

**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 2019”**

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. This year the average yield was higher for Westlock location compared to peace location, but the beta-glucan content averaged higher for the Peace site. Most of the milling oats varieties surpassed the 4% mark for the total beta-glucan content. Westlock and peace both sites had ample to a little too much of the moisture during the season.

**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 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 ( $\beta$ -glucan). **A minimum of 4%  $\beta$ -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  $\beta$ -glucan amounts that the oat miller desire. To emphasize this fact, since 2015 two millers are helping to fund this variety trial to get it started before outside funding can be located to make oats in Alberta more competitive.

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  $\beta$ -glucan solubility and viscosity are the main criteria for the processing industry. Many studies have shown that oat  $\beta$ -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 resistance 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  $\beta$ -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 ( $\beta$ -glucan) attribute.

### **Objective**

- To investigate the impact of genotype and growing condition on the yield and  $\beta$ -glucan content of milling oat varieties in Alberta.

### **Methodology**

Eleven milling oat varieties and four forage oat varieties were tested in 2016 (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 three 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 at the site. A clean composite sample (500g) was collected and sent to laboratory analysis for the  $\beta$ -glucan estimation. The growing season of 2019 was very high moisture throughout the year.

**Table 1: Agronomic details for the POGA Trail 2019**

Location:	Peace region	Westlock
Seeding Date:	May 16th, 2019	May 10th, 2019
Harvest Date:	Sept 23th, 2019	Oct 10th, 2019
Soil Temp:	7.5 Celsius	10.1 Celsius
Soil Moisture:	adequate	Very good
Seeding Depth:	$\frac{3}{4}$ inch	$\frac{3}{4}$ inch
Fertility total Nutrients Lbs/acre	<b>110N-40P2O5-15K2O-25S</b>	<b>127N- 31P2O5- 75K2O- 15S</b>
Herbicides applied to the trial	Pre-burn Koril 0.5L/Ac and Roundup 1L/Ac on May 16	Pre-burn Roundup 1L/Ac on May 9
Herbicides applied to trial	In crop Broad leaf: stellar A (400 ml/ Acre) + stellar B (240 ml/ Acre) on 16 June	In crop Broad leaf: Curtail M (600 ml/ Acre) on 21 June
Fungicides applied to the trial	none	none
Rainfall (mm)	251 mm	374 mm
Comment:	Pre-harvest weed control on Sept 5	Best possible harvest conditions

### **Results and Discussion**

The overall yield averaged at Westlock site was 249 Bu/acre compared to an average of 222 Bu/Acre in the peace area. At Westlock site, except OT 3087 and Summit, no other oat varieties come close to beat AC Morgan in 2019. At peace site **CDC Arborg, CDC Seabiscuit** and **CS Camden** were **top-yielding milling oats varieties as compared to AC Morgan**.

**Table.2: Yield - 2019 Comparison**

		Westlock			Peace Region		
		% of AC Morgan	Bu/Acre		% of AC Morgan	Bu/Acre	
1	AC Morgan	100	262	ab	100	224	-
2	CS Camden	95	250	bc	104	232	-
3	CDC Seabiscuit	91	238	cd	107	240	-
4	Triactor	96	252	bc	100	224	-
5	CDC Ruffian	89	234	d	91	203	-
6	AC Summit	100	262	ab	101	227	-
7	CDC Arborg	96	252	bc	105	236	-
8	CDC ENDURE	104	273	a	100	225	-
9	CDC SKYE	99	260	ab	95	213	-
10	ORE3542M	85	223	d	92	205	-
11	CDC Norseman	88	230	d	96	214	-

**Table.3: Other results from the POGA trial 2019 Westlock Site.**

		HEIGHT cm		Lodging 1-9 scale		Test Wt kg/HL	
1	AC Morgan	140	a	1.0	d	60.3	ab
2	CS Camden	129	b	1.0	d	61.2	ab
3	CDC Seabiscuit	140	a	8.5	a	59.6	b
4	Triactor	138	a	1.0	d	59.8	b
5	CDC Ruffian	122	c	2.3	c	63.5	a
6	AC Summit	109	d	1.0	d	62.3	ab
7	CDC Arborg	139	a	1.0	d	62.5	ab
8	CDC ENDURE	138	a	1.2	d	62.2	ab
9	CDC SKYE	136	ab	1.4	d	62.2	ab
10	ORE3542M	130	b	1.0	d	60.2	ab
11	CDC Norseman	134	ab	4.5	b	61.6	ab
LSD P=.05		5.51				2.073	
Standard Deviation		3.23				1.435	
CV		2.45				2.34	

**Table.4: Other results from the POGA trial 2019 Peace Site.**

		HEIGHT cm	Lodging 1-9 scale	Test Wt kg/HL
1	AC Morgan	103 ab	2.5 a	48.8 ab
2	CDC Ruffian	91 e	0.3 ab	48.1 ab
3	AC Summit	95 cde	1.3 ab	48.2 ab
4	CDC Arborg	107 a	0.7 ab	<b>49.2 a</b>
5	CDC Norseman	101 abc	2.0 ab	45.9 cd
6	CDC ENDURE	103 ab	0.9 ab	48.1 ab
7	CS Camden	102 abc	1.3 ab	48.1 ab
8	CDC Seabiscuit	104 ab	<b>2.9 a</b>	45.4 d
9	ORE3542M	93 de	0.7 ab	46.1 cd
10	Triactor	102 abc	0.0 b	45.1 d
11	CDC SKYE	98 bcd	1.3 ab	47.2 bc
LSD P=.05		5.51		2.073
Standard Deviation		3.23		1.435
CV		2.45		2.34

Test weight is an important indicator of grain milling quality. CDC Seabiscuit, Triactor and Norseman were among the three lowest oat varieties for the test weight at Westlock as well as the peace region.

**Table 5: The Beta-Glucan results from the POGA trial of 2019.**

		Westlock			Peace Region		
		1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)	1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)
1	AC Morgan	39.9	21.3	<b>3.9</b>	38.1	22.6	<b>3.7</b>
2	CS Camden	39.2	18.7	4.4	34.4	21.9	<b>5.2</b>
3	CDC Seabiscuit	42.2	16.7	<b>4.5</b>	37.5	23.0	4.2
4	Triactor	38.4	21.4	4.1	32.6	27.9	4.3
5	CDC Ruffian	38.1	17.2	<b>3.6</b>	35.1	15.3	<b>3.7</b>
6	AC Summit	34.6	17.6	4.3	34.1	23.6	4.6
7	CDC Arborg	38.4	16.5	<b>4.2</b>	33.9	29.1	4.3
8	ORE3542M	41.0	15.2	<b>3.8</b>	37.4	25.2	4.2
9	CDC Norseman	37.5	20.7	<b>4.7</b>	37.1	21.7	4.4
10	CDC SKYE	39.8	23.1	<b>4.5</b>	36.5	19.6	<b>5.0</b>
11	CDC ENDURE	39.8	17.5	<b>4.5</b>	37.6	25.0	<b>4.7</b>

**Beta Glucan results:** The beta-glucan content of the 11 different milling varieties ranged between 3.6% and 5.2%, with the lowest reported for Ruffian at both sites similar to the last years' findings. **CDC Norseman, CDC Seabiscuit, CDC ENDURE and CDC SKYE were the highest beta-glucan varieties at Westlock**, whereas **CS Camden, CDC ENDURE and CDC SKYE** had higher beta-glucan levels in the peace region as compared to AC Morgan.

### **Conclusion:**

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 2019 similar to 2018 CDC Endure had shown to be great milling oat with **high yield, specifically in Westlock**, and **high beta-glucan and good test weight**, which are preferred characteristics for the grain millers.

### **Overall Summary of the trial:**

#### **Yields from 2016 to 2019**

	Yield	Overall Average	2019	2018	2017	2016
<b>Milling oats</b>	% of AC Morgan	Yield (Bu/Ac)	Yield (Bushel/Acre)			
<b>AC Morgan</b>	<b>100</b>	<b>215</b>	243	226	212	178
CS Camden	98	210	241	206	226	167
CDC Seabiscuit	99	212	239	212	208	189
Triactor	98	212	238	229	208	172
CDC Ruffian	100	216	219	207	245	193
AC Summit	97	208	245	203	217	167
CDC Arborg	108	233	244	221	-	-
Akina	96	206	-	221	222	176
ORE3542M	97	208	214	201	-	-
CDC Norseman	101	218	222	213	-	-
CDC Endure	110	238	249	226	-	-
CDC SKYE	110	237	237	-	-	-
CDC Orrin	94	202	-	218	221	168
Souris	81	174	-	-	194	155
Kara	92	199	-	-	222	175
CDC Minstrel	88	188	-	-	202	174

**Beta glucan (%) contents in milling oats from 2016 to 2019.**

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

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



**GRAIN MILLERS**



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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#### **Yields from 2016 to 2019**

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**Beta glucan (%) contents in milling oats from 2016 to 2019.**

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

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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 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 ( $\beta$ -glucan). **A minimum of 4%  $\beta$ -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  $\beta$ -glucan amounts that the oat miller desire. To emphasize this fact, since 2015 two millers are helping to fund this variety trial to get it started before outside funding can be located to make oats in Alberta more competitive.

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  $\beta$ -glucan solubility and viscosity are the main criteria for the processing industry. Many studies have shown that oat  $\beta$ -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 resistance 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  $\beta$ -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 ( $\beta$ -glucan) attribute.

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Eleven milling oat varieties and four forage oat varieties were tested in 2016 (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 three replications. The trial site was maintained weed-free with the use of herbicides or



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**Table 1: Agronomic details for the POGA Trail 2019**

Location:	Peace region	Westlock
Seeding Date:	May 16th, 2019	May 10th, 2019
Harvest Date:	Sept 23th, 2019	Oct 10th, 2019
Soil Temp:	7.5 Celsius	10.1 Celsius
Soil Moisture:	adequate	Very good
Seeding Depth:	$\frac{3}{4}$ inch	$\frac{3}{4}$ inch
Fertility total Nutrients Lbs/acre	<b>110N-40P2O5-15K2O-25S</b>	<b>127N- 31P2O5- 75K2O- 15S</b>
Herbicides applied to the trial	Pre-burn Koril 0.5L/Ac and Roundup 1L/Ac on May 16	Pre-burn Roundup 1L/Ac on May 9
Herbicides applied to trial	In crop Broad leaf: stellar A (400 ml/ Acre) + stellar B (240 ml/ Acre) on 16 June	In crop Broad leaf: Curtail M (600 ml/ Acre) on 21 June
Fungicides applied to the trial	none	none
Rainfall (mm)	251 mm	374 mm
Comment:	Pre-harvest weed control on Sept 5	Best possible harvest conditions

### **Results and Discussion**

The overall yield averaged at Westlock site was 249 Bu/acre compared to an average of 222 Bu/Acre in the peace area. At Westlock site, except OT 3087 and Summit, no other oat varieties come close to beat AC Morgan in 2019. At peace site **CDC Arborg, CDC Seabiscuit** and **CS Camden** were **top-yielding milling oats varieties as compared to AC Morgan**.

**Table.2: Yield - 2019 Comparison**

		Westlock			Peace Region		
		% of AC Morgan	Bu/Acre		% of AC Morgan	Bu/Acre	
1	AC Morgan	100	262	ab	100	224	-
2	CS Camden	95	250	bc	104	232	-
3	CDC Seabiscuit	91	238	cd	107	240	-
4	Triactor	96	252	bc	100	224	-
5	CDC Ruffian	89	234	d	91	203	-
6	AC Summit	100	262	ab	101	227	-
7	CDC Arborg	96	252	bc	105	236	-
8	CDC ENDURE	104	273	a	100	225	-
9	CDC SKYE	99	260	ab	95	213	-
10	ORE3542M	85	223	d	92	205	-
11	CDC Norseman	88	230	d	96	214	-

**Table.3: Other results from the POGA trial 2019 Westlock Site.**

		HEIGHT cm		Lodging 1-9 scale		Test Wt kg/HL	
1	AC Morgan	140	a	1.0	d	60.3	ab
2	CS Camden	129	b	1.0	d	61.2	ab
3	CDC Seabiscuit	140	a	8.5	a	59.6	b
4	Triactor	138	a	1.0	d	59.8	b
5	CDC Ruffian	122	c	2.3	c	63.5	a
6	AC Summit	109	d	1.0	d	62.3	ab
7	CDC Arborg	139	a	1.0	d	62.5	ab
8	CDC ENDURE	138	a	1.2	d	62.2	ab
9	CDC SKYE	136	ab	1.4	d	62.2	ab
10	ORE3542M	130	b	1.0	d	60.2	ab
11	CDC Norseman	134	ab	4.5	b	61.6	ab
LSD P=.05		5.51				2.073	
Standard Deviation		3.23				1.435	
CV		2.45				2.34	

**Table.4: Other results from the POGA trial 2019 Peace Site.**

		HEIGHT cm	Lodging 1-9 scale	Test Wt kg/HL
1	AC Morgan	103 ab	2.5 a	48.8 ab
2	CDC Ruffian	91 e	0.3 ab	48.1 ab
3	AC Summit	95 cde	1.3 ab	48.2 ab
4	CDC Arborg	107 a	0.7 ab	<b>49.2 a</b>
5	CDC Norseman	101 abc	2.0 ab	45.9 cd
6	CDC ENDURE	103 ab	0.9 ab	48.1 ab
7	CS Camden	102 abc	1.3 ab	48.1 ab
8	CDC Seabiscuit	104 ab	<b>2.9 a</b>	45.4 d
9	ORE3542M	93 de	0.7 ab	46.1 cd
10	Triactor	102 abc	0.0 b	45.1 d
11	CDC SKYE	98 bcd	1.3 ab	47.2 bc
LSD P=.05		5.51		2.073
Standard Deviation		3.23		1.435
CV		2.45		2.34

Test weight is an important indicator of grain milling quality. CDC Seabiscuit, Triactor and Norseman were among the three lowest oat varieties for the test weight at Westlock as well as the peace region.

**Table 5: The Beta-Glucan results from the POGA trial of 2019.**

		Westlock			Peace Region		
		1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)	1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)
1	AC Morgan	39.9	21.3	<b>3.9</b>	38.1	22.6	<b>3.7</b>
2	CS Camden	39.2	18.7	4.4	34.4	21.9	<b>5.2</b>
3	CDC Seabiscuit	42.2	16.7	<b>4.5</b>	37.5	23.0	4.2
4	Triactor	38.4	21.4	4.1	32.6	27.9	4.3
5	CDC Ruffian	38.1	17.2	<b>3.6</b>	35.1	15.3	<b>3.7</b>
6	AC Summit	34.6	17.6	4.3	34.1	23.6	4.6
7	CDC Arborg	38.4	16.5	<b>4.2</b>	33.9	29.1	4.3
8	ORE3542M	41.0	15.2	<b>3.8</b>	37.4	25.2	4.2
9	CDC Norseman	37.5	20.7	<b>4.7</b>	37.1	21.7	4.4
10	CDC SKYE	39.8	23.1	<b>4.5</b>	36.5	19.6	<b>5.0</b>
11	CDC ENDURE	39.8	17.5	<b>4.5</b>	37.6	25.0	<b>4.7</b>

**Beta Glucan results:** The beta-glucan content of the 11 different milling varieties ranged between 3.6% and 5.2%, with the lowest reported for Ruffian at both sites similar to the last years' findings. **CDC Norseman, CDC Seabiscuit, CDC ENDURE and CDC SKYE were the highest beta-glucan varieties at Westlock**, whereas **CS Camden, CDC ENDURE and CDC SKYE** had higher beta-glucan levels in the peace region as compared to AC Morgan.

### **Conclusion:**

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 2019 similar to 2018 CDC Endure had shown to be great milling oat with **high yield, specifically in Westlock**, and **high beta-glucan and good test weight**, which are preferred characteristics for the grain millers.

### **Overall Summary of the trial:**

#### **Yields from 2016 to 2019**

	Yield	Overall Average	2019	2018	2017	2016
<b>Milling oats</b>	% of AC Morgan	Yield (Bu/Ac)	Yield (Bushel/Acre)			
<b>AC Morgan</b>	<b>100</b>	<b>215</b>	243	226	212	178
CS Camden	98	210	241	206	226	167
CDC Seabiscuit	99	212	239	212	208	189
Triactor	98	212	238	229	208	172
CDC Ruffian	100	216	219	207	245	193
AC Summit	97	208	245	203	217	167
CDC Arborg	108	233	244	221	-	-
Akina	96	206	-	221	222	176
ORE3542M	97	208	214	201	-	-
CDC Norseman	101	218	222	213	-	-
CDC Endure	110	238	249	226	-	-
CDC SKYE	110	237	237	-	-	-
CDC Orrin	94	202	-	218	221	168
Souris	81	174	-	-	194	155
Kara	92	199	-	-	222	175
CDC Minstrel	88	188	-	-	202	174

**Beta glucan (%) contents in milling oats from 2016 to 2019.**

Milling oats	Average	2016		2017		2018		2019	
		Westlock	Peace	Westlock	Peace	Westlock	Peace	Westlock	Peace
<b>AC Morgan</b>	3.9	3.9	4.1	3.8	4.2	3.9	3.4	3.9	3.7
<b>CS Camden</b>	4.3	3.7	3.9	4.4	4.6	4.4	3.8	4.4	5.2
<b>CDC Seabiscuit</b>	4.2	3.7	3.7	4.6	4.6	4.4	3.7	4.5	4.2
<b>Triactor</b>	4.1	3.5	3.7	4.4	4.5	4.4	4.0	4.1	4.3
<b>CDC Ruffian</b>	3.4	2.7	3.3	3.8	3.9	3.6	2.7	3.6	3.7
<b>CDC Orrin</b>	3.8	3.2	3.7	4.4	4.0	4.1	3.4		
<b>AC Summit</b>	4.1	3.6	3.7	4.3	4.4	4.3	3.7	4.3	4.6
<b>Souris</b>	4.3	3.6	4.4	4.9	4.4				
<b>Akina</b>	4.4	3.8	3.7	5.0	4.9	4.8	4.0		
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Soil Moisture:	adequate	Very good
Seeding Depth:	$\frac{3}{4}$ inch	$\frac{3}{4}$ inch
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Herbicides applied to trial	In crop Broad leaf: stellar A (400 ml/ Acre) + stellar B (240 ml/ Acre) on 16 June	In crop Broad leaf: Curtail M (600 ml/ Acre) on 21 June
Fungicides applied to the trial	none	none
Rainfall (mm)	251 mm	374 mm
Comment:	Pre-harvest weed control on Sept 5	Best possible harvest conditions

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		HEIGHT cm		Lodging 1-9 scale		Test Wt kg/HL	
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4	Triactor	138	a	1.0	d	59.8	b
5	CDC Ruffian	122	c	2.3	c	63.5	a
6	AC Summit	109	d	1.0	d	62.3	ab
7	CDC Arborg	139	a	1.0	d	62.5	ab
8	CDC ENDURE	138	a	1.2	d	62.2	ab
9	CDC SKYE	136	ab	1.4	d	62.2	ab
10	ORE3542M	130	b	1.0	d	60.2	ab
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LSD P=.05		5.51				2.073	
Standard Deviation		3.23				1.435	
CV		2.45				2.34	

**Table.4: Other results from the POGA trial 2019 Peace Site.**

		HEIGHT cm	Lodging 1-9 scale	Test Wt kg/HL
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2	CDC Ruffian	91 e	0.3 ab	48.1 ab
3	AC Summit	95 cde	1.3 ab	48.2 ab
4	CDC Arborg	107 a	0.7 ab	<b>49.2 a</b>
5	CDC Norseman	101 abc	2.0 ab	45.9 cd
6	CDC ENDURE	103 ab	0.9 ab	48.1 ab
7	CS Camden	102 abc	1.3 ab	48.1 ab
8	CDC Seabiscuit	104 ab	<b>2.9 a</b>	45.4 d
9	ORE3542M	93 de	0.7 ab	46.1 cd
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Test weight is an important indicator of grain milling quality. CDC Seabiscuit, Triactor and Norseman were among the three lowest oat varieties for the test weight at Westlock as well as the peace region.

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		Westlock			Peace Region		
		1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)	1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)
1	AC Morgan	39.9	21.3	<b>3.9</b>	38.1	22.6	<b>3.7</b>
2	CS Camden	39.2	18.7	4.4	34.4	21.9	<b>5.2</b>
3	CDC Seabiscuit	42.2	16.7	<b>4.5</b>	37.5	23.0	4.2
4	Triactor	38.4	21.4	4.1	32.6	27.9	4.3
5	CDC Ruffian	38.1	17.2	<b>3.6</b>	35.1	15.3	<b>3.7</b>
6	AC Summit	34.6	17.6	4.3	34.1	23.6	4.6
7	CDC Arborg	38.4	16.5	<b>4.2</b>	33.9	29.1	4.3
8	ORE3542M	41.0	15.2	<b>3.8</b>	37.4	25.2	4.2
9	CDC Norseman	37.5	20.7	<b>4.7</b>	37.1	21.7	4.4
10	CDC SKYE	39.8	23.1	<b>4.5</b>	36.5	19.6	<b>5.0</b>
11	CDC ENDURE	39.8	17.5	<b>4.5</b>	37.6	25.0	<b>4.7</b>

**Beta Glucan results:** The beta-glucan content of the 11 different milling varieties ranged between 3.6% and 5.2%, with the lowest reported for Ruffian at both sites similar to the last years' findings. **CDC Norseman, CDC Seabiscuit, CDC ENDURE and CDC SKYE were the highest beta-glucan varieties at Westlock**, whereas **CS Camden, CDC ENDURE and CDC SKYE** had higher beta-glucan levels in the peace region as compared to AC Morgan.

### **Conclusion:**

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 2019 similar to 2018 CDC Endure had shown to be great milling oat with **high yield, specifically in Westlock**, and **high beta-glucan and good test weight**, which are preferred characteristics for the grain millers.

### **Overall Summary of the trial:**

#### **Yields from 2016 to 2019**

	Yield	Overall Average	2019	2018	2017	2016
<b>Milling oats</b>	% of AC Morgan	Yield (Bu/Ac)	Yield (Bushel/Acre)			
<b>AC Morgan</b>	<b>100</b>	<b>215</b>	243	226	212	178
CS Camden	98	210	241	206	226	167
CDC Seabiscuit	99	212	239	212	208	189
Triactor	98	212	238	229	208	172
CDC Ruffian	100	216	219	207	245	193
AC Summit	97	208	245	203	217	167
CDC Arborg	108	233	244	221	-	-
Akina	96	206	-	221	222	176
ORE3542M	97	208	214	201	-	-
CDC Norseman	101	218	222	213	-	-
CDC Endure	110	238	249	226	-	-
CDC SKYE	110	237	237	-	-	-
CDC Orrin	94	202	-	218	221	168
Souris	81	174	-	-	194	155
Kara	92	199	-	-	222	175
CDC Minstrel	88	188	-	-	202	174

**Beta glucan (%) contents in milling oats from 2016 to 2019.**

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

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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. This year the average yield was higher for Westlock location compared to peace location, but the beta-glucan content averaged higher for the Peace site. Most of the milling oats varieties surpassed the 4% mark for the total beta-glucan content. Westlock and peace both sites had ample to a little too much of the moisture during the season.

**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 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 ( $\beta$ -glucan). **A minimum of 4%  $\beta$ -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  $\beta$ -glucan amounts that the oat miller desire. To emphasize this fact, since 2015 two millers are helping to fund this variety trial to get it started before outside funding can be located to make oats in Alberta more competitive.

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  $\beta$ -glucan solubility and viscosity are the main criteria for the processing industry. Many studies have shown that oat  $\beta$ -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 resistance 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  $\beta$ -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 ( $\beta$ -glucan) attribute.

### **Objective**

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Eleven milling oat varieties and four forage oat varieties were tested in 2016 (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 three 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 at the site. A clean composite sample (500g) was collected and sent to laboratory analysis for the  $\beta$ -glucan estimation. The growing season of 2019 was very high moisture throughout the year.

**Table 1: Agronomic details for the POGA Trail 2019**

Location:	Peace region	Westlock
Seeding Date:	May 16th, 2019	May 10th, 2019
Harvest Date:	Sept 23th, 2019	Oct 10th, 2019
Soil Temp:	7.5 Celsius	10.1 Celsius
Soil Moisture:	adequate	Very good
Seeding Depth:	$\frac{3}{4}$ inch	$\frac{3}{4}$ inch
Fertility total Nutrients Lbs/acre	<b>110N-40P2O5-15K2O-25S</b>	<b>127N- 31P2O5- 75K2O- 15S</b>
Herbicides applied to the trial	Pre-burn Koril 0.5L/Ac and Roundup 1L/Ac on May 16	Pre-burn Roundup 1L/Ac on May 9
Herbicides applied to trial	In crop Broad leaf: stellar A (400 ml/ Acre) + stellar B (240 ml/ Acre) on 16 June	In crop Broad leaf: Curtail M (600 ml/ Acre) on 21 June
Fungicides applied to the trial	none	none
Rainfall (mm)	251 mm	374 mm
Comment:	Pre-harvest weed control on Sept 5	Best possible harvest conditions

### **Results and Discussion**

The overall yield averaged at Westlock site was 249 Bu/acre compared to an average of 222 Bu/Acre in the peace area. At Westlock site, except OT 3087 and Summit, no other oat varieties come close to beat AC Morgan in 2019. At peace site **CDC Arborg, CDC Seabiscuit** and **CS Camden** were **top-yielding milling oats varieties as compared to AC Morgan**.

**Table.2: Yield - 2019 Comparison**

		Westlock			Peace Region		
		% of AC Morgan	Bu/Acre		% of AC Morgan	Bu/Acre	
1	AC Morgan	100	262	ab	100	224	-
2	CS Camden	95	250	bc	104	232	-
3	CDC Seabiscuit	91	238	cd	107	240	-
4	Triactor	96	252	bc	100	224	-
5	CDC Ruffian	89	234	d	91	203	-
6	AC Summit	100	262	ab	101	227	-
7	CDC Arborg	96	252	bc	105	236	-
8	CDC ENDURE	104	273	a	100	225	-
9	CDC SKYE	99	260	ab	95	213	-
10	ORE3542M	85	223	d	92	205	-
11	CDC Norseman	88	230	d	96	214	-

**Table.3: Other results from the POGA trial 2019 Westlock Site.**

		HEIGHT cm		Lodging 1-9 scale		Test Wt kg/HL	
1	AC Morgan	140	a	1.0	d	60.3	ab
2	CS Camden	129	b	1.0	d	61.2	ab
3	CDC Seabiscuit	140	a	8.5	a	59.6	b
4	Triactor	138	a	1.0	d	59.8	b
5	CDC Ruffian	122	c	2.3	c	63.5	a
6	AC Summit	109	d	1.0	d	62.3	ab
7	CDC Arborg	139	a	1.0	d	62.5	ab
8	CDC ENDURE	138	a	1.2	d	62.2	ab
9	CDC SKYE	136	ab	1.4	d	62.2	ab
10	ORE3542M	130	b	1.0	d	60.2	ab
11	CDC Norseman	134	ab	4.5	b	61.6	ab
LSD P=.05		5.51				2.073	
Standard Deviation		3.23				1.435	
CV		2.45				2.34	



**Table.4: Other results from the POGA trial 2019 Peace Site.**

		HEIGHT cm	Lodging 1-9 scale	Test Wt kg/HL
1	AC Morgan	103 ab	2.5 a	48.8 ab
2	CDC Ruffian	91 e	0.3 ab	48.1 ab
3	AC Summit	95 cde	1.3 ab	48.2 ab
4	CDC Arborg	107 a	0.7 ab	<b>49.2 a</b>
5	CDC Norseman	101 abc	2.0 ab	45.9 cd
6	CDC ENDURE	103 ab	0.9 ab	48.1 ab
7	CS Camden	102 abc	1.3 ab	48.1 ab
8	CDC Seabiscuit	104 ab	<b>2.9 a</b>	45.4 d
9	ORE3542M	93 de	0.7 ab	46.1 cd
10	Triactor	102 abc	0.0 b	45.1 d
11	CDC SKYE	98 bcd	1.3 ab	47.2 bc
LSD P=.05		5.51		2.073
Standard Deviation		3.23		1.435
CV		2.45		2.34

Test weight is an important indicator of grain milling quality. CDC Seabiscuit, Triactor and Norseman were among the three lowest oat varieties for the test weight at Westlock as well as the peace region.

**Table 5: The Beta-Glucan results from the POGA trial of 2019.**

		Westlock			Peace Region		
		1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)	1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)
1	AC Morgan	39.9	21.3	<b>3.9</b>	38.1	22.6	<b>3.7</b>
2	CS Camden	39.2	18.7	4.4	34.4	21.9	<b>5.2</b>
3	CDC Seabiscuit	42.2	16.7	<b>4.5</b>	37.5	23.0	4.2
4	Triactor	38.4	21.4	4.1	32.6	27.9	4.3
5	CDC Ruffian	38.1	17.2	<b>3.6</b>	35.1	15.3	<b>3.7</b>
6	AC Summit	34.6	17.6	4.3	34.1	23.6	4.6
7	CDC Arborg	38.4	16.5	<b>4.2</b>	33.9	29.1	4.3
8	ORE3542M	41.0	15.2	<b>3.8</b>	37.4	25.2	4.2
9	CDC Norseman	37.5	20.7	<b>4.7</b>	37.1	21.7	4.4
10	CDC SKYE	39.8	23.1	<b>4.5</b>	36.5	19.6	<b>5.0</b>
11	CDC ENDURE	39.8	17.5	<b>4.5</b>	37.6	25.0	<b>4.7</b>

**Beta Glucan results:** The beta-glucan content of the 11 different milling varieties ranged between 3.6% and 5.2%, with the lowest reported for Ruffian at both sites similar to the last years' findings. **CDC Norseman, CDC Seabiscuit, CDC ENDURE and CDC SKYE were the highest beta-glucan varieties at Westlock**, whereas **CS Camden, CDC ENDURE and CDC SKYE** had higher beta-glucan levels in the peace region as compared to AC Morgan.

### **Conclusion:**

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### **Overall Summary of the trial:**

#### **Yields from 2016 to 2019**

	Yield	Overall Average	2019	2018	2017	2016
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**Beta glucan (%) contents in milling oats from 2016 to 2019.**

Milling oats	Average	2016		2017		2018		2019	
		Westlock	Peace	Westlock	Peace	Westlock	Peace	Westlock	Peace
<b>AC Morgan</b>	3.9	3.9	4.1	3.8	4.2	3.9	3.4	3.9	3.7
<b>CS Camden</b>	4.3	3.7	3.9	4.4	4.6	4.4	3.8	4.4	5.2
<b>CDC Seabiscuit</b>	4.2	3.7	3.7	4.6	4.6	4.4	3.7	4.5	4.2
<b>Triactor</b>	4.1	3.5	3.7	4.4	4.5	4.4	4.0	4.1	4.3
<b>CDC Ruffian</b>	3.4	2.7	3.3	3.8	3.9	3.6	2.7	3.6	3.7
<b>CDC Orrin</b>	3.8	3.2	3.7	4.4	4.0	4.1	3.4		
<b>AC Summit</b>	4.1	3.6	3.7	4.3	4.4	4.3	3.7	4.3	4.6
<b>Souris</b>	4.3	3.6	4.4	4.9	4.4				
<b>Akina</b>	4.4	3.8	3.7	5.0	4.9	4.8	4.0		
<b>Kara</b>	4.2	3.6	3.7	4.3	5.0				
<b>CDC Minstrel</b>	3.6	2.9	3.5	3.9	4.3				
<b>CDC Arborg</b>	4.2					4.4	3.8	4.2	4.3
<b>ORE3542M</b>	3.9					4.0	3.5	3.8	4.2
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Location:	Peace region	Westlock
Seeding Date:	May 16th, 2019	May 10th, 2019
Harvest Date:	Sept 23th, 2019	Oct 10th, 2019
Soil Temp:	7.5 Celsius	10.1 Celsius
Soil Moisture:	adequate	Very good
Seeding Depth:	$\frac{3}{4}$ inch	$\frac{3}{4}$ inch
Fertility total Nutrients Lbs/acre	<b>110N-40P2O5-15K2O-25S</b>	<b>127N- 31P2O5- 75K2O- 15S</b>
Herbicides applied to the trial	Pre-burn Koril 0.5L/Ac and Roundup 1L/Ac on May 16	Pre-burn Roundup 1L/Ac on May 9
Herbicides applied to trial	In crop Broad leaf: stellar A (400 ml/ Acre) + stellar B (240 ml/ Acre) on 16 June	In crop Broad leaf: Curtail M (600 ml/ Acre) on 21 June
Fungicides applied to the trial	none	none
Rainfall (mm)	251 mm	374 mm
Comment:	Pre-harvest weed control on Sept 5	Best possible harvest conditions

### **Results and Discussion**

The overall yield averaged at Westlock site was 249 Bu/acre compared to an average of 222 Bu/Acre in the peace area. At Westlock site, except OT 3087 and Summit, no other oat varieties come close to beat AC Morgan in 2019. At peace site **CDC Arborg, CDC Seabiscuit** and **CS Camden** were **top-yielding milling oats varieties as compared to AC Morgan**.

**Table.2: Yield - 2019 Comparison**

		Westlock			Peace Region		
		% of AC Morgan	Bu/Acre		% of AC Morgan	Bu/Acre	
1	AC Morgan	100	262	ab	100	224	-
2	CS Camden	95	250	bc	104	232	-
3	CDC Seabiscuit	91	238	cd	107	240	-
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10	ORE3542M	85	223	d	92	205	-
11	CDC Norseman	88	230	d	96	214	-

**Table.3: Other results from the POGA trial 2019 Westlock Site.**

		HEIGHT cm		Lodging 1-9 scale		Test Wt kg/HL	
1	AC Morgan	140	a	1.0	d	60.3	ab
2	CS Camden	129	b	1.0	d	61.2	ab
3	CDC Seabiscuit	140	a	8.5	a	59.6	b
4	Triactor	138	a	1.0	d	59.8	b
5	CDC Ruffian	122	c	2.3	c	63.5	a
6	AC Summit	109	d	1.0	d	62.3	ab
7	CDC Arborg	139	a	1.0	d	62.5	ab
8	CDC ENDURE	138	a	1.2	d	62.2	ab
9	CDC SKYE	136	ab	1.4	d	62.2	ab
10	ORE3542M	130	b	1.0	d	60.2	ab
11	CDC Norseman	134	ab	4.5	b	61.6	ab
LSD P=.05		5.51				2.073	
Standard Deviation		3.23				1.435	
CV		2.45				2.34	

**Table.4: Other results from the POGA trial 2019 Peace Site.**

		HEIGHT cm	Lodging 1-9 scale	Test Wt kg/HL
1	AC Morgan	103 ab	2.5 a	48.8 ab
2	CDC Ruffian	91 e	0.3 ab	48.1 ab
3	AC Summit	95 cde	1.3 ab	48.2 ab
4	CDC Arborg	107 a	0.7 ab	<b>49.2 a</b>
5	CDC Norseman	101 abc	2.0 ab	45.9 cd
6	CDC ENDURE	103 ab	0.9 ab	48.1 ab
7	CS Camden	102 abc	1.3 ab	48.1 ab
8	CDC Seabiscuit	104 ab	<b>2.9 a</b>	45.4 d
9	ORE3542M	93 de	0.7 ab	46.1 cd
10	Triactor	102 abc	0.0 b	45.1 d
11	CDC SKYE	98 bcd	1.3 ab	47.2 bc
LSD P=.05		5.51		2.073
Standard Deviation		3.23		1.435
CV		2.45		2.34

Test weight is an important indicator of grain milling quality. CDC Seabiscuit, Triactor and Norseman were among the three lowest oat varieties for the test weight at Westlock as well as the peace region.

**Table 5: The Beta-Glucan results from the POGA trial of 2019.**

		Westlock			Peace Region		
		1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)	1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)
1	AC Morgan	39.9	21.3	<b>3.9</b>	38.1	22.6	<b>3.7</b>
2	CS Camden	39.2	18.7	4.4	34.4	21.9	<b>5.2</b>
3	CDC Seabiscuit	42.2	16.7	<b>4.5</b>	37.5	23.0	4.2
4	Triactor	38.4	21.4	4.1	32.6	27.9	4.3
5	CDC Ruffian	38.1	17.2	<b>3.6</b>	35.1	15.3	<b>3.7</b>
6	AC Summit	34.6	17.6	4.3	34.1	23.6	4.6
7	CDC Arborg	38.4	16.5	<b>4.2</b>	33.9	29.1	4.3
8	ORE3542M	41.0	15.2	<b>3.8</b>	37.4	25.2	4.2
9	CDC Norseman	37.5	20.7	<b>4.7</b>	37.1	21.7	4.4
10	CDC SKYE	39.8	23.1	<b>4.5</b>	36.5	19.6	<b>5.0</b>
11	CDC ENDURE	39.8	17.5	<b>4.5</b>	37.6	25.0	<b>4.7</b>



**Beta Glucan results:** The beta-glucan content of the 11 different milling varieties ranged between 3.6% and 5.2%, with the lowest reported for Ruffian at both sites similar to the last years' findings. **CDC Norseman, CDC Seabiscuit, CDC ENDURE and CDC SKYE were the highest beta-glucan varieties at Westlock**, whereas **CS Camden, CDC ENDURE and CDC SKYE** had higher beta-glucan levels in the peace region as compared to AC Morgan.

### **Conclusion:**

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 2019 similar to 2018 CDC Endure had shown to be great milling oat with **high yield, specifically in Westlock**, and **high beta-glucan and good test weight**, which are preferred characteristics for the grain millers.

### **Overall Summary of the trial:**

#### **Yields from 2016 to 2019**

	Yield	Overall Average	2019	2018	2017	2016
<b>Milling oats</b>	% of AC Morgan	Yield (Bu/Ac)	Yield (Bushel/Acre)			
<b>AC Morgan</b>	<b>100</b>	<b>215</b>	243	226	212	178
CS Camden	98	210	241	206	226	167
CDC Seabiscuit	99	212	239	212	208	189
Triactor	98	212	238	229	208	172
CDC Ruffian	100	216	219	207	245	193
AC Summit	97	208	245	203	217	167
CDC Arborg	108	233	244	221	-	-
Akina	96	206	-	221	222	176
ORE3542M	97	208	214	201	-	-
CDC Norseman	101	218	222	213	-	-
CDC Endure	110	238	249	226	-	-
CDC SKYE	110	237	237	-	-	-
CDC Orrin	94	202	-	218	221	168
Souris	81	174	-	-	194	155
Kara	92	199	-	-	222	175
CDC Minstrel	88	188	-	-	202	174

**Beta glucan (%) contents in milling oats from 2016 to 2019.**

Milling oats	Average	2016		2017		2018		2019	
		Westlock	Peace	Westlock	Peace	Westlock	Peace	Westlock	Peace
<b>AC Morgan</b>	3.9	3.9	4.1	3.8	4.2	3.9	3.4	3.9	3.7
<b>CS Camden</b>	4.3	3.7	3.9	4.4	4.6	4.4	3.8	4.4	5.2
<b>CDC Seabiscuit</b>	4.2	3.7	3.7	4.6	4.6	4.4	3.7	4.5	4.2
<b>Triactor</b>	4.1	3.5	3.7	4.4	4.5	4.4	4.0	4.1	4.3
<b>CDC Ruffian</b>	3.4	2.7	3.3	3.8	3.9	3.6	2.7	3.6	3.7
<b>CDC Orrin</b>	3.8	3.2	3.7	4.4	4.0	4.1	3.4		
<b>AC Summit</b>	4.1	3.6	3.7	4.3	4.4	4.3	3.7	4.3	4.6
<b>Souris</b>	4.3	3.6	4.4	4.9	4.4				
<b>Akina</b>	4.4	3.8	3.7	5.0	4.9	4.8	4.0		
<b>Kara</b>	4.2	3.6	3.7	4.3	5.0				
<b>CDC Minstrel</b>	3.6	2.9	3.5	3.9	4.3				
<b>CDC Arborg</b>	4.2					4.4	3.8	4.2	4.3
<b>ORE3542M</b>	3.9					4.0	3.5	3.8	4.2
<b>CDC Norseman</b>	4.4					4.5	3.8	4.7	4.4
<b>CDC Endure</b>	4.8					4.7	4.2	4.5	4.7
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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. This year the average yield was higher for Westlock location compared to peace location, but the beta-glucan content averaged higher for the Peace site. Most of the milling oats varieties surpassed the 4% mark for the total beta-glucan content. Westlock and peace both sites had ample to a little too much of the moisture during the season.

**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 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 ( $\beta$ -glucan). **A minimum of 4%  $\beta$ -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  $\beta$ -glucan amounts that the oat miller desire. To emphasize this fact, since 2015 two millers are helping to fund this variety trial to get it started before outside funding can be located to make oats in Alberta more competitive.

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  $\beta$ -glucan solubility and viscosity are the main criteria for the processing industry. Many studies have shown that oat  $\beta$ -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 resistance 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  $\beta$ -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 ( $\beta$ -glucan) attribute.

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Eleven milling oat varieties and four forage oat varieties were tested in 2016 (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 three 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 at the site. A clean composite sample (500g) was collected and sent to laboratory analysis for the  $\beta$ -glucan estimation. The growing season of 2019 was very high moisture throughout the year.

**Table 1: Agronomic details for the POGA Trail 2019**

Location:	Peace region	Westlock
Seeding Date:	May 16th, 2019	May 10th, 2019
Harvest Date:	Sept 23th, 2019	Oct 10th, 2019
Soil Temp:	7.5 Celsius	10.1 Celsius
Soil Moisture:	adequate	Very good
Seeding Depth:	$\frac{3}{4}$ inch	$\frac{3}{4}$ inch
Fertility total Nutrients Lbs/acre	<b>110N-40P2O5-15K2O-25S</b>	<b>127N- 31P2O5- 75K2O- 15S</b>
Herbicides applied to the trial	Pre-burn Koril 0.5L/Ac and Roundup 1L/Ac on May 16	Pre-burn Roundup 1L/Ac on May 9
Herbicides applied to trial	In crop Broad leaf: stellar A (400 ml/ Acre) + stellar B (240 ml/ Acre) on 16 June	In crop Broad leaf: Curtail M (600 ml/ Acre) on 21 June
Fungicides applied to the trial	none	none
Rainfall (mm)	251 mm	374 mm
Comment:	Pre-harvest weed control on Sept 5	Best possible harvest conditions

### **Results and Discussion**

The overall yield averaged at Westlock site was 249 Bu/acre compared to an average of 222 Bu/Acre in the peace area. At Westlock site, except OT 3087 and Summit, no other oat varieties come close to beat AC Morgan in 2019. At peace site **CDC Arborg, CDC Seabiscuit** and **CS Camden** were **top-yielding milling oats varieties as compared to AC Morgan**.

**Table.2: Yield - 2019 Comparison**

		Westlock			Peace Region		
		% of AC Morgan	Bu/Acre		% of AC Morgan	Bu/Acre	
1	AC Morgan	100	262	ab	100	224	-
2	CS Camden	95	250	bc	104	232	-
3	CDC Seabiscuit	91	238	cd	107	240	-
4	Triactor	96	252	bc	100	224	-
5	CDC Ruffian	89	234	d	91	203	-
6	AC Summit	100	262	ab	101	227	-
7	CDC Arborg	96	252	bc	105	236	-
8	CDC ENDURE	104	273	a	100	225	-
9	CDC SKYE	99	260	ab	95	213	-
10	ORE3542M	85	223	d	92	205	-
11	CDC Norseman	88	230	d	96	214	-

**Table.3: Other results from the POGA trial 2019 Westlock Site.**

		HEIGHT cm		Lodging 1-9 scale		Test Wt kg/HL	
1	AC Morgan	140	a	1.0	d	60.3	ab
2	CS Camden	129	b	1.0	d	61.2	ab
3	CDC Seabiscuit	140	a	8.5	a	59.6	b
4	Triactor	138	a	1.0	d	59.8	b
5	CDC Ruffian	122	c	2.3	c	63.5	a
6	AC Summit	109	d	1.0	d	62.3	ab
7	CDC Arborg	139	a	1.0	d	62.5	ab
8	CDC ENDURE	138	a	1.2	d	62.2	ab
9	CDC SKYE	136	ab	1.4	d	62.2	ab
10	ORE3542M	130	b	1.0	d	60.2	ab
11	CDC Norseman	134	ab	4.5	b	61.6	ab
LSD P=.05		5.51				2.073	
Standard Deviation		3.23				1.435	
CV		2.45				2.34	

**Table.4: Other results from the POGA trial 2019 Peace Site.**

		HEIGHT cm	Lodging 1-9 scale	Test Wt kg/HL
1	AC Morgan	103 ab	2.5 a	48.8 ab
2	CDC Ruffian	91 e	0.3 ab	48.1 ab
3	AC Summit	95 cde	1.3 ab	48.2 ab
4	CDC Arborg	107 a	0.7 ab	<b>49.2 a</b>
5	CDC Norseman	101 abc	2.0 ab	45.9 cd
6	CDC ENDURE	103 ab	0.9 ab	48.1 ab
7	CS Camden	102 abc	1.3 ab	48.1 ab
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**Table 5: The Beta-Glucan results from the POGA trial of 2019.**

		Westlock			Peace Region		
		1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)	1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)
1	AC Morgan	39.9	21.3	<b>3.9</b>	38.1	22.6	<b>3.7</b>
2	CS Camden	39.2	18.7	4.4	34.4	21.9	<b>5.2</b>
3	CDC Seabiscuit	42.2	16.7	<b>4.5</b>	37.5	23.0	4.2
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5	CDC Ruffian	38.1	17.2	<b>3.6</b>	35.1	15.3	<b>3.7</b>
6	AC Summit	34.6	17.6	4.3	34.1	23.6	4.6
7	CDC Arborg	38.4	16.5	<b>4.2</b>	33.9	29.1	4.3
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**Beta glucan (%) contents in milling oats from 2016 to 2019.**

Milling oats	Average	2016		2017		2018		2019	
		Westlock	Peace	Westlock	Peace	Westlock	Peace	Westlock	Peace
<b>AC Morgan</b>	3.9	3.9	4.1	3.8	4.2	3.9	3.4	3.9	3.7
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<b>CDC Seabiscuit</b>	4.2	3.7	3.7	4.6	4.6	4.4	3.7	4.5	4.2
<b>Triactor</b>	4.1	3.5	3.7	4.4	4.5	4.4	4.0	4.1	4.3
<b>CDC Ruffian</b>	3.4	2.7	3.3	3.8	3.9	3.6	2.7	3.6	3.7
<b>CDC Orrin</b>	3.8	3.2	3.7	4.4	4.0	4.1	3.4		
<b>AC Summit</b>	4.1	3.6	3.7	4.3	4.4	4.3	3.7	4.3	4.6
<b>Souris</b>	4.3	3.6	4.4	4.9	4.4				
<b>Akina</b>	4.4	3.8	3.7	5.0	4.9	4.8	4.0		
<b>Kara</b>	4.2	3.6	3.7	4.3	5.0				
<b>CDC Minstrel</b>	3.6	2.9	3.5	3.9	4.3				
<b>CDC Arborg</b>	4.2					4.4	3.8	4.2	4.3
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Soil Temp:	7.5 Celsius	10.1 Celsius
Soil Moisture:	adequate	Very good
Seeding Depth:	$\frac{3}{4}$ inch	$\frac{3}{4}$ inch
Fertility total Nutrients Lbs/acre	<b>110N-40P2O5-15K2O-25S</b>	<b>127N- 31P2O5- 75K2O- 15S</b>
Herbicides applied to the trial	Pre-burn Koril 0.5L/Ac and Roundup 1L/Ac on May 16	Pre-burn Roundup 1L/Ac on May 9
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Fungicides applied to the trial	none	none
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		% of AC Morgan	Bu/Acre		% of AC Morgan	Bu/Acre	
1	AC Morgan	100	262	ab	100	224	-
2	CS Camden	95	250	bc	104	232	-
3	CDC Seabiscuit	91	238	cd	107	240	-
4	Triactor	96	252	bc	100	224	-
5	CDC Ruffian	89	234	d	91	203	-
6	AC Summit	100	262	ab	101	227	-
7	CDC Arborg	96	252	bc	105	236	-
8	CDC ENDURE	104	273	a	100	225	-
9	CDC SKYE	99	260	ab	95	213	-
10	ORE3542M	85	223	d	92	205	-
11	CDC Norseman	88	230	d	96	214	-

**Table.3: Other results from the POGA trial 2019 Westlock Site.**

		HEIGHT cm		Lodging 1-9 scale		Test Wt kg/HL	
1	AC Morgan	140	a	1.0	d	60.3	ab
2	CS Camden	129	b	1.0	d	61.2	ab
3	CDC Seabiscuit	140	a	8.5	a	59.6	b
4	Triactor	138	a	1.0	d	59.8	b
5	CDC Ruffian	122	c	2.3	c	63.5	a
6	AC Summit	109	d	1.0	d	62.3	ab
7	CDC Arborg	139	a	1.0	d	62.5	ab
8	CDC ENDURE	138	a	1.2	d	62.2	ab
9	CDC SKYE	136	ab	1.4	d	62.2	ab
10	ORE3542M	130	b	1.0	d	60.2	ab
11	CDC Norseman	134	ab	4.5	b	61.6	ab
LSD P=.05		5.51				2.073	
Standard Deviation		3.23				1.435	
CV		2.45				2.34	

**Table.4: Other results from the POGA trial 2019 Peace Site.**

		HEIGHT cm	Lodging 1-9 scale	Test Wt kg/HL
1	AC Morgan	103 ab	2.5 a	48.8 ab
2	CDC Ruffian	91 e	0.3 ab	48.1 ab
3	AC Summit	95 cde	1.3 ab	48.2 ab
4	CDC Arborg	107 a	0.7 ab	<b>49.2 a</b>
5	CDC Norseman	101 abc	2.0 ab	45.9 cd
6	CDC ENDURE	103 ab	0.9 ab	48.1 ab
7	CS Camden	102 abc	1.3 ab	48.1 ab
8	CDC Seabiscuit	104 ab	<b>2.9 a</b>	45.4 d
9	ORE3542M	93 de	0.7 ab	46.1 cd
10	Triactor	102 abc	0.0 b	45.1 d
11	CDC SKYE	98 bcd	1.3 ab	47.2 bc
LSD P=.05		5.51		2.073
Standard Deviation		3.23		1.435
CV		2.45		2.34

Test weight is an important indicator of grain milling quality. CDC Seabiscuit, Triactor and Norseman were among the three lowest oat varieties for the test weight at Westlock as well as the peace region.

**Table 5: The Beta-Glucan results from the POGA trial of 2019.**

		Westlock			Peace Region		
		1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)	1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)
1	AC Morgan	39.9	21.3	<b>3.9</b>	38.1	22.6	<b>3.7</b>
2	CS Camden	39.2	18.7	4.4	34.4	21.9	<b>5.2</b>
3	CDC Seabiscuit	42.2	16.7	<b>4.5</b>	37.5	23.0	4.2
4	Triactor	38.4	21.4	4.1	32.6	27.9	4.3
5	CDC Ruffian	38.1	17.2	<b>3.6</b>	35.1	15.3	<b>3.7</b>
6	AC Summit	34.6	17.6	4.3	34.1	23.6	4.6
7	CDC Arborg	38.4	16.5	<b>4.2</b>	33.9	29.1	4.3
8	ORE3542M	41.0	15.2	<b>3.8</b>	37.4	25.2	4.2
9	CDC Norseman	37.5	20.7	<b>4.7</b>	37.1	21.7	4.4
10	CDC SKYE	39.8	23.1	<b>4.5</b>	36.5	19.6	<b>5.0</b>
11	CDC ENDURE	39.8	17.5	<b>4.5</b>	37.6	25.0	<b>4.7</b>

**Beta Glucan results:** The beta-glucan content of the 11 different milling varieties ranged between 3.6% and 5.2%, with the lowest reported for Ruffian at both sites similar to the last years' findings. **CDC Norseman, CDC Seabiscuit, CDC ENDURE and CDC SKYE were the highest beta-glucan varieties at Westlock**, whereas **CS Camden, CDC ENDURE and CDC SKYE** had higher beta-glucan levels in the peace region as compared to AC Morgan.

### **Conclusion:**

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 2019 similar to 2018 CDC Endure had shown to be great milling oat with **high yield, specifically in Westlock**, and **high beta-glucan and good test weight**, which are preferred characteristics for the grain millers.

### **Overall Summary of the trial:**

#### **Yields from 2016 to 2019**

	Yield	Overall Average	2019	2018	2017	2016
<b>Milling oats</b>	% of AC Morgan	Yield (Bu/Ac)	Yield (Bushel/Acre)			
<b>AC Morgan</b>	<b>100</b>	<b>215</b>	243	226	212	178
CS Camden	98	210	241	206	226	167
CDC Seabiscuit	99	212	239	212	208	189
Triactor	98	212	238	229	208	172
CDC Ruffian	100	216	219	207	245	193
AC Summit	97	208	245	203	217	167
CDC Arborg	108	233	244	221	-	-
Akina	96	206	-	221	222	176
ORE3542M	97	208	214	201	-	-
CDC Norseman	101	218	222	213	-	-
CDC Endure	110	238	249	226	-	-
CDC SKYE	110	237	237	-	-	-
CDC Orrin	94	202	-	218	221	168
Souris	81	174	-	-	194	155
Kara	92	199	-	-	222	175
CDC Minstrel	88	188	-	-	202	174

**Beta glucan (%) contents in milling oats from 2016 to 2019.**

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

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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. This year the average yield was higher for Westlock location compared to peace location, but the beta-glucan content averaged higher for the Peace site. Most of the milling oats varieties surpassed the 4% mark for the total beta-glucan content. Westlock and peace both sites had ample to a little too much of the moisture during the season.

**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 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 ( $\beta$ -glucan). **A minimum of 4%  $\beta$ -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  $\beta$ -glucan amounts that the oat miller desire. To emphasize this fact, since 2015 two millers are helping to fund this variety trial to get it started before outside funding can be located to make oats in Alberta more competitive.

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  $\beta$ -glucan solubility and viscosity are the main criteria for the processing industry. Many studies have shown that oat  $\beta$ -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 resistance 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  $\beta$ -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 ( $\beta$ -glucan) attribute.

### **Objective**

- To investigate the impact of genotype and growing condition on the yield and  $\beta$ -glucan content of milling oat varieties in Alberta.

### **Methodology**

Eleven milling oat varieties and four forage oat varieties were tested in 2016 (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 three 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 at the site. A clean composite sample (500g) was collected and sent to laboratory analysis for the  $\beta$ -glucan estimation. The growing season of 2019 was very high moisture throughout the year.

**Table 1: Agronomic details for the POGA Trail 2019**

Location:	Peace region	Westlock
Seeding Date:	May 16th, 2019	May 10th, 2019
Harvest Date:	Sept 23th, 2019	Oct 10th, 2019
Soil Temp:	7.5 Celsius	10.1 Celsius
Soil Moisture:	adequate	Very good
Seeding Depth:	$\frac{3}{4}$ inch	$\frac{3}{4}$ inch
Fertility total Nutrients Lbs/acre	<b>110N-40P2O5-15K2O-25S</b>	<b>127N- 31P2O5- 75K2O- 15S</b>
Herbicides applied to the trial	Pre-burn Koril 0.5L/Ac and Roundup 1L/Ac on May 16	Pre-burn Roundup 1L/Ac on May 9
Herbicides applied to trial	In crop Broad leaf: stellar A (400 ml/ Acre) + stellar B (240 ml/ Acre) on 16 June	In crop Broad leaf: Curtail M (600 ml/ Acre) on 21 June
Fungicides applied to the trial	none	none
Rainfall (mm)	251 mm	374 mm
Comment:	Pre-harvest weed control on Sept 5	Best possible harvest conditions

### **Results and Discussion**

The overall yield averaged at Westlock site was 249 Bu/acre compared to an average of 222 Bu/Acre in the peace area. At Westlock site, except OT 3087 and Summit, no other oat varieties come close to beat AC Morgan in 2019. At peace site **CDC Arborg, CDC Seabiscuit** and **CS Camden** were **top-yielding milling oats varieties as compared to AC Morgan**.

**Table.2: Yield - 2019 Comparison**

		Westlock			Peace Region		
		% of AC Morgan	Bu/Acre		% of AC Morgan	Bu/Acre	
1	AC Morgan	100	262	ab	100	224	-
2	CS Camden	95	250	bc	104	232	-
3	CDC Seabiscuit	91	238	cd	107	240	-
4	Triactor	96	252	bc	100	224	-
5	CDC Ruffian	89	234	d	91	203	-
6	AC Summit	100	262	ab	101	227	-
7	CDC Arborg	96	252	bc	105	236	-
8	CDC ENDURE	104	273	a	100	225	-
9	CDC SKYE	99	260	ab	95	213	-
10	ORE3542M	85	223	d	92	205	-
11	CDC Norseman	88	230	d	96	214	-

**Table.3: Other results from the POGA trial 2019 Westlock Site.**

		HEIGHT cm		Lodging 1-9 scale		Test Wt kg/HL	
1	AC Morgan	140	a	1.0	d	60.3	ab
2	CS Camden	129	b	1.0	d	61.2	ab
3	CDC Seabiscuit	140	a	8.5	a	59.6	b
4	Triactor	138	a	1.0	d	59.8	b
5	CDC Ruffian	122	c	2.3	c	63.5	a
6	AC Summit	109	d	1.0	d	62.3	ab
7	CDC Arborg	139	a	1.0	d	62.5	ab
8	CDC ENDURE	138	a	1.2	d	62.2	ab
9	CDC SKYE	136	ab	1.4	d	62.2	ab
10	ORE3542M	130	b	1.0	d	60.2	ab
11	CDC Norseman	134	ab	4.5	b	61.6	ab
LSD P=.05		5.51				2.073	
Standard Deviation		3.23				1.435	
CV		2.45				2.34	

**Table.4: Other results from the POGA trial 2019 Peace Site.**

		HEIGHT cm	Lodging 1-9 scale	Test Wt kg/HL
1	AC Morgan	103 ab	2.5 a	48.8 ab
2	CDC Ruffian	91 e	0.3 ab	48.1 ab
3	AC Summit	95 cde	1.3 ab	48.2 ab
4	CDC Arborg	107 a	0.7 ab	<b>49.2 a</b>
5	CDC Norseman	101 abc	2.0 ab	45.9 cd
6	CDC ENDURE	103 ab	0.9 ab	48.1 ab
7	CS Camden	102 abc	1.3 ab	48.1 ab
8	CDC Seabiscuit	104 ab	<b>2.9 a</b>	45.4 d
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Test weight is an important indicator of grain milling quality. CDC Seabiscuit, Triactor and Norseman were among the three lowest oat varieties for the test weight at Westlock as well as the peace region.

**Table 5: The Beta-Glucan results from the POGA trial of 2019.**

		Westlock			Peace Region		
		1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)	1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)
1	AC Morgan	39.9	21.3	<b>3.9</b>	38.1	22.6	<b>3.7</b>
2	CS Camden	39.2	18.7	4.4	34.4	21.9	<b>5.2</b>
3	CDC Seabiscuit	42.2	16.7	<b>4.5</b>	37.5	23.0	4.2
4	Triactor	38.4	21.4	4.1	32.6	27.9	4.3
5	CDC Ruffian	38.1	17.2	<b>3.6</b>	35.1	15.3	<b>3.7</b>
6	AC Summit	34.6	17.6	4.3	34.1	23.6	4.6
7	CDC Arborg	38.4	16.5	<b>4.2</b>	33.9	29.1	4.3
8	ORE3542M	41.0	15.2	<b>3.8</b>	37.4	25.2	4.2
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10	CDC SKYE	39.8	23.1	<b>4.5</b>	36.5	19.6	<b>5.0</b>
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**Beta Glucan results:** The beta-glucan content of the 11 different milling varieties ranged between 3.6% and 5.2%, with the lowest reported for Ruffian at both sites similar to the last years' findings. **CDC Norseman, CDC Seabiscuit, CDC ENDURE and CDC SKYE were the highest beta-glucan varieties at Westlock**, whereas **CS Camden, CDC ENDURE and CDC SKYE** had higher beta-glucan levels in the peace region as compared to AC Morgan.

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### **Overall Summary of the trial:**

#### **Yields from 2016 to 2019**

	Yield	Overall Average	2019	2018	2017	2016
<b>Milling oats</b>	% of AC Morgan	Yield (Bu/Ac)	Yield (Bushel/Acre)			
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**Beta glucan (%) contents in milling oats from 2016 to 2019.**

Milling oats	Average	2016		2017		2018		2019	
		Westlock	Peace	Westlock	Peace	Westlock	Peace	Westlock	Peace
<b>AC Morgan</b>	3.9	3.9	4.1	3.8	4.2	3.9	3.4	3.9	3.7
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<b>CDC Seabiscuit</b>	4.2	3.7	3.7	4.6	4.6	4.4	3.7	4.5	4.2
<b>Triactor</b>	4.1	3.5	3.7	4.4	4.5	4.4	4.0	4.1	4.3
<b>CDC Ruffian</b>	3.4	2.7	3.3	3.8	3.9	3.6	2.7	3.6	3.7
<b>CDC Orrin</b>	3.8	3.2	3.7	4.4	4.0	4.1	3.4		
<b>AC Summit</b>	4.1	3.6	3.7	4.3	4.4	4.3	3.7	4.3	4.6
<b>Souris</b>	4.3	3.6	4.4	4.9	4.4				
<b>Akina</b>	4.4	3.8	3.7	5.0	4.9	4.8	4.0		
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- To investigate the impact of genotype and growing condition on the yield and  $\beta$ -glucan content of milling oat varieties in Alberta.

### **Methodology**

Eleven milling oat varieties and four forage oat varieties were tested in 2016 (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 three 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 at the site. A clean composite sample (500g) was collected and sent to laboratory analysis for the  $\beta$ -glucan estimation. The growing season of 2019 was very high moisture throughout the year.

**Table 1: Agronomic details for the POGA Trail 2019**

<b>Location:</b>	<b>Peace region</b>	<b>Westlock</b>
Seeding Date:	May 16th, 2019	May 10th, 2019
Harvest Date:	Sept 23th, 2019	Oct 10th, 2019
Soil Temp:	7.5 Celsius	10.1 Celsius
Soil Moisture:	adequate	Very good
Seeding Depth:	$\frac{3}{4}$ inch	$\frac{3}{4}$ inch
Fertility total Nutrients Lbs/acre	<b>110N-40P2O5-15K2O-25S</b>	<b>127N- 31P2O5- 75K2O- 15S</b>
Herbicides applied to the trial	Pre-burn Koril 0.5L/Ac and Roundup 1L/Ac on May 16	Pre-burn Roundup 1L/Ac on May 9
Herbicides applied to trial	In crop Broad leaf: stellar A (400 ml/ Acre) + stellar B (240 ml/ Acre) on 16 June	In crop Broad leaf: Curtail M (600 ml/ Acre) on 21 June
Fungicides applied to the trial	none	none
Rainfall (mm)	251 mm	374 mm
Comment:	Pre-harvest weed control on Sept 5	Best possible harvest conditions

### **Results and Discussion**

The overall yield averaged at Westlock site was 249 Bu/acre compared to an average of 222 Bu/Acre in the peace area. At Westlock site, except OT 3087 and Summit, no other oat varieties come close to beat AC Morgan in 2019. At peace site **CDC Arborg, CDC Seabiscuit** and **CS Camden** were **top-yielding milling oats varieties as compared to AC Morgan**.

**Table.2: Yield - 2019 Comparison**

		Westlock			Peace Region		
		% of AC Morgan	Bu/Acre		% of AC Morgan	Bu/Acre	
1	AC Morgan	100	262	ab	100	224	-
2	CS Camden	95	250	bc	104	232	-
3	CDC Seabiscuit	91	238	cd	107	240	-
4	Triactor	96	252	bc	100	224	-
5	CDC Ruffian	89	234	d	91	203	-
6	AC Summit	100	262	ab	101	227	-
7	CDC Arborg	96	252	bc	105	236	-
8	CDC ENDURE	104	273	a	100	225	-
9	CDC SKYE	99	260	ab	95	213	-
10	ORE3542M	85	223	d	92	205	-
11	CDC Norseman	88	230	d	96	214	-

**Table.3: Other results from the POGA trial 2019 Westlock Site.**

		HEIGHT cm		Lodging 1-9 scale		Test Wt kg/HL	
1	AC Morgan	140	a	1.0	d	60.3	ab
2	CS Camden	129	b	1.0	d	61.2	ab
3	CDC Seabiscuit	140	a	8.5	a	59.6	b
4	Triactor	138	a	1.0	d	59.8	b
5	CDC Ruffian	122	c	2.3	c	63.5	a
6	AC Summit	109	d	1.0	d	62.3	ab
7	CDC Arborg	139	a	1.0	d	62.5	ab
8	CDC ENDURE	138	a	1.2	d	62.2	ab
9	CDC SKYE	136	ab	1.4	d	62.2	ab
10	ORE3542M	130	b	1.0	d	60.2	ab
11	CDC Norseman	134	ab	4.5	b	61.6	ab
LSD P=.05		5.51				2.073	
Standard Deviation		3.23				1.435	
CV		2.45				2.34	

**Table.4: Other results from the POGA trial 2019 Peace Site.**

		HEIGHT cm	Lodging 1-9 scale	Test Wt kg/HL
1	AC Morgan	103 ab	2.5 a	48.8 ab
2	CDC Ruffian	91 e	0.3 ab	48.1 ab
3	AC Summit	95 cde	1.3 ab	48.2 ab
4	CDC Arborg	107 a	0.7 ab	<b>49.2 a</b>
5	CDC Norseman	101 abc	2.0 ab	45.9 cd
6	CDC ENDURE	103 ab	0.9 ab	48.1 ab
7	CS Camden	102 abc	1.3 ab	48.1 ab
8	CDC Seabiscuit	104 ab	<b>2.9 a</b>	45.4 d
9	ORE3542M	93 de	0.7 ab	46.1 cd
10	Triactor	102 abc	0.0 b	45.1 d
11	CDC SKYE	98 bcd	1.3 ab	47.2 bc
LSD P=.05		5.51		2.073
Standard Deviation		3.23		1.435
CV		2.45		2.34

Test weight is an important indicator of grain milling quality. CDC Seabiscuit, Triactor and Norseman were among the three lowest oat varieties for the test weight at Westlock as well as the peace region.

**Table 5: The Beta-Glucan results from the POGA trial of 2019.**

		Westlock			Peace Region		
		1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)	1000 groat weight (g)	Hull percentage (%)	Flour BG (%, db)
1	AC Morgan	39.9	21.3	<b>3.9</b>	38.1	22.6	<b>3.7</b>
2	CS Camden	39.2	18.7	4.4	34.4	21.9	<b>5.2</b>
3	CDC Seabiscuit	42.2	16.7	<b>4.5</b>	37.5	23.0	4.2
4	Triactor	38.4	21.4	4.1	32.6	27.9	4.3
5	CDC Ruffian	38.1	17.2	<b>3.6</b>	35.1	15.3	<b>3.7</b>
6	AC Summit	34.6	17.6	4.3	34.1	23.6	4.6
7	CDC Arborg	38.4	16.5	<b>4.2</b>	33.9	29.1	4.3
8	ORE3542M	41.0	15.2	<b>3.8</b>	37.4	25.2	4.2
9	CDC Norseman	37.5	20.7	<b>4.7</b>	37.1	21.7	4.4
10	CDC SKYE	39.8	23.1	<b>4.5</b>	36.5	19.6	<b>5.0</b>
11	CDC ENDURE	39.8	17.5	<b>4.5</b>	37.6	25.0	<b>4.7</b>

**Beta Glucan results:** The beta-glucan content of the 11 different milling varieties ranged between 3.6% and 5.2%, with the lowest reported for Ruffian at both sites similar to the last years' findings. **CDC Norseman, CDC Seabiscuit, CDC ENDURE and CDC SKYE were the highest beta-glucan varieties at Westlock**, whereas **CS Camden, CDC ENDURE and CDC SKYE** had higher beta-glucan levels in the peace region as compared to AC Morgan.

### **Conclusion:**

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 2019 similar to 2018 CDC Endure had shown to be great milling oat with **high yield, specifically in Westlock**, and **high beta-glucan and good test weight**, which are preferred characteristics for the grain millers.

### **Overall Summary of the trial:**

#### **Yields from 2016 to 2019**

	Yield	Overall Average	2019	2018	2017	2016
<b>Milling oats</b>	% of AC Morgan	Yield (Bu/Ac)	Yield (Bushel/Acre)			
<b>AC Morgan</b>	<b>100</b>	<b>215</b>	243	226	212	178
CS Camden	98	210	241	206	226	167
CDC Seabiscuit	99	212	239	212	208	189
Triactor	98	212	238	229	208	172
CDC Ruffian	100	216	219	207	245	193
AC Summit	97	208	245	203	217	167
CDC Arborg	108	233	244	221	-	-
Akina	96	206	-	221	222	176
ORE3542M	97	208	214	201	-	-
CDC Norseman	101	218	222	213	-	-
CDC Endure	110	238	249	226	-	-
CDC SKYE	110	237	237	-	-	-
CDC Orrin	94	202	-	218	221	168
Souris	81	174	-	-	194	155
Kara	92	199	-	-	222	175
CDC Minstrel	88	188	-	-	202	174

**Beta glucan (%) contents in milling oats from 2016 to 2019.**

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

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**GRAIN MILLERS**



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