

2022 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.

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. 2022 was a good year for all crops. Overall, crop yields were satisfactory for grain producers.

Background

Oat production in Alberta has been on a relatively steady decline since 2011. Oats have earned the status of major Canadian export crop from domestic crop status. According to Prairie Oat Grower's Association (POGA), an estimated 3.1 million acres of oats 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 oat variety grown in Alberta is Morgan which 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.** Morgan is consistently at or below that amount. Therefore, oat producers in Alberta need an oat variety that can consistently beat the yields of Morgan but has the higher β -glucan amounts that the oat miller desire. To emphasize this fact, since 2015 Grain Millers have 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 varieties 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, functional attributes 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, and this disease is moving west, towards Alberta. Morgan does not 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 staying profitable in oat production. The β -glucan content in oat may vary with changes 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 yields 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 2022. Based on the soil fertility recommendations, fertilizers were added to maintain the optimal levels of growing conditions. Seeding rates were calculated based on the 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 9.59 sq. m. (1.37 m width and 7 m long) and there were four replications. The trial site was maintained weed-free with the use of herbicides (Table

1). The trial was harvested with a Zurn 150 plot combine (5-foot header) and grain yield from each plot was measured using electronic scales. A clean composite sample (500g) was collected and sent for β -glucan estimation. The growing season of 2019 and 2020 provided very high moisture throughout the year while the 2022 growing season was a somewhat normal year for crop production.

Table 1: Soil Information - 2022

	Nitrogen (lbs/ac)	Phosphorus (lbs/ac)	Potassium (lbs/ac)	Sulphur (lbs/ac)	pH (0- 14)	CEC (meq/100g)	Organic Matter (%)
Westlock	124	36	228	31	5.5	26.2	7.5
Peace Region	14	46	658	28	6.4	21.9	5.8

Table 2: Agronomic details for the POGA Trail 2022

Location:	Westlock	Peace Region
Seeding Date:	May 12 th , 2022	May 25 th , 2022
Harvest Date:	September 02 nd , 2022	Sept 16 th , 2022
Soil Temp:	14 ^o Celsius	22 ^o Celsius
Soil Moisture:	Adequate	Adequate
Seeding Depth:	1 ^{1/4} inch	¾ inch
Fertility total Nutrients (Actual lb/acre)	35 N-30.16 P-80 K-21.19 S- 2.48 Cu	127 N-35 P-35 K-10 S
Herbicides applied to the trial	Pre-emergence Roundup @ 0.78 l/ac (May 6)	Pre-burn Roundup Weathermax and Conquer II @ 670 ml/acre & 242 ml/acre (May 26)
Herbicides applied to trial	In crop Broadleaf: Curtail M @750 ml/ ac (7 June)	In crop Stellar XL @405 ml/ac (June 15)
Fungicides applied to the trial	None	Prosaro @ 325 ml/acre (July 08)
Rainfall (mm)	174.1 mm	210 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.

Table 3: Yield - 2022 Comparison

Variety	Westlock		Peace Region	
	% of AC Morgan	Yield bu/ac	% of AC Morgan	Yield bu/ac
AC MORGAN	100%	192 abc	100%	235 -
CS CAMDEN	98%	189 bc	113%	265 -
KALIO	94%	180 c	106%	248 -
OT3112	102%	195 abc	114%	268 -
CDC RUFFIAN	108%	208 a	110%	259 -
OT 6024	101%	193 abc	106%	250 -
CDC ARBORG	103%	198 ab	114%	269 -
CDC ENDURE	102%	195 abc	102%	240 -
ORE LEVEL 50	95%	182 bc	93%	219 -
AAC WESLEY	104%	199 ab	113%	266 -
AAC DOUGLAS	101%	193 abc	108%	254 -

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

A common oat variety in Alberta, CDC Ruffian, was the highest-yielding variety for 2022 in Westlock, followed by AAC Wesley and AC Arborg. While, in the Peace region, CDC Arborg=OT 3112>AAC Wesley=CS Camden>CDC Ruffian were the top-performing varieties.

Table 4: Other results from the POGA trial 2022 Westlock Site

		Height cm	Lodging (1-9)	Maturity Days	Test Weight kg/HL	TKW g
1	AC MORGAN	104 ab	4.5 c	92 -	59.4 -	35.6 -
2	CS CAMDEN	104 ab	4.5 c	94 -	56.3 -	31.8 -
3	KALIO	99 ab	7.3 a	91 -	57.3 -	32.9 -
4	OT3112	92 b	4.5 c	94 -	56.4 -	35.6 -
5	CDC RUFFIAN	103 ab	7.5 a	97 -	57.8 -	34.1 -
6	OT 6024	104 ab	5.3 bc	98 -	57.1 -	35.8 -
7	CDC ARBORG	110 a	7.5 a	93 -	59.6 -	37.6 -
8	CDC ENDURE	109 a	7.8 a	92 -	57.2 -	39 -
9	ORE LEVEL 50	99 ab	5.8 bc	92 -	55.3 -	38.8 -
10	AAC WESLEY	96 ab	6.5 ab	94 -	56 -	33.6 -
11	AAC DOUGLAS	100 ab	5.8 bc	92 -	59.9 -	35.6 -
LSD P=.05		6.91	0.96		3.50	4.30
Standard Deviation		4.79	0.67		2.10	3.00
CV		4.69	10.98		3.60	7.50

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

Table 5: Other results from the POGA trial 2022 Peace site.

		Height cm		Lodging (1-9)		Test Weight kg/HL		TKW g	
1	AC MORGAN	40	a	1	-	58.7	a	38.6	bc
2	CS CAMDEN	39	ab	1	-	57.4	bcd	38.5	bc
3	KALIO	40	a	1	-	57.2	cd	36.9	cd
4	OT3112	34	c	1	-	57	d	36.5	cd
5	CDC RUFFIAN	37	b	1	-	56.8	d	36.9	cd
6	OT 6024	39	ab	1	-	56.6	d	35.2	d
7	CDC ARBORG	41	a	1	-	58.2	abc	38.9	bc
8	CDC ENDURE	41	a	1	-	56.7	d	37.6	c
9	ORE LEVEL 50	39	a	1	-	55.4	e	41.3	a
10	AAC WESLEY	36	b	1	-	55.5	e	37.3	cd
11	AAC DOUGLAS	41	a	1	-	58.4	abc	40	ab
LSD P=.05		1.95		.		0.88		1.55	
Standard Deviation		1.35		0.00		0.61		1.07	
CV		3.50		0.00		1.06		2.83	

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

Test weight is an important indicator of grain milling quality. ACC Douglas had the highest test weight at Westlock and AC Morgan had the highest test weight at Peace region.

Table 6: The Beta-Glucan Results from the POGA trial of 2022

		Westlock (GRO) – 2022		Peace Region (SARDA) – 2022	
	Variety	Hull percentage (%)	Flour BG (%, db)	Hull percentage (%)	Flour BG (%, db)
1	AC MORGAN	23.77	3.33	28.69	3.66
2	CS CAMDEN	21.64	3.82	17.22	4.22
3	KALIO	21.88	4.56	21.27	4.08
4	OT3112	17.72	4.85	20.38	5.41
5	CDC RUFFIAN	20.33	3.62	17.98	5.10
6	OT 6024	18.77	4.34	28.55	5.93
7	CDC ARBORG	19.68	4.23	22.76	5.49
8	CDC ENDURE	14.64	4.88	22.42	6.02

9	ORE LEVEL 50	16.11	4.72	22.30	5.23
10	AAC WESLEY	20.23	4.04	19.77	5.30
11	AAC DOUGLAS	22.89	4.78	16.47	5.21

Beta Glucan results: The beta-glucan content of the 11 different milling varieties ranged between 3.33% and 6.01%, with the lowest reported for AC Morgan at Westlock and also in the Peace region. **CDC Endure, OT3112, and AAC Douglas were the highest beta-glucan varieties** at the Westlock location, while **CDC Endure, OT 6024, and CDC Arborg were the highest varieties for beta-glucan** in the Peace region.

Crop Year	Top 3 Varieties for Beta Glucan at Westlock		
	2022	CDC Endure	OT3112
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
Crop Year	Top 3 Varieties for Beta Glucan at Peace Region		
	2022	CDC Endure	OT 6024
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

Conclusion:

There is a significant effect of location and variety for yield, as well as beta-glucan levels in the years 2016 to 2022. Environmental conditions affect the yield capacity of a variety to a higher degree than the effect on beta-glucan levels.

Table 7: Overall Summary of the trial - Yields from 2016 to 2022 at Westlock, Alberta

	Yield	Overall Average	2022	2021	2020	2019	2018	2017	2016
Milling Oats	% of AC Morgan	Yield (Bu/Ac)	Yield (Bushel/Acre)						
AC Morgan	100	202	192	161	203	243	226	212	178
CS Camden	98	199	189	150	211	241	206	226	167
CDC Ruffian	101	204	208	147	206	219	207	245	193
CDC Arborg	101	204	198	150	208	244	221	-	-
CDC Endure	100	201	195	143	194	249	226	-	-
OT3112	90	183	195	140	213	-	-	-	-
Kalio	79	161	180	141	-	-	-	-	-
AAC Douglas	84	171	193	148	-	-	-	-	-
ORE Level 50	90	182	182	-	-	-	-	-	-
OT 6024	95	193	193	-	-	-	-	-	-
AAC Wesley	98	199	199	-	-	-	-	-	-
AC Summit	93	189	-	121	178	245	203	217	167
CDC Skye	93	188	-	115	211	237	-	-	-
ORE3541M	57	115	-	115	-	-	-	-	-
CDC Seabiscuit	104	211	-	-	205	239	212	208	189
ORE3542M	99	199	-	-	183	214	201	-	-
CDC Norseman	103	208	-	-	190	222	213	-	-
Triactor	105	212	-	-	-	238	229	208	172
Akina	102	206	-	-	-	-	221	222	176
CDC Orrin	100	202	-	-	-	-	218	221	168

Souris	86	175	-	-	-	-	-	194	155
Kara	98	199	-	-	-	-	-	222	175
CDC Minstrel	93	188	-	-	-	-	-	202	174

Table 7: Beta-glucan (%) contents in milling oats from 2016 to 2022

Milling Oats	Average	2022		2021		2020		2019		2018		2017		2016	
		Westlock	Peace												
AC Morgan	3.8	3.3	3.7	3.5	3.5	3.9	3.8	3.9	3.7	3.9	3.4	3.8	4.2	3.9	4.1
CS Camden	4.2	3.8	4.2	4.0	4.0	4.7	4.3	4.4	5.2	4.4	3.8	4.4	4.6	3.7	3.9
CDC Ruffian	3.6	3.6	5.1	3.3	3.9	4.3	3.5	3.6	3.7	3.6	2.7	3.8	3.9	2.7	3.3
CDC Arborg	4.3	4.2	5.5	3.8	4.2	4.6	3.6	4.2	4.3	4.4	3.8	-	-	-	-
CDC Endure	4.7	4.9	6.0	4.1	4.5	5.2	4.6	4.5	4.7	4.7	4.2	-	-	-	-
OT3112	5.2	4.9	5.4	4.9	5.1	6.1	4.8	-	-	-	-	-	-	-	-
Kalio	4.0	4.6	4.1	3.6	3.8	-	-	-	-	-	-	-	-	-	-
AC Douglas	4.5	4.8	5.2	3.7	4.1	-	-	-	-	-	-	-	-	-	-
ORE Level 50	5.0	4.7	5.2	-	-	-	-	-	-	-	-	-	-	-	-
OT 6024	5.1	4.3	5.9	-	-	-	-	-	-	-	-	-	-	-	-
AAC Wesley	4.7	4.0	5.3	-	-	-	-	-	-	-	-	-	-	-	-
AC Summit	4.1	-	-	3.4	3.4	4.8	4.5	4.3	4.6	4.3	3.7	4.3	4.4	3.6	3.7
CDC Skye	4.6	-	-	4.0	4.2	4.9	5.0	4.5	5.0	-	-	-	-	-	-
ORE 3541M	3.7	-	-	3.6	3.8	-	-	-	-	-	-	-	-	-	-
CDC Seabiscuit	4.2	-	-	-	-	4.6	4.0	4.5	4.2	4.4	3.7	4.6	4.6	3.7	3.7
ORE3542M	4.0	-	-	-	-	4.4	3.8	3.8	4.2	4.0	3.5	-	-	-	-
CDC Norseman	4.5	-	-	-	-	4.8	4.6	4.7	4.4	4.5	3.8	-	-	-	-
Triactor	4.1	-	-	-	-	-	-	4.1	4.3	4.4	4.0	4.4	4.5	3.5	3.7
Akina	4.4	-	-	-	-	-	-	-	-	4.8	4.0	5.0	4.9	3.8	3.7

CDC Orrin	3.8	-	-	-	-	-	-	-	-	4.1	3.4	4.4	4.0	3.2	3.7
Souris	4.3	-	-	-	-	-	-	-	-	-	-	4.9	4.4	3.6	4.4
Kara	4.2	-	-	-	-	-	-	-	-	-	-	4.3	5.0	3.6	3.7
CDC Minstrel	3.7	-	-	-	-	-	-	-	-	-	-	3.9	4.3	2.9	3.5

Results and Discussion

2022 was a little dry but the crop production did not affect too much crop's water requirement was fulfilled by the rain. The average site yield at Westlock was 193 bu/ac compared to 252 bu/ac in the Peace region. Westlock site had some lodging issues while at the Peace site, no lodging was noticed. Also, the plant height was surprisingly short in the Peace region compared to the Westlock site. There was no noticeable difference in the test weight at both locations. The quality of grain was a little bit lower at the Peace region site with a higher average hull percentage (21.16%) compared to the Westlock site (19.78%). The average thousand kernel weight was lower at the Westlock site (35.49 g) compared to the Peace region site (37.97 g).

Acknowledgments: We would like to thank **Prairie Oat Growers Association (POGA)** and **Grain Millers Canada** for their full financial assistance. Special thanks to Dr. Thava Vasanthan for their contribution to lab analysis for this trial.



GRAIN MILLERS



We would like to thank Canterra Seeds, Canada Seed Depot, SeCan, Alliance Seed, and FP Genetics for their generous seed donations for the 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 the named variety/products is implied.