

# Assessing Fertility Program for Yield Potential of Winter Wheat Varieties

**Project duration:** 2019-2020

**Collaborators:** Ducks Unlimited, Western Ag

## Objectives

To establish a fertility program for achieving high yield in winter wheat.

## Results

Variety appeared to have influenced wheat yield and protein at three of the four sites under study in 2019. Elevate and Wildfire varieties had significantly higher yields compared to Gateway at Melita ( $P=0.001$ ) and Arborg ( $P=0.036$ ) while there were no significant differences among varieties at Roblin and Carberry. Although Gateway variety had lower grain yield, it had higher protein content of 15.8% at Melita, 13.8% at Roblin and 13.5% at Arborg compared to Wildfire and Elevate. Wildfire had higher protein content (15.2%) compared to Elevate (14.4%) at Melita while there were no significant differences between the same varieties at Arborg.

Table 1. Analysis of variance and mean comparisons for wheat yield and protein % at different DC sites.

Variety / Fert. application	Melita		Roblin		Carberry		Arborg	
	Yield $\text{kg ha}^{-1}$	Protein%	Yield $\text{kg ha}^{-1}$	Protein%	Yield $\text{kg ha}^{-1}$	Protein%	Yield $\text{kg ha}^{-1}$	Protein%
Elevate (1)	3974a	14.4c	4802	12.6b	4459	13.9	5860a	12.1b
Gateway (2)	3688b	15.8a	4361	13.8a	4879	13.7	5188b	13.5a
Wildfire (3)	4150a	15.2b	4646	11.4c	4621	13.8	5728a	12.3b
100% Spring appl. (A)	3901	15.2	4175b	12.2b	4442b	14.3a	5466	12.4b
Balanced appl. (B)	3974	15.2	5031a	13.0a	4864a	13.4b	5718	12.9a
1*A	4000	14.5d	4228	12.4	4470	14.5	5823	12.1
2*A	3682	15.6b	3761	13.5	4662	14.1	5140	13.0
3*A	4020	15.4bc	4536	10.6	4194	14.2	5434	12.0
1*B	3948	14.4d	5375	12.7	4449	13.4	5898	12.1
2*B	3694	16.0a	4961	14.1	5097	13.3	5235	14.0
3*B	4280	15.2c	4757	12.3	5047	13.4	6022	12.6
<b>P (Var)</b>	<b>0.001</b>	<b>&lt;0.001</b>	0.574	<b>&lt;0.001</b>	0.524	0.909	<b>0.036</b>	<b>0.001</b>
<b>P (Fert)</b>	0.324	0.891	<b>0.029</b>	<b>0.003</b>	0.182	<b>0.035</b>	0.212	<b>0.027</b>
<b>P (Var*Fert)</b>	0.213	<b>0.049</b>	0.441	0.082	0.504	0.933	0.481	0.236

Means contain the same letter are not statistically different at  $P<0.05$ .

Balanced application of fertilizer resulted in higher grain yield at Roblin (5031 kg ha<sup>-1</sup>) and Carberry (4864 kg ha<sup>-1</sup>) compared to 100% spring application. Balanced application of fertilizer resulted in higher protein content compared to 100% spring applied fertilizer at Roblin and Arborg sites. On the other hand, 100% spring applied fertilizer resulted in higher protein than balanced fertilizer application at Carberry.

There was a significant interaction between variety and fertilizer at Melita site for protein content, but not for wheat yield. An interaction of Gateway variety and balanced fertilizer application resulted in significantly higher protein content (16.0%) compared to other variety-fertilizer combinations.

### **Project Findings**

Based on the preliminary results from this study, balanced fertilizer application seemed to a better option to improve wheat yield and protein content at least at two sites. This testing will be repeated in 2020 to confirm proper recommendations for winter wheat producers.

### **Background / Additional Resources / References**

Management practices that can be utilized to improve winter wheat production are; increasing seeding rate and application of starter fertilizer by banding during seeding (Anderson, 2008). Fertility management, in particular nitrogen and phosphorus, remains the integral part of the overall management package aimed at achieving higher yields (Halvorson *et al.* 1987). The ideal fertility management package would help counteract escalating cost of production per unit area, which is the main goal producers aim to achieve.

There is still a knowledge gap on the rates as well as timing of application of nitrogen fertilizer, particularly in Western Canada, that would result in improved yield per given area without compromising on the quality of grain.

#### **References**

- Anderson, R. L. 2008. Growth and yield of winter wheat as affected by the preceding crop and crop management. *Agronomy Journal* 100 (4): 977-980.
- Halvorson, A.D., Alley, M. M., and Murphy, L. S. 1987. Nutrient requirements and fertilizer use: In *Wheat and Wheat Improvement – Agronomy Monograph (13) 2<sup>nd</sup> Edition*. Madison, WI 53711, USA.

### **Materials and Methods**

This testing was done at four locations; Melita, Arborg, Carberry and Roblin in Manitoba in 2018/2019 growing season.

*Experimental Design* – Randomised block design with three replications.

*Treatments* – Treatments were laid out in a 2 x 3 factorial (fertility practice x wheat varieties) design. Wheat varieties used were Gateway, Elevate and Wildfire and fertilizer treatments included Producer practice at 100 lbs of nitrogen (urea plus agrotain) per acre applied in spring and 30 lbs phosphorus banded at seeding in fall. Balanced fertility practice as per Western Ag recommendations (based on soil test) was split applied with 50% banded at seeding and the other 50% urea plus Agrotain broadcasted in spring. A summary of fertility treatments is presented in table 2:

Table 2: Fertility treatments for Balanced (high yield) and Producer practices

Practice	N	P	K	S
Balanced fertility with 50 % N applied in fall	44-0-0	11-52-0	0-0-60	20-0-0-24
Producer practice with N applied in spring	46-0-0	11-52-0		

*Plot size – 9.12m<sup>2</sup>*

*Data collected – plant height, lodging, grain yield & moisture*

An IM 9500 NIR grain analyzer was used to determine protein content on dry basis from a 500g subsample of each treatment.

***Agronomic info***

*Stubble, soil type – Canola, heavy clay*

*Fertilizer applied – Soil nutrient levels (lbs/acre): N – 21, P<sub>2</sub>O<sub>5</sub> – 41, K<sub>2</sub>O – 23*

5N-30P-70K (lbs/acre) were applied at seeding in balanced fertility practice and rest (135N-0P-0K) were applied in the spring (May 6).

*Pesticides applied – Sprayed 2,4-D @ 300ml/acre on June 2.*

*Seeding/harvesting date – Sept 5/Aug 8*