2021 Final Research Report

from the

East Central Research Foundation

Project Title: Can Farm-saved Seed of Wheat (Triticum aestivum L.) Perform as well as Certified Seed in Saskatchewan?

(SWDC #181106-101)

Principal Investigators:

Mike Hall[1], Heather Sorestad[1], Robin Lokken[2], Christiane Catellier[3], Brianne McInnes[4], Jessica Slowski[4], Lana Shaw[5], Garry Hnatowich[6], Gursahib Singh[6], Jessica Enns[7], Kayla Slind[7], Bryan Nybo[8] and Amber Wall[8]

[1]East Central Research Foundation, Yorkton, SK.
[2]Conservation Learning Centre, Prince Albert, SK
[3]Indian Head Research Foundation, Indian Head, SK.
[4]Northeast Agriculture Research Foundation, Melfort, SK
[5]South East Research Farm, Redvers, SK
[6]Irrigation Crop Diversification Centre, Outlook, SK
[7]Western Applied Research Corporation, Scott, SK
[8]Wheatland Conservation Area Inc., Swift Current, SK

Project Identification

1. **Project Number:** SWDC #181106-101
2. **Producer Group Sponsoring the Project:** Saskatchewan Wheat Development Commission
3. **Project Location(s):** Yorkton, Prince Albert, Indian Head, Melfort, Redvers, Outlook, Scott and Swift Current, SK
4. **Project start and end dates (month & year):** April 2018 to April 2022
5. **Project contact person & contact details:**

Mike Hall, Research Coordinator

East Central Research Foundation/Parkland College
Box 1939, Yorkton, SK, S3N 3X3
Phone: 306-621-6032
Email: m.hall@parklandcollege.sk.ca

Objectives and Rationale

6. **Project objectives:**
    - To compare the vigor and yield performance of various lots of farm-saved wheat seed relative to the same varieties of certified seed.
    - To determine the degree to which seed treatment can improve the vigor and yield potential of farm-saved and certified seed lots of wheat.

7. **Project Rationale:**

Producers of cereal grains are free to retain seed for planting on their own farm. This retained seed is commonly referred to as "farm-saved seed" (FSS). While the yield loss from growing saved seed from hybrid crops such as canola[1] has been well documented, little research has compared yields between certified and farm-saved seed for wheat in western Canada. Despite the guaranteed quality of certified seed, a phone survey of 800 producers in 2004 determined approximately 70 to 80% of cereal acres in western Canada were seeded with farm-saved seed[2]. Producers cited "reduced costs" and "knowing what is in the seed" as reasons for preferring FSS. Farm-saved seed is typically a cheaper seed source than certified seed. A 13-year study in Alberta between 2003 and 2016 found the average price premium for certified wheat seed over FSS was $3.75/bu[3], even when assuming a 1.5 bu/ac yield benefit from using a new variety of certified seed. To be fair, the Canadian Seed Growers' Association does not mention higher yields when discussing the certified advantage[4]. Certified seed is valuable because it is "true to type" meaning it has retained all the genetic benefits developed by the breeder. This helps with quality assurance for the end users, which is of increasing importance as the industry moves toward a value chain model. In addition, to be "certified", seed must meet high standards of germination and freedom from impurities, which are determined by an officially recognized third-party agency[5]. Finally, it is important to support a system that ensures the development of new varieties to keep Canadian wheat producers globally competitive. The exact form of this support is currently

under debate.

Many producers believe they are capable of producing quality FSS which is comparable to certified seed. Producers will typically grow FSS for 2-3 years and then purchase certified seed to introduce better genetics to the farm. This may prove to be true for many producers in Saskatchewan as past study with winter wheat in central Oklahoma found FSS could often perform as well as certified seed. However, the relative comparison changed between years in their study. In 2003, they observed 9 out of 19 farm-saved seed lots were inferior for grain production compared to the best certified seed source. In contrast, only 2 out of 27 farm-saved samples were inferior in 2004 and only 4 out of 17 were inferior in 2005.[6] The authors concluded "that if farms use quality control measures similar to those required for certified seed, farm-saved wheat seed can produce forage and grain yield comparable to that of certified seed" [6]. To ensure quality seed is being planted, seed must be sent away for testing.

There are a number of seed labs, which offer vigor testing and disease screening to help producers determine the suitability of a seed lot for seeding. Vigor tests are superior to the standard germination test as they will give a better indication of crop emergence and strength under adverse conditions. A fungal screen can determine the presence of a number of seed-borne pathogens that can also affect seed vigor. Low vigor seed lots with high fungal screens can be retested to determine if seed treatment can improve vigor[7]. Seed treatment will often improve the vigor of a seed lot by 10%. However, the level of seed-borne disease may help to determine if locating a better seed lot would be advisable.

The quality of farm-saved seed lots are likely to be more variable than certified seed, which must meet exacting standards. The intent of this study is to randomly compare the vigor and yield potential of FSS relative to certified seed in Saskatchewan from 2019-2021. The intent is to sample as many FSS and certified seed lots as possible. In the three years of this study, 72 different seed lots of FSS were compared against the same varieties of 72 different seed lots of certified seed.

[1]Clayton, G.W., Brandt, S., Johnson, E.N., O'Donovan, J.T., Harker, K.N., Blackshaw, R.E., Smith, E.G., Kutcher, H.R., Vera, C., and M. Hartman. 2009. Comparison of Certified and Farm-Saved Seed on Yield and Quality Characteristics of Canola. Agron. J. 101: 1581-1588

[2]https://www.cropweek.com/presentations/2005/ssga.pdf

[3]Overview of Certified Seed and Farm-saved Seed, March 2018. Economics and Competitiveness Branch. Alberta Government.
https://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/econ15976/$FILE/Overview%20of%20Certified%20Seed%20and%20Farm%20Saved%20Seed%20II.pdf

[4]The Certified Advantage
https://seedgrowers.ca/farms/the-certified-advantage/

[5]What is Canadian Certified Seed?
http://seedgrowers.ca/seed-growers/what-is-canadian-certified-seed/

[6]Edwards, J.T. and E. G. Krenzer Jr. 2006. Quality of Farm-saved Wheat Seed is Variable in the Southern Great Plains. Online. Crop Management doi:10.1094/CM-2006-0531-01-RS

[7]What is a Fungal ScreenTM for Cereals? 20/20 Seed Labs
https://www.2020seedlabs.ca/what-is-a-fungal-screen-for-cereals/

Methodology and Results

8. Methodology:

The trials were setup as a 2 by 3 by 2 factorial in a randomized complete block design with 4 replicates at each site-year. The plot size, row spacing, and fertilizer application techniques for seeding varied between locations. However, managers at each site applied macronutrients at rates to adequately compensate for any limitations and all small plots were direct seeded into standing stubble. Individual treatments are listed in Table 1 below. Seed treatments varied between locations and years (Tables 2-4). Raxil Pro and Cruiser Vibrance Quattro were used most frequently. Raxil Pro was used at 11 site-years and Cruiser Vibrance Quattro was used at 10 site-years. Cruiser Maxx Vibrance and Cruiser Maxx Cereal were only used at 1 and 2 site-years, respectively. Seed lots were selected from FSS that producers intended to sow in each given year. Once a FSS lot was selected, a certified seed lot of the same variety was obtained from a certified seed grower for the variety comparison. Certified seed was usually sourced from the same region as the FSS. A seed lot of FSS or certified seed was never used more than once in this study, as the goal was to sample as many different seed lots as possible.

Table 1. Treatment list for the "Can Farm-saved Seed Wheat (Triticum aestivum L.) perform as well as Certified Seed in Saskatchewan?" Trial

Trt #	Seed treatment	Variety pairing	Seed type
1	Untreated	A	Certified
2	Untreated	A	Farm-saved Seed
3	Untreated	B	Certified
4	Untreated	B	Farm-saved Seed
5	Untreated	C	Certified
6	Untreated	C	Farm-saved Seed
7	Treated	A	Certified
8	Treated	A	Farm-saved Seed
9	Treated	B	Certified
10	Treated	B	Farm-saved Seed
11	Treated	C	Certified
12	Treated	C	Farm-saved Seed

The variety used for each variety pairing for each site-year is presented in Table 2. Beside each variety is the number of years the FSS was removed from certified. Of the 72 variety comparisons, 27 were AAC Brandon. AAC Brandon was a popular variety of FSS and producers frequently offered this variety for the study. ACC Viewfield was the next most prevalent variety

and was used in 8 of the comparisons. The remaining HRS comparisons in descending prevalence were AAC Elie, Cardale, AAC Cameron, CDC Landmark, CDC Plentiful, Redberrry, Steller, Faller and AAC Connery. While the vast majority of varieties were hard red spring, a few durum varieties were grown at Swift Current and Redvers. In each year, Swift Current used AC Transcend, AAC Spitfire and CDC Fortitude for their variety comparisons. Redvers used AC Transcend for one variety comparison in 2019. CS Accelerate is a CPSR wheat variety and was used at Indian Head in 2021.

Table 2. Variety Comparisons of Certified vs Farm-Saved Seed at each Location and Year[A]

Site	Year	Comparison A	Comparison B	Comparison C
Yorkton	2019	AAC Brandon (2)	AAC Brandon (2)	AAC Elie (2)
Redvers	2019	AAC Brandon (3)	AAC Brandon (2)	AC Transcend (2)
Indian Head	2019	AAC Brandon (2)	AAC Brandon (2)	AAC Elie (2)
Swift Current	2019	AC Transcend (3)	AAC Spitfire (1)	CDC Fortitude (3)
Scott	2019	AAC Brandon (2)	AAC Elie (2)	Stettler (2)
Outlook	2019	AAC Brandon (2)	AAC Brandon (2)	Cardale (2)
Prince Albert	2019	Cardale (1)	AAC Elie (1)	AAC Brandon (3)
Melfort	2019	AAC Brandon (?)	AAC Brandon (3)	AAC Brandon (2)
Yorkton	2020	AAC Connery (2)	AAC Brandon (1)	AAC Brandon (2)
Redvers	2020	AAC Brandon (4)	AAC Brandon (2)	AAC Elie (2)
Indian Head	2020	Faller (1)	AAC Brandon (1)	AAC Viewfield (2)
Swift Current	2020	AC Transcend (2)	AAC Spitfire (3)	CDC Fortitude (4)
Scott	2020	AAC Brandon (3)	AAC Viewfield (1)	CDC Plentiful (1)
Outlook	2020	AAC Brandon (2)	AAC Brandon (2)	AAC Viewfield (2)
Prince Albert	2020	AAC Cameron VB (1)	CDC Landmark VB (1)	AAC Cameron VB (1)
Melfort	2020	Cardale (5)	AAC Elie (3)	AAC Redberry (1)
Yorkton	2021	AAC Viewfield (2)	AAC Brandon (1)	AAC Viewfield (3)
Redvers	2021	AAC Brandon (3)	AAC Brandon (3)	AAC Elie (2)
Indian Head	2021	CS Accelerate (1)	AAC Viewfield (2)	CDC Landmark VB (1)
Swift Current	2021	AC Transcend (3)	AAC Spitfire (1)	CDC Fortitude (3)
Scott	2021	AAC Brandon (2)	AAC Viewfield (2)	CDC Plentiful (4)
Outlook	2021	AAC Viewfield (2)	Cardale (2)	AAC Brandon (2)
Prince Albert	2021	AAC Brandon (1)	CDC Landmark VB (1)	AAC Cameron VB (1)
Melfort	2021	AAC Cameron VB (1)	Cardale (5)	AAC Redberry (1)

[A]numbers in parenthesis indicated the number of years the FSS was removed from certified.

On average, seed lots of farm saved seed (FSS) used in this study were 2.06 years removed from certified. However, the FSS lots ranged from 1 to 5 years removed from certified (Table 2). Of the 72 variety comparisons, only 5 comparisons were made with FSS that was 4 or 5 years removed from certified. The vast majority were with seed lots that were 3 years removed or less. There were 13 seed lots that were 3 years removed, 32 seed lots that were 2 years removed and 21 seed lots were only 1 year removed from certified. The number of years removed from certified for the FSS of AAC Brandon used in comparison A at Melfort is not known. While it was not the intent of the study to have so many seed lots that were only 1 year removed from certified, this is an accurate reflection of what farmers were using. Seven of the seed lots, which were only 1 year removed from certified, were midge tolerant varietal blends. Seeding a varietal blend more than 1 year removed from certified is illegal, in order to maintain the efficacy of the resistance gene.

All trials for each year were seeded within the month of May (Table 3,4 and 5). Each site targeted 300 live seeds/m^2 and seed treatment was applied just prior to seeding using a cement mixer style of application. Dates of operations, measurements taken and products used in 2019, 2020 and 2021 are available in tables 3,4, and 5, respectively.

Table 3. Dates of operations in 2019 for the "Can Farm-saved Seed Wheat Perform as well as Certified Seed in Saskatchewan" trial

Activity	**----------Date----------**							
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**
Pre-seed Herbicide Application	May 12 (Glyphosate)	May 24 (Glyphosate + Heat LQ + Merge)	N/A	N/A	N/A	May 19 (Glyphosate 540 + AIM)	May 13 (RT540)	N/A
Seeding & Seed treatment applied	May 7 & (Raxil PRO)	May 23 & (Cruiser Vibrance Quattro)	May 14 & (Cruiser Vibrance Quattro)	May 23 & (Raxil PRO)	May 6 & (Raxil PRO)	May 14 & (CruiserMaxx Cereal)	May 16 & (Cruiser Vibrance Quattro)	May 7 and 8 & (CruiserMaxx Vibrance)
Emergence Counts	June 4	June 21	June 14	June 12	June 5	June 5	June 7	May 30
Vigor Rating	June 4	July 12	June 20	July 11	N/A	June 27		June 12 and June19
In-crop Herbicide Application	June 17 (OcTTain + Simplicity)	June 27th (Axial July 4 Prestige XC)	June 10 (Badge II & Simplicity)	June 27 (Stellar A + B)	June 10 (Buctril M + Clodinafop)	June 26 (Axial + Buctril M)	June 12 (Varro + Octane + Agral90)	June 12 (Prestige) June 25 (MCPA) July 3 (MCPA)
In-crop Fungicide Application	July 9 (Prosaro)	N/A	July 15 (Caramba)	N/A	July 12 (Caramba)	N/A	N/A	July 3 (Acapela)
Lodging Rating	N/A	Oct 9	N/A	N/A	N/A	Aug 26	Aug 20	Sept 3
Desiccant	Aug 28 (Glyphosate)	N/A	N/A	Sept 5 (Glyphosate)	N/A	Sept 6 (Heat LQ Roundup 540 Merge)	N/A	Sept 3 (Roundup Transorb)
Harvest	Sept 6	Oct 9	Sept 24	Oct 1	Aug 29	Sept 16	Aug 27	Sept 16

Table 4. Dates of operations in 2020 for the "Can Farm-saved Seed Wheat Perform as well as Certified Seed in Saskatchewan" trial

Activity	**----------Date----------**							
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**
Pre-seed Herbicide Application	May 14 (Glyphosate)	May 24 (Heat LQ + Glyphosate 540)	N/A	N/A	May 14 (Glyphosate)	May 9 (Glyphosate + AIM)	May 4 (Glyphosate +AIM)	N/A
Seeding & Seed treatment applied	May 20 (Raxil Pro)	May 23 (Raxil Pro)	May 22 (Cruiser Vibrance Quattro)	May 26 (Raxil Pro)	May 16 (Raxil Pro)	May 12 & (Cruiser Cereal)	May 8 (Cruiser Vibrance Quattro)	May 6 & (Vibrance Quattro)
Emergence Counts	June 12	June 2	N/A	June 15	June 4	June 11	June 4	May 25
Vigor Rating	June 22	June 29	June 16	June 29	June 10	June 15	June 9	June 12
In-crop Herbicide Application	June 15 (OcTTain + Simplicity GoDRI)	June 23 (Prestige XC) July 3 (Axial)	June 16 (Buctril M + Simplicity)	June 10 (Infinity)	June 2 (Infinity FX)	June 16 (Axial Ipak)	May 29 (Liquid Achieve + Buctril M + Turbocharge)	May 29 (Prestige) June 8 (Simplicity)
In-crop Fungicide Application	July 16 (Prosaro)	July 24 (Caramba)	N/A	July 21 (Twinline)	July 7 (Caramba)	July 16 (Caramba)	N/A	July 2 (Caramba)
Lodging Rating	N/A	Sept 16	Aug 18-24	Sept 21	N/A	Aug 21	Aug 23	N/A
Desiccant	July 19 (Roundup Weathermax)	Sept 8 (Glyphosate 540)	N/A	N/A	N/A	Aug 25 (Roundup)	N/A	(Roundup Transorb)
Harvest	Aug 27	Sept 16	Aug 31	Sept 25	Aug 23	Sept 11	Aug 24	Aug 12

Table 5. Dates of operations in 2021 for the "Can Farm-saved Seed Wheat Perform as well as Certified Seed in Saskatchewan" trial

Activity	**----------Date----------**							
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**
Pre-seed Herbicide Application	May 11 (Glyphosate)	May 14 (Glyphosate +Heat)	N/A	N/A	N/A	May 13 (Glyphosate 540 + AIM)	May 3 (Glyphosate + AIM)	None
Seeding & Seed treatment applied	May 18 (Raxil PRO)	May 11 & May 7 (Raxil PRO)	May 17 & May 10 (Cruiser Vibrance Quattro)	May 28 & May 27 (Raxil PRO)	May 13 & May 13 (Raxil PRO)	May 17 & April 30 (Cruiser Vibrance Quattro)	May 12 & May 12(Cruiser Vibrance Quattro)	May 7 & May 6 (Cruiser Vibrance Quattro)
Emergence Counts	June 8	May 31	June 2	June 21		June 2	June 2	June 3
Vigor Rating	June 17	June 9	June 7	July 14	June 7	June 17	June 22	June 3
In-crop Herbicide Application	June 12 (Prestige + Simplicity)	June 8 (Prestige XC) June 22 (Axial)	June 8 (Buctril M/Simplicity)	June 15 (Dyvel)	June 1 (Buctril M)	June 13 (Axial Ipak) June 24 (Buctril M)	June 7 (Liquid Achieve + Buctril M + Turbocharge)	June 7 (Prestige) June 16 (Axial)
In-crop Fungicide Application	July 11 (Prosaro XTR)	July 9 (Caramba)	July 8 (Priaxor)	July 13 (Folicur)	N/A	July 13 (Caramba)	N/A	July 6 (Prosaro XTR)
Lodging Rating	N/A	Aug 19	Varying by date of Maturity	Sept 22	N/A	Aug 9	Aug 30	N/A
Desiccant	Aug 13 (Glyphosate)	N/A	N/A	N/A	None	Aug 13 (Glyphosate + Heat + Merge)	N/A	N/A
Harvest	Aug 31	Aug 19	Aug 17	Sept 22	Aug 14	Aug 30	September	Aug 16

9. Results:

Growing Season Weather

Mean monthly temperatures and precipitation amounts for 2019-2021 with long-term (1981-2010) averages for the 8 sites are listed in Tables 6 and 7, respectively. In 2019, all sites were cooler than the long-term average, precipitation in May was below average at all locations. However, when averaged from May to August, precipitation was only substantially below average at Prince Albert, Redvers and Yorkton. Yields were pretty typical for each location because soil moisture reserves were adequate. In 2020, season temperatures were near normal at most locations. Yorkton and Swift Current were a little warmer than average and Prince Albert was a little cooler. Precipitation was well below average at Indian Head, Redvers and Yorkton. However, low yields resulting from drought were only an issue at Yorkton where soil moisture levels were depleted. In 2021, temperatures were well above seasonal at all locations. Precipitation was well below average at Melfort, Outlook, Scott, Swift Current and Yorkton. Drought caused a moderate yield loss at Yorkton but severe yield losses at Scott and Swift Current. Drought was not an issue at Prince Albert, Redvers or Outlook (irrigation site). Melfort did not appear to suffer substantial yield losses due to drought despite low levels of recorded precipitation.

Table 6. Mean monthly temperatures amounts along with long-term (1981-2010) normals for the 2019, 2020 and 2021 growing seasons at 8 sites in Saskatchewan.

Location	Year	May	June	July	August	Avg. / Total
		----------*Mean Temperature (°C)* ----------				
Indian Head	2019	8.9	15.7	17.4	15.8	14.4
	2020	10.7	15.6	18.4	17.9	15.6
	2021	9.0	17.7	20.3	17.1	16.0
	Long-term	***10.8***	***15.8***	***18.2***	***17.4***	***15.6***
Melfort	2019	8.8	15.3	16.9	14.9	14.0
	2020	10.1	14.3	18.8	17.6	15.2
	2021	9.6	18.2	20.1	16.9	16.2
	Long-term	***10.7***	***15.9***	***17.5***	***16.8***	***15.2***
Outlook	2019	9.9	16.0	18.0	16.2	15.0
	2020	11.3	15.9	19.1	18.8	16.2
	2021	10.1	18.8	21.6	17.9	17.1
	Long-term	***11.3***	***16.0***	***18.6***	***17.8***	***15.9***
Prince Albert	2019	9.5	15.8	17.4	15.1	14.5
	2020	9.2	13.4	17.6	16.1	14.1
	2021	10.1	18.3	20.3	17.0	16.4
	Long-term	***11.4***	***15.9***	***18.5***	***17.1***	***15.6***
Redvers	2019	9.5	16.3	18.5	16.6	15.2
	2020	10.5	16.8	19.2	18.5	16.3
	2021	10.0	18.7	20.8	17.5	16.8
	Long-term	***11.1***	***16.2***	***18.7***	***18.0***	***16.0***
Scott	2019	9.1	14.9	16.1	14.4	13.6
	2020	10.2	14.6	17.1	16	14.5
	2021	3.6	8.9	17.3	19.6	17.2
	Long-term	***10.8***	***14.8***	***17.3***	***16.3***	***14.8***
Swift Current	2019	*9.5*	*15.8*	*17.7*	*16.8*	*15.0*
	2020	10.9	16.6	18.2	19.5	16.3
	2021	9.5	18.4	21.7	18	16.9
	Long-term	***10.3***	***15.3***	***18.2***	***17.6***	***15.8***
Yorkton	2019	8.6	16	18.3	16.1	14.8
	2020	10.5	16.4	19.9	18.3	16.3
	2021	8.9	19.1	21.0	17.3	16.5
	Long-term	***10.4***	***15.5***	***17.9***	***17.1***	***15.2***

Table 7. Precipitation amounts along with long-term (1981-2010) normals for the 2019, 2020 and 2021 growing seasons at 8 sites in Saskatchewan.

Location	Year	May	June	July	August	Avg. / Total
			---------- *Precipitation (mm)* ----------			
Indian Head	2019	13.3	50.4	53.1	96.0	212.8
	2020	27.3	23.5	37.7	24.9	113.4
	2021	81.6	62.9	51.2	99.4	295.1
	Long-term	***51.7***	***77.4***	***63.8***	***51.2***	***241.4***
Melfort	2019	18.8	87.4	72.7	30.7	209.6
	2020	26.7	103.7	52.4	18.5	201.3
	2021	31.4	37.6	0.2	69.3	138.5
	Long-term	***42.9***	***54.3***	***76.7***	***52.4***	***226.3***
Outlook	2019	13.2	90.2	43.8	39.6	186.8
	2020	27.8	79.2	29.6	19.0	155.6
	2021	44.5	10.3	13.8	37.7	106.3
	Long-term	***43.2***	***69.3***	***57.6***	***44.2***	***214.3***
Prince Albert	2019	30.0	54.4	57.4	16.8	158.6
	2020	68.4	91.4	32.2	33.2	225.2
	2021	30.1	80.3	8.6	59.9	178.6
	Long-term	***40.4***	***79.6***	***84.6***	***42.9***	***247.5***
Redvers	2019	18.3	59.7	34.0	85.1	197.1
	2020	22.9	59.7	47.8	36.1	166.5
	2021	41.4	95.2	38.4	72.1	247
	Long-term	***60***	***95.2***	***65.5***	***46.6***	***267***
Scott	2019	12.7	97.7	107.8	18.0	236.2
	2020	48.3	70.2	129.4	25.8	273.7
	2021	43.9	43.8	10.4	51.3	150.1
	Long-term	***38.9***	***69.7***	***69.4***	***48.7***	***226.7***
Swift Current	2019	13.3	156	11.1	42.6	223.0
	2020	36.3	80.0	62.5	6.5	185.3
	2021	35	29.6	38.9	55.8	159.3
	Long-term	***44.1***	***74.5***	***51.9***	***43.2***	***213.7***
Yorkton	2019	11.1	81.6	49.1	32.2	174
	2020	16.7	33.6	80.1	49.3	179.7
	2021	24.6	18.1	35.2	69.7	147.6
	Long-term	***51***	***80***	***78***	***62***	***272***

Background levels of soil N were fairly typical at most site-years for a continuous cropping system (Table 8). However, there were a few exceptions. Residual soil N was extremely high at

Swift Current 2019 and Prince Albert 2020 at 253 lb N/ac and 199 lb N/ac, respectively. In 2021, Melfort and Yorkton had moderately high background levels of soil N at 93 and 111 lb/ac, respectively.

Table 7. Soil Test Nitrate Levels for each location (lb N/ac).

2019								
Nitrate Levels (lbs NO_3-N/ac)	**Indian Head**	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**
0-15cm (0-6in)	16	9	8	17	29	14	28	14
15-30cm (6-12in)		10		12				
15-60cm (6-24in)	39		10		42	18	225	18
Total 0-60cm (0-24in)	55	29[z]	18	44[z]	71	32	253	32
Total 0-30 cm (0-12in)		19		29				
2020								
Nitrate Levels (lbs NO_3-N/ac)	**Indian Head**	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**
0-15cm (0-6in)	11	21	31	84	22	14	25	27
15-30cm (6-12in)		33		49				
15-60cm (6-24in)	12		42		39	21	24	33
Total 0-60cm (0-24in)	23	81[z]	73	199[z]	61	35	49	60
Total 0-30 cm (0-12in)		54		133				
2021								
Nitrate Levels (lbs NO3-N/ac)	Indian Head	Melfort	Outlook	Prince Albert	Redvers	Scott	Swift Current	Yorkton
0-15cm (0-6in)	13	34	29	22		13	9	
15-30cm (6-12in)		28	13					
15-60cm (6-24in)	24			27		18	21	
Total 0-60cm (0-24in)	37	93z	68	49		31	30	92
Total 0-30 cm (0-12in)		62						74

[z]Estimate based on 1.5*level found in 0-30 cm.

Seed Lot Quality

Certified and FSS seed lots were tested for germination, vigor, 1000 kernel weight and seed-borne disease (Tables 9, 10, and 11). The purpose of seed testing was to compare the quality of FSS against certified seed being used by producers and was not used as a means to select lots of FSS. Of the parameters measured, vigor and seed-borne disease are considered to provide the best indication of seed quality. A vigor test gives a better indication of crop emergence under stressful conditions (ie: cold soils) than a standard germination test. In this study, a significant linear relationship was detected between seed lot vigor and crop yield. When averaged across all site-years, a reduction in seed vigor from 100% to 80% reduced crop yield from 4163 kg/ha to 3978 kg/ha, respectively. In other words, a 20% decline in seed vigor was associated with a 4.4% decline in yield, regardless of seed type (certified vs FSS). However, a significant relationship between the level of seed-borne fusarium and yield was not detected.

When averaged over all seed lots, the vigor of certified seed did not statistically differ from FSS for any of the years separately or in combination (Table 12). When averaged over all seed lots used in the study from 2019-2021, the vigor of certified seed was numerically higher at 93.1% compared to 91.7% for FSS. However, even if this difference was statistically significant it would be of little agronomic significance. Levels of seed-borne disease were also low and inconsequential.

The 5 seed-borne pathogenic fungi which are typically screened for when determining seed quality include:

- *Cochliobolis sativus* – Seedling blight, foot and root rot or spot blotch (leaf blight)
- *Fusarium graminearum* – Head blight
- *Fusarium* spp. – Seedling blight, root and crown rot, and head blight
- *Pyrenophora* spp. – Leaf blight (leaf stripe, net blotch and tan spot), and seedling blight (oats)
- *Septoria* spp. – Leaf blotch

According to the 20/20 Seed Labs Inc. website, seed treatment may not provide sufficient control if infection with any one disease is higher than 8%, or if the total disease of 3 or more pathogens is more than 12%. While overall levels of seed-borne disease were low and did not statistically differ between FSS and certified seed for all 3 years (Table 12), there were a few instances where limits were exceeded by both seed types. At Prince Albert (2019), farm saved AAC Brandon had a relatively high level of seed-borne fusarium (18.5%) but this was not associated with low vigor (92%) (Table 9). At Melfort (2020), certified Cardale and Redberry as well as FSS lots of Cardale and AAC Elie exceeded thresholds (Table 10). Thresholds were also exceeded by FSS lots of AAC Brandon at Outlook and Redvers as well as certified Landmark and farm saved AAC Cameron at Prince Albert. However, there were only a couple instances where high levels of seed-borne disease was associated with a relatively low vigor rating. This occurred for certified Redberry (85% vigor-Melfort 2020) and certified Landmark (84% vigor- Prince Albert 2020). `In 2021, the 20/20 Seed lab thresholds were only exceeded for a few of the seed lots. These included certified and farm-saved Cardale and Farm-saved AAC Cameron VB at Melfort (Table 11). At Prince Albert, Farm-saved AAC Brandon also exceeded thresholds. However, high seed-borne disease was only associated with a low vigor for farm-saved Cardale (78%) at

Melfort and farm-saved AAC Brandon (79%) at Prince Albert.

When averaged over all seed lots used in the study, the level of seed-borne fusarium was 2.76% for certified seed and 3.75% for FSS (Table 12). These values are not high or significantly different. Of the seed lots that exceeded 20/20 Seed lab thresholds, 9 of them were FSS and 4 were certified seed lots. Only 4 of the seed lots with high seed-borne fusarium also had relatively low vigor below 85%. While there is some evidence to suggest the seed quality of farm-saved seed was poorer than certified seed, the differences were small and insignificant. For the most part, seed lots of FSS were good quality and comparable to certified seed lots in this study. Good harvest conditions in recent years has resulted in the wide spread production of quality seed.

Site Establishment

While seeding rates for each seed lot were adjusted based on 1000 kernel weight and seed vigor to achieve 300 live seeds/m^2, crop emergence varied between site-years. Average crop emergence was as high as 376 plants/m^2 at Indian Head (2021) and as low as 82 plants/m^2 at Prince Albert (2019). The poor emergence at Prince Albert (2019) was the result of poor soil moisture conditions. Emergence was also relatively low (116 plants/m^2) at Prince Albert in 2020, but emergence for the remaining site-years were above 156 plants/m^2. The main goal was to achieve similar emergence rates between seed types in order to make fair comparisons. This was largely accomplished as emergence did not significantly differ between certified and FSS for the vast majority of variety comparisons. There were a few exceptions where either significant main effects of seed type or significant interactions between seed type and variety comparisons were detected (Tables 13-15). However, very few of these significant differences were large enough to cause agronomic differences (Tables 16-21). The exception to this would have been at Indian Head in 2020. At this site-year, the emergence for the FSS in the B comparison was substantially lower compared to the certified seed, whether seed was bare or treated. However, this difference did not result in a significant yield difference between seed types (Table 39).

Relative Productivity of sites

Overall, yields were good to excellent at most site-years over the course of this study. High yields were achieved at Yorkton (6081 kg/ha) and Melfort (5471 kg/ha) in 2019, Indian Head (5294 kg/ha) and Outlook (6080 kg/ha) in 2020, and at Outlook (6520 kg/ha) in 2021 under irrigation. Relatively poor yields due to drought were observed at Swift Current (2128 kg/ha) in 2019, Yorkton (2511 kg/ha) in 2020, and at Scott (1518 kg/ha) and Swift Current (783 kg/ha) in 2021. Yields for the remaining site-years ranged from 3797 kg/ha to 4794 kg/ha.

Variety Comparisons

Even at an individual site level, there is little value discussing any main effects of variety comparisons because determining differences between varieties was not an objective of this study. It even has less value if all seed lots within a location are the same variety. As mentioned earlier, combining the data between locations to discuss variety comparison is inappropriate as variety comparisons A, B and C between site-years have no relation to each other. While values

and statistical analysis for variety comparison are included in each individual site table, their presence only serves to help the reader understand how the trials were structured and to determine if there were any interactions between seed type and variety comparison. For example, differences between seed type may only be detected for some of the variety comparisons.

Effects of Seed Treatment

Site managers were free to choose seed treatments based on local preference and availability. The objective of this study was to determine the value of seed treatment in general and not to determine their relative efficacy or to promote one product over another. Of the 24 site-years in this study, 11 site-years used Raxil Pro, 10 site-years used Cruiser Vibrance Quattro, 2 site-years used Cruiser Maxx Cereal and 1 site-year used Cruiser Maxx Vibrance (Tables 3-5).

A combined analysis of all 24 site-years was done for seedling vigor ratings, crop yield, and grain protein data (Table 22). Unlike the individual site analysis, variety pairing was treated as a random effect in the model, as the variety pairings are different between each site year and it does not make sense to combine effect of each pairing across site-years. However, individual site analysis still has variety pairing as a fixed effect in order to detect interaction between seed type and variety pairing.

When averaged across all site-years, the use of seed treatment significantly increased seedling vigor, albeit modestly, from a rating of 8.00 for the untreated check to a rating of 8.20 for treated seed based on a scale from 1 to 10 (Table 22). Seed treatment did not significantly affect yield. Untreated seed yielded 4066 kg/ha and treated seed yielded 4042 kg/ha, which is an extremely small difference. Grain protein was significantly higher for untreated seed (13.90%) compared to treated seed (13.78%). However, this difference is quite small and of little economic significance. The combined analysis detected significant seed treatment by site-year interactions for the seedling vigor and yield data but not the protein data. However, individual site year analysis did reveal more differences between sites than the combined analysis determined. The discussion will largely focus on individual site analysis.

Seedling vigor, yield or grain protein was not significantly affected by seed treatment for most site-years. However, there were a few exceptions. Treating seed did significantly increase seedling vigor at Swift Current in all 3 years and at Scott and Melfort in 2020 (Tables 23-28). However, visual observations of improved seedling vigor did not always correspond to significantly higher yields. The increase in observed seedling vigor from seed treatment resulted in significant yield gains of 1.5% for Scott and 3.8% for Swift Current in 2020 (Tables 33 and 36). Yield at Melfort in 2020 also increased in response to seed treatment but the difference was not statistically significant. In contrast, yield did not respond to seed treatment at Swift Current in 2019 (Tables 32 and 35), despite an increase in observed seedling vigor. Oddly, yield was significantly reduced by almost 25% by seed treatment at Swift Current 2021 (Table 34 and 37) despite significantly better vigor ratings associated with the treated seed (Tables 25 and 28). In contrast, seed treatment significantly reduced seedling vigor at Indian Head in 2020 (Tables 24 and 27) and yield was significantly reduced by 1.4% (Tables 33 and 36).

When averaged over all site-years, treated seed yielded 4039 kg/ha (60.1 bu/ac) and untreated seed yielded 4066 kg/ha (60.5 bu/ac). The yield difference is very small and statistically insignificant. However, significant seed treatment effects and/or significant interactions involving seed treatment were detected for the yield data at Yorkton 2019, Indian Head from 2019-2021, Prince Albert 2020, Scott 2020, and Swift Current from 2020-2021. For the sake of brevity, all the significant difference will not be described. However, 18 out of 144 comparisons found yield was significantly higher with treated seed and 28 comparisons found seed treatment significantly reduced yield. The author has previously observed decreases in cereal yield resulting from seed treatment, particularly in the absence of significant disease pressure, which was largely the case in this study. Non-uniform coverage of seed with seed treatment may have resulted in phytotoxic effects in some cases. Most research stations treat small batches of seed using a cement mixer and this process may not always ensure uniform coverage. As an aside, some manufacturers will refuse to participate in seed treatment studies unless the seed has been treated commercially with a G40 applicator or better to ensure uniform coverage. However, this study as a whole found the effect of seed treatment on yield was inconsistent when yield differences were detected. For the vast majority of comparisons, no significant yield differences were detected between treated and untreated seed.

The combined site analysis found grain protein was reduced from 13.90% with untreated seed to 13.78% when treated ($p=0.001$) (Table 22). Even if though significant, this effect is very small and is of little economic significance to the producer. However, individual site analysis found the effects of seed treatment on protein were not consistent. Seed treatment significantly increased grain protein at Swift Current in 2019 and decreased grain protein at Melfort 2020, Swift Current 2021 and Indian Head 2021 (Tables 44-46). A significant decrease in protein at Indian Head 2021 corresponded to a significant increase in yield, which makes sense. However, the opposite was true for Swift Current 2021, which is puzzling. No relationship between a significant protein change resulting from seed treatment and yield was observed at the remaining site-years. For the most part, individual site analysis (Tables 41-43) did not detect an effect of seed treatment on grain protein and when averaged over all site-years the significant effect was very small and not of economic importance.

Certified vs FSS

When averaged across all site-years, no significant differences in either seedling vigor, yield or grain protein could be detected between certified and farm saved seed (Table 22). A significant interaction between seed type and site-year was detected for the combined analysis of the seedling vigor data but not the yield and grain protein data. While the vast majority of variety comparisons found no significant difference in seedling vigor between certified and FSS, there were a few site-years that detected either a main effect of seed type and/or an interaction between seed type and variety pairing (Tables 23, 24 and 25). This occurred at Indian Head and Yorkton in 2019 and 2020 and Prince Albert in 2020. A closer examination of these individual site-years found seedling vigor, averaged over seed treatment, was significantly greater for certified seed for one variety pairing at both Indian Head and Prince Albert in 2020. In contrast, one variety comparison at Indian Head (2019) and Yorkton (2020) found FSS had significantly higher seedling vigor. Moreover, the main effect for seed type found seedling vigor was significantly

higher for FSS at Yorkton 2019 (Table 26). All other seed type comparisons at these locations were not significantly different. In summary, there is little evidence to suggest seedling vigor differed between seed types and it was inconsistent when it did.

When all site-years were combined, no significant yield or grain protein differences were detected between seed types and neither was there a significant interaction between site-year and seed type (Table 22). Main effects of seed type or an interaction between seed type and variety pairing for yield were only significant at Scott 2019 (Table 32), and Outlook and Redvers in 2021 (Table 34). At Scott 2019, the yield for certified seed in the B variety comparison was 9% higher yielding. The seed vigor was lower for the FSS compared to certified in this variety pairing (92 vs 99%) but this is not likely to account for such a large yield difference. At Indian Head 2019, there was a significant interaction between seed type, seed treatment and variety pairing. At this site-year, FSS was significantly higher yielding (4241 kg/ha vs 3898 kg/ha) but only for the untreated "C" variety pairing. The vigor was 97% for the FSS and 94% for the certified but it does not seem likely that this difference in vigor would account for the significant yield difference. At Redvers 2021, certified seed averaged over seed treatment was 7% higher yielding for only the "A" variety comparison. At Outlook 2021, certified seed when averaged over all variety pairing was 11% higher yielding than FSS but only for treated seed. However, in the vast majority of cases yield differences between certified and FSS could not be detected. Over the course of this study, 144 comparisons were made between certified and FSS (8 sites by 3 years by 3 variety comparisons by 2 seed treatments). Out of 144 comparisons, 7 found higher yields with certified seed and 1 found a higher yield with FSS. However, the vast majority of comparisons (136) could not detect a significant difference with seed type. When averaged over all comparisons within the study, certified seed averaged 4070 kg/ha (60.6 bu/ac) vs 4037 kg/ha (60.1 bu/ac) for FSS which is small and economically insignificant.

Main effects of seed type or an interaction between seed type and variety pairing for grain protein were significant at Outlook 2019, Scott 2019, Melfort 2020, Indian Head 2020, Scott 2020, and Swift Current 2020 (Tables 41-43). For the sake brevity, all the interactions will not be described in detail. However, out of 144 comparisons between certified and FSS from the study as a whole, these sites only had 16 comparisons where a difference in grain protein between certified and FSS was significant. Moreover, differences were inconsistent. There were 8 comparisons where certified seed had significantly higher protein and 8 comparisons where the opposite was true. When averaged over all comparisons within the study, certified seed averaged 13.83% and FSS averaged 13.85%. Again this difference is small and economically insignificant.

10. Conclusions and Recommendations

Farm saved seed used in this study was on average 2.06 years removed from certified. However, some seeds lots were up to 5 years removed. Overall, the quality of FFS and certified seed used in this study was comparable. When averaged over all site-years, certified seed had vigor of 93.1% and the presence of seed-borne fusarium was 2.76%. In comparison, FSS had a slightly lower vigor of 91.7% and a slightly higher level of seed-borne fusarium (3.75%). Neither of these differences were statistically significant or of agronomic concern.

In the majority of cases, seedling vigor, yield, and grain protein were unaffected by seed treatment. Differences that were detected, were inconsistent. While there were a number of positive effects detected with the use of seed treatment there were just as many negative effects. Perhaps this can be attributed to random variation or seed treatment was actually causing negative effects. The lack of disease pressure during the course of this study may have revealed mild phytotoxic effects of seed treatment, possibly due to uneven application of product. Overall, seed treatment had little affect on crop performance during this study.

For the vast majority of site-years, seedling vigor, yield and grain protein did not differ between certified or FSS. Where differences were detected, the responses was inconsistent. Overall, FSS performed as well as certified seed in this study. When averaged over all comparisons within the study, certified seed averaged 4070 kg/ha (60.6 bu/ac) with a grain protein of 13.83% vs 4037 kg/ha (60.1 bu/ac) with a grain protein of 13.85% for FSS. These differences were neither large, statistically significant or of economic concern.

Growing FSS was more economical in this study, because doing so incurred no yield or protein disadvantage and certified seed is typically more expensive. However, there is certainly value in purchasing certified seed, to assure quality, true to type grain for end users and to introduce better genetics to the farm. Certified seed should be purchased at a premium, as these assurances have value, and there is value in supporting a system where new genetics can be developed and brought to the farm to keep Canadian producers globally competitive. Exactly how this support will continue is currently under debate. This study does not suggest that there is no value in purchasing certified seed, only that there were no production risks to growing FSS from 2019-2021. Growing FSS for a couple years between purchasing new certified varieties with better genetics is an economic approach based on the results from this study. As long as wheat producers use quality control measures similar to those required for certified seed, the quality of FSS will be comparable.

<u>Extension 2019</u>

- The trial was toured at Swift Current on July 9 during WCA directors and staff tour (20 attendees) and on July 30 during Swift Current Crop Club tour (12 attendees). The trial was also promoted on Swift Current's Facebook page and CKSW's weekly program "Walk the Plots" reaching thousands of listeners in southwest Saskatchewan.
- The trial was toured at Outlook during their July 11 CSIDC Field Day, where 200 producers and agronomists attended.
- Indian Head toured the trial during their Indian Head Crop Management Field Day on July 16 (125 attendees).

Extension 2020

- Covid restrictions did not allow for any physical tours of trials in 2020.
- Top Crop Magazine wrote the following article based upon the 2019 results: "A farm-saved seed/certified seed matchup" (Sept 6, 2020) by Carolyn King https://www.topcropmanager.com/farm-saved-seed-certified-seed-matchup/

Extension 2021

- Country Guide wrote the following article based on 2019-2020 results: "Choosing your seed. Certified or Farm Saved." https://www.country-guide.ca/crops/choosing-your-seed-certified-or-farm-saved/
- ECRF has created video entitled "Certified vs Farm-saved Wheat Seed: How does the quality compare?" This video was viewed at the AgriARM webinar on Jan 13, 2022 (167 attendees). Parts of this video have been broadcasted by GX94 Yorkton. Video will be presented at ECRF/Parkland College's Webinar in late March and then posted on the www.ecrf.ca website.

Supporting Information

11. Acknowledgements:

This project was funded by the Saskatchewan Wheat Development Commission.

12. Appendices

Table 9. Discovery Seed Labs. Seed Quality Results 2019				
	Germination	**Vigor**	**Thousand Kernel Weights**	**Fungal Screen**
Indian Head				
a. Certified AAC Brandon	98	99	33.8	0%
b. Certified AAC Brandon	99	98	41.8	0.5% Total *Fus.*
c. Certified AAC Elie	98	94	36.6	0%
a. Farm-saved AAC Brandon	99	96	41.1	0.5% Total *Fus.*
b. Farm- Saved AAC Brandon	99	95	41.7	2% Total *Fus.*
c. Farm-saved AAC Elie	99	97	35.4	2% Total *Fus.*
Melfort				
a. Certified AAC Brandon	98	96	40.5	0.5% Total *Fus.*
b. Certified AAC Brandon	96	92	38.1	0.5% Fus *gram.* & 2% Total *Fus.*
c. Certified AAC Brandon	97	94	44.8	3% Total *Fus.*
a. Farm-saved AAC Brandon	97	98	39.8	7.5% Total *Fus.*
b. Farm- Saved AAC Brandon	99	97	39.8	1% Total *Fus.*
c. Farm- Saved AAC Brandon	99	96	37.2	1% Total *Fus.*
Outlook				
a. Certified AAC Brandon	99	93	40.0	1% Total *Fus.*
b. Certified AAC Brandon	99	91	34.8	0%
c. Certified Cardale	99	92	36.0	0.5% Total *Fus.*
a. Farm-saved AAC Brandon	99	93	33.0	1.5% Total *Fus.*
b. Farm- Saved AAC Brandon	98	92	32.1	0%
c. Farm-saved Cardale	99	92	37.0	0%
Prince Albert				
a. Certified Cardale	96	89	39.1	0.5% Fus *gram.*, 2.5% Total *Fus.*& 1% Coch. *sat.*
b. Certified AAC Elie	77	74	39.3	4% Total *Fus.*
c. Certified AAC Brandon	99	99	39.4	3.5% Total *Fus.*
a. Farm-saved Cardale	94	95	35.9	0
b. Farm-saved AAC Elie	95	90	43	5.5% Total *Fus.*
c. Farm-saved AAC Brandon	88	92	40.4	1.5% Fus *gram.* & 18.5% Total *Fus.*

Table 9 (Continued). Discovery Seed Labs. Seed Quality Results 2019				
	Germination	**Vigor**	**Thousand Kernel Weights**	**Fungal Screen**
Redvers				
a. Certified AAC Brandon	97	89	40.1	1.5% Total *Fus.*
b. Certified AAC Brandon	98	97	39.3	1% Fus *gram.* & 2.5% Total *Fus.*
c. Certified Transcend Durum	94	89	45.0	1.5% Total *Fus.*
a. Farm-saved AAC Brandon	99	95	40.5	0.5% F. gram.
b. Farm-saved AAC Brandon	98	93	39.0	0.5% Fus *gram.* & 2% Total *Fus.*
c. Farm-saved Transcend Durum	97	86	43.0	0%
Scott				
a. Certified AAC Brandon	98	92	38.9	3% Total *Fus.*
b. Certified AAC Elie	98	97	39.3	2% Total *Fus.*
c. Certified Stettler	97	97	34.7	0.5% Total *Fus.*
a. Farm-saved AAC Brandon	96	96	39.2	3% Total *Fus.*
b. Farm-saved AAC Elie	92	92	33.2	0%
c. Farm-saved Stettler	99	94	40.2	1.5% Total *Fus.*
Swift Current				
a. Certified Transcend Durum	98	84	43.5	0%
b. Certified AAC Spitfire Durum	98	92	47.1	0.5% Total *Fus.*
c. Certified CDC Fortitude Durum	98	96	38.1	0.5% Total *Fus.*
a. Farm-saved Transcend Durum	97	93	47.1	0%
b. Farm-saved AAC Spitfire Durum	95	93	38.6	0%
c. Farm-saved CDC Fortitude Durum	93	84	40.3	0.5% Total *Fus.*
Yorkton				
a. Certified AAC Brandon	99	96	38.8	6% Total *Fus.*
b. Certified AAC Brandon	99	97	34.3	0%
c. Certified AAC Elie	99	98	40.7	3.5% Total *Fus.* & 0.5% Coch. *sat.*
a. Farm-saved AAC Brandon	99	95	40.5	6.5% Total *Fus.*
b. Farm-saved AAC Brandon	98	89	43.1	3.5% Total *Fus.*
c. Farm-saved AAC Elie	96	97	40.1	1.5% Total *Fus.*

Table 10. Discovery Seed Labs. Seed Quality Results 2020				
	Germination	**Vigor**	**Thousand Kernel Weights**	**Fungal Screen**
Indian Head				
a. Certified Faller	98	97	35.7	0.5% Total *Fus.*
b. Certified AAC Brandon	99	97	37.2	2.5% Total *Fus.*
c. Certified AAC Viewfield	99	98	39.4	1% Total *Fus.*
a. Farm-saved Faller	99	96	37.7	0
b. Farm-saved AAC Brandon	98	97	39	0.5% Fus *gram.* & 3% Total *Fus.*
c. Farm-saved AAC Viewfield	74	75	37.3	6% Total *Fus.* & 0.5% Coch. *sat.*
Melfort				
a. Certified Cardale	97	94	37.0	2.5% Fus. *gram.* 10.5% Total *Fus*.
b. Certified AAC Elie	97	94	43.0	3% Total *Fus.*
c. Certified AAC Redberry	85	82	43.0	1% Fus. *gram.*, 14% Total *Fus.* & 0.5% Coch. *sat.*
a. Farm-saved Cardale	95	89	40.0	1% Fus. *gram.* & 12% Total *Fus.*
b. Farm-saved AAC Elie	98	93	47.1	15% Total *Fus.* & 0.5% Coch. *sat.*
c. Farm- Saved AAC Redberry	92	89	40.7	5.5% Total *Fus.*
Outlook				
a. Certified AAC Brandon	97	98	36.5	0%
b. Certified AAC Brandon	99	97	40.3	0%
c. Certified AAC Viewfield	99	92	37.4	0%
a. Farm-saved AAC Brandon	93	91	39.0	2.5% Fus. *gram.*, 9.5% Total *Fus.* & *1*% Coch. *sat.*
b. Farm-saved AAC Brandon	94	91	39.7	0.5% Fus. *gram.* & 6% Total *Fus.*
c. Farm-saved AAC Viewfield	94	90	38.7	0.5% Fus. *gram.*, *3*% Total *Fus.* & *0.5*% Coch. *sat.*
Prince Albert				
a. Certified AAC Cameron VB	95	97	45.2	0.5%Total *Fus*.
b. Certified CDC Landmark VB	84	81	44.6	Fus *gram.* 3% & 15.5% Total *Fus.*
c. Certified AAC Cameron VB	98	95	46.9	0
a. Farm-saved AAC Cameron VB	85	75	34.7	0
b. Farm-saved CDC Landmark VB	97	93	38.0	0.5% Total *Fus.*
c. Farm-saved AAC Cameron VB	92	94	41.9	2% Fus *gram.* & 18% Total *Fus.*

Table 10 (continued). Discovery Seed Labs. Seed Quality Results 2020				
	Germination	**Vigor**	**Thousand Kernel Weights**	**Fungal Screen**
Redvers				
a. Certified AAC Brandon	98	97	39.3	Fus *gram.* 1% & Total *Fus.* 2.5%
b. Certified AAC Brandon	95	N/A	36.2	N/A
c. Certified AAC Elie	98	N/A	37.9	N/A
a. Farm-saved AAC Brandon	99	94	41.0	1% Fus *gram.* & 15% Alternaria
b. Farm-saved AAC Brandon	94	88	36.7	N/A
c. Farm-saved AAC Elie	93	91	35.5	N/A
Scott				
a. Certified AAC Brandon	96	93	36.0	0.5% Fus. *gram*. & 4.5% Total *Fus*.
b. Certified AAC Viewfield	99	97	40.7	3%Total *Fus.*
c. Certified CDC Plentiful	97	94	34.5	0.5% Fus. *gram.* & 1.5% Total *Fus.*
a. Farm-saved AAC Brandon	97	95	45.3	0.5% Fus. *gram.* & 2.5% Total *Fus.*
b. Farm-saved AAC Viewfield	97	96	42.5	1% Total *Fus.*
c. Farm-saved CDC Plentiful	94	93	42.4	2.5% Total *Fus.*
Swift Current				
a. Certified Transcend Durum	95	91	46.5	0
b. Certified AAC Spitfire Durum	99	94	42.6	4.5% Total *Fus.*
c. Certified CDC Fortitude Durum	99	91	41.2	*1%* Total *Fus.*
a. Farm-saved Transcend Durum	97	93	38.9	0.5% Coch. *sat.*
b. Farm-saved AAC Spitfire Durum	96	91	43.3	0.5% Fus. *gram.* & 2.5% Total *Fus.*
c. Farm-saved CDC Fortitude Durum	99	94	42.8	0
Yorkton				
a. Certified AAC Connery	99	94	42.2	0.5%. Fus *gram*. & 2.5% Total *Fus.*
b. Certified AAC Brandon	99	95	44.8	7.5% Total *Fus.* & 0.5% Coch. *sat.*
c. Certified AAC Brandon	97	94	39.6	0.5% Fus *gram.* & 6.5% Total *Fus.*
a. Farm-saved AAC Connery	96	88	43.4	8.5% Total *Fus.*
b. Farm-saved AAC Brandon	98	94	38.6	0
c. Farm-saved AAC Brandon	98	93	44.5	4.5% Total *Fus.*

Table 11. Discovery Seed Labs. Seed Quality Results 2021				
	Germination	**Vigor**	**Thousand Kernel Weights**	**Fungal Screen**
Indian Head				
a. Certified CS Accelerate	98	96	34.3	0.5% Fus. *gram.* & 6.5% Total Fus.
b. Certified AAC Viewfield	96	97	40.4	1% Total *Fus*.
c. Certified CDC Landmark VB	90	85	42.6	3% Total *Fus.*
a. Farm-saved CS Accelerate	99	94	33.4	2% Total *Fus.*
b. Farm-saved AAC Viewfield	96	95	34.0	1% Total *Fus.* & 0.5% Coch. *sat.*
c. Farm-saved CDC Landmark VB	86	86	43.7	1% Total *Fus.*
Melfort				
a. Certified AAC Cameron VB	95	96	43.2	2.5% Fus. *gram.* & 5.5% Total *Fus.*
b. Certified Cardale	91	94	36.0	2.5% Fus. *gram.*, 10.5% Total *Fus.* & 2.5% Coch. *sat.*
c. Certified Redberry	98	98	33.7	1.5% Fus. *gram.* & 3% Total *Fus.*
a. Farm-saved AAC Cameron VB	91	91	43.8	1.5 Fus. *gram.* & 10.5% Total *Fus*.
b. Farm-saved Cardale	86	78	35.7	3% Fus. *gram*., 12.5% Total *Fus.* & 0.5% Coch. *sat*.
c. Farm-saved Redberry	93	89	35.7	2% Fus. *gram.* & 4% Total *Fus.*
Outlook				
a. Certified AAC Viewfield	94	92	38.5	1% Total *Fus.*
b. Certified Cardale	95	95	36.0	1.5% Fus. *gram.*, 9% Total *Fus. &* 2% Coch. *sat.*
c. Certified AAC Brandon	99	98	38.7	2% Total *Fus*.
a. Farm-saved AAC Viewfield	96	95	35.4	1% Total *Fus*.
b. Farm-saved Cardale	97	93	28.0	0.5% Total *Fus*.
c. Farm-saved AAC Brandon	99	96	27.7	0%
Prince Albert				
a. Certified AAC Brandon	97	91	44.2	5% Total *Fus*.
b. Certified CDC Landmark	89	85	46.5	0.5% Total *Fus*.
c. Certified AAC Cameron VB	98	95	38.2	1.5% Total *Fus*.
a. Farm-saved AAC Brandon	88	79	41.8	0.5% Fus. *gram.* & 15.5% Total *Fus*.
b. Farm-saved CDC Landmark	90	89	34.6	0.5% Fus. *gram.* & 5.5% Total *Fus.*
c. Farm-saved AAC Cameron VB	97	97	43.1	0.5% Fus. *gram.* & 7.5% Total *Fus.*

Table 11 (Continued). Discovery Seed Labs. Seed Quality Results 2021				
	Germination	**Vigor**	**Thousand Kernel Weights**	**Fungal Screen**
Redvers				
a. Certified AAC Brandon	97	96	40.3	0% Total Fus.
b.Certified AAC Brandon	98	92	39.5	0.5% Fus *gram*. & 2.5% Total Fus.
c.Certified AAC Elie	96	95	34.2	3.5% Total Fus
a. Farm-saved AAC Brandon	99	92	36.5	3% Total *Fus.*
b. Farm-saved AAC Brandon	99	95	35.0	0.5 Fus. *gram.* & 4.5% Total Fus.
c. Farm-saved AAC Elie	97	90	34.0	2.5% Fus. *gram.* & 19% Total *Fus.*
Scott				
a. Certified AAC Brandon	99	96	44.9	2% Total Fus.
b. Certified AAC Viewfield	97	93	38.7	1% Fus. *gram.* & 4% Total *Fus.*
c. Certified CDC Plentiful	98	93	32.0	0%
a. Farm-saved AAC Brandon	94	85	39.4	4% Total *Fus.*
b. Farm-saved AAC Viewfield	95	87	36.0	1% Total *Fus*
c. Farm-saved CDC Plentiful	95	90	38.5	0%
Swift Current				
a. Certified AC Transcend	98	84	43.5	0%
b. Certified AAC Spitfire	98	92	47.1	0.5% Total *Fus.*
c. Certified CDC Fortitude	98	96	38.1	0.5% Total *Fus.*
a. Farm-saved AC Transcend	97	93	47.1	0%
b. Farm-saved AAC Spitfire	95	93	38.6	0%
c. Farm-saved CDC Fortitude	93	84	40.3	0.5% Total *Fus.*
Yorkton				
a. Certified AAC Viewfield	99	91	35.4	8% Total *Fus.*
b. Certified AAC Brandon	96	93	34.0	1% Fus *gram*., 6.5% Total *Fus.* & 1% Coch. *sat.*
c. Certified AAC Viewfield	79	80	39.4	1% Total *Fus.*
a. Farm-saved AAC Viewfield	99	96	35.1	6.5% Total *Fus.*
b. Farm-saved AAC Brandon	98	95	34.2	3% Total *Fus.* & 0.5% Coch. *sat.*
c. Farm-saved AAC Viewfield	99	98	35.7	1% Fus. *gram*. & 4.5% Total *Fus.*

Table 12. Seed Vigor and Levels of Seed-borne Fusarium for Certified and Farm-Saved Seed				
	2019	**2020**	**2021**	**Total/Average**
Certified Vigor (%)	93.1	93.7	92.4	93.1
FSS Vigor (%)	93.3	91.1	90.6	91.7
T-test significance	NS (p=0.87)	NS (p=0.096)	NS (p=0.29)	NS (p=0.13)
Certified Total Fusarium (%)	1.63	3.68	3.04	2.76
FSS Total Fusarium (%)	2.44	4.59	4.29	3.75
T-test significance	NS (p=0.36)	NS (p=0.54)	NS (p=0.32)	NS (p=0.16)

Table 13. Significance of seed treatment, variety, and type effects on wheat emergence at multiple locations in 2019.

	Emergence 2019							
	I.H.	**Melfort**	**Outlook**	**P.A.**	**Redvers**	**Scott**	**S.C.**	**Yorkton**
Effect	---------- p-values [z] ----------							
Seed Treatment (S)	NS	NS	NS	NS	0.014	NS	<0.001	NS
Variety (V)	NS	NS	0.013	NS	0.075	0.075	0.003	NS
S x V	NS	NS	NS	NS	0.016	NS	NS	NS
Type (T)	NS	NS	0.010	NS	0.01	<0.001	0.088	NS
S x T	NS	NS	NS	NS	NS	NS	NS	NS
V x T	0.028	NS	NS	NS	<0.001	<0.001	0.002	NS
S x V x T	NS	NS	NS	NS	0.063	NS	NS	NS

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

Table 14. Significance of seed treatment, variety, and type effects on wheat emergence at multiple locations in 2020.								
	Emergence 2020							
	I.H.	**Melfort**	**Outlook**	**P.A.**	**Redvers**	**Scott**	**S.C.**	**Yorkton**
Effect	---------- p-values [z] ----------							
Seed Treatment (S)	<0.001	NS	N/A	NS	NS	NS	NS	0.032
Variety (V)	0.001	NS	N/A	NS	NS	NS	0.003	0.001
S x V	0.026	NS	N/A	NS	NS	0.006	0.018	NS
Type (T)	<0.001	NS	N/A	NS	NS	NS	0.002	0.012
S x T	0.006	NS	N/A	NS	NS	0.0003	NS	NS
V x T	<0.001	NS	N/A	NS	NS	0.024	NS	0.001
S x V x T	NS	NS	N/A	NS	0.023	NS	NS	0.026

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

Table 15. Significance of seed treatment, variety, and type effects on wheat emergence at multiple locations in 2021.

	Emergence 2021							
	I.H.	**Melfort**	**Outlook**	**P.A.**	**Redvers**	**Scott**	**S.C.**	**Yorkton**
Effect	---------- p-values [z] ----------							
Seed Treatment (S)	<0.001	NS	NS	NS	NS	NS	NS	NS
Variety (V)	0.014	NS	NS	NS	NS	0.008	NS	NS
S x V	NS	NS	NS	NS	NS	NS	NS	NS
Type (T)	NS	NS	NS	NS	NS	0.005	NS	NS
S x T	NS	NS	NS	NS	NS	NS	NS	NS
V x T	NS	NS	NS	NS	NS	0.014	NS	NS
S x V x T	NS	NS	NS	NS	NS	NS	NS	NS

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

Table 16. Main effects of seed treatment, variety, and type of seed on wheat emergence at multiple locations in 2019.									
Main effect	**Emergence 2019**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Seed Treatment	---------- plants/m^2 ----------								
Untreated	358 a	177 a	212 a	78 a	243 a	232 a	165 b	277 a	218
Treated	352 a	184 a	196 a	85 a	225 b	226 a	217 a	276 a	220
LSD	NS	NS	NS	NS	14.4	NS	14.7	NS	--
Variety comparison									
A	360 a	173 a	219 a	84 a	242 a	222 a	192 ab	272 a	220
B	351 a	189 a	168 b	81 a	222 a	239 a	206 a	279 a	217
C	355 a	179 a	224 a	80 a	237 a	226 a	174 b	279 a	219
LSD	NS	NS	41.3	NS	NS	NS	18.5	NS	--
Type									
Farm-saved	349 a	179 a	225 a	90 a	243 a	241 a	185 a	272 a	223
Certified	361 a	181 a	182 b	73 a	224 b	217 b	197 a	281 a	215
LSD	NS	NS	32.8	NS	14.4	13.0	NS	NS	--

Table 17. Main effects of seed treatment, variety, and type of seed on wheat emergence at multiple locations in 2020.

Main effect	**Emergence 2020**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Seed Treatment	---------- plants/m^2 ----------								
Untreated	264 a	244 a	N/A	115 a	207 a	161 a	151 a	307 b	207
Treated	236 b	238 a	N/A	117 a	219 a	164 a	158 a	326 a	208
LSD	11	NS	N/A	NS	NS	NS	NS	18	--
Variety comparison									
A	257 a	253 a	N/A	108 a	214 a	162 a	162 a	304 b	208
B	236 b	231 a	N/A	122 a	210 a	165 a	161 a	305 b	204
C	257 a	239 a	N/A	118 a	208 a	160 a	140 b	341 a	209
LSD	13	NS	N/A	NS	NS	NS	14	22	--
Type									
Certified	277 a	241 a	N/A	121 a	218 a	161 a	145 b	306 b	210
Farm-saved	223 b	241 a	N/A	111 a	208 a	164 a	164 a	328 a	206
LSD	11	NS	N/A	NS	NS	NS	11	18	--

Table 18. Main effects of seed treatment, variety, and type of seed on wheat emergence at multiple locations in 2021.									
Main effect	**Emergence 2021**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Seed Treatment	---------- plants/m^2 ----------								
Untreated	357 b	214 a	290 a	202 a	212 a	210 a	152 a	188 a	228
Treated	394 a	208 a	302 a	197 a	225 a	210 a	154 a	179 a	234
LSD	21	NS	NS	NS	NS	NS	NS	NS	--
Variety comparison									
A	355 b	211 a	293 a	199 a	221 a	216 a	149 a	191 a	229
B	382 a	209 a	306 a	192 a	220 a	216 a	150 a	183 a	232
C	391 a	212 a	289 a	208 a	213 a	199 b	159 a	176 a	231
LSD	25	NS	NS	NS	NS	12	NS	NS	--
Type									
Certified	382 a	209 a	298 a	207 a	215 a	217 a	157 a	180 a	233
Farm-saved	370 a	212 a	294 a	192 a	221 a	203 b	149 a	187 a	229
LSD	NS	NS	NS	NS	NS	10	NS	NS	--

Table 19. Individual treatment means for seed treatment, variety, and type of seed on wheat emergence at multiple locations in 2019.									
Main effect	**Emergence 2019**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Main Effects	---------- plant/m^2 ----------								
1. Untreated A Certified	349 a	167 a	243 ab	75 a	250 abc	223 cd	174 cde	271 a	219
2. Untreated A Farm-saved Seed	379 a	179 a	218 abc	84 a	266 ab	227 cd	148 de	270 a	221
3. Untreated B Certified	369 a	167 a	203 abc	106 a	240 abcd	284 a	180 cd	288 a	230
4. Untreated B Farm-saved Seed	348 a	190 a	124 c	54 a	239 abcd	208 cd	170 cde	263 a	200
5. Untreated C Certified	338 a	185 a	273 a	85 a	276 a	209 cd	130 e	273 a	221
6. Untreated C Farm-saved Seed	368 a	172 a	212 abc	65 a	186 e	240 bc	186 bcd	298 a	216
7. Treated A Certified	354 a	172 a	211 abc	82 a	227 bcde	227 cd	233 ab	272 a	222
8. Treated A Farm-saved Seed	357 a	173 a	206 abc	94 a	225 bcde	212 cd	213 abc	273 a	219
9. Treated B Certified	348 a	198 a	212 abc	88 a	209 cde	274 ab	217 abc	278 a	228
10. Treated B Farm-saved Seed	338 a	200 a	134 b	75 a	202 de	191 d	258 a	286 a	211
11. Treated C Certified	335 a	184 a	211 abc	106 a	258 ab	229 cd	174 cde	250 a	218
12. Treated C Farm-saved Seed	380 a	175 a	200 abc	67 a	228 bcde	225 cd	208 bc	297 a	223
L.S.D	53	51	108	101	47	43	48	73	--

Table 20. Individual treatment means for seed treatment, variety, and type of seed on wheat emergence at multiple locations in 2020.

Main effect	**Emergence 2020**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Main Effects	---------- plant/m^2 ----------								
1. Untreated A Certified	277 bcd	261 a	N/A	127 a	186 b	157 bc	160 abc	252 d	203
2. Untreated A Farm-saved Seed	257 cdef	255 a	N/A	95 a	226 ab	155 c	179 a	331 ab	220
3. Untreated B Certified	321 a	228 a	N/A	123 a	207 ab	172 ab	147 abc	325 ab	218
4. Untreated B Farm-saved Seed	166 g	248 a	N/A	123 a	213 ab	164 bc	155 abc	265 cd	191
5. Untreated C Certified	298 ab	248 a	N/A	108 a	219 ab	163 bc	123 c	312 bc	210
6. Untreated C Farm-saved Seed	264 bcde	225 a	N/A	116 a	188 b	156 c	141 bc	359 ab	181
7. Treated A Certified	242 def	261 a	N/A	103 a	251 a	157 bc	150 abc	307 bcd	210
8. Treated A Farm-saved Seed	254 cdef	233 a	N/A	107 a	194 ab	181 a	159 abc	327 ab	208
9. Treated B Certified	286 abc	215 a	N/A	137 a	209 ab	163 bc	165 ab	315 abc	213
10. Treated B Farm-saved Seed	169 g	235 a	N/A	105 a	210 ab	163 bc	179 a	316 abc	197
11. Treated C Certified	240 ef	235 a	N/A	126 a	235 ab	155 c	126 c	323 abc	206
12. Treated C Farm-saved Seed	226 f	249 a	N/A	122 a	218 ab	165 bc	171 ab	372 a	218
L.S.D	35	53	N/A	46	58	15	37	58	--

Table 21. Individual treatment means for seed treatment, variety, and type of seed on wheat emergence at multiple locations in 2021.									
Main effect	**Emergence 2021**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Main Effects	---------- plant/m^2 ----------								
1. Untreated A Certified	354 bcd	223 a	293 a	239 a	215 a	230 a	153 a	203 a	239
2. Untreated A Farm-saved Seed	348 cd	208 a	272 a	177 a	208 a	212 ab	138 a	186 a	219
3. Untreated B Certified	366 bcd	213 a	316 a	189 a	224 a	231 a	151 a	179 a	234
4. Untreated B Farm-saved Seed	360 bcd	211 a	298 a	190 a	215 a	203 ab	135 a	188 a	225
5. Untreated C Certified	371 abcd	213 a	284 a	196 a	203 a	188 b	167 a	180 a	225
6. Untreated C Farm-saved Seed	343 d	216 a	277 a	222 a	205 a	199 ab	167 a	194 a	228
7. Treated A Certified	357 bcd	207 a	301 a	197 a	210 a	222 a	156 a	182 a	229
8. Treated A Farm-saved Seed	363 bcd	208 a	305 a	184 a	252 a	201 ab	148 a	193 a	232
9. Treated B Certified	411 abc	197 a	294 a	204 a	214 a	230 a	161 a	189 a	238
10. Treated B Farm-saved Seed	390 abcd	216 a	317 a	184 a	229 a	201 ab	154 a	175 a	233
11. Treated C Certified	433 a	201 a	300 a	218 a	225 a	205 ab	151 a	149 a	235
12. Treated C Farm-saved Seed	415 ab	217 a	296 a	198 a	218 a	205 ab	153 a	183 a	236
L.S.D	66	43	60	56	53	32	47	54	--

Table 22. Main effect means and significance of seed treatment and seed type and their interaction			
Main effect	**All 24 site-years combined**		
	Seedling Vigor (1-10)	**Yield (kg/ha)**	**Protein (%)**
Seed Treatment (S)			
Untreated	8.00 b	4066 a	13.90 a
Treated	8.20 a	4042 a	13.78 b
p-value	<0.001	NS	0.001
Seed Type (T)			
Certified	8.14 a	4070 a	13.83 a
Farm-saved	8.06 a	4037 a	13.85 a
p-value	NS (0.09)	NS	NS
(S by T)			
Untreated Certified	8.07 a	4070 a	13.89 a
Untreated Farm-saved	7.93 a	4062 a	13.91 a
Treated Certified	8.22 a	4072 a	13.77 a
Treated Farm-saved	8.18 a	4013 a	13.79 a
S by T interaction p-value	NS	NS	NS
Site-year (STYR) p-value	<0.001	<0.001	<0.001
S by STYR p-value	<0.001	0.0013	NS
T by STYR p-value	<0.001	NS	NS
S by T by STYR p-value	NS	NS	NS

Table 23. Significance of seed treatment, variety, and type effects on wheat vigor at multiple locations in 2019.

	Vigor 2019							
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**
Effect	---------- p-values [z] ----------							
Seeding Treatment (S)	NS	NS	NS	NS	NS	NS	<0.001	NS
Variety (V)	NS	NS	0.0011	NS	NS	NS	0.0065	NS
S x V	NS	NS	NS	NS	NS	NS	NS	NS
Type (T)	0.023	NS	NS	NS	NS	NS	NS	0.014
S x T	NS	NS	NS	NS	NS	NS	NS	NS
V x T	<0.001	NS	NS	NS	NS	NS	NS	NS
S x V x T	NS	NS	NS	NS	NS	NS	NS	NS

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

Table 24. Significance of seed treatment, variety, and type effects on wheat vigor at multiple locations in 2020.

	Vigor 2020							
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**
Effect	---------- p-values [z] ----------							
Seeding Treatment (S)	0.020751	0.023983	NS	NS	NS	0.004893	0.029177	NS
Variety (V)	<0.001	NS	NS	<0.001	NS	0.000206	0.032719	NS
S x V	NS	NS	NS	NS	NS	NS	NS	NS
Type (T)	<0.001	NS	NS	0.003084	NS	NS	NS	NS
S x T	NS	NS	NS	NS	0.056702	0.018861	NS	NS
V x T	<0.001	NS	NS	0.000162	NS	NS	NS	0.027832
S x V x T	NS	NS	NS	NS	0.017291	NS	NS	NS

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

Table 25. Significance of seed treatment, variety, and type effects on wheat vigor at multiple locations in 2021.

	Vigor 2021							
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**
Effect	---------- p-values [z] ----------							
Seeding Treatment (S)	NS	NS	NS	NS	NS	NS	<0.001	NS
Variety (V)	<0.001	NS	NS	NS	NS	NS	NS	NS
S x V	NS	NS	NS	NS	NS	NS	NS	NS
Type (T)	NS	NS	NS	NS	NS	NS	NS	NS
S x T	NS	NS	NS	NS	NS	NS	NS	NS
V x T	NS	NS	NS	NS	NS	NS	NS	NS
S x V x T	NS	NS	NS	NS	NS	NS	NS	NS

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

Table 26. Main effects of seed treatment, variety, and type of seed on wheat vigor at multiple locations in 2019.

Main effect	Vigor 2019								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Seed Treatment	---------- 1-10 ----------								
Untreated	8.4 a	7.9 a	9.1 a	6.3 a	NS	5.9 a	8.5 b	7.3 a	7.7
Treated	8.1 a	7.8 a	9.3 a	7.0 a	NS	6.0 a	9.5 a	7.5 a	7.9
LSD	NS	NS	NS	NS	NS	NS	0.52	NS	--
Variety comparison									
A	8.1 a	8.0 a	8.5 b	6.4 a	NS	6.2 a	9 a	7.3 a	7.7
B	8.4 a	7.7 a	9.6 a	6.9 a	NS	5.6 a	9.6 a	7.3 a	7.9
C	8.3 a	7.8 a	9.5 a	6.7 a	NS	5.9 a	8.5 b	7.6 a	7.8
LSD	NS	NS	0.64	NS	NS	NS	0.65	NS	--
Type									
Certified	8.0 a	7.9 a	9.3 a	6.6 a	NS	5.9 a	8.8 a	7.2 b	7.7
Farm Saved	8.5 a	7.8 a	9.2 a	6.7 a	NS	5.9 a	9.2 a	7.5 a	7.8
LSD	0.36	NS	NS	NS	NS	NS	NS	0.23	--

Table 27. Main effects of seed treatment, variety, and type of seed on wheat vigor at multiple locations in 2020.

Main effect	Vigor 2020								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Seed Treatment	---------- 1-10 ----------								
Untreated	8.1 a	7.3 b	9.6 a	7.7 a	9.0 a	7.0 b	9.5 a	8.0 a	8.3
Treated	7.7 b	8.1 a	9.8 a	7.6 a	9.0 a	7.5 a	9.8 a	8.1 a	8.5
LSD	0.4	0.7	NS	NS	NS	0.3	0.3	NS	--
Variety comparison									
A	8.4 a	7.4 a	9.6 a	7.0 c	9.0 a	6.8 b	9.8 a	8.1 a	8.3
B	7.2 b	7.9 a	9.9 a	8.2 a	8.9 a	7.2 b	9.8 a	7.9 a	8.4
C	8.1 a	7.7 a	9.8 a	7.7 b	9.1 a	7.7 a	9.4 b	8.1 a	8.5
LSD	0.5	NS	NS	0.4	NS	0.4	0.3	NS	--
Type									
Certified	8.7 a	7.9 a	9.8 a	7.9 a	9.1 a	7.3 a	9.6 a	8.0 a	8.5
Farm-saved	7.1 b	7.4 a	9.7 a	7.4 b	8.9 a	7.2 a	9.8 a	8.1 a	8.2
LSD	0.4	NS	NS	0.3	NS	NS	NS	NS	--

Table 28. Main effects of seed treatment, variety, and type of seed on wheat vigor at multiple locations in 2021.

Main effect	Vigor 2021								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Seed Treatment	---------- 1-10 ----------								
Untreated	7.3 a	9.7 a	9.0 a	6.5 a	5.0 a	10.0 a	8.6 b	6.8 a	7.9
Treated	7.6 a	9.8 a	9.0 a	6.6 a	5.2 a	10.0 a	9.8 a	6.9 a	8.1
LSD	NS	NS	NS	NS	NS	NS	0.6	NS	--
Variety comparison									
A	6.5	9.9 a	9.0 a	6.5 a	5.1 a	10.0 a	8.9 a	7.2 a	7.9
B	7.6	9.7 a	9.0 a	6.4 a	5.3 a	10.0 a	9.1 a	6.7 a	8.0
C	8.3	9.7 a	9.0 a	6.8 a	4.9 a	10.0 a	9.5 a	6.6 a	8.1
LSD		NS	NS	NS	NS	NS	NS	NS	--
Type									
Certified	7.6 a	9.6 a	9.0 a	6.5 a	5.0 a	10.0 a	9.3 a	7.0 a	8.0
Farm-saved	7.3 a	9.9 a	9.0 a	6.6 a	5.2 a	10.0 a	9.0 a	6.7 a	8.0
LSD	NS	NS	NS	NS	NS	NS	NS	NS	--

Table 29. Individual treatment means for seed treatment, variety, and type of seed on wheat vigor at multiple locations in 2019.									
Main effect	**Vigor 2019**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Main Effects	---------- (1-10) ----------								
1. Untreated A Certified	7.3 cd	7.8 a	8.5 a	5.5 a	Na	6.5 a	8.5 abc	6.9 c	7.3
2. Untreated A Farm-saved Seed	9.3 a	8.3 a	8.3 a	5.8 a	Na	6.3 a	8.5 abc	7.1 abc	7.7
3. Untreated B Certified	9.0 a	7.5 a	10.0 a	6.8 a	Na	5.8 a	9.3 ab	7.3 abc	8.0
4. Untreated B Farm-saved Seed	8.5 ab	7.8 a	9.3 a	6.9 a	Na	5.5 a	9.5 ab	7.4 abc	7.8
5. Untreated C Certified	8.3 abc	8.5 a	9.5 a	7.0 a	Na	5.5 a	7.3 c	7.3 abc	7.6
6. Untreated C Farm-saved Seed	8.3 abc	7.5 a	9.3 a	5.8 a	Na	5.8 a	8.3 bc	7.8 a	7.5
7. Treated A Certified	7.0 d	7.5 a	8.5 a	6.9 a	Na	5.8 a	9.5 ab	7.5 abc	7.5
8. Treated A Farm-saved Seed	8.8 ab	8.5 a	8.8 a	7.5 a	Na	6.3 a	9.5 ab	7.6 abc	8.1
9. Treated B Certified	8.3 abc	8.3 a	9.8 a	5.6 a	Na	5.5 a	9.5 ab	7.0 bc	7.7
10. Treated B Farm-saved Seed	7.8 bcd	7.3 a	9.5 a	8.4 a	Na	5.8 a	10.0 a	7.6 abc	8.1
11. Treated C Certified	8.5 ab	7.8 a	9.3 a	7.8 a	Na	6.5 a	9.0 ab	7.5 abc	8.1
12. Treated C Farm-saved Seed	8.3 abc	7.3 a	10.0 a	6.1 a	Na	6.0 a	9.5 ab	7.7 ab	7.8
L.S.D	1.2	2.1	1.7	4.2	Na	1.3	1.7	0.76	--

Table 30. Individual treatment means for seed treatment, variety, and type of seed on wheat vigor at multiple locations in 2020.									
Main effect	**Vigor 2020**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Main Effects	---------- (1-10) ----------								
1. Untreated A Certified	8.8 ab	7.3 ab	9.3 a	7.9 a	9.0 ab	6.8 bc	9.8 a	7.8 bc	8.3
2. Untreated A Farm-saved Seed	8.3 ab	6.8 ab	9.5 a	6.3 b	9.3 ab	6.3 c	10.0 a	8.5 a	8.1
3. Untreated B Certified	9.3 a	7.8 ab	9.8 a	8.1 a	9.3 ab	7.5 ab	9.5 ab	7.9 abc	8.7
4. Untreated B Farm-saved Seed	5.5 c	7.3 ab	10.0 a	8.3 a	8.5 b	6.8 bc	9.8 a	7.6 c	8.0
5. Untreated C Certified	9.0 ab	8.3 ab	9.8 a	7.9 a	9.5 ab	7.5 ab	8.8 b	8.0 abc	8.6
6. Untreated C Farm-saved Seed	8.0 ab	6.3 b	9.5 a	7.6 a	8.5 b	7.3 abc	9.5 ab	8.3 ab	8.1
7. Treated A Certified	8.3 ab	8.0 ab	9.8 a	7.6 a	9.0 ab	7.0 abc	9.8 a	8.0 abc	8.4
8. Treated A Farm-saved Seed	8.3 ab	7.8 ab	9.8 a	6.1 b	8.8 ab	7.3 abc	9.8 a	8.1 abc	8.3
9. Treated B Certified	9.0 ab	7.8 ab	10.0 a	8.0 a	9.0 ab	7.0 abc	10.0 a	8.1 abc	8.6
10. Treated B Farm-saved Seed	5.0 c	8.8 a	9.8 a	8.5 a	8.8 ab	7.5 ab	10.0 a	8.0 abc	8.3
11. Treated C Certified	7.8 b	8.5 ab	10.0 a	7.9 a	8.8 ab	8.0 a	9.8 a	8.0 abc	8.6
12. Treated C Farm-saved Seed	7.8 b	7.8 ab	9.8 a	7.5 a	9.8 a	8.0 a	9.8 a	8.1 abc	8.6
L.S.D	1.3	2.4	1.0	1.1	1.2	1.0	0.9	0.6	--

Table 31. Individual treatment means for seed treatment, variety, and type of seed on wheat vigor at multiple locations in 2021.									
Main effect	**Vigor 2021**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Main Effects	---------- (1-10) ----------								
1. Untreated A Certified	6.8 cde	9.8 a	9.0 a	7.0 a	4.5 a	10.0 a	9.0 ab	7.4 a	7.9
2. Untreated A Farm-saved Seed	6.5 de	10.0 a	9.0 a	6.3 a	5.5 a	10.0 a	7.8 b	6.8 a	7.7
3. Untreated B Certified	7.5 bcd	9.5 a	9.0 a	5.0 a	6.0 a	10.0 a	8.3 ab	6.6 a	7.7
4. Untreated B Farm-saved Seed	7.3 bcde	9.8 a	9.0 a	7.0 a	4.8 a	10.0 a	8.3 ab	6.4 a	7.8
5. Untreated C Certified	8.0 ab	9.5 a	9.0 a	6.5 a	4.5 a	10.0 a	9.3 ab	6.5 a	7.9
6. Untreated C Farm-saved Seed	8.0 ab	9.8 a	9.0 a	7.4 a	5.0 a	10.0 a	9.3 ab	6.9 a	8.2
7. Treated A Certified	6.5 de	9.8 a	9.0 a	7.0 a	4.8 a	10.0 a	10.0 a	7.5 a	8.1
8. Treated A Farm-saved Seed	6.3 e	10.0 a	9.0 a	5.6 a	5.5 a	10.0 a	9.0 ab	7.0 a	7.8
9. Treated B Certified	8.0 ab	9.8 a	9.0 a	7.0 a	5.0 a	10.0 a	10.0 a	7.3 a	8.3
10. Treated B Farm-saved Seed	7.8 abc	9.8 a	9.0 a	6.5 a	5.5 a	10.0 a	10.0 a	6.6 a	8.2
11. Treated C Certified	8.8 a	9.5 a	9.0 a	6.6 a	5.3 a	10.0 a	9.5 ab	6.6 a	8.2
12. Treated C Farm-saved Seed	8.3 ab	10.0 a	9.0 a	6.6 a	5.5 a	10.0 a	10.0 a	6.5 a	8.2
L.S.D	1.0	0.9	0	2.7	1.6	0	2	1.5	--

Table 32. Significance of seed treatment, variety, and type effects on wheat yield at multiple locations in 2019.

	Yield 2019							
	I.H.	**Melfort**	**Outlook**	**P.A**	**Redvers**	**Scott**	**S.C.**	**Yorkton**
Effect	---------- p-values [z] ----------							
Seeding Treatment (S)	NS	NS	NS	NS	NS	NS	NS	0.011
Variety (V)	Ns	NS	NS	NS	0.0074	<0.001	NS	NS
S x V	0.0029	NS	NS	NS	NS	NS	NS	NS
Type (T)	NS	NS	NS	NS	NS	NS	NS	NS
S x T	NS	NS	NS	NS	NS	NS	NS	NS
V x T	NS	NS	NS	NS	NS	0.0045	NS	NS
S x V x T	0.0064	NS	NS	NS	NS	NS	NS	NS

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

Table 33. Significance of seed treatment, variety, and type effects on wheat yield at multiple locations in 2020.

	Yield 2020							
	I.H.	**Melfort**	**Outlook**	**P.A**	**Redvers**	**Scott**	**S.C.**	**Yorkton**
Effect	---------- p-values [z] ----------							
Seeding Treatment (S)	0.015619	NS	NS	0.029177	NS	0.021772	<0.001	NS
Variety (V)	0.027832	NS	<0.001	NS	NS	<0.001	NS	NS
S x V	NS	NS	NS	NS	NS	NS	NS	NS
Type (T)	NS	NS	NS	NS	NS	NS	NS	NS
S x T	NS	NS	NS	NS	NS	NS	NS	NS
V x T	NS	NS	NS	NS	NS	NS	NS	NS
S x V x T	NS	NS	NS	NS	NS	NS	NS	NS

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

Table 34. Significance of seed treatment, variety, and type effects on wheat yield at multiple locations in 2021.

	Yield 2021							
	I.H.	**Melfort**	**Outlook**	**P.A**	**Redvers**	**Scott**	**S.C.**	**Yorkton**
Effect	---------- p-values [z] ----------							
Seeding Treatment (S)	0.014	NS	NS	NS	NS	NS	<0.001	NS
Variety (V)	<0.001	NS	<0.001	NS	NS	NS	<0.001	NS
S x V	NS	NS	NS	NS	NS	NS	NS	NS
Type (T)	NS	NS	0.086	NS	0.007	NS	NS	NS
S x T	NS	NS	0.052	NS	NS	NS	NS	NS
V x T	NS	NS	NS	NS	0.06	NS	NS	NS
S x V x T	NS	NS	NS	NS	NS	NS	NS	NS

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

Table 35. Main effects of seed treatment, variety, and type of seed on wheat yield at multiple locations in 2019.

Main effect	**Yield 2019**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Seed Treatment	---------- kg/ha @ 14.5% ----------								
Untreated	3951 a	5529 a	4286 a	3681 a	4393 a	4799 a	2139 a	6179 a	4370
Treated	3910 a	5412 a	4306 a	3912 a	4397 a	4788 a	2116 a	5982 b	4353
LSD	NS	NS	NS	NS	NS	NS	NS	152	--
Variety comparison									
A	3942 a	5571 a	4180 a	3841 a	4450 a	5098 a	2147 a	6119 a	4419
B	3889 a	5385 a	4430 a	3728 a	4503 a	4755 b	2187 a	5999 a	4360
C	3961 a	5455 a	4277 a	3821 a	4232 b	4527 c	2048 a	6124 a	4306
LSD	NS	NS	NS	NS	180	157	NS	NS	--
Type									
Certified	3922 a	5520 a	4344 a	3620 a	4419 a	4843 a	2131 a	6086 a	4361
Farm Saved	3939 a	5420 a	4247 a	3973 a	4371 b	4745 a	2124 a	6076 a	4362
LSD	NS	NS	NS	NS	NS	NS	NS	NS	--

Table 36. Main effects of seed treatment, variety, and type of seed on wheat yield at multiple locations in 2020.

Main effect	**Yield 2020**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Seed Treatment	---------- kg/ha @ 14.5% ----------								
Untreated	5331 a	3821 a	6052 a	4252 a	4703 a	5687 b	3823 b	2500 a	4521
Treated	5257 b	3912 a	6108 a	3747 b	4851 a	5775 a	3970 a	2522 a	4518
LSD	60	NS	NS	456	NS	74.6	126	NS	--
Variety comparison									
A	5345 a	3748 a	5933 b	4077 a	4787 a	5745 b	3933 a	2360 a	4491
B	5245 b	4036 a	5934 b	4012 a	4772 a	5926 a	3923 a	2582 a	4553
C	5292 ab	3816 a	6373 a	3909 a	4773 a	5523 c	3834 a	2590 a	4514
LSD	76	NS	196	NS	NS	93.9	NS	NS	--
Type									
Certified	5309 a	3960 a	6093 a	4003 a	4800 a	5763 a	3920 a	2512 a	4545
Farm-saved	5279 a	3773 a	6066 a	3996 a	4755 a	5699 a	3873 a	2510 a	4494
LSD	NS	NS	NS	NS	NS	NS	NS	NS	--

Table 37. Main effects of seed treatment, variety, and type of seed on wheat yield at multiple locations in 2021.									
Main effect	**Yield 2021**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Seed Treatment	---------- kg/ha @ 14.5% ----------								
Untreated	3614 b	3536 a	6579 a	4228 a	3124 a	1571 a	894 a	2903 a	3306
Treated	3670 a	3551 a	6460 a	4117 a	3132 a	1465 a	673 b	2977 a	3256
LSD	46	NS	NS	NS	NS	NS	92	NS	--
Variety comparison									
A	3781 a	3523 a	6789 a	4413 a	3094 a	1546 a	828 a	2870 a	3356
B	3798 a	3512 a	5894 b	4054 a	3157 a	1620 a	651 b	2996 a	3210
C	3348 b	3595 a	6876 a	4052 a	3134 a	1388 a	872 a	2954 a	3277
LSD	57	NS	487	Ns	NS	NS	116	NS	--
Type									
Certified	3640 a	3495 a	6686 a	4201 a	3180 a	1533 a	751 a	2964 a	3306
Farm-saved	3644 a	3592 a	6353 a	4145 a	3076 b	1504 a	816 a	2916 a	3256
LSD	NS	NS	NS	NS	74	NS	NS	NS	--

Table 38. Individual treatment means for seed treatment, variety, and type of seed on wheat yield at multiple locations in 2019.

Main effect	**Yield 2019**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Main Effects	---------- kg/ha @ 14.5% ----------								
1. Untreated A Certified	3979 ab	5571 a	4485 a	3584 a	4462 a	5253 a	2220 a	6113 ab	4458
2. Untreated A Farm-saved Seed	3855 b	5443 a	3864 a	3934 a	4407 a	5155 ab	2179 a	6147 ab	4373
3. Untreated B Certified	3864 b	5550 a	4164 a	3280 a	4627 a	4832 bc	2175 a	6202 ab	4337
4. Untreated B Farm-saved Seed	3839 b	5465 a	4593 ab	3912 a	4426 a	4558 cd	2261 a	6179 ab	4404
5. Untreated C Certified	3930 b	5681 a	4384 a	3666 a	4194 a	4378 d	1967 a	6156 ab	4295
6. Untreated C Farm-saved Seed	4240 a	5463 a	4225 a	3713 a	4242 a	4619 cd	2033 a	6279 a	4352
7. Treated A Certified	4023 ab	5627 a	4245 a	3689 a	4525 a	4950 abc	2087 a	6089 ab	4404
8. Treated A Farm-saved Seed	3911 b	5643 a	4128 a	4156 a	4408 a	5037 ab	2104 a	6127 ab	4439
9. Treated B Certified	3836 b	5229 a	4545 ab	3414 a	4463 a	5077 ab	2213 a	5878ab	4332
10. Treated B Farm-saved Seed	4018 ab	5295 a	4417 a	4306 a	4495 a	4555 cd	2100 a	5739 b	4366
11. Treated C Certified	3902 b	5466 a	4244 a	4089 a	4245 a	4569cd	2126 a	6075 ab	4340
12. Treated C Farm-saved Seed	3772 b	5210 a	4256 a	3818 a	4248 a	4544 cd	2066 a	5986 ab	4238
L.S.D	268	571	626	1283	471	410	344	501	---

Table 39. Individual treatment means for seed treatment, variety, and type of seed on wheat yield at multiple locations in 2020.

Main effect	**Yield 2020**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Main Effects	---------- kg/ha @ 14.5% ----------								
1. Untreated A Certified	5450 a	3887 a	5851 bc	4484 a	4778 a	5701 bcd	3897 ab	2434 a	4560
2. Untreated A Farm-saved Seed	5360 ab	3547 a	5832 c	4051 a	4582 a	5673 cd	3835 ab	2257 a	4392
3. Untreated B Certified	5335 ab	4122 a	5902 bc	4001 a	4796 a	5937 ab	3890 ab	2523 a	4563
4. Untreated B Farm-saved Seed	5254 ab	3509 a	5883 bc	4645 a	4792 a	5798 bc	3875 ab	2802 a	4570
5. Untreated C Certified	5303 ab	3920 a	6353 ab	4170 a	4676 a	5502 d	3625 b	2738 a	4536
6. Untreated C Farm-saved Seed	5285 ab	3941 a	6492 a	4163 a	4596 a	5513 d	3815 ab	2245 a	4506
7. Treated A Certified	5286 ab	3986 a	6159 abc	3956 a	4823 a	5805 bc	4173 a	2326 a	4564
8. Treated A Farm-saved Seed	5285 ab	3574 a	5889 bc	3817 a	4964 a	5802 bc	3828 ab	2425 a	4448
9. Treated B Certified	5223 b	4249 a	5945 bc	3565 a	4924 a	6106 a	4042 a	2481 a	4567
10. Treated B Farm-saved Seed	5168 b	4264 a	6007 abc	3838 a	4577 a	5862 abc	3885 ab	2525 a	4516
11. Treated C Certified	5258 ab	3596 a	6352 ab	3842 a	4801 a	5529 d	3897 ab	2569 a	4481
12. Treated C Farm-saved Seed	5323 ab	3806 a	6296 abc	3461 a	5018 a	5546 d	3998 ab	2809 a	4532
L.S.D	198	1072	513	1501	732	246	414	691	--

Table 40. Individual treatment means for seed treatment, variety, and type of seed on wheat yield at multiple locations in 2021.									
Main effect	**Yield 2021**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Main Effects	---------- kg/ha @ 14.5% ----------								
1. Untreated A Certified	3725 a	3228 a	6843 ab	4736 a	3195 a	1514 a	938 a	3019 a	3400
2. Untreated A Farm-saved Seed	3764 a	3714 a	6856 ab	4336 ab	3028 ab	1650 a	998 a	2865 a	3401
3. Untreated B Certified	3784 a	3350 a	5882 bc	3849 b	3214 a	1642 a	847 ab	2790 a	3170
4. Untreated B Farm-saved Seed	3752 a	3547 a	5947 abc	4119 ab	3117 ab	1687 a	718 abc	2958 a	3231
5. Untreated C Certified	3337 b	3853 a	6944b a	3945 ab	3108 ab	1502 a	870 ab	2920 a	3310
6. Untreated C Farm-saved Seed	3320 b	3526 a	7004 ab	4285 ab	3083 ab	1430 a	994 a	2864 a	3313
7. Treated A Certified	3860 a	3580 a	7170 a	4442 ab	3222 a	1537 a	610 bc	2961 a	3423
8. Treated A Farm-saved Seed	3774 a	3568 a	6287 abc	4136 ab	2930 b	1483 a	768 ab	2635 a	3198
9. Treated B Certified	3784 a	3488 a	6446 abc	4253 ab	3139 ab	1613 a	443 c	3060 a	3278
10. Treated B Farm-saved Seed	3872 a	3665 a	5300 c	3894 b	3159 ab	1539 a	595 bc	3177 a	3150
11. Treated C Certified	3351 b	3472 a	6831 ab	3980 ab	3202 a	1387 a	799 ab	3036 a	3257
12. Treated C Farm-saved Seed	3382 b	3531 a	6724 ab	3998 ab	3141 ab	1232 a	825 ab	2996 a	3229
L.S.D	148	691	1277	800	245	570	304	639	--

Table 41. Significance of seed treatment, variety, and type effects on wheat protein at multiple locations in 2019.

	Protein 2019							
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**
Effect	---------- p-values [z] ----------							
Seeding Treatment (S)	NS	NS	NS	NS	NS	NS	0.02	NS
Variety (V)	NS	NS	0.012	NS	NS	NS	NS	NS
S x V	NS	NS	NS	NS	NS	NS	NS	0.045
Type (T)	NS	NS	0.006	NS	NS	NS	NS	NS
S x T	NS	NS	NS	NS	NS	NS	NS	0.048
V x T	NS	NS	<0.001	NS	NS	0.007	NS	NS
S x V x T	NS	NS	NS	NS	NS	NS	NS	NS

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

Table 42. Significance of seed treatment, variety, and type effects on wheat protein at multiple locations in 2020.

	Protein 2020							
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**
Effect	---------- p-values [z] ----------							
Seeding Treatment (S)	NS	0.008	NS	NS	NS	NS	NS	NS
Variety (V)	<0.001	<0.001	<0.001	0.045	NS	<0.001	0.009	<0.001
S x V	NS	NS	NS	NS	NS	NS	NS	NS
Type (T)	<0.001	NS	NS	NS	NS	0.002	NS	NS
S x T	NS	NS	NS	NS	NS	NS	NS	NS
V x T	<0.001	0.054	NS	NS	NS	0.035	0.014	NS
S x V x T	NS	NS	NS	NS	0.049	NS	NS	NS

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

Table 43. Significance of seed treatment, variety, and type effects on wheat protein at multiple locations in 2021.

	Protein 2021							
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**
Effect	---------- p-values [z] ----------							
Seeding Treatment (S)	<0.001	NS	NS	NS	NS	NS	<0.001	NS
Variety (V)	<0.001	0.001	0.062	NS	NS	0.016	<0.001	0.057
S x V	NS	NS	NS	NS	NS	NS	NS	NS
Type (T)	NS	NS	NS	NS	NS	NS	NS	NS
S x T	NS	NS	NS	NS	NS	NS	NS	NS
V x T	NS	NS	NS	NS	NS	NS	NS	NS
S x V x T	NS	NS	NS	NS	NS	NS	NS	NS

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

Table 44. Main effects of seed treatment, variety, and type of seed on wheat protein at multiple locations in 2019.									
Main effect	**Protein 2019**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Seed Treatment	---------- % ----------								
Untreated	15.0 a	13.2 a	12.7 a	13.8 a	13.3 a	12.8 a	19.7 b	13.3 a	14.2
Treated	15.0 a	13.1 a	12.6 a	13.7 a	13.4 a	12.5 a	20.1 a	13.3 a	14.2
LSD	NS	NS	NS	NS	NS	NS	0.35	NS	---
Variety comparison									
A	15.0 a	13.2 a	12.9 a	13.7 a	13.3 a	12.7 a	19.9 a	13.3 a	14.3
B	15.0 a	13.2 a	12.3 c	13.5 a	13.5 a	12.5 a	19.7 a	13.4 a	14.1
C	15.0 a	13.2 a	12.7 b	14.0 a	13.3 a	12.7 a	20.0 a	13.2 a	14.3
LSD	NS	NS	0.4	NS	NS	NS	NS	NS	---
Type									
Certified	15.0 a	13.2 a	12.9 a	13.6 a	13.4 a	12.8 a	19.8 a	13.3 a	14.3
Farm Saved Seed	15.0 a	13.2 a	12.4 b	13.9 a	13.3 a	12.5 a	19.9 a	13.3 a	14.2
LSD	NS	NS	0.34	NS	NS	NS	NS	NS	---

Table 45. Main effects of seed treatment, variety, and type of seed on wheat protein at multiple locations in 2020.

Main effect	**Protein 2020**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Seed Treatment	---------- % ----------								
Untreated	12.2 a	12.8 a	12.7 a	12.0 a	12.8 a	12.2 a	10.4 a	17.3 a	12.8
Treated	12.2 a	12.4 b	12.7 a	11.6 a	12.5 a	12.1 a	10.4 a	17.3 a	12.7
LSD	NS	0.3	NS	NS	NS	NS	NS	NS	--
Variety comparison									
A	12.2 b	13.2 a	12.8 a	11.8 ab	12.7 a	12.5 a	10.3 b	17.8 a	12.9
B	12.5 a	12.5 b	12.9 a	12.3 a	12.8 a	12.0 b	10.0 b	17.1 b	12.8
C	11.7 c	12.1 b	12.3 b	11.4 b	12.5 a	11.9 b	11.1 a	17.2 b	12.5
LSD	0.1	0.4	0.3	0.8	NS	0.3	0.7	0.3	--
Type									
Certified	12.0 b	12.6 a	12.6 a	11.7 a	12.5 a	11.9 b	10.5 a	17.3 a	12.6
Farm-saved	12.3 a	12.6 a	12.8 a	12.0 a	12.8 a	12.3 a	10.4 a	17.4 a	12.8
LSD	0.1	NS	NS	NS	NS	0.3	NS	NS	--

Table 46. Main effects of seed treatment, variety, and type of seed on wheat protein at multiple locations in 2021.									
Main effect	**Protein 2021**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Seed Treatment	---------- % ----------								
Untreated	14.3 a	12.6 a	12.5 a	14.5 a	13.4 a	16.0 a	18.3 a	15.7 a	14.7
Treated	14.2 b	12.2 a	12.4 a	14.2 a	13.2 a	16.0 a	18.1 b	15.6 a	14.5
LSD	0.08	NS	NS	NS	NS	NS	0.14	NS	--
Variety comparison									
A	13.6 c	12.3 ab	12.0 a	14.5 a	13.4 a	16.3 a	18.5 a	15.8 a	14.6
B	14.3 b	13.0 a	12.6 a	14.3 a	13.1 a	15.9 b	18.0 c	15.7 a	14.6
C	14.9 a	11.9 b	12.7 a	14.2 a	13.4 a	15.9 b	18.2 b	15.4 a	14.6
LSD	0.1	0.8	NS	NS	NS	0.34	0.18	NS	--
Type									
Certified	14.3 a	12.5 a	12.5 a	14.4 a	13.3 a	16.0 a	18.2	15.7 a	14.6
Farm-saved	14.3 a	12.3 a	12.3 a	14.2 a	13.4 a	16.0 a	18.3	15.5 a	14.5
LSD	NS	NS	NS	NS	NS	NS	NS	NS	--

Table 47. Individual treatment means for seed treatment, variety, and type of seed on wheat protein at multiple locations in 2019.

Main effect	**Protein 2019**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Main Effects	---------- % ----------								
1. Untreated A Certified	15.2 a	13.1 a	12.6 a	13.4 a	13.1 a	12.9 a	19.6 a	13.6 a	14.19
2. Untreated A Farm-saved Seed	14.9 a	13.2 a	13.5 a	13.7 a	13.3 a	12.8 ab	19.8 a	13.5 a	14.34
3. Untreated B Certified	15.1 a	13.2 a	13.4 a	13.2 a	13.5 a	13.0 a	19.7 a	13.4 ab	14.31
4. Untreated B Farm-saved Seed	15.0 a	13.3 a	11.4 b	14.0 a	13.5 a	12.4 ab	19.4 a	13.4 ab	14.05
5. Untreated C Certified	15.1 a	13.4 a	12.6 a	14.0 a	13.5 a	12.6 ab	19.4 a	13.2 ab	14.23
6. Untreated C Farm-saved Seed	14.9 a	13.3 a	12.6 a	14.3 a	13.0 a	13.0 a	20.1 a	13.0 ab	14.28
7. Treated A Certified	15.0 a	13.2 a	12.6 a	13.7 a	13.5 a	12.3 ab	20.3 a	12.8 b	14.18
8. Treated A Farm-saved Seed	15.1 a	13.2 a	12.8 a	14.0 a	13.3 a	12.9 a	20.1 a	13.4 ab	14.35
9. Treated B Certified	14.9 a	13.1 a	13.0 a	13.5 a	13.4 a	13.1 a	19.8 a	13.5 a	14.29
10. Treated B Farm-saved Seed	15.0 a	13.2 a	11.3 b	13.5 a	13.7 a	11.7 b	19.9 a	13.4 ab	13.96
11. Treated C Certified	15.0 a	13.1 a	13.1 a	13.7 a	13.4 a	12.9 a	20.0 a	13.1 ab	14.29
12. Treated C Farm-saved Seed	15.0 a	12.8 a	12.7 a	13.8 a	13.3 a	12.4 ab	20.4 a	13.4 ab	14.23
L.S.D.	0.5	0.8	1.1	1.7	0.9	1.1	1.2	0.6	---

Table 48. Individual treatment means for seed treatment, variety, and type of seed on wheat protein at multiple locations in 2020.

Main effect	**Protein 2020**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Main Effects	---------- % ----------								
1. Untreated A Certified	12.2 b	13.7 a	12.6 abc	11.9 a	12.7 ab	12.6 ab	10.1 b	17.7 ab	12.9
2. Untreated A Farm-saved Seed	12.4 b	13.1 abc	12.9 ab	12.1 a	13.1 ab	12.7 a	10.8 ab	18.0 ab	13.1
3. Untreated B Certified	12.2 b	12.4 bcd	13.1 ab	12.3 a	13.0 ab	11.4 d	9.8 b	17.2 ab	12.7
4. Untreated B Farm-saved Seed	12.8 a	12.8 abcd	12.6 abc	12.9 a	12.2 ab	12.6 ab	9.7 b	16.8 ab	12.8
5. Untreated C Certified	11.8 cd	12.2 bcd	12.5 abc	11.6 a	12.7 ab	11.7 cd	12.3 a	17.1 a	12.7
6. Untreated C Farm-saved Seed	11.6 d	12.6 abcd	12.7 abc	11.6 a	13.2 ab	12.0 abcd	10.2 b	17.3 ab	12.7
7. Treated A Certified	12.1 bc	13.2 ab	12.9 ab	11.3 a	12.6 ab	12.3 abc	9.7 b	17.6 ab	12.7
8. Treated A Farm-saved Seed	12.3 b	12.7 abcd	13.0 ab	11.8 a	12.4 ab	12.4 abc	10.7 ab	17.9 ab	12.9
9. Treated B Certified	12.1 bc	12.3 bcd	12.8 abc	11.7 a	12.2 ab	11.7 cd	9.9 b	17.1 b	12.5
10. Treated B Farm-saved Seed	12.8 a	12.4 bcd	13.2 a	12.4 a	13.8 a	12.3 abc	10.5 ab	17.2 ab	13.1
11. Treated C Certified	11.8 cd	11.7 d	11.9 c	11.3 a	11.9 b	11.8 bcd	11.1 ab	17.2 a	12.3
12. Treated C Farm-saved Seed	11.8 cd	12.0 cd	12.2 bc	11.0 a	12.3 ab	12.2 abcd	10.8 ab	17.1 ab	12.4
L.S.D.	0.3	1.1	0.9	2.0	1.7	0.8	1.9	0.9	--

Table 49. Individual treatment means for seed treatment, variety, and type of seed on wheat protein at multiple locations in 2021.

Main effect	**Protein 2021**								
	Indian Head	**Melfort**	**Outlook**	**Prince Albert**	**Redvers**	**Scott**	**Swift Current**	**Yorkton**	**All Sites Average**
Main Effects	---------- % ----------								
1. Untreated A Certified	13.6 e	12.7 a	12.0 a	14.2 a	13.3 a	16.4 a	18.5 ab	15.8 ab	14.6
2. Untreated A Farm-saved Seed	13.6 e	12.7 a	12.5 a	14.5 a	13.5 a	16.3 a	18.7 a	15.5 ab	14.7
3. Untreated B Certified	14.5 bc	12.8 a	12.7 a	14.7 a	13.2 a	15.8 a	18.2 abc	16.0 ab	14.7
4. Untreated B Farm-saved Seed	14.4 cd	13.2 a	12.5 a	14.5 a	13.2 a	15.9 a	17.9 c	15.9 ab	14.7
5. Untreated C Certified	15.0 a	12.7 a	12.8 a	14.5 a	13.8 a	15.9 a	18.2 abc	15.4 ab	14.8
6. Untreated C Farm-saved Seed	15.0 a	11.4 a	12.7 a	14.6 a	13.7 a	15.8 a	18.4 abc	15.6 ab	14.7
7. Treated A Certified	13.5 e	12.0 a	12.3 a	14.6 a	13.2 a	16.2 a	18.3 abc	16.2 a	14.5
8. Treated A Farm-saved Seed	13.6 e	11.9 a	11.3 a	14.6 a	13.6 a	16.4 a	18.4 abc	15.7 ab	14.4
9. Treated B Certified	14.3 cd	12.9 a	12.8 a	14.4 a	13.0 a	16.0 a	18.0 bc	15.7 ab	14.6
10. Treated B Farm-saved Seed	14.1 d	13.2 a	12.7 a	13.6 a	13.2 a	15.9 a	18.0 bc	15.3 ab	14.5
11. Treated C Certified	14.8 ab	12.0 a	12.7 a	14.3 a	13.1 a	16.0 a	18.0 bc	15.4 ab	14.5
12. Treated C Farm-saved Seed	14.8 ab	11.4 a	12.5 a	13.6 a	13.1 a	15.8 a	18.2 abc	15.2 b	14.3
L.S.D.	0.3	2.0	1.7	1.6	0.8	0.9	0.5	0.9	--

Abstract

13. Abstract/Summary:

From 2019 to 2021, a study was conducted in Saskatchewan to compare the vigor and yield performance of various lots of farm-saved wheat seed relative to the same varieties of certified seed. A second objective was to determine if seed vigor and yield potential of any seed lot could be improved by using seed treatment. Trials were established at AgriARM locations near Yorkton, Redvers, Indian Head, Swift Current, Scott, Outlook, Prince Albert and Melfort. In each year, every site randomly selected 3 lots of farm saved seed (FSS), which local producers intended to plant. These seed lots were then matched against a certified seed lot of the same variety. Each of the 3 variety comparisons were evaluated with and without seed treatment making a total of 12 treatments at each site. The variety selected for each of the 3 pairings varied between locations and year. The vast majority of variety pairings used CWRS varieties of wheat. However, all 3 variety pairing at Swift Current were durum in each year and 1 variety pairing at Redvers in 2019 was also a durum. A CPRS variety was also used once at Indian Head. A seed lot of FSS or certified seed was never used more than once. After three years, the study has made 72 variety comparisons between certified and FSS (3 years by 8 sites by 2 seed treatments by 3 variety comparisons). On average, the FSS used in this study was 2.06 years removed from certified. The quality of all seed lots of farm-saved and certified seed was determined after seeding and was not used as criteria for seed selection. Overall, the quality of FFS and certified seed was comparable. When averaged over all seed lots used in the study, the vigor of certified seed was numerically higher at 93.1% compared to 91.7% for FSS. Levels of seed-borne fusarium were 2.76% for certified seed and 3.75% for FSS. Neither the differences in seed vigor or level of seed-borne fusarium were significantly different or of agronomic concern. Overall, seed treatment had little effect on yield for either FSS or certified seed. This was likely the result of low levels of seed-borne disease and good growing conditions after seeding. There was little difference in the performance between FSS and certified seed. Seedling vigor did not differ between FSS and certified seed for the vast majority of cases. Where differences in seedling vigor existed, the trend was inconsistent. On average, certified seed yielded 4070 kg/ha (60.6 bu/ac) with a grain protein of 13.83% and FSS yielded 4037 kg/ha (60.1 bu/ac) with a grain protein of 13.85%. These differences are neither large or statistically significant. Growing FSS was more economical in this study, because doing so incurred no yield or protein disadvantage, and certified seed is typically more expensive. However, certified seed has value as it is “true to type” which is of growing importance to the end user. Purchasing certified seed introduces improved genetics to the farm and supports a breeding system that keeps Canadian wheat producers globally competitive. This study does not discount the importance of certified seed.

However, the popular approach of many farmers to grow farm saved seed for a couple of years between purchases of new certified seed appears economically sound.