POGA Milling Oats Trial

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Increase the Oat Acres in Alberta by Finding a High Yielding Oat Variety that maximizes Producer Income and Meets the Demands of the Millers.

"Year 2021"

Summary:

This study is a continuous effort to collect data on 11 milling variety oats 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. Year 2021, was comparatively very dry year for both location in Alberta. The two weeks of excessive heat period was too detrimental for the oats. Therefore, overall yield were lower compared to previous years.

Background

Oat production in Alberta has been on a relatively steady decline since 2011. Oats has earned the status of 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 oat were seeded in the year 2015-16. However, 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 at or 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 Grain Millers has helped 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 selection of variety 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 new disease resistant varieties 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 higher yield and increased functional properties (β-glucan) attribute.

Objective

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 2021 (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 9-inch spaced 6 rows Fabro small plot seeder was used for the seeding. Each plot of a variety occupied 10.96 sq. m. (1.37 m width and 8 m long) and there were four replications. The trial site was maintained weed-free with the use of herbicides or hand weeding methods (Table 1). The trial was harvested with a Wintersteiger Nursery Mate Elite combine (5-foot header) and grain yield from each plot was measured using Electronic Scales. A clean composite sample (500g) was collected and sent to laboratory analysis for the β-glucan estimation. The growing season of 2019 provided very high moisture throughout the year while the 2021 growing season was very dry throughout the year.

Soil Information – GRO – Westlock - 2021

Nitrogen (lbs/ac)	Phosphorus (lbs/ac)	Potassium (lbs/ac)	Sulphur (lbs/ac)	pH (0-14)	CEC (meq/100g)	Organic Matter (%)
85	34	242	38	5.9	23.6	7.1

Table 1: Agronomic details for the POGA Trail 2021

Location:	Peace region	Westlock
Seeding Date:	May 01st, 2021	May 06th, 2021
Harvest Date:	Sept 23th, 2021	September 15, 2021
Soil Temp:	14.5^0 Celsius	9^0 Celsius
Soil Moisture:	Adequate	Very good
Seeding Depth:	¾ inch	1$^{1/4}$ inch
Fertility total Nutrients (Actual lb/acre)	**112N-30P2O5-15K2O-10S**	**56.38N-30.16P205-30K20-20S**
Herbicides applied to the trial	Pre-burn Roundup @ 1L/acre (May 26)	Pre-emergence Roundup 0.78L/Ac on May 14
Herbicides applied to trial	In Crop Stellar XL @405 ml/ac (June 04) In Crop Lontrel XL@138 ml/ac (June 22)	In crop Broad leaf: Curtail M (750 ml/ Acre) on 7 June
Fungicides applied to the trial	None	None
Rainfall (mm)	128.78 mm	187.70 mm

The decision for applying fertilizer at 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 year 2021 was not the best year to show the high yield potential for the varieties in Alberta. It was very dry compared to the last 5-year average. We have about 75% less precipitation in both sites with a spell of two weeks with temperature ranging more than 30 C which is very unusual for northern Alberta. Overall Westlock area still fared well and had an average site yield of 139 bu/acre compared to just 23 bu/acre in the peace region site. The quality of grain was also sustainably lower in the peace region site with a lower average test weight (33 Kg/Hl), a lower average thousand kernel weight (32 g) and a higher average hull percentage (27%) compared to the Westlock site with an average of 56 Kg/Hl test weight, TKW of 43 g and 17% hull percentage.

Table.2: Yield - 2021 Comparison

		Westlock			Peace Region		
	Variety	% of AC Morgan	Yield bu/ac		% of AC Morgan	Yield bu/ac	
1	AC Morgan	100	161	a	100	19.6	de
2	CS Camden	93	150	a	145	28.5	a
3	Kalio	88	141	a	111	21.8	b-e
4	OT3112	87	140	a	117	22.9	a-e
5	CDC Ruffian	91	147	a	109	21.3	cde
6	AC Summit	75	121	b	99	19.4	e
7	AC Arborg	93	150	a	141	27.6	ab
8	CDC Endure	89	143	a	129	25.2	a-d
9	CDC Skye	72	115	b	104	20.3	de
10	AAC Douglas	92	148	a	104	20.3	de
11	ORE3541M	71	115	b	138	27.1	abc

Table.3: Other results from the POGA trial 2021 Westlock Site.

		Height cm		Lodging (1-9)		Test Weight kg/HL		TKW g		Maturity Days	
1	**AC Morgan**	93.7	ab	1.0	-	56	Bcd	43	bc	96.7	-
2	**CS Camden**	88.0	b	1.0	-	54	Cd	44	ab	98.7	-
3	**Kalio**	85.0	b	1.0	-	54	D	41	cd	98.0	-
4	**OT3112**	71.7	c	1.0	-	54	D	44		97.0	-
5	**CDC Ruffian**	88.3	b	1.5	-	57	Bc	43	abc	97.3	-
6	**AC Summit**	87.0	b	1.6	-	59	A	40	d	98.3	-
7	**AC Arborg**	98.0	a	1.0	-	58	Ab	46	a	96.7	-
8	**CDC Endure**	92.7	ab	1.2	-	56	Bcd	44	abc	97.0	-
9	**CDC Skye**	88.3	b	1.0	-	55	Cd	42	bc	97.0	-
10	**AAC Douglas**	85.0	b	1.0	-	55	Cd	44	ab	98.7	-
11	**ORE3541M**	84.7	b	1.8	-	57	Bc	41	cd	97.0	-
LSD P=.05		6.22		0.8		1.739		1.81		1.3	
Standard Deviation		3.65		0.10		1.20		1.25		0.76	
CV		4.18		30.07		2.15		2.92		0.78	

The most popular oat variety of Alberta, AC Morgan was the highest yielding variety for 2021 in Westlock followed by AC Arborg and CS Camden. For the beta-glucan percentage in Oats, variety OT 3112 (about 5%) was highest in both sites, which was consistent with our previous year's results (2019-2020). CDC endure had the highest groat weight (plumper oat) at the Westlock site which is one of the preferred parameters for the grain millers.

Table.4: Other results from the POGA trial 2021 Peace Site.

		Height cm		Lodging (1-9)		Test Weight kg/HL		TKW g	
1	**AC Morgan**	38.2	b	1	-	31.1	cd	29.6	-
2	**CS Camden**	39.4	b	1	-	32.8	bcd	30.2	-
3	**Kalio**	38.5	b	1	-	31.4	cd	30.8	-
4	**OT3112**	36.1	a	1	-	27.9	de	33.2	-
5	**CDC Ruffian**	41.5	ab	1	-	38.2	ab	28.2	-
6	**AC Summit**	45.3	a	1	-	41.7	a	33.4	-
7	**AC Arborg**	37.2	b	1	-	31	cd	31.0	-
8	**CDC Endure**	40.3	b	1	-	34	bc	29.0	-
9	**CDC Skye**	28.1	c	1	-	25	e	32.4	-
10	**AAC Douglas**	40.1	b	1	-	34.2	bc	34.4	-
11	**ORE3541M**	40.8	ab	1	-	37.7	ab	35.6	-
LSD P=.05		4.683				4.83		1.81	
Standard Deviation		3.228				0.05		1.248	
CV		8.3				3.35		2.92	

Test weight is an important indicator of grain milling quality. AC Summit had the highest test weight at Westlock as well as Peace Region. At Westlock site, the test weight was not significantly different among the varieties.

Table 5: The Beta-Glucan results from the POGA trial of 2021.

		Westlock (GRO) – 2021		Peace Region (SARDA) – 2021	
	Variety	Hull percentage (%)	Flour BG (%, db)	Hull percentage (%)	Flour BG (%, db)
1	AC Morgan	16.97	3.5	17.76	3.5
2	CS Camden	20.38	4.0	38.37	4.0
3	Kalio	18.37	3.6	30.45	3.8
4	OT3112	22.96	4.9	24.14	5.1
5	CDC Ruffian	14.64	3.3	34.01	3.9
6	AC Summit	20.92	3.4	40.24	3.4
7	AC Arborg	20.42	3.8	20.71	4.2
8	CDC Endure	15.08	4.1	28.65	4.5
9	CDC Skye	14.82	4.0	29.05	4.2
10	AAC Douglas	18.08	3.7	18.55	4.1
11	ORE3541M	12.43	3.6	18.39	3.8

Beta Glucan results: The beta-glucan content of the 11 different milling varieties ranged between 3.3% and 5.1%, with the lowest reported for CDC Ruffian and AC Summit at Westlock and Peace region respectively. **OT3112, CDC ENDURE and CDC SKYE were the highest beta-glucan varieties** at both locations same as year 2020.

Conclusion:

Significant effect of location and varietal difference for the yields as well as beta-glucan levels in 2016, 2017, 2018, 2019, 2020 and 2021. Environmental conditions effect yield capacity of a **variety** to a higher degree than the effect on Beta-glucan levels.

Similar to the 2020, OT3112 had shown to be great milling oat and replace the CDC Endure with **high yield, specifically in Westlock,** and **high beta-glucan** and **good test weight,** which are preferred characteristics for the grain millers.

Crop Year	Top 3 Varieties for Beta Glucan at Westlock		
2021	OT3112	CDC Endure	CDC Skye
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 for Beta Glucan at Peace Region		
2021	OT3112	CDC Endure	CDC Skye
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

Table 6: Overall Summary of the trial: Yields from 2016 to 2021

	Yield	Overall Average	2021	2020	2019	2018	2017	2016
Milling oats	% of AC Morgan	Yield (Bu/Ac)	Yield (Bushel/Acre)					
AC Morgan	100	204	161	203	243	226	212	178
CS Camden	98	200	150	211	241	206	226	167
CDC Seabiscuit	103	211	-	205	239	212	208	189
OT3112	87	177	140	213	-	-	-	-
CDC Ruffian	100	203	147	206	219	207	245	193
AC Summit	92	189	121	178	245	203	217	167
CDC Arborg	101	206	150	208	244	221	-	-
ORE3542M	98	199	-	183	214	201	-	-
CDC Norseman	102	208	-	190	222	213	-	-
CDC Endure	100	203	143	194	249	226	-	-
CDC SKYE	92	188	115	211	237	-	-	-
CDC Orrin	99	202	-	-	-	218	221	168
Souris	86	175	-	-	-	-	194	155
CDC Minstrel	92	188	-	-	-	-	202	174
Triactor	104	212	-	-	238	229	208	172
Akina	101	206	-	-	-	221	222	176
Kalio	69	141	141	-	-	-	-	-
AAC Douglas	73	148	148	-	-	-	-	-
ORE3541M	56	115	115	-	-	-	-	-

Table 7: Beta glucan (%) contents in milling oats from 2016 to 2021

Milling oats		2016		2017		2018		2019		2020		2021	
	Average	Westlock	Peace	Westlock	Peace	Westlock	Peace	Westlock	Peace	Westlock	Peace	Westlock	Peace
AC Morgan	3.8	3.9	4.1	3.8	4.2	3.9	3.4	3.9	3.7	3.9	3.8	3.5	3.5
CS Camden	4.3	3.7	3.9	4.4	4.6	4.4	3.8	4.4	5.2	4.7	4.3	4.0	4.0
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	5.2									6.1	4.8	4.9	5.1
CDC Ruffian	3.5	2.7	3.3	3.8	3.9	3.6	2.7	3.6	3.7	4.3	3.5	3.3	3.9
AC Summit	4.1	3.6	3.7	4.3	4.4	4.3	3.7	4.3	4.6	4.8	4.5	3.4	3.4
CDC Arborg	4.1					4.4	3.8	4.2	4.3	4.6	3.6	3.8	4.2
ORE3542M	4.0					4.0	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	4.6					4.7	4.2	4.5	4.7	5.2	4.6	4.1	4.5
CDC SKYE	4.6							4.5	5.0	4.9	5.0	4.0	4.2
CDC Orrin	3.8	3.2	3.7	4.4	4.0	4.1	3.4						
Souris	4.3	3.6	4.4	4.9	4.4								
Kara	4.2	3.6	3.7	4.3	5.0								
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	4.0	4.1	4.3				
Akina	4.4	3.8	3.7	5.0	4.9	4.8	4.0						
Kalio	3.7											3.6	3.8
AC Douglas	3.9											3.7	4.1
ORE3541M	3.7											3.6	3.8

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