2022 Final Research Report

from the

East Central Research Foundation

Project Title: Grain Millers Oat Variety Trial (Yorkton) 2019-2022

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Project Identification

1. **Project Number:** 229
2. **Sponsoring the Project:** Grain Millers
3. **Project Location(s):** Yorkton, SK
4. **Project start and end dates (month & year):** April 2019 to February 2023
5. **Project contact person & contact details:**

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Objectives and Rationale

6. **Project objectives:**

The objective of this study was to compare yield and quality of oat varieties, which are either recommended or under consideration by Grain Millers.

7. **Project Rationale:**

As new oat varieties continue to emerge in the market place, farmers need to stay up to date on how the newest genetics are performing locally. This study shows producers a local comparison of Zone 2 recommended varieties for Grain Millers as well as varieties under their consideration.

8. **Methodology:**

The trials were established as a Randomized Complete Block Design (RCBD) with 4 replications. Plots were 11 by 30 ft and were seeded with a 10 ft wide Seedmaster drill on 12-inch row spacings. The study compared the yield and quality of oat varieties listed below. Oats were seeded at 300 viable seeds/m^2, correcting for seed vigour and thousand kernel weight. The middle 4 rows by 30 ft were harvested from each plot with a Wintersteiger plot combine. Oat varieties compared in each year are listed in Table 1. Dates of key operations are listed in Table 2.

Table 1. Grain Millers Oat Variety Comparisons by Year				
	2019	**2020**	**2021**	**2022**
CDC Arborg[1]	X	X	X	X
CS Camden[1]	X	X	X	X
Summit[1]	X	X	X	X
Ore3542M[1]	X	X	X	X
CDC Endure[3]	X	X	X	X
AAC Kongsore[2]		X	X	X
CDC Ruffian[2]	X	X		
Kalio[3]			X	X
CDC Skye[3]		X		X
AAC Douglas[3]			X	X
CDC Leggett	X			
CDC Minstrel	X			
Level 48				X
OT3112				X
OT2129				X
[1]Recommended (zone 2) [2]Acceptable [3]Under Review				

Table 2. Dates of operations for the "Grain Millers Oat Variety Trial (Yorkton) 2022" trial.				
Operation	**2019**	**2020**	**2021**	**2022**
Pre-seed herbicide	none	none	none	none
Seeded trial	**May 13**	**May 12**	**May 6**	**May 24**
Crop vigour			**June 3**	
Emergence counts	**June 4**	**June 2**	**June 3**	**June 7**
In-crop herbicide application	**June 10** (Frontline) **June 25** (MCPA)	**June 2** (Prestige)	**June 7** (Prestige)	**June 8** (Akito)
In-crop fungicide	**July 3** (Caramba)		None	**July 6** (Trivapro AB)
Height		**July 17**	**July 21**	**Aug 2**
Maturity rating	**Aug 13**	**July 30**	**July 27**	
Lodging rating	**Sept 3**			**Aug 22**
Harvest	**Sept 4 & 6**	**Aug 26**	**Aug 11**	**Sept 9**

9. Results:

Growing Season Weather

Mean monthly temperatures and precipitation amounts for Yorkton for 2019-2022 are listed in Table 3. The growing season was cool and dry in 2019, but oat yield was still very high (approx. 175 bu/ac) due to excellent reserves of soil moisture and little leaf disease. In 2020 and 2021, the seasons were warmer than the long-term average and precipitation was well below average. The ensuing drought resulted in average oat yields of only 70 bu/ac. In 2022, above average precipitation was received ending the drought. Unfortunately, some of this precipitation came in the form of hail on June 23, 2022. Despite heavy hail damage, the oat crop recovered well yielding 140 bu/ac on average.

Table 3. Mean monthly temperatures and precipitation amounts for 2022 along with long-term normals (1981-2010) for Yorkton in Saskatchewan.

Location	Year	May	June	July	August	Avg. / Total
		----------*Mean Temperature (°C)* ----------				
Yorkton	2022	10.6	15.7	18.6	18.9	16.0
Yorkton	2021	8.9	19.1	21.0	17.3	16.5
Yorkton	2020	10.5	16.4	19.9	18.3	16.3
Yorkton	2019	8.6	16	18.3	16.1	14.8
	Long-term	***10.4***	***15.5***	***17.9***	***17.1***	***15.2***
		---------- *Precipitation (mm)* ----------				
Yorkton	2022	137.9	57.9	38.4	90.8	325.0
Yorkton	2021	24.6	18.1	35.2	69.7	147.6
Yorkton	2020	16.7	33.6	80.1	49.3	179.7
Yorkton	2019	11.1	81.6	49.1	32.2	174
	Long-term	***51***	***80***	***78***	***62***	***272***

Tables 4 to 10 list oat emergence, lodging, yield, test weight, maturity, height and thins for varieties grown from 2019-2022. Each table lists the varieties from highest to lowest value for each year. Crop emergence was excellent for all varieties in each year (Table 4). The lowest emergence rate was 258 plants/m^2 and the highest was 373 plants/m^2. Emergence rates did not statistically differ between varieties, as desired, within any year

except 2020. In 2020, AAC Kongsore and CDC Ruffian had significantly lower rates of emergence. However, the differences were not likely to be of substantial agronomic significance. Crop lodging was not apparent in 2022 or 2019 (data not shown). Differences in lodging between varieties were detected in 2021 and 2019 (Table 5). In 2021, lodging for Summit was significantly more than all other varieties. However, with a rating of 2.5 on a 0-9 scale, the degree of lodging was modest and would have had a minimal impact on yield. In 2019, lodging for CDC Leggett and CDC Ruffian was significantly more than all other varieties. Again, the degree of lodging would have only minimally impacted yield.

CS Camden, CDC Arborg, Summit, ORe3542M and CDC Endure were the only varieties that were commonly grown in every year of the study. All of these "commonly grown" varieties are on the recommended list for Grain Millers (zone 2), excepting CDC Endure which is under review. As mentioned earlier, growing conditions were excellent in 2019, poor in 2020 and 2021and fairly respectable in 2022 despite hail. Thus these varieties were compared under a wide range of environmental conditions, and their yield ranking changed between years (Table 6). On average, CDC Arborg was highest yielding variety which was 5% greater than the regional check CS Camden (Table 11). This is similar to regional information which lists CDC Arborg as 6% higher yielding than CS Camden. However, there is a lot of variability between years. Statistically, there were no yield differences between these "commonly grown" varieties in the hail year of 2022 or the drought year of 2021. During the drought year of 2020, CDC Arborg yielded significantly more than any variety except CDC Ruffian. In contrast, CDC Arborg was the second lowest yielding variety during the excellent growing conditions of 2019. When averaged across all years, ORe3542M was the lowest yielding of the commonly grown varieties (Table 11). This is also supported by regional data that lists Ore3542M as yielding only 92% of CS Camden. But again there is variation, as ORe3542M managed to be the highest yielding variety in 2019. Despite the lower yield potential, ORe3542M had other redeeming attributes. It is a shorter variety (Table 9) that resisted lodging well (Table 5) and it is rated as resistant to crown rust.

In general test weights were good for all varieties in every year except 2021 (Table 7). Not sure how drought affects test weight as they were very high in the drought of 2020 and very low during the drought of 2021. Of the commonly grown varieties, test weight was highest for Summit and lowest for CS Camden which was highly reflective of regional information. With the exception of 2019, Summit consistently had one of the highest test weights and CS Camden consistently had the lowest (Table 7). Despite CS Camden's consistently low test weights relative to other varieties, this has not resulted in significant rejection issues for this variety at Grain Millers.

Of the "commonly grown" varieties, differences in maturity were small, even between varieties with "long" vs "medium" maturity ratings based on regional trial information (Table 12). Keep in mind all trials were seeded early from May 6 to May 24 and drought with warm conditions were experienced for 2 of the 4 years. Early seeding and warm dry conditions will tend to minimize maturity differences between varieties. Of the

"commonly grown" varieties, CDC Arborg tended to be the tallest variety and CS Camden and CDC Arborg tended to have higher levels of thins (Table 12).

Of the varieties not grown in every year, OT3112 and OT2129 appeared to be high yielding varieties in the hail year of 2022 (Table 6). They were also shorter varieties with OT3112 being the shortest of all varieties. Any added lodging resistance due to short stature could not be determined as lodging was not an issue for any variety in 2022 On the negative side, OT3112 had the longest maturity and the 2nd lowest test weight. However, if low test weight is not a commercial issue for CS Camden it may not be an issue for OT3112 either. Level 48 was the lowest yielding variety with a relatively low test weight, short stature, and early maturity. AAC Kongsore was grown from 2020-2022. It tended to be a tall, and lower yielding variety but had a consistently high test weight. In 2021, it was much later maturing than the other varieties but this was not apparent in the other two years. Kalio and AAC Douglas were grown in 2021 and 2022. Numerically AAC Douglas was higher yielding than Kalio. Other test factors were in the middle of the pack generally.

10. Conclusions and Recommendations

Of the varieties on the recommended list for zone 2 (CDC Arborg, CS Camden, AAC Summit and Ore3542M), CS Camden consistently has the lowest test weight and AAC Summit the highest test weight. However, low test weights for CS Camden do not appear to be causing many rejection issues commercially. Lodging is AAC Summit's weakness. While lodging was not a serious issue for any variety in this study, AAC Summit was most prone to lodging. On average, CDC Arborg was the highest yielding variety but this was not consistent between years. Test weights were decent and despite being a relatively tall variety it showed good lodging resistance. Based on one year of data, OT2129 and OT3112 were high yielding varieties. While the test weight was relatively high for OT2129 it was relatively low for OT3112. However, the test weight for CS Camden was even lower but this is not translating into significant rejection issues for commercial milling oat.

Supporting Information

11. Acknowledgements:

This project was funded by Grain Millers.

12. Appendices

Table 4. Varietal Emergence of Oat (Yorkton 2019-2022)

2022		2021		2020		2019	
Variety	**Plants/m^2**	**Variety**	**Plants/m^2**	**Variety**	**Plants/m^2**	**Variety**	**Plants/m^2**
AAC Douglas	308.8 a	CDC Arborg	273.3 a	CDC Arborg	373.6 a	ORe3542M	325 a
Kalio	298.1 a	CDC Endure	256.8 a	CDC Endure	373.6 a	CS Camden	308 a
Level 48	295.7 a	Summit	247.5 a	CDC Skye	359.2 a	CDC Arborg	308 a
CDC Endure	294.9 a	ORe3542M	240.3 a	Summit	349.4 a	CDC Leggett	304 a
OT2129	280.9 a	Kalio	240.0 a	CS Camden	317.0 ab	CDC Endure	296 a
CDC Skye	274.8 a	CS Camden	238.5 a	ORe3542M	304.7 ab	CDC Ruffian	288 a
CDC Arborg	269.9 a	AAC Douglas	229.8 a	AAC Kongsore	266.2 b	CDC Minstrel	281 a
ORe3542M	264.9 a	AAC Kongsore	227.5 a	CDC Ruffian	258.0 b	Summit	275 a
OT3112	262.5 a						
CS Camden	262.1 a						
AAC Kongsore	261.7 a						
Summit	258.8 a						

Means followed by the same letter are not significantly different at 0.05 level of significance.

Table 5. Varietal Lodging Rating of Oat (Yorkton 2019-2022)

2021		2019	
Variety	**(0-9)**	**Variety**	**(0-9)**
Summit	2.50 a	CDC Leggett	3.0 a
CDC Arborg	1.00 b	CDC Ruffian	2.3 b
CDC Endure	0.50 bc	Summit	1.8 c
Kalio	0.50 bc	CDC Endure	1.8 c
AAC Kongsore	0.30 bc	CDC Minstrel	1.6 cd
AAC Douglas	0.30 bc	ORe3542M	1.5 cd
CS Camden	0.00 c	CS Camden	1.4 cd
ORe3542M	0.00 c	CDC Arborg	1.3 d

Means followed by the same letter are not significantly different at 0.05 level of significance.

Table 6. Varietal Yield of Oat (Yorkton 2019-2022)

2022		2021		2020		2019	
Variety	**Bu/ac**	**Variety**	**Bu/ac**	**Variety**	**Bu/ac**	**Variety**	**Bu/ac**
OT3112	161 a	CDC Endure	77 a	CDC Arborg	83 a	ORe3542M	183 a
OT2129	152 ab	AAC Douglas	71 a	CDC Ruffian	77 ab	CDC Ruffian	183 a
CDC Skye	143 abc	CS Camden	70 a	CDC Endure	74 bc	CDC Minstrel	182 a
AAC Douglas	141 bcd	Summit	69 a	CS Camden	67 cd	Summit	179 ab
CS Camden	139 bcd	CDC Arborg	67 a	AAC Kongsore	65 de	CDC Endure	176 ab
CDC Arborg	139 bcd	Kalio	64 a	CDC Skye	65 de	CDC Leggett	176 ab
Summit	137 bcde	ORe3542M	62 a	Summit	62 de	CDC Arborg	172 b
ORe3542M	132 cde	AAC Kongsore	57 a	ORe3542M	58 e	CS Camden	163 c
Kalio	130 cde						
AAC Kongsore	127 cde						
CDC Endure	124 de						
Level 48	118 e						

Means followed by the same letter are not significantly different at 0.05 level of significance.

Table 7. Varietal Test Weight of Oat (Yorkton 2019-2022)

2022		2021		2020		2019	
Variety	**g/0.5 l**	**Variety**	**g/0.5 l**	**Variety**	**g/0.5 l**	**Variety**	**g/0.5 l**
AAC Kongsore	269.4 a	Summit	241.6 a	Summit	280.7 a	CDC Ruffian	254.7 a
CDC Skye	259.4 ab	AAC Kongsore	235.1 ab	AAC Kongsore	272.8 ab	CDC Minstrel	253.5 a
CDC Endure	256.6 bcd	ORe3542M	231 b	ORe3542M	271.4 bc	CDC Arborg	251.8 a
Summit	255.5 bcd	CDC Endure	221.6 c	CDC Arborg	265 bcd	CDC Endure	251.8 a
Kalio	253.1 bcd	CDC Arborg	220.4 c	CDC Ruffian	265 bcd	CDC Leggett	250.6 a
OT2129	251.2 bcd	AAC Douglas	219.4 c	CDC Endure	264.1cd	CS Camden	246.5 a
ORe3542M	249.5 bcd	Kalio	212.1 d	CDC Skye	261.1 d	Summit	245.9 a
AAC Douglas	249.4 bcd	CS Camden	205 d	CS Camden	259.2 d	ORe3542M	242.4 a
CDC Arborg	249.2 bcd						
Level 48	246.4 cd						
OT3112	242.3 d						
CS Camden	241.8 d						

Means followed by the same letter are not significantly different at 0.05 level of significance.

Table 8. Varietal Maturity of Oat (Yorkton 2019-2022)

2022		2021		2020		2019	
Variety	**days**	**Variety**	**days**	**Variety**	**days**	**Variety**	**days**
OT3112	1.5 a	AAC Kongsore	6.5 a	CDC Arborg	0.5 a	CDC Leggett	5.25 a
CDC Skye	0.5 a	CDC Endure	2.5 b	CS Camden	0 a	CDC Ruffian	5.25 a
ORe3542M	0.5 a	Summit	2.3 b	Summit	-0.7 ab	CDC Minstrel	4.5 a
CDC Arborg	0.3 a	ORe3542M	2.3 b	AAC Kongsore	-1 ab	ORe3542M	4.25 a
Summit	0.3 a	CDC Arborg	1.8 bc	CDC Ruffian	-1.7 b	Summit	3.75 a
AAC Kongsore	0.3 a	Kalio	0.8 bc	CDC Endure	-2.2 b	CDC Arborg	0.25 b
CS Camden	0 a	AAC Douglas	0.8 bc	CDC Skye	-2.2 b	CS Camden	0 b
OT2129	0 a	CS Camden	0 c	ORe3542M	-2.2 b	CDC Endure	0 b
Kalio	-0.7 a						
Level 48	-0.7 a						
CDC Endure	-1 a						
AAC Douglas	-1.2 a						

Means followed by the same letter are not significantly different at 0.05 level of significance.

Table 9. Varietal Height of Oat (Yorkton 2019-2022)

2022		2021		2020	
Variety	**cm**	**Variety**	**cm**	**Variety**	**cm**
CDC Arborg	108.5 a	Summit	79.4 a	Summit	66.5 a
AAC Kongsore	107.3 a	CDC Endure	77.9 a	CDC Arborg	63.4 ab
AAC Douglas	99.9 b	AAC Kongsore	77 ab	AAC Kongsore	57.5 bc
Kalio	99.8 b	CDC Arborg	76.5 ab	CDC Skye	57.4 bc
CDC Endure	96.9 bc	AAC Douglas	71.5 bc	CDC Endure	55.9 c
CS Camden	95.6 bc	CS Camden	67.3 cd	ORe3542M	54.1 c
ORe3542M	92.9 cd	ORe3542M	66.4 cd	CS Camden	52.6 c
OT2129	91.4 cde	Kalio	64.6 d	CDC Ruffian	52.6 c
CDC Skye	90 de				
Level 48	88.5 de				
Summit	86 e				
OT3112	85.9 e				

Means followed by the same letter are not significantly different at 0.05 level of significance.

Table 10. Varietal Level of Thins for Oat (Yorkton 2019-2022)

2022		2021		2020	
Variety	**%**	**Variety**	**%**	**Variety**	**%**
Summit	5.9 a	CS Camden	13.0 a	CDC Skye	0.8 a
AAC Douglas	5.6 a	AAC Douglas	11.2 ab	CDC Arborg	0.3 b
CDC Arborg	4.4 ab	CDC Arborg	10.5 b	ORe3542M	0.3 b
Kalio	4.4 ab	Kalio	9.9 bc	CS Camden	0.2 b
CS Camden	4.3 ab	CDC Endure	7.5 c	Summit	0.2 b
AAC Kongsore	3.6 bc	Summit	4.5 d	AAC Kongsore	0.2 b
OT3112	2.9 bcd	ORe3542M	3.0 de	CDC Endure	0.2 b
Level 48	2.5 cd	AAC Kongsore	1.9 e	CDC Ruffian	0.2 b
CDC Endure	2.4 cd				
OT2129	2.2 cd				
CDC Skye	1.7 d				
ORe3542M	1.4 d				

Means followed by the same letter are not significantly different at 0.05 level of significance.

Table 11. Comparison of Regional Information vs Average Results from Yorkton (2019-2022) for Yield, Test Weight and Lodging

	Yield (%)		Test Weight (g/0.5l)		Lodging	
Variety	**Regional**	**Yorkton**	**Regional**	**Yorkton**	**Regional (resistance)**	**Yorkton (0-9)**
CS Camden	100	100	242	238	Very Good	0.7
CDC Arborg	106	105	250	247	Very Good	1.15
ORE3542M	92	99	247	249	Very Good	0.75
Summit	95	102	256	256	Good	2.15
CDC Endure	105	103	245	249	Very Good	1.15

Table 12. Comparison of Regional Information vs Average Results from Yorkton (2019-2022) for Height, Maturity and Plump or Thins

	Height (cm)		Maturity		Plump/Thins (%)	
Variety	**Regional**	**Yorkton**	**Regional**	**Yorkton (day)**	**Regional (Plump)**	**Yorkton (Thins)**
CS Camden	100	100	Long	0	82	5.9
CDC Arborg	106	105	Medium	0.7	85	5.1
ORE3542M	92	99	Long	1.2	95	1.6
Summit	95	102	Medium	1.4	81	3.5
CDC Endure	102	77	Medium	-0.2	89	3.4

Abstract

13. Abstract/Summary:

Oat variety trials were conducted at Yorkton from 2019-2022. Growing conditions were excellent during 2019 with yields averaging 175 bu/ac. Drought was an issue during 2020 and 2021 and oat yields only averaged 70 bu/ac. In 2022, growing conditions were excellent except for the hail damage received on June 23. Despite the damage, yields were still respectable averaging 140 bu/ac. CDC Arborg, CDC Endure, CS Camden, ORe3542M and Summit were varieties "commonly grown" in all years of the study. All of these varieties, excepting CDC Endure are currently on Grain Millers recommended list for zone 2. Of the recommended varieties, CS Camden consistently has the lowest test weight and AAC Summit the highest test weight. However, low test weights for CS Camden do not appear to be causing many rejection issues commercially. Lodging is AAC Summit's weakness. While lodging was not a serious issue for any variety in this study, AAC Summit was most prone to lodging. On average, CDC Arborg was the highest yielding variety but this was not consistent between years. Test weights were decent and despite being a relatively tall variety it showed good lodging resistance. Based on one year of data, OT2129 and OT3112 were high yielding varieties. While the test weight was relatively high for OT2129 it was relatively low for OT3112. However, the test weight for CS Camden was even lower but this is not translating into significant rejection issues for commercial milling oat.