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Irrigation Crop Diversification Corporation

Research and Demonstration Report



Research and Demonstration Program Report 2018

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ICDC Research and Demonstration Report 2018

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This report is published annually. Copies of this report can be found on our website. If you would like to be added to our mailing list, please contact us:

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VISION

To be the leading research and development organization for maximizing the value of irrigation.

OBJECTIVES AND PURPOSES OF ICDC

- a) to research and demonstrate to producers and irrigation districts profitable agronomic practices for irrigated crops;
- b) to develop or assist in developing varieties of crops suitable for irrigated conditions;
- c) to provide land, facilities and technical support to researchers to conduct research into irrigation technology, cropping systems and soil and water conservation measures under irrigation and to provide information respecting that research to district consumers, irrigation districts and the public;
- d) to co-operate with the Ministry in promoting and developing sustainable irrigation in Saskatchewan.

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BOARD OF DIRECTORS

Director	Position	Irrigation District	Development Area Represented	Term Expiry (current term)
Anthony Eliason	Chairman	Individual Irrigator	Non-District	2021 (2 nd)
Nigel Oram	Vice Chairman	Grainland	NDA	2019 (1 st)
Murray Purcell	Director	Moonlake	NDA	2020 (1 st)
David Bagshaw	Director	Riverhurst	SEDA	2019 ¹
Paul Heglund	Director	Consul-Nashlyn	SWDA	2020 (2 nd)
Kaitlyn Gifford	Director	LDDA	SSRID	2020 (1 st)
Greg Oldhaver	Director	Miry Creek	SWDA	2019 ²
Larry Lee	Director	SSRID	SIPA representative	Appointed
Aaron Gray	Director	Miry Creek	SIPA representative	Appointed
Kelly Farden	Director	N/A	SA representative	Appointed
Penny McCall	Director	N/A	SA representative	Appointed

¹ Pursuant to Bylaw 7, David Bagshaw was appointed to a one year term

² Pursuant to Bylaw 7, Greg Oldhaver was appointed to a one year term

The four Development Areas (DA), as defined in ICDC's bylaws, are:

Northern (NDA),
 South Western (SWDA),
 South Eastern (SEDA), and
 Lake Diefenbaker (LDDA).

ICDC Directors are elected by District Delegates who attend the annual meeting. Each Irrigation District is entitled to send one Delegate per 5,000 irrigated acres or part thereof to the annual meeting. Two Directors are elected from LDDA, two from SWDA and one each from NDA and SEDA. Non-district irrigators elect one representative.

The Saskatchewan Irrigation Projects Association (SIPA) and the Saskatchewan Ministry of Agriculture (SA) appoint two directors each to the ICDC board.

In accordance with the *Irrigation Act, 1996*, the majority of the ICDC board must be comprised of irrigators.

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FIELD CROP VARIETY TRIALS 2018

Irrigated Field Pea Regional Variety Trial

Funding

This project was funded by the Irrigation Crop Diversification Corporation and the Saskatchewan Variety Performance Group.

Principal Investigator

- Garry Hnatowich, PAg, Research Director, ICDC (Project Lead)

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Saskatchewan Variety Performance Group
- Saskatchewan Advisory Council on Grain Crops

Objectives

The objectives of this study were to:

- (1) Evaluate experimental pea lines pursuant to registration requirements;
- (2) Assess entries for suitability to irrigated production; and
- (3) Update ICDC's annual *Crop Varieties for Irrigation* guide.

Research Plan

Pea Regional variety trials were conducted at two locations in the Outlook irrigation area. Each site and soil type are as follows:

CSIDC Off-station: Elstow loam (Pederson)

Pea varieties were tested for their agronomic performance under irrigation. The CSIDC Off-station site was seeded on May 14. Plot size was 1.5 m x 4 m. All plots received 35 kg P₂O₅/ha as 12-51-0 as a side banded application and Nodulator granular inoculant at a rate of 3.7 kg/ha as a seed place application during the seeding operation. Weed control consisted of a spring pre-plant soil incorporated application of granular Edge (ethalfluralin) and a post-emergence application tank mix of Viper ADV (imazamox + bentazon) at 0.4 L/ac with 0.81 L UAN/ac (28-0-0). Supplemental hand weeding was conducted as required. The trial was arranged in a randomized complete block design with three replicates. The trial was desiccated with 0.81 L/ac of Reglone Ion (diquat) on August 13, 2018. The trial was direct harvested with a small plot combine August 17, 2018.

Thirty-six pea varieties representing seven market classes were evaluated in 2018. Seventeen registered varieties were Yellow pea market class, eleven registered and one unregistered were Green market class, two registered Red cotyledon entries, two registered Maple varieties, two registered varieties in the Maple market class, one registered Dun market class variety, one registered Forage market class variety and one unregistered entry in an exploratory class CDC has designated as wrinkled.

Results

Varieties included in the trial were as follows;

Yellow Market Class – CDC Amarillo, Agaaaiz, AAC Ardill, AAC Asher, AAC Carver, AAC Chrome, AAC Lacombe, AAC Profit, CDC Athabaska, CDC Canary, CDC Golden, CDC Inca, CDC Lewochko, CDC Meadow, CDC Saffron, CDC Spectrum and Hyline.

Green Market Class – AAC Comfort, Blueman, CDC Forrest, CDC Greenwater, CDC Limerick, CDC Patrick, CDC Pluto, CDC Raezer, CDC Striker, CDC Spruce, CDC Tetris, CDC 4639-8.

Red Market Class – Redbat 8, Redbat 88

Maple Market Class – AAC Liscard, CDC Blazer

Dun Market Class – CDC Dakota

Forage Market Class – CDC Jasper

Wrinkled Market Class – CDC 4140-4

Table 1. Irrigated Pea Regional Variety Trial, CSIDC Site, 2016.

Variety	Yield (kg/ha)	Protein (%)	Test weight (kg/hl)	1 K Seed weight (mg)	10% Flower (days)	Maturity (days)	Height (cm)	Lodge rating (1=erect; 10=flat)
Yellow								
CDC Amarillo	3915	21.1	84.1	243	47	82	63	1
Agassiz	4134	22.3	80.8	259	44	81	64	1
AAC Ardill	4590	19.5	82.0	219	48	80	60	1
AAC Asher	5870	24.3	81.7	315	47	85	52	1
AAC Carver	4008	19.8	82.0	238	45	82	61	1
AAC Chrome	5725	22.8	81.9	283	47	86	60	1
AAC Lacombe	4396	20.9	84.0	275	48	81	59	1
AAC Profit	5058	23.3	80.8	262	47	82	62	1
CDC Athabaska	4376	23.2	79.1	325	46	80	57	1
CDC Canary	4807	22.2	83.6	243	45	79	63	1
CDC Golden	3014	21.8	82.1	193	45	81	55	1
CDC Inca	4053	22.8	82.2	231	49	84	71	1
CDC Lewochko	5659	24.5	81.4	247	49	84	77	1
CDC Meadow	4867	22.0	83.0	231	45	80	58	1
CDC Saffron	3798	21.8	80.2	237	47	78	49	1
CDC Specrum	3502	21.5	81.0	235	47	80	51	1
Hyline	4709	21.1	81.1	272	47	82	53	1.3
Green								
AAC Comfort	4003	24.2	78.6	287	50	88	62	1
Blueman	3866	25.4	80.2	243	49	86	60	1
CDC Forrest	4524	19.3	81.3	259	48	82	58	1
CDC Greenwater	3653	20.3	81.9	232	47	81	56	1
CDC Limerick	3549	24.2	81.0	220	46	82	58	1
CDC Patrick	4715	22.4	81.0	202	47	84	65	1
CDC Pluto	4154	19.7	82.4	160	43	77	47	1

CDC Raezer	4474	23.0	80.2	246	45	81	69	1
CDC Striker	3657	23.5	81.1	259	46	81	50	1
CDC Spruce	4647	23.5	81.2	281	48	85	68	1
CDC Tetris	4823	24.5	80.8	250	53	86	72	1
CDC 4639-8	4747	22.3	82.4	263	48	82	64	1
Red								
Redbat 8	5223	24.7	80.6	232	46	85	60	1
Redbat 88	4140	21.6	81.8	231	49	82	59	1
Maple								
AAC Liscard	3647	22.5	80.8	220	53	81	57	1
CDC Blazer	3346	25.2	80.9	182	46	81	62	1.3
Dun								
CDC Dakota	4059	24.0	81.6	238	50	80	59	1
Forage								
CDC Jasper	4132	22.7	82.3	211	45	82	64	1
Wrinkled								
CDC 4140-4	2324	21.3	76.2	187	46	81	53	1
LSD (0.05)	1542	2.4	2.6	35.2	1.0	3.8	10.9	0.2
CV (%)	22.1	6.6	2.0	8.9	1.3	2.9	11.2	13.2

Upon statistical analysis this trials yield indicated a coefficient of variation such that the yield results are deemed unreliable. No further discussion of these results will be included, data is presented for record maintenance only.

Irrigated Canola Performance Trial

Funding

This project was funded by the Canola Council of Canada.

Principal Investigator

- Garry Hnatowich, PAg, Research Director, ICDC (Project Lead)

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Canola Council of Canada

Objectives

The objectives of this study were to:

- (1) Evaluate experimental lines and registered canola hybrids for regional performance;
- (2) Assess entries for suitability to irrigated production; and
- (3) Update ICDC's annual *Crop Varieties for Irrigation* guide.

Research Plan

The irrigated canola performance trial was conducted on rented land owned by R. Pederson and located approximately 16 km from CSIDC. Canola varieties were tested for their agronomic performance under irrigation. Five Clearfield, three Liberty and nineteen Roundup tolerant canola hybrids were evaluated in 2018. The trial was seeded on May 14. Plot size was 1.5 m x 6.0 m, varieties were blocked into their respective herbicide tolerance grouping for purpose of comparison and appropriate post emergent herbicide applications. The seed was treated with Helix Xtra (thiamethoxam, difenoconazole, metalaxyl & fludioxonil) for seed borne disease and early season flea beetle control. The trial was established on potato stubble and soil testing indicated available residual N levels of 122 kg N in the top 60 cm. Supplemental nitrogen fertilizer was applied at 60 kg N/ha as 46-0-0 and phosphorus at 35 kg P₂O₅/ha as 12-51-0 side-banded at the time of seeding. Weed control consisted of post emergent applications of the appropriate herbicide per herbicide tolerant entries. Clearfield entries received an application of Odyssey (imazamox + imazethapyr) tank mixed with Equinox (tepraloxym) and Merge adjuvant. Liberty Link entries received an application of Liberty 150SN (glufosinate ammonium) tank mixed with Centurion (clethodim) and Merge adjuvant. Roundup Ready entries received an application of Round Up Transorb (glyphosate). All herbicide applications occurred on June 14. All plots received a fungicidal application of Headline EC at 240 ml/ac on July 11. Plots were mechanically separated on August 13 and varieties swathed when exhibiting > 60% seed colour change. All plots were mechanically harvested with a small plot Wintersteiger combine on September 4.

Results

Results are outlined in Table 1. Median grain yield of all twenty-seven varieties was 4041 kg/ha (72.1 bu/ac). The Liberty tolerant variety L252 was statistically higher yielding than all other varieties with yields less than 4300 kg/ha. Median oil content was 50.9%, test weight 62.8 kg/hl and 1000 seed weight (TKW) 4.8 grams. Plant heights ranged from 97 to 127 cm. Little difference occurred between varieties with respect to days to 1st flower with a 3 days difference between the first and last variety to flower, this difference was however statistically significant. Maximum difference in maturity between the earliest and latest maturing hybrids was 5 days.

The results from this trial will be used to update the irrigation variety database at ICDC and provide information to irrigators on the best canola varieties suited to irrigation production practices.

Table 1. Yield and agronomic data for the 2017 Irrigated Canola Performance Trial.

Variety	Type	Yield (kg/ha)	Oil (%)	Test Weight (kg/hl)	TKW (gm/1000 seed)	Height (cm)	First Flower (days)	Maturity (days)	Lodge rating (1=erect; 5=flat)
Clearfield-tolerant									
5545 CL	HYB	4156	50.0	63.7	74.2	110	43	87	1.8
46H75	HYB	3806	51.0	61.4	67.9	110	44	87	1.3
CS 2500 CL	HYB	3759	51.5	63.2	67.1	106	44	88	1.5
DL1745 CL	HYB	3723	50.5	62.2	66.4	116	44	88	1.8
PV 200 CL	HYB	3899	49.9	63.1	69.6	112	45	86	2.5
Liberty-tolerant									
L230	HYB	4061	50.9	63.5	72.4	104	42	87	2.0
L241C	HYB	4365	48.3	62.7	77.9	105	44	89	1.5
L252	HYB	4834	52.3	62.4	86.2	104	44	90	2.0
Roundup-tolerant									
540 G	HYB	3839	50.1	61.4	68.5	103	44	88	2.0
581 GC	HYB	3857	50.4	62.1	68.8	106	44	88	2.3
6074 RR	HYB	4399	50.4	63.4	78.5	103	43	89	2.0
6076 RR	HYB	3709	48.3	63.3	66.2	120	45	90	1.5
6090 RR	HYB	4276	49.7	63.3	76.3	127	45	90	2.3
CS2000	HYB	3941	49.5	62.9	70.3	108	44	87	2.8
CS2100	HYB	3709	51.3	64.1	66.2	104	44	89	1.8
CS2300	HYB	4331	50.8	62.7	77.3	110	44	88	1.5
D3155C	HYB	4023	51.0	62.1	71.8	109	44	87	3.0
DL 1634 RR	HYB	4220	50.2	62.1	75.3	114	45	90	1.3
V12-3	HYB	4080	51.6	62.3	72.8	104	44	86	2.5
V14-1	HYB	4085	52.3	63.1	72.9	117	45	89	1.0
16RH5088	HYB	3991	50.5	63.2	71.2	117	45	89	1.0
45CS40	HYB	3936	47.8	62.1	70.2	105	44	88	1.8
45H33	HYB	3841	50.4	61.1	68.5	106	43	86	2.5
45M35	HYB	4556	52.4	62.9	81.3	101	44	86	2.3
74-44 BL	HYB	4086	52.3	63.6	72.9	100	43	88	2.3
75-42 CR	HYB	3743	51.3	63.0	66.8	100	44	86	2.0
75-65 RR	HYB	3733	50.3	63.0	66.6	97	43	85	2.0
LSD (0.05)		519	1.7	1.0	9.3	9.0	0.9	2.99	0.7
CV (%)		9.1	2.4	1.2	10.9	5.9	1.4	2.4	27.5

HYB = Hybrid

NS = Not Significant

NC = Observation Not Captured

Irrigated Canola Variety Trial

Funding

This project was funded by the Agriculture Development Fund, Western Grains Research Foundation and the Irrigation Crop Diversification Corporation.

Principal Investigator

- Garry Hnatowich, PAg, Research Director, ICDC (Project Lead)

Organizations

- Irrigation Crop Diversification Corporation (ICDC)

Objectives

The objectives of this study were to:

- (1) Evaluate registered canola hybrids for which ICDC has limited data;
- (2) Assess entries for suitability to irrigated production; and
- (3) Update ICDC's annual *Crop Varieties for Irrigation* guide.

Every year ICDC conducts the Irrigated Canola Variety Trial. Selection of canola varieties is based upon results obtained prior seasons through canola coop trials conducted by ICDC for the Canola Council of Canada. Once varieties are commercially available companies are invited to provide seed of those varieties that prior observations have shown to be agronomically suitable for irrigation production. Companies approached for seed are also invited to provide an additional variety (registered or experimental) of their choosing for inclusion. Results from these trials are used to update the irrigation variety database at CSIDC and provide recommendations to irrigators on the best canola varieties suited to irrigation conditions and will be used in the development of the annual publications "*Crop Varieties for Irrigation*."

Research Plan

Two irrigated canola variety trials were conducted at two locations in the Outlook irrigation area. Each site and soil type are as follows:

ICDC Knapik Site (NW12-29-08-W3): Asquith sandy loam (SE quadrant)

ICDC Pederson Site (NE17-28-07-W3): Elstow loam (NW quadrant)

A total of fifteen canola varieties were tested for their agronomic performance under irrigation. Varietal selection was based upon prior variety agronomic performance and solicitation of seed companies for entries they deemed suitable to intensive irrigation production practices. Seeding dates for the sites were: ICDC Pederson May 25, ICDC Knapik May 18. Plot size was 1.5 m x 4.0 m, all plots were seeded on 25 cm row spacings. All seed was treated by the seed suppliers for seed borne disease and early season flea beetle control. At Pederson supplemental fertilizer was applied at an application rate of 60 kg N/ha as 46-0-0 and supplemental phosphorus at 35 kg P₂O₅/ha as 12-51-0, all fertilizer was side banded. At Knapik supplemental fertilizer was applied at an application rate of 110 kg N/ha as 46-0-0 and supplemental phosphorus at 35 kg P₂O₅/ha as 12-51-0, all fertilizer was side banded. Weed control consisted of a pre-plant soil incorporated application of granular Edge (ethalfluralin) and a post-emergent tank-mix application of Muster Toss-N-Go (ethametsulfuron-methyl) and Poast Ultra (sethoxydim) and supplemented by periodic hand weeding. Both trials received a foliar application of

Headline EC (pyraclostrobin) fungicide at 50% bloom. Both trials were separated on August 20, swathed August 30 and after proper dry down Knapik was harvested September 10, the Pederson trial could not be harvested, due to weather, until October 5. Total in-season rainfall at CSIDC (closest weather station) from May through August was 86.0 mm. Total in-season irrigation at Knapik was 197 mm (7.75"), at Pederson 140 mm (5.5").

Results

Results obtained at the Knapik location are shown in Table 1, those of the Pederson site in Table 2, and combined site analyses in Table 3.

Canola varieties in the Knapik trial (Table 1) were not statistically significantly different from each other. Median yield of varieties was 6097 kg/ha (108.8 bu/ac). Disease and insects were not an issue in 2018.

Percent oil content ranged from 46.4% (PV 200 CL) to 50.1% (L255PC). Median oil content of all varieties was 47.4%. Median test weight was 62.1 kg/hl and thousand seed weight 5.3 gm. All entries flowered within a 2 day period from one another. Any variety with days to maturity greater than 94 days was statistically later maturing than the control. Median days to mature for canola hybrids was 95 days, which is earlier maturing than most irrigated seasons and likely a reflection of the dry, warm season. Plant heights varied from the shortest with plant height of 116 cm (L255PC) to the tallest height of 134 cm (5400), plants did not achieve the height normally expected for irrigated canola. Hybrids did differ statistically in lodging at this location, any hybrid with a lodging rating exceeding 1.5 differed statistically from the control 5440. However even the highest lodging score of 2.75 (45H33) would not cause serious harvest issues.

At the Pederson location (Table 2) varieties did differ statistically from one another. CS2300 obtained the highest yield, CS2500CL the lowest. However, only CS2500 CL differed statistically from the check variety, 5440. Median yield of varieties was 4517 kg/ha (80.6 bu/ac).

Percent oil content ranged from 47.3% (5440) to 51.7% (45M35). Median oil content of all varieties was 49.6%. Median test weight was 63.1 kg/hl and thousand seed weight 4.9 gm. Median days to 10% flower was 41 days. L2339 and 45M35 were the earliest to flower, 6090 RR the latest. Any hybrids that flowered prior to 41 days, or later than 42 days were statistically different than the check 5440. Median days to maturity was very early at 85 days, hybrid 45M35 was the earliest to mature, 6076 CR the latest. Only hybrids with a height of 122 cm, or greater, were statistically taller than the control. No hybrids were statistically shorter in height from the control. Any hybrids with a lodging rating of 2.0, or higher, differed statistically from the control. As was the case at the Knapik location the degree of lodging evident at Pederson would not be deemed problematic.

Comparison between the two site location trials (Table 3) found that the Knapik trial had yields, seed weights and maturity significantly higher than the Pederson trial.

Results from these trials are used to update the irrigation variety database at ICDC and provide recommendations to irrigators on the best canola varieties suited to irrigation conditions and will be used in the development of the annual publications *"Crop Varieties for Irrigation."*

Table 1. Yield and agronomic data for the 2018 ICDC Knapik Irrigated Canola Variety Trial.

Entry	Yield (kg/ha)	Oil (%)	Test Weight (kg/hl)	TKW (gm/1000 seed)	Height (cm)	First Flower (days)	Maturity (days)	Lodge rating (1=erect ; 5=flat)
5440	5286	46.9	63.6	5.4	134	41	93	1.0
L233P	5767	47.5	62.5	5.3	118	40	94	1.8
L241C	5708	46.7	62.9	5.4	123	41	93	1.5
L255PC	6752	50.1	64.2	5.7	116	42	95	1.0
45H33	5202	47.7	61.0	5.3	119	40	93	2.8
45M35	5874	49.5	64.0	5.6	119	40	92	2.3
CS2300	5752	48.6	62.8	5.5	124	41	96	1.3
CS2500 CL	5207	47.3	65.0	5.9	122	41	95	2.0
4187 RR	5891	48.2	63.9	5.7	125	42	96	1.5
5545 CL	5189	47.0	64.4	5.8	121	40	95	2.3
6076 CR	5707	47.4	62.5	5.3	125	41	95	2.3
6090 RR	5926	47.6	63.1	5.3	128	42	96	2.0
PV 200 CL	4904	46.4	62.5	5.3	123	42	94	2.3
PV 540 G	5318	47.2	61.3	5.4	119	41	94	2.3
PV 581 GC	5718	48.3	60.2	5.2	124	41	94	2.0
LSD (0.05)	NS	1.2	0.7	0.2	NS	0.8	1.2	0.7
CV (%)	13.4	1.7	0.8	2.8	6.4	1.4	0.9	26.5

NS = Not Significant

Table 2. Yield and agronomic data for the 2018 ICDC Pederson Irrigated Canola Variety Trial.

Entry	Yield (kg/ha)	Oil (%)	Test Weight (kg/hl)	TKW (gm/1000 seed)	Height (cm)	First Flower (days)	Maturity (days)	Lodge rating (1=erect ; 5=flat)
5440	4256	47.3	64.0	4.7	114	41	86	1.3
L233P	4686	48.0	62.7	4.7	110	39	83	2.3
L241C	4519	48.0	62.8	4.8	116	41	84	1.5
L255PC	4544	51.3	64.1	5.1	112	41	87	1.0
45H33	4529	48.6	61.3	4.7	122	41	84	2.0
45M35	4630	51.7	63.1	4.9	116	39	81	2.3
CS2300	4824	49.6	63.4	4.8	121	42	86	1.0
CS2500 CL	3582	49.4	64.4	5.3	120	42	86	1.5
4187 RR	4820	50.6	63.4	4.8	123	42	88	1.0
5545 CL	4270	48.4	64.2	5.0	119	40	87	1.5
6076 CR	4212	48.4	63.1	4.9	120	42	89	1.3
6090 RR	4817	49.1	63.4	4.8	128	43	88	1.3
PV 200 CL	4268	49.2	62.9	4.6	119	42	84	2.0
PV 540 G	4489	49.0	60.9	4.8	111	41	83	2.0
PV 581 GC	4459	49.9	61.1	4.8	124	42	84	2.0
LSD (0.05)	571	1.3	0.6	0.3	7.7	0.8	1.9	0.6
CV (%)	9.0	1.9	0.6	4.5	4.6	1.3	1.6	28.3

Table 3. Yield and agronomic data for the 2018 ICDC Irrigated Canola Variety Trial, Combined Site Analysis, 2018.

Location / Entry	Yield (kg/ha)	Oil (%)	Test Weight (kg/hl)	TKW (gm/1000 seed)	Height (cm)	First Flower (days)	Maturity (days)	Lodge rating (1=erect; 5=flat)
Trial Site								
Knapik	5401	47.7	62.9	5.5	123	41	94	1.9
Pederson	4460	49.2	63.0	4.8	118	41	85	1.6
LSD (0.05)	746	NS	NS	0.04	NS	NS	1.7	NS
CV (%)	14.5	1.8	0.7	3.7	5.6	1.3	1.3	27.4
Variety								
5440	4771	47.1	63.8	5.1	124	41	89	1.1
L233P	5227	47.7	62.6	5.0	114	40	88	2.0
L241C	5114	47.3	62.8	5.1	120	41	88	1.5
L255PC	5245	50.7	64.1	5.4	114	42	91	1.0
45H33	4866	48.1	61.1	5.0	120	40	88	2.4
45M35	5252	50.6	63.5	5.2	117	39	87	2.3
CS2300	5288	49.1	63.1	5.2	123	41	91	1.1
CS2500 CL	4394	48.3	64.7	5.6	121	41	90	1.8
4187 RR	5356	49.4	63.6	5.2	124	42	92	1.3
5545 CL	4730	47.7	64.3	5.4	120	40	91	1.9
6076 CR	4379	47.9	62.8	5.1	123	41	92	1.8
6090 RR	5086	48.3	63.3	5.1	128	43	92	1.6
PV 200 CL	4448	47.8	62.7	4.9	121	42	89	2.1
PV 540 G	5113	48.1	61.1	5.1	115	41	89	2.1
PV 581 GC	4692	49.1	60.7	5.0	124	41	89	2.0
LSD (0.05)	710	0.9	0.4	0.2	6.7	0.5	1.1	0.5
Location x Variety Interaction								
LSD (0.05)	NS	NS	S	NS	NS	S	S	NS

S = Significant

NS = Not Significant

Irrigated Flax Variety Trial

Funding

Funded by the Irrigation Crop Diversification Corporation and the Saskatchewan Variety Performance Group

Principal Investigator

- Garry Hnatowich, PAg, Research Director, ICDC (Project Lead)

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Saskatchewan Variety Performance Group
- Saskatchewan Advisory Council on Grain Crops

Objectives

The objectives of this study were to:

1. Evaluate registered and experimental flax varieties
2. Assess entries for suitability to irrigated production; and
3. Update ICDC's annual *Crop Varieties for Irrigation* guide.

Research Plan

The irrigated flax trials were conducted at two locations, ICDC On-station (Area 51) and at the ICDC Pederson Off-station location.

Twenty-six flax varieties, twelve registered and fourteen experimental entries, were tested for their agronomic performance under irrigation. The ICDC site was seeded May 22 and the Pederson site on May 15. Plot size was 1.5 m x 4.0 m. The ICDC trial received supplemental fertilizer applied application rates of 120 kg N/ha, as 46-0-0, and 40 kg P₂O₅/ha as 12-51-0, all fertilizer was side-banded at the time of seeding. The Pederson trial received additional supplemental N fertilizer at a rate of 40 kg N/ha (the trial was established on potato stubble that soil testing procedures indicated had a soil N reserve of 122 kg N/ha) and 30 kg P₂O₅/ha as 12-51-0, all fertilizer was side-banded at the time of seeding. Weed control consisted of a post-emergence applications of Buctril M (bromoxynil +MCPA ester) + Centurion (clethodim), supplemented by some hand weeding. Both sites also received a season end desiccant application of Reglone (diquat), prior to combining. Combining occurred on October 4 at both trial locations. Total in-season irrigation at ICDC and at Pederson consisted of 197 mm (7.75") and 140 mm (5.5") respectively.

Results

Results obtained at the ICDC location are shown in Table 1. The new variety AAC Marvelous was the highest yielding entry at ICDC, but only statistically differing from those entries with yields > 2440 kg/ha. Westlin 60 was the lowest yielding variety. Test weight of entries AAC Bright was lowest. FP2513 had the highest 1000 Kernal Weights (TKW), NuLin VT50 the lowest. Varieties differed up to 8 days in time to achieve 50% flower, CDC Dorado was the earliest to mid-flower, the experimental entry FP2571 the latest. Westlin 60 was the latest maturing requiring 103 days, CDC Dorado was the earliest maturing entry at 99 days. FP2585 was the tallest entry, CDC Dorado the shortest entry. The tallest and shortest entries differed by 15 cm in height. No difference in lodging between entries was evident.

The Pederson location results for plant growth attributes are shown in Table 2. The experimental line FP2588 was the highest yielding, AAC Bright the lowest. Test weight was highest with AAC Marvelous and lowest with AAC Bright. Thousand Seed Weights were highly variable between entries. Time to 50% flower differed by 6 days between the earliest and latest flowering entries at this test location, differences between the earliest and latest flowering entries were statistically significant. Nine days difference occurred between the earliest and latest maturing entries. Entries varied in plant heights, with 19 cm differences between the shortest and tallest entries. No lodging of any entries occurred at the trial location in 2018.

Results from these trials are used to update the irrigation variety database at ICDC and provide recommendations to irrigators on the best flax varieties suited to irrigation conditions and will be used in the development of the annual publications *Crop Varieties for Irrigation* and the Saskatchewan Ministry of Agriculture's *Varieties of Grain Crops 2017*.

Table 1. Yield and agronomic data for the Saskatchewan Variety Performance Group Irrigated Flax Regional Trial, ICDC On-station site, 2018.

Variety	Yield (kg/ha)	Test weight (kg/hl)	Seed weight (mg)	Flower (days)	Maturity (days)	Height (cm)	Lodging (1=erect; 9=flat)
CDC Bethune (check)	2790	66.6	7.4	54	100	79	1
AAC Bright	2724	65.2	7.2	55	99	80	1
AAC Marvelous	2882	67.3	7.3	55	101	78	1
AAC Prairie Sunshine	2643	67.3	7.2	56	101	77	1
CDC Buryu	2517	67.5	7.4	56	99	79	1
CDC Dorado	2313	67.1	7.8	50	99	66	1
CDC Glas	2599	66.0	7.0	56	99	79	1
CDC Plava	2559	67.6	7.3	51	100	70	1
NuLin VT50	2447	66.8	6.6	55	100	76	1
WESTLIN 60	2138	66.0	7.4	51	103	69	1
WESTLIN 72	2449	67.2	7.0	58	102	77	1
Topaz	2644	66.7	7.1	55	100	77	1
FP2513	2338	67.1	8.0	57	102	78	1
FR2566	2592	65.9	7.0	56	101	76	1
FP2567	2451	66.2	7.6	55	102	77	1
FP2568	2750	67.1	7.5	54	101	80	1
FP2569	2862	66.1	7.5	55	101	72	1
FP2570	2490	65.3	7.6	55	102	74	1
FP2571	2492	66.4	7.5	58	102	76	1
FP2572	2805	65.8	7.3	55	101	78	1
FP2573	2584	66.7	7.3	54	101	80	1

FP2574	2686	66.7	7.5	57	101	79	1
FP2585	2399	66.8	7.1	55	101	81	1
FP2586	2434	66.6	7.1	54	101	78	1
FP2587	2511	66.4	6.8	56	102	80	1
FP2588	2488	66.3	6.8	56	101	79	1
LSD (0.05)	436	0.6	0.3	1.2	1.7	6.3	NS
CV (%)	10.4	0.6	2.7	1.4	1.0	5.0	0

NS = Not Significant

Table 2. Yield and Agronomic Data for the Saskatchewan Variety Performance Group Irrigated Flax Regional Trial, ICDC Off-Station Pederson Site, 2018.

Variety	Yield (kg/ha)	Test weight (kg/hl)	Seed weight (mg)	Flower (days)	Maturity (days)	Height (cm)	Lodging (1=erect; 9=flat)
<i>CDC Bethune (check)</i>	2579	67.5	8.2	56	103	51	1
AAC Bright	2204	66.0	8.1	56	107	41	1
AAC Marvelous	2887	68.6	8.5	55	109	55	1
AAC Prairie Sunshine	2586	68.0	8.1	57	110	48	1
CDC Buryu	2477	67.8	8.1	57	107	48	1
CDC Dorado	2399	68.0	8.4	51	102	53	1
CDC Glas	3072	66.9	7.8	56	107	57	1
CDC Plava	2480	67.3	8.1	54	103	49	1
NuLin VT50	2685	68.4	7.9	54	110	45	1
WESTLIN 60	2238	68.1	8.4	55	106	46	1
WESTLIN 72	2648	68.3	7.9	56	106	48	1
Topaz	3100	66.2	8.1	55	106	53	1
FP2513	3026	68.5	9.0	56	108	51	1
FR2566	2846	68.1	8.2	56	107	48	1
FP2567	3372	67.5	8.5	55	108	60	1
FP2568	3033	68.5	8.8	54	107	54	1
FP2569	3087	67.2	9.1	56	107	55	1
FP2570	2814	67.5	9.1	56	109	52	1
FP2571	2962	67.4	8.5	56	110	57	1
FP2572	3274	67.7	8.3	55	106	56	1
FP2573	3287	68.2	8.5	56	108	56	1
FP2574	2744	67.7	8.7	54	108	56	1

FP2585	3391	68.3	8.2	54	101	53	1
FP2586	2727	67.6	8.2	54	102	56	1
FP2587	3554	67.8	7.8	56	108	60	1
FP2588	3702	66.6	7.8	56	107	57	1
LSD (0.05)	NS	1.0	0.4	1.9	3.5	NS*	NS
CV (%)	15.4	0.9	3.0	2.1	2.0	12.1	0

NS = Not Significant

NS* = Significant at $P < 0.10$

Irrigated Early Season Sunflower Hybrid Trial

Funding

Funded by the Irrigation Crop Diversification Corporation

Principal Investigator

- Garry Hnatowich, PAg, Research Director, ICDC
- William May, AAFC, Indian Head

Organizations

- Agriculture & Agri-Food Canada
- Irrigation Crop Diversification Corporation (ICDC)

Objectives

The objectives of this study were to:

- (1) Evaluate sunflower varieties to irrigated production
- (2) Demonstrate the new early season hybrid Honeycomb NS; and
- (3) Determine the appropriate plant density for this new hybrid.

Research Plan

The trial was established at the ICDC Pederson Off-station location.

Two oilseed sunflower hybrids; Honeycomb NS and 8H270, were each planted to achieve a plant population of 20, 25, 30 and 35,000 plants/acre. Seed was packaged as per ICDC plot sizes at AAFC Indian Head and the trial was initially seeded on May 25, however, an error was made in seed setup such that incorrect plant populations were established. Therefore the trial was reseeded on June 4 and each plot hand thinned late June to establish the desired plant population. Plot size was 2 rows at 30" (75 cm) spacing, 6 m in length, with four replications.

The trial was established on potato stubble containing high levels of residual soil N (122 kg N/ha) so supplemental fertilizer was applied at rates of 71 kg N/ha, as 46-0-0, and 40 kg P₂O₅/ha as 12-51-0, all fertilizer was side-banded at the time of seeding. Weed control consisted of a pre-plant soil incorporated application of granular Edge (ethalfluralin) and periodic hand weeding. No fungicides or insecticides were deemed necessary in 2018. To prevent bird depredation we intended to cover each sunflower head with a plastic net bag, however, after completing a single replicate it was deemed to be too labour intensive both in terms of covering and removing at harvest. Therefore an alternative strategy of draping the remainder of the trial with bale wrap was employed (see pictures 1 & 2). Covering occurred during the third week of August.

At harvest individual sunflower head net bags or the net draping was removed. Individual heads from each plot were hand harvested and manually feed through a stationary combine in the field. Plant maturity differences were unable to be captured due the plant covering. Harvested seed was immediately weighed, then dried in heated forced-air drying cabinets, and reweighed for harvest seed moisture determinations. Harvest occurred on October 17, 2018.

Total in-season rainfall at CSIDC (closest weather station) from May through August was 86.0 mm. Total in-season irrigation at the Pederson Off-station site was 140 mm (5.5").

Results following are for the ICDC Outlook Saskatchewan trial only. This trial was however duplicated at Redvers, Swift Current, Melfort and Indian Head Saskatchewan locations.

Picture 1: Sunflower Heads in First Replicate Covered with Individual Net Bags.



Picture 2. Remainder of Replicates Draped with Bale Wrapping.



Results

Seed quality and agronomic plant characteristics collected from each treatment by ICDC are tabulated in Table 1. Factorial statistical analysis is given in Table 2.

Discussion will be based on the Factorial Analyses results outlined in Table 2. The early season sunflower hybrid Honeycomb NS did not yield as highly as the later maturing hybrid 8H270. The yield of Honeycomb NS was approximately 22% less than 8H270. Although plant maturity dates were not captured harvest seed moisture can be used as a relative indication of maturity. This observation suggests that there was a significant difference between maturities of the two hybrids. Though sunflower is considered a late maturing crop it could be that the hybrid Honeycomb NS is too early for the climatic conditions experienced either in 2018, or possible, for the Outlook region. In general early maturing cultivars tend to yield less than later maturing cultivars, regardless of crop species.

Seed rate did not appear to have a strong influence on seed yield in 2018. In general, seed yield appears to increase with seeding rate increases although these differences are relatively small. Harvest seed moisture does appear to decline as seeding rate increased. Plant population counts indicate that populations of the two hybrids were equal and that close to desired plant populations were achieved.

Honeycomb NS did bloom earlier than 8H270, both varieties were similar in plant height. Seeding rate had little impact on days to bloom or plant height.

It should be noted that the coefficient of variation (CV) for this trial was high and no recommendations should be made regarding either variety or seed rate without additional years of trialing.

Table 1: Treatment Means for each Observation

Hybrid	Seed Rate (plant/ac)	Yield kg/ha (10% H ₂ O)	Yield lbs/ac (10% H ₂ O)	Harvest Seed Moisture (%)	Plant Stand (plant/ac)	Bloom (days)	Plant Height (cm)
Honeycomb NS	20,000	2793	2492	29.5	20805	56	140
Honeycomb NS	25,000	2521	2248	22.5	25529	55	125
Honeycomb NS	30,000	2621	2338	25.0	30814	56	132
Honeycomb NS	35,000	3143	2804	23.4	36887	54	142
8H270	20,000	3173	2830	40.8	21480	60	133
8H270	25,000	3326	2967	42.7	25191	62	136
8H270	30,000	3842	3427	37.8	31039	61	143
8H270	35,000	3786	3372	40.4	34975	57	148
LSD (0.05)		882	787	5.1	2382	3.7	NS
CV (%)		19.1	19.1	10.6	5.7	4.4	9.4

Table 2: Factorial Analysis of Sunflower Hybrid Agronomic Characteristics

Hybrid/Plant Seed Rate	Yield kg/ha (10% H ₂ O)	Yield lbs/ac (10% H ₂ O)	Harvest Seed Moisture (%)	Plant Stand (plant/ac)	Bloom (days)	Plant Height (cm)
Hybrid						
Honeycomb NS	2770	2470	25.1	28509	55	135
8H270	3532	3150	40.2	28171	60	140
LSD (0.05)	567	505	2.7	NS	1.9	NS
CV (%)	24.7	24.7	11.4	5.7	4.4	9.4
Seed Rate (plants/ac)						
20,000	2983	2661	35.2	21143	58	137
25,000	2923	2608	32.6	25360	58	130
30,000	3231	2882	31.4	30927	58	138
35,000	3465	3090	31.9	35931	55	145
LSD (0.05)	NS	NS	NS	1684	NS	NS
Hybrid x Seed Rate Interaction						
LSD (0.05)	NS	NS	NS	NS	NS	NS

NS = not significant

Irrigated Sunflower Hybrid Trial

Funding

Funded by the Irrigation Crop Diversification Corporation

Principal Investigator

- Garry Hnatowich, PAg, Research Director, ICDC
- William May, AAFC, Indian Head

Organizations

- Agriculture & Agri-Food Canada
- Irrigation Crop Diversification Corporation (ICDC)

Objectives

To evaluate the yield and quality of sunflower grown under irrigation.

Research Plan

The trial was established at the ICDC Pederson Off-station location.

Five oilseed sunflower hybrids were evaluated. All hybrids were planted at a plant population of 11.1 plants m², one hybrid Honeycomb NS, was planted at the standard rate of 11.2 m² (high) but also at a lower population of 8.0 plants m² (low). Seed was packaged as per ICDC plot sizes at AAFC Indian Head and the trial was seeded on May 25. Plot size was 2 rows at 30" (75 cm) spacing, 6 m in length, with four replications.

The trial was established on potato stubble containing high levels of residual soil N (122 kg N/ha) so supplemental fertilizer was applied at rates of 71 kg N/ha, as 46-0-0, and 40 kg P₂O₅/ha as 12-51-0, all fertilizer was side-banded at the time of seeding. Weed control consisted of a pre-plant soil incorporated application of granular Edge (ethalfluralin) and periodic hand weeding. No fungicides or insecticides were deemed necessary in 2018. To prevent bird depredation we intended to cover each sunflower head with a plastic net bag, however, after completing a single replicate it was deemed to be too labour intensive both in terms of covering and removing at harvest. Therefore an alternative strategy of draping the remainder of the trial with bale wrap was employed (see pictures 1 & 2, Irrigated Early Season Sunflower Hybrid Trial). Covering occurred during the third week of August.

At harvest individual sunflower head net bags or the net draping was removed. Individual heads from each plot were hand harvested and manually feed through a stationary combine in the field. Plant maturity differences were unable to be captured due the plant covering. Harvested seed was immediately weighed, then dried in heated forced-air drying cabinets, and reweighed for harvest seed moisture determinations. Harvest occurred on October 17, 2018.

Total in-season rainfall at CSIDC (closest weather station) from May through August was 86.0 mm. Total in-season irrigation at the Pederson Off-station site was 140 mm (5.5").

Results

Yields and agronomic observations are shown in Table 1.

Table 1: Seed Yield and Agronomics of Sunflower Hybrids.

Hybrid	Yield kg/ha (10% H ₂ O)	Yield lbs/ac (10% H ₂ O)	Harvest Moisture %	Plant Stand (plant/ha)	Plant Stand (plant/ac)	Days to Bloom	Plant Height (cm)
63A21	2304	2055	26.3	61944	25079	61	120
AC Sierra	1316	1174	16.3	40278	16306	58	82
MY8H288CL	3879	3460	37.3	58611	23729	66	125
Honeycomb NS low	1984	1770	18.1	43056	17431	60	107
Honeycomb NS high	2325	2074	17.1	59722	24179	60	109
MY8H270CL	3902	3480	47.8	57500	23280	69	127
LSD (0.05)	932	832	5.2	10325	4180	1.9	13.0
CV (%)	23.6	23.6	12.8	12.8	12.8	2.0	7.8

Using harvest seed moisture as an indicator of maturity Table 1 indicates that the early maturing hybrids AC Sierra and Honeycomb NS were far lower yielding than later maturing varieties. Results suggest that producers in the Lake Diefenbaker Irrigation regions contemplating sunflower production should consider a latter maturing hybrid. Plant stands only achieved approximately 50% of the intended plant stand, demonstrating a high seed/seedling mortality.

It should be noted that the coefficient of variation (CV) for this trial was high and no recommendations should be made regarding either variety or seed rate without additional years of trialing.

This trial was also established at Redvers, Swift Current, Melfort and Indian Head Saskatchewan. A multi-site report will be developed by AAFC Indian Head.

Irrigated Wheat Variety Trial

Funding

Funded by the Agriculture Development Fund, Western Grains Research Foundation and the Irrigation Crop Diversification Corporation.

Principal Investigator

- Garry Hnatowich, PAg, Research Director, ICDC (Project Lead)

Organizations

- Irrigation Crop Diversification Corporation (ICDC)

Objectives

The objectives of this study were to:

1. Evaluate registered wheat varieties for which ICDC has limited data;
2. Assess entries for suitability to irrigated production; and
3. Update ICDC's annual *Crop Varieties for Irrigation* guide.

Research Plan

The irrigated wheat variety trials were conducted at two locations in the Outlook area. Each site and soil type are as follows:

ICDC Knapik Site (NW12-29-08-W3): Asquith sandy loam (SW quadrant)

ICDC Pederson Site (NE17-28-07-W3): Elstow loam (NW quadrant)

Twenty-five spring wheat varieties of two different market classes (20 CWRS varieties and 2 CPSR varieties) and three durum varieties were tested for their agronomic performance under irrigation. The ICDC Knapik site was seeded on May 18, ICDC Pederson site was seeded on May 15. Plot size was 1.5 m x 4.0 m (final harvest area). The seed was treated with Cruiser Maxx Cereals (thiamethoam + difenoconazole + metalaxyl-M) for seed and soil borne disease and wireworm control. Nitrogen fertilizer at Knapik was applied at a rate of 110 kg N/ha as 46-0-0 as a sideband application and 30 kg P₂O₅/ha as 12-51-0 seed placed. At the Pederson location nitrogen fertilizer was applied at a rate of 45 kg N/ha as 46-0-0 as a sideband application and 30 kg P₂O₅/ha as 12-51-0 seed placed (this trial was conducted on potato stubble that soil testing indicated available soil N of 122 kg/ha). Weed control at both sites consisted of a post-emergence tank mix application Simplicity (pyroxsulam) and Buctril M (bromoxynil +MCPA ester). Yields were estimated by direct cutting the entire plot with a small plot combine when the plants were dry enough to thresh and seed moisture content was <20%. Both trials were harvested on September 6. Total in-season irrigation at Knapik was 197 mm (7.75"), at Pederson 140 mm (5.5").

Results

Results obtained at the Knapik location are shown in Table 1, the Pederson location in Table 2 and combined site analysis in Table 3.

Results of the Knapik trial are provided in Table 1. The highest yield was obtained with the CPSR variety AAC Crossfield, the lowest yield with the CWRS variety AAC Connery. Within the CWRS class AC Brandon was the highest yielding, and the only CWRS variety statistically differing in yield from the control,

Carberry. Within the durum varieties CDC Precision was the lowest yielding, AAC Congress the highest. Median grain yield of the Knapik trial was 5842 kg/ha (86.8 bu/ac). Protein content generally followed the order of CWRS > CPSR > CWAD. AAC Viewfield had the highest test weight, AAC Jatharia VB the lowest. Durum varieties tended to have the highest seed weights, CWRS varieties the lowest. The CWAD varieties were significantly later maturing than all other varieties. AAC Cameron VB and Coleman were the tallest varieties and Coleman exhibited the greatest degree of lodging.

Results from the Pederson trial are shown in Table 2. At the Pederson trial every variety with a grain yield exceeding 7300 kg/ha was statistically higher yielding than the check Carberry. The CWRS variety Thorsby had the lowest yield, the CWAD variety AAC Congress the highest. The highest yielding CWRS variety was AAC Viewfield. Median grain yield at the Pederson location was 6735 kg/ha (100.1 bu/ac). Among market classes the CWRS varieties, in general, had higher protein contents as compared to other entries. Within the CWRS varieties the high yielding AAC Viewfield had the lowest % seed protein. AAC Viewfield had test weights statistically greater than all other varieties. Thousand seed weight was highest for the durum entries. Days to heading and maturity, plant height and lodging varied within and between classes, though the durum entries were among the longest to mature.

Combined site analysis is given in Table 3. Yield, protein, thousand kernel weight, plant height and days to heading of varieties behaved similarly between the two tests locations. All other measured agronomic parameters indicated that varieties differed between the two test locations.

Results from these trials, when deemed valid, are used to update the irrigation variety database at ICDC and provide recommendations to irrigators on the best wheat varieties suited to irrigation conditions and will be used in the development of the annual publications “Crop Varieties for Irrigation.”

Table 1. Yield and Agronomic Data for the ICDC Irrigated Wheat Variety Trial, ICDC Knapik Site, 2018.

Variety	Yield (kg/ha)	Yield % of Carberry	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
Canada Western Red Spring (CWRS)									
Carberry	5638	100	12.0	82.0	38.8	49	89	75	1.0
AAC Brandon	6729	119	11.6	81.6	38.9	50	90	77	1.0
AAC Cameron VB	5885	104	10.7	81.0	43.0	53	90	87	1.0
AAC Connery	5368	95	11.9	79.9	38.1	52	89	74	1.0
AAC Jatharia VB	5722	101	11.9	77.1	38.9	49	90	79	1.0
AAC Redberry	5819	103	11.5	81.5	37.5	49	87	77	1.0
AAC Tisdale	6118	109	11.2	81.1	39.5	52	89	82	1.0

AAC Viewfield	6516	116	11.0	83.2	35.6	53	91	74	1.0
AAC W1876	5947	105	11.9	81.9	37.5	51	91	77	1.3
CDC Adamant VB	5725	102	11.5	81.9	36.5	52	92	74	1.0
CDC Bradwell	6125	109	11.7	82.7	36.6	52	92	80	1.0
CDC Go	5790	103	11.8	78.8	38.3	48	86	83	1.3
CDC Hughes VB	5574	99	12.4	80.0	43.6	51	89	79	1.0
CDC Landmark VB	5512	98	11.9	81.5	41.1	53	91	76	1.0
Coleman	5684	101	11.5	81.6	36.1	50	88	88	3.5
Parata	6163	109	12.0	81.1	36.0	49	86	79	1.0
SY Chert	6439	114	11.0	80.6	41.6	51	92	85	1.0
SY Obsidian	5921	105	11.6	80.6	39.3	50	90	76	1.0
SY Slate	5722	101	11.4	81.1	38.9	50	90	76	1.0
Thorsby	5772	102	11.1	80.1	36.3	52	88	83	1.3
Canada Western Amber Durum (CWAD)									
AAC Congress	7096	126	9.8	81.0	43.7	57	95	81	1.0
CDC Credence	7010	124	9.9	81.6	43.6	57	95	84	1.3
CDC Precision	6063	108	10.2	81.5	44.0	55	95	81	1.0
Canada Prairie Spring Red (CPSR)									
AAC Crossfield	7177	127	10.4	80.3	42.1	51	91	80	1.0
AAC Goodwin	6543	116	11.1	80.7	40.5	52	90	75	1.0
LSD (0.05)	1062		0.7	2.2	2.4	1.9	2.3	8.8	0.32
CV (%)	12.4		4.3	1.9	4.4	2.4	1.8	7.9	20.2

Table 2. Yield and Agronomic Data for the ICDC Irrigated Wheat Variety trial, ICDC Pederson Site, 2018.

Variety	Yield (kg/ha)	Yield % of Carberry	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
Canada Western Red Spring (CWRS)									
Carberry	6637	100	12.5	81.6	39.9	51	87	85	1
AAC Brandon	7553	114	12.3	81.7	38.6	52	87	83	1
AAC Cameron VB	6650	100	11.7	80.9	44.0	54	88	101	1
AAC Connery	6421	97	12.8	80.6	40.1	54	88	81	1
AAC Jatharia VB	6295	95	12.2	81.8	40.4	51	87	93	1
AAC Redberry	6838	103	12.5	81.9	39.8	50	85	89	1
AAC Tisdale	6585	99	12.7	80.9	40.0	52	87	88	1
AAC Viewfield	7745	117	11.7	82.8	37.3	54	88	81	1
AAC W1876	6779	102	12.6	81.3	39.4	53	89	86	1
CDC Adamant VB	6253	94	12.4	81.3	38.7	54	89	83	1
CDC Bradwell	6441	97	12.6	82.3	37.2	54	89	88	1
CDC Go	6288	95	13.0	78.7	41.3	49	86	97	1.3
CDC Hughes VB	6508	98	12.3	81.4	42.4	52	86	86	1
CDC Landmark VB	6873	104	12.5	82.0	43.1	54	88	86	1
Coleman	6141	93	13.1	80.1	36.7	52	87	95	2
Parata	6520	98	12.8	80.3	38.4	49	86	92	1
SY Chert	6772	102	12.5	81.1	40.4	53	89	87	1
SY Obsidian	7090	107	12.1	81.3	40.9	52	88	83	1
SY Slate	6848	103	12.2	80.1	39.6	53	88	86	1
Thorsby	6020	91	12.2	80.3	37.9	52	87	94	1

Canada Western Amber Durum (CWAD)									
AAC Congress	7789	117	10.7	81.5	45.4	58	90	89	1
CDC Credence	7237	109	10.8	81.3	48.7	58	90	91	1
CDC Precision	7132	107	11.4	81.9	46.0	56	89	86	1
Canada Prairie Spring Red (CPSR)									
AAC Crossfield	7491	113	10.9	79.9	42.3	54	88	84	1
AAC Goodwin	7151	108	12.0	81.7	41.6	54	88	80	1
LSD (0.05)	652		0.7	0.3	2.4	1.2	1.4	4.3	0.3
CV (%)	6.8		4.2	0.3	4.2	1.6	1.1	3.5	18.5

Table 3. Yield and Agronomic Data for the ICDC Irrigated Wheat Variety trial, Combined Sites, 2018.

Location / Variety	Yield (kg/ha)	Yield % of Location/ Carberry	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
Trial Location									
ICDC Knapik	6082	100	11.3	81.0	39.4	51	90	79	1.1
ICDC Pederson	6802	112	12.2	81.1	40.8	53	88	88	1.0
LSD (0.05)	452		0.4	NS	0.5	0.8	0.5	1.7	NS
CV	9.7		4.2	1.4	4.3	2.0	1.5	5.9	19..4
Variety									
Canada Western Red Spring (CWRS)									
Carberry	6138	100	12.2	81.8	39.4	50	88	80	1.0
AAC Brandon	7141	116	11.9	81.6	38.7	51	89	80	1.0
AAC Cameron VB	6267	102	11.2	80.9	43.5	53	89	94	1.0
AAC Connery	5894	96	12.3	80.2	39.1	53	89	77	1.0
AAC Jatharia VB	6008	98	12.0	79.4	39.7	50	88	86	1.0

AAC Redberry	6329	103	12.0	81.7	38.7	49	86	83	1.0
AAC Tisdale	6351	103	12.0	81.0	39.8	52	88	85	1.0
AAC Viewfield	7130	116	11.3	83.0	36.4	54	90	77	1.0
AAC W1876	6363	104	12.3	81.6	38.4	52	90	82	1.1
CDC Adamant VB	5989	98	11.9	81.6	37.6	53	91	79	1.0
CDC Bradwell	6283	102	12.1	82.5	36.9	53	90	84	1.0
CDC Go	6039	98	12.4	78.7	39.8	49	86	90	1.3
CDC Hughes VB	6041	98	12.3	80.7	43.0	51	88	82	1.0
CDC Landmark VB	6192	101	12.2	81.8	42.1	53	90	81	1.0
Coleman	5912	96	12.3	80.8	36.4	51	87	91	2.8
Parata	6342	103	12.4	80.7	37.2	49	86	86	1.0
SY Chert	6605	108	11.7	80.9	41.0	52	90	86	1.0
SY Obsidian	6505	106	11.9	81.0	40.1	51	89	79	1.0
SY Slate	6285	102	11.8	80.6	39.2	52	89	81	1.0
Thorsby	5896	96	11.7	80.2	37.1	52	87	88	1.1
Canada Western Amber Durum (CWAD)									
AAC Congress	7442	121	10.2	81.2	44.5	57	93	85	1.0
CDC Credence	7123	16	10.4	81.4	46.2	57	93	87	1.1
CDC Precision	6597	107	10.8	81.7	45.0	56	92	83	1.0
Canada Prairie Spring Red (CPSR)									
AAC Crossfield	7334	119	10.7	80.1	42.2	52	89	82	1.0
AAC Goodwin	6847	112	11.5	81.2	41.0	53	89	77	1.0
LSD (0.05)	618		0.5	1.1	1.7	1.1	1.3	4.8	0.2
Location x Variety Interaction									
LSD (0.05)	NS		NS	S	NS	NS	S	NS	S

S = Significant NS = Not Significant

Saskatchewan Variety Performance Group Irrigated Wheat, Durum, Barley and Oat Regional Variety Trials

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Principal Investigator

- Garry Hnatowich, PAg, Research Director, ICDC (Project Lead)

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Saskatchewan Variety Performance Group
- Saskatchewan Advisory Council on Grain Crops

Objectives

The objectives of this study were to:

- (1) Evaluate experimental cereal lines pursuant for registration requirements;
- (2) Assess entries for suitability to irrigated production; and
- (3) Update ICDC's annual *Crop Varieties for Irrigation* guide.

Research Plan

The Saskatchewan Variety Performance Group (SVPG) wheat, durum, barley and oat regional trials were seeded between May 15 and 23. Plot size was 1.5 m x 4.0 m. The seed was treated with Cruiser Maxx Cereals (thiamethoam + difenoconazole + metalaxyl-M) for seed and soil borne disease and wireworm control. Nitrogen fertilizer at ICDC Knapik Off-station was applied at a rate of 110 kg N/ha as 46-0-0 as a sideband application and 30 kg P₂O₅/ha as 12-51-0 seed placed (second durum trial and the oat trial). At the ICDC Pederson Off-station location nitrogen fertilizer was applied at a rate of 45 kg N/ha as 46-0-0 as a sideband application and 30 kg P₂O₅/ha as 12-51-0 seed placed (this trial was conducted on potato stubble that soil testing indicated available soil N of 122 kg/ha). The Pederson location had the Hex1, Hex2, first Durum, Barley and Soft White Spring evaluations established. The soft white spring wheat (CWSWS Coop) is not part of the SVPG program but rather a separate evaluation but included here for an inclusive cereal report. Weed control consisted of a post-emergence tank mix application Simplicity (pyroxulam) and Buctril M (bromoxynil +MCPA ester) with wheat, Assert 300SC (imazamethabenz) and Buctril M (bromoxynil +MCPA ester) with barley and Buctril M (bromoxynil +MCPA ester) only was applied to the oat trial. Yields were estimated by direct cutting the entire plot with a small plot combine when the plants were dry enough to thresh and seed moisture content was <20%. In-season precipitation from May through August was 86 mm, in-season irrigation at Knapik was 258 mm and at Pederson 140 mm.

Results

Hex 1, Hex 2 and CWSWS are shown in Tables 1, 2 and 3, respectively. Results of the ICDC Knapik and Pederson and the Combined Site Analysis for the SVPG Durum trials are shown in Tables 4, 5 and 6 respectively. Results of the 2-row barley are shown in Table 7. Results of oat evaluation are shown in Table 8.

Results of these trials are used for registration purposes. Further, results from these trials are used to

update the irrigation variety database at ICDC and provide recommendations to irrigators on the best wheat and barley varieties suited to irrigation conditions and will be used in the development of the annual publications *“Crop Varieties for Irrigation”* and the Saskatchewan Ministry of Agriculture’s *“Varieties of Grain Crops 2019.”*

Table 1. Saskatchewan Variety Performance Group Irrigated Hex 1 Wheat Regional Variety Trial, ICDC Off-Station Pederson Site, 2018.

Variety	Yield (kg/ha)	Yield % of Carberry	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
Carberry	7546	100	12.2	82.0	42.2	51	86	86	1
AAC Alida VB	7245	96	12.4	82.0	42.5	53	87	90	1
AAC Cameron VB	7293	97	11.6	81.0	45.6	53	86	97	1
AAC Cirrus	7253	96	11.5	82.9	33.8	53	86	84	1
AAC Concord	7450	99	12.0	80.3	42.7	57	90	93	1.3
AAC Connery	7097	94	12.0	81.3	40.9	52	86	85	1
AAC Goodwin	8301	110	11.5	81.7	41.7	54	83	89	1
AAC Jatharia VB	7810	103	12.8	81.8	42.6	51	88	96	1
AAC Redberry	7286	97	11.9	82.9	39.2	49	84	90	1
AAC Tisdale	7893	105	12.6	81.6	42.1	52	83	89	1
AAC Viewfield	8069	106	11.4	83.4	37.1	53	86	80	1
AAC Warman VB	6935	92	12.0	82.3	40.9	50	86	97	1
AAC W1876	7511	100	12.5	81.6	40.9	53	85	87	1
CDC Adamant VB	7206	95	11.4	82.9	38.5	52	84	83	1
CDC Bradwell	7094	94	11.7	82.7	37.2	54	84	88	1
CDC Hughes VB	7668	102	12.8	80.8	45.7	53	85	92	1
CDC Kinley	7452	99	12.1	82.3	39.7	53	83	89	1

CDC Landmark VB	7108	94	11.7	82.7	44.2	52	86	88	1
Go Early	7087	94	12.3	79.9	41.1	49	84	96	1
Parata	7181	95	12.1	82.2	38.2	49	84	92	1
SY479 VB	6569	87	12.6	81.5	39.4	55	86	99	1
SY Chert VB	7362	98	11.5	81.1	41.9	52	87	88	1
SY Obsidian	7797	103	12.1	81.6	41.4	51	88	88	1
SY Slate	7078	94	11.3	81.5	40.2	51	85	86	1
SY Sovite	6666	88	12.8	81.7	42.6	51	89	90	1
Thorsby	6712	89	12.4	81.3	40.7	54	84	96	1
BW1041	7770	103	12.2	80.9	45.7	50	83	89	1
BW5011 VB	8246	109	12.2	82.7	43.5	53	88	84	1
BW5013 VB	8679	115	11.8	81.2	43.3	55	85	90	1
PT596	7539	100	12.0	81.0	36.4	53	83	88	1
PT650	6923	92	12.3	82.5	36.6	50	86	84	1
LSD (0.05)	862		NS	1.1	2.4	2.1	NS	4.5	NS
CV (%)	7.1		5.4	0.8	3.6	2.5	4.1	3.1	10.3

Table 2. Saskatchewan Variety Performance Group Irrigated Hex 2 Wheat Regional Variety Trial, ICDC Off-Station Pederson Site, 2018.

Variety	Yield (kg/ha)	Yield % of Carberry	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
Canada Western Red Spring (CWRS)									
<i>Carberry</i>	<i>7000</i>	<i>100</i>	<i>12.7</i>	<i>83.6</i>	<i>40.3</i>	<i>50</i>	<i>86</i>	<i>85</i>	<i>1</i>
Canada Northern Hard Red (CNHR)									
Faller	8026	115	10.9	81.8	43.5	53	87	79	1
Prosper	8303	119	12.1	81.3	45.3	54	88	82	1
Canada Prairie Spring – Red (CPSR)									
AAC Crossfield	8094	116	10.8	81.1	41.3	52	87	84	1

AAC Entice	7650	109	11.3	81.2	41.1	52	87	82	1
CDC Terrain	7393	106	11.9	80.3	47.0	57	91	85	1
Alderon	9758	139	9.8	73.5	42.7	59	94	82	1
Charing VB	9054	129	10.3	74.2	43.3	58	93	84	1
HY2003 VB	6640	95	12.1	80.6	42.4	51	87	84	1
SY Rowyn	7922	113	11.7	83.3	36.4	51	87	77	1
Canada Western Special Purpose (CWSP)									
AAC Awesome VB	9248	132	10.2	80.3	46.1	59	90	88	1
Canada Western Soft White Spring (CWSWS)									
AAC Indus VB	9515	136	9.8	77.2	41.4	59	92	87	1
AAC Paramount VB	9381	134	10.4	80.8	42.2	57	91	88	1
Canada Western General Purpose (CWGP)									
CDC Throttle	9002	129	10.7	81.4	45.1	53	89	82	1
Elgin ND	6998	100	12.3	82.1	38.9	52	85	91	1
Sparrow VB	8907	127	10.3	77.5	41.4	58	93	79	1
LSD (0.05)	636		0.8	2.4	2.9	1.8	1.7	6.4	NS
CV (%)	4.6		4.6	1.8	4.2	2.0	1.2	4.6	

Table 3. Soft White Spring Wheat Irrigated Coop Variety Trial, ICDC Off-Station Pederson Site, 2018.

Variety	Yield (kg/ha)	Yield % of AC Andrew	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
Carberry	6239	69	12.0	81.8	40.7	51	84	83	1
AC Andrew (SWS 241)	8982	100	9.5	78.7	40.4	58	92	83	1
AC Meena (SWS 234)	8688	97	9.3	79.2	38.3	58	93	86	1
AC Chiffon (SWS 408)	8327	93	9.4	79.9	44.8	58	90	97	1
Sadash (SWS 349)	8720	97	9.6	80.3	42.0	55	92	84	1

AAC Indus (SWS 427)	8875	99	9.7	79.5	45.8	60	94	88	1
SWS 460	8604	96	9.0	80.0	42.2	56	90	88	1
SWS 462	9102	101	10.3	81.4	40.3	58	93	85	1
SWS 465	8688	97	9.7	79.5	40.2	61	95	90	1
SWS 468	8622	96	10.2	80.2	38.7	52	90	78	1
SWS 470	8244	92	10.4	80.4	44.1	57	94	79	1
SWS 471	8720	97	9.4	80.4	41.7	54	90	83	1
SWS 472	8647	96	9.6	80.8	38.1	55	92	81	1
SWS 473	8176	91	10.2	81.1	40.9	59	93	78	1
SWS 474	8249	92	9.2	80.6	41.0	56	91	84	1
SWS 475	7378	82	9.7	80.3	40.9	55	90	82	1
SWS 476	8106	90	9.6	79.8	37.0	57	90	83	1
LSD (0.05)	775		0.9	0.7	2.1	2.5	3.2	4.2	NS
CV (%)	6.4		6.2	0.6	3.5	3.0	2.4	3.5	

Table 4. Saskatchewan Variety Performance Group Irrigated CWAD Wheat Regional Variety Trial, Off-Station Knapik Site 2018.

Variety	Yield (kg/ha)	Yield % of Strong field	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
CSIDC Site									
Carberry	6972	91	12.0	83.6	38.5	50	90	82	1.0
Strongfield	7632	100	9.9	77.0	52.2	60	97	94	1.0
AAC Cabri	7910	104	9.7	79.0	48.0	62	99	103	1.0
CDC Carbide VB	7752	102	10.0	81.8	45.4	60	98	99	1.7
AAC Congress	8299	109	9.3	80.9	46.0	60	99	98	1.0
AAC Spitfire	7976	105	9.7	81.8	47.8	59	96	92	1.0
AAC Stronghold	7984	105	10.2	80.4	47.6	60	98	96	1.0
AAC Succeed VB	7946	104	10.3	80.6	51.3	59	96	98	1.0
CDC Alloy	8504	111	9.9	83.4	48.4	59	97	97	1.0
CDC Credence	7325	96	9.9	80.0	48.5	61	99	104	1.7

CDC Dynamic	8071	106	10.2	81.0	46.4	61	98	97	1.0
CDC Precision	7346	96	10.4	82.6	45.7	59	97	98	1.0
DT587	8947	117	9.7	81.1	43.2	59	98	96	1.7
DT591	7500	98	10.0	81.4	47.3	57	98	95	1.0
DT878	6967	91	10.0	72.0	49.3	63	102	103	1.0
LSD (0.05)	1026		0.5	6.2	3.8	3.3	3.1	5.1	NS
CV (%)	7.9		3.0	4.6	4.8	3.3	1.9	45.6	3.2

Table 5. Saskatchewan Variety Performance Group Irrigated CWAD Wheat Regional Variety Trial, ICDC Off-Station Pederson Site 2018.

Variety	Yield (kg/ha)	Yield % of Strong field	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
CSIDC Site									
Carberry	6869	95	13.7	82.8	41.6	53	86	84	1
Strongfield	7208	100	11.1	83.5	50.6	63	88	87	1
AAC Cabri	7678	107	11.5	82.6	46.3	65	90	94	1
CDC Carbide VB	7783	108	11.4	82.5	46.6	63	88	90	1.3
AAC Congress	7830	109	11.9	82.6	48.5	63	91	89	1
AAC Spitfire	8133	113	10.8	81.8	46.5	62	87	88	1
AAC Stronghold	7869	109	13.2	82.0	49.9	63	90	92	1.7
AAC Succeed VB	7921	110	11.1	82.0	50.5	62	87	94	1
CDC Alloy	7906	110	12.2	83.1	47.5	62	90	92	1.7
CDC Credence	7708	107	12.7	81.7	49.8	64	92	94	1.3
CDC Dynamic	7664	106	12.0	82.8	44.4	64	89	89	1
CDC Precision	7406	103	12.4	82.8	46.0	62	91	89	1
DT587	7495	104	11.3	81.6	46.6	62	89	89	1
DT591	7894	110	11.0	81.8	50.0	60	87	90	1

DT878	8069	112	13.0	81.4	49.9	66	90	94	1
LSD (0.05)	NS		1.6	0.5	2.9	3.3	2.1	4.1	NS
CV (%)	9.2		8.0	0.4	3.7	3.2	1.4	2.7	1

Table 6. Saskatchewan Variety Performance Group Irrigated CWAD Wheat Regional Variety trial, Combined Site Analysis, 2018.

Location / Variety	Yield (kg/ha)	Yield % of Check	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
Knapik Site	7809		10.1	80.4	47.0	59	97	97	1.1
Pederson Site	7696		11.9	82.3	47.7	55	89	90	1.1
LSD (0.05)	NS		0.5	1.2	NS	0.9	1.4	2.9	NS
CV (%)	8.6		6.4	3.2	4.3	2.8	1.7	3.0	43.7
Variety									
Carberry	6921	93	12.9	83.2	40.1	50	88	83	1.0
Strongfield	7420	100	10.5	80.3	51.4	57	93	90	1.0
AAC Cabri	7794	105	10.6	80.8	47.2	60	95	98	1.0
CDC Carbide VB	7767	105	10.7	82.2	46.0	57	93	94	1.5
AAC Congress	8065	109	10.6	81.8	47.3	58	95	94	1.0
AAC Spitfire	8055	109	10.3	81.8	47.1	57	92	90	1.0
AAC Stronghold	7927	107	11.7	81.2	48.7	57	94	94	1.3
AAC Succeed VB	7934	107	10.7	81.3	50.9	56	92	96	1.0
CDC Alloy	8205	111	11.0	83.3	47.9	57	93	94	1.3
CDC Credence	7517	101	11.3	80.7	49.2	59	96	99	1.5
CDC Dynamic	7868	106	11.1	81.9	45.4	59	94	93	1.0

CDC Precision	7376	99	11.4	82.7	45.8	57	94	94	1.0
DT587	8221	111	10.5	81.4	44.9	58	94	92	1.3
DT591	7697	104	10.5	81.6	48.7	55	93	92	1.0
DT878	7518	101	11.5	76.7	49.6	58	96	98	1.0
LSD (0.05)	NS*		0.8	3.0	2.3	1.8	1.8	3.2	NS
Location x Variety Interaction									
LSD (0.05)	NS		NS	NS	NS	S	S	S	NS

S = Significant

NS = Not Significant

NS* = Significant at P < 0.10

Table 7. Saskatchewan Variety Performance Group Irrigated 2-Row Barley Regional Variety Trial, ICDC Off-Station Pederson Site, 2018.

Variety	Yield (kg/ha)	Yield % of AC Metcalfe	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
Malt									
AC Metcalfe	7908	100	10.9	67.3	49.1	59	80	81	1.0
AAC Synergy	8408	106	10.5	65.6	50.6	59	80	83	1.0
CDC Bow	8085	102	11.3	66.8	53.9	60	81	85	1.0
CDC Copeland	8534	108	10.6	65.3	53.5	60	81	93	1.0
CDC PlatinumStar	8339	105	10.8	65.5	52.7	60	81	87	1.0
Feed-Hulled									
Altorado	8918	113	11.5	67.6	54.3	60	83	82	1.0
Claymore	9448	119	10.4	66.8	53.0	60	83	87	1.0
Oreana	9751	123	10.8	67.4	55.2	61	84	74	1.0
Other (malting market may exist)1.0									
AAC Connect	8768	111	10.5	65.6	53.5	61	81	80	1.0
CDC Ascent	6163	78	13.0	75.4	47.3	63	87	77	1.0

CDC Copper	8464	107	10.0	65.5	50.4	60	83	77	1.0
CDC Fraser	8723	110	10.7	64.9	53.0	60	82	82	1.0
CDC Goldstar	8902	113	10.6	66.3	50.6	61	80	86	1.0
Lowe	8612	109	10.2	65.7	51.7	61	83	87	1.0
Sirish	8418	106	10.7	66.3	55.5	61	85	73	1.0
Experimental Entries									
TR15155	8680	110	10.2	66.2	52.8	61	82	78	1.0
TR14501	9034	114	11.3	64.8	45.4	53	83	87	1.0
TR16511	8473	107	11.1	62.1	533.6	53	84	99	1.0
LSD (0.05)	1034		0.7	0.8	1.9	1.3	1.9	6.6	NS
CV (%)	6.9		3.9	0.8	2.2	1.3	4.8	4.8	

NS = Not Significant

Table 8. Saskatchewan Variety Performance Group Irrigated Oat Regional Variety trial, ICDC Off-Station Knapik Site 2018.

Variety	Yield (kg/ha)	Yield % of CDC Dancer	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
CDC Dancer	7664	100	11.5	55.3	36.1	55	92	106	1.0
AC Morgan	8215	107	11.2	53.1	42.0	56	94	96	1.0
CS Camden	8969	117	12.4	52.8	39.5	54	91	92	1.0
CDC Arborg	9105	119	12.4	54.5	40.6	54	92	107	1.0
CDC Morrison	6922	90	14.4	53.6	35.7	55	91	93	1.0
CDC Norseman	8048	105	12.9	52.2	39.6	55	93	102	1.0
Akina	7932	103	11.9	52.9	41.4	57	94	97	1.0
Kara	8293	108	12.7	54.2	40.8	56	94	94	1.0
Ore3541M	6990	91	12.4	55.9	37.9	56	94	94	1.0
Ore3542M	6474	84	12.0	54.1	42.5	57	96	91	1.0
OT3087	8512	111	12.2	53.0	40.1	54	92	101	1.0
CFA1502	8638	113	11.9	55.0	38.4	55	94	95	1.0
LSD (0.05)	NS		0.5	1.3	3.5	2.1	1.6	7.2	NS
LSD (0.10)	1648								
CV (%)	12.2		2.6	1.4	5.3	2.3	1.02	4.4	

NS = Not Significant

Winter Wheat Variety Evaluation for Irrigation vs Dry Land Production

Funding

Funded by Agricultural Demonstration of Practices and Technologies (ADOPT) Program and ICDC

Principal Investigator

- Garry Hnatoiwich, PAg, Research Director, ICDC (Project Lead)
- Co-investigators: Dr. Robert Graf, AAFC Lethbridge Research Centre

Organizations

- Irrigation Crop Diversification Corporation (ICDC)

Objectives

This project's objective is to identify the top producing or best adapted varieties of winter wheat for irrigation production. Winter wheat varieties were last evaluated for their irrigation production potential approximately 25 years ago. No variety at that time suited intensive irrigation management. Genetic improvements to the latest winter wheat varieties warrant a renewed assessment for their potential under irrigation management. Results from these trials will also be used to develop a data base on winter wheat varieties for entry into the "*Crop Varieties for Irrigation*" publication.

Research Plan

Seed of twelve winter wheat varieties were acquired from winter wheat breeder Dr. R. Graf, AAFC-Lethbridge. Varieties were direct seeded into canola stubble on September 12, 2017. Winter wheat varieties were established in a small plot replicated and randomized trial design, replicated 3 times. All varieties are being evaluated under both irrigated and dry land systems. At seeding each trial received 80 kg N/ha as urea side banded and 25 kg P₂O₅/ha seed placed monoammonium nitrate, in the spring upon regrowth an additional 40 kg N/ha was intended to broadcast on the irrigated trial.

Results

Spring regrowth, or lack of, revealed significant over winter mortality among all varieties. The high winter mortality is attributed to the absence of snow cover and the extreme cold conditions that occurred through the 2017/2018 winter. The weather station at CSIDC reported temperatures as low of snow cover as -34.8 degrees Celsius on December 30th. Consequently, this trial was abandoned and will be repeated in 2018/2019.

Corn Variety Demonstration for Silage and Grazing

Funding

This project was funded by the Saskatchewan Ministry of Agriculture under the Canada-Saskatchewan Canadian Agricultural Partnership bi-lateral agreement.

Principal Investigator

- Travis Peardon, BSA, PAg. Livestock and Feed Extension Specialist, Saskatchewan Ministry of Agriculture.

Organizations:

- Saskatchewan Ministry of Agriculture
- Irrigation Crop Diversification Corporation (ICDC)

Objectives

Evaluate corn varieties suitable to growing conditions in the Lake Diefenbaker Development Area for silage quality and yield potential under irrigation.

Update ICDC's annual *Crop Varieties for Irrigation* guide.

Research Plan

Corn varieties were tested for their agronomic performance and nutritional quality under irrigation. The CSIDC site was planted on May 25 into soil classified as Bradwell loam to silty loam. Sixteen corn varieties were planted on 75cm (30 inch) row spacing. Each plot consisted of two corn rows. A seeding rate of 79,000 plants/ha (32,000 plants/ac) was targeted. Seed for each individual plot was packaged according to individual seed weights and adjusted for estimated per cent germination. All seed received from suppliers was treated. Fertilizer was broadcast and incorporated prior to seeding at a rate of 200 kg N/ha as urea (46-0-0). An additional 40 kg N/ha was side banded at seeding, and phosphorus fertilizer was seed placed at a rate of 20 kg P-2O₅/ha as 12-51-0 during the seeding operation. Weed control consisted of spring pre-plant and a post emergence application of glyphosate. All silage plots were harvested on September 20 with a Hegi forage harvest combine.

Sixteen corn varieties were provided by seed companies. Each variety selected was recommended for the corn heat units accumulated in the Lake Diefenbaker area.

Results

Cumulative Corn Heat Units as of September 5, 2018 were 2204 (date of first killing frost).

Table 1. Corn Varieties Included in 2018 Silage Corn Variety Demonstration

Company	Variety	Corn Heat Unit Rating
Dow Agro Sciences	Baxxos RR	2300
Thunder Seeds	TH 4126 RR	2250
Thunder Seeds	TH 7681 VT2P RIB	2350
Dekalb	DKC 27-55 RIB	2200
Dekalb	DKC 30-07RIB	2375
Dekalb	DKC 30-19RIB	2300
Brett Young/Elite	E44H12R	1950
Brett Young/Elite	E50P52R	2250
Brett Young/Elite	E58L17R	2675
Brett Young/Elite	Fusion	2250
Legend Seeds	LR 9579	2350
Legend Seeds	LR 9583	2450
Legend Seeds	LR 9676	2275
Legend Seeds	LR 98A84	2625
Pioneer	P7527AM	2150
Pioneer	P7958AM	2275

Table 2. Agronomic Data of Irrigated Silage Corn, 2018

Hybrid	Dry Yield (T/ha)	Dry Yield (T/ac)	Plant Stand (plants/ac)	Harvest Whole Plant Moisture (%)	10% Anthesis (days)	50% Silking (days)
BAXXOS RR	13.79	5.58	36648	73.4	70	73
4126 RR	13.96	5.65	31026	75.8	73	76
7681 VT2P RIB	13.81	5.59	36872	76.8	75	78
DKC 27-55 RIB	12.82	5.19	33162	75.7	70	73
DKC 30-07RIB	13.45	5.45	38109	77.2	74	78
DC 30-19	13.40	5.42	34399	75.1	71	74
E44H12R	13.54	5.48	32038	74.0	69	72
E50P52R	13.55	5.48	34399	76.6	74	77
E58L17R	13.04	5.28	34624	78.8	78	81
Fusion	14.96	6.06	35973	74.9	72	74
LR 9579	12.73	5.15	30802	77.7	75	78
LR 9583	12.85	5.20	33837	77.9	75	79
LR 9676	12.99	5.26	34624	76.1	70	74
LR 98A84	10.07	4.08	32376	80.2	78	81
P7527AM	14.58	5.90	35523	75.9	72	75
P7958AM	14.60	5.91	35186	74.8	72	76
LSD (0.05)	1.13	0.46	3902	1.2	1.1	1.2
CV (%)	5.9	5.9	8.0	1.1	1.1	1.1

Table 3. Nutritional Analysis of Irrigated Silage Corn, 2018

Variety	Corn Heat Units	Dry Yield (T/ac)	Crude Protein (%)	TDN (%)	Ca (%)	P (%)	Tons TDN/ac	Tons CP/ac
BAXXOS RR	2300	5.58	10.03	69.91	0.2	0.2	3.90	0.56
4126 RR	2250	5.65	10.13	67.29	0.24	0.18	3.80	0.57
7681 VT2P RIB	2350	5.59	9.85	65.37	0.21	0.19	3.65	0.55
DKC 27-55 RIB	2200	5.19	9.89	67.88	0.22	0.18	3.52	0.51
DKC 30-07RIB	2350	5.45	9.91	67.47	0.22	0.19	3.68	0.54
DC 30-19RIB	2300	5.42	10.89	68.75	0.22	0.2	3.73	0.59
E44H12R	2100	5.48	10.74	68.00	0.21	0.18	3.73	0.59
E50P52R	2400	5.48	10.33	68.15	0.21	0.19	3.73	0.57
E58L17R	2675	5.28	10.53	64.22	0.27	0.18	3.39	0.56
Fusion	2250	6.06	9.83	69.13	0.23	0.17	4.19	0.60
LR 9579	2350	5.15	11.17	65.80	0.28	0.19	3.39	0.58
LR 9583	2450	5.20	10.18	66.59	0.23	0.19	3.46	0.53
LR 9676	2275	5.26	10.16	67.33	0.24	0.18	3.54	0.53
LR 98A84	2625	4.08	11.39	65.70	0.29	0.19	2.68	0.46
P7527AM	2150	5.90	10.04	70.27	0.18	0.21	4.15	0.59
P7958AM	2275	5.91	9.68	68.31	0.21	0.18	4.04	0.57

Based on the 2018 yield data, the variety that performed the best under irrigated conditions was Fusion (Table 2). It should be noted that plant moisture at harvest was much higher than the 62 – 65% moisture typically harvested at. The harvest was conducted at this time as a frost was experienced on September 5 that resulted in leaf desiccation and leaf drop. Baxxos RR was used as the check variety to which all other corn varieties were compared.

The DM yield and Total Digestible Nutrients (TDN) tended to be lower in varieties with higher CHU requirements. Crude Protein (CP) values did not correlate with CHU requirements. Overall feed value expressed in tons CP/ac or tons TDN/ac was greatest in varieties with lower heat unit requirements, largely due to greater yield performance (Table 3).

Alberta AAFC Irrigated Dry Bean Narrow Row and Wide Row Variety Trials

Funding

Funded by the Irrigation Crop Diversification Corporation, partial funding provided by the Agriculture Development Fund and the Western Grains Research Foundation

Principal Investigator

- Garry Hnatowich, PAg, Research Director, ICDC (Project Lead)
- Co-investigators: Dr. P. Balasubramanian, Cathy Daniels and J. Braun
AAFC Lethbridge Research Centre

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Agriculture & Agri-Food Canada

Objectives

The Alberta Dry Bean Narrow Row and Wide Row Regional variety trials are intended to evaluate the performance of registered dry bean varieties under both wide row and narrow row production systems. They are not intended to compare production systems as the varieties within each system can differ.

Research Plan

The Alberta Dry Bean Narrow Row and Wide Row Regional variety trials were established in the spring of 2018 at two ICDC Off-station sites – Knapik and Pederson.

Both the Narrow Row and Wide Row trials included twelve dry bean varieties consisting of five market classes (pinto, black yellow, cranberry and great northern) were evaluated. Individual plots consisted of four rows with 20 cm row spacing for the Narrow Row trial and two rows with 60 cm spacing for the Wide Row trial and measured 4 m in length. All seed was treated with Apron Maxx RTA (fludioxonil and metalaxyl-M and S-isomer) for various seed rots, damping off and seedling blights and with and Stress Shield 600 (imidacloprid) for wireworm control. For both trials phosphorus fertilizer was side-banded at a rate of 25 kg P₂O₅/ha during the seeding operation. Granular inoculant was unavailable so nitrogen requirements were met by supplemental broadcast urea at the Knapik location, applied and irrigated immediately, for a total application of 100 kg N/ha. No supplemental N fertilizer was applied to the Pederson trials as they were established on potato stubble which soil testing procedures indicated a soil N reserve of 122 kg/ha. The Knapik trials were established on May 24, the Pederson trials on May 28. Weed control consisted of a pre-plant soil incorporated application of granular Edge (ethalfluralin) and a post-emergent applications of Basagran Forte (bentazon) + Viper ADV (imazamox and bentazon) supplemented by one in-season cultivation, for wide row trials, and periodic in-row hand weeding. No fungicide applications were deemed necessary in 2018. Yields were estimated by harvesting the entire plot. In all trials plot were under-cut and windrowed, allowed to dry in the windrow and then threshed to determine yield. The Knapik trials were undercut on August 30 and combined on September 27, at Pederson location undercutting occurred on August 30 and harvest September 28. In-season precipitation from May through August was 86 mm, in-season irrigation at Knapik was 258 mm and at Pederson 140 mm.

Results

Narrow Row

Agronomic data collected from each Narrow Row trial is shown in Tables 1 and 2. In general, dry bean yields were very high at the Knapik location and average for the Pederson location. Yield differences between the two sites could be due to the difference in irrigation applied throughout the growing season. Yield was also more variable at both trial locations in comparison to prior years. It is uncertain why this might be the case at the Pederson location. At the Knapik location late season sclerotinia did appear that likely caused a degree of variability between treatments. This disease occurrence occurred in August and was unexpected as this trial location had no prior history of dry bean production and had not had canola seeded within the last ten years. Dry bean traditionally does tend to be more variable in testing due to the large differences between, and within, market classes. Therefore despite the higher trial variation these results are deemed to be viable.

AC Black Diamond Black market class bean was the highest yielding variety while the experimental Cranberry class variety L12CB004 was the lowest yielding variety at the Knapik trialing site. The experimental Pinto class entry L13PS389 was the highest yielding variety, AAC Y12 (Yellow) was the lowest yielding variety at the Pederson site. Median yield of all varieties at Knapik was 6586 kg/ha and 3964 kg/ha at the Pederson site. Other agronomic differences measured within sites are not discussed.

Combined Narrow Row site analysis is outlined in Table 3. Highest yield was obtained with the Pinto experimental entry L13PS389 which was significantly higher than all varieties yielding less than 5000 kg/ha. The two Yellow market class and the single experimental Cranberry entry were the lowest yielding, as has been the historical case. Median seed yield of all varieties, over both sites, was 4878 kg/ha.

Test weight did not differ between the two test sites. Varieties did statistically differ between entries with respect to test weight and also were variable between market classes, however, the two Yellow class entries did have the highest test weights. Varieties matured at the same time between trialing locations. Combined site analysis indicated the Black market class varieties AC Black Diamond and Black Diamond 2 with the Yellow market class entries AAC Y012 & AAC Y015 were the longest to mature (days to maturity rounded to full days in Table 3), the experimental Cranberry variety L12CB004 was statistically earlier to mature compared to all other varieties, excepting the Pinto class variety AC Island. Plant height of varieties was greater at the Pederson location compared to the Knapik test site. The Great Northern entry AAC Whitestar was the tallest structured variety, L12CB004 the shortest. Varieties grown at Knapik exhibited a greater degree of lodging than plants grown at the Pederson location. L13PS389 exhibited the greatest degree of lodging, AAC Y012 the least. L13PS389 had the least amount of pod clearance, CDC Blackstrap the greatest, making CDC Blackstrap a good selection for solid seeding production systems. Pod clearance was greatest at the Pederson trial location.

Wide Row

Agronomic data collected from each Wide Row trial is shown in Tables 4 and 5.

In the wide row study at Knapik the Pinto market bean AAC Explorer was the highest yielding variety, this yield was statistically higher than any bean variety with a yield less than 5000 kg/ha. At Knapik the tree Pinto market class varieties were the highest yielding. The Yellow class variety AAC Y012 was the lowest yielding, statistically lower than all other dry bean entries at this location. At the Pederson location the experimental Pinto entry L13PS389 was statistically higher yielding than all other entries. The Great Northern variety AAC Tundra was the lowest yielding. Median yield of all varieties at the

Knapik trial was 4517 kg/ha and 2097 kg/ha at the Pederson site. Other agronomic differences measured within sites are not discussed.

Combined Wide Row site analysis is outlined in Table 6. Mean yield statistically differed between trial locations, with the Knapik trial producing significantly higher wide row production yields. Highest yield was obtained with the Pinto experimental entry L13PS389, this yield was statistically significant from all other entries. The Yellow class experimental variety AAC Y012 was the lowest yielding variety. Combined analyses indicated that yield between market classes were Pinto > Black > Great Northern > Cranberry > Yellow. Median yield of the combined sites was 2914 kg/ha.

Test weights were higher at the Pederson location, the Yellow entries AAC Y012 and AAC Y015 had significantly higher test weights than all other entries, the experimental Cranberry entry L12CB004 had significantly lower test weights compared to all other trial entries. No difference in days to maturity occurred between trial locations. L12CB004 was the earliest maturing entry (values in Table 6 rounded to nearest whole day), the two Black market class varieties, AC Black Diamond and AAC Black Diamond 2) the latest maturing. Plants tended to be taller at the Pederson test location. The Great Northern variety AAC Whitestar produced the tallest plants, the four tallest varieties were all from the Great Northern market class. The Yellow variety AAC Y015 the shortest. Lodging was higher at the Knapik than the Pederson location. The high yielding experimental entry L13PS389 exhibiting the greatest lodging, the Yellow and Cranberry class entries the least. Pod clearance was higher at the Pederson site, the experimental entry L13PS389 had the least pod clearance, AC Black Diamond exhibited the greatest pod clearance.

The results from these dry bean Narrow Row and Wide Row trials are used to update the irrigation variety database at ICDC and provide information to irrigators on the best dry bean varieties suited to irrigation conditions.

Table 1. 2018 Saskatchewan Irrigated Dry Bean Narrow Row Variety Trial, ICDC Off-Station Knapik Site.

Variety	Yield (kg/ha)	Test Weight (kg/hl)	Plant Count (plant/m ²)	Flower (days)	Maturity (days)	Height (cm)	Lodging (1–5)	Pod Clearance (%)
Pinto								
<i>AC Island</i>	6462	297	27	47	89	40	3.3	63
AAC Explorer	7041	374	26	49	89	39	3.3	55
L13PS389	8140	395	30	49	90	43	4.3	53
Black								
AC Black Diamond	9271	253	37	51	92	46	1.8	76
AAC Black Diamond 2	5131	262	29	50	91	43	2.2	74
CDC Blackstrap	6268	251	23	48	88	43	4.2	90

Great Northern								
AAC Tundra	8838	413	28	48	88	44	2.5	69
AAC Whitehorse	7076	396	32	47	88	43	2.5	69
AAC Whitestar	5370	431	34	47	89	51	2.0	75
Yellow								
AAC Y012	5466	411	42	46	91	46	1.0	77
AAC Y015	5436	402	30	45	90	47	1.0	75
Cranberry								
L12CB004	5066	621	29	47	87	44	1.0	83
LSD (0.05)	2219	78	8.0	1.0	0.99	NS	2.4*	8.5
CV (%)	23.3	4.8	18.5	1.5	0.7	11.0	65.1	7.7

NS = not significant

* = Significant at $P < 0.10$

Table 2. 2018 Saskatchewan Irrigated Dry Bean Narrow Row Variety Trial, ICDC Off-station Pederson Site.

Variety	Yield (kg/ha)	Test Weight (kg/hl)	Plant Count (plant/m ²)	Flower (days)	Maturity (days)	Height (cm)	Lodging (1–5)	Pod Clearance (%)
Pinto								
<i>AC Island</i>	5221	77.4	38	47	87	53	1.3	79
AAC Explorer	4601	77.4	28	50	89	55	1.8	78
L13PS389	5224	78.9	29	48	89	51	2.8	63
Black								
AC Black Diamond	4010	78.3	35	52	92	52	1.0	86
AAC Black Diamond 2	4141	80.2	28	51	92	51	1.5	84
CDC Blackstrap	2625	77.0	15	49	88	49	1.0	80
Great Northern								
AAC Tundra	3673	78.3	30	47	87	58	1.0	80
AAC Whitehorse	3838	77.1	33	46	87	57	1.5	76
AAC Whitestar	3862	78.3	31	46	88	56	1.0	80

Yellow								
AAC Y012	2503	80.4	19	43	91	49	1.0	75
AAC Y015	2832	81.3	27	43	90	52	1.0	79
Cranberry								
L12CB004	3374	72.6	23	44	88	47	1.0	79
LSD (0.05)	1178	1.2	3.7	1.5	0.97	5.7	0.6	4.9
CV (%)	21.4	1.0	9.3	2.3	0.8	7.5	33.4	4.4

Table 3. 2018 Saskatchewan Irrigated Dry Bean Narrow Row Variety Trial, Combined site.

Location/Variety	Yield (kg/ha)	Test Weight (kg/hl)	Plant Count (plant/m²)	Flower (days)	Maturity (days)	Height (cm)	Lodging (1–5)	Pod Clearance (%)
Location								
Knapik Site	6630	77.4	30	48	89	44	2.4	71
Pederson Site	3825	78.1	28	47	89	52	1.3	78
LSD (0.05)	570	NS	NS	0.2	NS	2.7	1.0	4.4
CV (%)	23.6	3.5	15.1	1.9	0.7	9.2	59.6	6.0
Variety								
Pinto								
AC Island	5842	77.9	32	47	88	46	2.3	71
AAC Explorer	5821	76.7	27	49	89	47	2.5	66
L13PS389	6682	78.0	29	48	89	47	3.5	58
Black								
AC Black Diamond	6640	78.3	36	51	92	49	1.4	81
AAC Black Diamond 2	4636	79.5	28	50	91	47	1.9	79
CDC Blackstrap	4446	76.7	19	49	88	46	2.6	85
Great Northern								
AAC Tundra	6255	78.3	29	47	88	51	1.8	74
AAC Whitehorse	5457	76.4	32	46	88	50	2.0	72
AAC Whitestar	4616	77.9	32	47	88	54	1.5	78

Yellow								
AAC Y012	3984	80.8	31	44	91	47	1.0	76
AAC Y015	4134	81.2	28	44	90	49	1.0	77
Cranberry								
L12CB004	4220	71.4	26	45	87	46	1.0	81
LSD (0.05)	1233	2.7	4.4	0.9	0.7	4.4	1.2	4.6
Location x Variety Interaction								
LSD (0.05)	S	NS	S	S	S	S	NS	S

S = Significant

NS = Not Significant

Table 4. 2018 Saskatchewan Irrigated Dry Bean Wide Row Variety Trial, ICDC Off-Station Knapik Site.

Variety	Yield (kg/ha)	Test Weight (kg/hl)	Plant Count (plant/m²)	Flower (days)	Maturity (days)	Height (cm)	Lodging (1–5)	Pod Clearance (%)
Pinto								
<i>AC Island</i>	<i>5342</i>	<i>75.7</i>	<i>21</i>	<i>43</i>	<i>89</i>	<i>43</i>	<i>2.5</i>	<i>66</i>
AAC Explorer	5371	76.0	19	43	89	44	3.0	63
L13PS389	5288	76.3	19	45	89	44	3.0	55
Black								
AC Black Diamond	4768	77.6	21	46	91	44	1.5	83
AAC Black Diamond 2	4664	78.3	20	46	91	45	2.3	70
Great Northern								
AC Resolute	3777	77.6	11	43	89	49	2.0	69
AAC Tundra	4529	78.4	16	43	88	48	2.8	63
AAC Whitehorse	4235	77.0	20	43	88	47	2.3	68
AAC Whitestar	4288	75.7	21	43	88	48	2.0	70
Yellow								
AAC Y012	2264	81.0	17	41	90	43	1.3	69
AAC Y015	2907	81.2	16	41	90	41	1.0	69

Cranberry								
L12CB004	3177	72.5	15	42	87	45	1.3	70
LSD (0.05)	573	1.6	3.8	0.9	0.9	NS	1.0	7.0
CV (%)	9.4	1.5	15.2	1.5	0.7	10.4	35.0	7.2

Table 5. 2018 Saskatchewan Irrigated Dry Bean Wide Row Variety Trial, ICDC Off-Station Pederson Site.

Variety	Yield (kg/ha)	Test Weight (kg/hl)	Plant Count (plant/m ²)	Flower (days)	Maturity (days)	Height (cm)	Lodging (1–5)	Pod Clearance (%)
Pinto								
<i>AC Island</i>	2292	76.8	25	46	87	51	1.0	78
AAC Explorer	2212	77.4	18	48	88	51	1.3	78
L13PS389	3430	79.3	22	48	88	49	2.5	68
Black								
AC Black Diamond	2340	78.1	24	52	91	51	1.0	74
AAC Black Diamond 2	2365	80.2	20	51	91	47	1.3	73
Great Northern								
AC Resolute	2122	78.8	12	47	88	47	1.0	75
AAC Tundra	1452	78.1	19	47	88	53	1.3	75
AAC Whitehorse	2413	76.8	22	45	87	51	1.8	75
AAC Whitestar	1869	77.3	22	45	87	53	1.0	71
Yellow								
AAC Y012	2010	81.9	16	43	91	45	1.0	63
AAC Y015	1940	80.9	20	43	90	43	1.0	70
Cranberry								
L12CB004	1889	72.2	14	44	88	41	1.0	68
LSD (0.05)	652	1.4	2.6	1.2	0.9	4.6	0.5	7.1
CV (%)	20.6	1.2	9.4	1.8	0.7	6.6	25.4	6.9

Table 6. 2018 Saskatchewan Irrigated Dry Bean Wide Row Regional Variety Trial, Combined site.

Location/Variety	Yield (kg/ha)	Test Weight (kg/hl)	Plant Count (plant/m ²)	Flower (days)	Maturity (days)	Height (cm)	Lodging (1–5)	Pod Clearance (%)
Location								
Knapik Site	4217	77.3	18	43	89	45	2.1	68
Pederson Site	2194	78.1	19	46	89	48	1.3	72
LSD (0.05)	849	0.7	NS	0.8	NS	1.7	0.6	2.0
CV (%)	13.3	1.4	12.4	1.6	0.7	8.5	33.7	7.0
Variety								
Pinto								
<i>AC Island</i>	3817	76.2	23	44	88	47	1.8	72
AAC Explorer	3791	76.7	18	46	89	48	2.1	70
L13PS389	4359	77.8	20	46	89	46	2.8	61
Black								
AC Black Diamond	3554	77.8	22	49	91	48	1.3	78
AAC Black Diamond 2	3515	79.3	20	49	91	46	1.8	71
Great Northern								
AC Resolute	2949	78.2	11	45	89	48	1.5	72
AAC Tundra	2990	78.3	17	45	88	51	2.0	69
AAC Whitehorse	3324	76.9	21	44	87	49	2.0	71
AAC Whitestar	3078	76.5	21	44	88	51	1.5	71
Yellow								
AAC Y012	2137	81.4	16	42	91	44	1.1	66
AAC Y015	2423	81.1	18	42	90	42	1.0	69
Cranberry								
L12CB004	2533	72.3	14	43	87	43	1.1	69
LSD (0.05)	426	1.0	2.3	0.7	0.6	4.0	S	4.9
Location x Variety Interaction								
LSD (0.05)	S	S	NS	S	S	NS	S	S

S = Significant NS = Not Significant

Saskatchewan Dry Bean Narrow Row Regional Variety Trial

Funding

Funded by the Irrigation Crop Diversification Corporation and the Saskatchewan Variety Performance Group

Project Lead

- Garry Hnatowich
- Co-investigators: Dr. K. Bett, Crop Development Centre

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Crop Development Centre

Objectives

Regional performance trials provide information on the various production regions available in Saskatchewan to assess productivity and risk of dry bean. This information is used by extension personnel, pulse growers and researchers across Saskatchewan to become familiar with these new pulse crops.

Research Plan

Dry Bean Narrow Row Regional variety trials were conducted in the spring of 2018 at CSIDC off-station locations – Knapik and Pederson. The trials were seeded May 24 at Knapik and on May 28 at the Pederson location. Eighteen dry bean varieties consisting of seven market classes (pinto, black, navy, yellow, cranberry, fleur de jaune and carioca) were evaluated. All seed was treated with Apron Maxx RTA (fludioxonil and metalaxyl-M and S-isomer) for various seed rots, damping off and seedling blights and with Stress Shield 600 (imidacloprid) for wireworm control. For both trials phosphorus fertilizer was side-banded at a rate of 25 kg P₂O₅/ha during the seeding operation. Granular inoculant was unavailable so nitrogen requirements were met by supplemental broadcast urea, applied and irrigated immediately, for a total application of 100 kg N/ha. At no time during dry bean growth did plants exhibit symptoms of nitrogen deficiencies. Weed control consisted of a pre-plant soil incorporated application of granular Edge (ethalfluralin) and a post-emergent application of Basagran Forte (bentazon) + Viper ADV (imazamox and bentazon) supplemented by periodic in-row hand weeding. No fungicidal applications were applied in 2018. Individual plots consisted of four rows with 25 cm row spacing and measured 1.0 m x 4 m. Yields were estimated by harvesting the entire plot. All rows in each plot were under-cut and windrowed, allowed to dry in the windrow and then threshed when seed moisture content was <20%. Both trials were undercut on August 30, and harvested on September 27 at Knapik and September 28 at Pederson. In-season precipitation from May through August was 258 mm and in-season irrigation at Knapik was 258 mm and at Pederson 140 mm.

Results

Results of the trials are shown in Table 1 for Knapik, Table 2 for Pederson off-station.

Caution should be used when assessing the yield results obtained at the Knapik trial. Analysis of variance procedures indicate a high degree of variation between variety yields and for most crops results would be dismissed as invalid. Trial results will be included in the report for documentation and

record keeping only. Results of the Knapik trial will not be used to update the ICDC variety data base nor used in any extension or variety guide. No discussion of results from Knapik (Table 1) will be made.

Results of the Pederson trial are shown in Table 2. The Pinto market class experimental entry NN11-2 was the highest yielding, statistically greater than any variety with yields less than 4400 kg/ha. Median seed yield for the trial was 4213 kg/ha. Varieties differed greatly with respect to test weight. Entries did vary significantly in plant stand, the old Pinto class variety CDC Pintium had the lowest number of established plants per square meter, the Navy class variety Portage the highest. Median plant stand for the trial was 38 plants/m². The experimental Yellow class entry 4510-3-1 was the first variety to flower, CDC Jet the last, median days to flower for the test was 48 days. CDC Blackstrap and AC Island were the first varieties to mature, CDC Ray the latest, median days to mature for the test was 89 days. Bolt produced the tallest plants, Envoy was the shortest variety. CDC Ray exhibited the highest degree of lodging. Median pod clearance of all entries was 80%.

The results from these trials are used to update (if applicable) the irrigation variety database at ICDC and provide recommendations to irrigators on the best dry bean varieties suited to irrigation conditions. Results of the 2017 Irrigated Dry Bean Regional Variety Trial will also be used in the development of the annual publications *Crop Varieties for Irrigation* and the Saskatchewan Ministry of Agriculture's *Varieties of Grain Crops 2017*.

Table 1. Saskatchewan Irrigated Dry Bean Narrow Row Regional Variety Trial, ICDC Off-Station Knapik Site, 2018.

Variety	Yield (kg/ha)	Test weight (kg/hl)	Plant Stand (plant/m ²)	Flower (days)	Maturity (days)	Lodge rating 1=upright 5=flat	Pod clearance (%)	Height (cm)
Pinto								
AC Island	8748	77.3	41	49	93	3.3	62	44
CDC Pintium	5059	76.4	20	47	91	3.0	63	45
CDC WM-2	6274	76.2	30	48	92	2.7	70	45
Medicine Hat	7385	74.4	36	52	94	3.0	63	48
NN11-2	6607	76.4	32	48	92	1.7	78	44
Black								
CDC Blackstrap	6872	74.7	51	50	92	1.7	83	45
CDC Jet	6768	75.1	44	54	96	2.0	77	53
CDC Superjet	7359	76.2	55	54	96	3.0	67	51
Navy								
AAC Shock	5497	78.4	43	49	96	1.3	80	51
Bolt	4775	79.3	32	52	95	2.3	73	53

Envoy	3400	80.1	38	49	91	3.3	60	38
Portage	5151	76.9	48	48	94	1.3	80	50
3458-7	4575	78.8	31	48	91	2.0	62	40
Yellow								
CDC Sol	5139	82.2	45	45	94	1.0	80	51
4510-3-1	5032	79.0	40	44	92	1.3	80	43
Cranberry								
7ab-3bola-3	2313	76.4	35	46	92	3.7	50	43
Fleur de Jaune								
CDC Ray	5693	78.4	33	53	96	1.7	75	53
Carioca								
3568-1	6638	78.4	37	52	95	4.3	60	50
LSD (0.05)	NS	2.4	8.5	1.6	1.4	1.1	16	6.0
CV (%)	26.6	1.9	13.4	1.9	0.9	28.5	13.9	7.7

Table 2. Saskatchewan Irrigated Dry Bean Narrow Row Regional Variety Trial, ICDC Off-Station Pederson Site, 2018.

Variety	Yield (kg/ha)	Test weight (kg/hl)	Plant Stand (plant/m ²)	Flower (days)	Maturity (days)	Lodge rating 1=upright 5=flat	Pod clearance (%)	Height (cm)
Pinto								
<i>AC Island</i>	5291	77.1	41	46	87	1.5	82	54
CDC Pintium	3906	77.3	18	48	88	2.0	80	48
CDC WM-2	5248	78.4	25	47	88	1.0	80	50
Medicine Hat	4865	75.4	36	52	89	1.0	83	56
NN11-2	5345	78.4	30	46	88	1.0	82	50
Black								
CDC Blackstrap	4400	76.9	44	48	87	1.0	87	45
CDC Jet	3504	76.8	39	56	91	1.0	90	54
CDC Superjet	3550	77.7	47	54	91	1.3	83	50
Navy								
AAC Shock	4132	79.8	40	49	91	1.0	87	54
Bolt	4573	79.5	40	51	90	1.0	88	59
Envoy	2346	80.2	34	49	88	2.3	77	42
Portage	4623	80.3	50	46	88	1.0	87	50
3458-7	3406	79.1	32	46	88	2.0	73	45
Yellow								
CDC Sol	4223	79.3	41	43	90	1.0	75	50
4510-3-1	4559	80.6	44	43	89	1.0	68	47
Cranberry								
7ab-3bola-3	2548	79.0	43	43	90	2.0	72	43
Fleur de Jaune								
CDC Ray	4542	80.33	37	52	92	3.3	63	48
Carioca								
3568-1	4008	80.6	32	51	91	2.7	63	51
LSD (0.05)	527	1.4	8.2	2.4	0.95	0.9	9.2	6.0
CV (%)	14.3	1.1	13.1	3.0	0.6	34.3	7.0	7.2

Soybean Regional Variety Trial

Funding

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Project Lead

- Garry Hnatowich
- Co-investigators: S. Phelps, Saskatchewan Pulse Growers

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Saskatchewan Pulse Growers
- Manitoba Agriculture, Food & Rural Initiatives

Objectives

The objectives of this study are:

- (1) To evaluate the potential of soybean varieties for production in the irrigated west-central region of Saskatchewan
- (2) To assess the suitability of soybean to irrigation as opposed to dry land production
- (3) To create a data base on soybean for *Crop Varieties for Irrigation*

Research Plan

Originally sixty soybean varieties were received through the Saskatchewan Pulse Growers for evaluation under both dry land and irrigation production assessment. However during the growing season it became apparent that entry # 14 was extremely late maturing and determined to have been a mistaken variety sent by a seed company. This entry was best adapted to Ontario, therefore it was eliminated from the trial. These trials were established at the ICDC Pederson off-station location. Plot size was 1.2 m x 4 m. All plots received 35 kg P₂O₅/ha as 12-51-0 as a sideband application during the seeding operation. Granular inoculant (Cell-Tech) with the appropriate *Rhizobium* bacteria strain (*Bradyrhizobium japonicum*) specific for soybean was seed placed during the seeding operation at a rate of 11.2 kg/ha. Both trials were seeded on May 23. Weed control consisted of a pre-plant soil incorporated application of granular Edge (ethalfluralin) and a post-emergence application of Roundup Transorb (glyphosate) supplemented by some hand weeding. First killing frost occurred on the morning of September 30. All entries had reached maturity. Yields were estimated by direct cutting the entire plot with a small plot combine when the plants were dry enough to thresh and the seed moisture content was <20%. Both trials were harvested on October 12. Total in-season precipitation at Pederson from May through September was 109 mm. Total in-season irrigation at Pederson was 140 mm.

Results

Fifty-nine Roundup Ready soybean varieties were evaluated. Plant emergence and seedling development was excellent; lack of precipitation through the growing season limited dryland yield potential. Seed yield, quality and agronomic data collected for the irrigated soybean are shown in Table 1. Yields were very high with a median yield of all fifty-nine entries of 3537 kg/ha (52.6 bu/ac). Yields of irrigated soybean ranged from a low of 2833 kg/ha (42.1 bu/ac) to a high of 4260 kg/ha (63.3 bu/ac). Oil

content varied dramatically among entries with a 6.4% difference between the lowest and highest % oil entries. Median protein content was 27.9%, very low. Test weight and seed weight also exhibited a wide variance between entries. Average maturity was 110 days, all entries did reach physiological maturity (95% of pods had turned from green to yellow or brown) prior to the occurrence of a fall frost. The latest maturing took 124 days, the earliest 96 days. Plant height varied among entries with the shortest at 53 cm to the tallest at 97 cm, median plant height of all varieties was 80 cm. Lodging resistance in most entries was very good, with the highest exhibiting lodging scores of 1.7 which would not result in harvest difficulties.

Seed quality and agronomic data collected for the dry land soybean are shown in Table 2. Median yield of all fifty-nine entries was 2014 kg/ha (29.9 bu/ac). Yields of dry land soybean ranged from a low of 1433 kg/ha (21.3 bu/ac) to a high of 2645 kg/ha (39.3 bu/ac). Oil content varied among entries with a 3.9% difference between the lowest and highest % oil entries. Median protein content was 27.5%. Test weight and seed weight also exhibited a wide variance between entries. Median maturity was 104 days and plant height 70 cm. Lodging resistance for dry land production with all entries was very good.

Combined test analyses between irrigation and dry land studies are shown in Table 3. Statistical analysis indicated that irrigated production produced greater yields than dry land production. This is not surprising considering the below average precipitation received in 2017. Average irrigated yield was 3517 kg/ha (52.3 bu/ac), average dry land yield 2016 kg/ha (30.0 bu/ac). Irrigation resulted in lower mean % oil and % protein of soybean. Irrigation did not influence test weight but did increase seed weight compared to dry land. On average irrigation resulted in an eight day delay in maturity, which was statistically significant. Irrigation did not induce a higher degree of lodging than the rain feed system. Irrigation also resulted in statistically taller plant height compared to dry land.

The results from these trials are used to update the variety database at ICDC and provide information to producers on soybean performance under west central Saskatchewan growing conditions. Annual testing of soybean varieties is essential for this potential crop.

Table 1. Agronomics of 2018 WC Soybean Performance Evaluation - Irrigated Soybean, 2018.

#	Variety	Yield (kg/ha)	% Oil	% Protein	Test weight (kg/hl)	Seed weight (g/1000)	Plants m ²	Maturity (days)	Height (cm)	Lodge (1-5)
1	PV 17s0007 RR2X	3015	19.0	27.6	71.9	122	49	104	77	1.0
2	PV 16s004	3867	17.6	27.5	72.2	140	44	113	83	1.3
3	PV 11s001 RR2	3631	18.0	30.1	72.0	138	56	110	72	1.7
4	PV 15s0009	3294	17.6	28.6	71.7	123	50	111	93	1.3
5	PV 10S005 RR2	3482	18.1	27.5	69.2	121	51	124	87	1.0
6	Fisher R2X	3114	17.7	27.8	71.8	118	44	111	77	1.0
7	P000A87R	3059	19.3	28.5	71.2	124	52	100	64	1.0
8	P002A63R	4034	18.6	28.1	71.7	127	60	108	86	1.0
9	P0007A65R	2833	19.9	27.7	71.4	125	48	100	72	1.0
10	P0007A43R	3012	19.1	30.1	69.4	118	45	96	67	1.0
11	P005A27X	4083	18.3	27.7	71.2	135	54	111	79	1.0

12	P006T46R	3860	19.2	27.1	71.0	130	53	113	76	1.0
13	Nocoma R2	3804	17.3	30.7	72.7	126	54	104	83	1.7
14	INCORRECT VARIETY ENTERED INTO TRIAL - ELIMINATED									
15	CFS18.06 R2D	3776	17.9	29.3	71.5	139	43	119	97	1.0
16	CFS18.02 R2D	3957	17.7	28.2	71.4	138	46	116	86	1.3
17	CFS18.01 R2D	3520	17.6	28.2	71.4	122	46	114	80	1.0
18	CFS18.50	3969	16.7	29.2	72.9	125	51	112	89	1.3
19	LS TRI7XT	3537	18.1	28.2	72.7	124	52	108	84	1.0
20	LS TRI92R2Y	3126	19.0	27.4	71.4	117	49	109	83	1.0
21	LS 001XT	3621	18.2	27.0	72.1	128	49	107	86	1.0
22	LS TRI8XT	3151	17.2	28.3	71.6	121	51	107	78	1.0
23	DKB0005- 44	3708	18.4	27.6	71.2	106	51	103	82	1.0
24	22-60RY	3514	18.3	27.0	71.5	114	51	109	74	1.0
25	DKB003-29	3315	18.4	26.9	71.2	141	46	115	83	1.0
26	DKB0009- 89	3509	18.2	27.7	72.1	136	60	109	82	1.3
27	23-11RY	3384	18.2	27.1	72.1	113	46	112	81	1.0
28	NSC Newton RR2X	3422	17.8	29.8	70.7	132	42	120	91	1.0
29	NSC Redvers RR2X	3196	18.2	26.7	71.8	109	55	110	74	1.0
30	NSC Melfort RR2X	3252	19.4	27.7	70.3	98	59	105	72	1.0
31	NSC Watson RR2Y	3433	19.8	27.6	70.6	132	54	100	72	1.0
32	NSC LEROY RR2Y	3290	18.5	30.0	71.4	115	55	102	79	1.0
33	PS 00095 R2	3891	19.4	27.9	71.1	135	57	111	77	1.7
34	PS 0044 XRN	3516	18.2	27.3	72.4	118	57	114	85	1.0
35	PS 00078XRN	3798	18.1	28.4	71.7	114	53	110	73	1.0
36	PS 0035 NR2	3711	17.5	27.9	70.4	155	50	115	85	1.0
37	Barron R2X	2896	18.9	29.5	71.2	104	61	105	75	1.3
38	Mahony R2	3673	15.1	27.7	70.8	129	49	118	90	1.3

39	MCLEOD R2	3520	17.6	27.9	71.7	144	47	113	84	1.3
40	Prince R2X	3368	14.1	26.9	72.4	128	47	111	81	1.0
41	Foote R2	3953	16.8	27.1	71.4	113	53	122	95	1.3
42	DARIO R2X	3375	19.0	29.0	72.96	110	49	109	83	1.0
43	DAYO R2X	3171	18.8	29.0	71.4	119	52	102	53	1.3
44	CBZ916B2-CODNN	3586	19.0	29.2	72.6	118	55	111	94	1.0
45	Kosmo R2	3450	17.9	27.8	71.0	130	78	115	83	1.7
46	Torro R2	3124	18.6	28.1	71.7	117	52	110	86	1.0
47	S0007-B7X	2975	19.4	27.9	70.4	126	27	100	64	1.3
48	S0009-D6	4036	19.3	27.9	71.0	116	93	102	85	1.0
49	S0009-M2	3065	20.5	28.0	70.3	121	38	101	59	1.0
50	S003-L3	3807	20.0	27.8	70.9	143	44	103	73	1.3
51	S006-W5	3333	19.3	27.7	71.7	106	41	109	72	1.0
52	S007-Y4	4091	17.4	28.2	71.5	129	48	109	83	1.0
53	TH 33003 R2Y	3928	18.6	28.1	71.5	128	51	110	79	1.0
54	TH 890005 R2XN	3188	18.3	27.3	71.4	113	46	102	72	1.0
55	TH 87003 R2X	3610	18.0	28.7	71.0	136	56	112	85	1.3
56	TH 87000 R2X	3182	18.5	29.9	72.6	103	57	107	76	1.0
57	TH 37004 R2Y	3647	18.4	27.9	71.5	120	50	118	94	1.7
58	TH 32004 R2Y	4260	17.9	28.7	70.8	129	51	115	84	1.7
59	Akras R2	4009	16.3	27.0	73.2	127	40	117	80	1.0
60	RX000918	3573	18.1	27.0	71.6	117	51	110	76	1.7
	LSD (0.05)	653	1.9	1.5	1.0	11.4	8.9	4.9	9.7	NS
	CV (%)	11.5	6.4	3.4	0.9	5.7	10.9	7.5	7.5	31.6

NS = not significant

Table 2. Agronomics of 2018 WC Soybean Performance Evaluation – Dry Land Soybean, 2018.

#	Variety	Yield (kg/ha)	% Oil	% Protein	Test weight (kg/hl)	Seed weight (g/1000)	Plants m ²	Maturity (days)	Height (cm)	Lodge (1-5)
1	PV 17s0007 RR2X	1644	20.3	27.2	69.5	113	51	94	62	1
2	PV 16s004	2077	18.7	27.3	71.5	117	54	106	69	1
3	PV 11s001 RR2	1849	19.4	29.6	67.4	109	48	106	66	1
4	PV 15s0009	2006	19.2	28.2	71.9	109	52	105	77	1
5	PV 10S005 RR2	2162	18.9	26.8	71.2	118	44	113	69	1

6	Fisher R2X	1681	19.5	27.3	71.1	105	46	103	65	1
7	P000A87R	1595	20.2	29.4	71.2	110	55	93	58	1
8	P002A63R	2110	19.4	28.8	70.9	116	50	102	75	1
9	P0007A65R	1434	20.8	29.3	67.7	106	48	91	58	1
10	P0007A43R	1480	20.8	30.2	68.8	91	47	90	63	1
11	P005A27X	2645	18.8	29.4	71.6	132	48	109	71	1
12	P006T46R	2184	19.6	27.9	70.7	117	47	107	75	1
13	Nocoma R2	2044	19.7	28.2	72.1	115	45	94	75	1
14	INCORRECT VARIETY ENTERED INTO TRIAL – ELIMINATED									
15	CFS18.06 R2D	1757	19.3	28.0	71.6	107	37	112	77	1
16	CFS18.02 R2D	2283	19.2	27.5	71.7	113	43	106	72	1
17	CFS18.01 R2D	2255	18.9	28.1	71.5	109	44	107	70	1
18	CFS18.50	2058	17.5	28.0	72.6	113	46	106	68	1
19	LS TRI7XT	1745	19.8	27.4	70.5	110	48	100	74	1
20	LS TRI92R2Y	2010	19.7	27.9	71.6	114	56	102	70	1
21	LS 001XT	2054	19.1	27.3	72.0	118	48	102	75	1
22	LS TRI8XT	1916	19.3	27.2	70.2	101	50	101	68	1
23	DKB0005-44	1921	20.3	27.1	69.8	94	49	97	65	1
24	22-60RY	2251	18.9	27.4	71.3	104	55	107	62	1
25	DKB003-29	1995	19.1	27.2	71.5	147	51	105	78	1
26	DKB0009-89	2185	19.5	27.0	72.5	126	47	101	68	1
27	23-11RY	2071	19.5	26.8	71.1	98	41	105	67	1
28	NSC Newton RR2X	1801	19.3	29.5	71.1	101	44	108	76	1
29	NSC Redvers RR2X	2058	19.1	26.7	71.2	108	48	106	65	1
30	NSC Melfort RR2X	1490	20.2	27.8	69.9	89	43	101	65	1
31	NSC Watson RR2Y	2032	20.0	29.0	71.1	125	51	93	60	1
32	NSC LEROY RR2Y	1998	19.1	30.8	69.9	104	48	93	71	1
33	PS 00095 R2	2364	20.3	25.9	70.0	109	54	99	70	1
34	PS 0044 XRN	1961	19.6	26.8	72.2	103	63	105	67	1

35	PS 00078XRN	1888	19.6	27.7	71.1	96	44	101	60	1
36	PS 0035 NR2	2260	18.3	25.5	71.6	138	52	108	79	1
37	Barron R2X	1836	19.8	29.7	71.3	109	58	100	71	1
38	Mahony R2	2238	19.6	26.8	71.3	115	46	106	77	1
39	MCLEOD R2	2223	19.0	26.7	71.6	124	47	106	78	1
40	Prince R2X	1976	18.4	26.8	71.5	114	53	106	67	1
41	Foote R2	1861	18.1	26.4	72.1	109	46	112	68	1
42	DARIO R2X	1694	19.3	30.6	72.2	110	44	101	74	1
43	DAYO R2X	1834	20.3	28.6	71.1	101	50	93	54	1
44	CBZ916B2- CODNN	1919	20.0	29.1	72.2	112	43	104	72	1
45	Kosmo R2	2238	18.5	27.8	71.9	119	67	111	73	1
46	Torro R2	2195	19.2	28.5	71.2	113	63	101	76	1
47	S0007-B7X	2237	20.8	27.1	70.8	124	35	93	70	1
48	S0009-D6	2211	20.5	27.9	71.0	110	73	94	73	1
49	S0009-M2	2135	21.4	27.4	70.3	109	52	93	70	1
50	S003-L3	2267	20.6	27.5	70.8	132	47	99	67	1
51	S006-W5	1809	20.8	27.1	70.8	93	45	97	67	1
52	S007-Y4	2465	19.4	27.0	71.9	120	52	106	64	1
53	TH 33003 R2Y	2182	19.8	27.0	71.5	112	48	106	82	1
54	TH 890005 R2XN	2038	19.4	27.9	71.1	100	48	98	62	1
55	TH 87003 R2X	2011	19.4	27.2	71.5	108	48	105	75	1
56	TH 87000 R2X	1749	19.7	30.2	72.4	103	55	103	67	1
57	TH 37004 R2Y	1953	18.9	27.2	71.1	108	48	111	73	1
58	TH 32004 R2Y	1972	19.7	26.8	71.6	110	45	107	65	1
59	Akras R2	2362	17.7	26.7	73.2	123	44	107	67	1
60	RX000918	2278	19.8	26.7	70.6	106	52	104	71	1
	LSD (0.05)	417	0.7	1.6	1.6	16.3	14.1	2.9	7.7	NS
	CV (%)	12.8	2.2	3.5	1.4	9.0	17.7	1.8	6.9	1

NS = not significant

Table 3. Agronomics of 2018 WC Soybean Performance Evaluation – Irrigated vs Dry Land Soybean, 2018.

#	System Variety	Yield (kg/ha)	% Oil	% Protein	Test weight (kg/hl)	Seed weight (g/1000)	Plants m ²	Maturity (days)	Height (cm)	Lodge (1-5)
System										
	Irrigated	3517	18.2	28.1	71.5	124	51	110	80	1.2
	Dry Land	2016	19.5	27.8	71.1	111	49	102	69	1.0
	LSD (0.05)	219	0.6	0.1	NS	2.9	NS	0.4	3.8	NS
	CV (%)	12.3	4.7	3.4	1.1	7.4	14.6	2.4	7.3	23.9
Variety										
1	PV 17s0007 RR2X	2330	19.6	27.4	70.7	117	50	99	69	1.0
2	PV 16s004	2972	18.1	27.4	71.8	128	49	109	76	1.2
3	PV 11s001 RR2	2740	18.7	29.9	69.7	123	52	108	69	1.3
4	PV 15s0009	2650	18.4	28.4	71.8	116	51	108	85	1.2
5	PV 10S005 RR2	2822	18.5	27.2	70.2	119	47	119	78	1.0
6	Fisher R2X	2398	18.6	27.5	71.4	112	45	107	71	1.0
7	P000A87R	2327	19.8	28.9	71.2	117	53	97	61	1.0
8	P002A63R	3072	19.0	28.5	71.3	121	53	105	81	1.0
9	P0007A65R	2134	20.4	28.5	69.6	115	48	96	65	1.0
10	P0007A43R	2246	19.9	30.2	69.1	105	46	93	65	1.0
11	P005A27X	3364	18.5	28.6	71.4	133	51	110	75	1.0
12	P006T46R	3022	19.4	27.5	70.8	124	50	110	75	1.0
13	Nocoma R2	2924	18.5	29.4	72.4	121	49	99	79	1.3
14	INCORRECT VARIETY ENTERED INTO TRIAL – ELIMINATED									
15	CFS18.06 R2D	2767	18.6	28.7	71.6	123	40	116	87	1.0
16	CFS18.02 R2D	3120	18.4	27.8	71.6	126	45	111	79	1.2
17	CFS18.01 R2D	2888	18.2	28.2	71.5	116	45	111	75	1.0
18	CFS18.50	3014	17.1	28.6	72.8	119	48	109	78	1.2
19	LS TRI7XT	2641	19.0	27.9	71.6	117	50	104	79	1.0
20	LS TRI92R2Y	2568	19.4	27.6	71.5	115	52	106	77	1.0
21	LS 001XT	2837	18.7	27.1	72.1	123	49	104	81	1.0
22	LS TRI8XT	2533	18.3	27.7	70.9	111	50	104	73	1.0
23	DKB0005-44	2814	19.4	27.4	70.5	100	50	100	73	1.0

24	22-60RY	2882	18.6	27.2	71.4	109	53	108	68	1.0
25	DKB003-29	2655	18.8	27.1	71.4	144	49	110	81	1.0
26	DKB0009-89	2847	18.9	27.4	72.3	131	54	105	75	1.2
27	23-11RY	2727	18.9	27.0	71.6	106	43	109	74	1.0
28	NSC Newton RR2X	2612	18.6	29.7	70.9	117	43	114	83	1.0
29	NSC Redvers RR2X	2627	18.7	26.7	71.5	108	52	108	70	1.0
30	NSC Melfort RR2X	2371	19.8	27.8	70.1	93	51	103	69	1.0
31	NSC Watson RR2Y	2733	19.9	28.3	70.9	129	52	96	66	1.0
32	NSC LEROY RR2Y	2644	18.8	30.4	70.7	109	52	97	75	1.0
33	PS 00095 R2	3128	19.9	26.9	70.6	122	56	105	74	1.3
34	PS 0044 XRN	2738	18.9	27.0	72.3	111	60	110	76	1.0
35	PS 00078XRN	2843	18.9	28.1	71.4	105	49	105	66	1.0
36	PS 0035 NR2	2985	17.9	27.7	71.0	147	51	112	82	1.0
37	Barron R2X	2366	19.4	29.6	71.3	106	60	103	73	1.2
38	Mahony R2	2956	17.4	27.2	71.1	122	47	112	84	1.2
39	MCLEOD R2	2871	18.3	27.3	71.7	134	47	109	81	1.2
40	Prince R2X	2672	16.3	26.8	72.0	121	50	109	74	1.0
41	Foote R2	2907	17.4	26.8	71.8	111	50	117	81	1.2
42	DARIO R2X	2535	19.2	29.8	72.4	110	47	105	78	1.0
43	DAYO R2X	2502	19.5	28.8	71.2	110	51	98	53	1.2
44	CBZ916B2- CODNN	2753	19.5	29.1	72.4	115	49	108	83	1.0
45	Kosmo R2	2844	18.2	27.8	71.4	125	73	113	78	1.3
46	Torro R2	2660	18.9	28.3	71.5	115	57	106	81	1.0
47	S0007-B7X	2606	20.1	27.5	70.6	125	31	97	67	1.2
48	S0009-D6	3123	19.9	27.9	71.0	113	83	98	79	1.0
49	S0009-M2	2600	21.0	27.7	70.3	115	45	97	65	1.0
50	S003-L3	3037	20.3	27.7	70.8	137	46	101	70	1.2
51	S006-W5	2571	20.1	27.4	71.2	100	43	103	70	1.0
52	S007-Y4	3278	18.4	27.6	71.7	125	50	107	73	1.0

53	TH 33003 R2Y	3050	19.2	27.6	71.5	120	49	108	81	1.0
54	TH 890005 R2XN	2613	18.8	27.6	71.3	107	47	100	67	1.0
55	TH 87003 R2X	2811	18.7	28.0	71.2	122	52	109	80	1.2
56	TH 87000 R2X	2465	19.1	30.1	72.5	103	56	105	72	1.0
57	TH 37004 R2Y	2800	18.6	27.6	71.3	114	49	115	83	1.3
58	TH 32004 R2Y	3116	18.8	27.8	71.2	119	48	111	75	1.3
59	Akras R2	3185	17.0	26.9	73.2	125	42	112	73	1.0
60	RX000918	2925	19.0	26.9	71.1	112	52	107	74	1.3
	LSD (0.05)	385	1.0	1.1	0.9	9.9	8.3	2.9	6.2	NS
System vs Variety										
	LSD (0.05)	NS	NS	NS	S	S	NS	S	S	NS

S = Significant

NS = not significant

Conventional Soybean Variety Trial

Funding

Funded by the Irrigation Crop Diversification Corporation, partial funding provided by the Saskatchewan Pulse Growers

Project Lead

- Garry Hnatowich
- Co-investigators: S. Phelps, Saskatchewan Pulse Growers

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Saskatchewan Pulse Growers

Objectives

The objective of this study is

- To evaluate the potential of conventional soybean varieties for production in the irrigated west-central region of Saskatchewan.

Research Plan

Seven soybean varieties were received through the Saskatchewan Pulse Growers for evaluation under irrigation production assessment. Plot size was 1.2 m x 4 m. All plots received 35 kg P₂O₅/ha as 12-51-0 as a sideband application during the seeding operation. Granular inoculant (Cell-Tech) with the appropriate *Rhizobium* bacteria strain (*Bradyrhizobium japonicum*) specific for soybean was seed placed during the seeding operation at a rate of 11.2 kg/ha. The trial was seeded on May 23. Weed control consisted of a pre-plant soil incorporated application of granular Edge (ethalfluralin) and a post-emergence application of Viper ADV (imazamox & bentazon) supplemented by some hand weeding. First killing frost occurred on the morning of September 30. All entries had reached maturity. Yields were estimated by direct cutting the entire plot with a small plot combine when the plants were dry enough to thresh and the seed moisture content was <20%. The trial was harvested on October 12. Total in-season precipitation from May through September was 109.0 mm. Total in-season irrigation at was 140 mm.

Results

No reliable information on varieties can be made with respect to seed yield because of the high degree of variability within the test as determined by statistical analysis procedures. Part of the variability within the trial was due to noticeably salinity influencing plant growth within the trial. Yields obtained are similar to the glyphosate tolerant trial performed under dryland conditions discussed in the previous trial.

To ascertain how conventional soybean varieties perform under irrigated production requires trialing over numerous years.

Table 1. Yield and characteristics of irrigated conventional soybean varieties.

Variety	Yield (kg/ha)	% Oil	% Protein	Test weight (kg/hl)	Seed weight (g/1000)	Plants m ²	Maturity (days)	Height (cm)	Lodge (1-5)
<i>OAC Prudence</i>	2765	17.5	30.6	72.1	150	39	112	74	1
Terra S-11	2355	17.8	31.8	69.6	129	50	117	63	1
AAC Edward	2835	17.4	34.3	71.4	128	47	102	51	1
Alaska	2405	17.7	32.8	73.9	126	50	101	57	1
PR110524Z023	3317	18.7	29.7	72.9	130	53	109	70	1
Maxus	2595	16.9	32.5	72.3	148	37	110	67	1
JARI	2617	17.9	31.3	68.9	136	50	114	76	1
CF18.1.01	2302	17.8	32.0	68.8	128	55	113	58	1
LSD (0.05)	NS	NS	NS	2.6	NS	9.7	6.7	11.5	NS
CV (%)	26.2	6.0	7.8	2.1	10.6	11.6	3.5	10.2	1

NS = not significant

AGRONOMIC TRIALS

Defining Agronomic Practices for Forage Corn Production in Saskatchewan

Funding

Funded by the Agriculture Development Fund (ADF)

Project Leads

- Dr. Joy Agnew, PAMI
- Co-investigator:
 - Garry Hnatowich, ICDC Outlook
 - Lana Shaw, SERF Redvers
 - Michael Hall, ECRF Yorkton
 - Jessica Weber, WARC Scott
 - Stephanie Ginter, NARF Melfort
 - Dr. Bart Lardner, Western Beef Development Centre Lanigan

Organizations

- Prairie Agricultural Machinery Institute
- Western Beef Development Centre
- 5 Agri-ARM members

Objectives

The objectives of this study are to:

- (1) To develop and refine seeding and fertility recommendations for corn silage production
- (2) To evaluate the cost of production and feed quality of corn silage grown in Saskatchewan.

Research Plan

Corn production in Saskatchewan is gaining popularity due to its high feed quality for cattle production. The agronomic recommendations for corn production in Saskatchewan are based on field trials conducted before hybrids were developed for the corn heat units (CHUs) typically experienced in Saskatchewan. Since the input costs for corn production are more than double the input costs for barley or oats (*2015 Crop Production Guide*), more refined recommendations for seeding and fertility rates are required to maximize profitability. In addition, a detailed economic analysis on the cost of production and an analysis of the feed value of the product are required to facilitate management decisions regarding feedstocks and feeding practices.

The silage trial was established in the spring of 2018 at the ICDC Off-station Pederson site. The soil, developed on medium to moderately coarse-textured lacustrine deposits, is classified as Bradwell loam to silty loam.

All seeding operations were conducted using a commercial precision corn planter owned and operated

by PAMI. The trial was established in a factorial randomized complete block with three replications, treatments consisted of;

- two corn hybrids with varying corn heat unit maturity ratings,
- three seeding rates – 75,000 (low), 100,000 (mid) and 125,000 (high) plants/ha, and
- three rates of nitrogen (N) fertilizer application such that soil N + fertilizer N = 112 (low), 168 (mid) and 224 (high) kg N/ha (100, 150 and 200 lbs N/ac).

Corn hybrids were Pioneer P7958AM (2300 CHU) and DeKalb 30-07 (2325 CHU). Soil test analysis indicated a level of soil available N to a depth of 0 – 30 cm as 91 kg N/ha (81 lb N/ac) so supplemental N fertilizer, as 46-0-0, was applied in a broadcast application at rates of 21, 77 and 133 kg/ha (19, 69 and 119 lb N/ac) to achieve target N levels. Fertilizer was applied and incorporated on May 9. The corn was seeded on 76 cm row spacing. Four rows were seeded per treatment plot. Corn plots consisted of four rows and measured 3 m x 6 m.

The trials were seeded on May 17. Fertilizer N was broadcast and incorporated prior to seeding along with 45 kg P₂O₅/ha as 12-51-0 in a pre-seed band application. Weed control consisted of spring pre-plant and a post emergence applications of Roundup (glyphosate) supplemented by hand weeding.

Silage yield was obtained when the milk line of each hybrid from their respective mid-seeding rate and mid-N fertilizer rate reached the mid-point down the kernel. The silage was harvested with a Hegi forage harvest combine equipped with a corn silage chopper header, wet field yield was recorded and subsamples of chopped material sampled for processing. Silage corn was harvest September 18.

Growing season rainfall (May through September 18) and irrigation was 102 mm and 140 mm, respectively. Cumulative Corn Heat Units (CHU) were 2308 for the period May 15 - September 17. Climatic conditions in 2018 were normal for temperature but much drier than historic norms.

Results

Agronomic data collected in the study is tabulated in Table 1 (analysis of variance procedures conducted on entire data set), results of each factorial treatment within the test are summarized in Table 2.

Analysis of variance procedures conducted upon all treatments indicate that there were statistically significant differences between treatments with respect to dry and wet yield. However, factorial analysis of variance procedures indicates that only hybrid and seeding rate resulted in significant yield differences as shown in Table 2 and Figure 1. Though number of cobs per plot were not recorded the yield gain associated with increasing seeding rate can likely be attributed to the higher plant counts associated with higher plant density per plot. Yield differences between nitrogen (N) fertilization rates were not statistically different (Figure 1). The lack of yield response to N is surprising. Although the spring soil test analysis indicated a high level of available N in the soil (the trial was established on potato stubble), corn would have been thought to respond to fertilizer due to its high N demand and usage. There is a possibility that the lack of a nitrogen fertilizer yield response was due to high levels of available N in the soil at depths below which was sampled for analyses. Irrigation applied was likely minimal for corn (amount applied dictated by all crop types grown at this location) and with the dry growing season of 2018 it's possible the corn roots either grew into subsurface N reserves or N reserves moved to roots by upward movement of soil solution by capillary action. It is also possible that a portion of the broadcast N applied was lost to plant availability through such mechanisms as volatilization, denitrification, leaching or immobilization.

As indicated in Table 2 the hybrids evaluated differed in plant characteristics. N fertilizer application rates had little dramatic impact on any agronomic measurement captured in 2018.

These results are from the third and final year of a three-year study. PAMI will combine this data with the results from another four locations and a complete report prepared at project completion.

Table 1. Defining Agronomic Practices for Forage Corn Production – 2018 ICDC Pederson site.

Hybrid	N Rate	Seed Rate	Dry Yield (T/ha)	Wet Yield (65% Moisture T/ha)	% Moisture	Plant Stand (#/ha)	Days to Anthesis	Days to Silk	Plant Height (cm)
1. P7958AM	Low	Low	18.70	53.42	66.1	67982	69	73	229
2. P7958AM	Low	Mid	19.52	55.78	67.1	91740	69	72	236
3. P7958AM	Low	High	20.26	57.89	67.4	113670	69	71	239
4. P7958AM	Mid	Low	18.55	52.99	67.7	73465	70	73	236
5. P7958AM	Mid	Mid	20.79	59.42	65.5	92105	70	72	251
6. P7958AM	Mid	High	19.42	55.48	68.7	111842	69	73	206
7. P7958AM	High	Low	18.23	52.08	69.2	68713	69	73	242
8. P7958AM	High	Mid	20.20	57.71	66.9	92471	69	73	235
9. P7958AM	High	High	19.93	56.94	68.3	110015	70	73	230
10. 30-07	Low	Low	17.41	49.75	67.4	72368	70	73	242
11. 30-07	Low	Mid	18.03	51.50	68.4	91374	69	72	235
12. 30-07	Low	High	18.47	52.77	67.7	112573	69	73	243
13. 30-07	Mid	Low	16.66	47.60	69.6	72734	69	72	243
14. 30-07	Mid	Mid	18.75	53.56	68.6	93933	70	73	230
15. 30-07	Mid	High	19.71	56.30	69.9	116228	69	73	249
16. 30-07	High	Low	17.47	49.92	70.7	78947	70	74	235
17. 30-07	High	Mid	18.79	53.67	69.8	92386	70	73	247
18. 30-07	High	High	18.35	52.44	70.0	109284	70	74	240
LSD (0.05)			2.01	5.73	2.4	7190	NS	NS	17.7
CV (%)			6.4	6.2	2.1	4.7	1.3	1.8	4.5

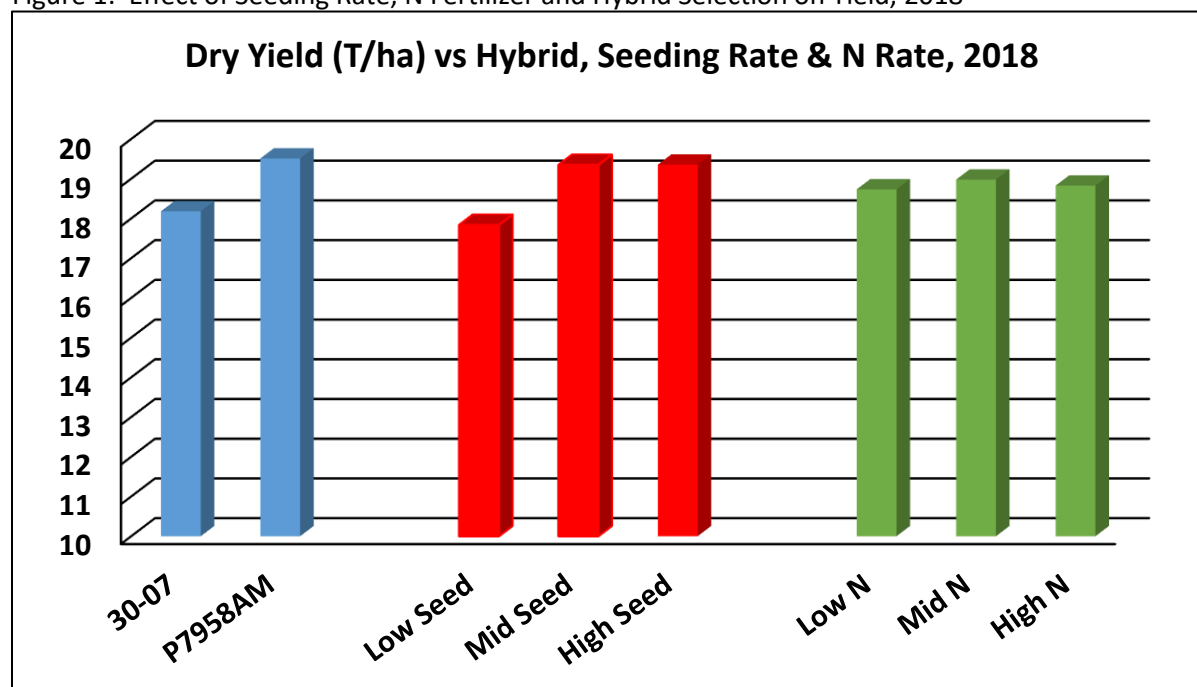
NS = not significant

Table 2. Factorial Analysis of Variance for Agronomic Parameters of Forage Corn – 2018 ICDC Pederson

Treatment	Dry Yield (T/ha)	Wet Yield (65% Moisture T/ha)	% H ₂ O	Plant Stand (#/ha)	Days to Anthesis	Days to Silk	Plant Height (cm)
Hybrid							
P7958AM	19.51	55.75	67.4	91334	69	73	234
30-07	18.18	51.95	69.1	93364	70	73	240
LSD (0.05)	0.67	1.91	0.8	NS	NS	NS	5.9
Seeding Rate							
Low	17.84	50.96	68.5	72368	70	73	238
Mid	19.35	55.27	67.7	92410	69	73	239
High	19.36	55.30	68.7	112269	69	73	235
LSD (0.05)		2.34	NS	2936	NS	NS	NS
Nitrogen Fertilizer Rate							
Low	18.73	53.52	67.4	91618	69	72	237
Mid	18.98	54.23	68.3	93384	70	73	236
High	18.83	53.79	69.1	92044	70	73	238
LSD (0.05)	NS	NS	0.9	NS	NS	NS	NS
CV (%)	6.4	6.4	2.1	4.7	1.3	1.8	4.5

NS = not significant

Figure 1. Effect of Seeding Rate, N Fertilizer and Hybrid Selection on Yield, 2018



Malt vs Feed Barley Management

Funding

Funded by the Saskatchewan Barley Development Commission

Project Lead

- Project Lead: Michael Hall (ECRF)
- ICDC Lead: Garry Hnatowich (ICDC)

Organizations

- East Central Research Foundation (ECRF)
- Irrigation Crop Diversification Corporation (ICDC)
- Conservation Learning Centre (CLC)
- Indian Head Research Foundation (IHARF)
- Northeast Agriculture Research Foundation (NARF)
- Western Applied Research Corporation (WARC)
- Southeast Agricultural Research Foundation (SERF)
- Saskatchewan Barley Development Commission

Objectives

The objectives of this project are:

- (1) to demonstrate that newer malt varieties can provide comparable yield to the best feed varieties.
- (2) to demonstrate the importance of adequate plant populations for yield and malt acceptance.
- (3) to demonstrate the differences in N management for malt versus feed of barley.

Research Plan

The trial was seeded on May 22. Plot size was 1.5 m x 8.0 m. The trial was established as a 3 order factorial replicated four times. The 1st factor compares barley varieties, the 2nd factor will contrast seeding rate and the 3rd factor nitrogen fertilizer rate. The two varieties were CDC Bow, a high yielding 2-row malt variety that yields 13% more than AC Metcalfe under irrigation, and CDC Austenson a feed barley yielding 21% more than AC Metcalfe under irrigation production. Each variety was seeded to achieve a theoretical plant stand of 200 or 300 seeds/m², seeding rate was adjusted for each variety to account for % germination and thousand kernel weight (TKW). The nitrogen fertilizer rates were 50, 75 and 100 lb N/ac. The combination of factors resulted in 12 treatments total as shown in Table 1. All nitrogen fertilizer applications were side-banded at the time of seeding. Each treatment also received a side-band application of 40 lb P₂O₅/ac at seeding. Weed control consisted of a post-emergence applications, at recommended rates, of Buctril M (bromoxynil +MCPA ester) on June 20 followed by Assert 300 SC (imazamethabenz) on June 21. Yields were estimated by direct cutting the entire plot with a small plot combine when the plants were dry enough to thresh and seed moisture content was <20%. The trial was harvested on August 15. Total in-season irrigation was 197 mm (7.75”), and natural precipitation 79.4 mm (3.1”).

This trial was duplicated at all eight Argi-ARM locations, as all other trials are conducted under dry land conditions the N fertilizer rates applied reflect lower applications than are likely optimal for irrigation. The rates were standardized across all trial locations for continuity and for data analyses.

Table 1. Experimental treatments

Trt	Variety	Seeding Rate - seed/m ² (~bu/ac)	N Rate – lb N/ac
1	CDC Bow	200 seeds/m ² (2 bu/ac)	50 lb N/ac
2	CDC Bow	300 seeds/m ² (3 bu/ac)	75 lb N/ac
3	CDC Bow	200 seeds/m ² (2 bu/ac)	100 lb N/ac
4	CDC Bow	300 seeds/m ² (3 bu/ac)	50 lb N/ac
5	CDC Bow	200 seeds/m ² (2 bu/ac)	75 lb N/ac
6	CDC Bow	300 seeds/m ² (3 bu/ac)	100 lb N/ac
7	CDC Austenson	200 seeds/m ² (2 bu/ac)	50 lb N/ac
8	CDC Austenson	300 seeds/m ² (3 bu/ac)	75 lb N/ac
9	CDC Austenson	200 seeds/m ² (2 bu/ac)	100 lb N/ac
10	CDC Austenson	300 seeds/m ² (3 bu/ac)	50 lb N/ac
11	CDC Austenson	200 seeds/m ² (2 bu/ac)	75 lb N/ac
12	CDC Austenson	300 seeds/m ² (3 bu/ac)	100 lb N/ac

Results

Seed quality and agronomic plant characteristics collected from each treatment by ICDC are tabulated in Table 2. Bulk seed from each CDC Bow treatment (seed bulked from all four reps and subsampled) was submitted to Intertek Laboratory for quality analyses and results are presented in Table 3. Factorial statistical analysis is given in Table 4.

Table 2. Seed Yield, Quality and Plant Agronomic Characteristics.

Trt	Variety	Yield (kg/ha)	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Heading (days)	Maturity (days)	Height (cm)
1	CDC Bow	4772	8.7	65.2	49.9	50	77	71
2	CDC Bow	5512	9.1	64.3	50.2	49	79	71
3	CDC Bow	6178	10.0	64.1	50.8	50	80	73
4	CDC Bow	5100	8.8	65.7	49.5	50	75	68
5	CDC Bow	5996	9.1	64.3	49.4	50	79	72
6	CDC Bow	6675	10.0	63.6	50.9	50	80	72
7	CDC Austenson	5196	8.2	66.6	51.5	49	78	68
8	CDC Austenson	6580	9.0	66.5	53.8	50	79	77
9	CDC Austenson	6981	10.1	65.7	53.4	50	80	80
10	CDC Austenson	5219	8.5	67.0	51.2	49	77	71
11	CDC Austenson	6715	9.1	66.6	52.3	50	79	76
12	CDC Austenson	7278	9.5	65.4	53.0	50	80	77
LSD (0.05)		749	0.5	1.1	1.6	NS	1.4	5.0
CV (%)		8.7	3.5	1.1	2.2	1.4	1.3	4.7

Table 3. Seed Quality Results from Intertek Laboratory on bulk CDC Bow treatments.

Trt	Variety	Protein (%)	Moisture (%)	Plump (%)	Thin (%)	P&B (%)	TFM (%)	TWT (kg/hl)	Germination (%)
1	CDC Bow	9.5	10.9	98.8	0.1	8.0	0.1	68.8	98
2	CDC Bow	9.5	10.9	99.0	0.1	6.4	0.1	69.0	98
3	CDC Bow	10.6	11.0	99.0	0.1	4.4	0.1	67.0	96
4	CDC Bow	9.6	10.8	98.8	0.1	5.9	0.1	68.8	95
5	CDC Bow	9.5	10.9	99.1	0.1	5.7	0.1	69.3	100
6	CDC Bow	10.5	11.0	98.9	0.1	5.6	0.1	67.2	97

Data not shown are results for % dockage, heated and chitted which were all 0.

Results as tabulated in Tables 2 & 3 will not be discussed in-depth but will be referred to within the discussion. The data presented in Tables 2 & 3 is also for data preservation and reference for possible future projects. The discussion will be based upon results as tabulated and analysed in Table 4.

Mean grain yield of CDC Austenson was significantly higher than the yield obtained for the malt variety CDC Bow. The % yield advantage of CDC Austenson in this study is greater than the approximately 8% historically obtained between these two varieties under irrigated production. Numerical grain yield was greater with the 300 seeds/m² seeding rate, although not statistically significant at a 95% confidence level it was statistically significant at the 94% confidence level. The yield gain achieved by a higher seeding rate more than compensated the cost of the increased seeding rate. Yield was statistically increased with each incremental addition of 25 lb N/ac. A strong yield response was not unexpected as soil testing indicated a total of 20 lb/ac available N to a 24" soil test depth (data not shown). Factor (i.e. variety, seeding rate, N fertilizer rate) interactions were not significant, indicating that varieties responded the same to seeding rates and N fertilizer rates. Grain yield for each treatment is illustrated in Figure 1.

Grain protein did not differ between varieties nor between seeding rates. Nitrogen fertilizer incremental additions resulted in higher % grain protein. Grain protein, regardless of treatment was very low, in fact no treatment would have likely been accepted for malt. Maltsters prefer lower malt than is often produced but do desire a protein level of between 11.0 – 12.5%. It is likely that had higher N fertilizer rates been included a response in both yield and grain protein may have been obtained. Increased N fertilizer rates delayed maturity and increased plant height.

Differences were slight in the seed quality parameters measured by Intertek Laboratory. (Table 3)

Once all participating sites have analysed their respective results a combined analysis of this trial will be conducted and a multi-site report prepared and posted to the Agri-ARM web site.

Table 4. Factorial Analysis of Variety, Seeding Rate and N Fertilizer Application on Seed Quality & Agronomics of Barley, 2018.

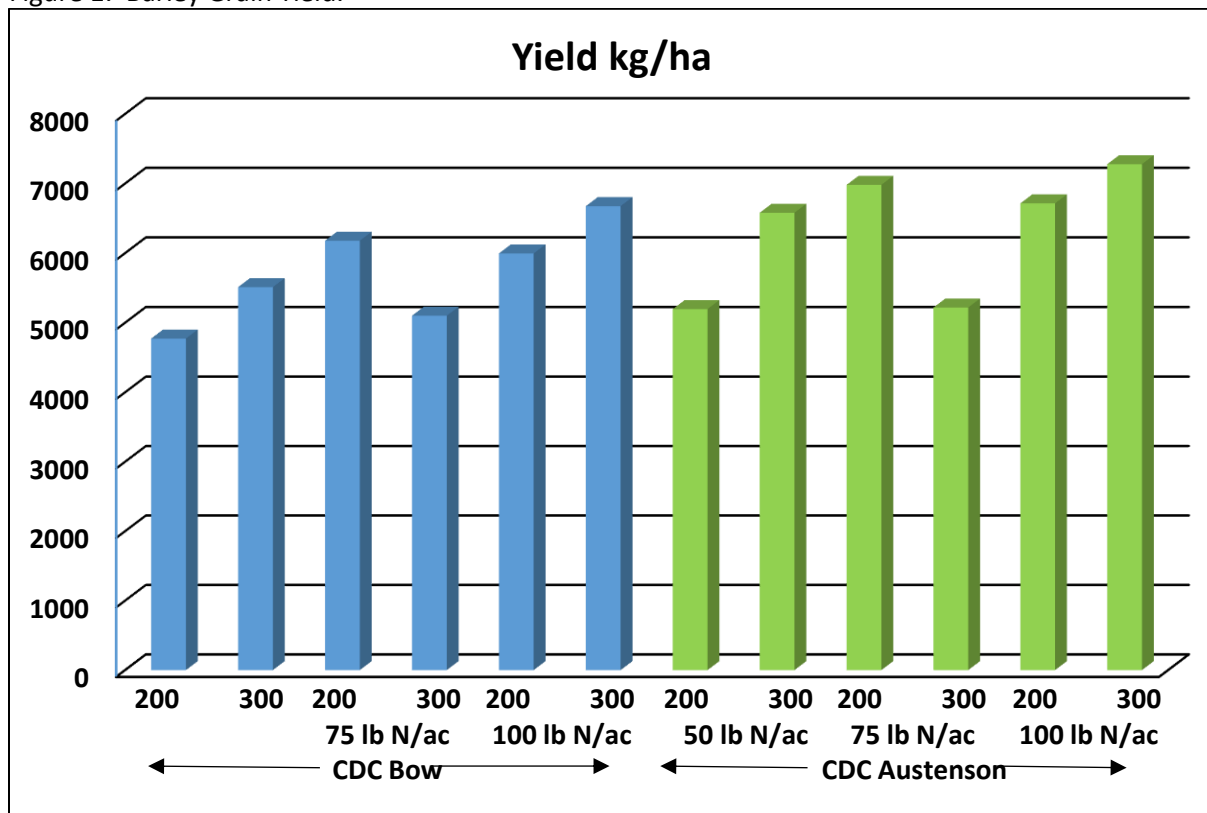
Treatment	Yield (kg/ha)	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Heading (days)	Maturity (days)	Height (cm)
Variety							
CDC Bow	5706	9.3	64.5	50.1	50	78	71
CDC Austenson	6328	9.1	66.3	52.5	50	79	75
LSD (0.05)	306	NS*	0.4	0.7	NS	NS	2.0
Seeding Rate (seeds/m²)							
200 seeds/m ²	5870	9.2	65.4	51.6	50	79	73
300 seeds/m ²	6164	9.2	65.4	51.1	50	78	73
LSD (0.05)	NS*	NS	NS	NS	NS	NS*	NS
N Fertilizer Rate – lb N/ac							
50 lb N/ac	5072	8.5	66.1	50.5	50	77	70
75 lb N/ac	6201	9.1	65.4	51.4	50	79	73
100 lb N/ac	6778	9.9	64.7	52.0	50	80	76
LSD (0.05)	374	0.2	0.5	0.8	NS	0.7	2.5
Variety x Seed Rate Interaction							
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS
Variety x N Rate Interaction							
LSD (0.05)	NS	NS	NS	NS	NS	S	S
Seed Rate x N Rate Interaction							
LSD (0.05)	NS	S	NS	NS	NS	S	NS
Variety x Seed Rate x N Rate Interaction							
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS
Trial CV (%)	8.7	3.5	1.1	2.2	1.4	1.3	4.7

S = Significant

NS = not significant

* = Significant at P < 0.06

Figure 1. Barley Grain Yield.



Improving Fusarium Head Blight Management in Durum Wheat in Saskatchewan

Funding

Funded by the Agriculture Development Fund (ADF) and Western Grains Research Foundation

Project Lead

- Project P.I.: Randy Kutcher (U of S)
- ICDC Lead: Garry Hnatowich (ICDC)

Objectives

The objective of this trial is to improve fungicide timing in durum wheat for the control of fusarium head blight (FHB) in Saskatchewan.

Research Plan

The trial was established on the ICDC Outlook main station land base (Area 51) seeded on May 22, the durum variety was CDC Desire. Plot size was 1.5 m x 6.0 m. Two seeding rates were evaluated, seed was packaged to achieve a seeding density of 75 plants/m² designated low seeding rate and 400 plants/m² designated as high seeding rate. CDC Desire seed was packaged to account for a germination of 96% and assuming a seedling survival of 90%. Nitrogen fertilizer was applied at a rate of 120 kg N/ha as 46-0-0 and 40 kg P₂O₅/ha as 12-51-0 as sideband applications. Weed control consisted of a post-emergence applications of Simplicity (pyroxsulam) and Buctril M (bromoxynil +MCPA ester).

The chemical fungicide used in the study was Caramba (metconazole) applied at the following phenological growth stages or timings;

- BBCH 59 – end of heading, spikes fully emerged from the boot (July 13)
- BBCH 61 – beginning of flowering (July 16)
- BBCH 65 – full flowering, 50% anthers mature (July 19)
- BBCH 69 – end of flowering (July 23)
- BBCH 73 – early milk (August 8)
- BBCH 61 for first fungicide application followed by a second at BBCH 73 (July 16 and August 8)
- Unsprayed control
- Sprayed control – plots received a fungicide application at each growth stage/timing.

Data collected for the study included emergence counts per square meter of each plot at the seedling stage, days to beginning and end of flowering and the number of spikes per square meter at the soft dough stage. Further data collection will include FHB index, grain yield, thousand kernel weight, test weight, protein content, FDK, and DON content.

Plots were harvested on September 6. Yields were estimated by direct cutting the entire plot with a small plot combine when the plants were dry enough to thresh and seed moisture content was <20%.

Total in-season rainfall from May through September was 109.2 mm. Total in-season irrigation at CSIDC was 197 mm.

Results

This was the third and final year of this trial. Results for 2018 are shown for each treatment in Table 1. The discussion will be based on factorial analysis as shown in Table 2.

In summary, fungicide timing and applications had no impact on durum yield, seed quality or agronomic characteristics measured during 2018. Considering the warm, dry growing season experienced this was not unexpected. Foliar disease and visual Fusarium Head Blight was not observed within the trial.

Seeding rate, not surprisingly, had a large impact on all agronomic measurements.

As indicated, this was the final year of this trial. A summary of the final multi-site report follows immediately after this report. If interested in viewing the full final report for this project please go to; <http://www.agriculture.gov.sk.ca/ADF/search> and enter the project ID.

Table 1: Effect of Fungicide Applications on Durum Agronomics, 2018

Seed Rate	Fung App Timing	Yield (kg/ha)	Protein %	Test Weight (kg/hl)	Seed Weight (mg)	Days to Mature	Plant Height (cm)	Plant Emerge (plant/m ²)
High	BBCH 59	6679	11.9	82.4	39.9	86	95	423
High	BBCH 61	7779	11.8	82.4	41.8	86	94	354
High	BBCH 65	7379	11.5	82.3	41.2	85	90	343
High	BBCH 69	7256	11.6	82.2	40.6	86	94	347
High	BBCH 73	7874	12.5	82.4	41.1	88	95	372
High	BBCH 61+73	7968	11.9	82.4	42.5	86	96	407
High	unsprayed	7586	12.0	82.2	40.5	87	94	415
High	Sprayed all BBCH	8079	11.5	83.0	43.7	85	90	430
Low	BBCH 59	5634	13.0	80.9	44.6	91	84	85
Low	BBCH 61	5389	13.1	80.8	45.1	92	87	75
Low	BBCH 65	5092	12.8	80.7	42.7	92	86	63
Low	BBCH 69	5698	12.9	81.2	46.8	91	85	67
Low	BBCH 73	5289	13.1	80.8	43.3	92	85	60
Low	BBCH 61+73	5861	13.0	81.0	45.2	91	89	88
Low	unsprayed	6147	12.7	81.8	45.0	92	85	77
Low	Sprayed all BBCH	5490	13.0	81.0	44.9	90	86	69
LSD (0.05)		986	0.8	0.5	2.6	2.5	7.7	84
Trial CV (%)		10.5	4.4	0.4	4.2	2.0	6.0	25.6

Table 2: Factorial Analysis of Fungicide Application and Timing on Durum Agronomics, 2018.

Treatment	Yield (kg/ha)	Protein %	Test Weight (kg/hl)	Seed Weight (mg)	Days to Mature	Plant Height (cm)	Plant Emerge (plant/m ²)	Spikes (m ²)
Seed Rate								
Low	5575	12.9	81.0	44.7	91	86	73	280
High	7575	11.8	82.4	41.4	86	93	386	457

LSD (0.05)	349	0.3	0.2	0.9	0.8	3.0	30	30
CV (%)	10.5	4.4	0.4	4.2	2.0	6.0	25.6	11.9
Fungicide Timing								
BBCH 59	6156	12.4	81.6	42.2	89	89	254	359
BBCH 61	6584	12.5	81.6	43.4	89	91	214	376
BBCH 65	6236	12.2	81.5	42.0	88	88	203	347
BBCH 69	6477	12.2	81.7	43.7	89	90	207	355
BBCH 73	6581	12.8	81.6	42.2	90	90	216	362
BBCH 61+73	6915	12.4	81.7	43.8	89	92	248	381
unsprayed	6866	12.3	82.0	42.8	89	90	246	401
Sprayed all BBCH	6785	12.2	82.0	44.3	87	88	249	367
CV (%)	NS	NS	0.4	NS	NS	NS	NS	NS
Seed Rate x Fungicide Timing Interaction								
CV (%)	NS	NS	S	NS	NS	NS	NS	NS

S = significant

NS = not significant

ADF Project Final Report

1. Project title and ADF file number.

ADF project #20150176 – February 15, 2018 to February 14, 2019 “Improving Fusarium Head Blight Management in Durum Wheat in Saskatchewan

Name of the Principal Investigator and contact information.

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Tom Wolf, AgriMetrix Research and Training, #208-111 Research Drive; Saskatoon, SK S7N 3B2 agrimetrix@gmail.com 306-241-1795 (advisor).

3. Abstract/ Summary:

Objective 1: Fusarium head blight (FHB) is one of the most important diseases of wheat in Canada. Presently farmers rely on the current recommendation to apply fungicide at 50% anthesis (BBCH 65) to manage the disease. Field trials were carried out from 2016- 2018 at Saskatoon, Melfort, Scott, Outlook and Indian Head to assess the effect of fungicide application timing and seeding rates on durum wheat affected by FHB. Eight treatments of metconazole fungicide ‘Caramba®’ were applied to two seeding rate treatments: 400 seeds/m² and 75 seeds/m². The fungicide treatments consisted of an untreated check (no fungicide), a treated check (fungicide application at all stages), and applications at: BBCH 59 (heading), BBCH 61 (early anthesis), BBCH 65 (50% anthesis), BBCH 69 (late anthesis), BBCH 73 (soft dough) and a treatment with two applications: BBCH 61 followed by BBCH 73. Evaluated parameters were: FHB index (IND), per cent *Fusarium*-damaged kernels (% FDK), deoxynivalenol (DON) content, protein content and yield. Seeding rate influenced all parameters; the higher seeding rate had higher IND and yield, and a lower level of FDK, DON, and protein as compared to the lower seeding rate. All fungicide application treatments led to lower IND, DON, and FDK than the untreated check in the cultivar CDC Desire (rated highly susceptible). Under extended wet conditions, when there was high risk of FHB, all anthesis applications starting at BBCH 61 to BBCH 69 had a similar effect on the FHB index, FDK, DON content and yield. While in years with moderate disease pressure, the BBCH 65 application (full flowering: 50% of anthers mature) had lower disease and toxin. There was no advantage of a fungicide application late in crop development (BBCH 73), which was made to reduce DON concentration. The results of the dual application (BBCH 61 + BBCH 73) treatment for disease control, FDK level and toxin accumulation were similar to the BBCH 65 application at all site-years

Objective 2: This study determined the *Fusarium* spp., the chemotype diversity and the mycotoxins levels in wheat samples collected across Saskatchewan from 2014-2016. Quantitative real-time PCR assays were used to quantify DNA of five *Fusarium* spp.: *F. graminearum*, *F. culmorum*, *F. avenaceum*, *F. poae*, and *F. sporotrichioides* from 132 wheat samples. The primers and probes used were found to be specific and sensitive. *Fusarium graminearum* was the dominant species detected followed by *F. avenaceum* from qPCR and identification based on morphology. Multiplex PCR based on the TRI3 gene revealed the chemotypes 3-ADON and 15-ADON. The detection of the 3-ADON amplicon among samples was more frequent than 15-ADON; no NIV amplicon was detected. Sample was tested for the presence of thirteen mycotoxins; five toxins were detected and quantified. The highest concentration was of DON, followed by 3-ADON, 15-ADON, T2 toxin and HT2 toxin. A weak correlation was detected between *F. graminearum* DNA and DON ($R^2 = 0.37$, $P = 0.0004$), while the correlation between DNA of other *Fusarium* spp., mycotoxin levels and FDK was not significant.

4. Key Messages:

- Under the conditions of study, fungicide applied to durum wheat under high FHB severity conditions was most effective to reduce FDK and DON between the BBCH61 to 69 stages. Under low to moderate FHB severity, fungicide was of benefit, however the window of application appeared to be smaller, BBCH61-65. There was no reduction in DON content from the application of fungicide late in crop development (BBCH 73).
- The optimum timing of application was the same for both seeding rates. The high seeding rate increased yield, but there was no interaction with fungicide application timing.
- *Fusarium graminearum* was the *Fusarium* spp. most often identified from infected wheat samples collected from the 2014 and 2016 epidemics. Five toxins were detected with DON observed to be in the greatest quantity.

Increasing Wheat Protein with a Post Emergent Applications of UAN

Funding

Funded by Saskatchewan Wheat Development Commission.

Project Lead

- Project P.I: Mike Hall (ECRF)
- ICDC Lead: Garry Hnatowich

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- East Central Research Foundation (ECRF)
- South East Research Foundation (SERF)
- Indian Head Research Foundation (IHARF)
- Western Applied Research Corporation (WARC)
- Northern Applied Research Foundation (NARF)
- Wheatland Conservation Association (WCA)

Objectives

Wheat yields in 2017 were surprisingly good in Saskatchewan considering the dry conditions, likely due in part to the lack of disease. However, many producers were disappointed by low levels of grain protein. When area wide protein levels are low, the premiums offered for high protein wheat tend to increase. This has left producers wondering what they could do to increase protein levels in the future. Post emergent application of N fertilizer is one of the only options to increase grain protein during the growing season. The results from this practice vary but it is more likely to be economical when yield potential is high and soil N is inadequate to maintain high protein levels. Applying nitrogen as a broadcast foliar spray is convenient for producers and some may feel that this is an efficient way to get N into the plant quickly late in the season; however, applying N in this manner comes with a higher risk of leaf burn and subsequent yield loss. To reduce this risk, producers can dilute the UAN 50:50 with water and try to avoid spraying during the heat of the day, but this may not always be realistic. Dribble banding reduces the risk of crop damage due to less fertilizer coming into direct contact with the leaves and may be a better alternative.

This demonstration will open the discussion around increasing wheat protein. It will serve to help farmers to apply post-emergent UAN to their crop as safely and efficiently as possible and to decide under what circumstances a post-anthesis application is likely to be profitable.

Its objectives are:

- (1) To demonstrate the potential of UAN (30 lbs/ac N) to increase wheat grain protein when applied post-anthesis
- (2) To demonstrate that improvements in grain protein with in-season N are more likely to occur for more nitrogen deficient wheat. (ie: base levels of 70 and 100 lbs/ac of N for comparison).

- (3) To demonstrate greater crop safety (less leaf burn) and potentially greater wheat yields when post-anthesis N is applied in a dribble band vs foliar broadcast (flat fan) sprays.
- (4) To demonstrate the potential for a better yield and protein response to post-emergent N when applied earlier in the season (5-6 leaf stage versus anthesis)
- (5) To demonstrate the overall risks and benefits of split-applications versus applying all N at seeding. Split-applications may decrease lodging and increase grain protein; however, applying the entire amount of N up front may provide greater yield potential. An economic analysis of the two practices will be performed.

Research Plan

The trial was established on canola stubble on the ICDC rented land adjacent to the Canada-Saskatchewan Irrigation Diversification Center (CSIDC) at Outlook. A total of 9 treatments were arranged in a four replicate randomized complete block design (RCBD) trial. The treatments are a combination of nitrogen fertilizer rates, 70, 100 or 130 kg N/ha side banded during seeding. Post-emergent applications of UAN (urea ammonium nitrate 28-0-0) at a rate of 30 kg N/ha were applied as a dribble surface band at pre-boot development stage of wheat or at 7-10 days post-anthesis (flowering) stage of wheat. When applications occurred post-anthesis the foliar applications were made with both a dribble band nozzle or with a 02 flat-fan nozzle. All UAN applications were applied at a rate of 20 gal/ac (10 gal UAN + 10 gal water). AAC Brandon was used as the test variety in the study and planted on May 22. Seed was treated with Cruiser Maxx Cereals (thiamethoam + difenoconazole + metalaxyl-M) for seed and soil borne disease and wireworm control. Post-anthesis applications occurred on July 25, assessment of foliar leaf burn occurred three days later.

Weed control at both sites consisted of a post-emergence tank mix application Simplicity (pyroxsulam) and Buctril M (bromoxynil +MCPA ester). Yields were estimated by direct cutting the entire plot with a small plot combine when the plants were dry enough to thresh and seed moisture content was <20%. The trial was harvested on August 17. A clean sample of grain was sent to Western Applied Research Corporation (WARC) for NIR protein level determinations. We did not determine protein with the CSIDC NIR as it was deemed prudent to have all samples from all cooperating test locations utilize the same protein analyzer.

Total in-season rainfall from May through September was 109.2 mm. Total in-season irrigation at CSIDC was 197 mm.

Results

Seed yield and seed quality parameters measured are shown in Table 1, agronomic observations are shown in Table 2.

Statistically yields did not differ between treatments. This was not anticipated, spring soil test available N levels at this site were relatively low at 22 kg N/ha total from 0 – 60 cm (20 lb N/ac in 0 – 24”). A significant yield response to the increased side banded N fertilizer rates was expected. This trial was established on soybean stubble so it’s possible there was a release of mineralized N being released through the growing season that effectively masked N rate responses? However, the lowest yield obtained was with the 70 kg N/ha side band application with no additional UAN application. The highest yield occurred with the 100 kg N/ha side band application and the additional 30 kg N/ha applied as a surface dribble band directly to the soil surface pre-boot. In-season applications of UAN did not elevate

grain protein above the comparable side band N applications for equal total amounts of N applied, however did increase protein when attempting a strategy of elevating protein over and above base spring banded N rates with a post-anthesis application (i.e 100 lb N/ha side band vs 100 lb N/ha side band + 30 lb N/ha post-anthesis). The economics of the additional N fertilizer application vs the benefit of additional protein levels would need to be evaluated. The impact of fertilizer applications on grain protein is graphically illustrated in Figure 1. Fertilizer application had limited, or no, effect on test weight and seed weight.

No fertilizer application had an influence on plant emergence or days to anthesis. Higher rates of N application did delay maturity. Plant height and lodging were not influenced in 2018. Foliar burn was greatest when UAN was applied with a flat fan nozzle that increased the contact between plant tissue and the fertilizer. This likely, did result in a yield reduction.

This project was conducted at seven Agri-ARM locations and the results of each trial will be compiled into a multi-site analysis and report. Once completed the results will be posted on individual trial location websites as well as on the Agri-Arm website.

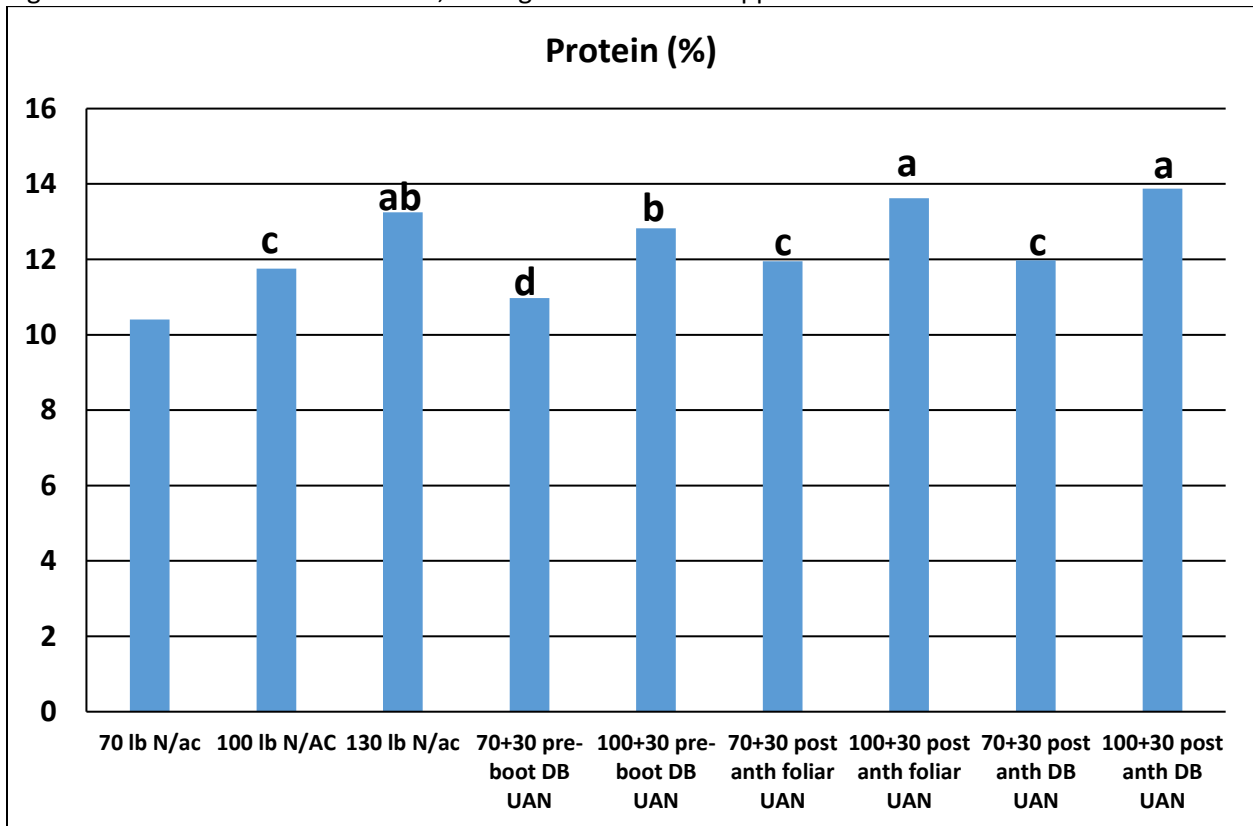
Table 1. Influence of Fertilizer Rate, Timing and Method of Application on Yield and Seed Quality.

Sideband N (lb/ac)	UAN Surface Dribble Band (lb/ac)	UAN Foliar Spray (kg/ha)	Yield (kg/ha)	Yield (bu/ac)	Protein (%)	Test weight (kg/hl)	Seed weight (gm)
70			4730	70.3	10.4	81.0	39.7
100			5388	80.1	11.8	79.2	40.0
130			5400	80.3	13.3	78.4	40.3
70	30 pre-		5218	77.6	11.0	81.4	40.1
100	30 pre-		5673	84.3	12.8	79.9	39.3
70		30 post-	5097	75.8	12.0	81.3	40.2
100		30 post-	5006	74.4	13.6	79.5	40.9
70	30 post-		4875	72.5	12.0	80.8	40.3
100	30 post-		5484	81.5	13.9	79.7	40.2
LSD (0.05)			NS	NS	0.6	1.8	NS
CV (%)			9.0	9.0	3.6	1.5	3.3

Table 2. Influence of Fertilizer Rate, Timing and Method of Application on Wheat Agronomics

Sideband N (kg/ha)	UAN Surface Dribble Band (kg/ha)	UAN Foliar Spray (kg/ha)	Emergence (plant m ²)	UAN Flag Leaf Burn (%)	Days to Anthesis	Days to Mature	Plant Height (cm)	Lodging 1=erect; 9=flat
70			306	1.3	53	79	77	1
100			254	1.3	53	80	78	1
130			332	1.3	54	81	79	1
70	30		286	5.0	53	79	77	1
100	30		296	3.8	54	81	78	1
70		30	363	13.8	53	80	79	1
100		30	292	11.3	53	81	79	1
70	30		296	2.5	53	81	76	1
100	30		294	5.0	54	82	78	1
LSD (0.05)			NS	7.2	NS	1.1	NS	NS
CV (%)			16.4	98	0.7	1.0	3.4	

Figure 1. Influence of Fertilizer Rate, Timing and Method of Application on Grain Protein.



Wheat Yield and Quality Response to Major Crop Inputs

Funding

Funded by the Agricultural Demonstration of Practices and Technologies Fund (ADOPT).

Project Lead

- ICDC Lead: Garry Hnatowich

Organizations

- Indian Head Research Foundation (IHARF)
- Conservation Learning Centre (CLC)
- Western Applied Research Corporation (WARC)
- Northeast Agriculture Research Foundation (NARF)
- Wheatland Conservation Area Inc. (WCA)
- Irrigation Crop Diversification Corporation (ICDC)

Objectives

Wheat, regardless of the class, is an important rotational crop for farmers and a major contributor to the provincial economy. Provided that top grades and protein can be achieved, wheat can also be quite profitable; however, consistently achieving high quality and yield is major challenge that can dramatically affect the profitability of the crop and be a deterrent for growers. The proposed project will demonstrate both the economic costs of higher seeding rates, fertility, PGR applications and foliar fungicide along with their respective contributions to grain yield, quality and subsequent revenues. The project is novel in that it will, in one project, demonstrate the effects of several major wheat inputs applied individually relative to a treatment where all are applied together in a high input, intensively managed treatment. Furthermore, the project will also provide a unique opportunity to demonstrate how major inputs might be expected to influence individual spring wheat yield components and, subsequently, grain yield. The proposed project is complimentary to numerous past and present trials and will prove highly valuable for extension purposes and of substantial interest to Saskatchewan farmers.

The objectives of the proposed project are to demonstrate the agronomic and economic responses of CWRS wheat to selected crop inputs both individually and in combination.

Research Plan

The trial was established on canola stubble on the ICDC rented land adjacent to the Canada-Saskatchewan Irrigation Diversification Center (CSIDC) at Outlook. A total of 7 treatments were arranged in a four replicate randomized complete block design (RCBD) trial. The treatments are a combination of CWRS wheat input combinations where five major crop inputs were varied. CDC Utmost VB was used as the test variety in the study and planted on May 22. The inputs varied were 1) seed-applied fungicide, 2) seeding rate, 3) overall fertility, 4) plant growth regulator, and 5) foliar-applied fungicide. The specific input treatments are provided in Table 1 below.

Table 1: Treatment Description.

Trt #	Name	Seed Applied Fungicide (no/yes)	Seed Rate (seeds/m ²)	Fertility (kg/ha N-P ₂ O ₅ -K ₂ O-S)	Manipulator PGR (no/yes)	Foliar Applied Fungicide (no/yes)
1	Low Input	No	250	90-20-10-10	No	No
2	Seed Applied Fungicide	Yes	250	90-20-10-10	No	No
3	Seed Rate	No	400	90-20-10-10	No	No
4	Fertility	No	250	135-40-20-20	No	No
5	PGR	No	250	90-20-10-10	Yes	No
6	Foliar Fungicide	No	250	90-20-10-10	No	Yes
7	High Input	Yes	400	135-40-20-20	Yes	Yes

Seed applied fungicide was Vibrance Quattro (difenoconazole + sedaxane + metalaxyl-M (and S-isomer) and fludioxonil). The plant growth regulator (PGR) used was Manipulator 620 (chlormequat chloride). The foliar fungicide was Prosaro 250 EC (prothioconazole + tebuconazole). All pesticides and PGR were applied at recommended rates and at recommended times of application. Nitrogen fertilizer was urea (46-0-0), phosphorus as monoammonium phosphate (11-20-0), potash as potassium chloride (0-0-60) and sulphur as ammonium sulphate (21-0-0-24). Fertilizer was made into a 90-20-10-10 and 135-40-20-20 blends and side band at seeding. Seeding rates incorporated % germination and seed weight into their determinations.

Weed control at both sites consisted of a post-emergence tank mix application Simplicity (pyroxulam) and Buctril M (bromoxynil + MCPA ester). Immediately prior to harvest plants within an m² area where hand harvested, dried and stationary combined, to determine straw and grain sample weights. Harvest Index is defined as Grain Weight/(Grain Weight + Straw Weight) x 100. Yields were estimated by direct cutting the entire plot with a small plot combine when the plants were dry enough to thresh and seed moisture content was <20%. The trial was harvested on August 17.

Total in-season rainfall from May through September was 109.2 mm. Total in-season irrigation at CSIDC was 197 mm.

Results

Results for yield and seed quality parameters are given in Table 2, plant agronomic measurements in Tables 3 & 4.

Yield was only statistically increased above the low input treatment yield by the fertility treatment and the high input treatment. Given the warm, extremely dry growing season, root and foliar diseases were not an issue so the lack of significant responses from the seed and foliar fungicides is not surprising. Similarly lodging was not an issue so PGR application failed to provide a significant yield gain. Higher seeding rate modestly improved yield. The additive contribution of each input is graphically illustrated in Figure 1. The larger contributions did derive from increased fertility. The sum of all inputs did contribute to the yield gains obtained with the full input treatment.

Protein content was statistically higher with the fertility treatment than all other treatments, followed by the high input which, though not statistically the same as the fertility, was significantly different from all remaining treatments. All remaining treatment protein contents did not differ from one another. Why there should be a difference in protein between the fertility and the high input treatments is not apparent, it may be a result of a dilution effect due to the higher yield in the high input treatment. Treatment effects did not influence test weight, seed weight or Fusarium Head Blight damage.

Plant emergence was highest for the high seed rate and high input treatments where seeding rate was increased above other treatments. Conversely the high seed rate and high input treatments had the least amount of tillering. The high input had significantly higher number of spikes formed per m² compared to all other treatments. Both straw and grain biomass sampling did not indicate treatment differences though when expressed as % Harvest Index, the HI was significantly higher for the seeding rate treatment compared to the PGR treatment. Very little practical or consequential treatment differences occurred with respect to days to heading or maturity, plant height or lodging.

This project was conducted at six Agri-ARM locations and the results of each trial will be compiled into a multi-site analysis and report. Once completed the results will be posted on individual trial location websites as well as on the Agri-Arm website.

Table 2: Treatments Effects on Seed Yield and Quality.

Trt #	Name	Yield (kg/ha)	Yield (bu/ac)	Protein %	Test Weight (kg/hl)	Seed Weight (mg)	FHB Damage Seed %
1	Low Input	6674	99.2	10.6	77.5	37.2	0.088
2	Seed Applied Fungicide	6923	102.9	10.7	77.5	38.0	0.074
3	Seed Rate	6963	103.5	10.5	79.2	37.2	0.038
4	Fertility	7581	112.7	12.1	77.0	37.9	0.060
5	PGR	6746	100.3	10.6	77.7	37.8	0.038
6	Foliar Fungicide	6790	101.0	10.5	78.3	37.0	0.035
7	High Input	7957	118.3	11.7	79.1	37.2	0.046
LSD (0.05)		292	4.3	0.4	NS	NS	NS
CV (%)		2.8	2.8	1.7	1.8	2.8	46.6

NS = not significant

Table 3: Treatment Effects on Plant Growth Characteristics.

Trt #	Name	Emergence (plant/m ²)	Tillers per plant	Spikes (m ²)	Biomass Grain (gm/m ²)	Biomass Straw (gm/m ²)	Harvest Index %
1	Low Input	233	3.0	591	975	1308	43
2	Seed Applied Fungicide	363	1.7	586	900	1214	43
3	Seed Rate	477	1.4	629	968	1139	46
4	Fertility	308	2.2	641	1003	1312	44
5	PGR	270	2.2	580	956	1303	42
6	Foliar Fungicide	331	1.9	603	901	1198	43
7	High Input	473	1.6	705	991	1244	44
LSD (0.05)		85	0.8	56	NS	NS	3.0
CV (%)		16.4	28.9	6.1	8.0	6.6	5.5

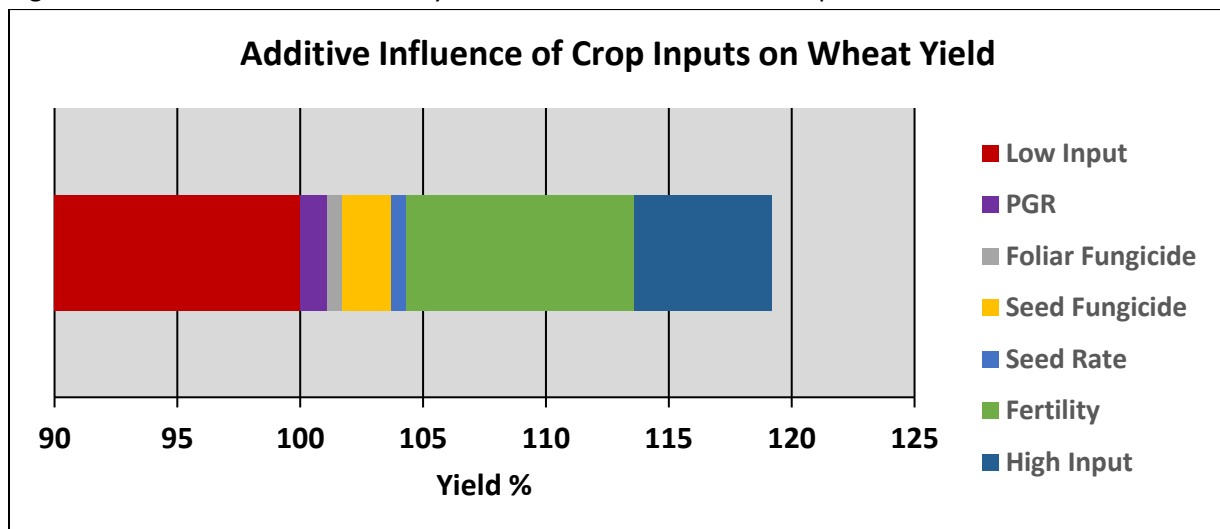
NS = not significant

Table 4: Treatment Effects on Plant Growth Characteristics.

Trt #	Name	Days to Heading	Days to Maturity	Height (cm)	Lodging 1=erect; 9=flat
1	Low Input	52	80	90	1
2	Seed Applied Fungicide	52	79	89	1
3	Seed Rate	52	79	90	1
4	Fertility	53	80	89	1
5	PGR	53	80	80	1
6	Foliar Fungicide	53	79	87	1
7	High Input	53	80	77	1
LSD (0.05)		0.6	0.8	3.8	NS
CV (%)		0.8	0.7	3.0	0

NS = not significant

Figure 1. Additive Contributions to yield Increases above the Low Input Treatment.



Demonstration of Nitrogen Rate Responses of Irrigated Conventional and Hybrid Fall Rye

Funding

Funded by the Agricultural Demonstration of Practices and Technologies Fund (ADOPT).

Project Lead

- ICDC Lead: Garry Hnatowich

Organizations

- Irrigation Crop Diversification Corporation (ICDC)

Objectives

Fall cereals in general have numerous rotational benefits including reduced disease, better weed control, increased water and nutrient use, and improved habitat for water fowl. At present producers are seeking cropping options to maintain their cereals in rotation but mitigate the problem of high Fusarium Head Blight associated with spring cereal production. Fall rye may provide a suitable choice. Fall rye has not been widely produced as quality for milling markets has been inconsistent and spring and winter wheat tends to displace it in the feed market. However, with the development of hybrid fall rye, with higher falling number than conventional rye, opportunities maybe available in the milling and distillers markets. The higher yields associated with hybrid over conventional rye may also enhance its ability for ethanol and feed market opportunities.

Since there is a lack of suitable fertilizer recommendations in general, and none for irrigation or higher moisture fall rye production, a demonstration of nitrogen fertilizer rate response is well warranted. Depending upon results obtained this demonstration could lead to an expanded fertility research program.

The objective is to demonstrate the nitrogen rate response of irrigated fall rye varieties to optimize yield and protein. In addition, to provide information that can be used to create nitrogen fertilizer recommendations for irrigated fall rye production.

Research Plan

The trial was established at the ICDC rented land adjacent to the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC). The trial was established in a randomized factorial design with three replications. Seed of two registered fall rye varieties, the conventional open-pollinated variety Hazlet and the hybrid variety Brasetto, were evaluated. Varieties were direct seeded into canola stubble on September 14, 2017. Nitrogen fertilizer as urea (46-0-0) was applied to each variety at rates of 0, 50, 100, 150, 200 and 250 kg N/ha. All nitrogen fertilizer was sideband at seeding, 25 kg P2O5/ha seed placed monoammonium nitrate (11-52-0) was applied with the seed. Weed control involved a single fall preseed application of glyphosate, with an in-season tank mix application of Simplicity (pyroxsulam) and Buctril M (bromoxynil +MCPA ester). Significant hand weeding was required through the growing season. Yields were estimated by direct cutting the entire plot with a small plot combine when the plants were dry enough to thresh and seed moisture content was <20%. Harvest occurred on August 7, 2018. Harvested samples were cleaned into respective crops and yields adjusted to a moisture content of 14.5%. An additional 197 mm was applied by irrigation to the irrigated production system to harvest.

Seasonal and 30 year historic precipitation and growing degree days at CSIDC are outlined in Tables 1 & 2. Seasonal precipitation was extremely low compared to 30 year averages. Seasonal Cumulative Growing Degree Days was higher than historic records by the end of July. Total irrigation to the trial totalled 197 mm (7.75”).

Table 1. Seasonal vs Long-Term Precipitation, CSIDC Outlook Weather Station			
	Year		
Month	2018 mm (inches)	30 Year Average mm (inches)	% of Long-Term
May	23.0 (0.9)	46.0 (1.8)	50
June	13.0 (0.5)	67.0 (2.6)	19
July	34.0 (1.3)	57.0 (2.2)	60
Total	70.0 (2.7)	170.0 (6.6)	41
Table 2. Cumulative Growing Degree Days (Base 0°C) vs Long-Term Average, CSIDC Outlook Weather Station			
	Year		
Month	2018	30 Year Average	% of Long-Term
May	289	224	129
June	934	708	132
July	1507	1290	117

Results

Results of this trial must be viewed skeptically due to the high coefficient of variation (CV %) value associated with yield observations. The statistical high CV obtained can be attributed to the level of winter kill associated within the trial treatments, winter kill did appear to have some degree of variety association but it was also variable within any given treatment. Therefore, no conclusions can be made from this study. The high winter mortality is attributed to the absence of snow cover and the extreme cold conditions that occurred through the 2017/2018 winter. The weather station at CSIDC reported temperatures as low of snow cover as -34.8 degrees Celsius on December 30th. Weed pressure was also very high do to the poor condition from the rye crop and in-season herbicide application was insufficient as new wild oat flushes occurred with every irrigation application and lack of crop competition. The trial was maintained in the hope that some useful observations might be obtained.

Agronomic data collected in the study is tabulated in Table 3 (analysis of variance procedures conducted on entire data set as a RCB design) and shown for record posterity only and will not be discussed.

The discussion will be based on results of each factorial treatment within the test which is summarized in Table 4. Though no conclusions can be drawn from the study the data collected does suggest that the conventional fall rye variety Hazlet was better able to overwinter than the hybrid variety Brasetto. Mean yield of Hazlet was approximately twice that obtained for Brasetto. The number of spikes per m2 (head counts obtained June 15, 2018) were significantly higher with Hazlet (tillering was similar between varieties – general observation), suggesting greater winter hardiness. The extent of winter kill can be inferred in that the seeded target plant population for each variety was 300 plants/m2. If only a single spike had formed per plant at the “target” population the number of spikes actually obtained are

dramatically less than desired. The two varieties did also differ in all other seed or plant characteristics measured.

Nitrogen fertilizer had no influence on any agronomic measurement. Due to experimental variation within this study due to winter mortality we were unsuccessful in defining variety nitrogen rate responses.

This trial will be repeated in 2018/2019.

Table 3. Yield and Agronomic Parameters Measured for Fall Rye 2018 (RCBD)

Variety	N Rate (kg N/ha)	Yield (kg/ha)	Yield (bu/ac)	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Height (cm)	Heads (spikes/m ²)
Hazlet	0	2460	39.2	10.4	70.4	36.5	90	115
Hazlet	50	2368	37.7	11.2	70.4	39.2	81	127
Hazlet	100	3605	57.4	12.2	66.4	37.5	88	87
Hazlet	150	4709	75.0	12.7	70.8	37.8	86	110
Hazlet	200	3694	58.8	12.4	69.5	38.0	90	87
Hazlet	250	3319	52.9	12.4	67.8	35.8	87	101
Brasetto	0	1576	25.1	9.9	62.1	34.6	77	59
Brasetto	50	1684	26.8	10.6	61.0	32.0	83	51
Brasetto	100	1796	28.6	11.7	62.0	30.8	83	49
Brasetto	150	1344	21.4	11.9	56.0	31.7	78	61
Brasetto	200	2195	35.0	11.9	64.4	31.6	78	98
Brasetto	250	1981	31.5	11.9	58.9	30.5	78	87
LSD (0.05)		1590	25.3	1.3	7.1	4.4	NS	NS
CV (%)		34.4	34.4	6.7	6.4	7.5	11.2	45.5

NS = not significant

Table 4. Yield and Agronomic Parameters Measured for Fall Rye 2018 (Factorial)

Treatment	Yield (kg/ha)	Yield (bu/ac)	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Height (cm)	Heads (spikes/m ²)
Variety							
Hazlet	3359	53.5	11.9	69.2	37.4	87	104
Brasetto	1763	28.1	11.3	60.7	31.9	79	68
LSD (0.05)	624	9.9	0.5	2.9	1.8	7	27
N Rate							
0 kg N/ha	2018	32.2	10.1	66.3	35.5	84	87
50 kg N/ha	2026	32.3	10.9	65.7	35.6	82	89
100 kg N/ha	2701	43.0	11.9	64.2	34.1	86	68
150 kg N/ha	3027	48.2	12.3	63.4	34.7	82	85
200 kg N/ha	2944	46.9	12.2	67.0	34.8	84	92
250 kg N/ha	2650	42.2	12.2	63.3	33.1	82	95
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS
CV (%)	34.4	34.4	6.7	6.4	7.5	11.2	45.5

NS = not significant

Lentil Input Study

Funding

Funded by the Agriculture Development Fund (ADF)

Project Lead

- Project P.I: Jessica Weber (WARC)
- ICDC Lead: Garry Hnatowich

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Western Applied Research Corporation (WARC)
- Indian Head Research Foundation (IHARF)
- East Central Research Foundation (ECRF)
- Wheatland Conservation Area Inc. (WCA)

Objectives

The objective of the study is to;

- (1) Determine which combination of common agronomic practices (seeding rate, herbicides and fungicides) produce the greatest lentil yield and
- (2) Determine which agronomic practices provide the best economic return to producers.

Research Plan

The trial was established at the ICDC Off-station Pederson location, in a 3 x 3 x 2 way factorial combination of three seeding rates (130, 190 and 260 seeds/m²), three fungicide treatments (no application, single application, two applications) and two herbicide management practices (pre-seed burn off + pre-emergent + in-crop and pre-seed burn off + in-crop) for a total of 18 treatments with four replications. Pre-seed burn off was with a glyphosate application at a rate of 0.67 L/ac as Roundup Transorb HC by itself or in combination with Focus (pyroxasulfone + carfentrazone) at 280 ml/ha on May 24, and in-crop applications of Ares (imazamox + imazapyr) at 244 ml/c + Merge at 0.5L/100L on July 3 followed by Centurion (clethodim) at 75 ml/ac + Amigo at 0.5L/100L on July 6. Fungicidal application was either a single application of Priaxor (fluxapyroxad + pyraclostobin) at 180 ml/ac on July 16 with selected treatments receiving an additional application of Lance WDG (boscalid) at 170 g/ac on July 23. The trial was desiccated with Reglone (diquat) at 0.83 L /ac on August 22 and plots were harvested by direct cutting the entire plot with a small plot combine on August 31.

Total in-season precipitation at Pederson from May through September was 109 mm. Total in-season irrigation at Pederson was approximately 100 mm.

A treatment description is provided in Table 1.

Table 1. Seeding Rate, Herbicide and Fungicide Treatments

Treatment	Seeding Rate (seed/m ²)	Fungicide	Herbicide	
			Pre	Post
1	130	None	Glyphosate + Focus	Ares + Centurion
2	130	None	Glyphosate	Ares + Centurion
3	130	Priaxor	Glyphosate + Focus	Ares + Centurion
4	130	Priaxor	Glyphosate	Ares + Centurion
5	130	Priaxor + Lance WDG	Glyphosate + Focus	Ares + Centurion
6	130	Priaxor + Lance WDG	Glyphosate	Ares + Centurion
7	190	None	Glyphosate + Focus	Ares + Centurion
8	190	None	Glyphosate	Ares + Centurion
9	190	Priaxor	Glyphosate + Focus	Ares + Centurion
10	190	Priaxor	Glyphosate	Ares + Centurion
11	190	Priaxor + Lance WDG	Glyphosate + Focus	Ares + Centurion
12	190	Priaxor + Lance WDG	Glyphosate	Ares + Centurion
13	260	None	Glyphosate + Focus	Ares + Centurion
14	260	None	Glyphosate	Ares + Centurion
15	260	Priaxor	Glyphosate + Focus	Ares + Centurion
16	260	Priaxor	Glyphosate	Ares + Centurion
17	260	Priaxor + Lance WDG	Glyphosate + Focus	Ares + Centurion
18	260	Priaxor + Lance WDG	Glyphosate	Ares + Centurion

Results

Seed quality and agronomic plant characteristics collected from each treatment are tabulated in Tables 2, 3 & 4. Factorial statistical analysis is given in Tables 5 & 6.

Results as tabulated in Tables 2, 3 & 4 will not be discussed and are presented for data preservation purposes. The discussion will be based upon results as tabulated and analysed in Tables 5 & 6.

Lentil seed yield was not significantly affected by any treatment. Results indicate that in 2018 lentil yield was not influenced by either plant seeding rate, herbicide or fungicide application. Rainfall was well below historic normal and irrigation was applied only to alleviate plant stress it might not be unexpected that yields would be static. With the dry growing season, accompanied with intense sunshine and continues winds neither weeds nor disease were present to a degree to play any significant part in influencing lentil yield. Treatments had either no, or only minimal, effect on all other measurements taken within this experiment. Disease ratings (data not shown) were taken throughout July and August weekly but no significant disease was apparent through the growing season.

This is the second year of a three-year trial and will be repeated in 2019.

Table 2. Impact of Treatments on Seed Yield and Seed Characteristics

Trt	Seed Rate (seed/m ²)	Fungicide Application	Pre-seed Herbicide Application	Yield (kg/ha)	Test weight (kg/hl)	Seed weight (mg)
1	130	None	Glyphosate + Focus	2488	79.8	34.7
2	130	None	Glyphosate	2865	79.9	36.1
3	130	Single	Glyphosate + Focus	2195	79.8	35.9
4	130	Single	Glyphosate	2038	79.5	35.0
5	130	Dual	Glyphosate + Focus	2243	79.7	35.8
6	130	Dual	Glyphosate	2716	79.8	37.3
7	190	None	Glyphosate + Focus	2908	79.7	35.6
8	190	None	Glyphosate	2833	79.7	35.5
9	190	Single	Glyphosate + Focus	2430	79.6	35.5
10	190	Single	Glyphosate	2810	80.0	35.9
11	190	Dual	Glyphosate + Focus	2040	79.5	35.2
12	190	Dual	Glyphosate	2672	79.9	36.9
13	260	None	Glyphosate + Focus	2323	79.7	35.0
14	260	None	Glyphosate	2530	79.7	36.2
15	260	Single	Glyphosate + Focus	2438	79.7	34.7
16	260	Single	Glyphosate	2268	79.5	35.5
17	260	Dual	Glyphosate + Focus	2499	79.9	35.4
18	260	Dual	Glyphosate	2841	79.5	36.7
LSD (0.05)				NS	NS	NS
CV				20.5	0.5	3.2

NS = Not significant

Table 3. Impact of Treatments on Lentil Maturation and Plant Stand.

Trt	Seed Rate (seed/m ²)	Fungicide Application	Pre-seed Herbicide Application	Days to Flower	Days to Mature	Plant Stand (plant/m ²)
1	130	None	Glyphosate + Focus	42	75	133
2	130	None	Glyphosate	41	75	115
3	130	Single	Glyphosate + Focus	42	74	109
4	130	Single	Glyphosate	42	74	112
5	130	Dual	Glyphosate + Focus	42	74	114
6	130	Dual	Glyphosate	41	74	127
7	190	None	Glyphosate + Focus	41	74	188
8	190	None	Glyphosate	41	74	197
9	190	Single	Glyphosate + Focus	41	74	154
10	190	Single	Glyphosate	41	74	194
11	190	Dual	Glyphosate + Focus	42	73	150
12	190	Dual	Glyphosate	41	74	172
13	260	None	Glyphosate + Focus	41	73	206
14	260	None	Glyphosate	41	73	210
15	260	Single	Glyphosate + Focus	41	73	211
16	260	Single	Glyphosate	40	73	237

17	260	Dual	Glyphosate + Focus	41	73	196
18	260	Dual	Glyphosate	41	73	213
LSD (0.05)				0.7	0.6	36
CV				1.3	0.6	15.2

Table 4: Impact of Treatments on Lentil and Weed Biomass and Weed Populations.

Trt	Seed Rate (seed/m ²)	Fungicide Application	Pre-seed Herbicide Application	Lentil Biomass (kg/ha)	Weed Biomass (kg/ha)	Total Plot Weed May 24	Total Plot Weed June 25
1	130	None	Glyphosate + Focus	11400	425	26	7
2	130	None	Glyphosate	12750	200	31	16
3	130	Single	Glyphosate + Focus	11100	150	26	6
4	130	Single	Glyphosate	10250	425	26	18
5	130	Dual	Glyphosate + Focus	10850	25	29	4
6	130	Dual	Glyphosate	12550	350	33	14
7	190	None	Glyphosate + Focus	12650	150	27	6
8	190	None	Glyphosate	12950	675	26	12
9	190	Single	Glyphosate + Focus	11650	50	28	2
10	190	Single	Glyphosate	13050	625	24	13
11	190	Dual	Glyphosate + Focus	12080	0	25	4
12	190	Dual	Glyphosate	13250	125	23	12
13	260	None	Glyphosate + Focus	11850	225	27	4
14	260	None	Glyphosate	14750	50	27	13
15	260	Single	Glyphosate + Focus	14000	100	35	4
16	260	Single	Glyphosate	13900	425	31	17
17	260	Dual	Glyphosate + Focus	14300	50	24	3
18	260	Dual	Glyphosate	14550	650	31	14
LSD (0.05)				NS	NS	NS	6
CV				19.2	152	23.9	48.2

NS = not significant

Table 5. Factorial Analysis of Seeding Rate, Herbicide and Fungicide Application on Seed Quality & Agronomics of Lentil, 2018.

Treatment	Yield (kg/ha)	Test weight (kg/hl)	Seed weight (mg)	Days to Flower	Days to Mature	Plant Stand (plant/m ²)
Seeding Rate (seeds/m²)						
130	2424	79.7	35.8	42	74	118
190	2616	79.7	35.8	41	74	175
260	2483	79.7	35.6	41	73	212
LSD (0.05)	NS	NS	NS	0.3	0.3	15
Pre-Seed Herbicide Application						
Glyphosate	2396	79.7	35.3	41.3	74	162
Glyphosate + Focus	2619	79.7	36.1	40.8	74	175
LSD (0.05)	NS	NS	0.5	0.3	NS	12
Fungicide Application						
None	2658	79.8	35.5	41	74.0	175
Priaxor	2363	79.7	35.4	41	73.7	169
Priaxor + Lance WDG	2502	79.7	36.2	41	73.5	162
LSD (0.05)	NS	NS	0.7	NS	0.3	NS
CV (%)	20.5	0.5	3.2	1.3	0.6	15.2

NS = not significant

Table 6. Factorial Analysis of Seeding Rate, Herbicide and Fungicide Application on Lentil and Weed Biomass & Weed Populations, 2018.

Treatment	Lentil Biomass (kg/ha)	Weed Biomass (kg/ha)	Total Plot Weed May 24	Total Plot Weed June 25
Seeding Rate (seeds/m²)				
130	11483	263	28	10
190	12605	271	25	8
260	13892	250	29	9
LSD (0.05)	1406	NS	NS	NS
Pre-Seed Herbicide Application				
Glyphosate	12209	392	27	4
Glyphosate + Focus	13111	131	28	14
LSD (0.05)	NS	NS	NS	2.1
Fungicide Application				
None	12725	288	27	9
Priaxor	12325	296	28	10
Priaxor + Lance WDG	12930	200	28	8
LSD (0.05)	NS	NS	NS	NS
CV (%)	19.2	152	23.9	48.2

NS = not significant

ADOPT Dry Bean Narrow vs Wide Row Trial

Funding

Funded by Agriculture Demonstration of Practices and Technologies (ADOPT)

Project Lead

- Jeff Ewen, SMA
- Garry Hnatowich, ICDC
- Co-investigators: Dr. K. Bett, Crop Development Centre

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Crop Development Centre (CDC)

Objectives

The objective of this project will be to demonstrate the effect narrow row spacing of 20 – 30 cm (8 – 12") has versus traditional wide row spacing of 60 cm (24") in irrigated dry bean production.

Research Plan

Trials were established at the Broderick (ICDC Pederson location) and at Riverhurst, SK. The trial at Broderick was established and maintained by ICDC, the Riverhurst by the CDC. Trials were established in a randomized split plot design with four replications, main plots were row spacing's and subplots were varieties.

The Broderick solid or narrow row plots were on 20 cm (8") row spacing's of four rows, the wide row on 60 cm (24") spacing's of two rows. At Riverhurst narrow rows were on 30 cm (12") spacing's of three rows and wide row on 60 cm (24") of two rows. Three market class dry beans, with two varieties each, were included in each test. Pinto market class varieties were AC Island and CDC WM-2, Black market class were CDC Blackstrap and CDC Jet and the Navy market class dry bean varieties were Envoy and Portage. At each site varieties were planted to establish a target plant population of 35 plants/m² for narrow row production and 25 plants/m² for wide row production. Planting rates for each system were adjusted for variety seed size and % germination. All seed was treated with Apron Maxx RTA (fludioxonil and metalaxyl-M and S-isomer) for various seed rots, damping off and seedling blights and with and Stress Shield 600 (imidacloprid) for wireworm control. Trials were seeded May 28 at Broderick and May 18 at Riverhurst.

At Broderick weed control consisted of a spring pre-plant soil incorporated application of granular Edge (ethalfluralin) and a post-emergent application of Basagran Forte (bentazon) + Viper ADV (imazamox & bentazon) supplemented by one in-season cultivation, for wide row trials, and periodic in-row hand weeding. No fungicides were applied to this trial location in 2018. Inter-row cultivation was conducted once only for wide row plots in 2018.

At Riverhurst weed control was controlled by a fall applied and incorporated application of Edge (ethalfluralin) and a post-emergent application of Basagran Forte (bentazon) + Viper ADV (imazamox &

bentazon) supplemented by one in-season cultivation, for wide row trials, and periodic in-row hand weeding.

Plots were undercut on August 30 to facilitate harvest at the Broderick but swathed September 4 at Riverhurst.

Plots were harvested September 28 at Broderick and September 19 at Riverhurst.

Total in-season precipitation at Broderick was 86 mm (3.4") and total in-season irrigation was 140 mm (5.5"). In-season precipitation totalled 97 mm (3.8") at Riverhurst with 202 mm (7.95") irrigation applied.

Results

Yield from both sites are shown in Table 1. Agronomic observations captured for the ICDC Broderick location are shown in Table 2.

Dry bean seed yield was statistically significantly increased at both locations when a solid seeded production system was established. At both locations the yield benefit of solid seeded beans as compared to a wide row production system was approximately 40%. Yield gains might be attributed to, in part, higher plant populations, quicker and more complete ground cover resulting in better weed competition and soil moisture utilization. Yield between market classes and within classes did vary at Broderick. In 2018 the two Pinto market class varieties were higher yielding at Broderick. At Riverhurst all market classes produced comparable yield. The combined yield of both sites is graphically illustrated in Figure 1.

At Broderick row spacing had no influence on seed test weight or thousand kernel weight, nor on days to flower and mature or on lodging. The solid or narrow row system resulted in taller plants and a greater number of pods forming higher on the plant which would facilitate a swathing or direct harvest operation. Plant populations did differ reflecting the difference in seeding rates, both systems had final plant populations reduced by approximately 20% from the number of seeds planted/m².

ICDC has now replicated this trial at both these locations for the past three growing seasons. Results generated in 2018 with respect to yield closely mirror results obtained in 2016 and 2017. A full report on three years of trials will be conducted and a fact sheet developed which will be posted on the ICDC web site. Although a full analysis has not been completed, a visual representation of dry bean yield over the three years of the study, comparing row spacing is provided in Figure 2.

Table 1. Dry Bean Yield as Influenced by Row Spacing and Variety.

Treatment	Broderick		Riverhurst	
	Yield		Yield	
	kg/ha	lb/ac	kg/ha	lb/ac
Row Spacing				
Solid	4099	3656	6522	5818
Wide	2330	2078	3887	3467
Row Spacing LSD (0.05)	1015	905	436	389
CV	23	23	8.6	8.6

Variety				
Pinto				
AC Island	4174	3723	5222	4658
CDC WM-2	4140	3692	4927	4394
Black				
CDC Blackstrap	3247	2896	5814	5186
CDC Jet	1932	1724	5172	4613
Navy				
Envoy	2210	1971	4543	4052
Portage	3584	3197	5552	4952
Variety LSD (0.05)	781	697	459	409
Row Spacing x Variety				
LSD (0.05)	S	S	NS	NS

S = significant

NS = not significant

Table 2. Dry Bean Agronomic Characteristics Observed at Broderick

Treatment	Test weight (kg/hl)	Seed weight (mg/1000)	Flower (days)	Maturity (days)	Lodge rating 1=upright 5=flat	Pod clearance (%)	Height (cm)	Plant Stand (plants /m²)
Row Spacing								
Solid	77.5	247	50	89	1.3	80	49	31
Wide	77.6	251	50	89	1.1	72	46	20
Row Spacing LSD (0.05)	NS	NS	NS	NS	NS	6.0	2.5	4.7
CV	2.1	16.2	2.1	0.9	28.6	5.0	8.6	8.7
Variety								
Pinto								
AC Island	77.1	343	47	89	1.1	74	49	27
CDC WM-2	77.1	375	47	89	1.0	74	49	23
Black								
CDC Blackstrap	76.1	219	50	87	1.0	75	43	27
CDC Jet	76.9	178	56	91	1.0	84	50	27
Navy								
Envoy	78.7	177	50	88	2.1	69	43	24
Portage	79.6	203	48	89	1.0	79	52	27
Variety LSD (0.05)	1.6	41	1.0	0.8	0.4	3.9	4.2	2.3
Row Spacing x Variety								
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS

S = Significant

NS = Not Significant

Figure 1. Yield, Combined CSIDC & Riverhurst 2017

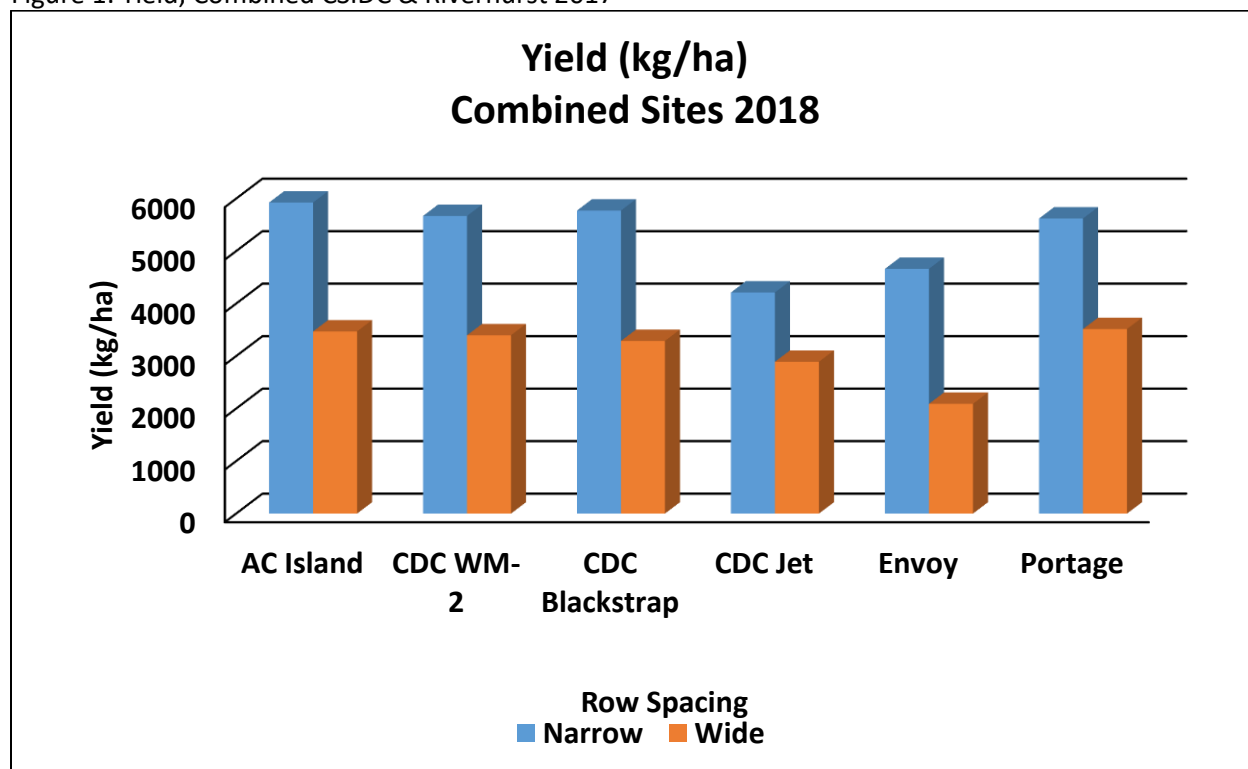
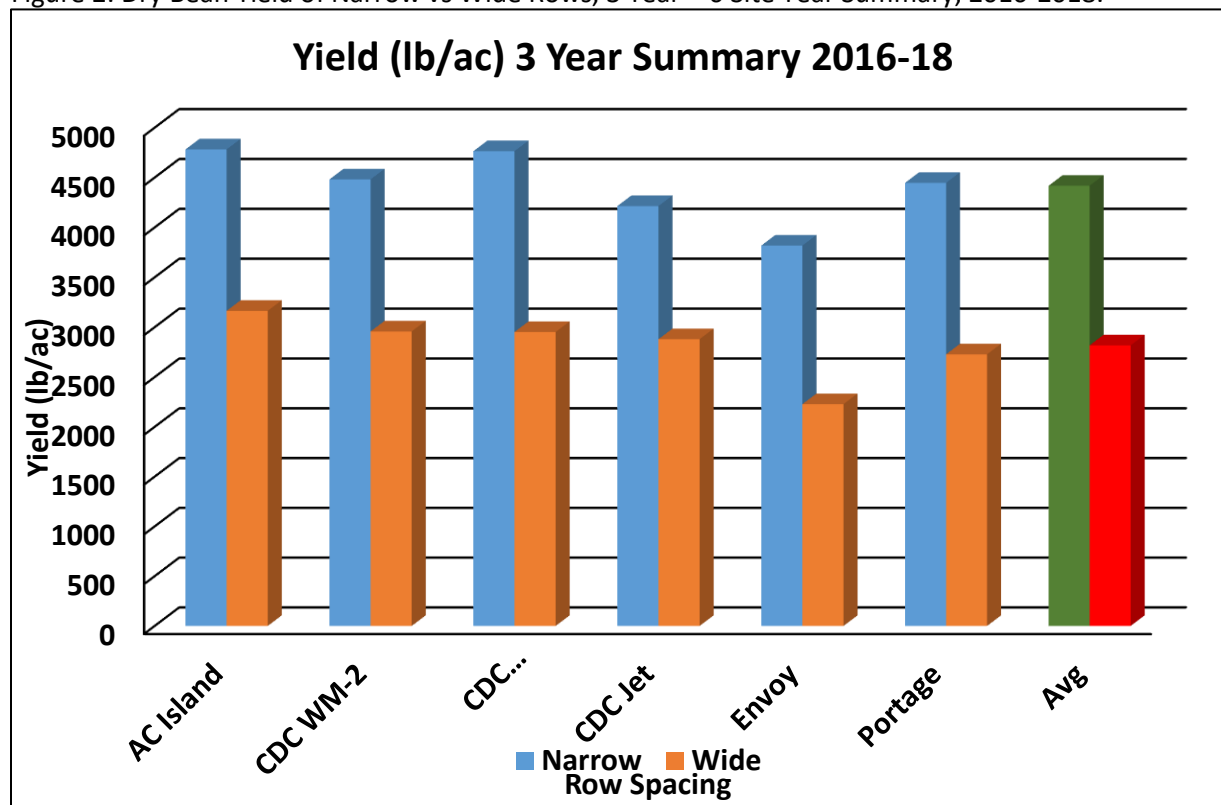


Figure 2. Dry Bean Yield of Narrow vs Wide Rows, 3 Year – 6 Site Year Summary, 2016-2018.



Control of Glyphosate Resistant Canola in Glyphosate Resistant Soybean

Funding

Funded by the Saskatchewan Pulse Growers

Project Lead

- Project P.I: Mike Hall (ECRF)
- ICDC Lead: Garry Hnatowich

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- East Central Research Foundation (ECRF)
- Indian Head Research Foundation (IHARF)
- Northeast Agriculture Research Foundation (NARF)
- Saskatchewan Pulse Grower

Objectives

The objectives of this project are:

- (1) To demonstrate the efficacy of specific pre and post-emergent herbicide options for the control of glyphosate resistant canola volunteers in glyphosate resistant soybeans.
- (2) To demonstrate improved control of glyphosate resistant canola volunteers by layering pre and post-emergent herbicides
- (3) To encourage the use of herbicides with differing modes of action to delay the development of herbicide resistance.

Research Plan

The trial was established at the ICDC Pederson Off-station location, this site had a history of glyphosate tolerant canola being grown within the previous two years. The glyphosate tolerant soybean variety NSG Leroy was sown due to its relative early maturity. All seed was pre-packaged by weight after adjusting for seed weight, % germination and assuming a 90% seedling survival. Target plant population was 519,000 plants/ha (210,000 plants/ac). The trial was established in a factorial randomized complete block plot design with four replications. Plots were seeded on May 29. Granular Cell-Tech soybean inoculant was applied at an application rate of 11.2 kg/ha with the seed. Supplemental phosphorus fertilizer as 11-52-0 was side banded at seeding at a rate of 35 kg P₂O₅/ha. Prior to seeding a broadcast application of 0.56 kg/ha of the glyphosate resistant hybrid 45M35 was applied across the trial to ensure a population of volunteer canola. Herbicide treatments are outlined in Table 1. A detailed treatment list with application rates follows Table 1. Application rates of products used follow Table 1. The pre-seed glyphosate burn-off occurred on May 24, the remaining pre-seed herbicides were applied May 29. In-crop herbicide applications occurred on July 5. Assessment of weed control achieved occurred approximately 14 days after emergence and then approximately 14, 21 and 56 days after post-emergent herbicide applications. Harvest area was 1.5 x 8.0 m, plots were combined with a Wintersteiger plot combine when the plants were dry enough to thresh and the seed moisture content was <18%. Harvest occurred on October 5. Harvested samples were cleaned and yields adjusted to a moisture content of 13.5%. Oil and protein content were determined with a Foss NIR analyser. Dockage was determined by combining seed for each treatment from all reps and submitting the treatment sample to an independent laboratory.

Total in-season precipitation at Pederson from May through September was 109 mm. Total in-season irrigation at Pederson was 140 mm.

Table 1. Herbicide Treatment List.

Treatment	Herbicide Application Time	Pre-seed Herbicides	Post-emergent Herbicides
1	No control	Glyphosate only	Glyphosate only
2	In-crop control only	Glyphosate only	Glyphosate + Viper ADV
3	Early control	Glyphosate + Blackhawk	Glyphosate only
4	Early control	Glyphosate + Authority Charge	Glyphosate only
5	Early control	Glyphosate + Express SG	Glyphosate only
6	Early control	Glyphosate + Heat LQ	Glyphosate only
7	Early + in-crop control	Glyphosate + Blackhawk	Glyphosate + Viper ADV
8	Early + in-crop control	Glyphosate + Authority Charge	Glyphosate + Viper ADV
9	Early + in-crop control	Glyphosate + Express SG	Glyphosate + Viper ADV
10	Early + in-crop control	Glyphosate + Heat LQ	Glyphosate + Viper ADV

Herbicide Application Rates

Roundup transorb (glyphosate) – 0.67 L/ac

Blackhawk (2,4-D ester + pyraflufen-ethyl) – 0.3L/ac

Authority Charge – Aim (carfentrazone) 18.75 ml/ac + Authority (sulfentrazone) 118 ml/ac

Express SG (tribenuron) – 4 gm/ac

Heat LQ (saflufenacil) – 21.4 ml/ac

Viper ADV (imazamox & bentazon) – 0.4L/ac + BASF 28% UAN – 0.81 l/ac

Results

The influence of the time of herbicide application and products applied on control of glyphosate resistant canola is shown in Table 2. The control of volunteer canola 14 days after seeding was significantly enhanced with the application of Blackhawk, Authority Charge, Express SG and Heat LQ with the glyphosate. These differences did continue throughout the growing season. There was also a significant benefit of the in-season application of Viper ADV in control of volunteer canola, despite a continued presence of canola within most plots due to successive “flushes” of canola with each irrigation application. Results strongly suggest that the most favored approach to controlling volunteer glyphosate resistant canola in glyphosate resistant soybean is a herbicide layering approach of residual pre-emergent products and an in-season herbicide with glyphosate applications.

Table 2. Influence of Time of Application and Herbicide on Control of Volunteer Glyphosate Canola

Main Effect	Time of Control Evaluation			
	14 DAS	14 DAPEA	21 DAPEA	56 DAPEA
In-crop control				
Glyphosate	69.8	62.5	51.8	48.0
Glyphosate + Viper ADV	74.3	83.0	82.3	78.8
LSD (0.05)	2.0	7.4	6.4	7.0
Pre-seed control				
Glyphosate	0	21.3	18.8	11.3
Glyphosate + Blackhawk	87.5	88.1	84.4	83.1

Glyphosate + Authority Charge	91.9	86.9	84.4	81.9
Glyphosate + Express SG	90.0	81.9	72.5	69.3
Glyphosate + Heat LQ	90.6	85.6	75.0	71.3
LSD (0.05)	3.1	11.7	10.1	11.1
Pre-seed vs In-crop Interaction				
LSD (0.05)	NS	NS	NS	NS
CV (%)	4.2	15.6	14.8	17.1

DAS = days after seeding

DAPEA = days after post-emergent applications

S = significant

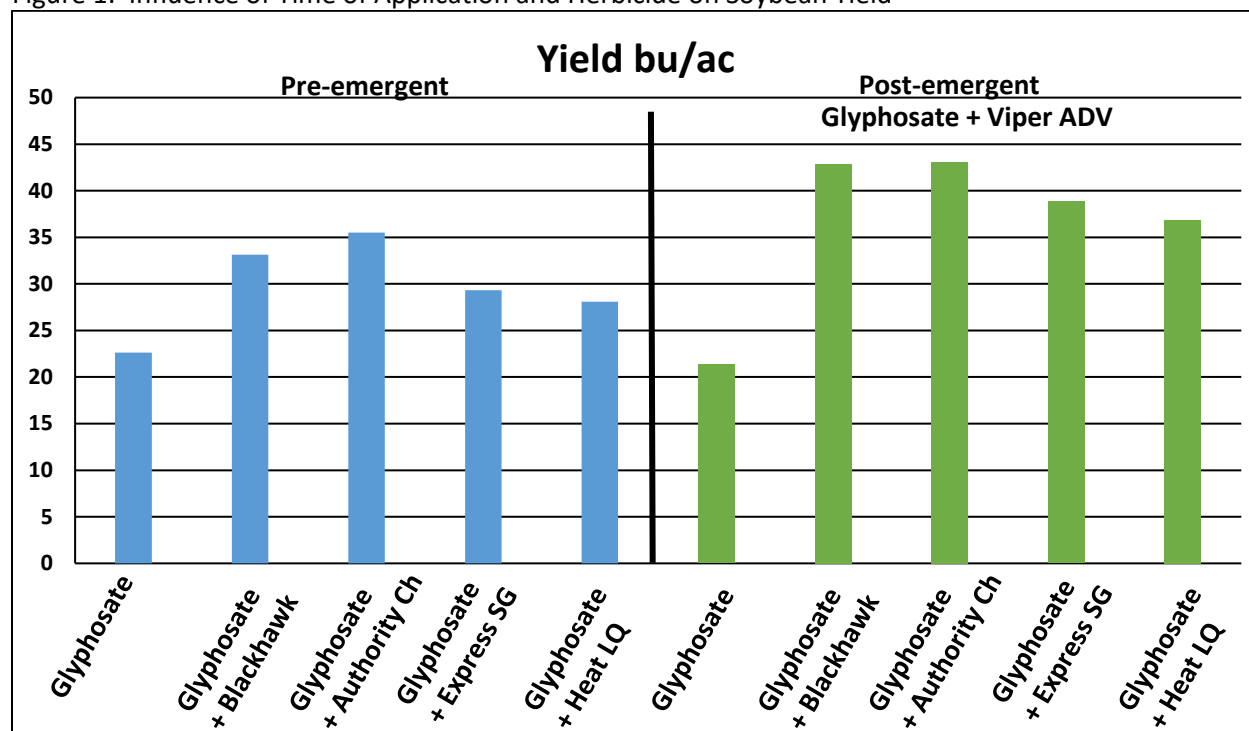
NS = not significant

The influence of the herbicide applications on yield, seed quality and plant stand of soybeans is provided in Table 3. Addition of all pre-emergent herbicide applications significantly increased soybean yield. Yield enhancement is directly attributed to volunteer glyphosate resistant canola control. For the same reason a soybean yield enhancement occurred with the in-season application of Viper ADV when applied with the in-season glyphosate application. Statistical analyses indicated a significant interaction between pre-emergence and post-emergence herbicide application. This effect is graphically illustrated in Figure 1. The primary difference is no benefit to yield with the post-emergent glyphosate + Viper ADV application. However Viper ADV application post-emergent enhanced the benefit already established with the additional pre-emergent herbicides applied. Similarly, the same findings occurred with % dockage. Herbicide timing and products had little or no impact on other seed quality measurements. This trial was also conducted at Yorkton, Indian Head and Melfort and a multi-site report prepared and posted to the Agri-ARM web site.

Table 3. Influence of Time of Application and Herbicide on Soybean Agronomics

Main Effect	Yield (kg/ha)	Protein (%)	Oil (%)	Test Weight (kg/hl)	Seed weight (g/1000)	Dockage (%)	Plant Stand (plant/m ²)
In-crop control							
Glyphosate	2001	30.3	17.9	72.8	125	28.4	53
Glyphosate + Viper ADV	2463	30.4	17.7	72.4	125	17.1	51
LSD (0.05)	117	NS	0.2	NS	NS	6.9	NS
Pre-seed control							
Glyphosate	1480	31.2	17.9	72.7	122	42.1	51
Glyphosate + Blackhawk	2558	30.3	17.7	72.4	126	20.6	49
Glyphosate + Authority Charge	2644	29.9	17.7	72.9	128	13.6	50
Glyphosate + Express SG	2294	30.1	17.8	72.2	127	18.7	55
Glyphosate + Heat LQ	2184	30.2	17.9	72.8	125	18.7	55
LSD (0.05)	185	NS	NS	NS	NS	10.9	NS
Pre-seed vs In-crop Interaction							
LSD (0.05)	S	S	NS	S	NS	NS	NS
CV (%)	8.1	2.9	2.2	1.8	4.3	46.7	25.2

Figure 1. Influence of Time of Application and Herbicide on Soybean Yield



Demonstrating 4R Nitrogen Management Principals for Canola

Funding

Funded by the Agricultural Demonstration of Practices and Technologies Fund (ADOPT).

Project Lead

- ICDC Lead: Garry Hnatowich

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Indian Head Research Foundation (IHARF)
- East Central Research Foundation (ECRF)

Objectives

Nitrogen is the most commonly limiting nutrient in annual crop production and often accounts for one of the most expensive crop nutrients, particularly for crops with high N requirements like wheat and canola. Most inorganic N fertilizers contain $\text{NH}_4\text{-N}$ but some (i.e. UAN) also contain $\text{NO}_3\text{-N}$. Since the advent of no-till and innovations in direct seeding equipment, side- or midrow-band applications and single pass seeding / fertilization quickly became the standard and most commonly recommended BMP for nitrogen. Side-or mid-row banding is effective with the major forms of N including anhydrous ammonia (82-0-0), urea (46-0-0) and urea ammonium-nitrate (28-0-0) and the combination of concentrating fertilizer (safely away from the seed row) and placing it beneath the soil surface dramatically reduced the potential for environmental losses while maintaining seed safety. Fall applications have always been popular, at least on a regional basis, in that fertilizer prices are usually lower and applying N in a separate pass can take logistic pressure off during seeding when labour and time are limited. It is primarily for these logistic reasons that many growers are again considering two pass seeding / fertilization strategies as a means of spreading out their workload and managing logistic challenges associated with handling large product volumes during the narrow seeding window. While the timing and/or placement associated with two pass systems are usually not ideal, enhanced efficiency formulations such as polymer coats (ESN), volatilization inhibitors (i.e. Agrotain) and volatilization / nitrification inhibitors (Super Urea) can reduce the potential risks associated with applying N well ahead of peak crop uptake (i.e. fall applications) or sub-optimal placement methods (i.e. surface broadcast, which seems to be increasing in popularity for irrigated production). Enhanced efficiency N products are more expensive than their more traditional counterparts; however, this higher cost may be justified by the potential improvements in efficacy and logistic advantages of alternative fertilization practices.

This project is relevant to producers because, for many, there has been a movement back to two pass seeding fertilization systems for logistic reasons. The availability of high speed floater applicators is increasing within major irrigation districts. While we do not necessarily want to encourage growers to revert to two pass seeding / fertilization systems, it is important for them to have a certain amount of flexibility with respect to how they manage N on their farms. By demonstrating different N fertilization strategies according to the 4R principles and providing data on their efficacy relative to benchmark BMPs we can help them to make informed decisions while taking into consideration both the advantages and potential disadvantages of the various options. Canola is a good candidate for this project since it is highly responsive to N fertilizer applications.

Developing Best Management Practices (BMPs) for nutrient applications has long been focussed on the 4R principles which refer to using the: 1) right source, 2) right rate, 3) right time and 4) right placement. These factors are not necessarily independent of each other. For example, depending on the source, application timings or placement options that would normally be considered high risk can become viable. The objective of this trial is to demonstrate canola response to varying rates of Nitrogen (N) along with different combinations of formulations, timing and placement options relative to side-banded, untreated urea as a benchmark. The proposed field trial design encompasses all four considerations (source, rate, time and placement) for 4R nutrient management.

Research Plan

The trial was established at the Canada-Saskatchewan Irrigation Diversification Center (CSIDC) Off-station Knapik land base. The trial was established in a randomized complete block design (RCBD) with four replications. Fall fertilizer applications were conducted on October 30, 2017; spring fertilizer band applications on May 3, 2018 and canola was seeded into wheat stubble on May 18. The Liberty tolerant hybrid L252 was seeded at a rate of 6.0 kg/ha. Pre-seed broadcast fertilizer applications were incorporated by the seeding operation. Fertilizer treatments are shown in Table 1. Soil analyses from fall 2017 sampling of the trial area is shown in Table 2. On the basis of soil test analyses the 1X rate of N fertilizer was identified as 75 kg N/ha. All treatments received 35 kg P₂O₅/ha seed placed monoammonium phosphate (12-51-0) at seeding. Weed control consisted of a post-emergent tank-mix application of Liberty 150SN (glufosinate) and Centurion (clethodim) and supplemented by periodic hand weeding. The trial received a foliar application of Headline EC (pyraclostrobin) fungicide at 50% bloom. Individual plots were mechanically separated on August 31 and swathed on September 10 but due to inclement weather not harvested with a small plot combine until October 4.

Total in-season rainfall from May through September was 116.0 mm (4.6"). Total in-season irrigation was 197 mm (7.75").

Table 1. 4R Nitrogen Canola Study Treatments

Treatment	Fertilizer Rate, Placement & Source
1	Un-fertilized control
2	0.5X spring side-band Urea
3	1.0X spring side-band Urea
4	1.5x spring side-band Urea
5	1.0x spring side-band Agrotain
6	1.0x spring side-band SuperU
7	1.0x spring side-band ESN
8	1.0x fall broadcast Urea
9	1.0x fall broadcast Agrotain
10	1.0x fall broadcast SuperU
11	1.0x fall band Urea
12	1.0x fall band Agrotain
13	1.0x fall band SuperU
14	1.0x fall band ESN

Table 2. Soil Testing Report, Agvise Labs, Sampled fall 2017

Depth (cm)	NO ₃ -N (lb/ac)	P (ppm)	K (ppm)	SO ₄ -S (lb/ac)
0 - 15	13	11	102	28
15 - 30	15			26
30 - 60	38			
Organic Matter	1.3%			
pH (0 - 15 cm)	7.9			
pH (15 - 60 cm)	8.0			
Soluble Salts (0 - 15 cm)	0.24 mmho/cm			
Soluble Salts (15 - 60 cm)	0.24 mmho/cm			

In-season environmental information is provided in Table 3 & 4. Seasonal precipitation was well below “normal” at seasons end. Seasonal Cumulative Growing Degree Days was greater than historic records.

Table 3. Seasonal vs Long-Term Precipitation, CSIDC Outlook Weather Station			
	Year		
Month	2018 mm (inches)	30 Year Average mm (inches)	% of Long-Term
May	25.0 (1.0)	46.0 (1.8)	54
June	13.0 (0.5)	67.0 (2.6)	19
July	36.0 (1.4)	57.0 (2.2)	64
August	17.0 (0.7)	46.0 (1.8)	38
September	25.0 (1.0)	33.0 (1.3)	78
Total	116.0 (4.6)	249.0 (9.8)	47

Table 4. Cumulative Growing Degree Days (Base 0°C) vs Long-Term Average, CSIDC Outlook Weather Station			
	Year		
Month	2018	30 Year Average	% of Long-Term
May	289	224	129
June	934	708	132
July	1507	1290	117
August	2054	1844	111
September	2303	2058	112

Results

Results obtained for the 4R Nitrogen Principals in Canola are shown in Table 5.

The highest yielding treatment occurred with the conventional 1.5X urea sideband at the time of seeding, this treatment was statistically higher yielding when compared to any treatment with a grain yield less than 4600 kg/ha (treatments 1, 2, 5, 6, 12, 13 and 14, respectively). The unfertilized control was the lowest yielding treatment but did not differ statistically from the fall broadcast urea,

demonstrating why broadcast “bare” urea is not a recommended practice, though becoming somewhat common, particularly in large acreage operation. Fall broadcast applications had lower numerical yields compared to their fall banded counterparts. The highest yielding fall application was with the banded SuperU treatment. Spring banded efficiency products failed to offer any yield advantage over the 1x spring band urea treatment in this study. Yield response to treatments are graphically illustrated in Figure 1.

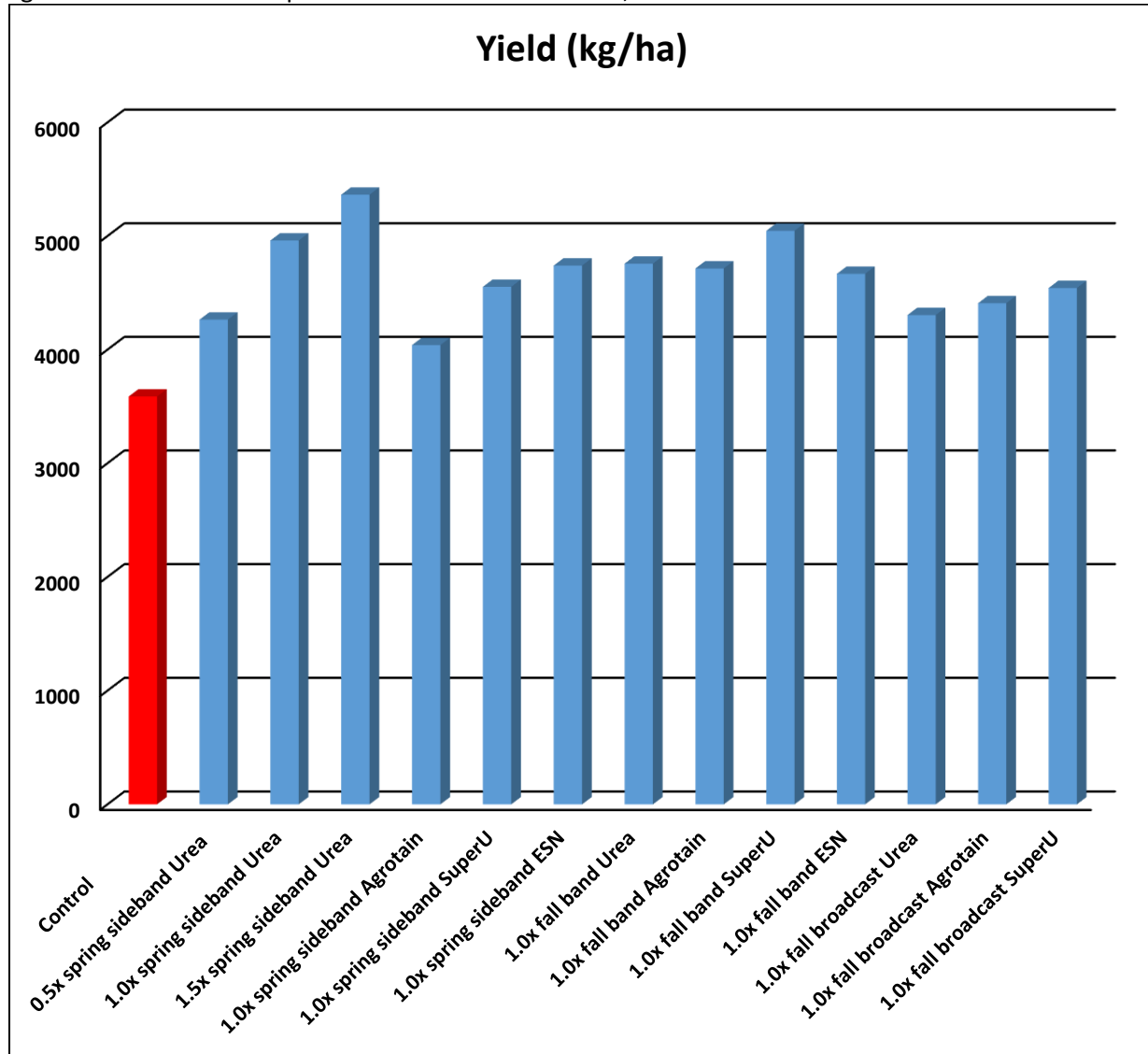
Oil content, test weight, thousand seed weight, height or lodging was not influenced by any fertilizer application. In general, fertilizer applications increased days to maturity.

Table 5. 4R Nitrogen Canola Study Results, 2018

Treatment	Yield (kg/ha)	Yield (bu/ac)	Oil (%)	Test weight (kg/hl)	Seed weight (gm/1000)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
1. Un-inoculated check	3588	64.0	49.4	64.1	5.1	94	108	2
2. 0.5X spring side-band Urea	4264	76.1	49.1	64.2	5.2	94	115	2
3. 1.0X spring side-band Urea	4961	88.5	48.8	64.2	5.2	94	115	2
4. 1.5x spring side-band Urea	5364	95.7	48.7	64.4	5.1	96	114	2
5. 1.0x spring side-band Agrotain	4041	72.1	49.6	64.5	5.2	94	114	2
6. 1.0x spring side-band SuperU	4553	81.2	49.5	64.5	5.3	95	113	2
7. 1.0x spring side-band ESN	4740	84.6	49.1	64.1	5.1	94	118	2
8. 1.0x fall broadcast Urea	4305	76.8	48.8	64.4	5.0	94	113	2
9. 1.0x fall broadcast Agrotain	4409	78.7	49.3	63.9	5.3	95	108	2
10. 1.0x fall broadcast SuperU	4543	81.1	49.0	64.0	5.0	94	110	2
11. 1.0x fall band Urea	4757	84.9	48.7	64.0	5.0	94	113	2
12. 1.0x fall band Agrotain	4715	84.1	49.2	64.0	5.0	94	118	2
13. 1.0x fall band SuperU	5046	90.0	49.3	64.2	5.0	94	119	2
14. 1.0x fall band ESN	4668	83.3	48.9	64.4	5.2	94	116	2
LSD (0.05)	794	14.2	NS	NS	NS	0.5	NS	NS
CV (%)	12.2	12.2	1.3	0.6	4.6	0.4	5.3	1.0

NS = not significant

Figure 1. Canola Yield Response to N Fertilizer Additions, 2018



An Economic Approach to Seeding Rate in Canola

Funding

Funded by the SaskCanola (Saskatchewan Canola Development Commission)

Project Lead

- ICDC Lead: Garry Hnatowich

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Indian Head Research Foundation (IHARF)
- East Central Research Foundation (ECRF)
- Western Applied Research Corporation (WARC)
- South East Research Foundation (SERF)
- Wheatland Conservation Association (WCA)
- Conservation Learning Center (CLC)

Objectives

High-quality hybrid canola seed, along with various seed treatment options, are technologically advanced and important tools available to producers. However, seed inputs comprise an increasingly larger proportion of overall input costs. Some producers are exploring lower seeding rates in order to save on seed input costs; though, as hybrid canola seed size is generally increasing, producers should be aware of the need to maintain or increase seeding rates to achieve adequate plant populations for maximum yield potential.

Further, as canola seed companies are proposing a change from cost per weight to cost per number of seeds, there has been some discussion about the effect of canola seed size on plant establishment and yield. Canola seed size theoretically could influence the emergence rate and seedling survival rate as larger seeds have greater energy reserve and vigour needed to emerge from greater depths and cooler temperatures, and seedlings may be larger and more vigorous to be able to withstand early stresses such as soil-borne diseases and insects. Past and current research on the effect of canola seed size on emergence and yield has shown varying results.

The objectives of this study are:

- (1) to demonstrate the need to adjust seeding rates to achieve adequate plant densities with varying canola seed sizes, and
- (2) to demonstrate the effect of canola seed size on vigour and yield under various local environmental conditions.

Research Plan

The trial was established at the ICDC Off-station Pederson site. The trial was established in a 2 x 2 x 3 factorial design with four replications. The trial was seeded into potato stubble on May 23. Two canola hybrids were evaluated, the Liberty tolerant hybrid L233P and the glyphosate tolerant hybrid 45M35. The two canola hybrids were each sieved to divide the seed lots into small-seeded and large-seeded fractions. The thousand seed weights (TKW) for small-seeded 233P was 4.3 gm, for the designated

large-seed fraction 5.5 gm. For 45M35 the TKW for the small-seeded fraction was 4.8 gm, the large-seeded fraction 5.9 gm. Both fractions of each hybrid was seeded at rates of 54, 108 and 161 seeds/m². Treatments are outlined in Table 1. Due to the high available soil N levels of the potato rotation the canola received supplemental fertilizer N at a rate of 60 kg N/ha plus 35 kg P₂O₅/ha, both fertilizer products (46-0-0 & 12-52-0) were side-banded at seeding. Soil analyses from spring 2018 sampling of the trial area is shown in Table 2. Weed control consisted of a pre-plant soil incorporated application of granular Edge (ethalfluralin) and a post-emergent tank-mix application of Muster Toss-N-Go (ethametsulfuron-methyl) and Poast Ultra (sethoxydim) and supplemented by periodic hand weeding. The trial received a foliar application of Headline EC (pyraclostrobin) fungicide at 50% bloom. Plots were mechanically separated on August 13, swathed August 20 and after proper dry down harvested September 5.

Total in-season precipitation was 86 mm (3.4") and total in-season irrigation was 140 mm (5.5").

Table 1. Canola Seeding Rate Treatment List

Trt	Hybrid	Seed Size	Seed Rate
1	L233P	Small (4.3 gm TKW)	54 seeds/m ²
2	L233P	Small (4.3 gm TKW)	108 seeds/m ²
3	L233P	Small (4.3 gm TKW)	161 seeds/m ²
4	L233P	Large (5.5 gm TKW)	54 seeds/m ²
5	L233P	Large (5.5 gm TKW)	108 seeds/m ²
6	L233P	Large (5.5 gm TKW)	161 seeds/m ²
7	45M35	Small (4.8 gm TKW)	54 seeds/m ²
8	45M35	Small (4.8 gm TKW)	108 seeds/m ²
9	45M35	Small (4.8 gm TKW)	161 seeds/m ²
10	45M35	Large (5.9 gm TKW)	54 seeds/m ²
11	45M35	Large (5.9 gm TKW)	108 seeds/m ²
12	45M35	Large (5.9 gm TKW)	161 seeds/m ²

Table 2. Soil Testing Report, Agvise Labs, Sampled Spring 2018

Depth (cm)	NO ₃ -N (lb/ac)	P (ppm)	K (ppm)	SO ₄ -S (lb/ac)	Cl (lb/ac)	Zn (ppm)	Cu (ppm)
0 - 15	63	9	223	120+	134	1.23	0.6
15 - 30	18			120+	71		
30 - 60	28						
Organic Matter	2.6%						
pH (0 - 15 cm)	8.0						
pH (15 - 60 cm)	8.1						
Soluble Salts (0 - 15 cm)	0.67 mmho/cm						
Soluble Salts (15 - 60 cm)	0.63 mmho/cm						

Results

Agronomic data collected in the study is tabulated in Table 3 (analysis of variance procedures conducted on entire data set as a RCB design) and shown for record posterity only and will not be discussed.

The discussion will be based on results of each factorial treatment within the test which is summarized in Table 4. As has been found in other trials the results of this evaluation tend to be somewhat inconclusive! Yield did not differ between the two hybrids. With respect to yield influence by seed size the difference was not statistically significant at $P < 0.05$, but did favour the large seed size at the $P < 0.10$ level. The mean influence of the large seed increased yield by approximately 5% but no firm conclusion should be formulated from the results as this trial is from a single year and a single site. Canola seed size did not influence any other seed or agronomic characteristic measures other than large seed producing a taller plant than small seed. Further seed rate did not have a strong influence on agronomic measurements within this study.

Once all participating sites have analysed their respective results a combined analysis of this trial will be conducted and clearer insight as to seed size and seed rate may appear. A multi-site report of this study will be prepared and posted to the Agri-ARM web site.

Table 3. Agronomic Summary and RCBD ANOVA Procedures.

Hybrid	Seed Size	Seed Rate (seed/m ²)	Yield (kg/ha)	Oil (%)	Test Wgt (kg/hl)	TKW (gm)	Height (cm)	Maturity (days)	Plant Pop. (plant/m ²)	Lodge rating (1=erect ; 5=flat)
L233P	Small	54	3701	48.4	63.7	5.50	101	81	35	1.8
L233P	Small	108	3954	48.9	62.7	5.33	95	80	58	1.8
L233P	Small	161	3917	49.2	63.0	5.33	100	80	115	2.0
L233P	Large	54	3855	48.8	63.3	5.35	104	82	37	2.0
L233P	Large	108	3793	48.8	63.4	5.25	105	83	42	2.0
L233P	Large	161	4008	49.2	62.8	5.18	104	80	86	2.0
45M35	Small	54	3466	52.0	63.3	5.55	101	82	34	2.3
45M35	Small	108	3786	52.3	63.4	5.50	102	81	53	1.8
45M35	Small	161	3786	52.7	63.4	5.25	99	81	58	1.5
45M35	Large	54	3859	51.2	63.7	5.55	102	83	51	2.0
45M35	Large	108	4205	51.8	63.3	5.68	108	81	65	2.3
45M35	Large	161	4105	50.7	63.8	5.53	104	81	122	2.5
LSD (0.05)			NS	1.4	NS	0.22	NS	NS*	45	NS
CV (%)			9.9	2.0	0.9	2.8	6.7	1.7	50.1	25.7

NS = Not significant

* = Significant at $P < 0.10$

Table 4. Agronomic Summary Factorial Analyses.

Treatment	Yield (kg/ha)	Oil (%)	Test Wgt (kg/hl)	TKW (gm)	Height (cm)	Maturity (days)	Plant Pop. (plant/m ²)	Lodge rating (1=erect; 5=flat)
Hybrid								
L233P	3871	48.9	63.1	5.3	101	81	62	1.9
45M35	3868	51.8	63.5	5.5	102	81	64	2.0
LSD (0.05)	NS	0.6	0.3	0.09	NS	NS	NS	NS
CV	9.9	2.0	0.9	2.8	6.7	1.7	50.1	25.7
Seed Size								
Small	3768	50.6	63.2	5.4	99	81	59	1.8
Large	3971	50.1	63.4	5.4	104	81	67	2.1
LSD (0.05)	NS*	NS	NS	NS	4.0	NS	NS	NS
Seed Rate (seeds/m²)								
54	3721	50.1	63.5	5.5	102	82	39	2.0
108	3935	50.4	63.2	5.4	102	81	54	1.9
161	3954	50.4	63.2	5.3	102	80	95	2.0
LSD (0.05)	NS	NS	NS	0.1	NS	0.9	23	NS
Hybrid x Seed Size Interaction								
LSD (0.05)	NS	S	NS	S	NS	NS	S	NS
Hybrid x Seed Rate Interaction								
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Seed Size x Seed Rate Interaction								
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Hybrid x Seed Size x Seed Rate Interaction								
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS

NS = Not significant

* = Significant at P < 0.10

Nitrogen Response Demonstration for Irrigated Quinoa

Funding

Agriculture Demonstration of Practices and Technologies (ADOPT)

Project Lead

- Joel Peru, PAg, Irrigation Agrologist, Saskatchewan Agriculture
- Garry Hnatowich, PAg, Research Director, ICDC

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Canada-Saskatchewan Irrigation Diversification Centre

Objectives

This demonstration provided local producers opportunity to see how quinoa responds to different rates of nitrogen under irrigated conditions.

Research Plan

This quinoa nitrogen rate trial was established in the spring of 2018 on CSIDC off site Knapiks location (NW12-29-8 W3M). The soil is classified as an Asquith sandy loam.

This demonstration utilized a randomized replicated small plot design and included the quinoa variety “Golden”. There were four treatments in this trial, 225, 150, 75 and 0lb N/ac. The plots with no N fertilizer applied was considered the control for this trial. Plot dimensions were 1.75 m by 6.0 m and were replicated three times under irrigated production. The plots were seeded on May 23rd 2018 with a small plot drill with a seeding depth of ½ inch. A desiccant, Reglone was applied to help prepare the plots for harvest and dry down weed material. Plots were harvested on October 4th 2018. This trial received a total of 109 mm of rain fall and 327 mm of irrigation during the growing season.

Figure 1. Plot Plan for Nitrogen Response Demonstration for Irrigated Quinoa

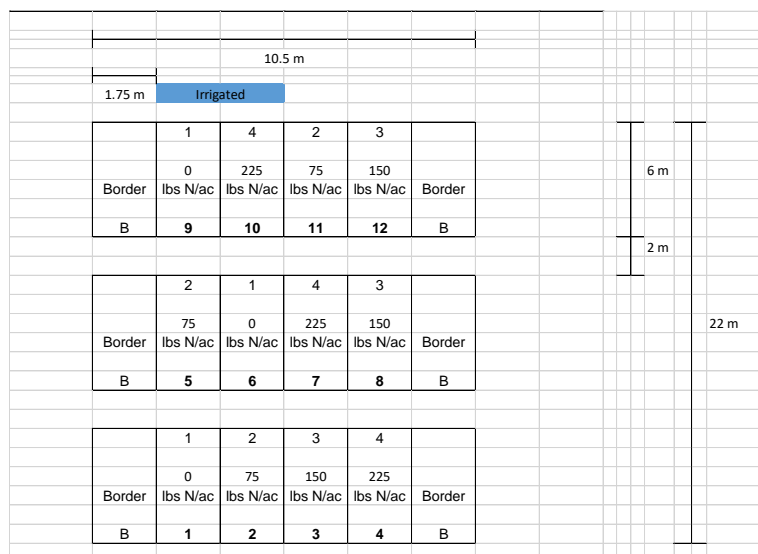


Figure 2. Quinoa Plots on June 22nd 2018



Figure 3. Flea Beetle Damage on Quinoa



Results and Discussion

Yields from this for this trial were minuscule due to the damage caused by stem borer, a pest that has shown up throughout Western Canada in quinoa fields. Stem borer has the ability to destroy a quinoa crop in as little as a 1-week period. Since there are no insecticides currently registered, stem borer is a large threat when growing this crop. The average yield measured in this trial for each treatment is listed in table 1. The yields generated in this trial failed to display quinoa's potential response to increased rates of nitrogen due to the presence of stem borer.

Table 1: Yield Results of 2018 Nitrogen Response Demonstration for Irrigated Quinoa

Treatment	Yield (kg/ha)	Yield (lb/ac)
0N lb N/ac	67	59
75N lb N/ac	62	55
150 lb N/ac	84	75
225 lb N/ac	51	45

Quinoa is an emerging crop that has the potential to yield well in Saskatchewan's conditions. Currently quinoa does not have any registered pesticide for in crop use so the risks are high as seen in this year's ADOPT trial. Weed pressure and insect damage is always an issue for quinoa but a particular stem borer can be devastating and cause crop failure. This stem borer has been identified as a major issue for growing quinoa in Western Canada. Once the stem borer is present in a quinoa crop it can do enough damage to the inner stem to wipe out its potential seed yield.

Yields from this for this trial were minuscule due to the damage caused by stem borer. Stem borer has the ability to destroy a quinoa crop in a little as a 1-week period and since there are no insecticides currently registered it is a large risk in its production. The average yield from the different treatments ranged from 51-84 kg/ha (45-75lb/ac). The yields obtained in this trial failed to display quinoa's potential response to increased rates of nitrogen due to the presence of stem borer. The gross value of this crop fell far below its cost of production and would have been considered a crop failure. For a detailed look of the cost of production for quinoa under irrigation in Saskatchewan, please refer the Irrigation Crop Diversification Corporation's "*Irrigation Economics and Agronomics*" publication located on their website and at the Ministry's regional office in Outlook.

Acknowledgements

- CSIDC staff
- Derek Flad, Norquin- sourcing seed and providing agronomic advice
- Garry Hnatowich, ICDC Research Director and ICDC Staff

Control of Sclerotinia for Irrigated Canola with Contans, Coniothrium minitans

Project Leads

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture
- Dale Ziprick, Product Manager, United Agri Products, Winnipeg, MB
- David Jessiman, Territory Manager, United Agri Products, Lucky Lake, SK
- Jon Weinmaster, Product Manager, BayerCropScience, Guelph, ON
- Tyler Scott, Crop and Campaign Marketing Manager, BayerCropScience, Calgary, AB

Co-operator

- Marc Gravelle, Irrigator, Riverhurst, SK

Project Objective

This project will compare the control of sclerotinia using foliar fungicide products alone or together with a biological control agent. Because the threat of sclerotinia in irrigated crops is so powerful, growers often insist on two foliar applications to the entire field even if the area has been treated with Contans. Because Contans is a biological approach to disease control, growers are more comfortable using the biological control practice as a complement to foliar fungicides.

Demonstration Plan

Many of the profitable cropping options open to irrigated producers are susceptible to sclerotinia. Close to 60% of the crops seeded in 2018 on irrigated land in the Lake Diefenbaker Development Area were hosts for sclerotinia. Crop rotation research has shown that crop rotation has limited success controlling this disease. The combination of infection from sclerotia bodies in the soil, frequent production of sclerotinia sensitive crops and the push to pay the costs of irrigation development and operation as well as maximize profits, sclerotinia susceptible crops are grown on irrigated land without an intervening cereal or forage break crop. Although using a biological control for sclerotinia is a sound fungicide resistance management approach, growers question the efficacy of the registered biological control and insist on foliar dual applications of fungicide on irrigated broadleaf crops to manage this disease. The current best practice for biological control of sclerotinia in susceptible crops is to apply Contans in fall prior to freeze-up. Rain following the application or recharge of soil moisture with irrigation improves the survival of the organism as the fungus seeks out sclerotia bodies in the soil to infect. A registration for fall application Contans with irrigation exists in other jurisdictions. This project has been conducted from spring 2016 until fall 2018 to demonstrate the advantage of multi-year disease management using both biological and foliar fungicide treatments. Another advantage with annual application of Contans for sclerotinia control is the minimum rate of 0.2 kg/ac can be practically applied as a top-up for the biological control. This approach hopefully will achieve effective control of the disease because the background soil store of sclerotia bodies is controlled. The cost of the 0.2 kg/ac application is currently \$7/ac or \$1000 per quarter section pivot. List pricing of Contans is \$35/kg.

Demonstration Site

The project was located at NW24-22-7-W3 on canola for 2018. Contans has been applied at 0.6 kg/ac in spring, 2016, 0.2 kg/ac in fall, 2016 and 0.2 kg/ac in fall, 2017. The crop rotation for the site was durum wheat in 2016, red lentil in 2017, and canola in 2018. The 2017 and 2018 growing seasons were both characterized by below average precipitation during the growing season.

The second field included in the project to demonstrate the advantage of using the multi-year strategy for sclerotinia control was located at NW14-22-7-W3 and was seeded to wheat for 2018. Monitoring of sclerotinia on the sites will continue for 2019 to evaluate the longer term benefit of Contans application to the fields.

Project Methods and Observations

The initial Contans application was applied in spring 2016 by spraying the control organism on the soil surface on durum stubble and incorporated with a light harrowing. The fall 2016 treatment was also applied with a high clearance sprayer and incorporated by harrowing. For 2017, Maxim lentil was seeded on the canola stubble. The lentils were irrigated with 3.5" of water over the growing season.

Table 1: Crop Yields in Contans Demonstrations

Year/Crop	Treatment (Fungicide application)	Lb/ac	Yield Increase (%)
2016/Canola	Early fungicide	3430	- 5%
	Early fungicide + Contans	3270	
	Late fungicide + Contans	3195	
	Early fungicide +Late fungicide	3295	
2017/ Dry Beans	Contans +2 foliar applications	2887	+ 7%
	Foliar fungicide only (2 applications)	2697	
2017/Lentil	Contans +2 foliar applications	2693	+ 5%
	Contans	2568	
2018/Canola	Foliar fungicide (2 applications) + Contans	3945	+ 2%
	Foliar fungicide (2 applications)	3875	

In 2017, a dry year with limited visible sclerotinia infection on irrigated production fields, use of Contans for sclerotinia control on lentil showed over 100 lb/ac advantage for the biological control strategy (Table 1). This was unexpected because sclerotinia infection could not be found in the lentil field. The dry conditions continued in 2018. No sclerotinia was observed in the field in either area. A yield advantage with Contans application under irrigation was 1.4 bu/ac for the Contans treated area (plus double fungicide) over the double fungicide treated area.

Final Discussion

This demonstration sought to show that the top-up approach of annual Contans applications for sclerotinia control is effective and feasible both practically and economically. Profitable control of sclerotinia is crucial for irrigated crop production. For any given year, about 60% of the irrigated area is sown to sclerotinia sensitive crops. Infection levels on irrigated soils are often higher because of the intensive broadleaf crop rotation, infection levels in moist hot spots, and the longer term humidity levels within irrigated crop stands. Contans shows promise as a control option for these conditions. Contans also confers an advantage for the irrigation producer by reducing labor constraints during the summer irrigation season by potentially replacing one fungicide application to broadleaf crops. The Contans application allows control of sclerotinia in micro-site areas of high humidity within the broadleaf stand.

Irrigation can also be a tool to apply and incorporate Contans in the fall when applied early enough to use water from the irrigation system prior to system shutdown in the fall. This practice is not currently registered for Contans in Canada, but the company, BayerCropsScience is working towards registration of fall chemigation application of Contans. It is registered in other jurisdictions. Fall chemigation of the Contans organism is an excellent means of applying the fungus for control of sclerotinia because the irrigation spreads the fungus to the shallowly buried sclerotia bodies on the surface of the soil and provides the moisture to “activate” the fungal attack on them.

The product is ideally suited for irrigated rotations that have dry beans and canola and other sensitive broadleaf crops grown frequently. The big advantage for including Contans in the integrated disease control strategy for irrigated rotations is disease control can occur even if weather conditions preclude control applications during the growing season.

To support this project, a presentation was prepared for the 2019 Soils and Crops Workshop in Saskatoon as well as a poster was submitted at the 2018 ICID Conference in Saskatoon.

Acknowledgements

United Agri Products and Bayercropscience have both contributed Contans for this project over the course of the three-year term for the project. Thanks to Dale Ziprick with UAP for his support and to David Jessiman, Territory Manager with United Agri Products, for his efforts to coordinate product delivery for the demonstration. Marc Gravelle, Riverhurst, has graciously contributed the labour, land and equipment to implement this project on two of his fields for the three-year period. Thanks to summer students Chloe Montreuil and Cassidy Sim as well as Regional Services’ Crops Extension Specialist, Kaeley Kindrachuk for evaluating the disease infection levels in the canola stands. Thanks to Jon Weinmaster and Tyler Scott with Bayercropscience for their product support and interest in fall application of Contans for control of sclerotinia.

Comparison of Faba bean and Dry Bean as Irrigated Crops

Project Leads

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture
- Joel Peru, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture

Co-operator

- Anthony Eliason, Irrigator, Broderick, SK

Project Objective

This project will compare the production practices of faba bean and dry bean as irrigated crops in terms of production levels and profitability.

Demonstration Plan

Faba bean and dry bean were sown on adjacent irrigated fields on opposite sides of the SWESS canal north of Broderick. Field operations were monitored during the growing season to determine the relative profitability of the two crops. The dry beans were sown with the solid seeding strategy as opposed to row cropping. This means that the crop was managed without inter row cultivation during the growing season.

Demonstration Site

The faba bean site was located on SE34-29-6-W3 on spring wheat stubble while the dry bean site was located on SW34-29-6-W3 also on spring wheat stubble. Both sites were heavy clay textured Tuxford soils. The Tuxford association soil was formed under grassland vegetation in moderately fine to fine textured, saline glacio-lacustrine deposits. Tuxford soils have pockets of Solonetzic soil profiles throughout the landscape.

Project Methods and Observations

Both faba bean and dry bean fields emerged fairly slowly with the dry spring. Irrigation of the field in spring recharged root zone moisture and provided suitable moisture for emergence of the seedlings from the clay soil. Faba bean tolerates light frosts in spring very well and performs well with early spring planting. Black beans are hurt or possibly killed if they have emerged before the last spring frost. They are also more sensitive to handling injury that occur during the seeding operation. The emergence of black bean in the field was hampered by the seeding method. A last minute adjustment to set the implement slightly deeper in an attempt to deal with the dry conditions was not successful. This adjustment reduced the emergence of black bean in this heavy textured Tuxford soil. Establishment of the faba bean stand was higher than targeted (6.5 plants/ft² vs 4.3 plants/ft²) while the black bean establishment was lower than targeted (1.3 plants/ft² vs 2.4 plants/ft²). It is suspected that seed damage through the pneumatic air delivery system of the seeder reduced the stand establishment with the dry beans. Dry beans emerge better when sown with a gentler single metering planter. A summary of the agronomic practices and field observations is presented in Table 1.

Table 1: Comparison of production practices of the bean crops

Observation	Fababean	Dry Bean
Field location	SE34-29-6-W3	SW34-29-6-W3
Seeding date	May 3	May 29
Seeding rate	180 lb/ac	74 lb/ac
Seeding depth	2 inch	1.5 inch
Fertilizer applied	35 lb/ac 11-52-0 (4-27-0 nutrient)	60 lb N /ac-40 lb P ₂ O ₅ /ac
Sowing implement	Bourgault 5810 Able to be planted with conventional air delivery seeding equipment	John Deere 1895
Plant density	Target – 4.3 plants/m ² Achieved – 6.5 plants/m ²	Target – 2.4 plants/m ² Achieved – 1.3 plants/m ²
Herbicide	Glyphosate and Heat preseed Odyssey Ultra	Glyphosate, Heat and liquid Rival preseed Viper ADV and half rate Basagran in crop
Irrigation	7 inches	6 inches
Harvest	Straight cut with John Deere 635F header with air reel Heat	Straight cut with John Deere 635F with air reel Heat
Harvest equipment	Planted by conventional gravity metering drill Straight cut – no special header required	Singulating planter reduces seed injury and improves seedling emergence Seed easily damaged during planting operation. Harvest simplified with flexheader Lodged by snow
Seed yield	4200 lb/ac	1800 lb/ac
Selling Price of Production	\$7.50/bu (12.5 cents/lb)	\$18/bu (30 cents/lb)
Net returns over costs	\$320 plus projected N fixation benefit of 70 lb N/ac	\$345
Harvest Losses	Stubble aids moisture recharge by catching snow	Lodging due to snow in fall 2018
Harvest date	Aug 29	Oct 15 (snow delayed)
Days in field	118	140

Due to market conditions, an opportunistic window opened for selling faba beans after harvest in September, 2018. The crop was able to be sold for a relatively high price off the combine which favoured the economics for this crop for 2018. The nitrogen fixation benefit of faba bean, which is difficult to measure in fall with soil testing, is an important consideration when evaluating the economics of growing faba bean.

Final Discussion

Both dry bean and faba bean generated over \$300 per acre gross return in 2018. The demonstration highlighted the need for gentle handling of dry bean during the field operations, especially seeding. Faba bean, although it has lower value grain, has great potential to generate a solid return because of its higher yield potential and its better suitability for production with conventional equipment. When the extra nitrogen fixation of the faba bean is included in the economic assessment, the faba bean performed comparably to the dry bean.

Acknowledgements

- Western Sales provided use of a drill for planting the dry beans.
- Anthony Eliason conducted the project on his irrigated farm north of Broderick and collected the data to assess the economics of both cropping systems.

Irrigation Crop Diversification Corporation

Figure 2. Hemp Plots on June 19th 2018



Figure 3. Hemp plots on July 13th 2018



Results and Discussion

The variety X59 yielded the highest and the variety Anka the lowest (table 1). Yields of the 9 varieties ranged from 673 kg/ha to 1037 kg/ha (600-925 lb/ac) with the median being 797 kg/ha (710 lb/ac). The shorter varieties, including CRS-1, Katani and X59 yielded higher than the taller varieties. Plant population counts were taken although not statistically significant due to the high LSD value.

Table 1: Results of 2018 Demonstration of Conventional Hemp as an Irrigated Crop

Hemp	Yield	Yield	Plant Population	Plant Population
Variety	kg/ha	lb/ac	plants/ha	plants/ac
CRS-1	886	790	771,250	312,121
Silesia	685	611	817,500	330,838
Joey	797	710	747,500	302,509
Anka	673	600	702,500	284,298
Canda	729	650	692,500	280,251
Katani	908	810	547,500	221,570
Piccolo	734	655	762,500	308,580
X59	1037	925	647,500	262,040
Grandi	870	776	652,500	264,063
LSD (0.05)	127	113	NS	NS
CV (%)	11.4	11.4	24.8	24.8

The Demonstration of Conventional Hemp as an Irrigated Crop ADOPT demonstration gave local

irrigators the opportunity to view 9 different varieties of conventional hemp perform under irrigated conditions in Outlook, Saskatchewan. Yields in this trial were fairly average ranging from 673 kg/ha to 1037 kg/ha (600-925 lb/ac) with the median being 797 kg/ha (710 lb/ac). This is lower than what was found in the 2015 ICDC demonstration but in range with the average reported by producers in Saskatchewan. The highest performer, X59 is the only variety in the trial that advertises having shatter resistance. Shatter loss is a major concern when growing hemp and it is recommended to harvest this crop early to minimize losses. Harvest was completed for this trial when the hemp seed still had high moisture in order to prevent this shatter loss. This created the need to dry down the grain after harvesting to prevent spoilage. The Shorter “dwarf” varieties, including CRS-1, Katani and X59 yielded higher than the taller “hybrid” varieties which are grown for both seed and fiber.

Economics:

Assuming a realistic price of hemp at \$0.83/lb, the variety X59 would have had a gross return of \$768/ac. The poorest yielding variety, Canda, would have had a gross return of \$540/acre in this trial. For a detailed cost of production of hemp under irrigation in Saskatchewan please refer the Irrigation Crop Diversification Corporation’s *Irrigation Economics and Agronomics* publication located on their website and at the Ministry’s regional office in Outlook.

Acknowledgements

- CSIDC staff
- Jeff Kostuik, Director of Operations Central Canada, US & International Hemp Genetics International- providing seed for trial
- Garry Hnatowich, ICDC Research Director and ICDC Staff

2018 Demonstration of Fall Rye as an Irrigated Crop

Funding

Agriculture Demonstration of Practices and Technologies (ADOPT)

Project Lead

- Joel Peru, PAg, Irrigation Agrologist, Saskatchewan Agriculture
- Garry Hnatowich, PAg, Research Director, ICDC

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Canada-Saskatchewan Irrigation Diversification Centre

Objectives

This demonstration provided local producers a yield and visual comparison of fall rye production under irrigated and dryland conditions in central Saskatchewan. Producers had the opportunity to compare how new hybrid varieties perform compared to conventional varieties.

Research Plan

The fall rye trial was established in the fall of 2017 at CSIDC. The soil, developed on medium to moderately coarse-textured lacustrine deposits, is classified as Bradwell loam to silty loam.

Seed of the eleven varieties used in this trial was acquired from Jamie Larson, Research Scientist with AAFC Lethbridge. The fall rye varieties were direct seeded into canola stubble at the CSIDC research farm on September 14th 2017. At seeding, each trial received 80 kg N/Ha as urea side banded and 25 kg P2O5/ha seed placed monoammonium phosphate. The plots received irrigation in fall to aid in germination and emergence. In spring the irrigated trial was top dressed with another 40 kg N/ha. Fall rye varieties were established in a small plot randomized trial design replicated 3 times. Yields were estimated by direct cutting the plot with a small plot combine once the fall rye reached maturity. Herbicide was applied at a rate of 0.4L/ac Buctril M and 0.2L/ac of Bison on May 31 2018. The varieties used in this trial are listed in Table 1. Harvest was conducted on August 7th 2018.

Specialized Nitrogen for Irrigated Canola

Project Leads

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture
- Joel Peru, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture
- Garry Hnatowich, ICDC Research Agronomist, Outlook, SK
- Scott Anderson, Agronomist, Rack Petroleum Ltd., Broderick, SK
- Rigas Karamanos, Senior Agronomist, Koch Agronomic Services, Calgary, AB

Co-operator

- Kaitlyn Gifford, Director, ICDC Board
- Murray Kasper, Broderick

Project Objective

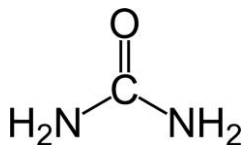
Several new sources of nitrogen fertilizer are available in the local irrigation marketplace. This project will compare some of these newer technologies for supplying broadcast nitrogen for irrigated canola.

Demonstration Plan

The project will compare the agronomic performance of four sources of nitrogen for irrigated canola for broadcast application without incorporation prior to seeding: 1) standard urea (46-0-0), 2) Super U (46-0-0) manufactured by Koch Industries in Brandon, Manitoba, 3) Amidas (40-0-0-5.5) imported by Yara Industries from Belgium and supplied from Moose Jaw, and 4) urea treated with Agrotain, a liquid treatment applied to urea to reduce volatilization losses.

Super U contains 46% nitrogen derived from urea ($\text{CH}_4\text{N}_2\text{O}$). It differs from regular urea because the ammonium nitrogen is stabilized against 1) conversion to nitrate by soil bacteria with 0.85% dicyandiamide and 2) loss of volatile ammonium by inhibiting activity of the urease enzyme in the soil with 0.06% N-(n-butyl) thiophosphoric triamide (NBPT). Dicyandiamide suppresses the activity of bacteria that convert ammonium nitrogen to nitrate nitrogen, the two step process known as nitrification. NBPT suppresses the activity of the urease enzyme which expedites the volatilization.

Figure 1: Chemical structure of urea molecule



Project Methods and Observations

The project was located on EH19-29-6-W3 just east of the South Saskatchewan River Irrigation District south of Highway #15. The fertilizers were broadcast on the soil surface at the site on May 14, 2018 with a Case IH floater. Each fertilizer blend was broadcast with a single pass (70 ft wide) across the field at a rate /ac of 140 lb N, and 20 lb S. The field was seeded the following day to Liberty Link L252 canola

with a Bourgault air seeder. The A side-banded blend of 50 lb. P205/ac was applied with the seeding operation. Weed control consisted of Liberty 150 SN@ 1.35 L/ac applied in 45 L/ac of water. An NDVI image was taken during the growing season as shown in Figure 1. It indicates the southern portion of the irrigated half section is uniform and a good location for the demonstration. The area which received the broadcast fertilizers is shown within the blue box shown in Figure 1. Seed yield samples were collected on September 28, 2018 from the fertilizer strips on the southern quarter of the half section. Each harvested strip of swathed canola was 380 m in length by 7.62 meter in width.

The field was irrigated over the growing season with just over 150 mm water.

Figure 1: NDVI image of EH19-29-6-W3 taken on July 19, 2018. The blue box indicates the location of the fertilizer plots.

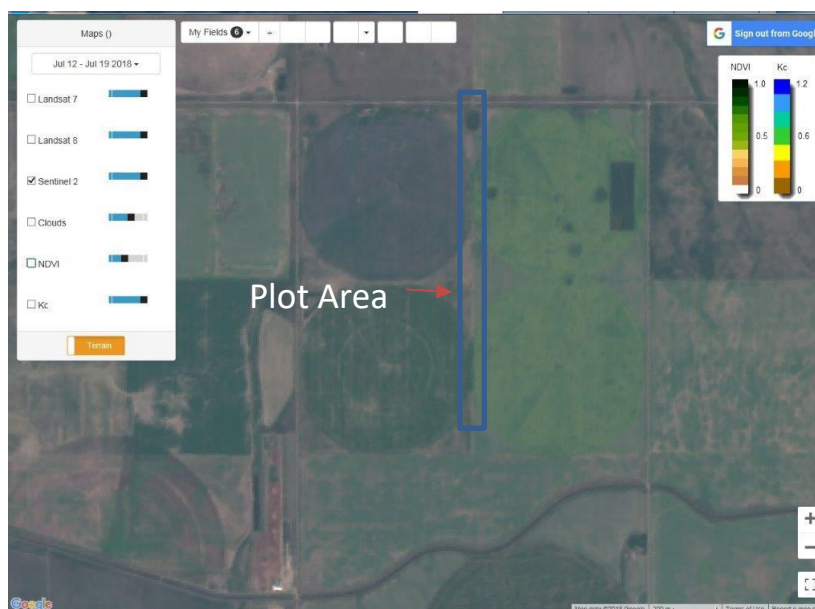


Table 1: Canola seed yield measured on September 28, 2018.

Treatment Fertilizer Source	Bu/ac	Ac/Tonne Fertilizer	Cost per Tonne (\$)	Cost of Fertilizer /Ac	Cost N/Bu	\$ Net Return/ac
Super U	73.7	7.24	655	90.47	1.23	646.53
Amidas	68.1	6.30	600	95.24	1.40	585.76
Agrotain	64.3	7.24	549	75.83	1.18	567.17
Bare urea	64.2	7.24	505	69.75	1.09	572.25

Final Discussion

The demonstration showed the potential for improved seed yields of canola through reduction of nitrogen losses due to volatilization and denitrification under irrigation. Leaching may also occur with heavy rainfall or irrigation. However, with the drier growing season of 2018, conservative application of irrigation water, and less than normal precipitation, the likelihood of leaching losses on this site are reduced.

Acknowledgements

Thanks to Murray Kasper for providing the irrigated land to conduct this project. Scott Anderson and the other supporting staff at The Rack in Broderick were instrumental in making this project successful. Thanks also to Agronomist Dr. Rigas Karamanos and Koch Industries for providing the Super U fertilizer applied to the plot. Thanks to Scott Anderson, Agronomist at the Rack for arranging Amidas and Agrotain treated urea for the demonstration. The Irrigation Crop Diversification Corporation provided administration services (Brenda Joyes).

Survey

2018 Irrigated Wheat Survey

Introduction

Cereals generally makes up 25 to 30% of the irrigated crop mix in Saskatchewan and are an important part of a good agronomic crop rotation. Wheat and durum generally have a lower expectation for net return compared to crops such as dry bean, potatoes and canola (see ICDC Agronomics and Economics publication). It is increasingly important for irrigators to maximise economic returns due to the rising costs associated with irrigation. In order to help determine how to make wheat more profitable under irrigated conditions, ICDC conducted a survey in the Lake Diefenbaker Area for the 2018 growing season. This survey was similar to the Maximum Economic Yields Demonstration from 1992 for the Outlook Irrigation Production Club.

The purpose of this project was to identify current management methods that Saskatchewan irrigators are using and determine which methods were generating the highest economic return. This report will summarize what was observed in irrigated wheat and durum crops in the Lake Diefenbaker Development area in during the 2018 growing season.

Objectives of the Survey

- (1) Identify current target yields that producers are basing their productions methods on.
- (2) Identify which production practises are generating the highest economic return.
- (3) Extend this information to Saskatchewan irrigators to assist with determining their production methods.

Data Collection

There was a total of 9 individual participants who submitted data in this survey. Each individual selected a field that they intended to grow either wheat or durum on in 2018. Participants where selected from the Lake Diefenbaker Development Area (LDDA) and were located in the following districts: South Saskatchewan River Irrigation District (SSRID), Riverhurst Irrigation District (RID), Luck Lake Irrigation District (LLID), Macrorie Irrigation District (MID), and 1 independent irrigator located in the Lakebend area on the west side of the lake. Table 1 shows the where the 9 fields where located in the LDDA and the crop that was grown.

Table 1: Location of Participants Who Provided Data in the 2019 Irrigated Wheat Survey

Irrigation District	SSRID	RID	LLID	MID	Independent
# of wheat fields	3	1	1	1	1
# of durum fields	0	2	0	0	0

During the growing season, the participants were given a survey at 3 different times; at time of seeding, mid season, and after harvest. An effort was made to capture as many agronomic and environmental variables as possible as well as general observations. The variables that were recorded are listed below:

- Variety
- Seeding date, seeding rate, seeding depth
- Stand count
- Nutrients applied
- Total irrigation and rainfall
- Pesticides used
- Plant Growth Regulator, if used
- Yield
- Grain sample quality

Methods and Analysis

The participating irrigators provided all the data on surveys except for stand count, total precipitation, yield, and grain sample quality. The plant stand count was measured by taking the average of 5 square meter samples in each field.

Rain gauges were set up on both the dryland corner and the irrigated portion of each field. Rain gauges were checked every 2 weeks in order to record the amount of rainfall and irrigation applied. This information was also used to create Alberta Irrigation Management Model (AIMM) graphs in order to evaluate each producers' irrigation management practices. Yields were determined by combining test strips in the field. Producers that had their own grain carts with scales recorded their own yields. Those without this capability took sample strips from their field which were weighed by the Saskatchewan Ministry of Agriculture's weigh wagon.

Grain samples were submitted to Cargill Ag Horizons for analysis. Analysis was done for protein and grade.

Since this survey was only one year in duration a limited amount of analysis could be done on all the recorded variables. The charts and tables made for this report are for observational purposes only and by are not statistically relevant. It is recommended that Saskatchewan irrigators review the replicated research done by ICDC and CSIDC before making changes to their production methods.

Results and Discussion

Environment

Weather conditions were highly favourable for growing wheat under irrigation during 2018. The year was characterised by a hot, dry spring and summer and a cooler fall. These conditions required irrigators to apply a lot of water but also helped to inhibit disease pressure. According to the weather station at CSIDC, the season provided 2329 accumulated corn heat units where between May 15th and the first major frost event (-2.8°C on September 27th). This number is just under the 1980-2014 average of 2353 accumulated CHU at CSIDC. Two thirds of the accumulated CHU (1552 CHU) occurred before August 1st, allowing the wheat and durum crops to grow rapidly. The cooler August did not effect yield although it did delay harvest for some of the later seeded crops. The total rainfall received

at the CSIDC weather station over the growing season (May to August) amounted to 93 mm (3.7 inch) which is far below the 1966-2018 average of 204 mm (8.2 inch).

Yield and Economic Summary

The cost of production for each participant was estimated based on the agronomic input data that was reported. Assumptions on inputs price, other cash costs and non-cash costs are based off the ICDC Irrigation Economics and Agronomics guide and the Ministry of Agriculture's Crop Production guide. Tables 2 and 3 provide a rough estimate on net return per acre based on reported yields. The value of the crop is based off the assumption that wheat is selling for \$6.75/bu for wheat and \$6.96/bu for durum.

The estimate done for this survey shows that the cost of production for irrigated wheat varied from \$594/ acre at the high end and \$462/ acre at the low end. Estimated net returns varied from \$179/ acre to \$9/ acre for spring wheat and \$275/ acre to \$249/ acre for durum. Both irrigated durum fields had great economic returns this year with similar costs and yields. As noted in the environment overview, disease pressure was low and fusarium head blight was not present in harvest samples. Fusarium head blight can greatly reduce the value of a cereal crop and durum is very susceptible to this disease.

The 2019 ICDC Irrigation Agronomics guide uses a target yield of 90 bu/acre for wheat and 100 bu/acre for durum. The net return based off the assumptions in this guide would be \$112/acre and \$184/acre for wheat and durum respectively. The information from this survey suggests that there are some growing methods being used in the Lake Diefenbaker Development Area that provide better net returns than others, especially for irrigated wheat. The rest of the report will elaborate on what these production methods were in order to help understand why there was differences in estimated net return.

Table 2: Yield information and Estimate of Economics for Wheat Fields

Field	Yield bu/acre	Cost of Production \$	Gross \$/acre	Net \$/acre
SSRID #1	85	496	574	78
SSRID #2	95	462	641	179
SSRID #3	76	504	513	9
Independent	104	594	702	108
MID	107	549	722	173
LLID	91	496	614	118
RID #1	96	583	648	65

Table 3: Yield information and Estimate of Economics for Durum Fields

Field	Yield bu/acre	Cost of Production \$	Gross \$/acre	Net \$/acre
RID #1	110	490	766	275
RID #2	103	468	717	249

Seeding Summary

An overview of the variety, rotation, seeding date, rate, depth, tillage practice and plant stand is listed in table 4 and 5. A column for yield is also present to help compare the results that these different variables contributed to. The survey data supports that earlier seeding of spring wheat, inclusion of grain legumes in rotation, and higher seeding rates increases the likelihood that yields will be higher. The relationship is certainly not strong but little agronomic factors put together add up to success in attaining higher yields.

Table 4: Seeding Summary for Wheat Fields

Field	Yield bu/acre	Variety	4 year rotation	Seeding Date	Seeding rate (lbs/acre)	Seeding depth (inch)	Tillage	Stand Count (#/m2)
SSRID #1	85	5605HR CL	Ca-Be-Be- Ca	7-May	120	1.5	Zero	152
SSRID #2	95	AC Cadillac	Ca-Po-Wh- Ca	12-May	90	2	tillage	130
SSRID #3	76	CDC Utmost	Ca-Wh-Ca- Po	20-May	110	1	Zero	204
Independent	104	ACC Brandon	So-Ba-Fl- Pe	6-May	120	1.5	min till	200
MID	107	Cardale	So-Ca-Le- Wh	20-May	120	1.5	min till	256
LLID	91	ACC Brandon	Ca-Wh-FB- Wh	29-May	124	0.75	zero	192
RID #1	96	Viewfield	Be-Ca	3-May	120	1	zero	160

Rotation key: Ca=Canola Be=Dry beans Po- Potatoes Fl=Flax Wh=Wheat So= Soybean Ba=Barley FB= Faba Bean Pe= field peas Le=lentils

Table 5: Seeding Summary for Durum Fields

Field	Yield bu/acre	Variety	4 year rotation	Seeding Date	Seeding rate (lbs/acre)	Seeding depth (inch)	Tillage	Stand Count (#/m2)
RID #1	110	Precision	Ca-Le-Du-Ca	7-May	100	1	Zero	192
RID #2	103	Brigade	Ca-Le-Be-Po	13-May	100	1	Zero	124

Rotation key: Ca=Canola Be=Dry beans Po- Potatoes Du=Durum Le=lentils

Input Summary

Tables 6 and 7 show the information provided by survey responders regarding cropping inputs for their irrigated wheat or durum field. Soils tests were not done for all fields so only added fertility was recorded in this survey. Drawing conclusions from this data is difficult due the lack of consistency of inputs among the highest yielding fields. A general take away from this information is that irrigators were able to achieve high yields using a variety of different production methods. On a year where that has larger rainfall events and more humid conditions, it is suspected that the use of a fungicide and PGR would have provided an advantage based on previous demonstrations done by ICDC.

Table 6: Crop Inputs for Wheat Fields

Field	Yield bu/acre	N applied (lbs/ac)	P applied (lbs/ac)	Total Moisture (inch)	In Crop Herbicide (group)	Fungicide	PGR Y/N
SSRID #1	85	90	60	12.8	4, 6	None	N
SSRID #2	95	100	35	11	1	None	N
SSRID #3	76	125	50	11	2, 6, 27	Prosaro	N
Independent	104	207	63	9.6	1, 2, 4	Prosaro	N
MID	107	144	42	8.4	2, 4	Trivapro	Y
LLID	91	129	51	9.2	N/A	N/A	N
RID #1	96	235	78	7.1	1, 2, 4	Prosaro	Y

Table 7: Crop Inputs for Durum Fields

Field	Yield bu/acre	N applied (lbs/ac)	P applied (lbs/ac)	Total Moisture (inch)	In Crop Herbicide (#apps/group)	Fungicide	PGR Y/N
RID #1	110	111	44	9	2, 4	Prosaro	N
RID #2	103	81	29	10.6	1, 2, 4	Prosaro	Y

Harvest Summary

The harvest date, pre harvest methods, sample grade and protein for the wheat and durum fields in this survey are recorded in tables 8 and 9. The most notable observation from this table is the harvest date ranging from August 25th to October 20th. The later harvest dates reduced the sample grade but did not seem to impact yield. The lower grade was caused from mildew which was a result of snowfalls occurring in September that lodged the remaining crops.

Table 8: Harvest Summary for Wheat Fields

Field	Yield bu/acre	Harvest Date	Pre Harvest	Grade	Protein	Soil Texture
SSRID #1	85	30-Aug	Round Up, Heat	1	14.7	Clay loam
SSRID #2	95	3-Sep	Swath	1	12.8	Sandy loam
SSRID #3	76	6-Sep	Round Up	1	12.9	Sandy loam
Independent	104	25-Aug	Swath	2	12.5	Sandy loam
MID	107	18-Oct	Round Up	2	14.9	Clay loam
LLID	91	18-Sep	None	feed	13.6	Loam
RID #1	96	1-Aug	None	N/A	N/A	Loam

Table 9: Harvest Summary for Durum Fields

Field	Yield bu/acre	Harvest Date	Pre Harvest	Grade	Protein	Soil Texture
RID #1	110	5-Sep	None	N/A	N/A	Loam
RID #2	103	20-Oct	None	N/A	N/A	Loam

General Conclusions

2018 proved to be an exceptional year for growing irrigated wheat in Saskatchewan. Spring wheat yields ranged from 72-107 bu/acre and averaging 91 bu/acre from the 7 participants located in the Lake Diefenbaker Development Area. The 2 participants who grew durum in the Riverhurst Irrigation District yielded 103 and 110 bu/acre. These yields are impressive if compared to the target yields in the 2018 ICDC irrigation Economics and Agronomics guide, which are 80 and 90 bu/acre for spring wheat and durum respectively. Many factors are responsible for the high yields that were seen this year including dry weather and a hot June and July. Producers in the survey also set aggressive yield targets beyond what is recommended in the Economics and Agronomics guide which helped achieve these yields. ICDC has now updated target yields in the guide to 90 and 100 bu/acre for spring wheat and durum respectively. These numbers reflect what irrigators in Saskatchewan are targeting which reflects the demand for a better economic return off this crop.

Yields in this survey were constantly above average across the range of production practices. Seeding dates ranged from May 3rd to May 29th and did not impact yield significantly. It is important to consider this was specific to the 2018 growing season and that replicated research conducted at CSIDC has shown the yield advantage of early seeding. Stand counts varied from 124 to 284 plants/m² and did not seem to have a major impact on yield or grain quality.

Irrigators that were involved in this survey fertilized for high yields. ICDC recommending 120 to 140 lbs of N/acre for an 80-bushel spring wheat crop and survey participants were fertilizing from 90 to over 200 lb of actual N per acre.

Low rainfall and hot, dry weather created a challenge for producer to keep up with crop water use. Wheat and durum utilize the most moisture during heading and flowering (up to 0.25 inch/day) which typically takes place in late July to early August. The 2004-2015 average for ET in wheat is 13.6 inches of water per year in Outlook. Total moisture received by the cereals in this survey ranged from 7 to 13 inches. Most producers applied at least 6 inches of effective irrigation which potentially was inadequate considering the low rainfall that was received. Moisture graphs created by the Alberta Irrigation Management Model showed that, for the most part, producers kept the soil profiles above 60% available moistures. The graphs did however show soil moisture often dipping below the 60% threshold in August. Although producers tend to cut back on water later in the growing season in order to minimize risk of lodging and to hasten maturity, they may be leaving yield potential in the field if they turn off the taps too soon.

Chemical applications varied significantly among the irrigators in this survey as well. The herbicide regimes varied and 7 out of 9 of the responders applied a fungicide. It is recommended to always apply fungicide on irrigated wheat or durum due to the higher disease pressure caused by a moist crop canopy. In dryer years such as 2018, crop canopy's dry out quick reducing the economic benefit of fungicide.

There were 3 fields surveyed that had a PGR applied. Check strips revealed that there were no yield increases associated with the PGR applications. The products were effective at reducing stand height in the crop but since no lodging occurred in the untreated areas of the field, there was no yield benefit observed. Lodging was an issue for some of the later seeded fields, caused by early snow fall. It should be noted that ICDC has conducted field scale trials in previous years which demonstrated strong yield advantages associated with PGR applications.

This survey was conducted with minimal effort from cooperators and provided observations and information for Saskatchewan irrigators. Irrigators who attended the 2018 SIPA/ICDC conference provided feedback suggesting a survey should be done in 2019 for irrigated canola. The Ministry and ICDC will be collaborating again in 2019 to conduct an irrigated canola survey.

FRUIT AND VEGETABLE CROPS

Effect of Apogee on Strawberry and Sour Cherry

Funding

- Agriculture Demonstration of Practices and Technologies (ADOPT)

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Canada-Saskatchewan Irrigation Diversification Centre (CSIDC)
- Saskatchewan Fruit Growers Association (SFGA)

Objectives

- (1) To demonstrate positive effects of Apogee on Strawberry, and Sour cherry production.
- (2) Apogee is a gibberellin inhibitor found to have a number of beneficial physiological effects on fruit species. It inhibits spread of diseases and reduces need to prune. It reduces “runnering” in Strawberry; and improves fruit quality in apples, strawberry, and cherries.
- (3) To measure effects of Apogee under Saskatchewan conditions on: disease inhibition, growth, “runnering” in strawberry, and fruit quality.

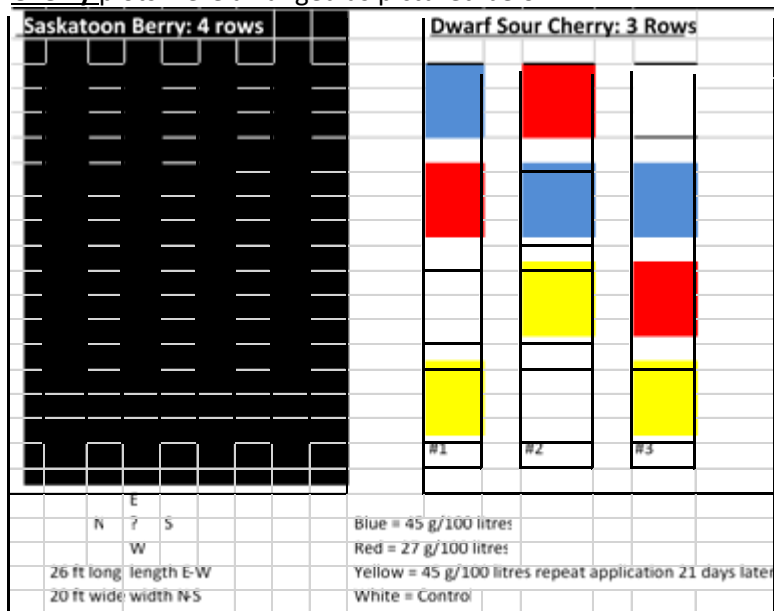
Project Plan

Established strawberry, and sour cherry plots at the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC) were treated with Apogee. Strawberry varieties included day-neutral varieties Seascape, and Albion; as well as June-bearing varieties Serenade, Serenity, Kent, and AC Wendy. The strawberry varieties were randomized according to the “Strawberry plot arrangement” featured below. Treatments included: Row 1 plots treated with Apogee at a rate of 27 grams/100 litres; row 2 plots treated with Apogee at 45 grams/100 litres; Row 3 plots were Control (No Spray); Row 5 received 45 g/100 L Application; and Row 4 plots were treated with 27 grams/100 L. Spray application occurred when new plant growth had been well initiated (May 25, 2018). A second application was tentatively planned within 21 days after initial application to Rows 4 and 5, but the effect of the initial application appeared to be too strong (in 2018 conditions) so additional applications were not applied.

Strawberry plot arrangement:													
Row 1		Row 2		Row 3		Row 4		Row 5					
Variety	Plot #	Variety	Plot #	Variety	Plot #	Variety	Plot #	Variety	Plot #				
Albion	1	Kent	6	Sapphire	11	Serenity	16	Seascape	21				
Seascape	2	Sapphire	7	Serenity	12	Albion	17	Kent	22				
Kent	3	Serenity	8	Albion	13	Sapphire	18	Albion	23				
Sapphire	4	Seascape	9	Kent	14	Seascape	19	Serenity	24				
Serenity	5	Albion	10	Seascape	15	Kent	20	Sapphire	25				
AC Wendy	26	AC Wendy	27	AC Wendy	28	AC Wendy	29	AC Wendy	30				
Row length = 100 ft with 20 plnts/plt		W S↕N E		Strawberries are planted approximately 12" apart									

Major fertilizer application was initially applied according to soil sample (N-P-K-S at 100-60-40-5 lbs./acre), and applications were made at rates based upon fertilizer product nutrient percentages to ensure 110-60-40-5 lbs was available. Initial fertilizer application occurred on May 17th. Subsequent fertilizer applications were made according to plant need using a water soluble Plant Prod 20-20-20 mix and a Dosatron injector. In 2017, some foliar applications of iron chelate had been used on Seascape and Albion day-neutral strawberry cultivars because they suffered iron chlorosis and were somewhat weak in late September 2017. All strawberries were planted into 1m wide black plastic mulch with ½ inch drip line running underneath (in the middle of the mulch width).

Cherry plots were arranged as pictured below:



Cherries were not given a second 45g application (Yellow plots), since the first application appeared to be too strong.

All plants were measured for length of new growth, fruit yield, and fruit quality. In general fruit quality was assessed via brix reading as well as average fruit size. Strawberries were assessed for amount of

“runnering”. Leaf material was collected prior to harvest to facilitate assessment of treatments on nutrient absorption. Leaf nutrient content was analyzed by ALS Lab Services in Saskatoon. All plots were photographed, and general observations were documented regarding alterations to standard plant physiology.

Results

Winter climatic conditions in 2017-2018 were harsher than the past 5 years and cold temperatures were sustained longer. In addition; Fall and Spring were significantly drier than average. Those general conditions led to physiological stress of plants (especially sour cherry), but also resulted in generally less insect and disease pressure. Prolonged winter, and general lack of early flowering resources also led to significant loss in bee populations.

Strawberry patches displayed less vigorous growth throughout May and June, due to overwinter stress and delayed application of irrigation after plants had come out of dormancy. Growth conditions in late June and throughout July and August were stronger; but cool wet conditions in September (in many regions the coldest September in over 100 years) reduced the productivity of late fruit-set in day-neutral varieties. The most popular June-bearing cultivar (Kent) remained tolerant of iron chlorosis (as were Sapphire, Serenity, and AC Wendy); but day-neutral varieties like Seascope, and Albion (that were more stressed through winter than the other varieties) were more susceptible to iron chlorosis when irrigation was applied, and this led to death and slow growth in early summer. In this way; application of Apogee as a growth inhibitor was not well suited to 2018 growing conditions.

In regard to fruit size in 2018; Albion had average fruit weight of 3 grams per berry which was the smallest fruit size (and was significantly less than 2017’s 10 g/berry). Seascope averaged 7 grams per berry (this was also significantly lower than 2017’s 12 g/berry). Early season Seascope averaged smaller (6 g/berry) than late August berries (that averaged roughly 10g/berry). Late season Seascope were roughly equivalent to Sapphire and Kent in size. Kent berries were roughly 10 grams per berry. Sapphire berries were roughly 9.5 grams per berry, but there was more size variation in this cultivar with a few larger berries from healthier plots versus smaller berries from plots that were stressed. Serenity and AC Wendy were consistently the largest fruit at an average of 11.0 grams per berry. Serenity and AC Wendy plants also appeared more consistently healthy, compared to the other varieties. Treatment effect did not appear to be a significant factor affecting fruit size. Unhealthy plots in high and no treatment rows corresponded with small fruit, and healthy plots in high and no treatment plots were similarly larger.

2018/2017 Average Strawberry Fruit Size:		
	2018	2017
	avg. fruit weight (g)	Avg. fruit weight (g)
Kent	10	12.2
Sapphire	9.5	11.75
Serenity	11	15.7
AC Wendy	11	N/A (planted in 2017)
Seascope	7	12
Albion	3	10

In regard to fruit quality (assessed according to Brix as a rough equivalent to sugar content); Kent Seascope and Albion were equivalent with brix readings that consistently averaged 9.5% (averaged over

all plots and over the season (for day-neutral varieties... berries were sweeter in August than the earlier fruit). Serenity was more consistent and had slightly higher brix readings with an average of 11%. Sapphire and AC Wendy were the sweetest of the varieties tested with a rough average of 12%, but there was more variation from plot to plot in Sapphire (compared to AC Wendy) which perhaps reflected the amount of chlorosis the cultivar succumbed to. The 2018 sugar content was roughly a percent lower in all varieties compared to 2017, and was not significantly influenced by Apogee treatment. This was a disappointment with respect to this project, because sugar content was expected to be increased in treated rows. In 2018, climate appears to have trumped the potential treatment effect. It is suspected Apogee didn't have the expected physiological effects, because the plants physiological stress responses outweighed the relatively smaller hormonal influence of Apogee (especially in the early phase of plant development when Apogee was applied).

2018/2017 Average Strawberry Fruit Quality:		
	2018	2017
	Brix %	Brix %
Kent	9.5	10
Sapphire	12	13
Serenity	11	12
AC Wendy	12	N/A (planted in 2017)
Seascape	9.5	10
Albion	9.5	10

In regard to yield; Albion produced roughly 40 grams per healthy plant, compared to Seascape at roughly 59 grams per plant (poor yield also reflects a very cold September 2018 that significantly reduced late-season production typical of these varieties). The June-bearing (mid-July production) varieties out-yielded day-neutrals with Kent averaging 93 grams per plant (produced within the narrowest harvest window). Sapphire exceeded day-neutral yields with average yield of 75 grams per plant, but was less than Kent). The highest yielding variety was Serenity (later harvest) with average yields per plant of 102 grams (this includes connected daughter plants). AC Wendy was planted in 2017, so its plots weren't as well established as Kent, Serenity, and Sapphire. AC Wendy yields were relatively low at 60 grams per plant, (but they didn't have connected daughter plants). AC Wendy plots were more consistent than other varieties with yields higher than day-neutrals. AC Wendy plants may also have shown more significant response to Apogee as high treatment plots showed slightly higher yield (roughly 68 grams/plant) than control plants (roughly 54 grams/plant).

2018/2017 Average Strawberry Fruit Yield:		
	2018	2017
	weight in grams (g)	weight in grams (g)
Kent	93	203
Sapphire	75	170
Serenity	102	241
AC Wendy	60	N/A (planted in 2017)
Seascape	59	129
Albion	40	100

In regard to Apogee's effect on the creation of runners; there was no significant production of runners in any of the treatments in 2018. It is suspected extremely dry conditions were more responsible for

prevention of runner development than Apogee, since even the control plots did not runner significantly. In addition; the healthier cultivar (AC Wendy) started sending out a few runners late in the season, whereas the other less healthy cultivars did not. Saskatchewan strawberries don't grow as vigorously as in many other production areas (due to relatively low heat units, and generally dry conditions). So under similar dry and cold conditions that occurred in 2018, it is not recommended that growers apply this product to control "runnering" in strawberries.

Cherry yield was very significantly below average (more than 50% lower than 2017) for all three cherry varieties in 2018. Fruit size was also below average, but quality (Brix %) was roughly average. Dwarf sour cherries can sustain high levels of yield (year-after-year), but the dry conditions combined with winter stress plummeted yield province-wide in 2018. The plants came out of dormancy with relatively little winter-kill, but when they leafed out, the number of leaves were greatly reduced (this phenomenon is called "blind-wood") when compared to previous years. In addition, although blossoms opened at the same rate as average years, they soon wilted and were dropped from plants (it appeared energy balance required to support fruit production was severely depleted). The lower presence of leaves may also have limited absorption of Apogee.

Often when relatively few fruit are left on a plant, they become larger and obtain higher sugar content. Unfortunately; 2018 sugar content was roughly 1% Brix below recent averages despite Apogee treatment. Fruit size was also significantly below average (more than 10% lower in all cultivars) and this was likely reflective of plant stress from winter and drought.

In regard to fruit size: the average Cupid fruit weight was 4.8 grams per cherry in 2018 compared to 5.3 grams in 2017; Valentine averaged roughly 3.4 grams per cherry in 2018, versus 3.9 grams per cherry in 2017; and Romeo averaged 3.9 grams per cherry compared to the 4.3 grams found in both 2016 and 2017. Treatments of Apogee did not display significant differences between treatments, nor was there a significant difference between treated plots and controls.

2018/2017 Average cherry fruit size:		
	2018	2017
	weight in grams (g)	weight in grams (g)
Cupid	4.8	5.3
Valentine	3.4	3.9
Romeo	3.9	4.3

Sugar content was roughly average to slightly below average: Cupid averaged 17.8 % Brix in 2018 vs 20 % in 2017; Valentine was 16.9 % in 2018 vs. 18 % in 2017; and Romeo averaged 19.1 % Brix in 2018 compared to 22% in 2017. Brix content did not vary based upon control versus treated plots, nor were there significant differences detected between treatments.

2018/2017 Average cherry fruit quality:		
	2018	2017
	Brix %	Brix %
Cupid	17.8	20
Valentine	16.9	18
Romeo	19.1	22

In regard to cherry diseases spread of the blight phase of brown rot in dwarf sour cherry orchards was very limited. This was likely due to early hot-dry conditions, and the significant early loss of flowers (that therefore limited the potential of spores to spread from flower to flower). It is possible disease reduction was partially controlled via application of Apogee, but very significant environmental influences minimized detection of treatment effects.

In regard to new growth in cherries: Apogee appeared to have a rate-related impact with higher rates promoting branch elongation. The immune enhancing effects may have provided growth stimulus to the stressed plants (as opposed to acting as a gibberellin inhibitor that should reduce elongation). It's also possible treated plots limited suckering and focused energy for growth in the mother plant (similar to reduction of strawberry runners).

Cupid averaged 8 inches of new growth in 45 g/100 L plots, 7 inches in 27 g/100L treatment, and 5.5 inches in control plots. Valentine was roughly the same as Cupid with roughly 7.6 inches of new growth in the 45 g /100L plots, roughly 7 inches in the 27 g/100L plots and 6.5 inches of new growth in the control plot. Romeo had the least amount of new growth averaging roughly 6.8 inches in the 45 g/100L plots, 4.8 inches in the 27 g/100L plots, and roughly 3.5 inches in the control plots. The apparent growth stimulating effects allowed the plants to grow marginally more than typical years.

2018/2017 Cherry, average length of new growth:			
	Treatment rate:	2018	2017
	Grams (g)	Length (inches)	Length (inches)
Cupid	45	8	
	27	7	
	Control (0)	5.5	6.25
Valentine	45	7.6	
	27	7	
	Control (0)	6.5	6.25
Romeo	45	6.8	
	27	4.8	
	Control (0)	3.5	5

Haskap Fertilizer and Irrigation Management under Photosensitive Netting

Funding

- Agriculture Demonstration of Practices and Technologies (ADOPT)

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Canada-Saskatchewan Irrigation Diversification Centre (CSIDC)
- Saskatchewan Fruit Growers Association (SFGA)

Objectives

To demonstrate the benefit of improved fertilizer and irrigation application protocols for haskap (using split-applications of fertilizers and more frequent irrigation spanning a greater portion of the production season).

To demonstrate benefits of photo-selective netting with respect to irrigation, nutrient management, plant health, and fruit quality.

Project Plan

Established Haskap plots at the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC) were used to support this project. Haskap varieties included Berry Blue from One Green World Nursery (Row 1); as well as Tundra, Borealis, '9-15', '9-92', and '9-91' from the University of Saskatchewan Fruit Research Program (Rows 2, 3, 4). Randomization of University cultivars at CSIDC within rows 2, 3, 4, is not known.

Photo-selective netting was arranged as per diagram below (with pearl net in row 2, red net in row 3, and blue net in row 4).

Haskap Plot Arrangement:										
Row1			Row 2			Row3			Row 4	
Variety	Plot #		Variety	Plot #		Variety	Plot #		Variety	Plot #
Berry Blue	1		U of SK	7		U of SK	13		U of SK	19
Berry Blue	2		U of SK	8		U of SK	14		U of SK	20
Berry Blue	3		U of SK	9		U of SK	15		U of SK	21
Berry Blue	4		U of SK	10		U of SK	16		U of SK	22
Berry Blue	5		U of SK	11		U of SK	17		U of SK	23
Berry Blue	6		U of SK	12		U of SK	18		U of SK	24
Control	0		Control	0		Control	0		Control	0
			Pearl Net			Haskap rows are planted roughly 6 m apart Plots have 3 plants of the same cultivar per plot Plants are spaced 1.5 meters apart				
			Red Net							
			Blue Net							

The net was supported above ground with 2" galvanized pipe and 3/32" galvanized aircraft cable purchased from local Saskatchewan companies (pipe from www.michels.ca, and airline cable from <http://northernstrands.com/>). Nets were held in place with galvanized ground anchors purchased from Peavey Mart.



Major fertilizer application was applied to control plots as well as select plants under netting (according to soil sample indicated need), to reach N-P-K-S at 100-60-40-5 lbs./acre on May 17. A fertilizer dose meter was attached to irrigation lines and split applications (at pre-bloom, post bloom, and during fruit formation) of water soluble Plant Prod 17-5-17 plus micronutrient mix were applied to the orchard rows (at rates to roughly match N application of 100 lbs/acre, and another at roughly 1.5X that amount). Tensiometers were placed within Haskap rows. Soil water levels were monitored at 20 cm and 46 cm depths, and irrigation was provided until leaf fall (as per Dr. Brown's recommendations) at roughly 1X, 1.25, and 1.5 volume rates. All rows featured ½ inch drip line running underneath plants (with emitters located beneath the plant canopy).

Various measures of plant health were assessed including: growth (length of new growth), nutrient status (via leaf analysis), yield (weight of fruit), and fruit quality (via measurement of Brix). Tensiometer readings were also logged to provide measure of soil moisture status. Pest pressure was noted, and plants were photographed.

Results

Winter climatic conditions in 2017-2018 were harsher than the past 5 years and cold temperatures were sustained longer. In addition; Fall and Spring were significantly drier than average. Those general conditions led to physiological stress of plants, but also resulted in less insect and disease pressure. The prolonged winter, and general lack of early flowering resources led to significant loss in bee populations. Later in Spring/early summer; bee activity in fruit crops was sufficient (partially due to delayed flowering in most conventional field crops forcing bees to seek nectar from other sources). Unfortunately; Haskap is the earliest flowering fruit species grown in Saskatchewan. Haskap berries form from bracteoles fused together around two ovaries (supporting 2 inflorescences). Usually both stigma's have to receive viable pollen to fertilize the ovaries sufficiently to form marketable fruit. So lack of pollination from bees, leads to poor fruit yield. Very few bees were present at the CSIDC plots in early 2018.

Early spring temperatures fluctuated (from somewhat warm to cold temperatures), but late Spring and early Summer conditions were consistently warm and dry. Upper soil layers became dry quickly after snow melt (when irrigation was not available to apply to the plots). Due to dryness, iron chlorosis

symptoms were negligible, but fruit quality was reduced due to lack of water availability in the early part of the season (when haskap achieve the majority of their annual growth). Lack of water and nutrient availability to the plants (particularly potassium) in the earliest development phases hindered later productivity when irrigation and nutrients became more accessible. The poor pollination combined with lack of water and nutrients in early spring, led to significantly below average fruit-set.

Tent Caterpillars were not present in large numbers (continuing population decline from their peak in 2016), however some damage to leaves was suspected to have been caused by thrips in the early stages of crop development.



Leaf damage evident in Early June.
Suspected to be caused by [Thrips](#).

There was also fruit damage caused by what appears to be early insect foraging. Symptoms appear in the photo below:



May 25 Photo of blemish to early development-stage haskap berry. It appeared insect foraging broke the skin and as the fruit expanded this created circular blemishes. In some cases, damaged fruit aborted.

In addition to lack of pollination, cedar waxwings swept through the orchard between the last week of May and first week of June and removed approximately 25% of the fruit that was developing on the plants at that time. It is believed the birds were struggling to find food resources due to the long cold winter coupled with drought conditions, and this forced them to eat (what would normally be) unpalatable green fruit. Ultimately the yield reducing factors resulted in a fruit-set that was well below 50% of the orchard's intrinsic potential. Photo-selective netting was not covering plants well enough (they need to be open for pollination) at that early season time-period to reduce losses. Poor pollination and fruit-set well below 50% of plant potential, was experienced throughout the province in 2018.

Irrigation was turned on at the CSIDC fruit orchard in early June and the availability of water and nutrient flow to the roots, then provided plant resources needed to grow more vigorously.

The photo below was taken June 8, 2018; it is evident that plant growth responded well to irrigation and fertilizer availability at that time.



New Growth (with red colored stem tissue) was evident throughout the Haskap plots by June 8, 2018. In 2017 plants were less vigorous looking (under similar environmental conditions)
Some fruit had also already begun to show some colour (turning slightly purple, as opposed to green)

By June 19th plants were responding well to irrigation and fertilizer treatments, however there was some leaf bronzing symptomology in control plots.



Leaf bronzing that is likely caused by intense solar radiation combined with lack of sufficiently available water (combined with potassium deficiency).
Photo was taken June 19'th in control plots.

Bronzing symptomology was also found under pearl colour photoselective netting, as can be seen pictured below.



By June 19th fruit was coloured blue, but sugar content was still relatively low (some at 4.7% brix).



Haskap fruit photographed June 19, 2018.
The fruit is average sized, but is not optimum for harvest on this date (sugar content remains low).

By July 23, some Haskap within control plots displayed more extensive bronzing/nutrient deficiency symptomology (perhaps potassium deficiency). That was also consistent with water deficiency and exposure to intense sunlight in these plots.



Control plot (in this case west of the blue netted portion of the plots) displaying leaf bronzing symptomology. This is likely a symptom of stress that could be caused by a combination of sunscald, water deficiency, and/or nutrient deficiency.

Plant growth characteristics under Photoselective netting became colour differentiated later in the summer (by August 2, 2018). Along with control plots, Pearl net covered plants appear to have begun senescencing earlier than red or blue net covered plants (as can be seen in the photographs below)



By September 19th most of the Haskap were physiologically shutting down, or had fully gone into senescence. Growth measurements were taken on that date, and the photos below are representative

of average growth found in each of the plots on that date.



Berry Blue cultivar in control plots averaging roughly 25 cm of new growth in 2018.

Berry Blue is the most vigorous growing Haskap (of the commonly grown varieties in Saskatchewan).



Berry Blue grown under Pearl net, averaging slightly over 26 cm new growth in 2018.

The plants under Pearl net went through senescence earlier than other treated types (including control plots), but new growth length didn't differ significantly from control plots.



All other cultivars grown in control plots averaged 16 cm new growth (the same as 2017 new growth averages). Lack of variability (relating to fertilizer and irrigation) in these plots may reflect a dramatically shortened early growth season. Plants grew significantly in June, but had definitely stopped growing before mid-June. By late August control plots were going into dormancy. In addition; September 2018 was the coldest September on record, so plants shut down earlier than in average years.

In regard to 2018 and 2017 new growth measurement (in centimeters), please see the table below:

Haskap under photoselective netting:									
		Control Plots		Pearl		Red		Blue	
Variety	Nutrient rate	2018	2017	2018	2017	2018	2017	2018	2017
Berry Blue	1X granular	25	25	26					
U of SK	1X granular	16	16	16.5	16	18	18	17	17
U of SK	1X split fertigation	16		16.5		19		17.2	
U of SK	1.5X split fertigation	16.5		17		20		19.2	
Average =		16.2		16.7		19		17.8	

University of Saskatchewan cultivars grown at higher fertilizer rates (1.5X) with no net had only slightly higher average new growth measurements than 1X treatments (at roughly 16.5 cm compared to 16.0 cm for 1X). 1X fertilizer treatments included 2 sub-categories; one that was a single granular application (the same as 2017), and another that was applied through fertigation at roughly the same total amount but split with irrigation treatments that were pre-bloom, post-bloom, and after fruit colouring (prior to harvest). No significant amount of growth difference in 1X treatments (at 16 cm) likely reflects limited early water and nutrient availability that overlapped with very early growth that was predominant in 2018 (and was very similar with respect to environmental conditions in 2017). Some physiological differences may be more detectable between granular and fertigation treatments in 2019, since the 1.5X and 1X fertigated plants may overwinter better and be better primed for flowering, growth, and productivity in 2019. That data will be collected in 2019 in order to facilitate comparisons (that couldn't be tracked within the bounds of the present reporting schedule).

In regard to 2018 photoselective net new-growth differences; University of Saskatchewan cultivars averaged: 16.7 cm under Pearl net (slightly higher than the 16 cm average in 2017); 19 cm under red net (higher than the 18.0 cm average in 2017); and roughly 17.8 cm under blue net (higher than the 17.0 cm average in 2017). Red net is known to support elongation of new growth tissues, but blue net and pearl were expected to be more similar. Blue and pearl growth differences may relate to much earlier senescence under pearl netting (in 2018).

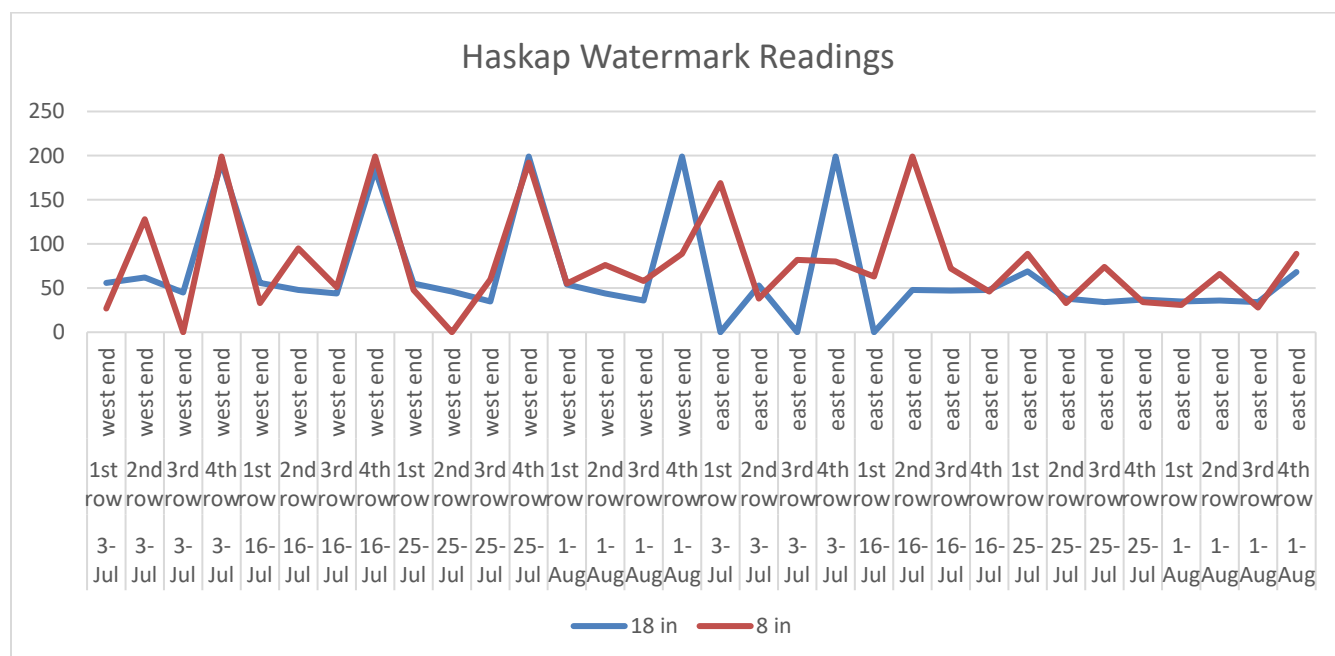
Greater length of new growth under photoselective net in 2018 likely relates to more availability of water and nutrients than in control plots (and 2017 treatments). In any event; it is expected differences could have been more significant had irrigation been available in plots earlier in the season when plants were more actively growing. The results show consistency with all nets showing more growth than control plots; red net achieving the most new growth, followed by blue; and pearl consistently achieving slightly less than blue (in 2017 and 2018). In reference to growth standards; a Russian industry anecdote indicates "if new growth doesn't achieve 13.0 cm length, then the branch should be removed". All treatments were able to exceed that 13.0 cm standard.

In regard to leaf nutrient analysis (with Table below); photoselective netting appears to display plant nutrient absorption differences. The red net and control plots were somewhat deficient in nitrogen, whereas blue and pearl net plants appear to have sufficient amounts. Red net plants grew the most, (growth requiring nitrogen). So, it is understandable those leaves were perhaps more deficient than other treatments. The control plots grew the least and suffered more drought or evapotranspiration stress, so perhaps those factors contributed to more apparent nutrient deficiency. All treatments appear to have been deficient in potassium (K) (at the time when leaves were harvested). Blue net plants

appear to have maintained better potassium absorption, with pearl and red slightly lower. Given that pearl senesced very early, and red grew more rapidly; the leaf measurement may be unfair to these treatments in particular because it is only a measurement at a specific point in time. In general, nutrient levels below 25 (in the table below) are considered deficient, however the reference micro-nutrient content is for apple. So; purported copper and zinc deficiencies (for example) may not be as significant as they appear. It is believed potassium levels are a fair reflection of leaf nutrient deficiency, and new strategies to improve potassium absorption under similar soil conditions should be explored.

2018 Haskap leaf nutrient status:											
Net Colour	N	P	K	S	Ca	Mg	Cu	Fe	Mn	Zn	B
Pearl	35	65	18	65	90	90	27	65	50	49	90
Red	25	30	18	65	90	90	25	65	50	54	90
Blue	50	35	23	49	90	90	23	65	50	27	90
Control	25	50	20	49	90	90	25	65	32	24	90

In regard to irrigation: the following chart reflects data collected from the Watermark sensors at (8 inch) 20 cm and (18 inch) 46 cm depths located within Haskap plots in 2018. In the chart; lower numbers represent wetter conditions, and high numbers represent dry soil condition. The vertical axis is measured in centibars and in general for the soil type in the CSIDC plots, irrigation should be applied at roughly 50 centibars. The following table describes general moisture conditions at different readings.



This graph is complex and is divided into different field sectors (east and west). The “east end” of the field was covered in photo-selective net, whereas the “west end” had no net cover. “West end” rows in this case correspond with 1.25x irrigation rate for row 1, 1X irrigation rate for row 2, 1.5X Irrigation rate for row 3, and 0.5X irrigation rate for row 4.

On the west end, number 3 rows (at 1.5X irrigation rate) and number 1 rows (at 1.25 irrigation rate)

consistently displayed better water availability (readings that are near 50 or below) than rows #2 and #4 (at 1X and 0.5x irrigation rates). The 4th row at 0.5X irrigation rate was consistently deficient at both 20 cm and 46 cm depths. Given how hot and dry the 2018 summer season was, serious plant stress was observable in 0.5X irrigation plots and this would have limited growth and production. It may also limit early growth and productivity in 2019, (this will be measured but was outside of the scope of the present reporting cycle).

In general; water availability was greater under photo-selective net. Nevertheless; under some circumstances water stress can still be a factor. It is believed the high watermark spikes on the east end correspond with pearl colored netting, that didn't provide as much shading (or had possibly been wind-blown off the plots prior to measurements being recorded). 1.25X and 1.5X irrigation rates under photo-selective net appeared to have provided more sufficient water availability under drought-like conditions with Bradwell Orthic Dark Brown sandy loam soil found at CSIDC. Higher irrigation rates that were not under photo-selective net, were less consistent at maintaining desired moisture levels, especially within the top 20 centimeters of the soil profile.

The timing for when this data was collected, doesn't give regard to when rainfall had occurred. In addition; the data was collected too late in the year to properly correlate irrigation with growth (that ceased by early to mid-June). In this way, the full potential of tensiometer readings was not realized in 2018. Nevertheless; it is evident photo-selective netting helps to improve soil moisture condition in both shallow and deeper soil horizons, and that this improves plant growth conditions for Haskap. It is apparent that blue and red net provided more reduction in evapotranspiration in 2018, than pearl net or control plots.

In regard to average weight of fruit in 2018 there was no significant difference between fruit under photo-selective net and control plots at roughly 1 gram per fruit (this differs somewhat from 2017 where control plot fruit averaged considerably lower due to bird foraging impacts, and poorer health status). There was also no significant variation between net colours; blue, red, and pearl net all averaged roughly 1 gram per fruit (which corresponded well with 2017 results that also averaged 1 g per fruit).

Total yield (see table below) varied significantly in 2018 with blue net and control plots averaging lowest at roughly 50 grams per plant (this corresponds with reported 2018 industry averages). Red net averaged higher at 82 grams per plant, and pearl net averaged highest at roughly 94 grams per plant. All yield results were significantly below 2016 and 2017, but this relates to poor pollination and overwinter plant stress. Yield results were also at odds with 2017 results with respect to net colour yield ranking. In 2017, blue net yielded 300 g/plant, followed by pearl at 255 g/plant, then red at 183 g/plant. It is unclear why the net colour yield rankings changed so significantly from 2017 to 2018.

2018 Haskap Total Average Yield (in grams) Per Plant:				
	2018	2017		
Control Plots	50	30		
Pearl Net	94	255		
Red Net	82	183		
Blue Net	50	300		

Fruit in 2017 control plots were aggressively foraged by Cedar Waxwings before harvest (so the 2017 30

grams/plant estimate in the table, doesn't properly reflect the productivity of the plants in 2017) . In regard to fruit quality (assessed according to Brix as a rough equivalent to sugar content); there were only slight variations between net colours (when averaged over the course of the season). All fruit averaged roughly 8% brix, which was significantly lower than 2017's average 14% brix.

It is possible Haskap berries could have remained on plants longer to allow for increased sugar content, but some abscission had started by late June. 2018 yields were very low; so no further fruit loss was deemed acceptable. Poor quality was a disappointment with respect to this project, because sugar content was supposed to be increased via photoselective net physiological effects. It was a very stressful year for Haskap (as well as other fruit types), so apparently Haskap plants couldn't overcome those challenges despite improved nutrient and water availability later in the season. Some fruit were harvested on different dates: with some early harvested berries taken on June 19'th, the majority harvested June 29, and the latest ripened fruit harvested July 5th .

Fruit under pearl net ripened earlier; with June 19 brix at 7.0%, June 29'th 7.7% Brix, and July 5'th roughly 8.4%. This may have corresponded with plant physiology that led to earlier senescence under this type of net. Red net plots were the latest ripening fruit with brix averaging at 4.7% on June 19, 6.2 % June 29, slightly over 8% July 5, 2018 (but there were only a few fruit available July 5). Fruit under blue net were slightly below 7.0 % brix on June 19'th and slightly above 7% Brix on June 29'th. Later ripened fruit under blue net were similar to the pearl net harvested July 5 with a rough average 8.5% brix. 2017 had less variation with respect to harvest time and brix, with different irrigation and fertilizer rates complicating comparisons with 2018.

Demonstration of Baby Carrot Varieties

Funding

This project was funded by the Irrigation Crop Diversification Corporation and the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canadian Agricultural Partnership Program.

Principal Investigators

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- Cara Drury, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Canada-Saskatchewan Irrigation Diversification Centre (CSIDC)
- Saskatchewan Vegetable Growers' Association (SVGA)

Objective

The objective of this project was to compare nine carrot varieties to the variety currently used by industry for the production of baby carrots.

Project Background

In Saskatchewan, producers and retailers have worked together to create an industry standard of carrot that is shorter and narrower than the traditionally marketed carrot. This relatively new standard is the baby carrot. Baby carrots are popular in the market, allowing producers to receive a premium for the size and has potential for exports to neighboring provinces.

The current variety used by Saskatchewan producers for this standard, Mokum (Figure 1), was chosen based on superior growth and flavor characteristics.

Unfortunately, this variety tends to grow too long to meet specifications and is often sold as oversized. Identifying a carrot variety with similar growth and flavor characteristics, but a shorter expression will increase producer's profitability. This will be achieved by increasing the amount of production sold in the baby carrot standard and reducing the amount of production sold as an oversized standard.



Figure 1. Mokum plot separated into industry size standards.

Research Plan

This project was located in the orchard area of the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC). The site has a sandy loam soil texture and the plot was cultivated and rototilled prior to seeding.

The project consisted of 10 carrot varieties, replicated three times in a randomized complete block design. Each treatment consisted of six, six meter rows.

Seeding took place on June 4th, 2018. There was a small rainfall event while seeding and all varieties were seeded into wet ground. Non-pelletized seed was planted with a wheel planter; while the pelletized seed was planted by hand due to mechanical injury to the seed coat. All pelletized seed was planted using one-inch spacing.

A 0-12" soil sample was taken for the plot area and found that background nutrient levels were adequate for growing carrots; therefore, no fertilizer was applied.

Drip irrigation was installed on June 6th. Soil moisture was monitored via tensiometers and maintained at 65% field capacity throughout the growing season.

Linuron was applied at the label's recommended rate on July 19th, for control of weeds.

For each plot, one of the four centre rows were harvested every two weeks once an acceptable marketable size was achieved. The first harvest took place on August 21st and was repeated on August 28th, September 5th and September 11th.



Figure 2. Baby carrot varieties demonstration plot.

Results

Harvested carrots were sorted into four size categories, counted and weighed. The size categories are Undersize (< 3 1/2" length and or < 3/8" diameter), Marketable (> 3 1/2" < 6" length and > 3/8" < 1" diameter), Oversized (> 6" length and or > 1" diameter) and Misshapen. The total counts and weights for all four harvest dates are reported in Table 1.

Table 1. Harvest Totals Per Variety for All Dates (Aug. 21, Aug. 28, Sept. 5 and Sept. 11)

Variety	Undersize Count	Undersize Yield (kg)	Mktable Count	Mktable Yield (kg)	Oversize Count	Oversize Yield (kg)	Misshapen Count	Misshapen Yield (kg)
Caracas	938	2.56	86	2.48	8	0.31	7	0.04
Sprint	698	1.39	239	1.84	548	12.23	37	0.51
Goldfinger	474	2.68	760	10.76	335	12.96	29	1.14
Sweetness	270	0.57	329	3.91	743	25.59	32	0.93
Mokum	183	0.52	406	6.12	791	34.74	59	1.74
Yaya	144	0.45	366	7.89	543	30.33	40	1.33
Little Finger	604	2.27	1015	19.70	638	46.43	116	3.06
Carvejo	129	0.49	621	12.40	465	21.20	68	2.16
Baby Spike	1242	3.08	707	5.25	847	17.26	143	2.17
Adelaide	140	1.39	558	13.14	206	7.97	47	2.13

The top three producers for marketable count and weight are Little Finger, Goldfinger and Baby Spike.

The top three producers for marketable weight are Little Finger, Adelaide and Carvejo.

The variety Little Finger was found to be the clear winner, producing the highest count and weight of product that is marketable as a baby carrot. Little Finger over doubled the marketable production of the current variety being used by industry Mokum, in both count and weight.

Final Discussion

The objective of this project was to compare nine carrot varieties to the industry standard variety (ten varieties in total) for the production of baby carrots. It has been found that four of the varieties grown out produced the current variety being used by industry (Mokum) based on marketable count and weight. The variety Little Finger, out produced all other varieties in both marketable count and weight. Based on count of marketable product, Little Finger produced 25% more than the next highest variety, Goldfinger. Based on weight of marketable product, Little Finger produced 33% more than the next highest variety, Adelaide.

The economic analysis of this crop based on a 12-inch row spacing and the retail price of the crop is reported in Table 2. These numbers report only on the average marketable yield per variety and use the assumption that all of the crop was sold.

Areas of further study for this project include exploring parameters such as ease of mechanical harvest, shelf life/storage, and flavour.

Variety	Price (\$/ac)	Variety	Price (\$/ac)
Caracas	1533.31	Yaya	4877.53
Sprint	1134.52	Little Finger	12177.43
Goldfinger	6651.34	Carvejo	7663.45
Sweetness	2418.67	Baby Spike	3243.44
Mokum	3785.04	Adelaide	8125.30

Garlic Cultivar Demonstration

Funding

This project was funded by the Irrigation Crop Diversification Corporation and the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canadian Agricultural Partnership Program.

Principal Investigators

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Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Canada-Saskatchewan Irrigation Diversification Centre (CSIDC)
- Saskatchewan Vegetable Growers' Association (SVGA)

Objectives

The objectives of this demonstration were to:

- (1) Compare the growth of 22 different cultivars of garlic in Saskatchewan's growing conditions.
- (2) Compare cultivars based on emergence, size, number of cloves, uniformity and storability.

Project Background

This project provided opportunities for Saskatchewan producers and buyers to compare garlic cultivars for suitability to various Saskatchewan markets. While garlic is grown commercially right across Canada, the majority sold in retail is imported from China. Saskatchewan garlic producers have had very good success selling garlic into retail, but are not meeting the demand. There are also processing market opportunities available. Although there are well over 100 varieties of garlic that grow well in Canada, Saskatchewan producers grow Music, the same variety that Ontario growers sell commercially. This project gave producers the opportunity to observe numerous varieties of garlic and perhaps choose varieties that better suit their markets. Music grows very large, but only produces four or five very large cloves. Perhaps another variety will produce more, smaller cloves. Music grows very large, with virtually all heads making the extra large, expensive grade. Producers in Saskatchewan are missing out on the medium head size that competes with the imported garlic in size, price and volume. As well, a variety more suited to processing might be available. These market opportunities could lead to export.

Research Plan

This project was located in the orchard area of the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC). The site has a sandy loam soil texture and the plot was cultivated and rototilled prior to seeding.

Twenty-two garlic cultivars were demonstrated in this project. Each cultivar had twenty cloves planted in a single row. This project was simply a demonstration and was not replicated.

Hand planting, using a five-inch spacing of the cloves took place in October 2017, as per recommended practice. Four to five inches of straw was forked onto the row to help insulate throughout the winter.

The demonstration was visually evaluated in the spring for winter kill, the cultivars that did not survive were noted.

A 0-12" soil sample was taken for the plot area and found that background nutrient levels were adequate for growing garlic; therefore, no fertilizer was applied.

Drip irrigation was installed on June 6th. Soil moisture was monitored via tensiometers and maintained at 65% field capacity throughout the growing season.

Pardner was applied at the label's recommended rate on July 19th, for control of weeds. The plot was also hand weeded as required.

Harvest was completed by hand, recovering both cloves and scapes. Harvest occurred on four different dates based on plant maturity; July 27, 2018, August 7, 2018, August 10, 2018 and August 14, 2018.

Results

Harvested garlic was assessed for number of bulbs that survived (20 were planted for each), weight, number of cloves per bulb for 5 random bulbs and average number of cloves per bulb. The results from this assessment are reported in Table 1.

Table 1. 2018 Garlic Harvest Assessment

Type	Variety	Harvest Date	No. Bulbs	Weight (g)	No. Cloves per bulb	No. Cloves per bulb	No. Cloves per bulb	No. Cloves per bulb	No. Cloves per bulb	Ave. No. cloves/bulb
Porcelain	Georgian Crystal	-	0	0.0	0	0	0	0	0	0
	Leningrad	14-Aug	2	39.9	2	2	0	0	0	2
	Music	14-Aug	10	319.3	4	6	2	4	4	4
	Newfoundland Tall	-	0	0.0	0	0	0	0	0	0
	Northern Quebec	-	0	0.0	0	0	0	0	0	0
	Romanian Red	-	0	0.0	0	0	0	0	0	0
	Susan Delafield	14-Aug	1	48.2	4	0	0	0	0	4
	Yugoslavian	14-Aug	18	794.2	4	5	6	3	6	4.8
Purples	Chesnok Red	14-Aug	10	263.7	12	7	12	10	8	9.8
	Khabar	-	0	0.0	0	0	0	0	0	0
	Linda Olesky	14-Aug	12	601.5	7	8	7	6	7	7
	Metechi	14-Aug	4	155.2	4	8	7	6	0	6.3
	Persian Star	14-Aug	16	486.8	7	9	10	7	10	8.6
	Red Rezan	14-Aug	17	528.6	12	10	8	9	12	10.2
	Italian Purple	14-Aug	13	397.4	13	8	6	6	5	7.6
	Kostyn's Red Russian	14-Aug	11	461.6	4	5	5	6	7	5.4
	Wengers	14-Aug	19	672.3	6	7	5	6	5	5.8
Rocamboles	Inchelium Red	7-Aug	16	552.7	11	15	12	15	11	12.8
	Sicilian Gold	7-Aug	19	481.1	3	11	11	11	12	9.6
Weakly Bolting	Rose de Lautrec	14-Aug	18	497.0	15	11	11	11	11	11.8
	Thai	27-Jul	18	394.5	5	9	9	6	9	7.6
Softneck	Western Rose	10-Aug	14	450.0	9	9	7	7	8	8

The cultivars with the highest average number of cloves per bulb are Inchelium Red (12.8), Rose de Lautrec (11.8), Red Rezan (10.2) and Chesnok Red (9.8).

The cultivars with the highest winter survival are Wengers, Sicilian Gold, Yugoslavian and Rose de Lautrec. The results from this demonstration have shown that:

- Five of the cultivars did not survive Saskatchewan's winter conditions: Georgian Crystal, Newfoundland Tall, Quebec Northern, Romanian Red and Khabar.
- Nine cultivars had a 70% or lower survival rate: Western Rose, Kostyn's Red Russian, Italian Purple, Metechi, Linda Olesky, Chesnok Red, Susan Delafield, Music and Leningrad.
- Eight cultivars had a survival rate of 80% and above: Yugoslavian, Persian Star, Red Rezan, Wengers, Inchelium Red, Rose de Lautrec and Thai.

Final Discussion

This project was intended as a demonstration and not replicated; therefore, no firm conclusions can be made about production numbers. It does indicate that there are several cultivars that do well in Saskatchewan growing conditions and that there is opportunity to grow these cultivars for different market classes based on their size and number of cloves per bulb.

The current industry favorite Music, was out performed by 13 cultivars based on yield and 12 on overwintering. Notably, Yugoslavian produced a similar amount of cloves per bulb as Music; but it had much higher yields and overwintering numbers. Wengers, Sicilian Gold and Rose de Lautrec had high yields, high overwintering numbers and more cloves per bulb than Music.

Areas of further study include replicated cultivar trials comparing yield, overwintering, processing, taste and storage. Additionally, the manipulation of bulb size through management techniques, evaluating agronomic protocols for establishment of garlic from bulbils and a study comparing processing quality of garlic rounds to standard bulbs should be conducted.

Comparison of the Effectiveness of Drip vs Overhead Irrigation for Direct-Seeded vs Transplanted Crops

Funding

This project was funded by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canadian Agricultural Partnership Program.

Principal Investigators

- Dr. Kate Congreves, College of Agriculture and Bioresources, University of Saskatchewan

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Canada-Saskatchewan Irrigation Diversification Centre (CSIDC)
- Saskatchewan Vegetable Growers' Association (SVGA)

Objectives

High quality vegetable crop production requires regular applications of water in Saskatchewan due to the semi-arid climate. Vegetable growers therefore use irrigation to supplement rainfall, the most common type of irrigation used is overhead irrigation. However, there are many different irrigation methods and growers must select the best method to maximize water use efficiency.

Drip irrigation offers more uniform germination, less weed growth between rows, less disease, and it efficiently provides water near crop roots – where it is required. In comparison, overhead irrigation is easier to set up, is more maintenance free, and generally enables easier access to the soil for cultivation. Drip irrigation may result in less disease because it efficiently provides water near crop roots – where it is required, rather than saturating a large volume of soil (i.e., a risk of overhead irrigation methods) and encouraging fungal outbreaks.

The objectives of these projects were to compare the two irrigation systems on vegetable crops that are direct-seeded or transplanted.

Project Background

As Saskatchewan's vegetable industry expands, producers are looking to invest in irrigation systems. Knowledge of the pros and cons of each type of irrigation and their influence on crop productivity, quality, and disease will help producers make better investment decisions – while also ensuring healthy crop growth.

Using drip irrigation can improve early-growth of direct seeded and transplanted crops – or help mitigate fungal disease outbreaks – and this may benefit harvestable yields. In Saskatchewan, overhead irrigation is most commonly used for vegetable production. However, in many other places with a dry-climate (such as California where large acres of produce are grown), drip irrigation is by far the single dominant form of irrigation. Drip irrigation systems provide very efficient use of water by minimizing less water loss via evaporation. Drip irrigation systems would be well suited to Saskatchewan, and research is needed to demonstrate its use on both direct seeded crops and transplanted crops.

Research Plan

The project was conducted at the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC). One block of strip plots for overhead irrigation were compared to another strip plot for drip irrigation. For both irrigation systems, we produced crops that were either transplanted (broccoli) or direct-seeded (carrot). Cabbage was originally planned for instead of broccoli, but there were issues attaining cabbage transplants, so a closely related crop – broccoli – was selected instead. The area selected for this project was tilled and cultivated to prepare the seed bed. Trifluralin was applied to the carrot and broccoli plots and incorporated. The carrot plots were shaped into raised beds using a potato hiller.

Fertilizer was broadcast and incorporated based on soil tests (for the 0-15cm, 15-30cm, 30-60cm depths), bringing total estimate available nutrients up to the minimum recommended levels for the crops. The site was fairly nutrient rich in deeper soil layers, so the total fertilizer amounts that ended up being applied were relatively low (i.e., 35 lbs/ac of N and 35 lbs/ac of P2O5).

The trial was set up under 2 spans of a pivot irrigation system. The nozzles passing over the trickle irrigated treatments were blocked to prevent them from being watered by the pivot. Drip irrigation was installed on June 6th. Soil moisture was monitored using tensiometers and was kept at 65% field capacity.

Crops were seeded on June 5. The carrots were seeded using a single wheel push planter. The broccoli was transplanted on June 6 using a water wheel transplanter.

It is important to mention that this trial was approached as a demonstration trial and not a scientific trial; therefore, the experimental design was not randomized or replicated. The results are to be interpreted accordingly.

Results

Yields

This project demonstrated to Saskatchewan growers that vegetable crops such as broccoli can be produced using a drip irrigation method resulting in roughly similar or greater yields as compared to an overhead irrigation method (Fig 1). Carrot, however, indicated yield reduction under drip irrigation, primarily due to germination issues in the drip irrigated plots at the site (Fig 1). Figure 1 reports the marketable yields; however, similar trends were observed for the total yields.

In general, the vegetable crop yields were low for both irrigation systems. This was attributed to the relatively low fertilizer applications that were applied (see methodology section) – a decision that was made to avoid artificially boosting yields which could present misleading information from a demonstration trial. In this case, the goal was to demonstrate the relative results between irrigation systems.

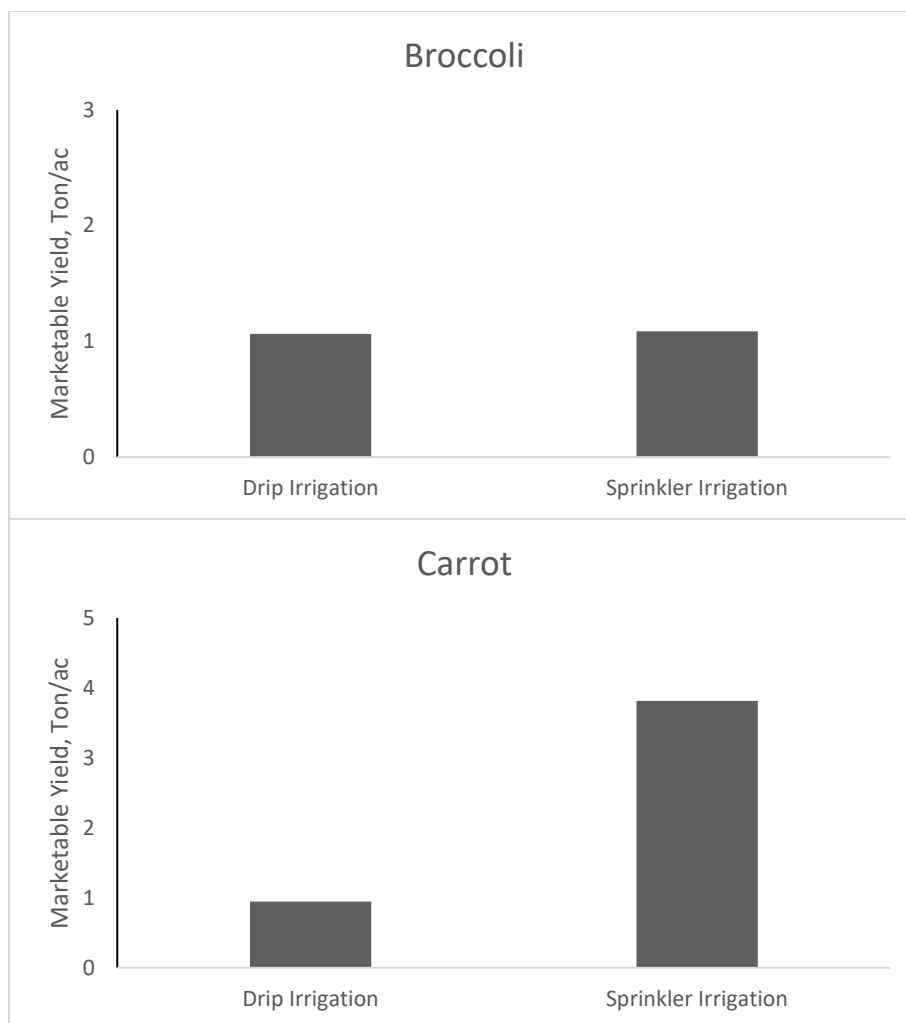


Fig 1. Marketable yields for broccoli and carrot with drip or sprinkler irrigation based on a demonstration trial in Outlook, 2018.



Broccoli production with drip irrigation (left) and sprinkler irrigation (right).
Photo credits: Cara Drury.



Carrot production with drip irrigation (top) and sprinkler irrigation (bottom).
Photo credits: Cara Drury.

Disease and Insect Damage

Little disease or insect damage was observed throughout the growing season. Broccoli heads and leaves had uniform color, with compact heads, and had showed generally little damage from disease or insects. Carrot, however, indicated signs of wireworm damage in both drip and overhead irrigated plots.

Soil Moisture Dynamics

On average throughout the growing season and compared to the overhead sprinkler system, the drip irrigation system resulted in numerically higher soil water tension (indicating lower soil moisture) in the top 8 inches of the soil (Fig 2), but numerically lower soil water tension (indicating higher soil moisture) in the top 18 inches of soil. This possibly reflects a more judicious use of water inputs, and likely less overall water loss under drip versus sprinkler irrigation.

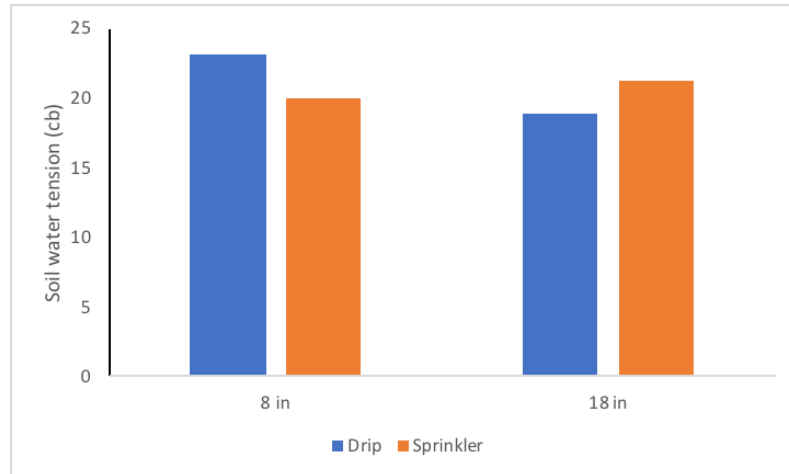


Fig 2. Average growing season soil water tension measurements from plots under drip or sprinkler irrigation.

Final Discussion

The demonstration trial showed growers an alternative way to irrigate crops, other than overhead irrigation. When adopting drip irrigation, it is recommended that growers focus on attaining the right irrigation pressure so that the drip irrigation system runs properly, especially early in the growing season. This is particularly important for small direct-seeded crops like carrot, that require good soil contact and sufficient moisture for germination. Based on the demonstration trial, broccoli tended to produce similar yields when under drip irrigation compared to overhead irrigation – this indicates a low risk for any yield penalties when adopting a more water efficient system.

Comparison of Drip vs Overhead Irrigation for Crops Susceptible to Fungal Diseases

Funding

This project was funded by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canadian Agricultural Partnership Program.

Principal Investigators

- Dr. Kate Congreves, College of Agriculture and Bioresources, University of Saskatchewan

Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Canada-Saskatchewan Irrigation Diversification Centre (CSIDC)
- Saskatchewan Vegetable Growers' Association (SVGA)

Objectives

High quality vegetable crop production requires regular applications of water in Saskatchewan due to the semi-arid climate. Vegetable growers therefore use irrigation to supplement rainfall, the most common type of irrigation used is overhead irrigation. However, there are many different irrigation methods and growers must select the best method to maximize water use efficiency.

Drip irrigation offers more uniform germination, less weed growth between rows, less disease, and it efficiently provides water near crop roots – where it is required. In comparison, overhead irrigation is easier to set up, is more maintenance free, and generally enables easier access to the soil for cultivation. Further, some vegetable crops are susceptible to fungal disease and crop losses which can be brought on by overly moist conditions can favour disease outbreaks. Drip irrigation may result in less disease because it efficiently provides water near crop roots – where it is required, rather than saturating a large volume of soil (i.e., a risk of overhead irrigation methods) and encouraging fungal outbreaks.

The objectives of these projects were to compare the two irrigation systems on vegetable crops that are susceptible to diseases associated with moist soil.

Project Background

As Saskatchewan's vegetable industry expands, producers are looking to invest in irrigation systems. Knowledge of the pros and cons of each type of irrigation and their influence on crop productivity, quality, and disease will help producers make better investment decisions – while also ensuring healthy crop growth.

Using drip irrigation can improve early-growth of direct seeded and transplanted crops – or help mitigate fungal disease outbreaks – and this may benefit harvestable yields. In Saskatchewan, overhead irrigation is most commonly used for vegetable production. However, in many other places with a dry-climate (such as California where large acres of produce are grown), drip irrigation is by far the single dominant form of irrigation. Drip irrigation systems provide very efficient use of water by minimizing less water loss via evaporation. Drip irrigation systems would be well suited to Saskatchewan, and research is needed to demonstrate its use on both direct seeded crops and transplanted crops.

Research Plan

The project was conducted at the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC). One block of strip plots for overhead irrigation were compared to another strip plot for drip irrigation. For both irrigation systems, we produced crops that were susceptible to fungal diseases (beans and cucumbers). The area selected for this project was tilled and cultivated to prepare the seed bed. Dual Magnum was applied to the cucumber and bean plots. The carrot plots were shaped into raised beds using a potato hiller.

Fertilizer was broadcast and incorporated based on soil tests (for the 0-15cm, 15-30cm, 30-60cm depths), bringing total estimate available nutrients up to the minimum recommended levels for the crops. The site was fairly nutrient rich in deeper soil layers, so the total fertilizer amounts that ended up being applied were relatively low (i.e., 35 lbs/ac of N and 35 lbs/ac of P₂O₅).

The trial was set up under 2 spans of a pivot irrigation system. The nozzles passing over the trickle irrigated treatments were blocked to prevent them from being watered by the pivot. Drip irrigation was installed on June 6th. Soil moisture was monitored using tensiometers and was kept at 65% field capacity.

Crops were seeded on June 5. The beans were seeded using a 4-row bean planter; the cucumbers were planted by hand.

It is important to mention that this trial was approached as a demonstration trial and not a scientific trial; therefore, the experimental design was not randomized or replicated. The results are to be interpreted accordingly.

Results

Yields

This project demonstrated to Saskatchewan growers that vegetable crops such as cucumber, and bean can, by in large, be produced using a drip irrigation method resulting in roughly similar or greater yields as compared to an overhead irrigation method (Fig 1). Figure 1 reports the marketable yields; however, similar trends were observed for the total yields.

In general, the vegetable crop yields were low for both irrigation systems. This was attributed to the relatively low fertilizer applications that were applied (see methodology section) – a decision that was made to avoid artificially boosting yields which could present misleading information from a demonstration trial. In this case, the goal was to demonstrate the relative results between irrigation systems.

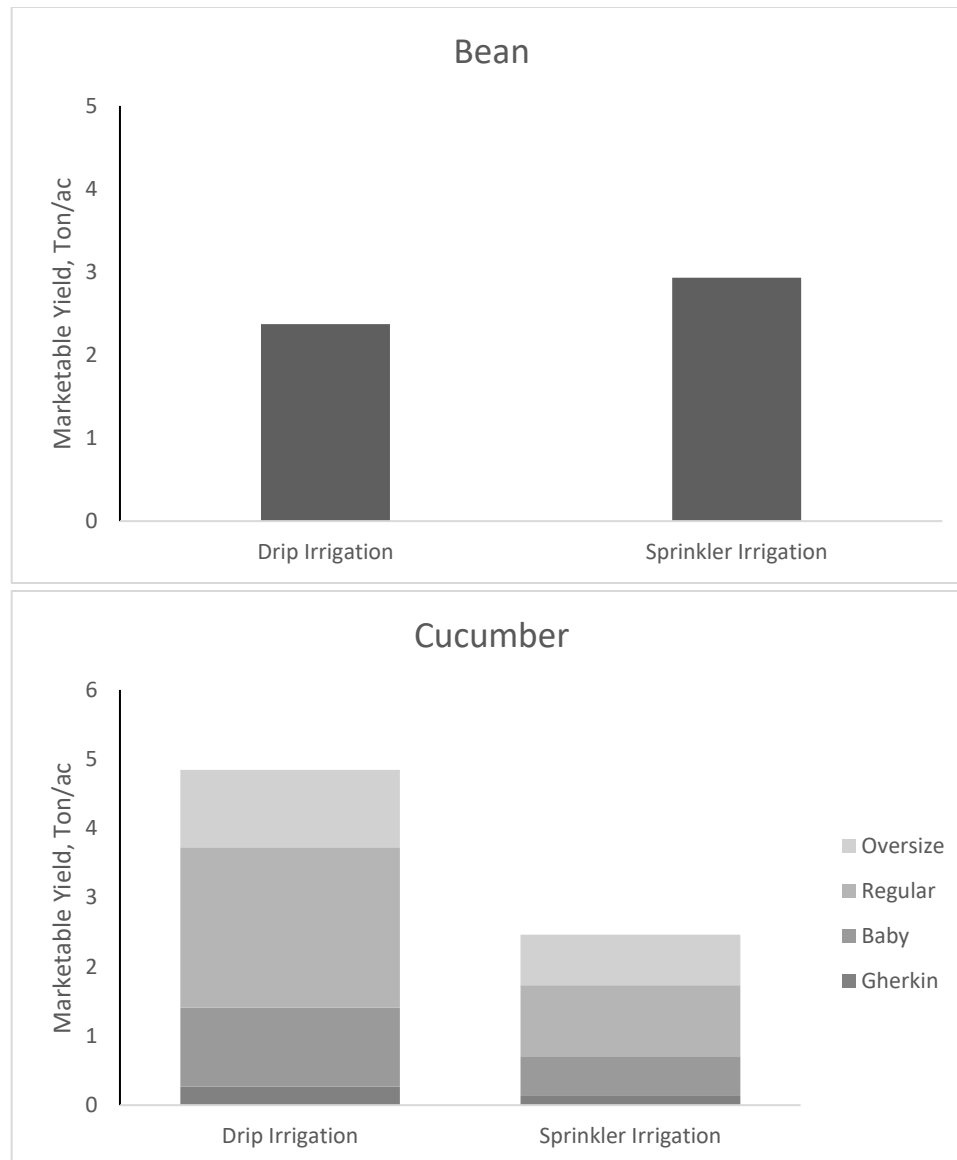


Fig 1. Marketable yields for bean and cucumber produced with drip or sprinkler irrigation based on a demonstration trial in Outlook, 2018.

Disease and Insect Damage

Little disease or insect damage was observed throughout the growing season. Beans were free from rust, shriveling, heat, disease or insect damage. Cucumber were also free from pest damage.

Soil Moisture Dynamics

On average throughout the growing season and compared to the overhead sprinkler system, the drip irrigation system resulted in numerically higher soil water tension (indicating lower soil moisture) in the top 8 inches of the soil (Fig 2), but numerically lower soil water tension (indicating higher soil moisture) in the top 18 inches of soil. This possibly reflects a more judicious use of water inputs, and likely less overall water loss under drip versus sprinkler irrigation.

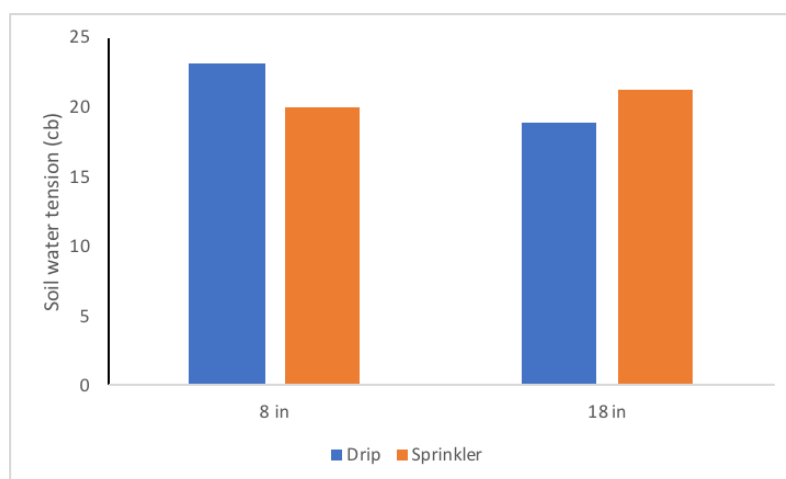


Fig 2. Average growing season soil water tension measurements from plots under drip or sprinkler irrigation.

Final Discussion

The demonstration trial showed growers an alternative way to irrigate crops, other than overhead irrigation. When adopting drip irrigation, it is recommended that growers focus on attaining the right irrigation pressure so that the drip irrigation system runs properly, especially early in the growing season. Based on the demonstration trial, both cucumber and bean tended to produce similar or greater yields when under drip irrigation compared to overhead irrigation – this indicates a low risk for any yield penalties when adopting a more water efficient system.

TECHNOLOGY TRANSFER

CSIDC Irrigation Field Day and Tradeshow, July 12

- Joel Peru – Hemp varieties
- Gary Kruger – Dry bean row spacing
- Garry Hnatowich – Cereal, Oilseed and Pulse research
- Kaeley Kindrachuk- Canola seeding rates
- Tour Leaders- Gary Kruger, Joel Peru

Dry Bean Field Tour, Riverhurst, July 28

- Jeff Ewen, Producer

ICDC Field Day, August 8

- Joel Peru
- Garry Hnatowich
- Cara Drury

Corn, Dry Bean, Soybean Field Day, August 9

- Garry Hnatowich – Soybean Varieties & Agronomy
- Joel Peru- Silage and grain corn agronomy
- Gary Kruger – Irrigated Dry Bean Production
- Cara Drury

ICID PreConference Tour – SK River Valley, Aug 12

- Kelly Farden
- Gary Kruger

ICID Moon Lake Tour – Moon Lake District, Warman, August 16

- Joel Peru

Workshops

Irrigation Scheduling Workshop- Maple Creek, February 14

- Joel Peru-Irrigation Scheduling
- Gary Kruger- Soils of the Maple Creek Region

Irrigation Scheduling Workshop- Richardson Pioneer- Saskatoon, March 8

- Joel Peru- Irrigation Scheduling/AIMM Demonstration
- Gary Kruger- Soils of the Clark's Crossing Region
- Jeff Ewen -
- Garry Hnatowich – Varieties for irrigation

ICDC Irrigated Wheat Agronomy Workshop- Elbow, March 21

- Joel Peru- Water Management of Wheat
- Gary Kruger- Wheat Fertility
- Garry Hnatowich- Wheat Varieties and Protein
- Kaeley Kindrachuk- Fusarium Head Blight

NARF Annual Field Day–Melfort –July 18th

- Joel Peru- New Crop Options

Irrigation Scheduling Workshop- SCIC- Outlook- July 19th

- Joel Peru
- Gary Kruger
- Kelly Farden

Crop Diagnostic School – Melfort – July 24-25 – 175 in attendance

- Gary Kruger- Environmental Stress in Cropping Systems – frost damage
- Joel Peru- New Crop Options
- Kaeley Kindrachuk- Insects and Beneficials

Posters

ICID Conference

- Gary Kruger- Soil Applied Contans WG as an Integrated Management Approach for Irrigated Crops Susceptible to Sclerotinia Sclerotiorum

Publications

- *Crop Varieties for Irrigation*, January
- *Irrigation Economics and Agronomics*, January
- *The Irrigator*, March and November
- *2017 ICDC Research and Demonstration Report* – March

Presentations

Joel Peru

- CSIDC Irrigation Field Day– Morning Tour Lead, Clubroot in Brassicas, July 12
- 2018 SIPA/ICDC Conference– 2018 Irrigated Wheat Survey, December 4
- Corn Summit- Growing corn under Irrigation in Saskatchewan, December 6

Gary Kruger

- Yield Response of Canola to Foliar Boron at Early Flowering, ATP Nutrition, Saskatoon March 6
- Micronutrient Requirements of Irrigated Crops in Saskatchewan, Canada, ICID Conference,

Saskatoon, SK – co-author with Dale Tomasiewicz August 12-17, 2018

- 2018 SIPA/ICDC Conference – 2017 Research and Demonstration Report, December 4

Cara Drury

- 2018 SIPA/ICDC Conference – 2018 Baby Carrot Demonstration, December 4

Kelly Farden

- Irrigation in Saskatchewan- SIA Annual Conference, Prince Albert, April 12
- Tile Drainage at CSIDC- ICID Conference, Saskatoon, August 14

Agriview Articles

Joel Peru

- February-Irrigating for Higher Yields

Joel Peru and Gary Kruger

- May – Learn to better manage irrigation

Kelly Farden

- June- 2018 CSIDC Field Day
- June – International Irrigation Conference Coming to Saskatoon

Other Articles

Joel Peru

- The Irrigator-spring- 2017 ICDC Horticulture Demonstration Program Overview
- The Irrigator-spring- Subsurface Irrigation A Fit for Saskatchewan
- The Irrigator-spring- 2018 Outlook Crop Walks
- The Irrigator-fall- 2018 Irrigated Wheat Production Survey

Gary Kruger

- The Irrigator- March – Disease Control Strategies for Irrigated Rotations
 - Selecting Bean Crops for Irrigation in Saskatchewan
- The Irrigator- November – Earlier seeding of irrigated cereals
 - Think You Understand Center Pivot Safety and Maintenance – Really?
 - Managing Boron Application for Irrigated Rotations
- Top Crop Manager – August – What's Up with Boron? – written by Bruce Barker

Cara Drury

- The Irrigator- November – 2018 Horticulture Program

Kelly Farden

- The Irrigator- Spring – Reclamation of CSIDC Field 12 with Tile Drainage and Leaching

Kaeley Kindrachuk

- SaskAg Now: Research right at our fingertips- April 5
- SaskAg Now: Crop Diagnostic School- June 5
- SaskAg Now: Clubroot Scouting- July 17
- SaskAg Now: Managing plant diseases by scouting now- Aug 9
- SaskAg Now: Clubroot Hosts- Aug 20
- West Central Ag Supplement: Mental Health in Agriculture- April 2018
- CJWW: Local research- June 27
- CJWW: Managing plant diseases by scouting now- Aug 15
- CJWW: Clubroot Hosts- Oct 10
- CJWW: Irrigation and clubroot- Dec 5
- YouTube: Clubroot Scouting- July 17- 206 views

Surveys 2017

- Lake Diefenbaker Development Area Cropping Survey (Jeff Ewen, Joel Peru, Gary Kruger)

Crop Production Newsletter

Joel Peru

- Crop Production News #1 Come Walk the Crops with Us- May 2 and 16
- Crop Production News #2 Outlook Crop Walks Crops Emerging and Seeding Near Completion
- Crop Production News #3 Come Walk the Crops with Us June 14
- Crop Production News #4 Come Walk the Crops with Us 2018 ICDC Fruit Program
- Crop Production News #5 Come Walk the Crops with Us- July 13- Plant Diseases
- Crop Production News #5 The Basics of Irrigation Scheduling
- Crop Production News #6 Come Walk the Crops with Us- Crop Diagnostic School
- Crop Production News #7 Come Walk the Crops 2018 ICDC Vegetable Program
- Crop Production News #8 Outlook Crop Walks a Social Media Success!

ABBREVIATIONS

AAFC	Agriculture and Agri-Food Canada
ac	acre or acres
ACC	Alberta Corn Committee
ADF	Agriculture Development Fund
ADOPT	Agriculture Demonstration of Practices and Technologies (Canadian Agricultural Partnership Program)
AIMM	Alberta Irrigation Management Model
bu	bushel or bushels
CCC	Canola Council of Canada
CDC	Crop Development Centre, University of Saskatchewan
cm	centimetre
CSIDC	Canada-Saskatchewan Irrigation Diversification Centre
DM	dry matter
FHB	Fusarium head blight
GPS	Global Positioning System
ICDC	Irrigation Crop Diversification Corporation
ICID	International Commission on Irrigation & Drainage
L	litre
lb	pound or pounds
m	metre
MAFRI	Manitoba Agriculture, Food and Rural Initiatives
mm	millimetre
SPARC	Semiarid Prairie Agricultural Research Centre
SVPG	Saskatchewan Variety Performance Group
t	tonne
TKW	thousand kernel weight
WGRF	Western Grains Research Foundation

The Irrigation Saskatchewan website at <http://irrigationsaskatchewan.com> is designed so that site visitors have access to irrigation topics related to ICDC, SIPA and the Ministry of Agriculture. The site directs visitors to an ICDC subsection, a SIPA subsection, and a link to the irrigation section of the Saskatchewan Ministry of Agriculture's website.

The ICDC section includes ICDC reports, publications, and events, as well as links to information relevant to irrigation crops.

ICDC PUBLICATIONS

ICDC Research and Demonstration Program Report Detailed descriptions of the projects undertaken each year.

Irrigation Economics and Agronomics An annual ICDC budget workbook designed to assist irrigators with their crop selection process. Irrigators can compare their on-farm costs and productivity relative to current industry prices, costs and yields.

Crop Varieties for Irrigation A compilation of yield comparison data from irrigated yield trials managed by CSIDC. It is useful as a guide for selecting crop varieties suitable for irrigation.

Irrigation Scheduling Manual Provides technical information required by an irrigator to effectively schedule irrigation operations for crops grown under irrigation in Saskatchewan.

Irrigated Alfalfa Production in Saskatchewan Provides technical information regarding the production practices and recommendations for irrigated alfalfa forage production.

Management of Irrigated Dry Beans This factsheet provides a comprehensive overview of agronomic management requirements for producing dry beans under irrigation.

Corn Production This factsheet provides information on corn heat units, variety selection and an overview of agronomic management requirements for producing grain, silage and grazing corn under irrigation in Saskatchewan.

Copies of these and other ICDC publications are available from the Ministry of Agriculture's Irrigation Branch office in Outlook, SK, ICDC office or on the ICDC website at <http://irrigationsaskatchewan>.