

## POGA Milling Oats Trial

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

**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 2020”**

### **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 hoping to identify oat varieties that will help Alberta producers access the milling market more consistently.

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

Test weight is the most commonly used indicator of grain quality. High test-weight varieties should be chosen by growers who intend to market oat grain. However, the functional attribute such as  $\beta$ -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 four replications. The trial site was maintained weed-free with the use of herbicides or hand weeding methods (Table 1). The trial was harvested with a Wintersteiger Nursery Mate Elite combine (5-foot header) and grain yield from each plot was measured using Electronic Scales. A clean composite sample (500g) was collected and sent to laboratory analysis for the  $\beta$ -glucan estimation. The growing season of 2019 was very high moisture throughout the year.

**Soil Information – GRO – Westlock - 2020**

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

**Table 1: Agronomic details for the POGA Trail 2020**

| Location:                                  | Peace region            | Westlock   |
|--|-------------------------|--|
| Seeding Date:                              | May 30th, 2020          | May 12th, 2020   |
| Harvest Date:                              | Sept 23th, 2020         | September 29, 2020   |
| Soil Temp:                                 | 13.4 Celsius            | 9 Celsius  |
| Soil Moisture:                             | adequate                | Very good  |
| Seeding Depth:                             | ¾ inch                  | 1 inch   |
| Fertility total Nutrients (Actual lb/acre) | <b>120N-20P-15K-15S</b> | <b>Fall Applied 100N-30P-40K-24S</b><br><b>Spring Applied 6.5N-30P-60K</b> |

|                                 |   |   |
|---------------------------------|---|---|
| Herbicides applied to the trial | Pre-burn Paradigm(granular) @ 7.5g/acre | Pre-burn Roundup 1L/Ac                                  |
| Herbicides applied to trial     | In crop Stellar XL @405 ml/ac           | In crop Broad leaf: Curtail M (600 ml/ Acre) on 16 June |
| Fungicides applied to the trial | None                                    | None  |
| Rainfall (mm)                   | 190.5 mm                                | 374.1 mm  |

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

### Results and Discussion

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

**Table.2: Yield - 2020 Comparison**

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

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

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

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

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

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

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

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

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

**Conclusion:**

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

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

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



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

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

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

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

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GRAIN MILLERS



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