2023 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 varieties of oats, in Central and Northern Alberta, since 2016. The goal is to determine how variety and growing location influence the **yield** and functional property attributes linked to **beta-glucan** levels of the oats. Similar to what has been recorded in past years, there were noticeable varietal differences between the two locations for the yields, as well as beta-glucan content. The province experienced significant dryness in May and early June, which led to some yield and quality loss. Overall, crop yields were average and satisfactory for grain producers.

Background

The Alberta oat acres had declined in the early 2010s but since 2018 have been steadily rising. According to Statistics Canada, an estimated 4.0 million acres of oats were seeded in 2022. However, many major millers would not accept oats from Alberta, or look to Alberta only after Manitoba and Saskatchewan's supply is gone because Morgan is the main oat variety grown in Alberta. **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 meet or beat the yields of Morgan but that also has the higher β-glucan amounts that oat millers desire. To emphasize this fact, since 2015 Grain Millers Canada Corp. 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 rotations 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 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 aid in 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 to assist a producer in choosing a newer and higher-yielding variety, specific to their region, is therefore, a particularly important step to staying profitable in oat production. The β-glucan content in oats 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) attributes.

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 were tested in 2023. 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 row Fabro small plot seeder was used for the seeding. Each variety was seeded in a plot occupying 9.59 sq. m. (1.37 m width and 7 m long), with four replications. The trial site was maintained weed-free with the use of herbicides. 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 2023 growing season was a relatively normal year for crop production.

Table 1: Soil Information - 2023

	Nitrogen (lbs/ac)	Phosphorus (lbs/ac)	Potassium (lbs/ac)	Sulphur (lbs/ac)	pH (0-14)	CEC (meq/100g)	Organic Matter (%)
Westlock	58	42	338	29	6.1	23.1	7.2
Peace Region	9	24	160	20	6.3	13.0	2.8

Table 2: Agronomic details for the POGA Trail 2023		
Location:	**Westlock**	**Peace Region**
Seeding Date:	May 03, 2023	May 01, 2023
Harvest Date:	September 14, 2023	Sept 08, 2023
Soil Temp:	14^0 Celsius	19.1^0 Celsius
Soil Moisture:	Adequate	Adequate
Seeding Depth:	$1^{1/4}$ inch	¾ inch
Fertilizer Applied (Actual lb/acre)	**46.4 N-30.16 P-60 K-10 S**	**110 N-35 P-50 K**
Pre-emergence Herbicides Applied	Pre-emergence Glyphosate (270g ae/ac) + Heat (10 g/ac) May 08	Pre-emergence: PrePass Flex (8.1 g/ac) + Roundup (0.67 l/acre) May 19
In-crop Herbicides Applied	In crop Broadleaf: MCPA Ester 600 @360 ml/ ac (May 31)	In crop Stellar XL @405 ml/ac (June 09)
Insecticide Applied	None	Decis @ 50 ml/acre (June 22) – For Grasshopper
Desiccation	Reglone Ion @ 1 l/ac (Sept 01)	Reglone Ion @ 1.31 l/ac (August 29)
Rainfall (mm)	361.1 mm	312 mm

*The decision to apply 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 – 2023 Comparison

#	Variety Name	Westlock % of AC Morgan	Westlock Yield bu/ac		Peace Region % of AC Morgan	Peace Region Yield bu/ac	
1	AC MORGAN	100%	257	ab	100%	187	-
2	CS CAMDEN	100%	257	ab	103%	192	-
3	KALIO	98%	252	abc	98%	184	-
4	OT3112 - CDC ANSON	99%	254	abc	95%	177	-
5	CDC RUFFIAN	93%	239	abc	101%	188	-
6	OT 6024	94%	241	abc	105%	196	-
7	CDC ARBORG	102%	263	a	104%	194	-
8	CDC ENDURE	98%	252	abc	98%	184	-
9	ORE LEVEL 50	88%	227	c	97%	181	-
10	AAC WESLEY	89%	230	bc	102%	190	-
11	AAC DOUGLAS	102%	261	a	99%	185	-

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

In Westlock, CDC Arborg and AAC Douglas were the highest-yielding varieties for 2023, followed by AC Morgan and CS Camden. While, in the Peace region, OT 6024 > CDC Arborg > AAC Wesley were the top-performing varieties.

Table 4: Other results from the POGA trial 2023 Westlock Site

	Variety Name	Height cm		Lodging (1-9)		Bushel Weight lbs/bu		Test Weight kg/HL		TKW g	
1	AC MORGAN	124	a	2.7	d	46	a	56.4	a	40.5	a
2	CS CAMDEN	118	bcd	3.0	d	45	a	55.1	a	38.4	b
3	KALIO	112	ef	7.5	a	45	a	55.4	a	36.0	bc
4	OT3112 - CDC ANSON	103	h	3.2	d	44	a	54.5	a	36.8	bc
5	CDC RUFFIAN	104	gh	7.7	a	42	a	52.1	a	32.4	d
6	OT 6024	116	de	4.5	c	41	a	50.9	a	35.4	c
7	CDC ARBORG	123	ab	7.2	a	43	a	53.0	a	36.4	bc
8	CDC ENDURE	119	a-d	8.0	a	41	a	51.1	a	34.6	c
9	ORE LEVEL 50	117	cde	4.7	c	41	a	50.2	a	36.5	bc
10	AAC WESLEY	108	fg	6.0	b	36	b	45.0	b	32.7	d
11	AAC DOUGLAS	122	abc	5.5	b	41	a	51.1	a	37.0	bc
	LSD P=.05	4.1		0.44 - 0.95		3.0		3.7		1.7	
	Standard Deviation	2.8		0.03t		1.7		2.2		1.2	
	CV	2.5		4.24t		4.1		4.1		3.3	

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

Table 5: Other results from the POGA trial 2023 Peace site

	Peace Region									
	Variety	**Height**		**Lodging**		**Bushel Weight**		**Test Weight**		**TKW**
	Name	**cm**		**(1-9)**		**lbs/bu**		**kg/HL**		**g**
1	AC MORGAN	90	a	1.7	ab	40	ab	49.7	ab	46.5	b
2	CS CAMDEN	78	bc	1	b	38	bcd	46.8	bcd	43.7	c
3	KALIO	81	ab	1.3	ab	39	bcd	48.1	bcd	41.6	e
4	OT3112 – CDC ANSON	65	d	1	b	34	e	42.1	e	46.6	b
5	CDC RUFFIAN	83	ab	2	ab	42	a	51.6	a	43.4	cd
6	OT 6024	82	ab	1	b	39	bc	48.6	bc	45.9	b
7	CDC ARBORG	88	a	1.3	ab	40	ab	49.2	ab	45.4	b
8	CDC ENDURE	88	a	2	a	40	ab	49.7	ab	45.1	b
9	ORE LEVEL 50	84	ab	1.3	ab	37	cd	46.0	cd	48.5	a
10	AAC WESLEY	73	c	1	b	37	d	45.6	d	42.0	de
11	AAC DOUGLAS	74	c	1	b	37	d	45.3	d	43.4	cd
LSD P=.05		5.8		0.5		1.6		2.0		1.3	
Standard Deviation		4.0		0.3		1.1		1.4		0.9	
CV		5		23.0		2.9		2.9		2.0	

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

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

Table 6: The Beta-Glucan Results from the POGA Trial of 2023

Treatment #	Variety Name	Westlock (GRO) – 2023		Peace Region (SARDA) – 2023	
		Hull percentage (%)	Flour BG (%, db)	Hull percentage (%)	Flour BG (%, db)
1	AC MORGAN	21.68	3.21	22.79	3.36
2	CS CAMDEN	23.67	4.20	24.47	4.61
3	KALIO	28.75	3.84	27.79	3.11
4	OT3112 - CDC ANSON	22.65	5.19	22.45	5.12
5	CDC RUFFIAN	25.50	3.51	23.42	3.30
6	OT 6024	22.53	4.76	26.05	4.83
7	CDC ARBORG	28.71	4.25	31.34	4.41
8	CDC ENDURE	22.38	4.52	23.20	5.04
9	ORE LEVEL 50	23.28	4.16	23.81	3.35
10	AAC WESLEY	28.52	4.88	25.42	4.35
11	AAC DOUGLAS	24.45	5.85	25.90	4.11

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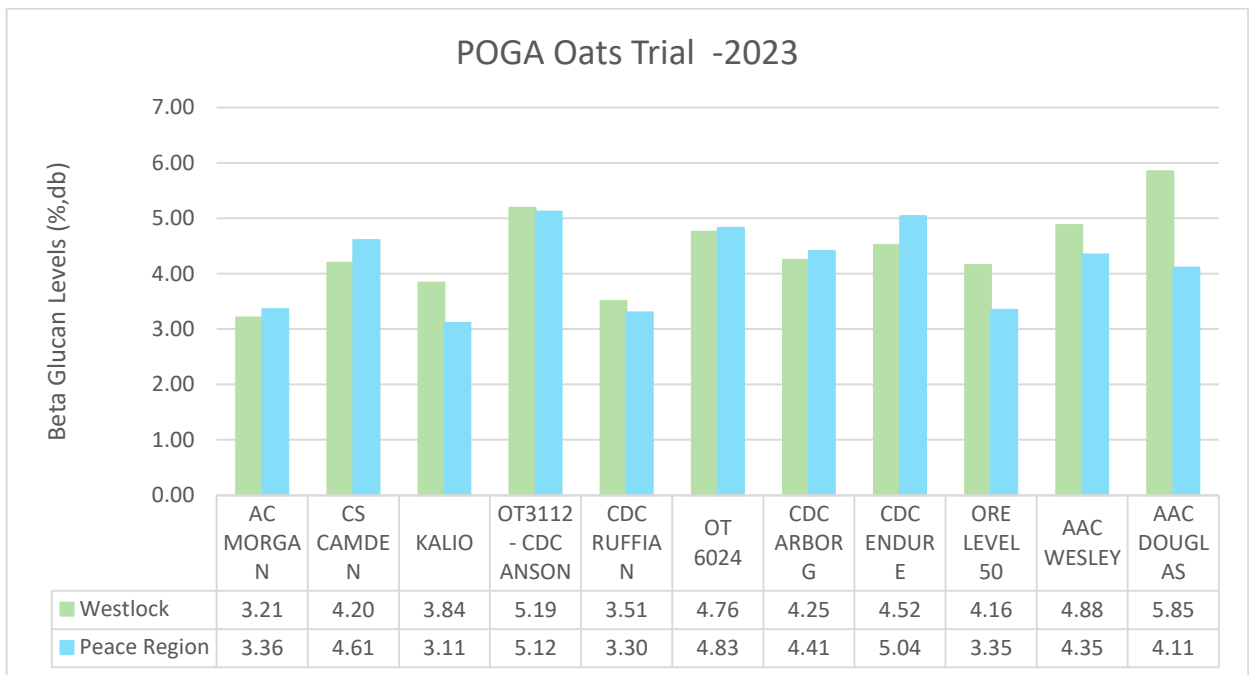| Beta Glucan Levels (%,db)	AC MORGAN	CS CAMDEN	KALIO	OT3112 - CDC ANSON	CDC RUFFIAN	OT 6024	CDC ARBORG	CDC ENDURE	ORE LEVEL 50	AAC WESLEY	AAC DOUGLAS
Westlock	3.21	4.20	3.84	5.19	3.51	4.76	4.25	4.52	4.16	4.88	5.85
Peace Region	3.36	4.61	3.11	5.12	3.30	4.83	4.41	5.04	3.35	4.35	4.11

Chart 1: Beta-glucan levels of 11 oat varieties assessed in 2023.

Beta Glucan results: The beta-glucan content of the 11 different milling varieties ranged between 3.11% and 5.85%, with the lowest reported for AC Morgan at Westlock and Kalio in the Peace region. **AAC Douglas, CDC Anson, and AAC Wesley** were the highest beta-glucan varieties at the **Westlock** location, while **CDC Anson, CDC Endure, and OT 6024,** were the highest varieties for beta-glucan in the **Peace** region.

Crop Year	Top 3 Varieties for Beta Glucan at Westlock		
2023	AAC Douglas	CDC Anson	AAC Wesley
2022	CDC Endure	OT3112	AAC Douglas
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		
2023	CDC Anson	CDC Endure	OT 6024
2022	CDC Endure	OT 6024	CDC Arborg
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

Results and Discussion

The average site yield in Westlock was 248 bu/ac, compared to 187 bu/ac in the Peace region. As usual, the Westlock location had some lodging issues, whereas the Peace site had no such issues. In addition, the plant height in the Peace region was comparatively lower than the Westlock site. Furthermore, we noticed up to 3.7 Kg/HL LSD (least standard difference) in test weights. There was no discernible difference in terms of hull percentage between the two locations.

In 2023, we were surprised to see that CDC Endure did not rank in the top three for beta-glucan levels at the Westlock site. Based on this long-term investigation, we can conclude that modern genetics offer significantly more promise in terms of quality and quantity. For example, AAC Wesley (newer genetics) outperformed the other varieties in terms of beta-glucan percentage.

In conclusion, cultivar (variety) and location have a substantial effect on yield and beta-glucan levels. Environmental factors also play a huge role in the variety's production capacity and beta-glucan levels.

Table 7: Overall Summary of the Trial - Yields from 2016 to 2023 at Westlock, Alberta

Milling Oats	Yield % of AC Morgan	Overall Average Yield (Bu/Ac)	2023	2022	2021	2020	2019	2018	2017	2016
						Yield (Bushel/Acre)				
AC Morgan	100%	209	257	192	161	203	243	226	212	178
CS Camden	99%	206	257	189	150	211	241	206	226	167
CDC Ruffian	100%	208	239	208	147	206	219	207	245	193
CDC Arborg	102%	214	263	198	150	208	244	221	-	-
CDC Endure	100%	210	252	195	143	194	249	226	-	-
CDC Anson - OT3112	96%	201	254	195	140	213	-	-	-	-
Kalio	91%	191	252	180	141	-	-	-	-	-
AAC Douglas	96%	201	261	193	148	-	-	-	-	-
ORE Level 50	98%	205	227	182	-	-	-	-	-	-
OT 6024	104%	217	241	193	-	-	-	-	-	-
AAC Wesley	103%	215	230	199	-	-	-	-	-	-
AC Summit	90%	189	-	-	121	178	245	203	217	167
CDC Skye	90%	188	-	-	115	211	237	-	-	-
ORE3541M	55%	115	-	-	115	-	-	-	-	-
CDC Seabiscuit	101%	211	-	-	-	205	239	212	208	189
ORE3542M	95%	199	-	-	-	183	214	201	-	-
CDC Norseman	100%	208	-	-	-	190	222	213	-	-
Triactor	101%	212	-	-	-	-	238	229	208	172
Akina	99%	206	-	-	-	-	-	221	222	176
CDC Orrin	97%	202	-	-	-	-	-	218	221	168
Souris	83%	175	-	-	-	-	-	-	194	155
Kara	95%	199	-	-	-	-	-	-	222	175
CDC Minstrel	90%	188	-	-	-	-	-	-	202	174

Table 8: Overall Summary of the Trial - Yields from 2016 to 2023 at Peace Region, Alberta

Milling Oats	Yield % of AC Morgan	Overall Average Yield (Bu/Ac)	2023	2022	2021	2020	2019	2018	2017	2016
			Yield (Bushel/Acre)							
AC Morgan	100%	194	187	235	20	211	224	252	220	203
CS Camden	99%	192	192	265	29	183	232	217	226	190
CDC Ruffian	102%	198	188	259	21	207	203	241	249	218
CDC Arborg	100%	194	194	269	28	199	236	237	-	-
CDC Endure	96%	187	184	240	25	206	225	243	-	-
CDC Anson - OT3112	84%	162	177	268	23	180	-	-	-	-
Kalio	78%	151	184	248	22	-	-	-	-	-
AAC Douglas	79%	153	185	254	20	-	-	-	-	-
ORE Level 50	103%	200	181	219	-	-	-	-	-	-
OT 6024	115%	223	196	250	-	-	-	-	-	-
AAC Wesley	118%	228	190	266	-	-	-	-	-	-
AC Summit	89%	173	-	-	19	181	227	228	210	173
CDC Skye	74%	143	-	-	20	196	213	-	-	-
ORE3541M	14%	27	-	-	27	-	-	-	-	-
CDC Seabiscuit	114%	221	-	-	-	196	240	242	224	203
ORE3542M	108%	209	-	-	-	197	205	225	-	-
CDC Norseman	110%	214	-	-	-	190	214	238	-	-
Triactor	117%	227	-	-	-	-	224	256	240	189
Akina	111%	215	-	-	-	-	-	242	214	190
CDC Orrin	109%	211	-	-	-	-	-	239	227	168
Souris	93%	180	-	-	-	-	-	-	191	169
Kara	107%	208	-	-	-	-	-	-	226	190
CDC Minstrel	100%	194	-	-	-	-	-	-	196	192

Table 9: Overall Summary of the Trial - Beta-glucan (%) contents in milling oats from 2016 to 2023

Milling Oats	Average		2023		2022		2021		2020		2019		2018		2017		2016	
	WL	PR	WL	PR	WL	PR	WL	PR	WL	PR	WL	PR	WL	PR	WL	PR	WL	PR
AC Morgan	3.68	3.72	3.21	3.36	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	4.20	4.33	4.2	4.61	3.8	4.2	4	4	4.7	4.3	4.4	5.2	4.4	3.8	4.4	4.6	3.7	3.9
CDC Ruffian	3.55	3.68	3.51	3.3	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	4.24	4.30	4.25	4.41	4.2	5.5	3.8	4.2	4.6	3.6	4.2	4.3	4.4	3.8	-	-	-	-
CDC Endure	4.65	4.84	4.52	5.04	4.9	6	4.1	4.5	5.2	4.6	4.5	4.7	4.7	4.2	-	-	-	-
OT3112	5.27	5.11	5.19	5.12	4.9	5.4	4.9	5.1	6.1	4.8	-	-	-	-	-	-	-	-
Kalio	4.01	3.67	3.84	3.11	4.6	4.1	3.6	3.8	-	-	-	-	-	-	-	-	-	-
AC Douglas	4.78	4.47	5.85	4.11	4.8	5.2	3.7	4.1	-	-	-	-	-	-	-	-	-	-
ORE Level 50	4.43	4.28	4.16	3.35	4.7	5.2	-	-	-	-	-	-	-	-	-	-	-	-
OT 6024	4.53	5.37	4.76	4.83	4.3	5.9	-	-	-	-	-	-	-	-	-	-	-	-
AAC Wesley	4.44	4.83	4.88	4.35	4	5.3	-	-	-	-	-	-	-	-	-	-	-	-
AC Summit	4.12	4.05	-	-	-	-	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	4.47	4.73	-	-	-	-	4	4.2	4.9	5	4.5	5	-	-	-	-	-	-
ORE 3541M	3.60	3.80	-	-	-	-	3.6	3.8	-	-	-	-	-	-	-	-	-	-
CDC Seabiscuit	4.36	4.04	-	-	-	-	-	-	4.6	4	4.5	4.2	4.4	3.7	4.6	4.6	3.7	3.7
ORE3542M	4.07	3.83	-	-	-	-	-	-	4.4	3.8	3.8	4.2	4	3.5	-	-	-	-
CDC Norseman	4.67	4.27	-	-	-	-	-	-	4.8	4.6	4.7	4.4	4.5	3.8	-	-	-	-
Triactor	4.10	4.13	-	-	-	-	-	-	-	-	4.1	4.3	4.4	4	4.4	4.5	3.5	3.7
Akina	4.53	4.20	-	-	-	-	-	-	-	-	-	-	4.8	4	5	4.9	3.8	3.7
CDC Orrin	3.90	3.70	-	-	-	-	-	-	-	-	-	-	4.1	3.4	4.4	4	3.2	3.7
Souris	4.25	4.40	-	-	-	-	-	-	-	-	-	-	-	-	4.9	4.4	3.6	4.4
Kara	3.95	4.35	-	-	-	-	-	-	-	-	-	-	-	-	4.3	5	3.6	3.7
CDC Minstrel	3.40	3.90	-	-	-	-	-	-	-	-	-	-	-	-	3.9	4.3	2.9	3.5

**WL – Westlock Site; PR – Peace River Site