lime	82.4	-	271.8	-	67.24	-	**105**
4	50% Hydrated lime + 50% Crushed lime	90.9	-	265.55	-	78.79	-	**123**
5	25% Hydrated lime + 75% Crushed lime	88.4	-	273.1	-	68.15	-	**106**
6	100% Crushed lime	83	-	277.18	-	60	-	**93**
	LSD P=.05	13.59		32.34		21.66		
	Standard Deviation	8.13		21.45		12.95		
	CV	9.37		7.89		19.67		

The lime source and rate had a less positive impact on the yellow peas yield. Again, when we are able to look at multi-year data from multiple locations at the end of the three-year trial period, we hope to establish if liming had any adverse or positive impact on peas yield and quality.

Gateway Research Organization

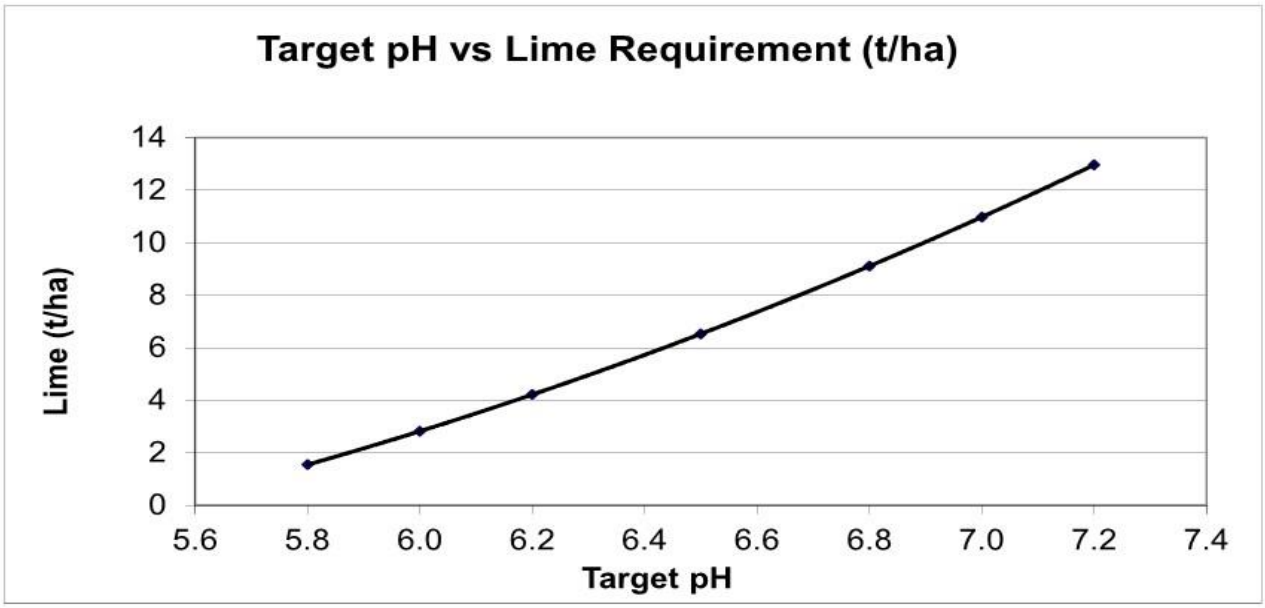
Soil pH Curve of topsoil (0-3”)

Base Addition	meq/100 g	0	1	2	4	8	12
Resulting pH	pH	5.5	5.7	5.9	6.2	6.6	7.1



Theoretical Lime Requirement

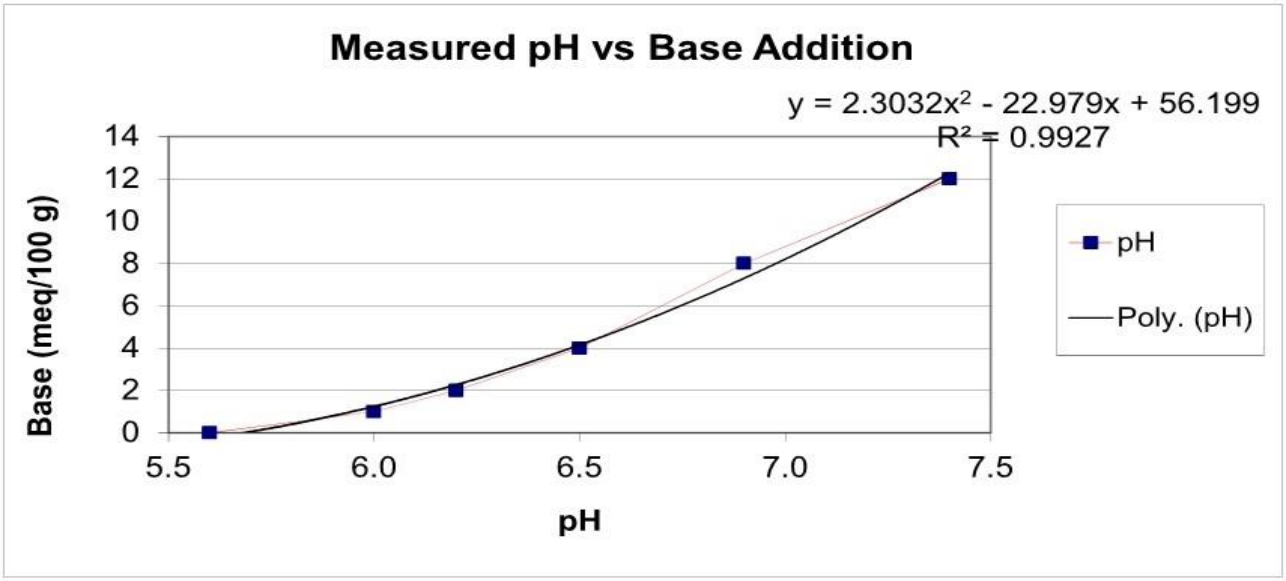
Target pH	5.8	6.0	6.2	6.5	6.8	7.0	7.2
Base Required (me/100g)	1.6	2.9	4.3	6.6	9.3	11.2	13.2
CaCO3 (mg/kg)	794	1448	2163	3350	4673	5631	6650
Lime Required (t/ha)	**1.5**	**2.8**	**4.2**	**6.5**	**9.1**	**11.0**	**13.0**



Note: Only valid within pH range measured

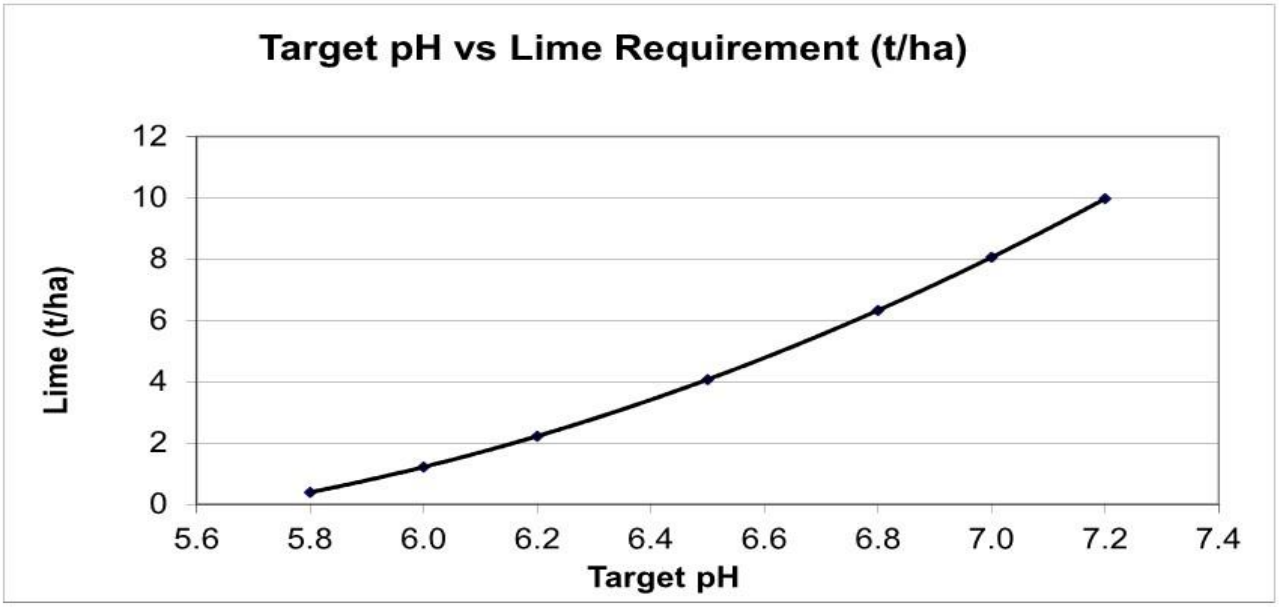
Picture: Soil pH Curve of lower soil (3-6”)

Base Addition	meq/100 g	0	1	2	4	8	12
Resulting pH	pH	5.6	6.0	6.2	6.5	6.9	7.4



Theoretical Lime Requirement

Target pH	5.8	6.0	6.2	6.5	6.8	7.0	7.2
Base Required (me/100g)	0.4	1.2	2.3	4.1	6.4	8.2	10.1
CaCO3 (mg/kg)	202	625	1141	2089	3247	4134	5115
Lime Required (t/ha)	**0.4**	**1.2**	**2.2**	**4.1**	**6.3**	**8.1**	**10.0**



Note: Only valid within pH range measured

Based on the above soil pH curve and the lime equivalency factor following lime calculation were made for each treatment.

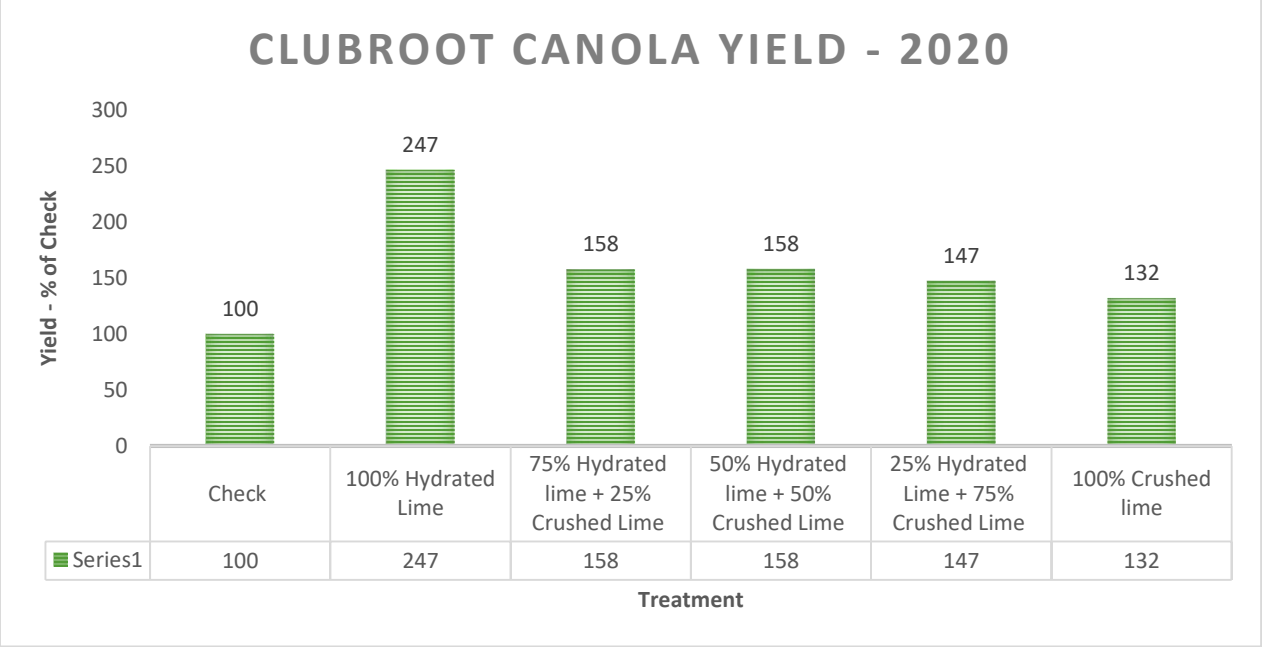
		Crushed lime (t/acre)	Hydrated lime (t/acre)
1	Control	0.00	0.00
2	100% Hydrated lime	0.00	1.50
3	75% Hydrated lime +25% crushed lime	0.40	1.19
4	50% Hydrated lime +50% Crushed lime	0.84	0.84
5	25% Hydrated lime +75% Crushed lime	1.33	0.44
6	100% Crushed lime	1.87	0.00

Lime Application: Lime was applied in each plot with using Scott's lime applicator. Later, the whole site was rototilled to a 4-inch depth after the lime application.

Agronomic information:

	Project Description
Seeding specifics	June 5, 2020
	½ inch canola
	Project Description
Fertilizer/acre	• Canola – Deep banded: 24-0-12-14 506 lbs/ac Side banded: 11-52-0 80 lbs/ac
Herbicide	Glyphosate 250ga/ac June 25, 2020 (canola)
Rainfall	Recorded from May 1 to Sept 15, 2020: **374.1mm**
Harvest Date (canola)	September 28, 2020

Results:



No	Treatment	Yield % of Check
1	Check	**100**
2	100% Hydrated lime	**247**
3	75% Hydrated lime + 25% Crushed lime	**158**
4	50% Hydrated lime + 50% Crushed lime	**158**
5	25% Hydrated lime + 75% Crushed lime	**147**
6	100% Crushed lime	**132**

Disease (clubroot) Severity Index:

Trt No.	Treatment	DISEASE(CR) SEVERITY INDEX
1	Check	0.99
2	100% Hydrated lime	0.77
3	75% Hydrated lime + 25% Crushed lime	0.94
4	50% Hydrated lime + 50% Crushed lime	0.95
5	25% Hydrated lime + 75% Crushed lime	0.98
6	100% Crushed lime	0.94

"Disease Severity Index was calculated clubroot Severity % multiply clubroot Incidence %".

- In the clubroot of canola trial, there was a **noticeable difference within treatments compared to the check.** The clubroot infection severity was delayed in lime applied treatment as compared to the check. The liming application had a visual observable positive impact on canola plant health.

Future Plan for 2021:

The soil samples for pH analysis will be taken from individual plots before the seeding of summer 2021 before seeding. This will help us see the efficiency of achieving the targeted pH for each treatment. If needed additional lime will be applied for each treatment type. In addition, soil samples for in depth biological assessment will be taken from each treatment.

Acknowledgement: The current project is funded by **Graymont** and Canadian Agricultural Partnership Program under the Adaptive Innovation Stream. The project will collect data in 2021 and 2022.

Gateway Research Organization

Adaptive Management On Marginal Lands Under Continuous Cropping in North Central Alberta

Background: Marginal land for our project is defined as land with limitations for profitable agricultural production and under continuous annual crop production for four consecutive years. We hypothesize that profit from crop production on such land has increased risks of disease and pests and might not be worth the inputs applied. For example, clubroot infestations are of increasing concern and the degradation of soil quality including increased greenhouse gas (GHG) emissions are occurring in these areas. Although producers might be lucky to gain a net profit out of these marginal lands with occasionally steep grain prices and favorable environmental conditions, it is very important to understand the long term economic and environmental consequences of a range of management options in these challenging conditions.

Optimizing economic returns while maintaining the productive capacity of marginal lands may require looking at alternative management to what is currently being practiced. Producers have to manage marginal lands carefully, based on the limitation they have. For example, growing crops that can be grazed by livestock will lower risks of losses from early frosts. Perennial crops can break disease and pest cycles while increasing soil carbon sequestration and improving the soil's resilience to changing climates. Fertility management plans will improve nutrient recovery from sandy soils, where chances of nutrient leaching are greater than with clay or loam soil.

Partnering municipalities currently have conservation programs in place. We plan to work with those program participants to collect data on the long-term economic feasibility of adaptive management projects as compared to portions of the land under current management. Additional measurements, estimates, and information about soil carbon sequestration, greenhouse gas (GHG) emissions, and other co-benefits will also be collected. Participation in this comparative project will be voluntary for farmers and ranchers making conservation efforts.

The study area will include seven collaborating counties in north central Alberta, the County of Barrhead; Lac Ste. Anne County, M.D. of Lesser Slave River, Thorhild County Westlock County, and Woodlands County, and Yellowhead County. Clubroot infestations were confirmed on more than 50 fields in four of these six counties[1]. Disease incidence probability increases with the more moisture available.

Sites for data collection will target lands classified as Class 4 (Severe Limitations) to Class 7 (Unsuitable), based on the Land Suitability Rating System (LSRS) for spring grains[2] as these are most likely to show benefits from adaptive management. Soil limitations in the area are primarily due to cold temperatures and excess moisture. Table 1 shows the results of a preliminary analysis of the AGRASID[3] soils database and the Annual Crop Inventory[4] where close to 70% of the

cropland in the six counties continuously grew an annual crop (e.g. various combinations of canola, wheat, barley or peas) each year from 2014 to 2017. About 20% of this area of continuous annual cropping is on marginal lands (LSRS > 4).

Table 1. Extent of continuous annual cropping (2014 to 2017) on marginal lands (class 4 to 7).

County	Continuous Annual Crop Area[4] (acres)	Continuous Annual Crop on Marginal Lands[3] Area (acres)	% of Continuous on Marginal Lands (%)
County of Barrhead	148,939	16,938	11
Lac Ste. Anne County	59,928	6,577	11
M.D. of Lesser Slave River	10,103	786	8
Westlock County	331,964	80,941	24
Woodlands County	16,104	2,370	15
Yellowhead County	20,894	7,684	37
Total	587,931	115,297	20

Outcome: The project will document/monitor current management practices for each farmer cooperator and apply adapting management techniques and diagnostics to identify and address the limitations for each parcel of land. These results will inform plans to switch to or test alternative cropping or other systems, such as cover crops, multi-stage crops, perennials, woodlots or other alternatives that may be feasible and more economically and environmentally sustainable in the long term. Results of alternative management will be documented to demonstrate changes in economic and environmental outcomes relative to current practices.

For example: The science-based estimates of soil organic carbon changes for the first 20 years of increasing perennial vs annual crops in the Parkland zone based on Canada's National Inventory Report with increased perennial instead of annual crop are - 0.55 Mg /ha /year or 0.22 t /ac /year. The following table is a quick analysis of the increase in soil carbon in tons/acre from the project. A goal for the project is a 30% adoption of adaptive management for marginal land, which would target the improvement of the 115, 297 acres.

Total Marginal	**Soil Organic Carbon (SOC)**					**Total SOC**
Assume 30% adoption	**No Till (Underseeded)**	**Year 1**	**Annual to Perennial**	**Year 2**	**Year 3**	**Yrs 1 to 3**
(ac)	**(t / ac / yr)**	**(t)**	**(t / ac / yr)**	**(t)**	**(t)**	**(t)**
34,589	**0.06**	**2,075**	**0.22**	**7,609**	**7,609**	**17,295**

The project will track changes from A) current or baseline practices to B) new adaptive management strategies chosen by each farmer cooperator, including details of:

- Initial site-specific characteristics and limitations (e.g. climate, moisture, fertility, nutrients, pH, infiltration, bulk density)
- Inputs (e.g. fertilizers) and outputs (e.g. yield)
- Production economics (e.g. contribution margins from AgriProfit cropping alternatives[5])
- Changes in soil health (e.g. soil carbon, infiltration, bulk density, fertility)
- Net GHG emissions using the Holos6 tool in common units of carbon dioxide equivalent (e.g. CO2e)
- Identification of co-benefits (e.g. riparian improvements, expected impacts on water quality, climate adaptation)
- Tracking may occur on a sub-field basis, where there is interest

Tracking inputs and yields from current and new adaptive management options will provide the information needed to calculate long-term contribution margins, as well as changes in farm-scale GHGs. Comparisons of current with adaptive management options will identify success factors to support viable management strategies. These results, along with the identification of co-benefits such as adaptation and water quality improvements will highlight improvements that can be made in other areas with similar characteristics, encouraging more widespread adoption of improved management.

The AgriProfit$[5] Cropping Alternatives approach and database developed by Alberta Agriculture and Forestry will be used as the basis for tracking inputs, yields, and contribution margins. This study has recently been expanded to include a wider range of cropping and livestock participants in various regions of Alberta. Application of these recent results will be of interest to farmers and project results will provide feedback to AgriProfit$ analysts.

The Holos[6] tool was developed to assess net GHG emissions at farm scale by scientists with Agriculture and AgriFood Canada. Holos is based on peer-reviewed science and is aligned with Canada's international reporting on GHG Sources and Sinks in Canada[7]. It will provide the basis for tracking changes in soil carbon sequestrations and GHG emission reductions. An economics component was recently added to Holos that will also help to quantify the economic aspects of management options. It is also aligned with Canada's National Inventory Report[8]. Holos has been incorporated into sustainability tools developed for the cropping sector (e.g. Canadian Fieldprint Calculator[9]). Holos has also provided the basis for evaluating GHG emissions and productivity for a number of life cycle assessments of integrated cropping and livestock systems in Canada's beef and dairy sectors.

The seven counties have similar soil limitations and environmental factors such as frost-free days, growing degree days and moisture situations. In addition, the area under continuous cropping in these counties is quite large, despite the unsuitability of some of the land for annual cropping.

Higher land prices and rental rates, the need for more inputs and challenging climatic conditions are making it increasingly difficult for farmers to realize profits from current practices on marginal lands. The project aims to work in collaboration with provincial, municipal and local applied research association experts and leading producers to identify the problem and their solution. Demonstrations of economically viable, alternative management practices will help to encourage adoption of adaptive management improvements.

This project will increase the farmer's familiarity with factors that increase long-term economic and environmental sustainability. For example, introducing more perennial pasture plants into annual cropping systems can reduce GHG emission levels from livestock production as perennial plants capture more atmospheric carbon and ultimately increase storage in the soil. The need for sustainable production practices such as intercropping are increasing while the demand for increased production, improved land use, and profitability is rising as well. So in order to balance sustainability and profitability, the producer needs to be educated about both at the same time.

With intercropping options, producers will have a greater yield advantage or a higher Land Equivalent Ratio (LER). According to the FAO10, LER is the ratio of the area under sole cropping to the area under intercropping needed to give equal amounts of yield at the same management level. LER is the sum of the fractions of the intercropped yields divided by the sole-crop yields. Learning more about this production method and its benefits to the livestock and cropping sectors in Alberta could mean increased economic gains as well as assurances that the agriculture industry is making strides in maintaining its reputation for high production standards as well as sustainability. Including forage in their crop rotation is another approach that will be beneficial for the producers. Research has shown that increased rotation impacts the net greenhouse gas (GHG) emission to the atmosphere. Management practices that concurrently improve N use efficiency and increases soil organic carbon stocks are needed for cropping systems to be net GHG sinks11. Increased familiarity will also help farmers improve record keeping which can open opportunities in new markets. So, this wide-ranging project involving research plots, demonstrations, farm figure calculations, and analyses is a new and innovative program designed to make local agriculture more profitable while reducing its impact on the environment.

Acknowledgement: The current project is funded by **Canadian Agricultural Partnership (Environmental Stewardship Program)** for this initiative. The project will collect data in 2021 and 2022.

References

[1]Cumulative clubroot infestation in Alberta, at: https://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/agdex11519

[2]Land Suitability Rating System for Small Grains, at: https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag16315

[3]AGRASID, Agricultural Region of Alberta Soil Inventory Database, Agriculture and Forestry, at: https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag10372

[4]Crop Inventory, AAFC, at: https://open.canada.ca/data/en/dataset/ba2645d5-4458-414d-b196-6303ac06c1c9

[5]AgriProfit$ Cropping Alternatives for Alberta Crop and Forage Producers, at: We https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/econ15298

[6]Farm Sustainability Readiness Tool: https://www.farmsustainability.ca/en/about

[7]Holos, at: http://www.agr.gc.ca/eng/science-and-innovation/agricultural-research-results/holos-software-program/?id=1349181297838

[8]Greenhouse Gas Sources and Sinks in Canada, at: https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html

9Canadian Fieldprint Calculator, at: http://fieldprint.ca/why-participate/what-is-it/

[10] Food and Agriculture Organization Soils Bulletin 55, at: http://www.fao.org/3/x5648e/x5648e00.htm#Contents

[11]Liebig et al. 2019. Net global warming potential of spring wheat cropping systems in a semiarid region. Land, 8(2), 32; https://doi.org/10.3390/land8020032

Gateway Research Organization

Alberta Soil Health Benchmark Monitoring Project

Background

The project is designed to promote a better understanding of soil health and develop a provincial data base of physical, biological and chemical soil parameters, all of which contribute to an over-all measure of soil health. The project will also measure the impact of various farmers' management practices on soil characteristics.

Chemical components of soil have been intensively evaluated by commercial soil testing labs in Canada, used primarily for chemical fertility recommendations. The role of soil biology, however, is not well understood and physical characteristics have not been monitored in detail. 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. Understanding and managing for a diverse micro-biological functional group underground 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.

Participating Organizations (Alphabetical order)

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

Gateway Research Organization

Progress to Date: Staff from all participating organizations have visited fields and pastures across to do on site evaluations of compaction and infiltration and to collect samples for lab assessments. 1297 samples have been processed to date (606 in 2019 and 691 in 2020). These samples were collected by the 11 partnering associations on 713 fields belonging to 331 farmers and/or ranchers. Reports for each field have been shared with the associations and their cooperating producers. Dr. Yamily Zavala has met with several of the farmers through webinars to discuss the reports.

Data from the sites is being compiled into a large data base. Management practices farmers are using at each of the sites will be monitored during the next few years. Sites will be revisited to determine the impact of management during the 2019-2022 period.

	2019			2020			Total		
	Farmers	Fields	Total Samples	Farmers	Fields	Total Samples	Farmers	Fields	Total Samples
BRRG	1	1	1	16	22	38	17	23	39
CARA	23	47	56	21	43	185	44	90	241
FS	14	31	38	21	35	57	35	66	95
FFGA	13	54	82	7	24	36	20	78	118
GRO	11	23	34	8	17	28	19	40	62
GWFA	10	19	26	19	32	34	29	51	60
LARA	8	20	38	0	0	0	8	20	38
MARA	0	0	0	22	27	94	22	27	94
NPARA	17	38	48	10	23	27	27	61	75
PCBFA	18	78	155	24	26	68	42	104	223
WCFA	9	15	20	28	44	72	37	59	92
Other	25	58	108	17	36	52	42	94	160
Total	**138**	**384**	**606**	**193**	**329**	**691**	**331**	**713**	**1297**

Methodology

- Association staff were trained in CARA's Soil Health Sampling Protocol and collection of site information by Dr. Yamily Zavala
- Each association received a Soil Health Sampling Kit which included the tools for site evaluations (compaction and infiltration measurements) as well as soil collection
- Additional supplies have been provided as required.
- GPS coordinates were recorded for each site

- Site history is being documented
- Parameters that have been analyzed:
    - Physical (on-site):
        - compaction (penetrometer on site)
        - infiltration
    - Physical (on-site or at CARA Lab):
        - wet aggregation stability (Cornell University protocol)
        - 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, TC, TOC (U of A)
        - soil microbial respiration (Cornell University protocol)
        - active & total bacteria
        - active & total fungi
        - nematode functional groups
        - protozoa functional groups
    - Chemical (commercial labs)
        - complete fertility assessment, including macro and micro nutrients, organic matter, pH, EC, etc.
- All information is being entered into a data base
- Information related to specific sites is being shared with the cooperating producers by association staff
- Management activities will be documented and linked to changes in soil health indicators

Environmental Significance

Development of a benchmark data base is very important in order to better understand soil health limitations and apply appropriate management strategies. Improvements in soil health can result in higher production potential and will strengthen the resiliency of the farm's systems to cope with issues related to climate change.

Target Audience

Farmers and ranchers from across Alberta will receive information on specific soils within their operations which they can use to help guide their management decisions. Because soils and the associated management systems can be very site specific, the information will have much more value than generalizations often promoted at agronomic events.

A broader audience will receive information on Soil Health Benchmarks at regional or provincial extension events. Participants at these events would include a broad representation of local producers. Information on the project has also been shared in several farm industry publications.

Gateway Research Organization

Pest Monitoring & Disease Survey

Partner: Producers from Counties of Westlock, Barrhead, and Woodlands. A very Special thanks to Shelley Barkley, Alberta Agriculture

The Gateway Research Organization (GRO) participated in the Prairie Pest Monitoring Program in 2019. The objective of the Prairie Pest Monitoring Program is to develop an early warning system for crop pests, with emphasis on insects and disease. Being forewarned means that scouting, information workshops, and control operations can be carried out in the affected areas before crop losses occur. Last year, GRO surveyed for diamondback moth, bertha armyworm, Cabbage Seedpod weevil, and Wheat Midge.

Westlock County Summary 2020.

- Of the twelve bertha armyworm sites in Westlock only one squeezed over the first warning level of 300 moths. Trapping will continue to be very important to track the population in 2021. There was one diamondback moth trap site in Westlock which had very few moths caught during the trapping period.
- Pea leaf weevil damage was lower this year than in 2019 in the survey we conducted in late May – early June. In general, if producers had experienced high levels in the past they probably want to stay with seed treatment. It will depend on the individual producer and their approach to risk management.
- Wheat midge numbers were down this year in our area. This population could increase to damaging levels if wet conditions and or late seeding occur. It would be a good idea for producers and agronomists to monitor fields closely in 2021 as the wheat heads out.
- No cabbage seedpod weevil were found in our area. The population in central Alberta seems to have reduced to very low levels.

County of Barrhead Summary 2020.

- Of the seven bertha armyworm sites in Barrhead County none were above the first warning level of 300 moths, although one was close. Trapping will continue to be very important to watch for a possible build-up in the population although we are not anticipating major risks for our area in 2021.
- Pea leaf weevil damage numbers were down in 2020 from the 2019 numbers. Whether producers choose to use an insecticide seed treatment will depend on their approach to risk management.
- Wheat midge numbers are low in our area.
- No cabbage seedpod weevil was found in our area. The population in central Alberta seems to have contracted.

Gateway Research Organization

Woodlands County Summary 2020.

- This summary reads just like last year! Such good news for your producers!
- There was one bertha armyworm site in Woodlands and it was very low and well below the first warning level of 300 moths. Trapping will continue to be very important to watch for a possible build-up in the population.
- Wheat midge numbers remain low in our area as we found no larvae in the two fields we surveyed. Certainly no risk for 2021.
- No cabbage seedpod weevil was found in our area. The population in central Alberta seems to have reduced to very low numbers.

For more Information about insects that we survey in 2020 and their impact on crops:

DIAMONDBACK MOTH (DBM)

- It is generally accepted that diamondback moth adults don't overwinter in the prairies and that most infestations occur when adult moths arrive on wind currents in the spring from the southern or western United States or northern Mexico. In mild winters there is suspicion that diamondback moth do overwinter in Alberta.

BERTHA ARMYWORM (BAW)

- Bertha armyworm is very cyclical. In order to catch outbreaks and help producers minimize losses it is necessary to maintain a good monitoring system using pheromone traps. The number of moths caught in the traps informs us of the risk of damaging populations with a 3 to 5 week lead time. These numbers are generated from paired pheromone traps in individual fields. Bertha armyworm populations are normally kept in check by such factors as weather and natural enemies. Potential damage may be more or less severe than suggested by the moth count data depending on weather and crop conditions and localized population dynamics. Research has clearly shown that very few fields are ever affected in an area with moth catches less than 300.

CABBAGE SEEDPOD WEEVIL (CSPW)

- In southern Alberta, including all counties south of and touching Highway 1, the earliest flowering canola crops will be at the highest risk from cabbage seedpod weevil and should be monitored very closely. Cabbage seedpod weevil overwinters as an adult so the risk of infestation is further indicated by the adult population of the preceding fall. Winter condition also appear to have an impact on populations with mild winter favoring build-up of populations and expansion of their range. We track the population of other insects in these sweeps as well.

WHEAT MIDGE (SOIL) (WM)

- Wheat midge is an insect that increases in numbers in wet years. Numbers can vary drastically from field to field and we try to sample wheat adjacent to the previous years' wheat in order to pick up populations if they are present. There is no definitive way to know exactly the risk in any given field so field scouting when the wheat comes into head is critical. Individual fields will have a different risk. The numbers are generated by taking soil samples from wheat fields after harvest using a standardized soil probe.