2022 Final Research Report

from the

East Central Research Foundation

Project Title: Nitrogen Management of CWRS vs. CWSP Varieties of Wheat

ADOPT # 20211078

Principal Investigators:

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Project Identification

1. **Project Number:** 20211078
2. **Producer Group Sponsoring the Project:** None
3. **Project Location(s):** Yorkton, SK
4. **Project start and end dates (month & year):** April 2022 to February 2023
5. **Project contact person & contact details:**

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Objectives and Rationale

6. **Project objectives:**
   The objective of this demonstration was to compare the yield and grain protein response to added nitrogen (N) between the CWRS variety AAC Brandon and the CWSP variety AAC Awesome.

7. **Project Rationale:**
   AAC Brandon is a commonly grown Canada western red spring (CWRS) wheat variety. CWRS is the most common class of wheat grown in the Yorkton area and the grain is used to make flour for mostly high volume pan breads[1]. AAC Awesome VB is a Canada Western Special Purpose (CWSP) Spring variety that is gaining interest but is relatively new to producers. This class of wheat has no defined quality attributes and is mostly intended for ethanol and livestock feed purposes[2]. Locally, AAC Awesome is being grown under contract with Terra Grain fuels near Belle Plaine. The yield potential difference between AAC Brandon and AAC Awesome is substantial. Relative to Carberry, the yield of AAC Brandon is only 6% higher whereas, AAC Awesome is 36% higher[2]. High protein is of value to producers and end users of CWRS bread varieties. In contrast, high protein grain is not desired by ethanol producers. High protein means less starch and less ethanol. Differences in yield potential and protein requirements has producers wondering if nitrogen management should differ between these classes of wheat.

8. **Methodology:**

The trial was established as a factorial in a RCBD with 4 replications. The first factor compared the CWRS variety "AAC Brandon" against the CWSP variety "AAC Awesome VB". The second factor compared rates of N from 0 to 150 lb/ac in 30 lb/ac increments. A complete treatment list is found in Table 1. Plot size was 6 by 30 ft and the trial was seeded with a 4 row disc drill on 12-inch row spacing. All treatments were fertilized with 30 lb P_2O_5/ac. Both varieties were seeded targeting 300 viable seeds/m^2. Dates of key operations are found in Table 2. All 4 rows of each plot were harvested with a Wintersteiger plot

combine.

Table 1. Treatment list for Management of CWRS vs. CWSP Varieties of Wheat trial		
Trt #	**Variety**	**Lb N/ac**
1	CWRS-AAC Brandon	0
2	CWRS-AAC Brandon	30
3	CWRS-AAC Brandon	60
4	CWRS-AAC Brandon	90
5	CWRS-AAC Brandon	120
6	CWRS-AAC Brandon	150
7	CWSP-AAC Awesome VB	0
8	CWSP-AAC Awesome VB	30
9	CWSP-AAC Awesome VB	60
10	CWSP-AAC Awesome VB	90
11	CWSP-AAC Awesome VB	120
12	CWSP-AAC Awesome VB	150

Table 2. Dates of operations in 2022 for the "Nitrogen Management of CWRS vs. CWSP Varieties of Wheat" trial.	
Pre-seed Herbicide Application	none
Seeding Date	May 12
Emergence Counts	June 2
In-crop Herbicide	Prestige June 6 Simplicity June 8
In-crop Fungicide	Caramba July 18
Lodging	August 22
Harvest	September 15?

9. Results:

Growing Season Weather

Mean monthly temperatures and precipitation amounts for Yorkton are listed in Table 3. A substantial hail event occurred on June 23. However, the crop recovered well as crop yields were very high due to timely rainfall and a high level of residual soil N.

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	15.95
	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
	Long-term	***51***	***80***	***78***	***62***	***272***

Original study results

This adopt demonstration is a resubmission of ADOPT #20200491. The demonstration was resubmitted because no yield response to added N was apparent in the original study. Residual soil N was quite high at the start of the 2021 season due to drought in 2020. High levels of soil N and low yield potentials in 2021 caused by continuing drought meant the most economic rate of N in this study for both varieties was none. Neither variety had a yield response to N. While protein was increased by 0.7% in response to 60 lb N/ac, this was of no value for a CWSP variety of ethanol wheat and would not prove economic for a CWRS variety of bread wheat. When assuming an N cost of $1.00/lb and a wide protein spread of $0.6/%/bu, the application of 60 lb N/ac would have cost $60/ac but the increase in protein would have only generated $15.54/ac for a CWRS wheat. Thus, the most optimum rate of N in this study for both varieties was zero. The CWRS variety would have been the most economic to grow as the varieties yielded the same and CWRS wheat is generally worth more. It was decided it would be of value to run this trial again during a more productive season.

Current study results

In 2022, the crop established reasonably well with emergence rates hovering just below 200 plants/m^2 (Table 4). No significant differences in emergence between wheat varieties or rates of applied N were detected. The 2022 season received adequate and timely rainfall which greatly increased yield potential compared to 2021. During the drought in 2021, AAC Brandon and AAC Awesome VB only averaged 2504 and 2479 kg/ha, respectively. During the better growing conditions of 2022, AAC Brandon and AAC Awesome VB yielded 5803 and 7142 kg/ha,

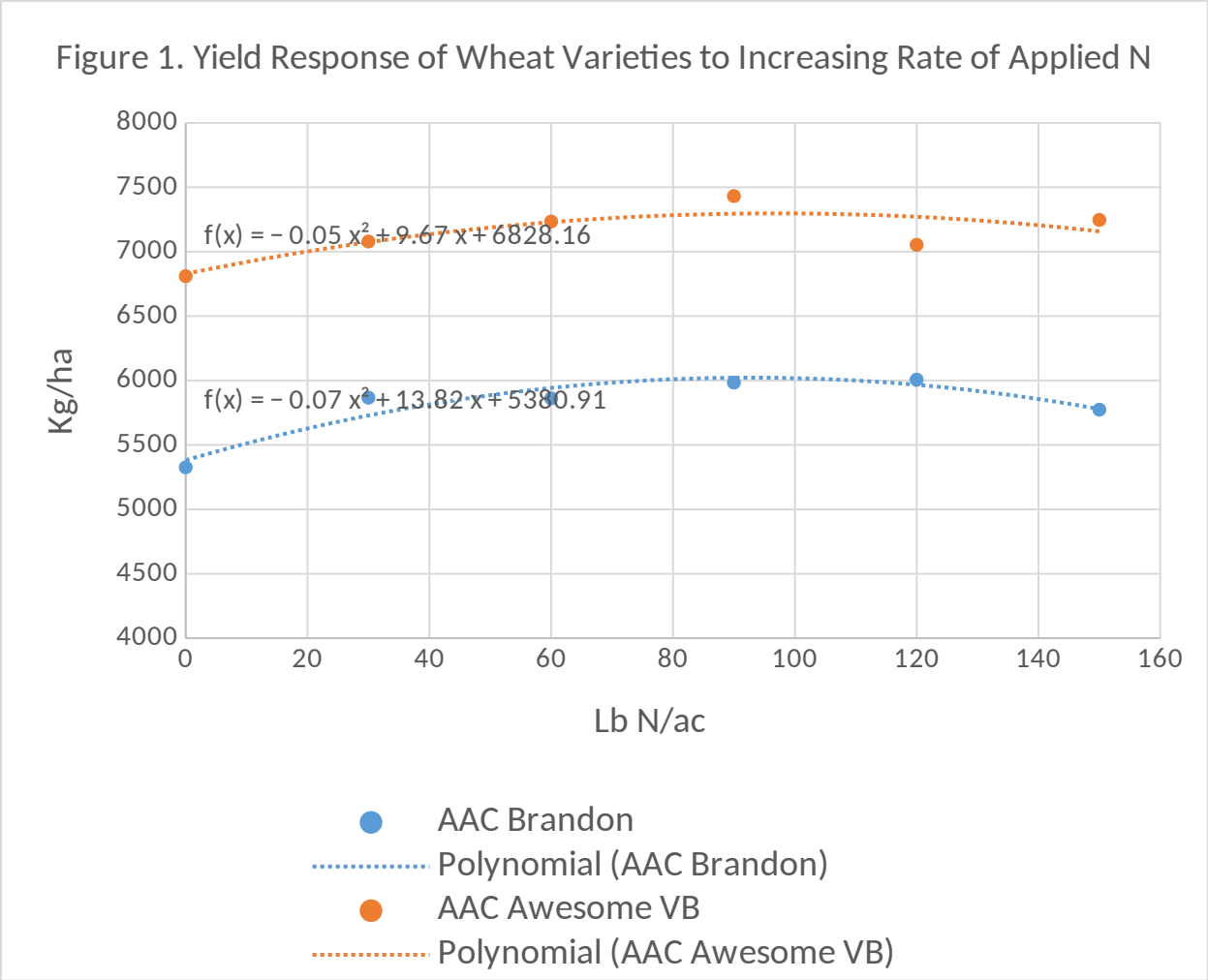
respectively (Table 4). As expected, the yield potential for AAC Awesome VB was much greater than AAC Brandon and in turn the grain protein was much lower. Despite a high background level of residual soil N (104 lb N/ac) lodging was not an issue for any treatment and a significant yield response to added N was detected. However, grain protein did not significantly respond to added N for either variety. While there were no significant interactions detected for the grain protein and crop yield data, a regression response for yield of AAC Brandon and AAC Awesome to increasing N has been presented in Figure 1 to help with an economic analysis.

Based on the polynomial equation for both wheat varieties, yield was maximized at 93 lb N/ac for AAC Brandon and at 97 lb N/ac for AAC Awesome. Increasing N rate from 0 to 93 lb/ac increased the yield of AAC Brandon by 640 kg/ha or 9.5 bu/ac. Increasing N rate from 0 to 97 lb/ac increased the yield of AAC Awesome by 469 kg/ha or 7 bu/ac. Even though the overall yield of AAC Awesome was higher, its response to added N was somewhat less than the response of AAC Brandon. However, the most economical rate of N is far below the rate of N that maximized yield for both varieties. There was no grain protein response to added N for either variety so that factor is not part of the economic analysis. Higher protein is also not desired for an ethanol variety. The 2022 Saskatchewan Crop Planner assumes a N cost of $1.33 lb and a value of $10.56/bu for CWRS wheat. When using these values, the most economic rate of N is only 36 lb/ac for AAC Brandon. The Crop Planner does not suggest a price per bu for an ethanol variety of wheat (CWSP). However, an ethanol wheat per bu is usually valued at a substantial discount to a hard red spring variety. In this study, the most economical rate of N for AAC Awesome would have been zero, as it was less responsive to added N and the price would need to be over $11/bu before any economic response to added N would have been apparent. However, this is not to say there is no value in growing an ethanol variety. Based on $1.33/ lb N and $10.56/bu, the maximum gross returns minus the cost of added N was $860.55/ac for AAC Brandon when 36 lb N/ac were added. Growing AAC Awesome with no nitrogen in this study could generate the same gross return if the price of ethanol wheat was $8.47/bu. However, this is probably an overly optimistic price for the CWSP variety.

Table 4. Main Treatment Effects on Emergence, Lodging, Grain Protein, Yield and Test

Weight.				
Treatments	**Emergence (plants/m^2)**	**Lodging (0-10)**	**Protein (%)**	**Yield (kg/ha)**
Variety (V)				
AAC Brandon	188 a	0 a	15.3 a	5803 b
AAC Awesome VB	196 a	0 a	12.0 b	7142 a
P-values[z]	NS	NS	<0.0001	<0.0001
LSD	NA	NA	0.13	176
Nitrogen (N) Rate (lb N/ac)				
0	188 a	0 a	13.7 a	6068 b
30	184 a	0 a	13.7 a	6473 a
60	192 a	0 a	13.8 a	6548 a
90	203 a	0 a	13.7 a	6708 a
120	189 a	0 a	13.7 a	6530 a
150	196 a	0 a	13.6 a	6510 a
P-values[z]	NS	NS	NS	0.0058
LSD	NA	NA	NA	305
V by N P-values[z]	NS	NS	NS	NS

[z] p-values ≤ 0.05 indicate that a treatment effect was significant and not due to random variability



10. Conclusions and Recommendations

Yield response to added N was statistically significant for both varieties but were very modest, as the level of residual soil N was quite high (104 lb N/ac). While AAC Awesome was higher yielding it was a little less responsive to added N in this study. The most economic rate of N for the CWRS variety (AAC Brandon) would have been only 36 lb N/ac based on $10.56/bu of wheat and 1.33/ lb N. The most economic rate of N for the CWSP variety (AAC Awesome) was zero, as the price would need to exceed $11/bu to have any economic response to added N. In other words, the N requirement for AC Brandon was higher than AAC Awesome based on the results of this demonstration. When a CWRS variety is at $10.56/bu, a CWSP variety would need to be at $8.47/bu to provide similar returns. The author believes that the price of a CWSP variety is unlikely to be this close to a CWRS variety and therefore concludes it is more economical to grow a CWRS variety. In conclusion, AAC Brandon requires more N than AAC Awesome but was a more economical variety to grow.

Supporting Information

11. Acknowledgements:

This project was funded by Agricultural Demonstration of Practices and Technologies (ADOPT)

12. Appendices

Abstract

13. Abstract/Summary:

A trial was conducted near Yorkton in 2022 with the objective of determining the most economic rate of N between a CWRS and a CWSP variety of wheat. The background level of soil N was very high at 104 lb N/ac. However, there was significant albeit modest response to added N as growing conditions were excellent. While the CWSP variety AAC Awesome was higher yielding than the CWRS variety AAC Brandon, it was somewhat less responsive to added N. Based on $10.56/bu and $1.33/ lb N, the most economic rate of N was 36 lb/ac for a CWRS variety. The most economic rate for the CWSP variety was zero, as the price per bu would need to be $11/bu before there would be any economic response to added N. This is not realistic as CWSP varieties trade at a discount to CWRS varieties. Based on the results of this study, AAC Awesome would need to be valued at $8.47/bu to be competitive with AAC Brandon. This value may still be relatively high for the CWSP variety. In conclusion, AAC Brandon requires more N than AAC Awesome but was a more economical variety to grow.