Wheatland Conservation Area Inc.
Swift Current, SK.

Seeding Date Demonstration in Winter Wheat

Start Date: August 1, 2018
End Date: January 31, 2021

Saskatchewan Winter Cereals Development Commission
ADOPT 2019

Interim Report

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Abstract

In 2018 a trial was established in Swift Current Saskatchewan titled "Seeding Date Demonstration in Winter Wheat." This project consisted of a 4-replicate RCBD demonstration with 5 different seeding dates representing the currently recommended seeding window and an expanded seeding window. AAC Wildfire (CWRW) was the variety of choices for this area to ensure best winter wheat survival rates and strong yield response. Potential yields for the 2019 growing season were closely related to environmental conditions with dry soil and lower than normal spring temperatures followed by extensive periods of precipitation from late June through to fall. Planting winter wheat within the currently recommended window of late August-early September has become more difficult with the addition of longer growing season crops and later harvest dates. Winter wheat yields show that a later planting date appears to be more promising than previously thought when planted late September and into October. In years when harvest is delayed, producers can decide whether there is value to planting winter wheat later in the season versus opting for a spring seeded crop instead. Factors producers must consider includes potential yields and profits, workloads, markets, disease and weed cycles, in addition to the risk factors of seeding late in September to October. This trial was brought to the attention of the group on the Annual Field Day on July 18, 2019 and was also promoted on a CKSW radio program called "Walk the Plots" which is broadcasted on a weekly basis throughout the summer. This project will also be presented by Amber Wall at the Agri-ARM research update at the Crop Production show taking place January 16, 2020 in Saskatoon, SK.[1]

Project Objectives

The objective of this project is to demonstrate to Saskatchewan producers' that the accepted final seeding date for winter wheat (previously September 15th, now September 30th deadline for Saskatchewan Crop Insurance Coverage[2]) can be extended into October and the seed still maintain a significant level of viability.

Project Rationale

Changes in seeding practices (i.e. crop rotations), growing longer season crops with later harvest dates, an increasing shift toward direct harvest for canola, as well as the possibility of delayed

[1] http://www.wheatlandconservation.ca/files/For_Website_WCA_Winter_Wheat.pdf
[2] https://www.scic.ca/calendar/event/211/

harvest due to weather means it is becoming more challenging for producers to plant winter wheat within the currently recommended window of late August/early September and still be eligible for crop insurance. Since the proposal of this application, the deadline to seed Winter Wheat and Fall Rye has been changed to September 30th, as a later planting date is shown to be more promising than previously anticipated. Research in Canada and the United States has shown that winter wheat depending upon the region (MB, SK, AB), can be planted in late September to mid-October and still maintain significant viability[3]. Yvonne Lawley at the University of Manitoba notes that establishment, winter survival and yield were dependent on winter and early spring weather conditions.

Later seeding dates may also delay the effects of wheat curl mite (wheat streak mosaic virus) on winter wheat. In Southern Alberta and Saskatchewan, experienced winter wheat producers have had viable winter wheat stands over winter with seeding dates as late as October 20th with good moisture and good late fall weather.

Demonstration of later seeding dates to local producers will widen the range of exposure to this research information and hopefully encourage more producers to consider winter wheat as a profitable cropping option.

With increasing concerns surrounding herbicide resistance, Fusarium head blight, wheat midge and late spring seeding dates, winter cereals offer producers a great option to manage some of these issues. This is achieved by improving competition or natural avoidance, reducing chemical inputs, farming increased acres and enabling the more efficient and longer use of seeding and harvesting equipment.

Increasing farm size and adoption of later maturing crops (soybeans, straight cut canola) makes getting winter cereals seeded by the currently recommended date difficult on many operations and producers are successfully seeding winter cereals at much later dates than September 15th. The Saskatchewan Winter Cereals Development Commission would like to publicly demonstrate the success of later seeding dates on winter wheat viability as well as address management issues that may arise due to seeding outside the ideal timeframe.

Methods

In the Fall of 2018, this trial was direct seeded into durum stubble using a Fabro built Cone Seeder with Atomjet openers and 9” row spacing. AAC Wildfire (CWRW) was seeded at 120 lb/ac with a target plant stand of 30 plants/ft2, and treated with Cruiser Vibrance Quattro (CVQ) at label rates (Table 1). All treatments received 200 lb/ac of sidebanded 30-15-0-6. This project consisted of 5 target seeding dates and included 4 replicates to better demonstrate consistent effects. Actual seeding dates are listed in Table 2. This trial was also established in the Fall of 2019 under the same parameters, with the exception of row spacing decreasing to 8.25”.

[3] https://www.topcropmanager.com/a-look-at-later-seeding-for-winter-wheat-20196/

Table 1. 2018-2019 List of Operations

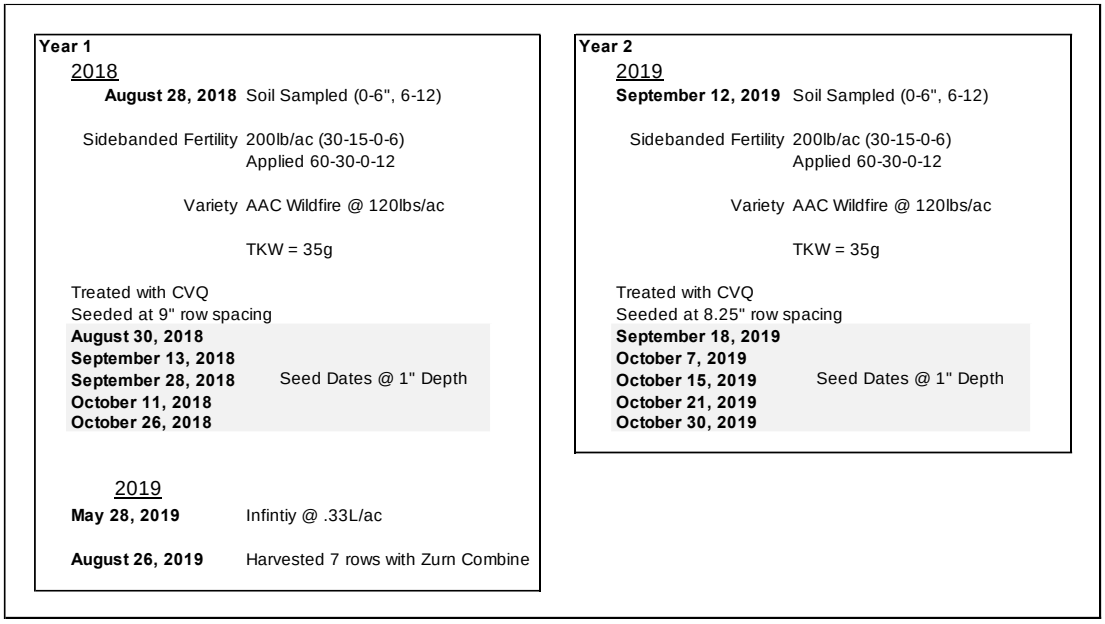

Table 2. Treatment List

2018-2019 (Year 1)		
Treatment #	**Target Seeding date**	**Actual Seed Date**
1	Sept 1, 2018	Aug 30, 2018
2	Sept 15, 2018	Sept 13, 2018
3	Oct 1, 2018	Sept 28, 2018
4	Oct 15, 2018	Oct 11, 2018
5	Oct 31, 2018	Oct 26, 2018
2019-2020 (Year 2)		
Treatment #	**Target Seeding date**	**Actual Seed Date**
1	Sept 1, 2019	Sept 18, 2019
2	Sept 15, 2019	Oct 7, 2019
3	Oct 1, 2019	Oct 15, 2019
4	Oct 15, 2019	Oct 21, 2019
5	Oct 31, 2019	Oct 30, 2019

The following measurements were taken:

- Soil Sample to determine stored soil nitrogen
- Crop Establishment – plants/m^2
- Rate of Weed Competition
- Leaf and Head Disease Rating
- Days to Maturity
- Grain Yield –corrected for dockage and 14.5% moisture
- Moisture
- MDK, FDK
- Protein %
- Test Weight

2019 General Site Conditions

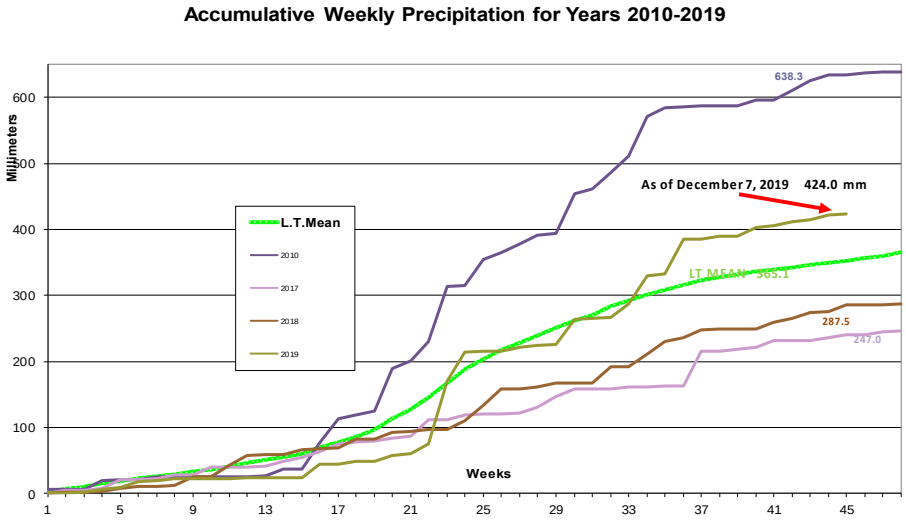

Figure 1. Accumulative weekly precipitation for years 2010 (record high), and 2017-2019 (AAFC).

In the Fall of 2018 winter wheat (AAC Wildfire) was seeded into very dry soil, but from seeding to harvest the crop received adequate moisture, with most of the rainfall accumulating from June 14, 2019 to harvest (Figure 1). The first 3 seed dates emerged before winter and the last 2 seed dates emerged early in the spring. Spring was cool and frost occurred more than once from May 18th to May 20th. With strong winds and little rainfall, the already moisture deficient fields resulted in crop progression that was behind normal stages of development. As the season progressed, lack of moisture and warm temperatures caused some thinning, and the already stunted winter cereal crops to prematurely head-out. Much needed rainfall in mid-June led to highly variable crop conditions. Although still behind normal developmental stages, moisture helped the later-seeded winter wheat crops to fill and replenish topsoil moisture, but a variety of growth stages resulted. Topsoil moisture again continued to deteriorate into July with these conditions generally resulting in poor yield for other early spring seeded crops. Winter Wheat plots were harvested August 26, 2019, before significant rainfall events caused delays through September and late into October for the second year of winter wheat seeding dates.

Results and Discussion

Overall, results were very dependent on the winter and early spring weather. Plant Density counts in the spring showed a significant advantage to seeding early as density generally decreased the later the seeding date (Figure 2). The earliest seed dates, treatments 1-3 had visibly emerged in 2018, but treatment 3 (seeded September 28th), as well as treatments 4 and 5 established later and did not overwinter as well. The last three seed dates resulted in a 51-68% decrease in plant stand compared to treatment 2 (202 plants/m^2), which resulted in the highest plants per square metre and was seeded on September 13th. Seeding later than September 14th reduced spring plant stand potential, due to having less time before winter to germinate and establish a fully developed crown compared to earlier seeded plots (Image 1).

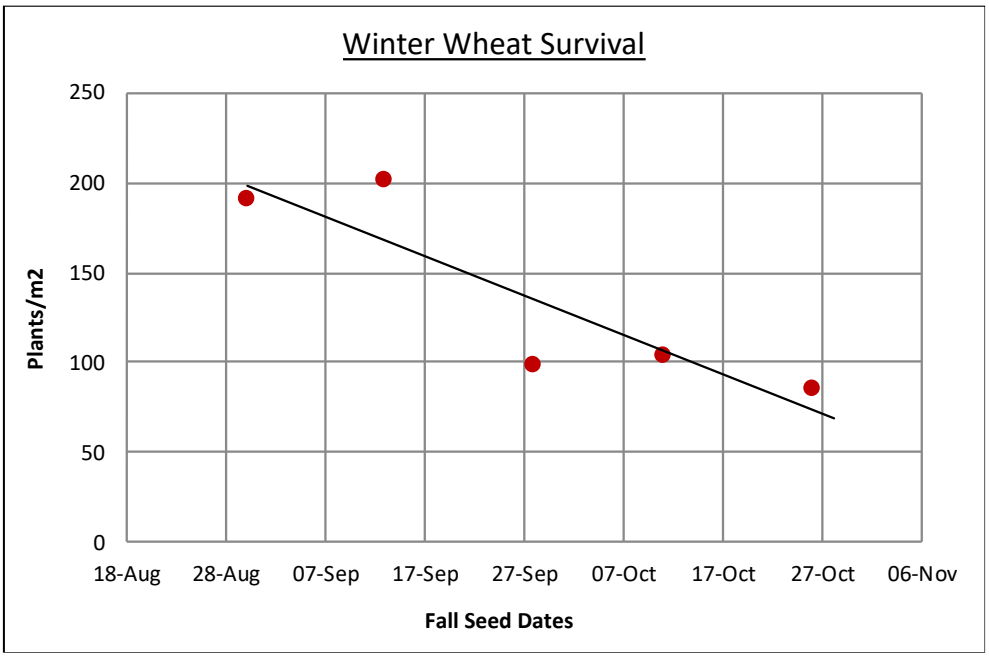

Figure 2. Spring plant density counts of each seed date shown in plants per square metre. (CV=11.8%, LSD=8.9 plants/m^2)

Image 1. Reduced spring plant stand on treatment 3 (September 28, 2018, photo taken May 23, 2019).

Although the earlier seeded dates showed the strongest establishment, due to the extremely dry spring conditions and delayed growing season precipitation that followed, timing of precipitation favoured later seeded plots, resulting in a negative correlation between emergence and yield (Figure 3). Later seeded treatments may have better utilized the shortage of soil moisture in spring

as a result of having a lower plant population. As the season progressed, the first two seed dates appeared more stressed than later seeded treatments. The highest yielding treatment from 2018-2019 resulted from the significantly lowest treatment in terms of plant density, which was the last seed date on October 26th (48 bu/ac). Yield was not significantly different than the third seed date on September 28th (47.9 bu/ac). Overall yield showed a positive increase from early seed dates to the latest signifying the potential success for winter wheat to be seeded late into October.

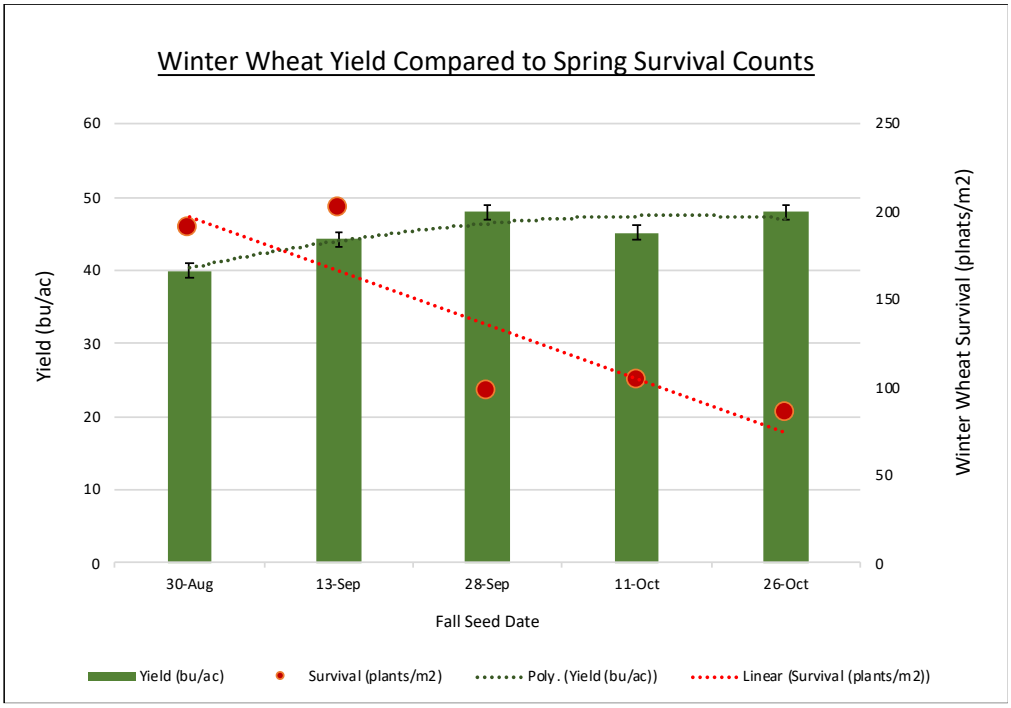

Figure 3. Winter wheat yield compared to plant density counts in Spring for each of the 5 seed dates. (CV=5.1%, LSD=1.3 bu/ac)

All plots yielded well from 40-48 bushels per acre and above the provincial average of 37 bushels per acre (Table 3). According to the 2019 Crop Report, winter wheat yields varied greatly throughout the province depending on how early the crop was seeded and the amount of moisture received throughout the growing season[4].

Table 3. Individual means for other field notes taken in Swift Current, SK.

SEED DATE	Days to Maturity %		Leaf Disease 1-10		Yield Kg/ha	Yield Bu/ac	
AUG 30, 2018	355.8	a	5.88	b	2683.32	39.9	c
SEPT 13, 2018	341.3	b	6.25	a	2979.22	44.3	b
SEPT 28, 2018	325.5	c	5.25	c	3221.33	47.9	a
OCT 11, 2018	311.0	d	5.75	b	3033.02	45.1	b
OCT 26, 2018	295.0	e	4.13	d	3228.05	48.0	a
P-VALUE	<0.05		<0.05			<0.05	
LSD	0.73		.31			1.3	
CV%	0.4		10.2			5.1	

[4] https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/agribusiness-farmers-and-ranchers/market-and-trade-statistics/crops-statistics/crop-report

The gradual increase in yield demonstrated here, shows there may be more promise seeding into October than previously thought. However, previous research indicates that if fall and early growing season precipitation had been adequate, the earlier seed dates would likely have benefited over the later seed dates.

Weed competition increased after scattered rainfall events in June, but remained low throughout the growing season. Protein levels between treatments were not significantly different, ranging from 12.2-12.53% and remains above the acceptable 11% minimum set by the Canadian Grains Commission.[5] Test weights between treatments were not significantly different (data not shown).

Head and leaf disease were rated at the appropriate stages. Percentage of head disease was not statistically different between treatments and remained below 5%. Leaf disease varied within treatments with treatment 1 (August 30th) having the highest percentage of disease and the treatment 5 (October 28th) having the least, which suggests that seeding later may delay the effects of wheat curl mite (wheat streak mosaic virus), as previously suggested (Table 3). Although all plots were under the maximum damage limits accepted by the CGC as No. 1 CWRW for Fusarium and Midge damaged kernels, there was a slight increase in FDK in the third seed date (September 28) and MDK showed a slight increase in the last seed date (October 28th).

There were differences in maturity with earlier seed dates requiring more days to mature (DTM), although all plots actually matured within a few days of one another (Table 3). All plots were harvested when the latest maturing treatment was ready. Earlier established winter wheat stands were subjected to drought and heat stress in the late spring during stem elongation and booting stages, which may have increased rates of tiller mortality (Image 2). Reduced tillering with only the main stem of each plant able to set seed during this time would have greatly impacted yield. When the drought ended in late spring with an abundance of heavy rainfall events, the plants developmental synchrony may have been disrupted leading to a variety of crop stages and later maturing heads, a similar problem in previous winter wheat research in 1993[6].

Images 2-3. Plots seeded August 30, 2018 (left) and October 26, 2018 (right), are shown at different stages of development on July 19, 2019.

[5] https://www.grainscanada.gc.ca/en/grain-quality/official-grain-grading-guide/04-wheat/primary-grade-determinants/cwrw-en.html

[6] Campbell, C. & Selles, F. & Zentner, R. & McLeod, J. & Dyck, F.(1991). Effect of seeding date, rate and depth on winter wheat grown on conventional fallow in S.W. Saskatchewan. Canadian Journal of Plant Science. 71. 51-61. 10.4141/cjps91-006.

This trial was brought to the attention of the group on the Annual Field Day held July 18, 2019 (120 participants) by Brad White, a SWCDC director and was also promoted on a CKSW radio program called "Walk the Plots" that was broadcasted on a weekly basis throughout the summer. Results of this trial will be presented at winter meetings and workshops including the Agri-ARM research update held during the Crop Production Show in Saskatoon on January 16th by Amber Wall of Wheatland Conservation Area[7]. Results will be also shared locally and a summary can be found on our website at www.wheatlandconservation.ca.

Conclusions and Recommendations

With increased acres of later maturing crops being seeded, as well as the chance of a delayed harvest, finding the time to seed winter wheat during the fall can be challenging, but damp mornings or down-time due to rain make for perfect seeding opportunities. After the initial year of growing winter wheat, growers find that the subsequent harvests are more spread out, easing the pressure of seeding the following winter wheat crop. With the Saskatchewan Crop Insurance extended deadline to seed winter wheat to September 30th (every year), there is more time and increased potential for yield increases even when seeding into October.

The first year of this project demonstrated that although winter survival does occur after September 15th, winter wheat is still highly competitive at later seeding dates compared to the currently recommended window of seeding, but very dependent on environmental conditions that are also likely to impact yield. Winter wheat yields show that a later winter wheat planting date appears to be more promising than previously thought when planted late September and into October. However, producers should decide whether there is value to planting in those later windows by comparing a winter wheat with their other cropping options, including potential yields and profits and consider the risk factors of seeding in the late September to October window. Moisture was limiting in the fall and spring, resulting in tiller mortality for the earliest seeded crops, therefore may have decreased yield. As yield is directly correlated with stored soil nitrogen and moisture, yield response will vary by year and may have been different if rainfall was received in a timely matter. Despite wet and snowy conditions this fall (2019), a second year of the demonstration was seeded, but target dates were slightly delayed. Unlike year one, winter wheat was seeded into adequate moisture (Figure 4) and actual seeding dates were based on the forecast and seeding when soil conditions were suitable (Table 2). A final report will be available in 2021.

[7] http://www.wheatlandconservation.ca/research.html

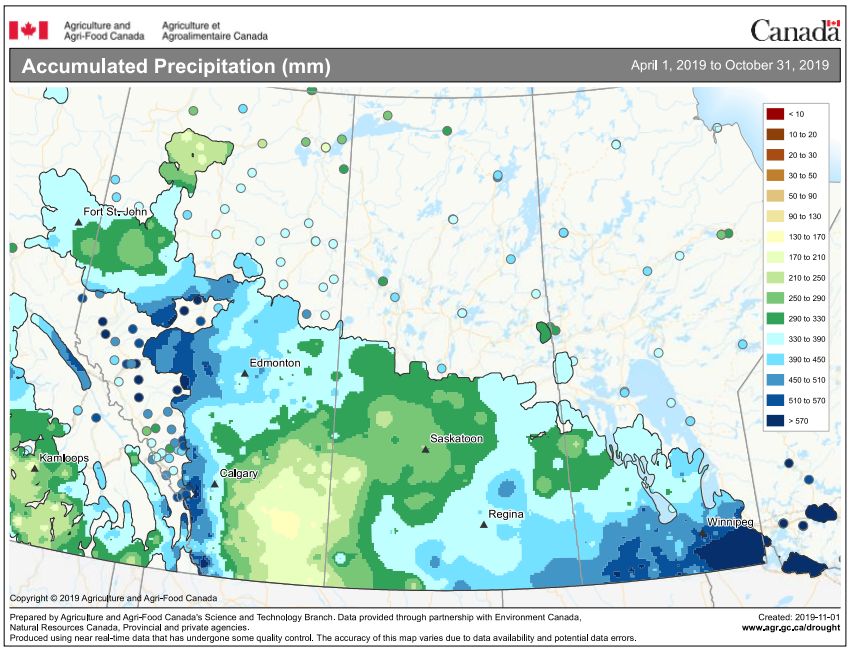

Figure 4. Accumulative precipitation from April 1, 2019 to October 31, 2019 (AAFC).

Acknowledgements

We thank the Ministry of Agriculture for all ADOPT projects including plot signage and verbal acknowledgement at field days and on PowerPoint slides during presentations. This will continue at each venue where an extension activity occurs. We also thank Shannon Chant with the Saskatchewan Ministry of Agriculture, as well as the Saskatchewan Winter Cereals Development Commission, including Executive Director, Carol Ann Patterson (carolann@swcdc.info) and Director, Brad White (bwhite@xplornet.com).