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# Irrigation Crop Diversification Corporation Research and Demonstration Report





# Research and Demonstration Program Report 2016

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# VISION

Through innovation, the Irrigation Crop Diversification Corporation stimulates and services the development and expansion of sustainable irrigation in Saskatchewan.

## 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 Minister in promoting and developing sustainable irrigation in Saskatchewan.

## CONTACT

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# BOARD OF DIRECTORS

Director	Position	Irrigation District	Development Area Represented	Term Expiry (current term)
Jay Anderson	Chairman	SSRID	LDDA	2017 (2nd)
Greg Oldhaver	Alternate Vice Chairman	Miry Creek	SWDA	2017 (2nd)
Ryan Miner	Director	Riverhurst	SEDA	2016 <sup>1</sup>
David Bagshaw	Vice-Chairperson	Luck Lake	LDDA	2016 (2nd)
Paul Heglund	Director	Consul-Nashlyn	SWDA	2017 (1st)
Nigel Oram	Director	Grainland	NDA	2016 <sup>2</sup>
Anthony Eliason	Director	Individual Irrigators	Non-District	2018 (1st)
Joel Vanderschaaf	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

<sup>1</sup> In December 2015, Ryan Miner was appointed pursuant to Bylaw 7 to serve his third year as director.

<sup>2</sup> In December 2015, Nigel Oram was appointed pursuant to Bylaw 7 to serve his first year as director

The four Development Areas (DA), as defined in ICDCs 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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# ONGOING VARIETY TRIALS

## Irrigated Canola Performance Trial

### Funding

- 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 ICDCs annual *Crop Varieties for Irrigation* guide.

### Research Plan

The irrigated canola performance trial was conducted at CSIDC (Field #12). Canola varieties were tested for their agronomic performance under irrigation. Four Clearfield, three Liberty and fourteen Roundup-tolerant canola hybrids were evaluated in 2016. Seeding date was May 16. 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. Supplemental nitrogen fertilizer was applied at 130 kg N/ha as 46-0-0, and phosphorus at 35 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0, both 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 (glyphosate). All herbicide applications occurred on June 14. All plots received an application of Headline EC (pyraclostrobin) fungicide at the early flowering stage for disease control and an application of Matador (lambda-cyhalothrin) for control of cabbage seedpod weevil presence. Varieties were swathed at the appropriate time of maturity and all plots were combined September 5. Total in-season precipitation at CSIDC from May through August was 351.2 mm. Total in-season irrigation amount consisted of a single application of 12.5 mm on June 14.

## Results

Results are outlined in Table 1. Hybrids VR 9562 GC, CS2100 and 5440 were statistically higher yielding than CS2200 CL, 6076 RR, 73-75 RR, Pv 200 CL and 5545 CL. Median seed yield of all hybrids was 3326 kg/ha (59.3 bu/ac). Median oil content was 46.9%, test weight 64.9 kg/hl and 1000 seed weight (TKW) 3.5 grams. Plant height ranged from 122 to 151 cm. 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. If experimental lines are registered, results from the 2016 Irrigated Performance Trials will be used to update ICDC's annual publication, *Crop Varieties for Irrigation*.

**Table 1. Yield and Agronomic Data for the 2016 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)
<i>Clearfield-tolerant</i>									
5545 CL	HYB	2971	46.6	64.7	3.8	136	42	102	NC
CS 2200 CL	HYB	3113	45.5	65.5	3.4	143	44	102	NC
DL 1504	HYB	3230	46.9	65.5	4.0	145	43	102	NC
Pv 200 CL	HYB	2999	45.5	64.6	3.5	142	44	102	NC
<i>Liberty-tolerant</i>									
5440	HYB	3818	46.2	65.2	3.4	145	43	98	NC
L130	HYB	3477	46.7	64.4	3.4	143	42	99	NC
L252	HYB	3463	48.6	65.5	3.3	140	44	101	NC
<i>Roundup-tolerant</i>									
6074 RR	HYB	3392	47.3	65.1	3.6	134	42	101	NC
6080 RR	HYB	3606	47.3	64.2	3.6	131	42	101	NC
6076 RR	HYB	3061	45.9	64.1	3.2	148	43	102	NC
CS2000	HYB	3366	45.9	64.1	3.5	142	44	102	NC
V12-1	HYB	3172	47.1	64.1	3.5	142	44	101	NC
DL 1513	HYB	3514	46.0	63.4	3.4	134	44	102	NC
SX1502	HYB	3478	47.0	66.0	3.4	151	44	100	NC
Pv 533 G	HYB	3356	46.6	64.6	3.7	135	42	98	NC
VR 9562 GC	HYB	4012	47.7	62.1	4.0	146	43	99	NC
74-44 BL	HYB	3318	48.7	65.0	3.5	132	42	97	NC
74-54 RR	HYB	3241	47.3	65.4	4.1	136	42	99	NC
73-75 RR	HYB	3023	48.0	64.6	3.8	122	41	98	NC
CS2100	HYB	3934	46.9	65.8	3.7	131	44	101	NC
LSD (0.05)	NS	1.3	1.4	0.4	11.7	0.7	1.4		
CV (%)	13.8	2.0	1.5	6.9	6.0	1.1	1.0		

HYB = Hybrid NS = Not Significant NC = Observation Not Captured

# Irrigated Canola Variety Trial

## Funding

- Agriculture Development Fund
- Western Grains Research Foundation
- Irrigation Crop Diversification Corporation

## Principal Investigator

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

## Organization

- 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 ICDCs annual *Crop Varieties for Irrigation* guide.

## Research Plan

Every year ICDC conducts the Irrigated Canola Variety Trial. Selection of canola varieties is based upon results obtained in prior seasons through canola co-op trials conducted by ICDC for the Canola Council of Canada. Once varieties are commercially available, companies are invited to provide seed for 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 ICDC and provide recommendations to irrigators on the best canola varieties suited to irrigation conditions and will be used to update ICDCs annual publication, *Crop Varieties for Irrigation*.

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

CSIDC: Bradwell loam-silty loam (Field #8)

CSIDC Off Station: Asquith sandy loam (Knapik NE)

A total of thirteen 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: CSIDC trial #1—May 19, CSIDC off station—May 20. Plot size was 1.5 m x 4.0 m, all plots were seeded at 25 cm row spacing. All seed was treated by the seed suppliers for seed borne disease and early season flea beetle control. Supplemental fertilizer was applied at an application rate of 130 kg N/ha as 46-0-0 and supplemental phosphorus at 35 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0,

all fertilizer was side banded at seeding at both sites. 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. Each trial received a tank-mix application of Headline EC (pyraclostrobin) fungicide at the early flowering stage for disease control and an application of Matador (lambda-cyhalothrin) for control of cabbage seedpod weevil presence. CSIDC plots were swathed August 25, and after proper dry down, harvested September 8; the CSIDC off station trial was swathed September 1 and combined September 8. Total in-season precipitation at CSIDC from May through August was 351.2 mm. Total in-season irrigation at CSIDC and at CSIDC off station consisted of a single application of 12.5 mm on June 14 and June 8, respectively.

## Results

Results obtained at the CSIDC location are shown in Table 1, those for the off station site in Table 2. Canola varieties in the CSIDC trial were not statistically significantly different from each other. Median yield of varieties was 3197 kg/ha (57.0 bu/ac). Yields in 2016 were lower than traditionally achieved and attributed to excess in-season precipitation.

Per cent oil content ranged from 45.5 (PV 200CL) to 49.2% (SY4135). Median oil content of all varieties was 47.7%. Median test weight was 64.0 kg/hl and thousand seed weight 3.9 gm. Hybrid SY4135 was the first variety to flower (10% flower), PV 540G the last, though neither was statistically different from the check 5440. Median days to 10% flower was 41 days. Any variety with days to maturity greater than 98 days was statistically later maturing than the control. Median days to mature for canola hybrids was 98 days. Plant height were not statistically different between hybrids.

At the off station location, varieties also did not differ statistically from one another. Median yield of varieties was 4294 kg/ha (76.6 bu/ac).

Per cent oil content ranged from 45.9 (L140P) to 49.4% (SY4135). Median oil content of all varieties was 46.7%. Median test weight was 63.1 kg/hl and thousand seed weight 4.5 gm. Days to flower were not captured and days to maturity did not differ statistically between hybrids. SY4135 was the shortest in plant height, PV 200 CL the tallest.

**Table 1. Yield and Agronomic Data for the 2016 ICDC Irrigated Canola Variety Trial, CSIDC Site.**

Entry	Yield (kg/ha)	Oil (%)	Test Weight (kg/hl)	TKW (gm/1000 seed)	Height (cm)	First Flower (days)	Maturity (days)
<b>5440*</b>	<b>3087</b>	<b>46.6</b>	<b>64.0</b>	<b>4.4</b>	<b>144</b>	<b>40</b>	<b>97</b>
6056CR	3104	47.5	64.2	4.2	134	40	99
6074RR	3141	46.2	64.3	4.1	131	39	98
CS 2000	3004	45.6	64.6	3.8	143	41	99
CS 2100	2980	47.6	64.9	4.2	129	40	98
CS 2200	3242	45.9	65.2	3.7	143	41	99
L140P	3301	46.8	63.4	3.9	134	40	97
L252	3411	48.6	64.2	3.8	139	42	98
PV 200CL	3415	45.5	64.2	3.6	139	40	99
PV 540G	3640	47.1	63.0	4.0	134	43	98

Entry	Yield (kg/ha)	Oil (%)	Test Weight (kg/hl)	TKW (gm/1000 seed)	Height (cm)	First Flower (days)	Maturity (days)
SY4114	2446	47.8	63.7	4.3	124	39	97
SY4135	3481	49.2	64.5	4.2	134	38	97
SY4157	3238	48.1	64.1	3.8	144	42	98
LSD (0.05)	NS	1.3	0.7	NS	NS	2.6	1.3
CV (%)	13.2	2.0	0.8	14.5	6.6	4.5	0.9

NS = Not Significant

\* Check Variety

**Table 2. Yield and Agronomic Data for the 2016 ICDC Irrigated Canola Variety Trial, CSIDC Off Station Site.**

Entry	Yield (kg/ha)	Oil (%)	Test Weight (kg/hl)	TKW (gm/1000 seed)	Height (cm)	First Flower (days)	Maturity (days)
<b>5440</b>	<b>4071</b>	<b>46.1</b>	<b>63.4</b>	<b>4.2</b>	<b>133</b>	<b>NC</b>	<b>102</b>
6056CR	4011	47.2	62.7	4.9	128	NC	102
6074RR	4353	46.9	62.5	4.3	132	NC	103
CS 2000	4299	46.4	62.6	5.2	127	NC	102
CS 2100	4033	47.4	64.6	4.7	127	NC	100
CS 2200	4127	46.9	64.5	5.6	135	NC	102
L140P	4203	45.9	62.9	4.5	130	NC	101
L252	4162	48.1	64.8	4.6	125	NC	101
PV 200CL	4413	46.1	61.5	4.8	138	NC	102
PV 540G	4265	46.0	62.1	4.7	129	NC	102
SY4114	3457	47.4	64.2	4.4	127	NC	99
SY4135	4246	49.4	64.1	4.6	123	NC	102
SY4157	4429	47.6	62.7	4.1	138	NC	102
LSD (0.05)	NS	1.6	1.0	0.8	9.3		NS
CV (%)	11.5	2.3	1.1	11.6	5.0		1.3

NS = Not Significant

NC = Observation Not Captured

\* Check Variety

# Western Canada Irrigated Canola Co-operative Trials XNL1 and XNL2

## Funding

- Canola Council of Canada

## Principal Investigator

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

## Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Western Canada Canola/Rapeseed Recommending Committee
- Canola Council of Canada

## Objectives

The objectives of this study were to:

- Evaluate crop varieties for intensive irrigated production; and
- Update ICDCs annual *Crop Varieties for Irrigation* guide.

## Research Plan

The canola co-operative trials were conducted on an irrigated site at CSIDC (Field #12). Thirty canola hybrids were evaluated in each XNL1 and XNL2 trial; check varieties 45H29 and 5440 were included in each trial (a second 5440 entry was also included to keep an even number of entries, results of this “blank” 5440 entry are not included in the data analysis or discussion). Trials were seeded on May 18. Plot size was 1.5 m x 6 m. The seed was treated with Helix XTra (thiamethoxam, difenoconazole, metalaxyl & fludioxonil) for seed borne disease and early season flea beetle control. Supplemental nitrogen fertilizer was applied at 130 kg N/ha as 46-0-0 and phosphorus at 35 kg P<sub>2</sub>O<sub>5</sub>/ha, as 12-51-0, side-banded at the time of seeding. 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. Each trial received a tank-mix application of Headline EC (pyraclostrobin) fungicide at the early flowering stage for disease control and an application of Matador (lambda-cyhalothrin) for control of cabbage seedpod weevil presence. Both trials were swathed on August 25, XNL1 was combined on September 7 and the XNL2 on September 8. Total in-season precipitation at CSIDC from May through August was 351.2 mm. Total in-season irrigation amount consisted of a single application of 12.5 mm on June 14.

## Results

Yield and agronomic data collected are shown in Table 1 for the XNL1 and Table 2 for the XNL2 trials. Within the XNL1 two experimental entries, 5CN0128 and 5CN0428, were statistically higher yielding than the control 5440. No other entries had yields statistically different compared to the control.

Median seed yield of all entries in the trial was 3429 kg/ha. Median oil content was 47.4%, test weight 64.6 kg/hl, and 1000 kernel weight (TKW) of 5.0 grams. No experimental entry flowered in a significantly shorter time than at least one of the control varieties; however, four experimental entries were significantly later to flower than a control. No entry was significantly later in maturity than either control entry, but six entries were significantly earlier to mature than the control check varieties. Twelve entries were statistically shorter than the control varieties, no entries were statistically taller.

Within the XNL2, no entries were statistically higher yielding than the control 5440. Entries ( $n = 10$ ) with a yield less than 3490 kg/ha were significantly lower yielding compared to 5440. Median seed yield of all entries in the trial was 3641 kg/ha. Median oil content was 46.8%, test weight 64.9 kg/hl, and 1000 kernel weight (TKW) of 4.0 grams. Nine experimental entries were significantly later to flower than the control 5440. Twelve entries were statistically later maturing than the control variety, no entries were statistically earlier maturing. One entry, DL1501CL, was significantly taller and four entries were significantly shorter in plant height compared to the control variety.

The results from these trials are used to assist in the registration decision process for new proposed canola varieties. These trials will be repeated in 2017 with new entries. Some 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. If experimental lines are registered, results of the 2016 Western Canada Irrigated Canola Co-operative Trials will be used to update ICDCs annual publication, *Crop Varieties for Irrigation*.

**Table 1. Yield and Agronomic Data for the Irrigated Canola Cooperative Trial XNL1, 2016.**

Entry	Yield (kg/ha)	Oil (%)	Test Weight (kg/hl)	TKW (gm/1000 seed)	Height (cm)	First Flower (days)	Maturity (days)
<b>5440*</b>	<b>3408</b>	<b>46.0</b>	<b>65.0</b>	<b>4.9</b>	<b>151</b>	<b>41</b>	<b>100</b>
45H29	3448	47.8	63.9	4.5	149	40	100
15GG0241R	3699	47.2	63.7	4.7	139	40	97
5CN0097	3690	46.1	64.6	4.7	140	41	100
5CN0139	3971	47.2	64.4	5.2	123	40	99
DL1509RR	3435	46.7	64.1	5.0	139	40	102
G49659	3487	47.5	64.9	4.7	133	40	96
G15P9374	2333	47.4	63.6	4.6	132	41	98
14GG1212R	3074	47.2	63.9	5.0	133	41	99
5CN0128	4252	47.4	64.9	5.5	148	40	96
15GG0505R	3345	48.3	64.4	5.0	140	42	98
G15P9377	3249	48.1	64.9	6.2	135	40	99
5CN0424	3728	47.2	64.7	4.0	145	43	99
5CN0242	3961	46.9	66.0	4.7	154	43	100
5CN0385	3495	46.2	63.3	4.7	133	41	102
G15P9329	3343	48.1	64.3	5.3	139	40	99
G32362	3166	48.2	64.4	4.8	131	40	96
5CN0381	3545	46.2	64.3	5.2	146	41	99
G15P9304	3136	48.9	64.7	4.0	132	43	99
5CN0120	3698	46.1	65.3	5.4	135	42	102
G15P9323	3459	47.7	65.1	5.7	140	40	97
G32338	3608	48.2	65.2	4.7	139	40	99

Entry	Yield (kg/ha)	Oil (%)	Test Weight (kg/hl)	TKW (gm/1000 seed)	Height (cm)	First Flower (days)	Maturity (days)
14CG1217R	3363	47.2	63.3	4.6	144	40	97
G15P9399	3140	47.7	66.0	4.7	132	40	97
G15P9400	3217	47.9	65.1	5.0	122	41	98
DL1504CL	3678	47.4	65.4	5.5	157	41	101
14GG1221R	3585	45.3	65.6	5.2	133	40	98
DL1508RR	3488	47.9	65.5	4.9	146	44	102
5CN0428	4229	46.5	63.6	4.8	143	41	100
LSD (0.05)	649	1.8	1.0	NS	11.7	1.1	2.7
CV (%)	11.3	2.4	1.0	15.6	5.2	1.7	1.7

\* Check Variety

**Table 2. Yield and Agronomic Data for the Irrigated Canola Cooperative Trial XNL2, 2016.**

Entry	Yield (kg/ha)	Oil (%)	Test Weight (kg/hl)	TKW (gm/1000 seed)	Height (cm)	First Flower (days)	Maturity (days)
<b>5440*</b>	<b>4087</b>	<b>47.0</b>	<b>64.8</b>	<b>3.8</b>	<b>152</b>	<b>41</b>	<b>99</b>
45H29	3574	47.3	64.3	3.2	151	40	99
DL1502CL	3943	44.8	65.2	3.9	152	43	101
5CN0133	3837	46.4	65.3	3.7	156	46	101
G15P9349	3066	47.0	65.4	3.8	141	40	98
DL1513RR	3691	47.1	64.1	3.9	153	44	102
15GN1368R	3211	48.0	64.5	3.9	130	41	97
15GG0832R	4020	48.6	62.9	4.5	145	40	100
G15P9340	3650	46.6	64.9	4.1	140	40	99
4CN0133	3496	47.3	65.3	3.7	150	42	102
15GG0504R	3823	46.2	64.3	4.2	140	41	100
5CN0395	4070	48.2	65.5	3.5	152	44	101
G49287	3662	48.2	64.9	4.5	138	41	100
14H1222	3213	47.2	64.8	3.9	151	42	99
15RH1142	3502	44.3	65.3	4.4	145	41	101
14GG1210R	3653	46.1	63.5	4.2	145	40	99
DL1512RR	3271	45.0	64.8	4.8	149	41	102
5CN0237	3959	47.6	65.3	3.6	147	42	101
15GG0831R	3980	47.6	63.4	4.1	163	41	99
DL1503CL	3082	45.5	65.5	4.1	154	42	101
G44971	3636	49.2	64.5	3.8	140	40	99
G32418	3400	45.6	65.4	4.0	133	41	101
5CN0287	4100	47.2	65.6	3.4	150	42	101
14GG0892R	3202	47.3	65.1	4.2	146	42	100
15RH1167	3454	46.6	64.6	4.1	157	43	100
DL1501CL	4022	44.3	65.7	4.4	174	43	101
15GG0834R	3557	48.1	63.6	4.1	140	40	101
15GG0508R	3459	46.6	63.8	3.8	140	41	99
5CN0244	3732	46.2	65.5	4.1	150	44	101
14GG0895R	3489	47.1	64.6	4.9	148	41	99
LSD (0.05)	597	2.1	0.8	0.7	12.2	1.3	1.6
CV (%)	10.1	2.8	0.7	11.2	5.1	1.9	1.0

\* Check Variety



# Irrigated Flax Variety Trial

## Funding

- Irrigation Crop Diversification Corporation
- Saskatchewan Variety Performance Group

## Principal Investigator

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

## Organization

- Irrigation Crop Diversification Corporation (ICDC)

## 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 ICDCs annual *Crop Varieties for Irrigation* guide.

## Research Plan

The irrigated flax trials were conducted at two locations, on the main CSIDC station and at the CSIDC Off Station (Knapik) location.

Thirteen flax varieties, nine registered and four experimental entries, were tested for their agronomic performance under irrigation. The CSIDC site was seeded May 18 and the CSIDC off station site on May 20. Plot size was 1.5 m x 4.0 m. Each trial received supplemental fertilizer at application rates of 110 kg N/ha at CSIDC and 95 kg N/ha at CSIDC off station, as 46-0-0, and 25 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0; all fertilizer was side-banded at the time of seeding. Weed control consisted of a post-emergence application of Poast Ultra (sethoxydim) + Badge II (bromoxynil +MCPA ester) supplemented by some hand weeding. All sites received an application of Headline EC (pyraclostrobin) fungicide at the 40–50% bloom stage for Pasmox (septoria) control. Both sites also received a season-end desiccant application of Reglone (diquat) prior to combining. Combining occurred on September 27 at both trial locations. Total in-season irrigation at CSIDC and at CSIDC off station consisted of a single application of 12.5 mm on June 8 at both sites.

## Results

Results obtained at the CSIDC location are shown in Table 1. The variety CDC Neela was the highest yielding entry at CSIDC, statistically higher than all other entries with yields < 3300 kg/ha. Test weight of entries did not differ statistically at CSIDC. AAC Bravo had the highest 1000 kernel weights (TKW), NuLin VT50 the lowest. NuLin VT50 and Westlin 71 were significantly later maturing than all other entries, excepting Westlin 72. Entries varied in plant height, but no difference in lodging could be determined.

The CSIDC off station location results are shown in Table 2. Westlin 71 was the highest yielding at the off station location, statistically higher yielding than all varieties, with yields less than 1880 kg/ha. Test weight of entries did not differ statistically at the off station location. AAC Bravo also had the highest TKW as at CSIDC, CDC Glas the lowest. NuLin VT50 and Westlin 72 were significantly later maturing than all other entries. Entries varied in plant height. All entries with a lodging rating greater than 2 were significantly different from all other entries.

Combined analysis of the sites is shown in Table 3. Yields produced at CSIDC were greater than those at the off station trial. This is attributed to, in part, storm damage that the off station site experienced prior to harvest. Statistically, the only yield differences from the check variety, CDC Bethune, occurred between Westlin 71, which was significantly higher yielding, and experimental entry FP2454, which was significantly lower yielding. No varieties had test weights significantly different from the check. Seed weights differed significantly within varieties. NuLin VT50 and WESTLIN 72 were significantly later to mature, CDC Bethune the earliest to mature. The check variety, CDC Bethune, was the tallest registered variety, experimental FP2316 and registered entry CDC Plava exhibited the highest degree of lodging.

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 to update ICDCs annual publication, *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, CSIDC Site, 2016.**

Variety	Yield (kg/ha)	Test Weight (kg/hl)	Seed Weight (mg)	Maturity (days)	Height (cm)	Lodging (1=erect; 9=flat)
<b>CDC Bethune</b> ( <i>check variety</i> )	<b>3159</b>	<b>68.4</b>	<b>6.1</b>	<b>111</b>	<b>69</b>	<b>1.0</b>
CDC Glas	3507	67.9	5.7	112	69	1.0
CDC Neela	3838	68.5	6.0	112	70	1.0
CDC Plava	2597	68.6	5.7	113	60	1.3
AAC Bravo	3453	69.3	6.5	112	62	1.0
Prairie Sapphire	3467	67.7	6.1	113	65	1.0
NuLin VT50	3497	68.8	5.1	115	56	1.0
Westlin 71	3659	69.1	6.0	115	64	1.0
Westlin 72	2897	69.4	5.7	114	64	1.0
FP2316	3192	68.8	6.1	111	70	1.3
FP2454	2419	69.0	5.2	112	55	1.0
FP2457	3368	68.3	5.9	112	65	1.3
FP2388	2805	68.5	5.8	112	57	1.0
LSD (0.05)	632	NS	0.4	1.3	6.9	NS
CV (%)	11.7	0.9	4.2	0.7	6.4	23.5

NS = Not Significant

**Table 2. Yield and Agronomic Data for the Saskatchewan Variety Performance Group Irrigated Flax Regional Trial, CSIDC Off Station Site, 2016.**

Variety	Yield (kg/ha)	Test Weight (kg/hl)	Seed Weight (mg)	Flower (days)	Maturity (days)	Height (cm)	Lodging (1=erect; 9=flat)
<b>CDC Bethune</b> ( <i>check variety</i> )	<b>1911</b>	<b>66.8</b>	<b>5.5</b>	<b>51</b>	<b>102</b>	<b>69</b>	<b>1.7</b>
CDC Glas	1994	64.5	4.9	53	104	68	2.0
CDC Neela	1890	66.5	5.2	51	104	68	3.3
CDC Plava	1930	44.7	5.7	50	103	60	3.3
AAC Bravo	1862	66.8	6.0	49	104	67	1.7
Prairie Sapphire	1666	65.4	5.5	52	103	68	1.7
NuLin VT50	1889	67.3	5.0	52	109	61	2.0
Westlin 71	2223	67.8	5.7	52	106	66	1.3
Westlin 72	2025	67.2	5.3	53	109	69	1.7
FP2316	1324	66.9	5.6	52	104	70	4.0
FP2454	1541	67.3	5.5	47	103	62	1.0
FP2457	2012	67.4	5.5	52	104	67	1.0
FP2388	1603	66.9	5.5	49	104	62	1.3
LSD (0.05)	342	NS	0.4	2.1	1.9	5.7	1.6
CV (%)	11.1	14.2	4.4	2.4	1.1	5.1	46.5

NS = Not Significant

**Table 3. Yield and Agronomic Data for the Saskatchewan Variety Performance Group Irrigated Flax Regional Trial, Combined Site Analysis, 2016.**

Treatment	Yield (kg/ha)	Test Weight (kg/hl)	Seed Weight (mg)	Maturity (days)	Height (cm)	Lodging (1=erect; 9=flat)
<b>Trial Site</b>						
CSIDC	3220	68.7	5.8	113	63	1.1
CSIDC – Off station	1836	65.0	5.4	104	66	2.0
LSD Yield (0.10) LSD (0.05)	991	NS	0.3	1.1	NS	NS
CV	11.9	9.8	4.3	0.9	5.8	44.3
<b>Variety</b>						
<b>CDC Bethune</b> ( <i>check variety</i> )	<b>2535</b>	<b>67.6</b>	<b>5.8</b>	<b>107</b>	<b>69</b>	<b>1.3</b>
CDC Glas	2751	66.2	5.3	108	69	1.5
CDC Neela	2864	67.5	5.6	108	69	2.2
CDC Plava	2264	56.7	5.7	108	60	2.3
AAC Bravo	2658	68.1	6.3	108	64	1.3
Prairie Sapphire	2566	66.6	5.8	108	66	1.3
NuLin VT50	2693	68.1	5.1	112	59	1.5
Westlin 71	2941	68.4	5.8	110	65	1.2
Westlin 72	2461	68.3	5.5	112	66	1.3
FP2316	2258	67.9	5.8	108	70	2.7
FP2454	1980	68.2	5.4	107	58	1.0
FP2457	2690	67.9	5.7	108	66	1.2
FP2388	2204	67.7	5.6	108	59	1.2
LSD (0.05)	350	NS	0.3	1.1	4.3	0.8
<b>Location x Variety Interaction</b>						
LSD (0.05)	S	NS	S	S	NS	S

S = Significant NS = Not Significant

# Irrigated Field Pea Regional Variety Trial

## Funding

- Irrigation Crop Diversification Corporation
- Saskatchewan Variety Performance Group

## Principal Investigator

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

## Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Saskatchewan Variety Performance Group

## 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 ICDCs 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: Bradwell loam-silty loam (Field #12)

CSIDC Off Station: Asquith sandy loam (Knapik NE)

Pea varieties were tested for their agronomic performance under irrigation. The CSIDC location was seeded on May 13, and the CSIDC off station site on May 17. Plot size was 1.5 m x 4 m. All plots received 25 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0 as a side banded application and Nodulator granular inoculant at a rate of 5 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 Odyssey (imazamox + imazethapyr) and Equinox (tepraxoxydim) at both sites. Supplemental hand weeding was conducted at both locations. Fungicide applications occurred on July 7 at both sites with Headline EC (pyraclostrobin) for *Mycosphaerella* blight, powdery mildew, and white mold control. The trials were arranged in a randomized complete block design with three replicates. 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%. Pre-harvest desiccation occurred at both sites with Reglone at CSIDC on August 23 and at the CSIDC off station site on August 24. Harvest occurred at CSIDC on August 29 and at the CSIDC off station trial, August 30. Total in-season precipitation at CSIDC from May through August was 351.2 mm. Total in-

season irrigation at CSIDC and at CSIDC off station consisted of a single application of 12.5 mm on June 14 and June 8, respectively.

Thirty pea varieties representing seven market classes were evaluated in 2016. Ten registered varieties and five unregistered entries were Yellow pea market class, six registered and two 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 and one unregistered entry in an exploratory class CDC has designated as *wrinkled*.

## Results

Results of the CSIDC pea trial are shown in Table 1. Varieties differed widely with respect to yield, however these yield differences were not statistically different from each other. Analysis of Variance procedures indicated a high degree variation both between and within varieties such that no conclusions can be made with respect to yield. The above average rainfall induced a much higher than normal disease pressure within the trial, which resulted in the variability in yield. No further discussion of any other collected observations will occur due to the potential effects of yield variability.

Results of the CSIDC Off Station pea trial are shown in Table 2. Varieties differed widely with respect to yield, however it cannot be claimed that yield differences were exclusively due to genetic yield potential. The Coefficient of Variation (CV) associated with Analysis of Variance procedures was very high (CV = 21.8) and deemed outside reliability for yield. The high level of variability, within and between varieties, was attributed to the above “normal” incidence of root rot that was apparent within the trial. No further discussion of any other collected observations will occur due to the potential effects of yield variability.

Results from these trials will not be used to update ICDCs annual *Crop Varieties for Irrigation* guide.

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

<b>Variety</b>	<b>Yield (kg/ha)</b>	<b>Protein (%)</b>	<b>Test Weight (kg/hl)</b>	<b>1 K Weight Seed Weight (mg)</b>	<b>10% Flower (days)</b>	<b>Maturity (days)</b>	<b>Height (cm)</b>	<b>Lodge Rating (1=erect; 10=flat)</b>
<b>Yellow</b>								
<b>CDC Golden*</b>	<b>3406</b>	<b>23.1</b>	<b>77.2</b>	<b>192</b>	<b>51</b>	<b>86</b>	<b>81</b>	<b>10</b>
Abarth	3364	20.8	77.2	245	49	85	81	6.7
Agassiz	4223	23.1	76.0	216	49	87	97	9.3
AAC Ardill	4518	20.3	76.5	231	51	86	105	8.7
AAC Carver	4575	20.1	77.1	229	50	86	101	8.0
AAC Lacombe	2982	20.8	76.5	243	52	87	97	9.3
CDC Amarillo	3937	21.4	76.8	205	51	87	95	9.0
CDC Inca	3466	20.6	77.8	214	52	88	107	8.3
CDC Meadow	3384	21.9	78.7	206	49	85	90	7.3
CDC Saffron	2997	21.9	75.6	234	51	87	76	10
CDC 2936-7	3140	22.2	77.2	218	51	90	93	9.0
CDC 3094-5	2270	23.1	75.4	276	51	89	98	6.7
CDC 3360-7	3575	23.1	78.0	221	48	85	107	7.3
CDC 3525-5	3846	22.7	77.5	225	52	90	105	7.0
CDC 4061-4	3499	22.3	78.0	199	52	87	109	7.0
<b>Green</b>								
AAC Radius	2459	22.0	76.8	202	51	83	100	6.3
AAC Royce	2354	21.4	74.3	228	50	86	69	9.7
CDC Greenwater	3216	20.7	76.1	210	52	89	107	9.3
CDC Limerick	3293	24.6	78.2	193	51	88	92	8.7
CDC Raezer	3748	22.0	76.9	223	51	87	93	9.3
CDC Striker	3208	23.0	78.5	237	51	88	79	9.0
CDC 3007-6	3002	21.4	77.0	236	51	88	92	7.0
CDC 3422-8	3678	22.3	77.1	220	51	90	99	9.0
<b>Red</b>								
Redbat 8	2677	23.3	76.1	183	50	87	80	10
Redbat 88	2738	24.5	77.0	190	53	90	104	8.0
<b>Maple</b>								
AAC Liscard	3003	22.8	80.4	174	53	88	104	9.0
CDC Blazer	3691	24.5	76.3	162	51	88	95	9.7
<b>Dun</b>								
CDC Dakota	3484	24.3	76.6	198	52	87	99	7.7
<b>Forage</b>								
CDC 3548-2	2664	24.0	77.1	160	50	88	109	8.3
<b>Wrinkled</b>								
CDC 4140-4	2097	23.2	71.7	199	49	84	95	10
LSD (0.05)	NS	1.6	1.5	19.8	0.9	3.0	13.1	NS
CV (%)	21.2	4.5	1.2	5.7	1.1	2.1	8.4	19.5

\* Check Variety

Table 2. Irrigated Pea Regional Variety Trial, CSIDC Off Station 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)
<b>Yellow</b>								
<b>CDC Golden*</b>	<b>2672</b>	<b>24.5</b>	<b>81.4</b>	<b>179</b>	<b>49</b>	<b>NC</b>	<b>66</b>	<b>NC</b>
Abarth	2572	22.9	79.8	232	46	NC	68	NC
Agassiz	3923	26.3	80.7	194	45	NC	65	NC
AAC Ardill	2766	22.8	81.8	230	52	NC	68	NC
AAC Carver	2474	22.1	81.6	201	52	NC	68	NC
AAC Lacombe	2692	23.4	81.5	210	50	NC	75	NC
CDC Amarillo	2580	24.1	82.2	181	54	NC	72	NC
CDC Inca	2853	23.4	80.7	201	52	NC	69	NC
CDC Meadow	2401	22.2	81.6	346	47	NC	69	NC
CDC Saffron	2465	23.7	81.2	218	51	NC	67	NC
CDC 2936-7	2025	23.7	80.6	184	51	NC	74	NC
CDC 3094-5	2652	23.8	81.4	251	49	NC	85	NC
CDC 3360-7	2761	24.1	81.5	219	45	NC	73	NC
CDC 3525-5	2586	25.0	81.8	210	55	NC	78	NC
CDC 4061-4	3210	24.9	81.0	227	51	NC	81	NC
<b>Green</b>								
AAC Radius	2346	22.7	80.8	196	49	NC	69	NC
AAC Royce	1760	23.8	78.4	204	46	NC	58	NC
CDC Greenwater	2401	22.5	81.0	195	50	NC	71	NC
CDC Limerick	2344	24.8	81.3	179	49	NC	70	NC
CDC Raezer	2411	22.4	80.0	204	49	NC	71	NC
CDC Striker	2466	24.0	81.0	225	50	NC	64	NC
CDC 3007-6	2962	23.3	81.3	231	50	NC	67	NC
CDC 3422-8	2590	24.1	80.9	212	51	NC	72	NC
<b>Red</b>								
Redbat 8	2284	25.1	80.7	181	48	NC	66	NC
Redbat 88	1874	23.3	81.2	177	50	NC	65	NC
<b>Maple</b>								
AAC Liscard	3277	25.4	83.2	161	54	NC	66	NC
CDC Blazer	2710	27.0	81.4	152	50	NC	71	NC
<b>Dun</b>								
CDC Dakota	2931	25.6	81.3	184	50	NC	67	NC
<b>Forage</b>								
CDC 3548-2	2039	26.1	80.3	173	47	NC	66	NC
<b>Wrinkled</b>								
CDC 4140-4	2075	25.5	75.2	175	47	NC	78	NC
LSD (0.05)	916	1.9	1.5	77.5	2.1		NS	
CV (%)	21.8	4.9	1.1	23.2	2.3		11.3	

NC = Observation Not Captured

\* Check Variety

# Rudy Agro Irrigated Field Pea Evaluation

## Funding

- Irrigation Crop Diversification Corporation

## Principal Investigator

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

## Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Saskatchewan Variety Performance Group

## Objectives

The objectives of this study were to evaluate three marrowfat class pea and a yellow pea lines being contracted by Rudy Agro.

## 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: Bradwell loam-silty loam (Field #12)

CSIDC Off Station: Asquith sandy loam (Knapik NE)

Pea varieties were tested for their agronomic performance under irrigation. All plots received 25 kg  $P_2O_5$ /ha as 12-51-0 (side banded application) and Nodulator granular inoculant at a rate of 5 kg/ha (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 Odyssey (imazamox + imazethapyr) and Equinox (tepraxoxydim) at both sites. Supplemental hand weeding was conducted at both locations. Fungicide applications occurred on July 7 at both sites with Headline EC (pyraclostrobin) for *Mycosphaerella* blight, powdery mildew, and white mold control. The trials were arranged in a randomized complete block design with three replicates. 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%. Pre-harvest desiccation occurred at both sites with Reglone at CSIDC on August 23 and at the CSIDC off station site on August 24. Harvest occurred at CSIDC on August 29 and at the CSIDC off station trial, August 30. Total in-season precipitation at CSIDC from May through August was 351.2 mm. Total in-season irrigation at CSIDC and at CSIDC off station consisted of a single application of 12.5 mm on June 14 and June 8, respectively.



Four Rudy Agro acquired pea entries were compared to the agronomic performance of CDC Golden. Rudy Agro varieties entered were the yellow variety 832-13A and three marrowfat varieties; 757-1, Midori and Hitomi.

## Results

Results of the agronomic performance of the CSIDC site and the off station site are shown in Tables 1 and 2 respectively.

At both sites, all entries exhibited a high, and undesirable, degree of lodging. Lodging experienced was attributed to excessive growing season precipitation, resulting in the development of both root and foliar disease issues. Consequently, the high degree of variation expressed by the high CV make the results for both of these trials unreliable.

**Table 1. Rudy Agro Irrigated Pea Evaluation, 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)
<b>Yellow</b>								
<b>CDC Golden (Yellow)*</b>	<b>3406</b>	<b>23.1</b>	<b>77.2</b>	<b>192</b>	<b>51</b>	<b>86</b>	<b>81</b>	<b>10</b>
757-1 (MFP)	1625	24.1	76.0	352	52	87	58	10
Hitomi (MFP)	2293	22.9	76.0	304	51	87	75	9.3
Midori (MFP)	2460	24.4	75.1	328	50	87	74	10
832-13A (Yellow)	1999	22.9	78.8	307	52	88	97	6.7
LSD (0.05)	NS	NS	NS	68.3	0.6	NS	9.6	1.4
CV (%)	31.9	3.8	2.0	12.2	1.6	0.6	6.6	8.2

NS = Not Significant

\* Check Variety

**Table 2. Rudy Agro Irrigated Pea Evaluation, CSIDC Off Station 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)
<b>Yellow</b>								
<b>CDC Golden (Yellow)*</b>	<b>2672</b>	<b>24.5</b>	<b>81.4</b>	<b>179</b>	<b>49</b>	<b>NC</b>	<b>66</b>	<b>NC</b>
757-1 (MFP)	1887	25.5	79.0	315	52	NC	67	NC
Hitomi (MFP)	1083	24.9	77.7	282	51	NC	61	NC
Midori (MFP)	1559	25.7	77.4	320	47	NC	63	NC
832-13A (Yellow)	3039	24.8	81.2	273	51	NC	70	NC
LSD (0.05)	NS	NS	2.5	28.2	1.0		14.6	
CV (%)	34.9	3.7	1.7	5.5	1.0		11.9	

NS = Not Significant

NC = Observation Not Captured

\* Check Variety

# Saskatchewan Dry Bean Narrow Row Regional Variety Trial

## Funding

- Irrigation Crop Diversification Corporation
- Crop Development Centre, University of Saskatchewan

## Principal Investigator

- Garry Hnatoiwich, PAg, Research Director, ICDC (Project Lead)
- Co-investigator: Dr. K. Bett, Crop Development Centre, University of Saskatchewan

## Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Crop Development Centre, University of Saskatchewan

## 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 2016 at CSIDC and CSIDC Off Station locations. The trials were seeded May 26 at CSIDC and on May 25 at the Off Station location. Nineteen dry bean varieties consisting of six market classes (pinto, black, navy, yellow, cranberry and fleur de jaune) 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 P<sub>2</sub>O<sub>5</sub>/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 90 kg N/ha. At no time during dry bean growth did plants exhibit symptoms of nitrogen deficiencies. Weed control consisted of a fall pre-plant soil-incorporated application of granular Edge (ethalfluralin) and a post-emergent application of Basagran (bentazon) + Assure II (quizalofop-P-ethyl) supplemented by one in-season cultivation for wide row trials and periodic in-row hand weeding. The trial received a tank-mix application of Priaxor DS (fluxapyroxad & pyraclostrobin) and Copper 53W (tribasic copper sulphate) fungicide at flowering for white mold, anthracnose, and bacterial blight control. 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%. The trial was undercut on September 2 at both locations and harvested on September 19 at CSIDC and September 20 at CSIDC Off Station.

Total in-season irrigation at CSIDC and at CSIDC Off Station consisted of a single application of 12.5 mm on June 14 and June 8, respectively.

## Results

Results of the trials are shown in Table 1 for CSIDC, Table 2 for CSIDC Off Station and the combined site analysis is shown in Table 3.

Caution should be used when assessing the yield results obtained at the Off Station trial. Analysis of variance procedures indicate a high degree of variation between variety yields and, for most crops, results would be dismissed as invalid. The trial and the combined site analysis will be included in the report for documentation and record keeping only. Results of the Off Station trial will not be used to update the ICDC variety database nor used in any extension or variety guide.

Results of the CSIDC trial are shown in Table 1. The Pinto market class variety, Medicine Hat, was the highest yielding, statistically greater than any variety with yields less than 5400 kg/ha. Median seed yield for the trial was 4993 kg/ha. Varieties differed greatly with respect to test weight. CDC Sol was the first variety to flower, CDC Jet the last; median days to flower for the test was 48 days. CDC Marmot was the first variety to mature, entries Bolt and Portage the last; median days to mature for the test was 94 days. Entry Bolt produced the tallest plants, CDC Marmot was the shortest variety, but exhibited the highest degree of lodging. Median pod clearance of all entries was 85%.

Results from the Off Station site (Table 2) and the combined site analysis (Table 3) will not be discussed due to the high degree of variation within the study.

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 2016 Irrigated Dry Bean Regional Variety Trial will also be used in the development of ICDCs annual *Crop Varieties for Irrigation* guide and the Saskatchewan Ministry of Agriculture's *Varieties of Grain Crops 2017*.

**Table 1. Saskatchewan Irrigated Dry Bean Narrow Row Regional Variety Trial, CSIDC Site, 2016.**

<b>Variety</b>	<b>Yield (kg/ha)</b>	<b>Test Weight (kg/hl)</b>	<b>Flower (days)</b>	<b>Maturity (days)</b>	<b>Lodge Rating 1=upright 5=flat</b>	<b>Pod Clearance (%)</b>	<b>Height (cm)</b>
<b>Pinto</b>							
<b>Winchester*</b>	<b>5976</b>	<b>79.1</b>	<b>43</b>	<b>93</b>	<b>1.3</b>	<b>86</b>	<b>56</b>
AC Island	4773	79.8	45	93	2.8	72	49
CDC Marmot	3035	75.8	44	88	3.0	70	35
CDC Pintium	3111	78.1	45	90	1.7	87	44
CDC WM-2	4601	76.7	45	92	1.0	83	51
Medicine Hat	6360	77.9	52	95	1.0	82	51
<b>Black</b>							
CDC Blackstrap	5509	76.3	48	94	1.0	87	45
CDC Jet	6198	77.9	54	96	1.0	90	54
CDC Superjet	6028	77.7	53	96	2.0	80	55
<b>Navy</b>							
Bolt	6218	80.1	52	98	1.0	90	58
Envoy	4629	81.2	47	95	2.5	73	41
OAC Spark	3554	79.8	48	92	2.7	77	40
Portage	5030	80.4	51	98	1.0	90	54
2918-25	5530	80.0	50	93	1.0	90	47
3458-7	4348	78.88	46	9	2.7	73	42
NA6-27-2	4424	80.8	51	97	1.3	87	53
<b>Yellow</b>							
CDC Sol	5495	83.1	42	95	1.0	88	50
<b>Cranberry</b>							
7ab-3bola-3	2917	77.3	45	93	1.0	70	38
<b>Fleur de Jaune</b>							
3620-3	5884	78.1	50	96	2.0	73	50
LSD (0.05)	1268	1.4	1.9	1.6	0.97	9.0	9.1
CV (%)	15.3	1.0	2.3	1.0	35.6	6.6	11.3

\* Check Variety

**Table 2. Saskatchewan Irrigated Dry Bean Narrow Row Regional Variety Trial, CSIDC Off Station Site, 2016.**

<b>Variety</b>	<b>Yield (kg/ha)</b>	<b>Test Weight (kg/hl)</b>	<b>Flower (days)</b>	<b>Maturity (days)</b>	<b>Lodge Rating 1=upright 5=flat</b>	<b>Pod Clearance (%)</b>	<b>Height (cm)</b>
<b>Pinto</b>							
<b>Winchester*</b>	<b>4771</b>	<b>79.3</b>	<b>42</b>	<b>97</b>	<b>1.0</b>	<b>80</b>	<b>48</b>
AC Island	4980	77.6	42	96	2.3	73	49
CDC Marmot	4176	76.4	42	90	1.3	80	29
CDC Pintium	3880	77.8	45	90	1.0	90	36
CDC WM-2	4387	75.3	42	94	1.0	72	48
Medicine Hat	5264	76.7	49	96	1.0	78	50
<b>Black</b>							
CDC Blackstrap	4990	77.5	48	93	1.0	75	38
CDC Jet	4404	79.0	51	98	1.0	77	51
CDC Superjet	4279	79.2	50	97	1.0	80	50
<b>Navy</b>							
Bolt	5228	80.6	45	99	1.0	82	55
Envoy	4304	82.7	46	95	1.3	78	36
OAC Spark	3380	80.4	47	93	1.0	83	37
Portage	4023	81.5	48	99	1.0	73	44
2918-25	4322	80.6	47	93	1.0	83	33
3458-7	5435	80.3	44	93	1.7	78	35
NA6-27-2	4517	81.6	46	99	1.0	72	47
<b>Yellow</b>							
CDC Sol	3158	82.4	41	99	1.0	70	33
<b>Cranberry</b>							
7ab-3bola-3	4150	79.1	44	95	1.3	67	38
<b>Fleur de Jaune</b>							
3620-3	6788	80.1	48	97	1.0	77	45
LSD (0.05)	NS	2.0	1.6	1.2	0.5	7.9	6.9
CV (%)	29.7	1.5	2.1	0.8	25.4	5.8	9.9

\* Check Variety

**Table 3. Saskatchewan Irrigated Dry Bean Narrow Row Regional Variety Trial, Combined Site, 2016.**

<b>Variety</b>	<b>Yield (kg/ha)</b>	<b>Test Weight (kg/hl)</b>	<b>Flower (days)</b>	<b>Maturity (days)</b>	<b>Lodge Rating 1=upright 5=flat</b>	<b>Pod Clearance (%)</b>	<b>Height (cm)</b>
<b>Location</b>							
CSIDC	4927	78.9	48	94	1.6	81	48
CSIDC – Off station	4549	79.4	46	95	1.1	77	42
LSD (0.05)	NS	NS	0.5	NS	NS	NS	NS
CV (%)	23.1	1.3	2.2	0.9	33.2	6.3	10.7
<b>Variety</b>							
<b>Pinto</b>							
<b>Winchester*</b>	<b>5373</b>	<b>79.2</b>	<b>43</b>	<b>95</b>	<b>1.2</b>	<b>83</b>	<b>52</b>
AC Island	4877	78.7	44	95	2.6	73	49
CDC Marmot	3605	76.1	43	89	2.2	75	32
CDC Pintium	3495	78.0	45	90	1.3	88	40
CDC WM-2	4494	76.0	43	93	1.0	78	50
Medicine Hat	5812	77.3	50	96	1.0	80	51
<b>Black</b>							
CDC Blackstrap	5249	76.9	48	94	1.0	81	41
CDC Jet	5301	78.5	53	97	1.0	83	53
CDC Superjet	5154	78.4	51	96	1.5	80	52
<b>Navy</b>							
Bolt	5723	80.4	49	99	1.0	86	57
Envoy	4466	82.0	47	95	1.9	76	38
OAC Spark	3467	80.1	48	92	1.8	80	39
Portage	4527	81.0	49	98	1.0	82	49
2918-25	4926	80.3	49	93	1.0	87	40
3458-7	4892	79.6	45	93	2.2	76	38
NA6-27-2	4470	81.2	49	98	1.2	79	50
<b>Yellow</b>							
CDC Sol	4327	82.7	42	97	0.9	79	42
<b>Cranberry</b>							
7ab-3bola-3	3534	78.2	45	94	1.2	68	38
<b>Fleur de Jaune</b>							
3620-3	6336	79.1	49	97	1.5	75	48
LSD (0.05)	NS	1.2	1.2	1.02	0.5	5.9	5.6
<b>Location x Variety Interaction</b>							
LSD (0.05)	NS	S	S	S	S	S	NS

S = Significant

NS = Not Significant

\* Check Variety

# Alberta Dry Bean Narrow Row and Wide Row Regional Variety Trials

## Funding

- Irrigation Crop Diversification Corporation
- Agriculture Development Fund
- Western Grains Research Foundation

## Principal Investigator

- Garry Hnatowich, PAg, Research Director, ICDC (Project Lead)
- Co-investigators: Dr. P. Balasubramanian, Cathy Daniels and J. Braun at 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 2016 at CSIDC and CSIDC Off Station sites.

The Narrow Row trial included thirteen dry bean varieties, consisting of three market classes (pinto, black and great northern). The Wide Row trial consisted of thirteen dry bean varieties in four market classes (pinto, black, yellow and great northern). 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 Stress Shield 600 (imidacloprid) for wireworm control. For both trials, phosphorus fertilizer was side-banded at a rate of 25 kg P<sub>2</sub>O<sub>5</sub>/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 90 kg N/ha. Both trials were established on May 26. Weed control consisted of a fall pre-plant soil-incorporated application of granular Edge (ethalfluralin) and a post-emergent application of Basagran (bentazon) + Assure II (quizalofop-P-ethyl) supplemented by one in-season cultivation, for wide row trials, and periodic in-row hand weeding. The trial received a tank-mix application of Priaxor DS (fluxapyroxad & pyraclostrobin) and Copper 53W (tribasic copper sulphate) fungicide at flowering for white mold, anthracnose, and bacterial blight control. Yields were

estimated by harvesting the entire plot. In all trials, plots were under-cut and windrowed, allowed to dry in the windrow, and then threshed to determine yield. All trial plots were undercut on September 1 and combined on September 19 at CSIDC and September 20 Off Station. Total in-season irrigation at CSIDC and at CSIDC off station consisted of a single application of 12.5 mm on June 14 and June 8, respectively.

## **Results**

### *Narrow Row*

Agronomic data collected from each narrow row trial is shown in Tables 1 and 2. Caution should be used when assessing the yield results obtained at the Off Station trial. Analysis of variance procedures indicate a high degree of variation between variety yields and for most crops results would be dismissed as invalid. The trial will be included in this discussion, as dry beans can be more variable than other crops, but caution should be used on any conclusions stated.

Medicine Hat (Pinto) class bean was the highest yielding variety, while the Pinto class experimental variety, L11PS211 (A), was the lowest yielding variety at the CSIDC site. Medicine Hat (Pinto) was also the highest yielding variety, while AAC Tundra (Great Northern) was the lowest yielding variety at CSIDC Off Station. Median yield of all varieties at CSIDC was 5092 kg/ha and 4891 kg/ha at CSIDC Off Station. Other agronomic differences measured within sites are not discussed.

Combined narrow row site analysis is outlined in Table 3. Average (not median) yields were almost identical between both trials. Highest yield was obtained with the Pinto variety, Medicine Hat, which was significantly higher than all varieties, yielding less than 5500 kg/ha. CDC Marmot (Pinto) was the lowest yielding registered variety, the experimental Pinto entry, L11PS211 (A), the lowest yielding over-all.

Test weight was higher at the CSIDC location compared to the Off Station trial. Varieties did statistically differ between entries with respect to test weight. Varieties at the CSIDC trial matured earlier compared to those at CSIDC Off Station. Combined site analysis indicated the Pinto variety, L11PS211 (A), was the longest to mature (days to maturity have been rounded to full days in Table 3); the Pinto bean variety, CDC Marmot, was statistically earlier to mature compared to all other varieties. No difference in mean plant height occurred between sites. The experimental Great Northern entry, L10G N821, was the tallest structured variety, CDC Marmot the shortest. Varieties grown at CSIDC exhibited a greater degree of lodging than plants grown at the Off Station location. AC Island exhibited the greatest degree of lodging, Winchester the least. L11PS211 (A) had the least amount of pod clearance, AAC Burdett the greatest. Pod clearance was not statistically different between sites.

### *Wide Row*

Agronomic data collected from each wide row trial is shown in Tables 4 and 5.

As with the narrow row study, caution should be used when assessing the yield results obtained at the Off Station trial. Analysis of Variance procedures indicate a high degree of variation between variety yields and, for most crops, results would be dismissed as invalid. The trial will be included in



this discussion, as dry beans can be more variable than other crops, but caution should be used on any conclusions stated.

In the wide row study at CSIDC, the Black market bean, AC Black Diamond, was the highest yielding variety; this yield was statistically higher than any bean variety with a yield less than 3800 kg/ha. The Pinto class experimental variety, L11PS211 (A), was the lowest yielding. Winchester (Pinto) bean was the highest yielding variety at the CSIDC Off Station site, statistically significant from other varieties yielding less than 3600 kg/ha. As was the case at CSIDC, the Pinto class experimental variety, L11PS211 (A), was the lowest yielding. Median yield of all varieties at the CSIDC trial was 3742 kg/ha and 3371 kg/ha at CSIDC Off Station. Other agronomic differences measured within sites are not discussed.

Combined wide row site analysis is outlined in Table 6. Mean yield did not statistically differ between trial locations. Highest yield was obtained with the Pinto variety, Winchester—this yield was statistically significant from varieties with yields less than 3700 kg/ha. The Pinto class experimental variety, L11PS211 (A), was the lowest yielding variety. Median yield of the combined sites was 3609 kg/ha.

Test weight did not differ between sites; the Yellow experimental varieties, L11YL012 (A), and AAC Whitehorse had the highest and lowest test weights respectively. Varieties at CSIDC Off Station matured later than those at CSIDC. Median days to maturity was 95.5 days. AAC Burdett was significantly earlier maturing than all other varieties, L11YL015 (A) was the latest maturing. The Pinto variety, Winchester, produced the tallest plants; the Yellow experimental variety, L11YL015 (A), the shortest. Lodging did not differ between test locations; AC Island exhibiting the greatest lodging, L11YL012 (A) the least. Pod clearance was higher at the CSIDC site, L11PS211 (A) and AC Island had the least pod clearance, AAC Burdett 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. 2016 Saskatchewan Irrigated Dry Bean Narrow Row Regional Variety Trial, CSIDC site.**

Location/Variety	Yield (kg/ha)	Test Weight (kg/hl)	Flower (days)	Maturity (days)	Height (cm)	Lodging (1-5)	Pod Clearance (%)
<b>Pinto</b>							
Winchester	6160	79.4	44	94	53	1.0	89
AC Island	5045	79.3	46	96	52	2.5	71
Medicine Hat	6396	78.3	52	97	54	2.0	75
AAC Burdett	5037	78.4	47	91	53	1.6	86
CDC Marmot	3715	76.0	44	88	38	2.9	70
L11PS211(A)	3128	74.7	47	97	47	2.8	65
<b>Black</b>							
AC Black Diamond	5450	77.9	51	96	51	1.8	83
AAC Black Diamond 2	4865	78.9	49	95	53	1.6	85
CDC Blackcomb	5403	77.8	52	96	50	1.3	85
<b>Great Northern</b>							
AC Resolute	5530	78.5	44	96	47	1.8	83
AAC Tundra	4842	80.4	44	92	54	2.0	84
AAC Whitehorse	4759	76.9	44	92	55	2.3	78
L10GN821	5352	78.9	45	96	55	1.5	86
LSD (0.05)	1014	1.5	1.6	1.3	6.2	0.8	10
CV (%)	14.0	1.3	2.4	0.96	8.4	30.6	8.7

**Table 2. 2016 Saskatchewan Irrigated Dry Bean Narrow Row Regional Variety Trial, CSIDC Off Station Site.**

Location/Variety	Yield (kg/ha)	Test Weight (kg/hl)	Flower (days)	Maturity (days)	Height (cm)	Lodging (1-5)	Pod Clearance (%)
<b>Pinto</b>							
Winchester	5282	77.7	42	96	49	1.3	80
AC Island	5957	78.9	44	95	52	2.5	66
Medicine Hat	6234	76.3	49	97	47	1.5	74
AAC Burdett	4918	78.0	45	92	50	1.3	83
CDC Marmot	4217	75.6	43	90	33	1.8	75
L11PS211(A)	4191	77.3	45	98	43	1.8	59
<b>Black</b>							
AC Black Diamond	5716	77.7	48	97	47	1.0	78
AAC Black Diamond 2	5617	78.8	48	97	46	1.0	81
CDC Blackcomb	4213	78.1	50	94	42	1.3	75
<b>Great Northern</b>							
Resolute	4809	73.4	42	98	48	1.8	75
AAC Tundra	4024	75.7	42	93	50	1.8	66
AAC Whitehorse	4534	75.4	42	93	52	1.5	74
L10GN821	5987	76.0	43	98	52	1.5	79
LSD (0.05)	NS	NS	1.5	0.9	7.1	0.7	8.5
CV (%)	19.1	4.1	2.3	0.6	10.6	30.4	8.0

**Table 3. 2016 Saskatchewan Irrigated Dry Bean Narrow Row Regional Variety Trial, Combined Site.**

<b>Location/Variety</b>	<b>Yield (kg/ha)</b>	<b>Test Weight (kg/hl)</b>	<b>Flower (days)</b>	<b>Maturity (days)</b>	<b>Height (cm)</b>	<b>Lodging (1–5)</b>	<b>Pod Clearance (%)</b>
<b>Location</b>							
CSIDC	5052	78.1	47	94	51	1.9	80
CSIDC – Off station	5054	76.8	45	95	50	1.5	74
LSD (0.05)	NS	1.0	1.3	0.6	NS	0.4	NS
CV (%)	16.8	3.1	2.4	0.8	9.5	30.7	8.4
<b>Variety</b>							
<b>Pinto</b>							
Winchester	5721	78.6	43	95	51	1.1	84
AC Island	5501	79.1	45	95	52	2.5	69
Medicine Hat	6315	77.3	50	97	51	1.8	74
AAC Burdett	4977	78.2	46	91	51	1.4	84
CDC Marmot	3966	75.8	43	89	36	2.3	73
L11PS211(A)	3659	76.0	46	97	45	2.3	62
<b>Black</b>							
AAC Black Diamond	5583	77.8	49	97	49	1.4	80
AAC Black Diamond 2	5241	78.9	48	96	49	1.3	83
CDC Blackcomb	4808	77.9	51	95	46	1.3	80
<b>Great Northern</b>							
Resolute	5170	76.0	43	97	48	1.8	79
AAC Tundra	4433	78.1	43	93	52	1.9	75
AAC Whitehorse	4647	76.1	43	93	53	1.9	76
L10GN821	5670	77.4	44	97	54	1.5	83
LSD (0.05)	843	2.4	1.1	0.8	4.6	0.5	6.5
<b>Location x Variety Interaction</b>							
LSD (0.05)	NS	NS	NS	S	NS	NS	NS

S = Significant

NS = Not Significant

**Table 4. 2016 Saskatchewan Irrigated Dry Bean Wide Row Regional Variety Trial, CSIDC Site.**

Variety	Yield (kg/ha)	Test Weight (kg/hl)	Flower (days)	Maturity (days)	Height (cm)	Lodging (1–5)	Pod Clearance (%)
<b>Pinto</b>							
Winchester	4056	78.4	42	93	55	2.0	81
AC Island	3862	79.4	45	95	48	3.0	66
AAC Burdett	3491	78.1	46	90	54	1.8	84
L11PS211(A)	2361	76.5	46	95	45	2.5	69
<b>Black</b>							
AC Black Diamond	4446	77.7	49	97	54	1.8	84
AAC Black Diamond 2	3640	79.0	50	96	49	2.0	75
<b>Great Northern</b>							
Resolute	3967	78.1	42	96	49	2.0	80
AAC Tundra	3975	79.9	42	92	51	2.5	80
AAC Whitehorse	3378	76.8	42	92	50	2.3	84
L10GN821	3949	77.6	42	95	47	1.8	83
<b>Yellow</b>							
CDC Sol	3882	82.2	41	95	48	1.0	85
L11YL012(A)	3430	82.4	42	97	46	1.0	80
L11YL015(A)	3044	82.6	44	98	45	1.0	78
LSD (0.05)	680	1.1	1.1	1.2	7.2	0.7	6.8
CV (%)	13.0	1.0	1.7	0.9	10.1	26.4	6.0

**Table 5. 2016 Saskatchewan Irrigated Dry Bean Wide Row Regional Variety Trial, CSIDC Off Station Site.**

Variety	Yield (kg/ha)	Test Weight (kg/hl)	Flower (days)	Maturity (days)	Height (cm)	Lodging (1–5)	Pod Clearance (%)
<b>Pinto</b>							
Winchester	4578	77.8	41	94	58	2.3	76
AC Island	3347	78.9	41	94	49	3.0	65
AAC Burdett	3118	78.0	42	93	49	1.3	81
L11PS211(A)	2498	77.3	45	98	48	1.3	61
<b>Black</b>							
AC Black Diamond	3868	78.0	47	97	48	1.0	80
AAC Black Diamond 2	3716	79.4	46	97	46	1.0	80
<b>Great Northern</b>							
Resolute	2743	75.2	42	98	48	1.3	78
AAC Tundra	2845	80.0	41	94	53	2.0	73
AAC Whitehorse	3694	73.6	42	94	52	2.3	71
L10GN821	3128	75.3	43	98	52	1.5	78
<b>Yellow</b>							
CDC Sol	3715	81.7	41	98	40	1.0	74
L11YL012(A)	3068	82.4	42	99	39	1.0	63
L11YL015(A)	2742	81.2	45	99	37	1.0	61
LSD (0.05)	NS	3.7	1.8	0.9	5.0	0.5	9.0
CV (%)	21.8	3.3	2.7	0.6	7.3	24.2	8.6

NS = Not Significant

**Table 6. 2016 Saskatchewan Irrigated Dry Bean Wide Row Regional Variety Trial, Combined Site.**

<b>Location/Variety</b>	<b>Yield (kg/ha)</b>	<b>Test Weight (kg/hl)</b>	<b>Flower (days)</b>	<b>Maturity (days)</b>	<b>Height (cm)</b>	<b>Lodging (1–5)</b>	<b>Pod Clearance (%)</b>
<b>Location</b>							
CSIDC	3652	79.1	44	94	49	1.9	79
CSIDC – Off station	3312	78.4	43	96	47	1.5	72
LSD (0.05)	NS	NS	0.4	0.4	NS	NS	3.1
CV (%)	17.6	2.4	2.2	0.8	8.8	25.7	7.3
<b>Variety</b>							
<b>Pinto</b>							
Winchester	4317	78.1	42	94	57	2.1	79
AC Island	3604	79.2	43	95	48	3.0	66
AAC Burdett	3305	78.1	44	91	51	1.5	83
L11PS211(A)	2430	76.9	46	97	47	1.9	65
<b>Black</b>							
AAC Black Diamond	4157	77.8	48	97	51	1.4	82
AAC Black Diamond 2	3679	79.2	48	96	48	1.5	78
<b>Great Northern</b>							
Resolute	3355	76.6	42	97	49	1.6	79
AAC Tundra	3410	80.0	42	93	52	2.3	76
AAC Whitehorse	3536	75.2	42	93	51	2.3	78
L10GN821	3538	76.5	42	96	49	1.6	80
<b>Yellow</b>							
CDC Sol	3798	82.0	41	96	44	1.0	79
L11YL012(A)	3249	82.4	42	98	43	1.0	71
L11YL015(A)	2893	81.9	44	99	41	1.0	69
LSD (0.05)	611	1.9	1.0	0.7	4.3	0.4	5.5
<b>Location x Variety Interaction</b>							
LSD (0.05)	NS	NS	S	S	S	S	S

S = Significant

NS = Not Significant

# Western Canada Soybean Performance Evaluation

## Funding

- Irrigation Crop Diversification Corporation
- Agriculture Development Fund
- Western Grains Research Foundation
- Saskatchewan Pulse Growers

## Project Investigator

- Garry Hnatoiwich, PAg, Research Director, ICDC (Project Lead)
- Co-investigators: D. Lange, Manitoba Agriculture, Food & Rural Initiatives

## Organizations

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

## Objectives

The objectives of this study are to:

- Evaluate the potential of soybean varieties for production in the irrigated west-central region of Saskatchewan;
- Assess the suitability of soybean to irrigation as opposed to dryland production; and
- Create a database on soybean for ICDC's annual publication, *Crop Varieties for Irrigation*.

## Research Plan

Thirty-six soybean varieties were received through the Manitoba Pulse and Soybean Growers for evaluation under both dryland and irrigation production assessment. Plot size was 1.2 m x 4 m. All plots received 25 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0 as a sideband application during the seeding operation. Granular inoculant (Nodulator) with the appropriate Rhizobium bacteria strain (*Bradyrhizobium japonicum*) specific for soybean was seed placed at a rate of 8 kg/ha during the seeding operation. Both trials were seeded on May 21. Weed control consisted of a pre- and post-emergence application of Roundup (glyphosate) supplemented by some hand weeding. First frost occurred on the morning of October 5. 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%. Total in-season precipitation at CSIDC from May through October was 423.8 mm. Total in-season irrigation at CSIDC consisted of a single application of 12.5 mm on June 14.

## Results

Thirty-six Roundup Ready soybean varieties were evaluated. Plant emergence and seedling development was extremely excellent, ideal conditions through June until frost established excellent

yield potential. Seed quality and agronomic data collected for the irrigated soybean are shown in Table 1. Yields were very high, with a median yield of all thirty-six entries of 4219 kg/ha (62.7 bu/ac). Yields of irrigated soybean ranged from a low of 3176 kg/ha (47.2 bu/ac) to a high of 5160 kg/ha (76.7 bu/ac). Oil content varied among entries, with a 2.9% difference between the lowest and highest per cent oil entries. Median protein content was 36.5%. Test weight and seed weight also exhibited a wide variance between entries. Average maturity was 116 days which is considerably earlier than previous trials conducted at CSIDC excepting 2016, 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. Plant height was also higher than typically measured in soybean trials at Outlook. Lodging resistance in most entries was very good, however several entries exhibited lodging scores > 3.0, which could result in harvest difficulties.

Seed quality and agronomic data collected for the dryland soybean are shown in Table 2. Median yield of all thirty-six entries was a very high 4401 kg/ha (65.4 bu/ac). Yields of dryland soybean ranged from a low of 3516 kg/ha (52.3 bu/ac) to a high of 5101 kg/ha (75.8 bu/ac). Oil content varied among entries, with a 2.9% difference between the lowest and highest oil percentage entries. Median protein content was 35.7%. Test weight and seed weight also exhibited a wide variance between entries. Average maturity was 112 days, plant height was much higher than has been measured in soybean trials at Outlook in the past, and lodging resistance in most entries was very good.

Combined test analyses between irrigation and dryland studies are shown in Table 3. Statistical analysis indicated no significant difference between the irrigated and dryland system yields. This is not surprising, considering the above average precipitation received in 2016 and the fact that only one irrigation application was required throughout the entire growing season. Irrigation did not influence oil percentage nor protein percentage. No differences between the two production systems occurred in test weight but irrigated seed weight was higher than dryland. On average, irrigation resulted in a four-day delay in maturity. Irrigation did not induce a statistically higher degree of lodging nor a difference in plant height.

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 2016 WC Soybean Performance Evaluation—Irrigated Soybean.**

<b>Variety</b>	<b>Yield (kg/ha)</b>	<b>% Oil</b>	<b>% Protein</b>	<b>Test Weight (kg/hl)</b>	<b>Seed Weight (g/1000)</b>	<b>Maturity (days)</b>	<b>Height (cm)</b>	<b>Lodging (1-5)</b>
22-60 RY	4330	15.7	36.1	68.8	173	112	91	1.0
22-61 RY	3960	17.4	35.4	68.8	195	117	91	3.7
23-11 RY	3834	15.9	37.1	69.4	183	119	95	2.0
23-60RY	3712	15.0	37.2	69.1	187	117	108	3.0
Akras R2	4381	14.9	35.6	70.5	188	116	92	1.3
Bishop R2	4244	15.7	37.4	69.7	186	112	104	2.7
CFS16.3.01 R2	4992	17.6	35.7	68.3	171	111	105	1.3
EXP 00917 R2	4477	17.8	35.7	67.6	194	111	87	3.0
EXP TH 37004R2Y	3925	15.9	37.3	69.6	179	120	99	3.7
Hero R2	3289	16.2	36.8	69.3	196	119	99	3.7
HS 006RYS24	3350	15.1	37.2	69.3	198	120	108	2.7
Lono R2	4600	15.8	35.1	70.3	167	119	90	2.3
LS 002R24N	3368	15.7	36.3	69.4	201	117	106	3.0
LS NorthWester	4269	17.3	36.8	68.2	202	118	107	3.0
LS SOLAIRE	4140	16.2	37.5	68.6	219	121	112	2.3
Mahony R2	4562	16.6	36.6	69.0	191	118	96	1.3
McLeod R2	4404	15.8	37.1	69.0	212	115	107	2.0
NSC Leroy RR2Y	4205	15.5	38.5	69.4	187	109	95	1.7
NSC Reston RR2Y	4268	15.4	37.2	68.6	167	114	93	1.7
NSC Tilston RR2Y	3704	16.8	35.3	68.4	176	120	93	3.7
NSC Watson RR2Y	4623	17.4	35.5	67.8	194	110	90	1.0
P002T04R	4646	16.6	37.6	67.9	175	107	96	1.0
P005T13R	4104	16.2	38.6	68.1	201	115	93	1.3
P006T46R	5160	16.3	36.1	69.2	190	113	101	1.0
P006T78R	4315	16.1	37.9	68.6	190	112	92	1.0
PS 0035 NR2	3531	15.5	36.6	69.3	205	118	103	2.3
PS 0055 R2	4794	16.8	35.8	68.5	167	120	104	1.7
S001-B1	5102	16.7	36.6	69.4	190	111	96	1.0
S003-L3	4935	17.0	36.2	68.6	207	111	91	1.0
S007-Y4	4864	15.3	36.9	67.5	183	114	95	1.0
S0009-M2	4471	17.6	35.8	68.0	179	109	92	1.0
Tamula R2	4391	15.9	36.1	69.8	188	122	89	3.0
TH 32004R2Y	3903	16.4	36.4	69.2	181	120	97	3.0
TH 33003R2Y	3276	16.8	35.5	68.6	179	118	97	3.7
TH 33005R2Y	4010	15.2	36.3	69.0	192	121	98	1.7
TH 35002R2Y	3243	15.5	36.4	68.9	155	117	92	3.0
LSD (0.05)	791	0.5	0.7	1.2	16	3.6	9.2	0.9
CV (%)	11.6	1.9	1.2	1.1	5.1	1.9	5.8	24.7

NS = Not Significant



**Table 2. Agronomics of 2016 WC Soybean Performance Evaluation – Dryland Soybean, 2016.**

<b>Variety</b>	<b>Yield (kg/ha)</b>	<b>% Oil</b>	<b>% Protein</b>	<b>Test Weight (kg/hl)</b>	<b>Seed Weight (g/1000)</b>	<b>Maturity (days)</b>	<b>Height (cm)</b>	<b>Lodging (1-5)</b>
22-60 RY	4254	16.7	34.7	68.4	162	108	86	1.0
22-61 RY	3516	17.9	34.7	68.3	173	111	93	3.7
23-11 RY	3968	16.3	35.9	68.8	159	111	93	1.0
23-60RY	3561	15.2	36.4	68.6	173	111	93	2.7
Akras R2	4372	15.4	35.5	70.3	185	111	95	1.3
Bishop R2	4218	16.0	36.5	69.6	169	111	105	2.7
CFS16.3.01 R2	4295	17.6	35.1	68.6	167	109	103	1.3
EXP 00917 R2	3926	17.6	35.5	67.6	188	109	93	2.7
EXP TH 37004R2Y	4820	16.0	36.7	69.2	173	118	110	2.3
Hero R2	4839	16.5	36.4	69.0	196	115	104	3.3
HS 006RYS24	4450	15.2	36.6	69.5	189	118	113	2.3
Lono R2	4337	16.3	35.3	69.9	171	113	90	1.7
LS 002R24N	4402	15.5	35.8	68.4	199	114	116	2.3
LS NorthWester	3680	17.7	36.2	68.2	181	111	107	1.3
LS SOLAIRE	4550	15.6	36.4	68.9	200	118	112	1.3
Mahony R2	3764	16.6	35.8	68.4	185	112	96	1.7
McLeod R2	3982	15.8	35.7	69.6	193	112	103	1.0
NSC Leroy RR2Y	4366	15.9	38.0	69.7	179	105	102	1.3
NSC Reston RR2Y	4228	16.2	35.8	69.3	142	110	88	1.0
NSC Tilston RR2Y	4169	16.8	35.2	69.8	189	113	110	2.3
NSC Watson RR2Y	5101	17.7	34.9	68.4	187	108	94	1.0
P002T04R	4390	16.9	36.6	68.4	156	108	104	1.7
P005T13R	4942	16.3	38.0	67.3	197	112	87	1.7
P006T46R	4447	17.3	34.5	68.8	176	117	100	1.0
P006T78R	4435	16.2	37.3	68.4	170	113	94	1.0
PS 0035 NR2	4057	15.8	36.4	68.7	206	111	107	1.3
PS 0055 R2	4530	17.0	34.8	68.7	144	112	97	1.0
S001-B1	4937	17.0	36.3	67.9	179	109	104	1.7
S003-L3	4121	17.2	35.5	68.1	186	113	98	2.3
S007-Y4	4593	15.9	36.0	69.2	176	111	97	1.0
S0009-M2	4981	18.1	35.1	68.5	175	107	95	1.0
Tamula R2	4160	16.2	35.2	70.5	173	112	92	1.7
TH 32004R2Y	4458	16.7	35.4	68.8	170	112	99	2.7
TH 33003R2Y	4283	16.9	35.7	68.8	175	115	111	3.3
TH 33005R2Y	4814	15.3	36.0	69.7	188	117	107	2.0
TH 35002R2Y	3872	15.7	35.6	69.8	162	116	92	2.7
LSD (0.05)	9.4	0.4	0.8	1.2	16.6	3.8	12.9	1.1
CV (%)	13.3	1.6	1.4	1.1	5.8	2.1	7.9	37.1

**Table 3. Agronomics of 2016 WC Soybean Performance Evaluation – Irrigated versus Dryland Soybean.**

<b>System/Variety</b>	<b>Yield (kg/ha)</b>	<b>% Oil</b>	<b>% Protein</b>	<b>Test Weight (kg/hl)</b>	<b>Seed Weight (g/1000)</b>	<b>Maturity (days)</b>	<b>Height (cm)</b>	<b>Lodging (1-5)</b>
Irrigated	4205	16.2	36.6	68.9	187	116	97	2.1
Dryland	4328	16.5	35.9	68.9	178	112	100	1.8
LSD (0.05)	NS	NS	NS	NS	7.4	2.2	NS	NS
CV (%)	12.5	1.8	1.3	1.1	5.4	2.0	7.0	30.6
<b>Variety</b>								
22-60 RY	4292	16.2	35.4	68.6	168	110	88	1.0
22-61 RY	3738	17.7	35.1	68.5	184	114	92	3.7
23-11 RY	3901	16.1	36.5	69.1	171	115	94	1.5
23-60RY	3636	15.1	36.8	68.9	180	114	106	2.8
Akras R2	4377	15.2	35.6	70.4	187	114	94	1.3
Bishop R2	4231	15.9	37.0	69.6	178	111	104	2.7
CFS16.3.01 R2	4644	17.6	35.4	68.4	169	110	104	1.3
EXP 00917 R2	4201	17.7	35.6	67.6	191	110	90	2.8
EXP TH 37004R2Y	4372	16.0	37.0	69.4	176	119	104	3.0
Hero R2	4064	16.4	36.6	69.1	196	117	101	3.5
HS 006RYS24	3900	15.2	36.9	69.4	193	119	111	2.5
Lono R2	4469	16.1	35.2	70.1	169	116	90	2.0
LS 002R24N	3885	15.6	36.1	68.9	200	116	111	2.7
LS NorthWester	3974	17.5	36.5	68.2	191	114	107	2.2
LS SOLAIRE	4345	15.9	36.9	68.7	210	120	112	1.8
Mahony R2	4163	16.6	36.2	68.7	188	115	96	1.5
McLeod R2	4193	15.8	36.4	69.3	202	114	105	1.5
NSC Leroy RR2Y	4285	15.7	38.2	69.6	183	107	99	1.5
NSC Reston RR2Y	4248	15.8	36.5	69.0	155	112	90	1.3
NSC Tilston RR2Y	3936	16.8	35.2	69.1	183	116	101	3.0
NSC Watson RR2Y	4862	17.5	35.2	68.1	190	109	92	1.0
P002T04R	4518	16.8	37.1	68.2	165	108	100	1.3
P005T13R	4523	16.3	38.3	67.7	199	113	90	1.5
P006T46R	4804	16.8	35.3	68.7	183	115	101	1.0
P006T78R	4375	16.2	37.6	68.8	180	113	93	1.0
PS 0035 NR2	3794	15.6	36.5	69.0	206	115	105	1.8
PS 0055 R2	4662	16.9	35.3	68.6	156	116	101	1.3
S001-B1	5019	16.9	36.5	68.7	184	110	100	1.3
S003-L3	4528	17.1	35.8	68.3	197	112	94	1.7
S007-Y4	4728	15.6	36.5	68.4	180	113	96	1.0
S0009-M2	4726	17.9	35.5	68.2	177	108	93	1.0
Tamula R2	4276	16.0	35.7	70.1	180	117	91	2.3
TH 32004R2Y	4181	16.5	35.9	69.0	175	116	98	2.8
TH 33003R2Y	3780	16.9	35.6	68.7	177	117	104	3.5
TH 33005R2Y	4412	15.2	36.1	69.3	190	119	102	1.8
TH 35002R2Y	3558	15.6	36.0	69.4	159	116	92	2.8
LSD (0.05)	607	0.3	0.5	0.9	11.3	2.6	7.9	0.7
<b>System x Variety Interaction</b>								
LSD (0.05)	S	S	NS	NS	NS	NS	NS	S

S = Significant

NS = not significant

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

## Funding

- Irrigation Crop Diversification Corporation
- Saskatchewan Variety Performance Group

## Principal Investigator

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

## Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Saskatchewan Variety Performance Group

## 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 ICDCs 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 16 and 20. Plot size was 1.5 m x 4.0 m. Nitrogen fertilizer was applied to CSIDC located trials at a rate of 110 kg N/ha as 46-0-0 as a sideband application and 15 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0 seed placed (Hex1, Hex2, durum, barley, soft white spring), the second durum trial and the oat trial located at the CSIDC Off Station location received 130 kg N/ha as 46-0-0 as a sideband application and 35 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0 side banded. Separate trials were conducted for common wheat (Hex 1 - CWRS), high yield wheat (Hex 2 – CWRS, CPSR, CWSWS and CWGP), durum wheat (CWAD) and 2-row and 6-row barley. The soft white spring wheat (CWSWS Co-op is not part of the SVPG program, but rather a separate evaluation; it is included here for an inclusive cereal report). Weed control consisted of a post-emergence tank mix application Bison (tralkoxydim) and Badge (bromoxynil +MCPA ester); Badge only was applied to the oat trial. An application of Headline EC (pyraclostrobin) fungicide was applied at the early flag leaf stage for suppression of leaf diseases. 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 irrigation at CSIDC consisted of a single application of 12.5 mm on June 8.

## Results

No results were obtained for the Hex 1 trial due to very erratic seedling emergence and establishment as a consequence of severe soil crusting.

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

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. The information will also be used to update ICDC's annual *Crop Varieties for Irrigation* guide and the Saskatchewan Ministry of Agriculture's *Varieties of Grain Crops 2017*.

**Table 1. Saskatchewan Variety Performance Group Irrigated Hex 2 Wheat Regional Variety Trial, CSIDC Site 2016.**

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)
<b>Canada Western Red Spring (CWRS)</b>									
<b>Carberry*</b>	<b>4322</b>	<b>100</b>	<b>14.9</b>	<b>78.5</b>	<b>49.1</b>	<b>49</b>	<b>101</b>	<b>79</b>	<b>1</b>
<b>Canada Northern Hard Red (CNHR)</b>									
Faller	6015	139	13.8	78.6	42.6	54	102	85	1
Prosper	6169		13.7	78.7	53.7	53	102	83	1
<b>Canada Prairie Spring – Red (CPSR)</b>									
AAC Crossfield	5129	119	14.1	75.0	51.5	51	101	79	1
AAC Crusader	4353	101	14.3	75.2	47.8	52	101	75	1
AAC Entice	5599	130	14.0	74.1	54.6	52	101	81	1
AAC Penhold	4299	99	15.0	78.0	54.7	51	102	71	1
AAC Ryley	4248	98	14.1	73.1	60.9	51	101	74	1
AAC Tenacious VB	4886	113	13.4	78.8	49.5	56	101	103	1
HY537	4611	107	13.7	73.7	57.7	55	102	83	1
HY2003	5441	126	14.9	74.6	55.4	49	102	79	1
HY2013	4701	109	13.9	78.6	45.6	50	102	68	1
KWS Alderon	4915	114	12.0	68.7	41.0	59	103	68	1
KWS Charing	6243	144	12.7	73.0	41.2	59	104	80	1
SY995	4451	103	13.2	74.1	58.5	55	103	79	1
<b>Canada Western Special Purpose (CWSP)</b>									
SY087	6288	145	14.0	78.9	50.3	51	102	86	1
WFT603	5317	123	12.9	76.4	49.7	54	104	92	1
<b>Canada Western Soft White Spring (CWSWS)</b>									
AAC Chiffon	6289	146	11.8	75.2	44.2	57	103	92	1
AAC Indus	5897	136	11.4	76.4	46.5	57	103	85	1
SWS433	6344	147	11.6	75.6	40.7	53	101	87	1
<b>Canada Western General Purpose (CWGP)</b>									
AAC Foray VB	5721	132	13.5	75.2	50.2	54	102	82	1
AAC NRG097	4905	113	12.1	75.1	51.5	50	102	78	1
AAC Proclaim	4124	95	12.1	78.2	48.8	54	102	86	1

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)
Belvoir	5985	138	11.3	68.4	49.7	59	102	71	1
Elgin ND	5638	130	14.7	78.0	45.8	49	102	83	1
GP131	5558	129	13.2	76.7	48.5	53	103	80	1
GP151	6338	147	11.7	77.0	52.8	57	01	85	1
Sparrow	6300	146	12.2	73.1	41.9	60	104	78	1
LSD (0.05)	1153		0.6	1.4	NS	1.6	1.8	7.5	NS
CV (%)	13.1		2.8	1.2	20.9	1.8	1.1	5.6	>.00001

\* Check Variety

**Table 2. Soft White Spring Wheat Irrigated Coop Variety Trial, CSIDC Site, 2016.**

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	2963	57	15.0	80.3	37.0	49	102	70	1
<b>AC Andrew (SWS 241)*</b>	<b>5201</b>	<b>100</b>	<b>11.5</b>	<b>74.3</b>	<b>32.5</b>	<b>55</b>	<b>102</b>	<b>83</b>	<b>1</b>
AC Meena (SWS 234)	4284	82	11.6	75.0	33.4	53	103	80	1
AC Chiffon (SWS 408)	5814	112	11.7	75.5	36.3	56	102	87	1
Sadash (SWS 349)	4467	86	11.6	76.5	36.6	51	103	80	1
AAC Indus (SWS 427)	5695	109	11.3	76.7	36.0	57	104	91	1
SWS 448	5158	99	11.4	75.2	34.4	56	103	78	1
SWS 450	5482	105	11.4	76.2	35.2	52	102	81	1
SWS 454	4275	82	11.4	75.8	32.7	53	102	78	1
SWS 455	4958	95	11.3	76.7	36.3	53	103	79	1
SWS 456	5152	99	11.3	76.4	36.4	53	102	83	1
SWS 459	4420	85	11.8	76.2	33.2	52	102	80	1
SWS 460	5187	100	11.3	76.4	36.1	53	103	78	1
SWS 461	4169	80	11.2	75.0	32.6	53	102	75	1
SWS 462	4969	96	11.6	77.6	34.4	52	103	80	1
SWS 463	4794	92	12.3	74.9	33.3	56	103	82	1
SWS 464	4705	90	11.6	76.1	34.6	51	102	80	1
LSD (0.05)	1156		0.3	0.9	NS	1.7	NS	6.9	NS
CV (%)	16.9		1.6	0.8	7.7	2.3	0.8	6.1	>.00001

\* Check Variety

**Table 3. Saskatchewan Variety Performance Group Irrigated CWAD Wheat Regional Variety Trial, CSIDC 2016.**

Variety	Yield (kg/ha)	Yield (% of Strongfield)	Protein (%)	Test Weight (kg/hl)	Seed Weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging (1=erect; 9=flat)
<b>CSIDC Site</b>									
Carberry	3635	82	15.2	78.4	48.7	49	101	76	1
<b>Strongfield*</b>	<b>4411</b>	<b>100</b>	<b>14.3</b>	<b>71.4</b>	<b>52.4</b>	<b>52</b>	<b>103</b>	<b>91</b>	<b>1</b>
AAC Cabri	4670	106	14.5	73.9	57.7	57	105	90	1
AAC Carbide VB	5062	115	14.1	70.7	46.7	52	104	95	1
AAC Congress	5507	125	13.5	73.8	56.2	56	104	93	1
AAC Current	3785	86	15.4	71.5	60.8	53	105	91	1
AAC Durafield	5627	128	14.2	73.2	55.7	54	104	91	1
AAC Marchwell VB	4543	103	14.8	70.4	64.9	56	104	94	1
AAC Raymore	5358	121	15.0	70.9	54.4	51	104	90	1
AAC Spitfire	5493	125	14.3	71.6	57.2	53	103	89	1
CDC Alloy	4946	112	14.7	72.9	59.4	53	103	91	1
CDC Desire	4567	104	14.6	71.2	47.2	52	102	89	1
CDC Dynamic	5475	124	14.5	73.7	57.9	57	104	96	1
CDC Fortitude	4821	109	13.9	72.8	56.7	55	103	89	1
CDC Precision	5190	118	13.9	74.6	59.1	53	103	91	1
CDC Vivid	4740	107	14.5	71.8	62.9	52	103	88	1
DT583	4850	110	14.4	73.2	57.2	57	104	96	1
DT862	5019	114	14.2	72.8	51.8	52	103	85	1
LSD (0.05)	777		0.7	1.5	NS	2.1	1.0	6.3	NS
CV (%)	9.7		3.1	1.2	14.8	2.3	0.6	4.2	1

\* Check Variety

**Table 4. Saskatchewan Variety Performance Group Irrigated CWAD Wheat Regional Variety Trial, CSIDC Off Station Site 2016.**

Variety	Yield (kg/ha)	Yield (% of Strongfield)	Protein (%)	Test Weight (kg/hl)	Seed Weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging (1=erect; 9=flat)
<b>CSIDC Site</b>									
Carberry	3216	78	13.9	79.0	46.2	47	97	78	1.2
<b>Strongfield*</b>	<b>4106</b>	<b>100</b>	<b>15.9</b>	<b>69.8</b>	<b>40.7</b>	<b>53</b>	<b>98</b>	<b>93</b>	<b>4.3</b>
AAC Cabri	4166	101	16.5	72.2	41.3	57	100	93	5.3
AAC Carbide VB	4487	109	15.4	70.8	37.0	52	98	93	3.7
AAC Congress	4380	107	14.2	75.0	40.9	55	100	88	1.7
AAC Current	4323	105	16.2	71.6	35.9	55	98	94	4.0
AAC Durafield	4732	115	15.3	73.2	35.8	55	99	92	3.7
AAC Marchwell VB	3994	97	15.9	70.5	38.2	57	98	89	3.0
AAC Raymore	3441	84	15.5	70.5	43.3	53	99	93	3.7
AAC Spitfire	4753	116	15.5	71.4	36.2	54	98	89	2.0
CDC Alloy	4065	99	15.1	72.5	34.8	53	98	88	3.7
CDC Desire	3948	96	14.9	71.8	39.7	52	97	87	2.3
CDC Dynamic	4555	111	14.9	74.5	37.0	56	98	88	1.7
CDC Fortitude	4382	107	14.8	73.6	39.7	55	99	88	2.0

Variety	Yield (kg/ha)	Yield (% of Strongfield)	Protein (%)	Test Weight (kg/hl)	Seed Weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging (1=erect; 9=flat)
CDC Precision	4475	109	13.5	76.1	38.3	56	101	92	3.3
CDC Vivid	4298	105	14.7	73.2	38.1	53	97	92	1.0
DT583	4649	113	15.0	73.7	39.0	57	100	96	2.3
DT862	4399	107	14.4	73.8	47.1	54	98	86	1.0
LSD (0.05)	747		1.3	2.3	NS	2.3	1.4	6.1	2.2
CV (%)	10.5		5.0	1.9	15.0	2.6	0.9	4.1	48

\* Check Variety

**Table 5. Saskatchewan Variety Performance Group Irrigated CWAD Wheat Regional Variety trial, Combined Site Analysis, 2016.**

Location / Variety	Yield (kg/ha)	Yield (% of Strongfield)	Protein (%)	Test Weight (kg/hl)	Seed Weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging (1=erect; 9=flat)
CSIDC	4817		14.5	72.7	55.9	54	103	90	1.0
CSIDC Off Station	4243		15.1	73.0	39.4	54	98	90	2.8
LSD (0.05)	250		NS	NS	1.9	NS	0.6	NS	0.6
CV (%)	10.1		4.2	1.6	15.1	2.4	0.7	4.1	49.9
<b>Variety</b>									
Carberry	3425	80	14.5	78.7	47.4	48	99	77	1.1
<b>Strongfield*</b>	<b>4258</b>	<b>100</b>	<b>15.1</b>	<b>70.6</b>	<b>46.5</b>	<b>53</b>	<b>100</b>	<b>92</b>	<b>2.7</b>
AAC Cabri	4418	104	15.5	73.1	49.5	57	102	92	3.2
AAC Carbide VB	4774	112	14.8	70.7	41.9	52	101	94	2.3
AAC Congress	4944	116	13.9	74.4	48.6	56	102	91	1.3
AAC Current	4054	95	15.8	71.6	48.4	54	101	93	2.5
AAC Durafield	5179	122	14.8	73.2	45.8	54	101	91	2.3
AAC Marchwell VB	4268	100	15.4	70.5	51.5	57	101	91	2.0
AAC Raymore	3900	92	15.3	70.7	48.9	52	101	92	2.3
AAC Spitfire	5123	120	14.9	71.5	46.7	54	100	89	1.5
CDC Alloy	4506	106	14.9	72.7	47.1	53	101	89	2.3
CDC Desire	4258	100	14.8	71.5	43.5	52	100	88	1.7
CDC Dynamic	5015	118	14.7	74.1	47.5	56	101	92	1.3
CDC Fortitude	4602	108	14.4	73.2	48.2	55	101	88	1.5
CDC Precision	4832	113	13.7	75.4	48.7	54	102	92	2.2
CDC Vivid	4519	106	14.6	72.5	50.5	52	100	90	1.0
DT583	4749	112	14.7	73.5	48.1	57	102	96	1.7
DT862	4709	111	14.3	73.3	49.4	53	101	86	1.0
LSD (0.05)	529		0.7	1.3	NS	1.5	0.9	4.3	1.1
<b>Location x Variety Interaction</b>									
LSD (0.05)	NS		S	NS	NS	NS	S	NS	S

S = Significant NS = Not Significant \* Check Variety

**Table 6. Saskatchewan Variety Performance Group Irrigated 2-Row Barley Regional Variety Trial, CSIDC Site 2016.**

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)
<b>Malt</b>									
<b>AC Metcalfe*</b>	<b>6586</b>	<b>100</b>	<b>15.1</b>	<b>64.5</b>	<b>40.7</b>	<b>57</b>	<b>92</b>	<b>78</b>	<b>3.3</b>
AAC Synergy	8140	124	15.1	63.5	42.2	57	92	79	3.0
CDC Bow	8034	122	14.8	63.4	42.7	54	95	73	4.7
CDC PlatinumStar	6741	102	14.9	64.7	43.9	58	94	83	5.3
Cerveza	7849	119	15.2	63.4	43.9	58	92	74	1.7
<b>Feed-Hulled</b>									
Amisk	7243	110	14.6	59.0	37.4	56	95	82	1.7
Canmore	6581	100	15.2	64.6	39.7	57	93	79	2.3
Muskwa	5480	83	13.1	58.5	29.8	57	93	73	4.0
<b>Experimental Entries</b>									
TR10214	7044	107	14.9	62.4	43.0	58	92	77	4.3
TR12135	7623	116	14.6	63.3	43.3	57	95	79	4.0
TR12733	8414	128	14.7	63.0	41.8	58	93	80	3.7
TR12735	6958	106	15.0	62.0	40.9	57	92	76	5.7
TR13606	7782	118	14.7	64.0	40.6	58	91	76	4.7
TR13740	7602	115	12.3	63.4	40.7	58	92	74	3.7
TR13609	6603	100	14.6	64.0	43.9	59	93	83	3.7
TR14928	6537	99	14.5	63.4	40.2	58	92	72	1.7
HB13324	6956	106	15.0	72.7	38.0	57	95	80	2.3
LSD (0.05)	1410		1.5	2.2	4.2	2.0	1.5	NS	1.8
CV (%)	11.8		6.0	2.0	6.1	2.1	0.9	5.7	30.8

NS = Not Significant \* Check Variety

**Table 7. Saskatchewan Variety Performance Group Irrigated Oat Regional Variety Trial, CSIDC Off Station Site 2016.**

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)
<b>CDC Dancer*</b>	<b>8060</b>	<b>100</b>	<b>12.2</b>	<b>52.3</b>	<b>27.2</b>	<b>54</b>	<b>98</b>	<b>111</b>	<b>2.3</b>
AAC Justice	8720	108	11.7	53.3	29.4	55	98	113	2.7
CS Camden	10059	125	12.3	47.9	30.0	53	96	105	5.0
CDC Haymaker	8303	103	12.7	42.3	30.6	59	105	112	4.3
CDC Morrison	8290	103	13.8	50.5	27.3	54	97	106	2.3
CDC Norseman	8742	108	13.0	47.0	25.9	54	99	113	4.7
CDC Ruffian	8903	110	12.6	51.6	27.0	55	97	104	4.3
Akina	9646	120	12.0	48.1	30.5	53	96	107	5.0
Kara	9445	117	12.4	51.8	30.7	53	97	101	4.0
Summit	9559	119	12.5	50.9	30.4	54	99	97	3.3
CFA1207	9779	121	12.4	50.4	34.6	55	97	111	4.3
CFA1220	8755	109	11.7	51.2	28.0	55	100	104	5.0
OT6008	9464	117	13.0	52.1	28.7	54	98	107	3.7
OT6009	9397	117	12.1	49.7	28.8	55	99	104	4.0
OT6011	9437	117	12.0	48.8	29.9	55	98	106	3.3
LSD (0.05)	786		0.6	3.9	NS	1.0	0.8	7.7	NS
CV (%)	5.2		2.9	4.7	9.6	1.1	0.5	4.3	42.9

NS = Not Significant \* Check Variety



# ICDC Irrigated Wheat Variety Trial

## Funding

- Agriculture Development Fund
- Western Grains Research Foundation
- Irrigation Crop Diversification Corporation

## Principal Investigator

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

## Organization

- 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 ICDCs 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:

CSIDC (SW15-29-08-W3): Bradwell loam – silty loam (Field #110)

CSIDC off station (NW12-29-08-W3): Asquith sandy loam (Knapik SW quadrant)

Sixteen spring wheat varieties of different market classes and six durum varieties were tested for their agronomic performance under irrigation. The CSIDC site was seeded on May 16, CSIDC off station site was seeded on May 20. 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 CSIDC was applied at a rate of 110 kg N/ha as 46-0-0 as a sideband application and 15 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0 seed placed. At the CSIDC Off Station location, nitrogen fertilizer was applied at a rate of 120 kg N/ha as 46-0-0 as a sideband application and 30 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0 seed placed. Weed control at CSIDC consisted of a pre-emergent fall-applied application of Fortress (trifluralin + trifluralin) and post-emergence tank mix application of Bison (tralkoxydim) and Badge II (bromoxynil +MCPA ester). At the off station site only, the post-emergent herbicides were utilized. An application of Headline EC (pyraclostrobin) fungicide was applied at the early flag leaf stage for suppression of leaf diseases. 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 CSIDC plots were harvested on September 14 and the Off Station trial on September 16. Total in-season irrigation at CSIDC consisted of a single application of 12.5 mm on June 8.

## Results

Results obtained at the CSIDC location are shown in Table 1 and CSIDC Off Station in Table 2.

Analysis of Variance procedures indicated a higher than acceptable coefficient of variation (CV%), and therefore the data and results generated are deemed invalid. Soil moisture at this site was excellent at seeding; however, additional rainfall during crop emergence resulted in soil crusting. Additionally, germinating seedlings struggling to emerge through the crust exhibited symptoms of trifluraline/triallate damage from prolonged exposure in the high concentration zone within the herbicide application zone. Data for the trial is presented in Table 13, but will not be discussed and not used in ICDCs wheat variety database.

Results from the off station trial are shown in Table 2. At the CSIDC Off Station trial, no CWRS variety was statistically higher yielding than the check, Carberry. The spring wheat variety AAC Foray VB was statistically higher yielding compared to all varieties with a yield less than that of Carberry's. Median grain yield at CSIDC Off Station was 5022 kg/ha. Within varieties, the durum varieties generally had higher protein content compared to the spring wheat entries. Test weight and seed weight varied within and between classes. The check variety, AC Carberry, was the first to heading, the CWAD variety, CDC Fortitude, the latest to heading and to maturity. AAC Penhold was the shortest variety and CDC Prevail VB the tallest. The varieties Carberry, AAC Penhold, and AAC Connery exhibited the highest resistance to lodging and AAC Concord the least.

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. The results will also be used to update ICDCs annual *Crop Varieties for Irrigation* guide and the Saskatchewan Ministry of Agriculture's *Varieties of Grain Crops 2017*.

**Table 1. Yield and Agronomic Data for the ICDC Irrigated Wheat Variety Trial, CSIDC Site, 2016.**

<b>Variety</b>	<b>Yield (kg/ha)</b>	<b>Yield (% of Carberry)</b>	<b>Protein (%)</b>	<b>Test Weight (kg/hl)</b>	<b>Seed Weight (mg)</b>	<b>Heading (days)</b>	<b>Maturity (days)</b>	<b>Height (cm)</b>	<b>Lodging (1=erect; 9=flat)</b>
<b>Canada Western Red Spring (CWRS)</b>									
<b>Carberry</b>	<b>4286</b>	<b>100</b>	<b>14.7</b>	<b>79.8</b>	<b>34.2</b>	<b>NC</b>	<b>102</b>	<b>73</b>	<b>1</b>
5605 HR CL	4162	97	15.5	80.1	36.4	NC	103	82	1
AAC Cameron VB	5136	120	15.0	78.8	37.3	NC	101	87	1
AAC Connery	3362	78	15.4	77.7	31.6	NC	102	73	1
AAC Prevail VB	3805	89	15.2	78.4	35.4	NC	102	88	1
AAC Redberry	4252	99	15.2	80.1	32.9	NC	100	77	1
CDC Titanium VB	3677	86	15.5	78.0	33.2	NC	102	79	1
Thorsby	4272	100	15.2	78.1	34.0	NC	101	87	1
<b>Canadian Northern Hard Red (CNHR)1</b>									
AAC Concord	3780	88	15.1	77.3	37.7	NC	101	84	1
Elgin ND	4310	101	15.0	79.1	35.5	NC	103	82	1
<b>Canada Western Amber Durum (CWAD)</b>									
AAC Durafield	3259	76	14.6	73.0	35.4	NC	103	71	1
AAC Marchwell VB	2636	62	15.4	71.9	35.5	NC	103	74	1
AAC Spitfire	2036	48	14.4	71.7	36.5	NC	103	66	1
CDC Carbide VB	2382	56	15.5	73.0	34.9	NC	102	81	1
CDC Fortitude	3599	84	14.9	72.9	35.4	NC	102	81	1
CDC Precision	4388	102	14.8	74.8	38.8	NC	102	84	1
<b>Canada Prairie Spring Red (CPSR)</b>									
AAC Crusader	3692	86	14.6	76.4	32.8	NC	103	72	1
AAC Foray VB	4690	109	14.0	76.3	37.7	NC	103	84	1
AAC Penhold	4052	95	14.8	78.7	36.1	NC	103	68	1
AAC Ryley	4397	103	14.2	73.7	37.1	NC	102	77	1
<b>Canada Western Hard White Spring (CWHWS)</b>									
AAC Iceberg	3793	88	15.3	77.7	33.5	NC	103	78	1
AAC Whitefox	3675	86	14.8	79.7	34.0	NC	100	84	1
LSD (0.05)	NS		0.5	1.2	3.7		1.5	7.8	1
CV (%)	25.0		2.5	1.1	7.5		1.0	7.0	>.00001

NC = Observation Not Captured

\* Check Variety

**Table 2. Yield and Agronomic Data for the ICDC Irrigated Wheat Variety trial, CSIDC Off Station Site, 2016.**

<b>Variety</b>	<b>Yield (kg/ha)</b>	<b>Yield (% of Carberry)</b>	<b>Protein (%)</b>	<b>Test Weight (kg/hl)</b>	<b>Seed Weight (mg)</b>	<b>Heading (days)</b>	<b>Maturity (days)</b>	<b>Height (cm)</b>	<b>Lodging (1=erect; 9=flat)</b>
<b>Canada Western Red Spring (CWRS)</b>									
<b>Carberry*</b>	<b>5380</b>	<b>100</b>	<b>15.1</b>	<b>80.0</b>	<b>31.1</b>	<b>47</b>	<b>98</b>	<b>87</b>	<b>1.0</b>
5605 HR CL	5112	95	15.8	79.9	30.4	52	97	96	1.5
AAC Cameron VB	5509	102	15.2	78.1	33.3	51	98	96	2.0
AAC Connery	4643	86	16.5	77.9	31.7	52	98	89	1.0
AAC Prevail VB	4553	85	15.6	77.6	29.0	54	99	102	3.5
AAC Redberry	4649	86	15.7	78.3	29.4	48	97	88	3.3
CDC Titanium VB	5495	102	16.3	79.0	33.2	49	98	93	2.0
Thorsby	5194	97	15.2	78.3	31.8	52	98	99	2.5
<b>Canadian Northern Hard Red (CNHR)</b>									
AAC Concord	4067	76	15.6	77.3	33.0	56	99	89	4.0
Elgin ND	5496	102	15.6	78.5	28.6	52	98	89	2.3
<b>Canada Western Amber Durum (CWAD)</b>									
AAC Durafield	4847	90	15.6	74.0	30.1	55	99	91	3.0
AAC Marchwell VB	3889	72	17.1	68.5	27.9	58	99	96	3.8
AAC Spitfire	3948	73	17.6	67.4	24.7	56	98	95	2.0
CDC Carbide VB	4723	88	15.9	71.7	29.8	54	98	97	3.3
CDC Fortitude	4400	82	15.9	74.2	31.0	59	100	90	1.8
CDC Precision	4526	84	15.5	75.6	32.7	56	100	95	3.0
<b>Canada Prairie Spring Red (CPSR)</b>									
AAC Crusader	5709	106	14.8	75.1	29.5	51	98	84	3.8
AAC Foray VB	6133	114	14.4	75.8	33.9	55	99	91	2.8
AAC Penhold	5636	105	14.6	78.9	31.5	53	99	82	1.0
AAC Ryley	5457	101	14.1	73.4	34.5	51	99	87	1.5
<b>Canada Western Hard White Spring CWHWS)</b>									
AAC Iceberg	4911	91	15.1	77.6	30.3	48	98	84	2.3
AAC Whitefox	4718	88	14.5	80.6	32.1	50	96	96	2.0
LSD (0.05)	819		0.7	1.7	2.6	1.5	1.3	5.4	1.7
CV (%)	11.7		3.3	1.6	6.0	2.1	0.9	4.2	49.1

\* Check Variety

# FIELD CROPS

## Soybean Row Spacing and Plant Population Study

### Funding

- Agriculture Development Fund
- Western Grains Research Foundation
- Irrigation Crop Diversification Corporation

### Principal Investigator

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

### Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Saskatchewan Ministry of Agriculture
- Western Grains Research Foundation

### Objectives

A study was initiated to determine optimal soybean seeding rates for both irrigated solid seeded and row cropped production.

### Research Plan

The trial was established at CSIDC with DeKalb variety 23-10RY, seed was pretreated with the fungicide/insecticide seed treatment Acceleron (fluxapyroxad, pyraclostrobin, matalaxyl, and imidacloprid). All seed was pre-packaged by weight after adjusting for seed weight, % germination, and assuming a 90% seedling survival. The trial was established in a randomized split-plot design with four replications. Row spacing was 25 or 50 cm as main plots. Sub-plots were target plant populations starting at 300,000 plants/ha and increasing at 100,000 plants/ha increments to 700,000 plants/ha. Prior to seeding, the plots were worked with a heavy harrow to encourage soil surface exposure in order to warm the soil. The trial was seeded on May 20. All treatments received a side band application at seeding of 25 kg P<sub>2</sub>O<sub>5</sub>/ha and seed-placed Nodulator granular inoculant at a rate of 5.6 kg/ha. Plots were maintained weed free by a pre-plant burn-off and post-emergent glyphosate applications. Priaxor DS (fluxapyroxad and pyraclostrobin) and Copper 53W (tribasic copper sulphate) fungicides were applied for foliar disease prevention. 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 < 20%. Harvest occurred October 21. Harvested samples were cleaned and yields adjusted to a moisture content of 14%. Oil and protein content were determined with a Foss NIR analyser. Total in-season precipitation at CSIDC from May through October was 423.8 mm. Total in-season irrigation at CSIDC consisted of a single application of 12.5 mm on June 14.

## Results

Collected agronomic data is shown in Table 1. Per cent emergence of target population for each row spacing is illustrated in Figure 1. Final plant establishment was at or higher than target for all wide row treatments. Final plant population for the narrow row production averaged 94% across all seeding rates. Seed rate was adjusted to assume 10% seed/seedling mortality. Greater plant emergence in wide row production has been observed in prior studies; it is suggested that the epigeal germination of soybean, whereby the seed is carried to the surface, fractures the soil to a greater extent than narrow row production due to the higher seed density within rows in wide row production. In short, each seed is assisted by its neighbour in wider rows, resulting in fewer emerging plants incurring snapped hypocotyls and higher plant population establishment. Actual plant population versus targeted plant population is graphically illustrated in Figure 2.

In 2016, row cropping soybeans at 50 cm (row spacing similar to that typically used in irrigated dry bean production in Saskatchewan) was statistically higher yielding than solid seeded soybean. Wide row production was approximately 10% higher in yield than either the narrow row or solid seeded production system. A portion of this yield increase is likely associated with the higher plant populations achieved with the wider rows. On average, final plant populations of the wide row production system was 7% higher than the population achieved with wide row production.

Mean yield increased with each plant population increase above 300,000 plants/ha. Analysis of variance procedures indicate that there was not a significant interaction between row spacing and plant populations, indicating that the row spacing for both responded in the same manner to increasing plant populations. The effect of actual plant populations and soybean yield for each production system is graphically illustrated in Figure 3.

Wider row spacing increased percentage of oil content within soybean seed; it had no effect on any other seed quality parameter, nor on plant height. As seeding rate increased, the protein content of seed increased. Seeding rate had no effect on any other measured seed parameter or plant height.

This concludes the third and final year of a three year study. A three year summary of the results of this study will be completed and available by the end of March, 2017, on the ICDC website, (<http://irrigationsaskatchewan.com/icdc/>).

**Table 1. Effect of Row Spacing and Plant Population on Agronomic Measurements, 2016.**

Treatment	Yield (kg/ha)	Yield (bu/ac)	Oil (%)	Protein (%)	Test Weight (kg/hl)	1000 Seed Weight (mg)	Height (cm)	Final Plants (ha)	Final Plants (ac)
25 cm	4138	61.5	16.31	37.7	67.6	227	93	471125	190585
50 cm	4589	68.2	16.44	37.6	66.8	217	92	506083	204726
LSD (0.05)	210	3.1	0.10	NS	NS	NS	NS	33700	13614
CV	11.1	11.1	1.3	0.6	1.4	14.3	2.5	5.4	5.4
<b>Plant Population</b>									
300,000	3845	57.2	16.4	37.4	67.5	225	92	280729	113564
400,000	4194	62.3	16.5	37.6	67.1	201	92	392083	158610
500,000	4318	64.2	16.3	37.7	67.3	222	93	485521	196408
600,000	4689	69.7	16.3	37.9	66.6	235	92	590208	238758
700,000	4771	70.9	16.4	37.8	67.3	228	95	694479	280938
LSD (0.05)	501	7.4	NS	0.2	NS	NS	NS	27100	10982
<b>Row Spacing x Plant Population</b>									
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS = not significant

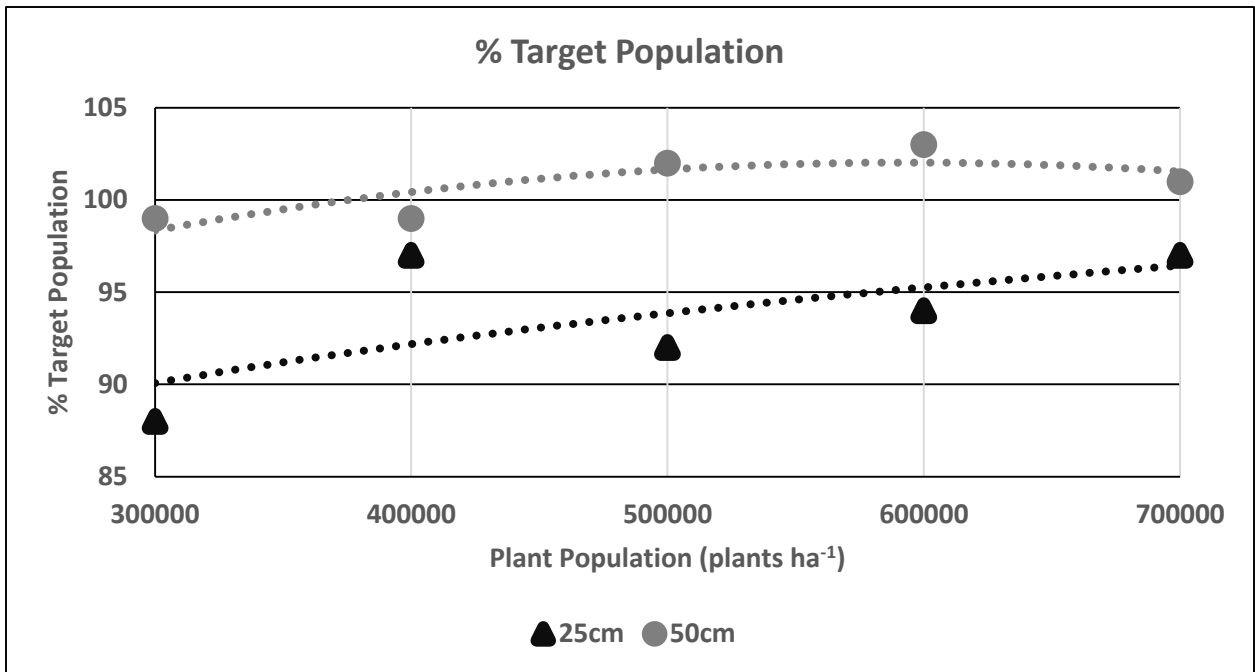


Figure 1. Effect of Row Spacing and Plant Population on % Target Emergence, 2016.

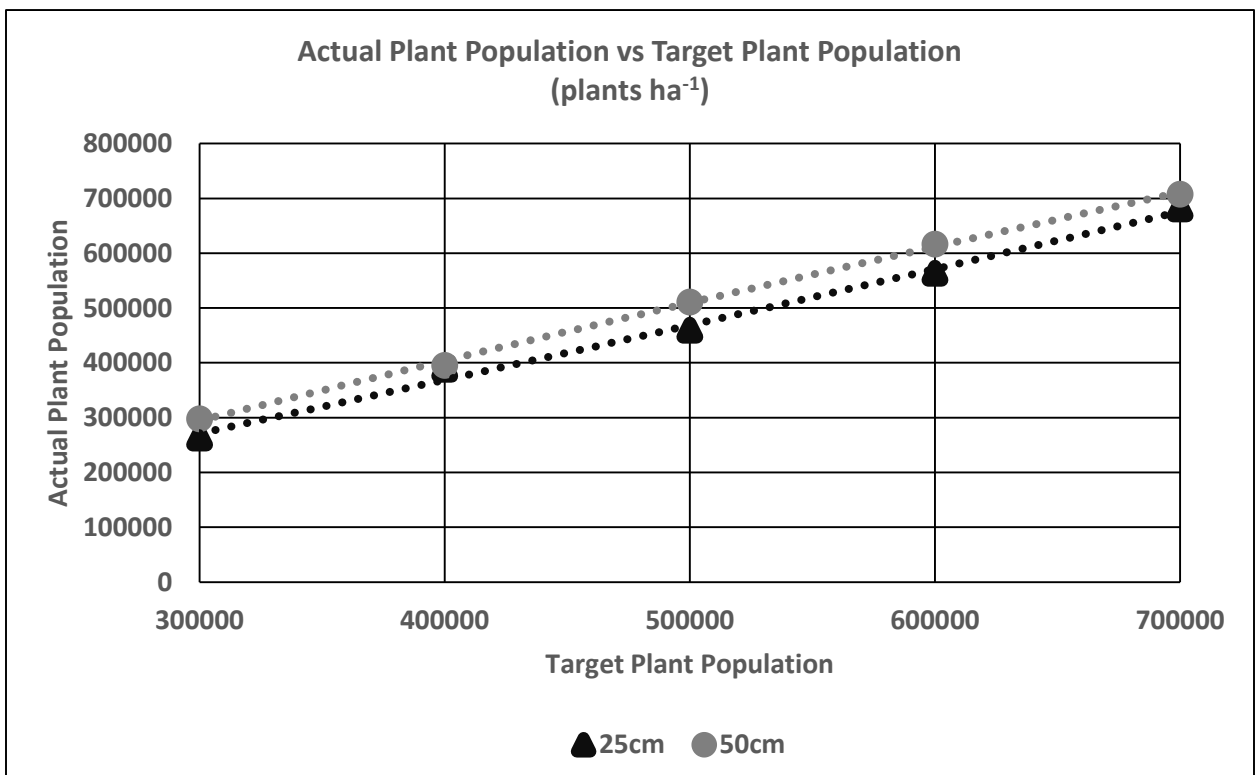


Figure 2. Effect of Row Spacing and Target Plant Population on Actual Stand Establishment, 2016.

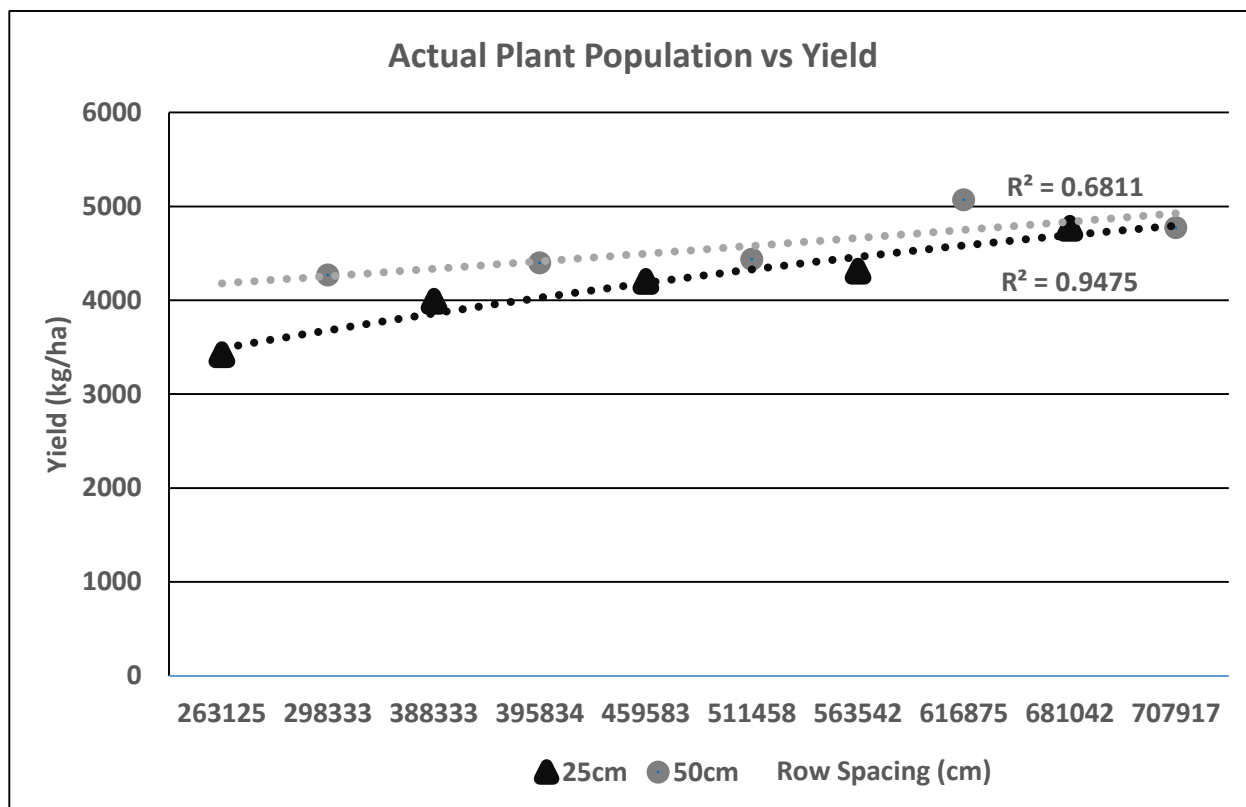


Figure 3. Effect of Row Spacing and Actual Plant Population on Yield, 2016.



# Soybean Seeding Date & Seed Treatment Study

## Funding

- Agriculture Development Fund
- Western Grains Research Foundation
- Irrigation Crop Diversification Corporation

## Principal Investigator

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

## Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Saskatchewan Ministry of Agriculture
- Western Grains Research Foundation

## Objectives

A study was initiated to determine optimal soybean seeding date ranges and the effect dates have on yield and seed quality.

## Research Plan

The trial was established at CSIDC. The soybean variety, 23-10RY, was used due to its relatively 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 445,000 plants/ha. The trial was established in a randomized split-plot design with four replications. Main plot planting dates were: May 5, May 12, May 19, May 26, June 2, and June 9. Subplots within each planting date were bare untreated seed or seed treated with Apron Maxx RTA (fludioxonil + metalaxyl-M + S-isomer) and Stress Shield 600 (imidacloprid). Prior to seeding, the plots were worked with a heavy harrow to encourage soil surface exposure in order to warm the soil. All treatments received a side band application at seeding of 15 kg P<sub>2</sub>O<sub>5</sub>/ha and seed-placed granular inoculant at an above recommended rate of 13.5 kg/ha. Plots were maintained weed free by a pre-plant burn-off and post-emergent glyphosate applications Priaxor DS (fluxapyroxad and pyraclostrobin), and Copper 53W (tribasic copper sulphate) fungicides were applied for foliar disease prevention. Prior to combining, 10 plants from each plot were cut at the soil surface and pod counts and pod clearance determined. 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 < 20%. Harvested samples were cleaned and yields adjusted to a moisture content of 14%. Oil and protein content was determined with a Foss NIR analyser. The trial was harvested on November 3.

Total in-season precipitation at CSIDC from May through October was 423.8 mm. Total in-season irrigation at CSIDC consisted of a single application of 12.5 mm on June 14.

Growing season precipitation, growing degree days, and corn heat units are shown in Tables 1, 2, and 3 respectively.

**Table 1. 2016 Growing Season Precipitation versus Long-Term Average, CSIDC.**

Month	Year		% of Long-Term
	2016 mm (inches)	30 Year Average mm (inches)	
May	49.8 (2.0)	45.0 (1.8)	111
June	57.4 (2.3)	63.0 (2.5)	91
July	177.2 (7.0)	55.0 (2.2)	322
August	66.8 (2.6)	42.0 (1.7)	159
September	21.6 (0.9)	36.0 (1.4)	60
<b>Total</b>	<b>284.4 (11.2)</b>	<b>241.0 (9.6)</b>	<b>118</b>

**Table 2. 2016 Cumulative Growing Degree Days (Base 0°C) versus Long-Term Average, CSIDC.**

Month	Year		% of Long-Term
	2016	30 Year Average	
May	246	224	110
June	769	708	109
July	1323	1290	103
August	1867	1844	101
September	2230	2058	<b>108</b>

**Table 3. 2016 Cumulative Corn Heat Units versus Long-Term Average, CSIDC.**

Month	Year		% of Long-Term
	2016	Long-Term	
May	262	211	124
June	866	742	117
July	1557	1409	111
August	2166	2024	107
September	2538	2338	<b>109</b>

## Results

Agronomic data collected for seed yield and seed quality are shown in Table 4. Mean seed yield statistically maintained the same at each May planting date, yields significantly declined with each June planting date. Seed treatment had no mean effect on seed yield in 2016. The effect of planting dates and seed treatments at each date is illustrated in Figure 1. Soybean is a warm-season crop that requires warm soil temperatures (> 9° C) for germination and vigorous plant growth. Usually, temperatures are not optimal until mid-May or later. However, in 2016, temperatures in May were 24% warmer than historic averages and mimicked June; undoubtedly this was responsible for the high yields obtained from the first two planting dates in May. A comparison of the May daily minimum and maximum temperatures for the three-year period, 2014–16, the duration of this study, is shown in Figures 2 and 3. Seed oil content decreased with each seeding date, significantly so every 14 days through May and every 7 days in June. Seed protein increased with each seeding rate delay. Test weight generally significantly increased with June seeding dates compared to all May seeding dates. Seed weight decreased with seeding delays. The mean effect of seed treatment had no effect on oil, protein, or test weight; seed weight was higher for bare seed.

Agronomic observations on soybean growth are shown in Table 5. Plant height was not statistically influenced by seeding dates, nor by seed treatment in 2016; there was no seeding date by seed treatment interaction with respect to plant height. Target plant population for all treatments was 445,000 plants/ha. No seeding date achieved establishment of intended plant populations. Plant establishment was significantly lower for the May 12 seeding date compared to all other seeding dates. This result was likely not a reflection of the seeding date, but rather on the soil seedbed conditions at the time of seeding. From May 9 through to May 11, a total of 23.4 mm of precipitation was received, which resulted in a less than ideal seedbed and presumably caused lower emergence. Seed treatment overall did not, on average, influence stand establishment. However, a significant interaction between seeding date and seed treatment did occur (Figure 4). Treated seed benefit on plant populations diminished with seeding date, while bare seed population increased as seeding date was prolonged. Both scenarios are attributed to a warming of soil temperature with seeding date delays.

**Table 4. Effect of Seeding Dates and Seed Treatment on Yield and Seed Quality, 2016.**

<b>Treatment</b>	<b>Yield (kg/ha)</b>	<b>Yield (bu/ac)</b>	<b>Oil (%)</b>	<b>Protein (%)</b>	<b>Test weight (kg/hl)</b>	<b>TKW (mg)</b>
<b>Seeding Date</b>						
May 5	5130	76.3	15.9	36.8	68.5	213
May 12	4928	73.3	15.9	36.8	68.7	207
May 19	4698	69.8	15.7	36.9	68.4	211
May 26	4804	71.4	15.5	36.8	68.5	199
June 2	3718	55.3	15.1	36.9	70.0	193
June 9	2660	39.6	14.6	37.1	69.8	178
LSD (0.05)	522	7.8	0.24	NS	0.99	11.9
CV	11.0	11.0	1.9	0.9	1.2	3.0
<b>Seed Treatment</b>						
Bare seed	4324	64.3	15.4	36.9	68.9	202
Treated seed	4322	64.3	15.5	36.9	69.1	198
LSD (0.05)	NS	NS	NS	NS	NS	3.6
<b>Seeding Date x Seed Treatment</b>						
LSD (0.05)	NS	NS	NS	NS	NS	NS

NS = not significant

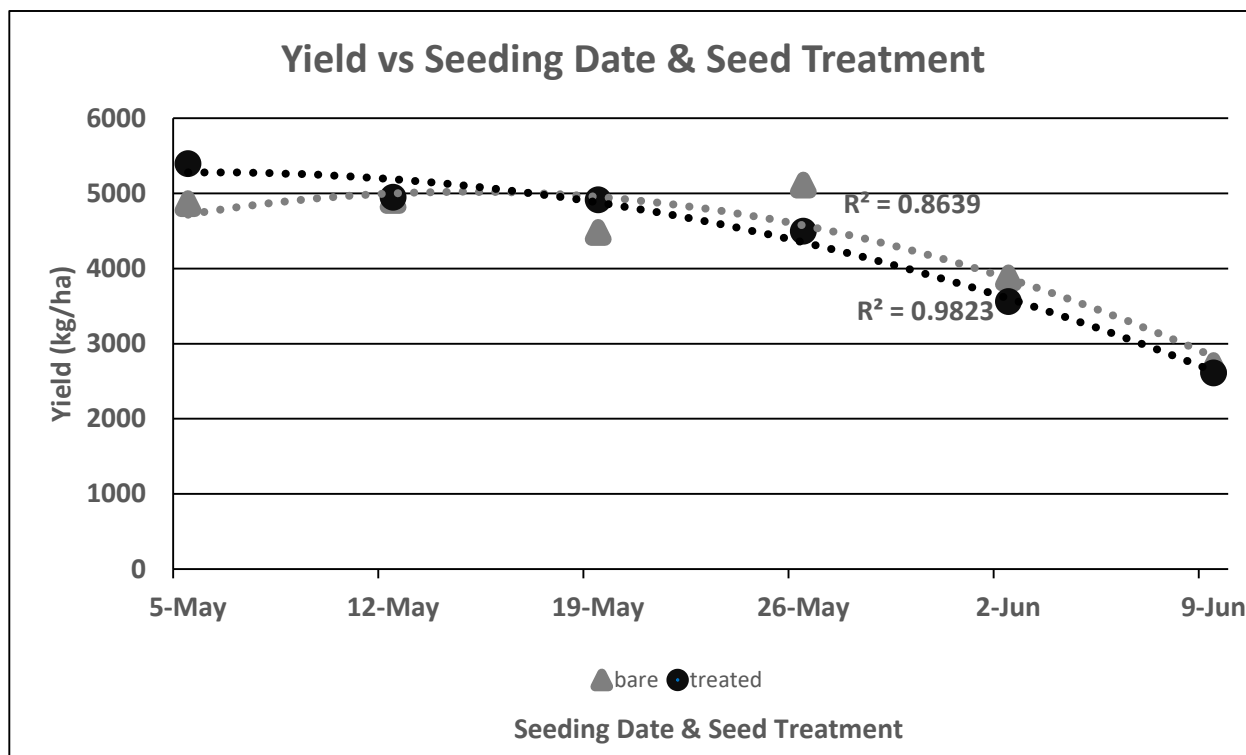


Figure 1. Effect of Seeding Date and Seed Treatment on Grain Yield, 2016.

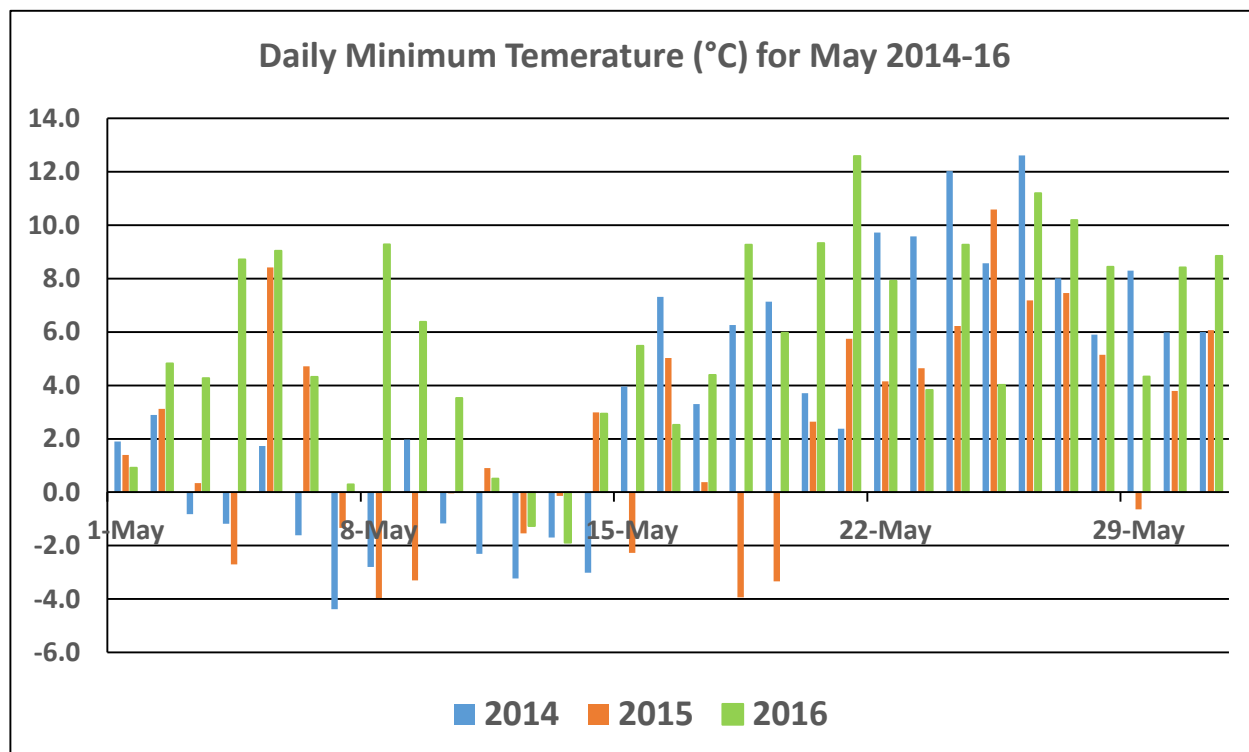


Figure 2. Daily Minimum Temperatures for May, 2014-16

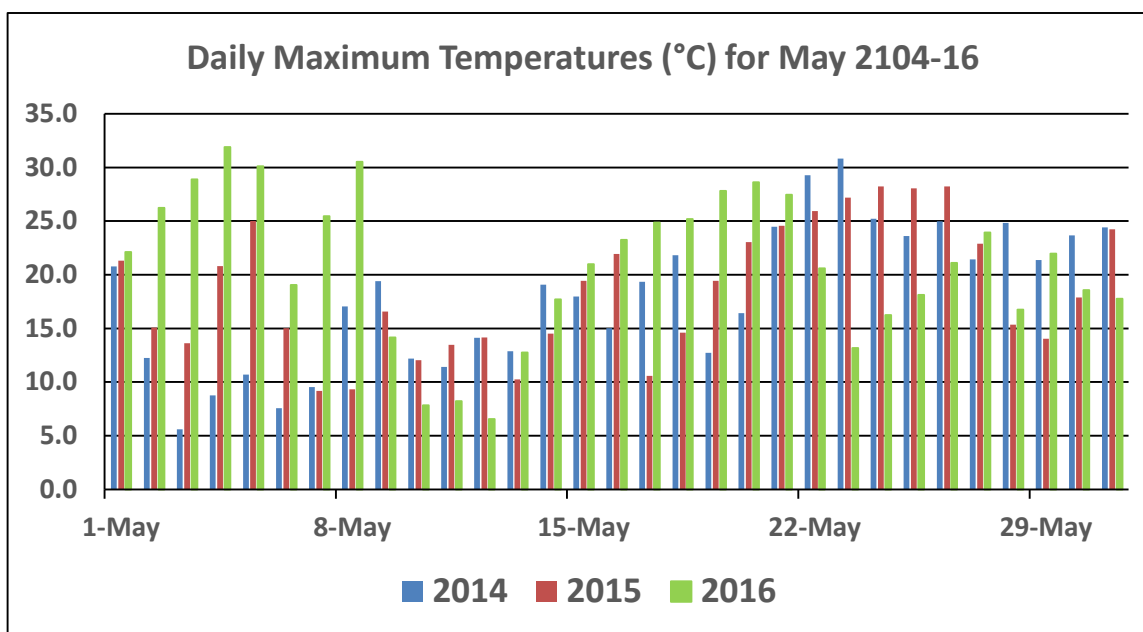


Figure 3. Daily Maximum Temperatures for May, 2104-16.

Table 5. Field Observations of Seeding Dates on Soybean Growth, 2016.

Treatment	Height (cm)	% Target Population	Plant Population (plants/ha)	*Pod Clearance	Pods per Plant (average)
<b>Seeding Date</b>					
May 5	82	89	399861	1.65	25.1
May 12	84	78	348889	1.55	30.0
May 19	87	87	390694	1.36	30.3
May 26	86	95	427500	0.54	25.0
June 2	83	86	385000	0.84	24.3
June 9	85	95	428611	0.38	18.7
LSD (0.05)	NS	10.7	48361	0.23	2.9
CV	4.8	12.0	12.0	41.5	20.4
<b>Seed Treatment</b>					
Bare seed	85	89	401065	1.0	24.9
Treated seed	84	87	392454	1.1	26.3
LSD (0.05)	NS	NS	NS	NS	NS
<b>Seeding Date x Seed Treatment</b>					
LSD (0.05)	NS	S	S	NS	NS

\* Pod Clearance = # pods per plant with < 31.25 mm from the bottom of the pod to soil surface

S = significant

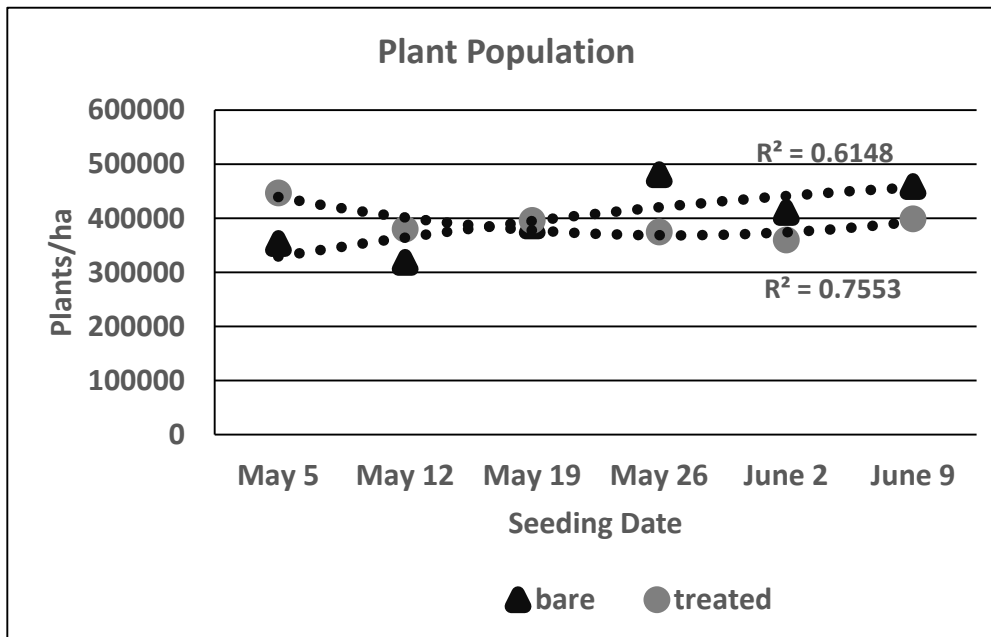
NS = not significant

**Table 6. Effect of Seeding Date and Seed Treatment on Plant Pod Production, 2016.**

Treatment	1 Seed/Pod (# pods/ha)	2 Seed/Pod (# pods/ha)	3 Seed/Pod (# pods/ha)	4 Seed/Pod (# pods/ha)	Total Pods (pods/ha)
<b>Seeding Date</b>					
May 5	1.21 E+06	3.10 E+06	5.30 E+06	256625	9.87 E+06
May 12	1.05 E+06	3.14 E+06	6.04 E+06	322278	1.05 E+07
May 19	1.27 E+06	3.47 E+06	6.78 E+06	387903	1.19 E+07
May 26	1.35 E+06	3.14 E+06	5.63 E+06	403666	1.05 E+07
June 2	1.19 E+06	3.03 E+06	4.83 E+06	275889	9.33 E+06
June 9	1.03 E+06	2.51 E+06	4.28 E+06	156278	7.98 E+06
LSD (0.05)	NS	485951	616028	141191	1.08 E+06
CV	27.8	17.7	29.9	63.7	24.7
<b>Seed Treatment</b>					
Bare seed	1.21 E+06	3.11 E+06	5.23 E+06	252704	9.80 E+06
Treated seed	1.15 E+06	3.02 E+06	5.73 E+06	348176	1.02 E+07
LSD (0.05)	NS	NS	NS	NS	NS
<b>Seeding Date x Seed Treatment</b>					
LSD (0.05)	NS	NS	NS	NS	NS

NS = not significant

The ten harvested plants collected from each plot were used to estimate the total number of pods produced per plant and this extrapolated to the number of pods/ha. These same samples were also used to estimate pod clearance. Pod clearance is defined as the distance between the soil surface and the bottom of the lowest pod. If pod clearance is less than 31.25 mm (1.25”) it is likely the combine cutter bar would shatter these pods resulting in harvest loss.



**Figure 4. Effect of Seeding Date and Seed Treatment on Plant Establishment, 2016.**

The effect of seeding date and seed treatment on pod clearance is shown in Figure 5. The number of “problematic” pods declines significantly with delays in seeding until the end of May. Seed treatment did not influence pod clearance.

The effect of seeding date and seed treatment on the number of seeds/pod is shown in Table 6, and graphically illustrated in Figure 6. The number of pods containing four seeds was the fewest, the number of pods containing three seeds per pod was the majority. The total number of pods formed per hectare at each seeding date is illustrated in Figure 7. In general, the mean effect of seeding date was to increase pod formation and development with seeding dates until approximately the third week of May. Total pods per hectare was not influenced by seed treatment in 2016. Seed treatment had no influence on seeds per pod at any planting time.

This concludes the third and final year of a three year study. A three year summary of the results of this study will be completed and available by the end of March, 2017, on the ICDC website (<http://irrigationsaskatchewan.com/icdc>).

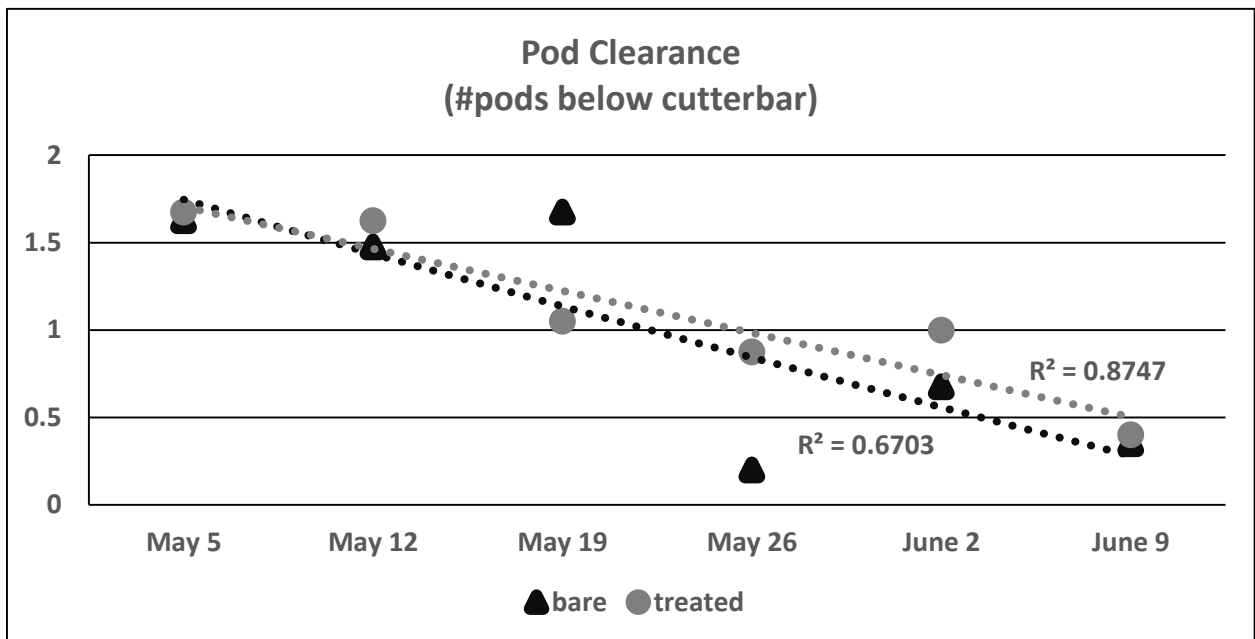


Figure 5. Number of Pods per Plant with Insufficient Pod Clearance, 2016.

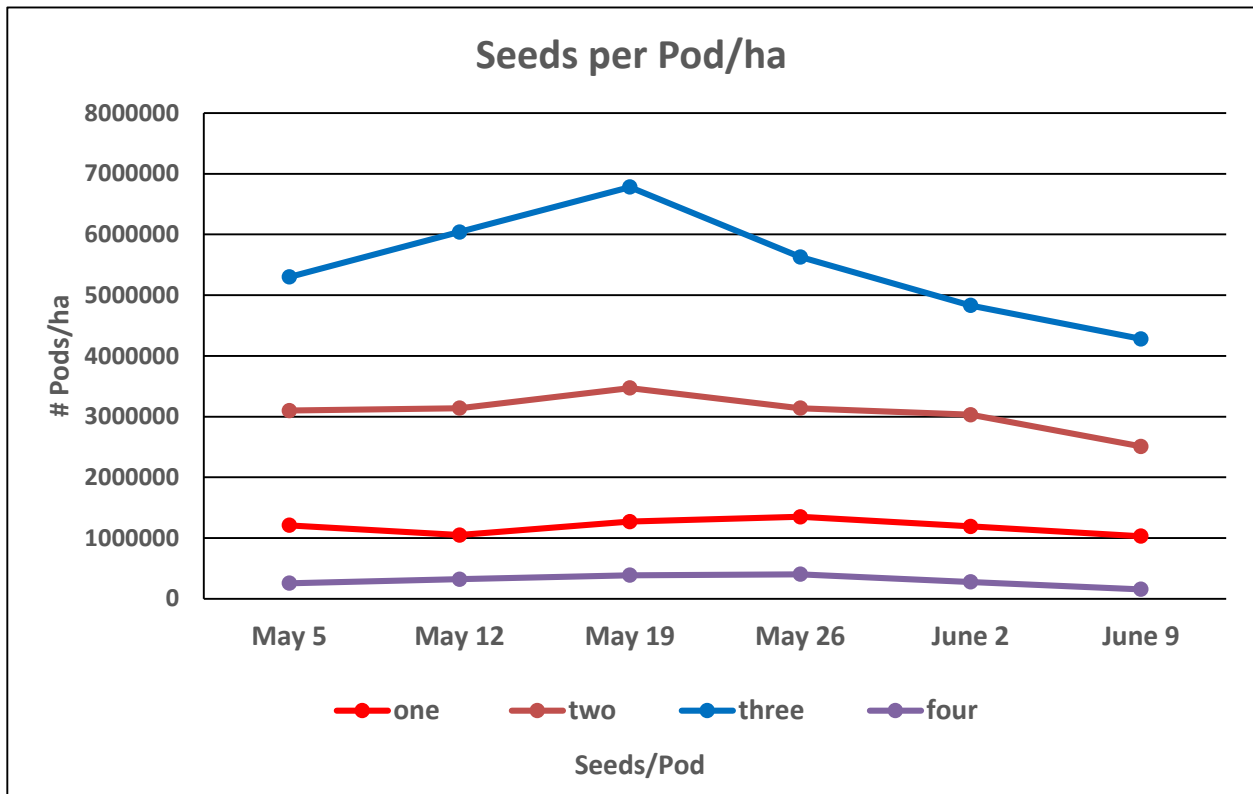


Figure 6. Effect of Seeding Date on Number of Seeds Forming per Pod, 2016.

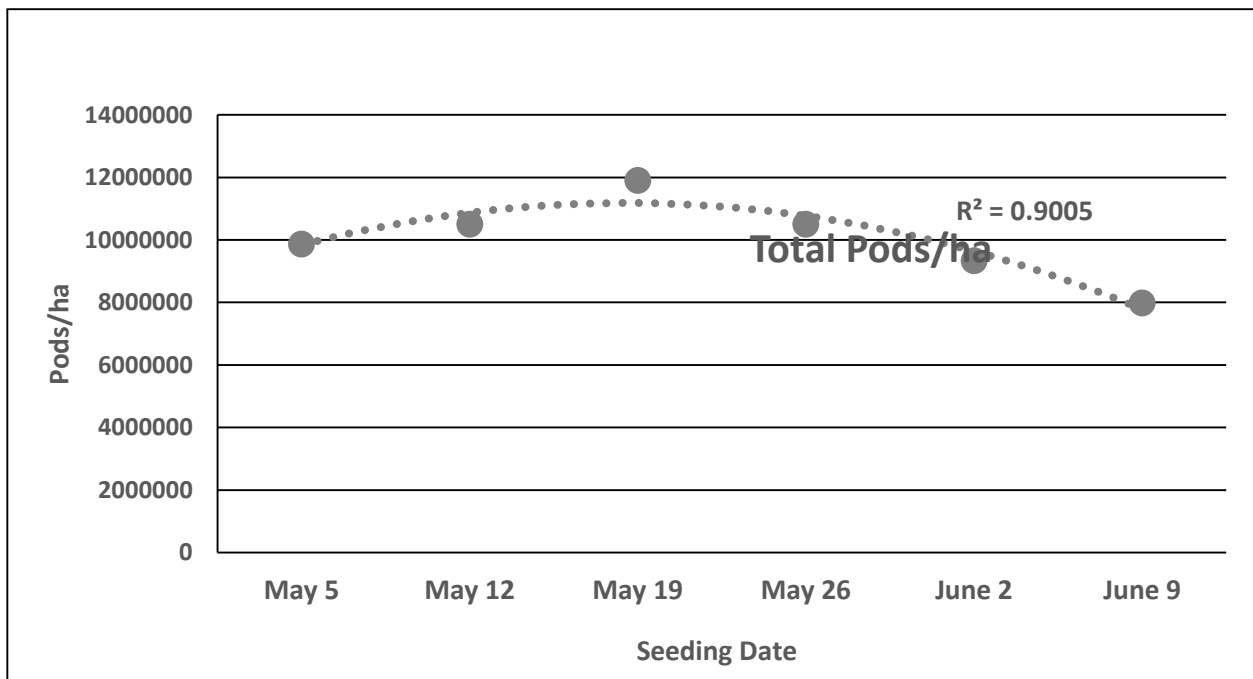


Figure 7. Effect of Seeding Dates on Total Pod Development, 2016



# Developing Nitrogen Management Recommendations for Soybean Production in Saskatchewan

## Funding

- Saskatchewan Pulse Growers

## Principal Investigators

- Project Principal Investigator: Chris Holzapfel (IHARF)
- Garry Hnatowich, PAg, Research Director, ICDC (ICDC Project Lead)

## Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Indian Head Research Foundation (IHARF)
- Northeast Agriculture Research Foundation (NARF)
- Saskatchewan Pulse Growers

## Objectives

The objective of this study is to investigate soybean responses to, and interactions between, granular inoculant rates and contrasting nitrogen (N) fertilization practices.

## Research Plan

The trial was established at CSIDC. The soybean variety, 23-10RY, was used due to its relatively 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 445,000 plants/ha. Seed was treated with Acceleron (fluxapyroxad, pyraclostrobin, matalaxyl, and imidacloprid). The trial was established in a randomized complete block plot design with four replications. Plots were seeded on May 19. Granular Cell-Tech soybean inoculant was applied at an application rate of 0, 4.5, 9.0, or 18.0 kg/ha (0, 1x, 2x, or 4x recommended application rate) with the seed. Granular urea and ESN were side banded at seeding, UAN was surface dribble banded at R1 growth stage of soybean, and all nitrogen fertilizers were applied at a rate of 55 kg N/ha. Plots were maintained weed free by a pre-plant burn-off and post-emergent glyphosate applications. Priaxor DS (fluxapyroxad & pyraclostrobin) and Copper 53W (tribasic copper sulphate) fungicides were applied for foliar disease prevention. Whole plant harvest of a 1 m<sup>2</sup> area occurred at R3 stage (early pod) for N uptake determination. Harvest area was 1.5 x 7.0 m; plots were combined with a Wintersteiger plot combine when the plants were dry enough to thresh and the seed moisture content was < 20%. Harvest was delayed by frequent rainfall events until November 3. Harvested samples were cleaned and yields adjusted to a moisture content of 14%. Oil and protein content were determined with a Foss NIR analyser.

Total in-season precipitation at CSIDC from May through October was 423.8 mm. Total in-season irrigation at CSIDC consisted of a single application of 12.5 mm on June 14.

Soil test results obtained prior to seeding are shown in Table 1.

**Table 1. Soil Test Results, Agvise Labs 2016.**

Depth (cm)	Nutrient (ppm)			
	NO <sub>3</sub> -N	P	K	SO <sub>4</sub> -S
0 - 15	5	12	231	5
15 - 60	7			7
Organic Matter	2.4%			
pH (0 - 15 cm)	7.6			
pH (15 - 60 cm)	8.1			
Carbonate	0.4%			
Soluble Salts (0 - 15 cm)	0.31 mmho/cm			
Soluble Salts (15 - 60 cm)	0.35 mmho/cm			

## Results

Seed and seed quality parameters measured are outlined in Table 2. Field observations and P tissue concentrations (if available at time of printing) are outlined in Table 3.

The addition of nitrogen fertilizer, regardless of fertilizer source, had no statistically significant impact on seed yield (Table 2). The average yield response to the three nitrogen fertilizer sources at a rate of 55 kg N/ha without inoculant application, compared to the “control” no granular inoculant, was 80 kg/ha (1.2 bu/ac). Granular inoculation, regardless the rate applied, had no statistical impact on grain yield above the un-inoculated control. Granular inoculation at rates beyond the recommended rate of 4.5 kg/ha had no impact on seed yield. This trial was established on ground that had a prior history of soybean production. As the bacteria required to effectively cause biological N-fixation in soybean is not indigenous to native prairie soils in Western Canada, but can survive in the soil once introduced, it is possible that background and known indigenous bacteria, may have contributed to the lack of inoculation response by their presence and infection of the root system.

Oil content of seed did differ between treatments, but in no apparent pattern. Neither inoculation nor nitrogen fertilizer had any impact on protein content, test weight, seed weight, plant height, square meter biomass yield, or plant population.

Plant tissue and seed N concentrations have not as yet been determined.

This is the second year of this trial; it will be repeated again in 2017.

**Table 2. Effect of Treatments on Seed Yield and Quality.**

Entry	N Fertilizer Treatment	Granular Inoculant	Yield (kg/ha)	Oil (%)	Protein (%)	Test weight (kg/hl)	TKW (mg)
1	none	no granular inoculant	4292	15.4	37.2	68.4	212
2	none	4.5 kg/ha	4612	15.0	37.4	68.7	202
3	none	9.0 kg/ha	4716	15.2	37.5	68.2	209
4	none	18.0 kg/ha	4587	15.4	37.4	68.4	214
5	Urea	no granular inoculant	4524	15.2	37.6	68.3	212
6	Urea	4.5 kg/ha	4782	15.4	37.3	69.2	207
7	Urea	9.0 kg/ha	4510	15.6	37.2	68.5	201
8	Urea	18.0 kg/ha	4669	15.4	37.4	68.6	209
9	ESN	no granular inoculant	4377	15.4	37.4	67.9	202
10	ESN	4.5 kg/ha	4275	15.3	37.3	69.2	203
11	ESN	9.0 kg/ha	4440	15.3	37.4	68.3	207
12	ESN	18.0 kg/ha	4455	15.2	37.3	68.6	207
13	UAN	no granular inoculant	4215	15.2	37.3	68.3	202
14	UAN	4.5 kg/ha	4674	15.7	37.0	69.3	201
15	UAN	9.0 kg/ha	4494	15.4	37.3	69.1	206
16	UAN	18.0 kg/ha	4665	15.3	37.3	68.7	205
LSD (0.05)			NS	0.3	NS	NS	NS
CV			6.5	1.4	0.7	1.3	3.7

**Table 3. Effect of Treatments on Field Observations and N Concentration.**

Entry	N Fertilizer Treatment	Granular Inoculant	Plant Population (plants/ha)	Plant Biomass (g/1m <sup>2</sup> )	Biomass N (%)	Seed N (%)	Height (cm)
1	none	no granular inoculant	546563	288	TBA	TBA	96
2	none	4.5 kg/ha	545625	262	TBA	TBA	98
3	none	9.0 kg/ha	508125	263	TBA	TBA	95
4	none	18.0 kg/ha	516250	196	TBA	TBA	99
5	Urea	no granular inoculant	510000	232	TBA	TBA	96
6	Urea	4.5 kg/ha	529063	263	TBA	TBA	97
7	Urea	9.0 kg/ha	551563	241	TBA	TBA	95
8	Urea	18.0 kg/ha	518750	276	TBA	TBA	98
9	ESN	no granular inoculant	526875	341	TBA	TBA	98
10	ESN	4.5 kg/ha	525313	261	TBA	TBA	92
11	ESN	9.0 kg/ha	523125	215	TBA	TBA	98
12	ESN	18.0 kg/ha	540938	240	TBA	TBA	95
13	UAN	no granular inoculant	537188	265	TBA	TBA	95
14	UAN	4.5 kg/ha	499063	245	TBA	TBA	95
15	UAN	9.0 kg/ha	544375	235	TBA	TBA	96
16	UAN	18.0 kg/ha	524375	262	TBA	TBA	94
LSD (0.05)			NS	NS	TBA	TBA	NS
CV			6.0	21.4	TBA	TBA	4.4

# **Developing Phosphorus Management Recommendations for Soybean Production in Saskatchewan**

## **Funding**

- Saskatchewan Pulse Growers

## **Project Investigators**

- Project Principal Investigator: Chris Holzapfel (IHARF)
- Garry Hnatowich, PAg, Research Director, ICDC (ICDC Project Lead)

## **Organizations**

- Irrigation Crop Diversification Corporation (ICDC)
- Indian Head Research Foundation (IHARF)
- Northeast Agriculture Research Foundation (NARF)
- Western Applied Research Corporation (WARC)
- Saskatchewan Pulse Growers

## **Objectives**

The objective of this study is to improve phosphorus (P) management recommendations for soybeans in Saskatchewan by investigating crop response to monoammonium phosphate (MAP; 11-52-0) rates and placement methods.

## **Research Plan**

The trial was established at CSIDC. The soybean variety, 23-10RY, was used 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 445,000 plants/ha. Seed was treated with Acceleron (fluxapyroxad, pyraclostrobin, matalaxyl, and imidacloprid). The trial was established in a randomized complete block plot design with four replications. Plots were seeded on May 19. Broadcast phosphorus as monoammonium phosphate (11-52-0) was applied prior to seeding and incorporated with the seeding operation, side banded, or seed placed at seeding. Granular Cell-Tech soybean inoculant was applied at an application rate of 10 kg/ha with the seed. Plots were maintained weed free by a pre-plant burn-off and post-emergent glyphosate applications. Priaxor DS (fluxapyroxad & pyraclostrobin) and Copper 53W (tribasic copper sulphate) fungicides were applied for foliar disease prevention. Whole plant harvest of a 1 m<sup>2</sup> area occurred at R3 stage (early pod) for P uptake determination. Harvest area was 1.5 x 7.0 m; plots were combined October 21 with a Wintersteiger plot combine when the plants were dry enough to thresh and the seed moisture content was < 20%. Harvested samples were cleaned and yields adjusted to a moisture content of 14%. Oil and protein content was determined with a Foss NIR analyser.

Total in-season precipitation at CSIDC from May through October was 423.8 mm. Total in-season irrigation at CSIDC consisted of a single application of 12.5 mm on June 14.

Soil test results obtained prior to seeding or fertilizer application are shown in Table 1.

**Table 1. Soil Test Results 2016 – Agvise Laboratories.**

Depth (cm)	Nutrients (ppm)			
	NO <sub>3</sub> -N	P	K	SO <sub>4</sub> -S
0 – 15	5	12	231	5
15 – 60	7			7
Organic Matter	2.4%			
pH (0 – 15 cm)	7.6			
pH (15 – 60 cm)	8.1			
Carbonate	0.4%			
Soluble Salts (0 – 15 cm)	0.31 mmho/cm			
Soluble Salts (15 – 60 cm)	0.35 mmho/cm			

## Results

Seed and seed quality parameters measured are outlined in Table 2. Field observations and P tissue concentration (if available at the time of printing) are shown in Table 3.

Phosphorus fertilizer applications had no statistically significant effect on grain yield of soybean at the 5% confidence level. The site was chosen on the basis of a soil test report submitted in mid-May to ALS Labs in Saskatoon; the lab provided quick response. The soil available phosphorus (P) level determined in this soil test was 8 ppm and deemed deficient in available P. A second soil sample from the test area was taken closer to seeding and sent to Agvise Laboratories in accordance with the project protocols. The resulting soil test results are shown in Table 1 and indicate an available P level deemed medium to high. Agvise recommends a fertilizer P application of 17 kg P<sub>2</sub>O<sub>5</sub>/ha for soybean. Soybeans are known to be effective scavengers of soil P, which could explain a portion of the non-response at this statistical level of significance. However, at a slightly higher confidence level of 8%, statistical significant yield differences did occur. At this level of significance, all P fertilizer treatments, other than the 40 kg side-banded P<sub>2</sub>O<sub>5</sub>/ha, were significantly higher yielding than the unfertilized control treatment. Yields versus fertilizer rate and application are graphically illustrated in Figure 1. Seed placed P fertilizer at rates exceeding 20 kg P<sub>2</sub>O<sub>5</sub>/ha were the lowest yielding methods of fertilizer application. Lower yields associated with higher rates of seed-placed fertilizer are attributed, in part, to fertilizer sensitivity on seed germination, as evident by lower plant populations established with these treatments. Present recommendations for soybean suggest a sensitivity to seed-placed fertilizer and rates exceeding 20 kg P<sub>2</sub>O<sub>5</sub>/ha may be damaging. Yields tended to be highest at the 20 kg P<sub>2</sub>O<sub>5</sub>/ha rate, higher application rates were not warranted.

Phosphorus fertilization had no statistically significant impact on oil percentage, protein percentage, test weight, thousand kernel seed (TKS) weight, plant height, or plant biomass.

Plant tissue and seed N concentrations have not as yet been determined.

This is the second year of this trial; it will be repeated again in 2017.

**Table 2. Effect of Treatments on Seed Yield and Quality.**

Entry	P <sub>2</sub> O <sub>5</sub> Rate	P <sub>2</sub> O <sub>5</sub> Placement	Yield (kg/ha)	Oil (%)	Protein (%)	Test Weight (kg/hl)	TKS (mg)
1	Control (0 P <sub>2</sub> O <sub>5</sub> )	N/A	3476	15.1	37.2	71.6	178
2	20 P <sub>2</sub> O <sub>5</sub> kg/ha	1_Seed-Placed	4011	15.4	37.2	71.4	188
3	20 P <sub>2</sub> O <sub>5</sub> kg/ha	2_Side-Banded	4002	15.4	37.1	70.9	185
4	20 P <sub>2</sub> O <sub>5</sub> kg/ha	3_Broadcast	3888	15.4	37.2	71.2	186
5	40 P <sub>2</sub> O <sub>5</sub> kg/ha	1_Seed-Placed	3728	15.3	37.0	70.6	181
6	40 P <sub>2</sub> O <sub>5</sub> kg/ha	2_Side-Banded	3977	15.2	37.2	71.0	191
7	40 P <sub>2</sub> O <sub>5</sub> kg/ha	3_Broadcast	3886	15.4	37.1	71.0	182
8	80 P <sub>2</sub> O <sub>5</sub> kg/ha	1_Seed-Placed	3825	15.3	37.3	70.8	195
9	80 P <sub>2</sub> O <sub>5</sub> kg/ha	2_Side-Banded	4005	15.5	36.9	71.0	186
10	80 P <sub>2</sub> O <sub>5</sub> kg/ha	3_Broadcast	3903	15.4	37.3	70.7	195
LSD (0.05)			NS @0.05 S @0.08	NS	NS	NS	NS
CV			6.0	1.2	0.5	0.9	5.1

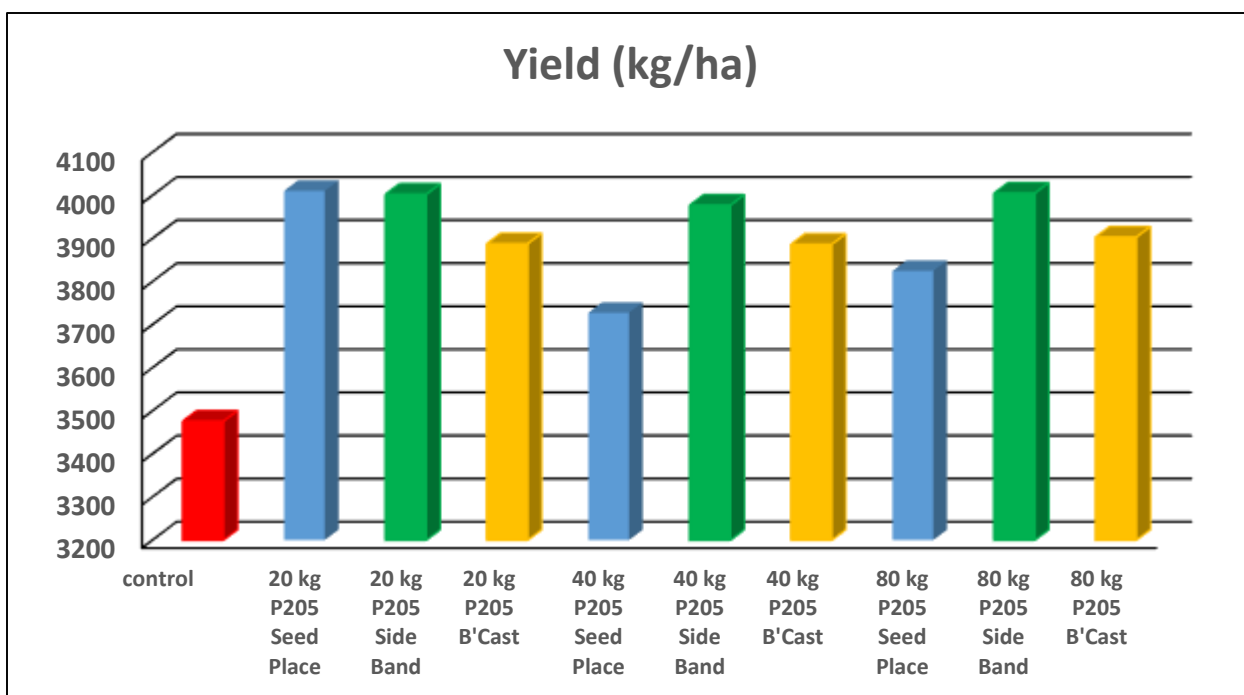
S = significant

NS = not significant

**Table 3. Effect of Treatments on Field Observations and P Concentration.**

Entry	P <sub>2</sub> O <sub>5</sub> Rate	P <sub>2</sub> O <sub>5</sub> Placement	Plant Population (plants/ha)	Plant Height (cm)	Plant Biomass (g/1 m <sup>2</sup> )	Biomass P (%)	Seed P (%)
1	Control (0 P <sub>2</sub> O <sub>5</sub> )	N/A	467,813	91	263	TBA	TBA
2	20 P <sub>2</sub> O <sub>5</sub> kg/ha	1_Seed-Placed	448,438	92	234	TBA	TBA
3	20 P <sub>2</sub> O <sub>5</sub> kg/ha	2_Side-Banded	490,312	90	232	TBA	TBA
4	20 P <sub>2</sub> O <sub>5</sub> kg/ha	3_Broadcast	488,750	93	234	TBA	TBA
5	40 P <sub>2</sub> O <sub>5</sub> kg/ha	1_Seed-Placed	456,250	96	275	TBA	TBA
6	40 P <sub>2</sub> O <sub>5</sub> kg/ha	2_Side-Banded	508,750	94	263	TBA	TBA
7	40 P <sub>2</sub> O <sub>5</sub> kg/ha	3_Broadcast	489,063	94	258	TBA	TBA
8	80 P <sub>2</sub> O <sub>5</sub> kg/ha	1_Seed-Placed	361,250	90	229	TBA	TBA
9	80 P <sub>2</sub> O <sub>5</sub> kg/ha	2_Side-Banded	493,438	92	257	TBA	TBA
10	80 P <sub>2</sub> O <sub>5</sub> kg/ha	3_Broadcast	472,188	84	270	TBA	TBA
LSD (0.05)			62,292	NS	NS	TBA	TBA
CV			9.2	9.7	24.1	TBA	TBA

NS = not significant



**Figure 1. Effect of Phosphorus Fertilizer Application on Soybean Yield, 2016.**

# Soybean Inoculation Study

## Funding

- Agriculture Development Fund
- Western Grains Research Foundation
- Irrigation Crop Diversification Corporation

## Project Lead

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

## Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Saskatchewan Ministry of Agriculture
- Western Grains Research Foundation

## Objectives

A study was initiated to determine optimal soybean inoculation for irrigated crop production. This strategy assumes that soybeans will be established on fields with no prior, or limited, history of soybean in the rotation.

## Research Plan

The trial was established at CSIDC and the variety, 23-10RY, was used in all treatments. All seed was pre-packaged by weight after adjusting for seed weight, % germination, and assuming a 90% seedling survival, for a target population of 445,000 plants/ha. The trial was established in a randomized complete block design (RCBD) with four replications. Two inoculant companies, BASF and Novozymes (now Monsanto BioAg) inoculants were included, as each carry a second, but differing, active organism in addition to their respective Bradyrhizobium strain. Note, however, the purpose of the study is not a head-to-head inoculant brand comparison. These two companies represent together the greatest market share of inoculants in Western Canada. Both companies provided both liquid and granular soybean inoculant formulations. These formulations were evaluated by themselves or in combination, along with a seed treatment. The fungicidal seed treatment used was Apron Maxx RTA (fludioxonil + metalaxyl-M + S-isomer) and Stress Shield 600 (imidacloprid). The seed treatment was applied at the recommended rate and allowed to dry; this occurred approximately two weeks prior to seeding. Liquid inoculants were applied at recommended rates, allowed to dry, and seeded immediately. Granular inoculants were calibrated through granular boxes on the plot seeder and applied as a seed-placed application. Treatments were:

- | # | Treatment         |
|---|-------------------|
| 1 | control bare seed |
| 2 | seed treatment    |
| 3 | liquid Novozymes  |
| 4 | liquid BASF       |



#	Treatment
5	8 lb/ac granular Novozymes
6	8 lb/ac granular BASF
7	8 lb/ac granular Novozymes + liquid Novozymes
8	8 lb/ac granular BASF + liquid BASF
9	8 lb/ac granular Novozymes + liquid Novozymes + seed treatment
10	8 lb/ac granular BASF + liquid BASF + seed treatment
11	12 lb/ac granular Novozymes
12	12 lb/ac granular BASF
13	12 lb/ac granular Novozymes + liquid Novozymes
14	12 lb/ac granular BASF + liquid BASF
15	12 lb/ac granular Novozymes + liquid Novozymes + seed treatment
16	12 lb/ac granular BASF + liquid BASF + seed treatment

Prior to seeding, the plots were worked with a heavy harrow to encourage soil surface exposure in order to warm the soil. The trial was seeded on May 26. All treatments received a side band application at seeding of 20 kg P<sub>2</sub>O<sub>5</sub>/ha. Plots were maintained weed free by a pre-plant burn-off and post-emergent glyphosate applications. Priaxor DS (fluxapyroxad & pyraclostrobin) and Copper 53W (tribasic copper sulphate) fungicides were applied for foliar disease prevention. 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 < 20%. Harvest occurred on October 21. Harvested samples were cleaned and yields adjusted to a moisture content of 14%. Oil and protein content was determined with a Foss NIR analyser. Total in-season precipitation at CSIDC from May through October was 423.8 mm. Total in-season irrigation at CSIDC consisted of a single application of 12.5 mm on June 14.

## Results

Agronomic data collected is shown in Tables 1 and 2.

No inoculant applications statistically increased yield. This lack of response to inoculant applications was unexpected. All inoculants were maintained in a packaged, unopened, refrigerated state until use; no plugging or bridging of any granular inoculant occurred. It is assumed the product was viable, so the lack of response is unlikely due to an inoculation failure. The field that the trial was established on had a prior history of soybean production in 2014, the bare seed established, plants did have nodules formed on the root system, but number were few and far lower than on those treatments receiving inoculant, regardless of formulation or rate. Therefore, it is unlikely that limited nodulation from carry-over rhizobia from a past inoculation would provide sufficient N-fixation to optimize yield.

Yields obtained within this trial, regardless of treatment, were very high. A soil sample from the test field was submitted for N analysis to ALS Laboratory, a second sample from the same field location was obtained later and sent to Agvise Laboratory. Results are shown in Table 3. It is worthy of note that the two labs did differ in the total N available in the soil available for plant growth. Regardless, both labs considered the amount of available N as insufficient to obtain the yields obtained. Natural precipitation received was higher than historic values, particularly during May through August when

most soybean growth and development occurs (Table 4). The season was also warmer than historic averages indicate (Tables 5 and 6).

**Table 1. Effect of Inoculation on Yield, 2016.**

<b>Inoculant Treatment</b>	<b>Yield (kg/ha)</b>	<b>Yield (bu/ac)</b>	<b>Oil (%)</b>	<b>Protein (%)</b>
control bare seed	4085	60.7	16.2	37.4
seed treatment	4388	65.2	16.0	37.5
liquid Novozymes	4451	66.2	16.2	37.4
liquid BASF	4435	65.9	16.1	37.6
8 lb/ac granular Novozymes	4278	63.6	16.2	37.3
8 lb/ac granular BASF	4418	65.7	16.2	37.4
8 lb/ac granular Novozymes + liquid Novozymes	4433	65.9	16.2	37.5
8 lb/ac granular BASF + liquid BASF	4450	66.1	16.2	37.3
8 lb/ac granular Novozymes + liquid Novozymes + seed treatment	4298	63.9	16.1	37.7
8 lb/ac granular BASF + liquid BASF + seed treatment	4340	65.9	16.1	37.4
12 lb/ac granular Novozymes	4302	63.9	16.3	37.5
12 lb/ac granular BASF	4451	66.2	16.1	37.4
12 lb/ac granular Novozymes + liquid Novozymes	4056	60.3	16.1	37.5
12 lb/ac granular BASF + liquid BASF	4146	61.6	16.1	37.7
12 lb/ac granular Novozymes + liquid Novozymes + seed treatment	4410	65.6	16.0	37.5
12 lb/ac granular BASF + liquid BASF + seed treatment	4341	65.9	16.2	37.8
LSD (0.05)	NS	NS	NS	NS
CV (%)	7.8	7.8	1.7	0.6

NS = not significant

**Table 2. Effect of Inoculation on Seed Characteristics, 2016.**

<b>Inoculant Treatment</b>	<b>Test Weight (kg/hl)</b>	<b>1000 Seed Weight (mg)</b>	<b>Plant Height (cm)</b>
control bare seed	67.7	212	93
seed treatment	67.4	235	92
liquid Novozymes	68.0	231	94
liquid BASF	68.1	236	92
8 lb/ac granular Novozymes	67.6	228	92
8 lb/ac granular BASF	68.3	225	94
8 lb/ac granular Novozymes + liquid Novozymes	67.8	228	96
8 lb/ac granular BASF + liquid BASF	67.7	214	92
8 lb/ac granular Novozymes + liquid Novozymes + seed treatment	67.8	237	93
8 lb/ac granular BASF + liquid BASF + seed treatment	67.8	235	94
12 lb/ac granular Novozymes	68.4	233	91
12 lb/ac granular BASF	68.1	243	90
12 lb/ac granular Novozymes + liquid Novozymes	68.3	228	94
12 lb/ac granular BASF + liquid BASF	68.0	238	92
12 lb/ac granular Novozymes + liquid Novozymes + seed treatment	67.8	239	95
12 lb/ac granular BASF + liquid BASF + seed treatment	68.5	229	97
LSD (0.05)	NS	NS	NS
CV (%)	0.8	6.2	3.8

NS = not significant

It is hypothesised that the warmer and wetter conditions may have led to a sizeable portion of N being mineralized than normally occurs, particularly if the Agvise soil test is accurate with both its higher soil reserve of available N and % organic matter. A high release of plant-available N being made available to the plants through the growing season could attribute to the lack of a statistical yield response to inoculation. It should be indicated, though, that yield differences between treatments were not statistically different, inoculation did generally result in numerically higher yields than the uninoculated control. Yield response to inoculation is illustrated in Figure 1, the black horizontal bar indicates the average response obtained from all rhizobial inoculation treatments. Inoculation had no impact on any other seed quality or physical parameter measured.

This concludes the third and final year of a three year study. A three year summary of the results of this study will be completed by the end of March, 2017 and available on the ICDC website, <http://irrigationsaskatchewan.com/icdc>.

**Table 3. Soil Test Analyses for Available Nitrogen for the Trial Site.**

Soil Depth (cm)	Available NO <sub>3</sub> -N (kg/ha)	
	ALS Analysis Date 25-Apr-16	Agvise Analysis Date 11-May-16
0 – 15	13	11
15 – 30	9	24
30 - 60	27	35
Total NO <sub>3</sub> -N from 0 – 60cm	49	70
Lab Test Level Interpretation	Deficient	Low
% Organic Matter	1.8	2.4

**Table 4. 2016 Growing Season Precipitation versus Long-Term Average, CSIDC.**

Month	Year		% of Long-Term
	2016 mm (inches)	30 Year Average mm (inches)	
May	49.8 (2.0)	45.0 (1.8)	111
June	57.4 (2.3)	63.0 (2.5)	91
July	177.2 (7.0)	55.0 (2.2)	322
August	66.8 (2.6)	42.0 (1.7)	159
September	21.6 (0.9)	36.0 (1.4)	60
<b>Total</b>	<b>284.4 (11.2)</b>	<b>241.0 (9.6)</b>	<b>118</b>

**Table 5. 2016 Cumulative Growing Degree Days (Base 0° C) versus Long-Term Average, CSIDC.**

Month	Year		% of Long-Term
	2016	30 Year Average	
May	246	224	110
June	769	708	109
July	1323	1290	103
August	1867	1844	101
September	2230	2058	<b>108</b>

Table 6. 2016 Cumulative Corn Heat Units versus Long-Term Average, CSIDC.

Month	Year		% of Long-Term
	2016	Long-Term	
May	262	211	124
June	866	742	117
July	1557	1409	111
August	2166	2024	107
September	2538	2338	109

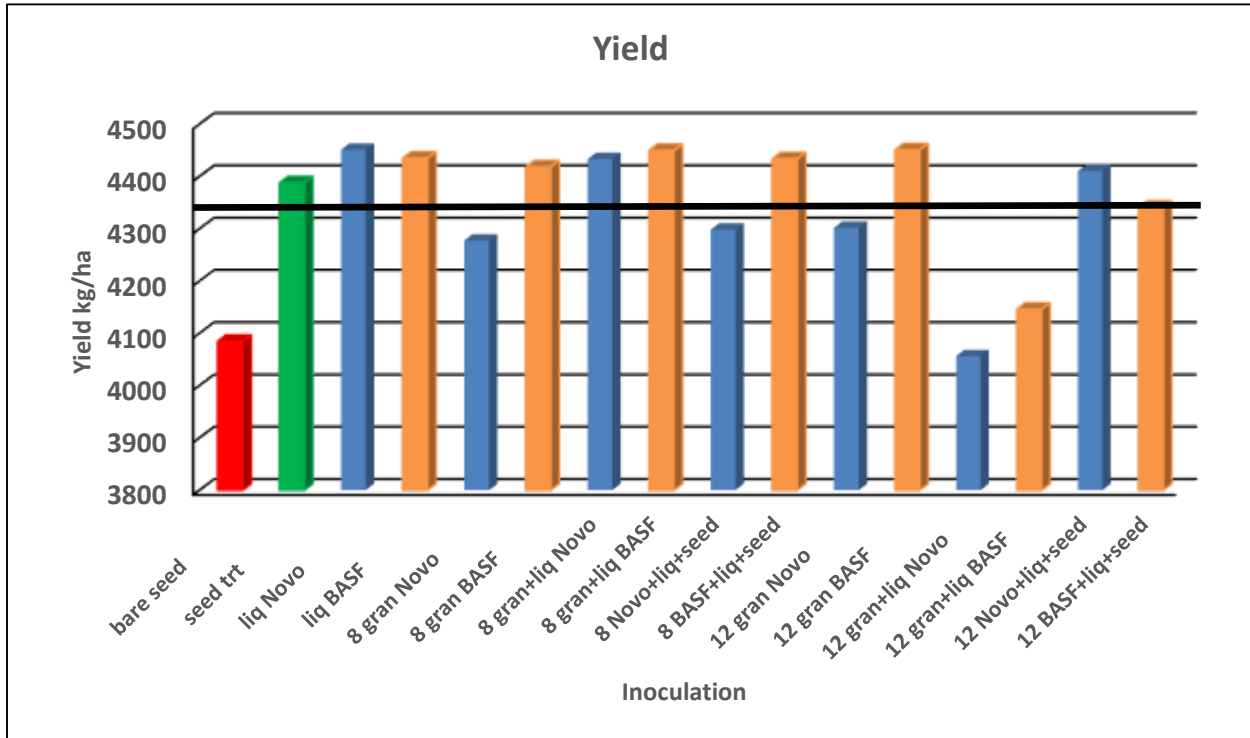


Figure 1. Effect of Inoculation on Soybean Yield 2016.

# Faba Bean Plant Population Evaluation

## Funding

- Saskatchewan Pulse Growers

## Principal Investigator

- Project Principal Investigator: Steve Shirtliffe (University of Saskatchewan)
- Garry Hnatoiwich, PAg, Research Director, ICDC (Project Lead)

## Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- University of Saskatchewan
- Indian Head Research Foundation (IHARF)
- Northeast Agriculture Research Foundation (NARF)
- Western Applied Research Corporation (WARC)
- East Central Research Foundation (ECRF)
- Wheatland Conservation Area Inc. (WCA)
- Southeast Agricultural Research Foundation (SARF)
- Saskatchewan Pulse Growers

## Objectives

Faba beans are a reasonably well adapted pulse crop for large areas of the Canadian Prairies; however, acreage for this crop has traditionally been small and agronomic recommendations along with producer production experience of faba beans are limited. It has traditionally been recommended that a target faba bean population of 45 plants/m<sup>2</sup> be established, but seedling mortality can be variable and difficult to estimate depending on spring soil moisture and temperatures. Higher faba bean seeding rates could have the advantages of accelerating maturity and increasing yields, but may also have implications for disease.

The objectives of this study are to investigate the effects of faba bean seeding rate on the agronomic growth and seed yield.

## Research Plan

The trial was established at CSIDC, in a randomized complete block design (RCBD) with four replications. Snowdrop faba bean was established at potential seeding rates of 20, 40, 60, 80 and 100 plants/m<sup>2</sup>. Seeding rate was established by pre-weighed seed per treatment, accounting for individual seed weight, 95% germination, and assuming 85% plant establishment. The trial was seeded on May 6. Plot size was 1.5 m x 8 m. All plots received 30 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0 as a side banded application and TagTeam granular inoculant at a rate of 9 kg/ha as a seed-placed 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 Odyssey

(imazamox + imazethapyr) and Equinox (tepraxydim). Supplemental hand weeding was conducted. Fungicide application of Headline EC (pyraclostrobin) was applied to control Ascochyta blight and powdery mildew. An application of Matador (lambda-cyhalothrin) was applied at early flowering for control of observed pea leaf weevil activity. 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%. Harvest occurred on September 29.

Total in-season precipitation at CSIDC from May through September was 372.8 mm. Total in-season irrigation at CSIDC consisted of a single application of 12.5 mm on June 14.

## Results

Agronomic observations collected are outlined in Table 1.

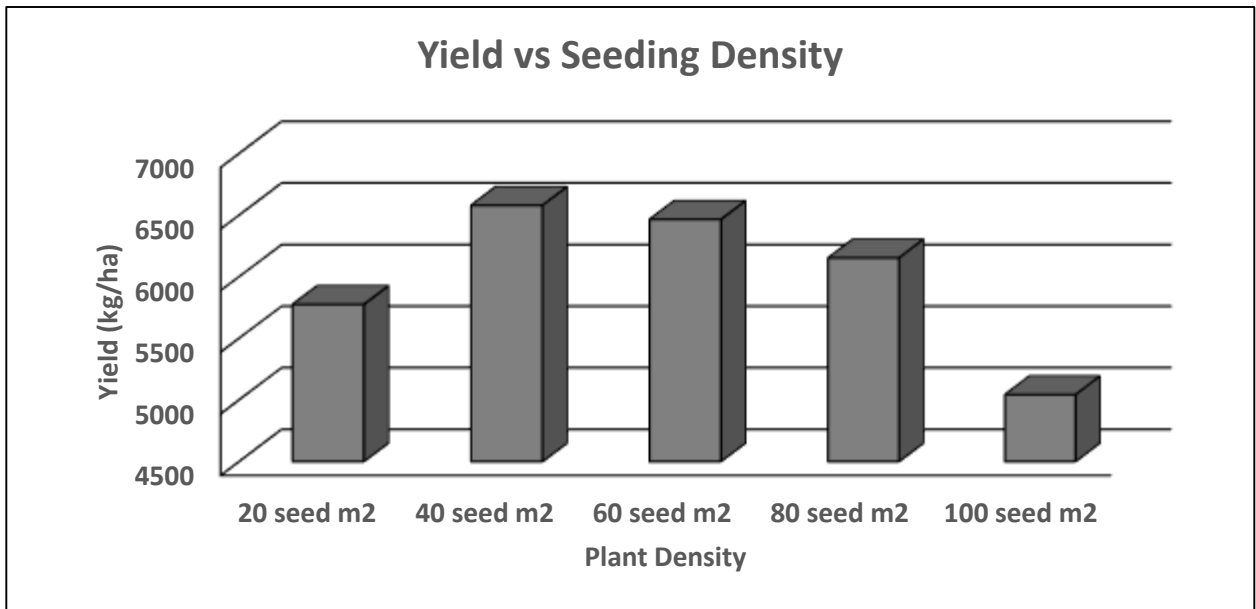
**Table 1. Impact of Seeding Rate on Seed Quality & Agronomics of Faba Bean, 2016.**

Seeding Rate (plants/m <sup>2</sup> )	Yield (kg/ha)	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Plant Population (plants/m <sup>2</sup> )	Maturity (days)	Height (cm)	Lodging (1-5)
20	5776	27.9	81.1	250	30	122	142	1.0
40	6580	28.2	80.9	255	54	118	151	1.8
60	6465	28.7	80.4	220	65	113	147	2.5
80	6154	29.0	79.1	251	90	110	136	3.0
100	5044	28.4	77.9	247	112	108	129	4.0
LSD (0.05)	507	0.6	0.9	NS	14.5	2.3	9.9	0.5
CV	5.5	1.3	0.7	13.6	13.4	1.3	4.5	12.9

NS = not significant

Highest yield was obtained at the seeding rate that provided 40 plants/m<sup>2</sup>; this yield was not statistically different from the 60 and 80 plants/m<sup>2</sup> rates, but was compared to the 20 and 100 plants/m<sup>2</sup> rates. Effect of plant density on yield is graphically illustrated in Figure 1. Target plant populations were attempted using seed germination % and an estimated seedling survival of 85%. Established populations were proportionally higher at the two lowest target populations. Higher populations were likely reduced due to plant-to-plant competition within a seed row. Protein in general increased as seeding rate increased. Test weight declined with each increase in planting density, the 80 and 100 plants/m<sup>2</sup> were significantly lower from each other and both significantly different from lower plant densities. Seed weight was not affected by seed rate. Plant height was significantly reduced at the two highest planting densities. Days to plant maturity were significantly reduced with each successive increase in plant density to 80 plants/m<sup>2</sup>. Increasing plant population significantly increased plant lodging.

This is the second year of this trial, it will be repeated in 2017.



**Figure 1. Effect of Target Plant Population on Faba Bean Yield, 2016.**

# Faba Bean Fungicide Product x Timing Study

## Funding

- Saskatchewan Pulse Growers

## Project Lead

- Project Principal Investigator: Steve Shirtliffe (University of Saskatchewan)
- Garry Hnatowich, PAg, Research Director, ICDC (Project Lead)

## Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- University of Saskatchewan
- Indian Head Research Foundation (IHARF)
- Northeast Agriculture Research Foundation (NARF)
- Western Applied Research Corporation (WARC)
- East Central Research Foundation (ECRF)
- Wheatland Conservation Area Inc. (WCA)
- Southeast Agricultural Research Foundation (SARF)
- Saskatchewan Pulse Growers

## Objectives

The objectives of this study are to investigate the merits of foliar fungicide applications on faba bean in Western Canada for the control of chocolate spot.

## Research Plan

The trial was established at CSIDC in a randomized complete block design (RCBD) with four replications. Snowdrop faba bean was established at a target seeding rate of 50 plants/m<sup>2</sup>. Seeding rate was established by pre-weighed seed per treatment, accounting for individual seed weight, % germination, and assuming 85% plant establishment. The trial was seeded on May 6. Plot size was 1.5 m x 8 m. All plots received 30 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0 as a seed placed application and TagTeam granular inoculant at a rate of 9 kg/ha as a seed placed 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 Odyssey (imazamox + imazethapyr) and Equinox (tepraxoxydim). Supplemental hand weeding was conducted.

Fungicide applications were applied at early and mid-flowering, using a high-clearance small plot sprayer. Early or 10% flower is considered to occur when the majority of plants have at least 1 flower open at the first node. Mid or 50% flower is considered to occur when the majority of plants have at least 1 flower open at the fourth node. Application for the 10% flower occurred on June 22 and 50% flower on July 6, 2016.



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%. Harvest occurred on September 29.

Total in-season precipitation at CSIDC from May through September was 372.8 mm. Total in-season irrigation at CSIDC consisted of a single application of 12.5 mm on June 14.

## Results

Faba bean agronomic observations and seed quality are shown in Table 1. Statistically, only the application of Priaxor DS at the 50% flower stage significantly increased faba bean seed yield. No other fungicide, regardless of application time, influenced seed yield. Yields were high overall, however, chocolate spot symptoms of leaf blackening and defoliation did begin to appear in August.

Fungicide treatment had no impact on seed protein, test weights, or thousand kernel seed (TKS) weight. The non-fungicide control treatment was significantly earlier to mature compared to all fungicide application treatments. Plant height was not influenced by any treatment. Slightly higher than target plant populations were achieved and were consistent across all treatments, so did not impart a stand density effect of any treatment.

The disease rating scale utilized in this study is shown in Table 2 and the dates and ratings obtained are shown in Table 3. In general, all fungicide applications appeared to have an effect of reducing disease severity incidence.

This is the second year of this trial; it will be repeated again in 2017. This data will also be combined with several other locations at which the trial was replicated, a full report of all sites will be developed at the completion of the study.

**Table 1. Agronomics & Seed Quality of Faba Bean, 2016.**

Entry	Fungicide	Application Timing	Yield (kg/ha)	Protein (%)	Test Weight (kg/hl)	1000 Seed Weight (mg)	Mature (days)	Height (cm)	Plant Population (plants/m <sup>2</sup> )
1	Control	N/A	6286	28.6	80.6	253	113	145	56
2	Priaxor DS	10% Flowering	6561	28.6	80.2	265	115	142	59
3	Propulse	10% Flowering	6365	29.1	80.8	259	116	143	54
4	Vertisan	10% Flowering	6392	28.6	80.5	283	117	139	56
5	Bravo	10% Flowering	5714	28.1	80.7	249	115	142	54
6	Priaxor DS	50% Flowering	7197	28.9	80.9	294	116	146	53
7	Propulse	50% Flowering	6922	28.9	80.8	274	116	144	56
8	Vertisan	50% Flowering	6265	28.8	80.9	248	116	146	54
9	Bravo	50% Flowering	6305	29.1	80.7	274	116	144	57
LSD (0.05)			756	NS	NS	NS	0.9	NS	NS
CV			8.0	1.7	0.7	8.5	0.5	2.1	6.4

NS = not significant

**Table 2. Disease Rating System.**

Score	0	1	2	3	4	5	6	7	8	9	10
% Disease	0	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100

**Table 3. Disease Ratings Until Beginning of Senescence.**

Entry	Fungicide	Application Timing	Disease Rating					
			June 21	July 5	July 22	Aug 4	Aug 16	Aug 26
1	Control	N/A	0	0.15	0.20	1.60	3.6	6.0
2	Priaxor DS	10% Flowering	0	0	0.15	1.05	1.9	3.1
3	Propulse	10% Flowering	0	0	0.15	0.85	2.1	3.0
4	Vertisan	10% Flowering	0	0	0.20	1.20	2.0	3.0
5	Bravo	10% Flowering	0	0	0.20	1.15	2.2	3.0
6	Priaxor DS	50% Flowering	0	0	0.20	0.90	2.1	3.0
7	Propulse	50% Flowering	0	0.15	0.15	0.90	2.0	2.9
8	Vertisan	50% Flowering	0	0	0.10	0.90	2.0	3.0
9	Bravo	50% Flowering	0	0	0.05	0.95	2.0	3.0
LSD (0.05)			NA	0.07	NS	0.40	0.2	0.1
CV			NA	144	64	26.1	5.1	3.1

NA = not applicable

# Evaluating Inoculant Options for Faba Beans

## Funding

- Saskatchewan Pulse Growers

## Project Lead

- Project Principal Investigator: Garry Hnatowich, PAg, Research Director, ICDC

## Organizations

- Irrigation Crop Diversification Corporation (ICDC)
- Indian Head Research Foundation (IHARF)
- Northeast Agriculture Research Foundation (NARF)
- Western Applied Research Corporation (WARC)
- East Central Research Foundation (ECRF)
- Wheatland Conservation Area Inc. (WCA)
- Southeast Agricultural Research Foundation (SERF)
- Saskatchewan Pulse Growers

## Project Objective

The objective of this trial is to determine the effects of two inoculants at different rates and in combination on faba bean grown in various soil/climatic zones of Saskatchewan.

## Research Plan

Field trials will be conducted at six locations (Outlook, Scott, Indian Head, Swift Current, Redvers, Yorkton SK) from 2015–2017. Two inoculants (Nodulator peat for faba bean and TagTeam granular for faba bean) in different combinations on two faba bean varieties (Snowbird and SSNS-1) will be arranged as a factorial in a randomized complete block design with four replicates (16 treatments).

A consistent treatment protocol was observed and followed at all participating trial locations. Inoculants as indicated, their formulation, and method of application was consistent across all sites. What did differ between locations was such practical aspects of date of seeding, method of seeding (direct versus worked), plot size, harvest date, etc., all variables that would be expected to differ among a multi-organizational study such as this.

## Trial Design and Treatments.

This study was established in a randomized complete block design with four replications. Treatments are shown in Table 1.

A seeding population of 43–54 plants/m<sup>2</sup> (4–5 plants/ft<sup>2</sup>) was targeted after accounting for seed size, % germination, and assuming 90% emergence. The thousand kernel weight (TKW) for Snowdrop was 306.1 g with a germ % of 98, SSNS-1 had a TKW of 339.1 g and a germ % of 89. 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. The CSIDC trial was seeded on May 5.

**Table 1. Varieties and Inoculation Formulation and Rate of Application.**

Treatments	Faba bean Variety	Inoculants
1	Snowdrop	Un-inoculated check
2	Snowdrop	Nodulator peat for Faba Beans
3	Snowdrop	0.5x rate TagTeam Granular for Faba bean
4	Snowdrop	1x rate TagTeam Granular for Faba bean
5	Snowdrop	2x rate TagTeam Granular for Faba bean
6	Snowdrop	Nodulator peat for Faba Beans + TagTeam granular for Faba Beans at 0.5x
7	Snowdrop	Nodulator peat for Faba Beans + TagTeam granular for Faba Beans at 1x
8	Snowdrop	Nodulator peat for Faba Beans + TagTeam granular for Faba Beans at 2x
9	SSNS-1	Un-inoculated check
10	SSNS-1	Nodulator peat for Faba Beans
11	SSNS-1	0.5x rate TagTeam Granular for Faba bean
12	SSNS-1	1x rate TagTeam Granular for Faba bean
13	SSNS-1	2x rate TagTeam Granular for Faba bean
14	SSNS-1	Nodulator peat for Faba Beans + TagTeam granular for Faba Beans at 0.5x
15	SSNS-1	Nodulator peat for Faba Beans + TagTeam granular for Faba Beans at 1x
16	SSNS-1	Nodulator peat for Faba Beans + TagTeam granular for Faba Beans at 2x

Supplemental fertilizer as 11-52-0 was applied at all locations at rates of 20–30 kg P<sub>2</sub>O<sub>5</sub>/ha and either side-banded or seed-placed, depending upon location. Two inoculants, Nodulator peat seed treatment (BASF) and TagTeam (Monsanto BioAg), a granular inoculant, were utilized in the study. Nodulator was applied to the seed at a recommended rate of 1.22 gm per kg of seed. All sites applied the Nodulator peat inoculant to the seed by damp inoculation method of applying 2.0 ml water to a kg of seed, adding 1.22 gm inoculant, and mixing well in either a large plastic bag or plastic container. Seed-placed peat inoculant was applied to seed immediately prior to seeding. TagTeam granular inoculant was metered through seeded boxes or pre-weighed and applied through a cone on the seeder. TagTeam granular inoculant was seed-placed at the recommended rate of application for the row spacing used at each testing site.

At all sites, plots were maintained weed free by herbicide burn-off prior to seeding, post herbicide applications, and, in many cases, significant hand weeding. Most sites received an in-season fungicide application for disease prevention; at the Swift Current location, weather conditions were such that fungicide application was not deemed needed.

Harvest at all locations was accomplished with a small plot combine in a straight cut operation and/or by hand harvesting procedures. At some locations, Reglone was applied in a desiccation application, at other locations natural dry down occurred.

## Results

Spring soil test analysis for the trial is shown in Table 2.

**Table 2. ALS Soil Test Results, Sampled Spring 2016.**

Depth (cm)	Nutrients (ppm)			
	NO <sub>3</sub> -N	P	K	SO <sub>4</sub> -S
0 - 15	6	8	173	10
15 - 30	4			>24
30 -- 60	6			24
Organic Matter	1.8%			
pH (0 - 15 cm)	8.0			
pH (15 - 30 cm)	8.2			
pH (30 - 60 cm)	8.5			
E.C. (0 - 15 cm)	0.2 mS/cm (1soil:2 water extract)			
E.C. (15 - 30 cm)	0.3 mS/cm (1soil:2 water extract)			
E.C. (30 - 60 cm)	0.5 mS/cm (1soil:2 water extract)			

## ICDC 2016 Trial

Seed quality and agronomic plant characteristics collected are tabulated in Table 3. Factorial statistical analysis is given in Table 4. Faba bean varieties differed significantly in their average final yield, with the coloured tannin variety, SSNS-1, having significantly higher yield than the zero tannin variety, Snowdrop. Inoculation had no statistically significant response on grain yield of either variety. Yields were high and soil test for available nitrogen (N) was considered deficient so a positive response to inoculation might have been expected. Lack of response is speculative, but a couple of possibilities are worth considering. Biological N-fixation in faba bean occurs with the infection of *Rhizobium leguminosarum*, which is native to prairie soils, but can also persist in soil from previous commercial inoculation applications. This field, the entire CSIDC Research Station, has a long and frequent history of pulse production and it might be that a “background” indigenous population of *R. leguminosarum* mitigated fresh commercial inoculant applications. Roots of the uninoculated control plots did have nodules formed on the root system, although in fewer numbers than inoculated treatments. Commercial inoculants utilized in the trial were stored in refrigerated conditions prior to use, so inoculant damage or reduced titre is not considered a contributing issue. To achieve the grain yields and biomass, recorded N was required; if plant demand was not fully satisfied by biological N-fixation, it must have been provided through soil availability. Soil test analysis indicated a deficient level of available N. One must consider that either the soil sample was subject to error (improper sampling, storage and handling, or drying) or soil analysis itself was inaccurate. Neither of these possibilities can be proved, but standard operating procedures for both suggest errors here are unlikely. Another possibility is that with the well above-normal precipitation and warm extended growing season, a large amount of N was made available to the plants through mineralization. Again, without measurable evidence, this is speculative, but the research literature indicates it does occur. The effect of inoculation on faba bean yield is illustrated in Figure 1.

Inoculation had no impact on either protein content, test weight, seed size, plant height, or mid-season biomass. Varieties did differ in every above-mentioned observation, other than seed weight and plant population. Results from this year will be combined with results from trial sites located at Indian Head, Swift Current, Scott, Melfort, Yorkton, Indian Head, and Redvers to complete a full report for 2016.

**Table 3. Impact of Inoculant on Seed Quality & Agronomics of Faba Bean, CSIDC 2016.**

Entry	Variety	Inoculant	Yield (kg/ha)	Protein (%)	Test Weight (kg/hl)	Seed Weight (mg)	Biomass (T/ha)	Height (cm)	Plant Population (plants/m <sup>2</sup> )
1	Snowdrop	Check	6581	28.5	81.1	260	9.9	142	45
2	Snowdrop	Nod peat	6775	28.2	80.3	276	13.4	143	45
3	Snowdrop	0.5X TT	6734	28.5	80.4	266	9.8	142	45
4	Snowdrop	1.0X TT	6727	28.5	80.4	265	11.8	139	44
5	Snowdrop	2.0X TT	6627	28.4	80.3	279	11.3	140	41
6	Snowdrop	Nod + 0.5X TT	6777	28.3	80.4	243	12.1	140	47
7	Snowdrop	Nod + 1.0X TT	6482	28.8	80.1	231	10.9	142	46
8	Snowdrop	Nod + 2.0X TT	6736	28.5	79.9	265	10.4	143	46
9	SSNS-1	Check	7109	30.5	85.7	265	10.7	150	45
10	SSNS-1	Nod peat	7053	30.1	85.0	263	10.6	147	43
11	SSNS-1	0.5X TT	6887	30.8	84.9	265	11.1	152	43
12	SSNS-1	1.0X TT	7258	30.8	84.7	271	9.8	147	44
13	SSNS-1	2.0X TT	7268	30.4	84.6	285	8.9	146	44
14	SSNS-1	Nod + 0.5X TT	7223	30.4	84.6	276	10.7	146	45
15	SSNS-1	Nod + 1.0X TT	7313	30.3	84.4	266	10.0	146	46
16	SSNS-1	Nod + 2.0X TT	7304	30.1	85.0	265	10.5	150	46
LSD (0.05)			404	0.6	1.0	NS	NS	4.7	NS
CV			4.1	1.5	0.9	8.4	16.4	2.3	8.1

NS = Not significant

**Table 4. Factorial Analysis of Varieties and Inoculation on Seed Quality & Agronomics of Faba Bean, 2016.**

Treatment	Yield (kg/ha)	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Biomass (T/ha)	Height (cm)	Plant Population (plants/m <sup>2</sup> )
<b>Variety</b>							
Snowdrop	6680	28.4	80.4	261	11.22	141	45
SSNS-1	7177	30.4	84.9	269	10.30	148	45
LSD (0.05)	139	0.2	0.4	NS	0.91	1.7	NS
CV	4.0	1.5	0.9	8.7	17.0	2.3	7.8
<b>Inoculant</b>							
Check	6845	29.5	83.4	262	10.33	146	45
Nod peat	6914	29.1	82.7	269	12.00	145	44
0.5X TT	6810	29.6	82.7	265	10.48	147	44
1.0X TT	6993	29.6	82.5	268	10.84	143	44
2.0X TT	6947	29.3	82.5	282	10.93	143	43
Nod + 0.5X TT	7000	29.3	82.5	260	11.41	145	46
Nod + 1.0X TT	6897	29.5	82.2	249	10.41	144	46
Nod + 2.0X TT	7020	29.4	82.5	265	9.68	147	46
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS

NS = Not significant

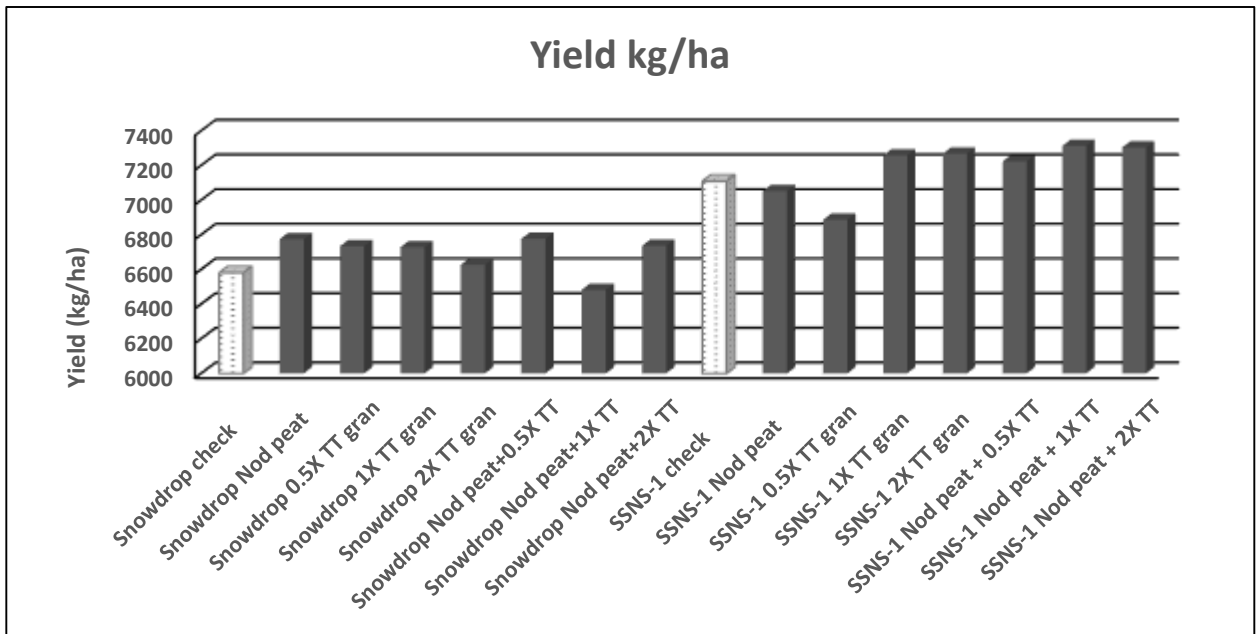


Figure 1. Effect of Inoculation on Faba Bean Grain Yield, ICDC 2016.

# Management of Irrigated Marrowfat Field Pea

## Funding

- Agricultural Demonstration of Practices and Technologies (ADOPT) GF2

## Project Leads

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture
- Garth Weiterman, Irrigation Agrologist

## Co-operators

- Joel Peru, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture
- Wes Walker, Grower, Rudy Agro, SSRID

## Project Objective

This project demonstrated irrigation scheduling practices for production of marrowfat field pea. The original project indicated that phosphate fertilization practices for pea would also be evaluated. This objective was omitted because the field chosen for the project was located on potato stubble, which is often very high in phosphorus due to heavy phosphorus fertilization for potato production. Field pea is strongly mycorrhizal and is effective at scavenging for phosphorus in soils.

## Demonstration Plan

A soil sample was submitted to ALS Laboratories for analysis. Phosphorus was certainly adequate for field pea, but not as high as expected for potato stubble.

## Demonstration Site

The project was located at NW35-29-8-W3 on Asquith fine sandy loam. Potato stubble is traditionally high in residual nutrients. A field sample was collected to check soil fertility levels (Table 1). Test results show that phosphate fertility was considered medium. Peas are thought to be relatively non responsive to phosphate fertilizer because of their association with mycorrhiza fungi.

**Table 1. Soil analysis of field selected for irrigated marrowfat pea demonstration (0-6")**

Legal Location	pH	EC (dS/m)	Nutrients (ppm)								
			N	P	K	S	Cu	Fe	Mn	Zn	B
NW35-29-8-W3	7.5	0.2	16	26	136	7	0.5	22	4.2	0.9	1.0

## Project Methods and Observations

The marrowfat variety, Lan 2035, was sown at 220 lb/ac, targeting 6 plants/sq. ft. No nitrogen was applied with the seed other than that found in 40 lb 12-51-0 placed with the seed. For herbicides, glyphosate at 356 g a.i. was applied mixed with 330 g a.i./ac trifluralin three days prior to cultivating. Once the crop was up, 80 g metribuzin was applied at the 5th leaf stage. Pyraclostrobin was applied for control of mycosphaerella blight at initiation of flowering. On July 19, hail fell on the northern portion of the field, damaging 70% of the pods.



## Irrigation

The initial plan was to maintain the north side of the pivot at a moisture status between 75% and 100% of field capacity. The south side of the pivot was to be kept drier by allowing the stand to dry out to 60% of field capacity. Precipitation was fairly uniformly distributed during the growing season, and even excessive on occasion in July. Thus, very little irrigation was applied due to the frequent rainfall. The pivot applied water on three dates during the latter half of June. The rainfall and irrigation is summarized in Table 2. The *Alberta Irrigation Manual* suggests a range of water use for Southern Alberta of 300–370 mm through the growing season. The water use recorded for the site is near the upper range of the projected water use for a growing season. The weather records indicate 27 rain events during the growing season in 2016, compared to only three irrigation events, all within the month of June. Irrigation at the site is not as simple as turning a tap on. The water must be ordered from the irrigation district with a lead time of as much as 48 hours before water can be delivered. This introduces another balancing act between when water is ordered, when it can be delivered, and when it is required. Cloud bursts associated with thunderstorms frequently change the need for water from one extreme to the other. This makes the accuracy of weather forecasts extremely valuable for scheduling irrigation. This becomes an art when crops are young and do not tolerate excessive moisture well. Field pea roots are sensitive to excessive moisture. Several times during the month of June, the crop was drying out too much, but rain came just in time to prevent undue moisture stress for the crop. The threat of aphanomyces to pulse crops is especially real when water logging of the soil profile takes place. We were fortunate that the site is lighter textured and thus reduced this risk to field pea.

**Table 2. Precipitation and Irrigation for 2016 at the Field Pea Site**

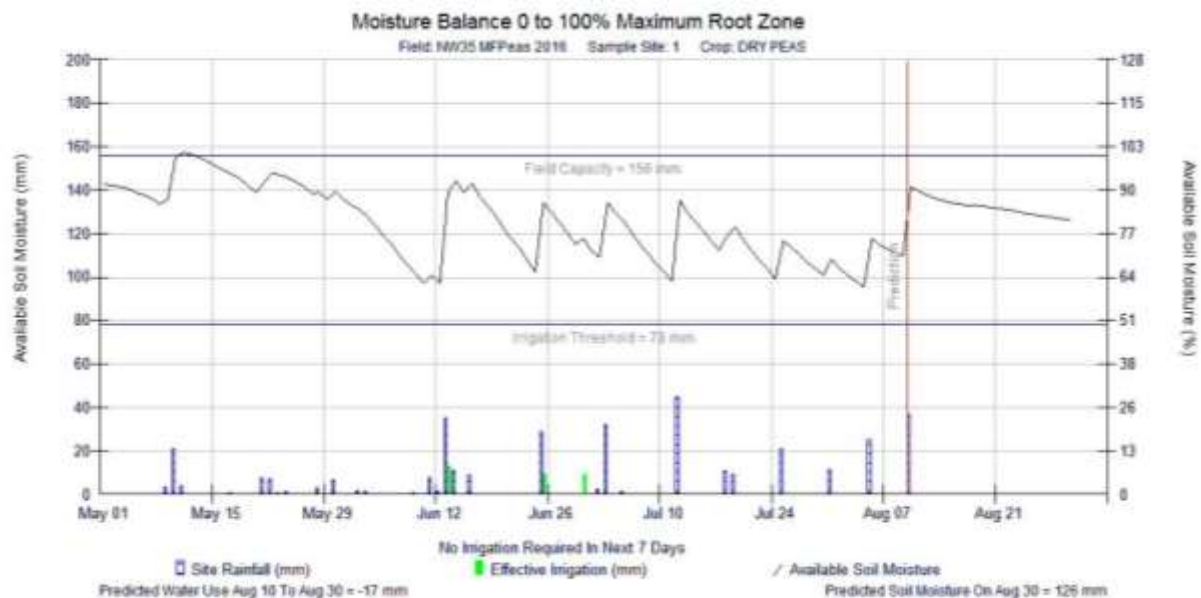
Month	Rainfall (mm)	Irrigation (mm)	Total (mm)
May	51	0	51
June	92	32	124
July	132	0	132
August	63	0	63
<b>Total</b>	<b>338</b>	<b>32</b>	<b>370</b>

Plant tissue samples were collected from both irrigated areas as another means of evaluating the fertility status of the field pea. These results are reported in Table 3. Interpretative guidelines suggest that 10-20 ppm boron in field pea is marginal for a healthy growing pea plant. No abortion of flowers was observed in the field, but application of boron will be tested on both field pea and canola in 2017. Rainfall quantities and frequency in 2016 may have contributed to inadequate boron supply for field pea. The site was a potato stubble field with a normal soil test boron level. Work with soil test boron has not been successful for predicting crop response.

Yield samples were weighed with a scale at the local cleaning plant. No difference was observed between the two halves of the pivot: both produced 33 bu/ac of marrowfat pea seed.

**Table 3. Plant Tissue Analysis of Field Pea Samples Collected from Irrigation Treatments at the Early Flower Stage at Marrowfat Field Pea Site Demo (June, 2016).**

Treatment (Fertilizer/ac)	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g
<b>Wetter treatment</b>											
Whole plant	5.9	0.52	3.2	0.31	2.2	0.54	6	105	112	69	15
Young field pea leaves	5.4	0.49	2.3	0.33	1.1	0.41	7	101	55	32	15
<b>Drier treatment</b>											
Young field pea leaves	5.6	0.54	3.2	0.33	1.0	0.35	7	117	50	25	14
<b>Threshold</b>	<b>4.5</b>	<b>0.25</b>	<b>1.5</b>	<b>0.20</b>	<b>2.0</b>	<b>0.3</b>	<b>7.0</b>	<b>50</b>	<b>30</b>	<b>25</b>	<b>25</b>



## Final Discussion

It was difficult to manage water for the project to achieve the objective of the demonstration. Several heavy showers occurred during June and July, which prevented maintaining the drier treatment. According to the graph of rainfall and irrigation over the growing season, 27 rain events occurred at the site in 2016. As such, the project objective to compare two moisture regimes could not be achieved.

## Acknowledgements

- Wes Walker and Rudy Agro provided the field for the marrowfat pea project. Garth Weiterman provided assistance with weather records and irrigation scheduling.

# Phostrol Evaluation for Field Pea Root Rot Control

## Funding

- Irrigation Crop Diversification Corporation

## Project Lead

- Garry Hnatowich, PAg, Research Director, ICDC (Project Lead)
- Phil Bernardin, Engage Agro

## Objectives

The objective of this trial was to determine if Phostrol (53.6% mono- and dibasic sodium, potassium, and ammonium phosphites formulated as a liquid flowable), a foliar fungicide has an effect on root rot incidence in field pea.

## Research Plan

This trial was conducted at the CSIDC off station site and seeded with the Green field pea variety CDC Striker on May 31. Plot size was 1.5 m x 30 m. All plots received 25 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0 as a side banded application and Nodulator granular inoculant at a rate of 5 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 Odyssey (imazamox + imazethapyr) and Equinox (tepraoxydim). Supplemental hand weeding was conducted. Phostrol was applied June 24.

The trial was arranged in a randomized complete block design with four replicates. 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%. Reglone (diquat) was applied August 25 and harvest occurred on August 30.

## Results

Yields obtained in the study were very low (Table 1) and possibly related to the late seeding of this trial. Results are likely not a true reflection or fair evaluation of the product applied. Plants collected during the growing season were confirmed to have an incidence of Aphanomyces root rot. This trial should be repeated at typical planting dates.

**Table 1. Data collected in 2016.**

Treatment	Yield (kg/ha)	Yield (bu/ac)	% Protein	Test weight (kg/hl)	Seed weight (mg)
Control	966	14.4	22.3	82.4	199
Phostrol	1064	15.8	22.6	82.4	201
LSD (0.05)	NS	NS	NS	NS	NS
CV (%)	18.2	18.2	1.5	0.8	1.7

# Demonstration of Narrow versus Wide Row Dry Bean Production

## Funding

- Agricultural Demonstration of Practices and Technologies (ADOPT) GF2

## Project Lead

- Jeff Ewen, AAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture
- Garry Hnatowich, PAg, Research Director, ICDC
- Co-investigators: Dr. Kirstin Bett, Crop Development Centre

## Organizations

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

## Objectives

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

## Research Plan

Trials were established at the Canada-Saskatchewan Irrigation Centre (CSIDC) in Outlook and at Riverhurst, SK. The trial at CSIDC was established and maintained by ICDC, the trial at Riverhurst by the CDC. Trials were established in a randomized split plot design with four replications; main plots were by row spacing size and subplots were by variety.

The CSIDC solid or narrow row plots were set at 20 cm (8") row spacing of four rows, the wide row was set at 60 cm (24") spacing of two rows. At Riverhurst, narrow rows were set at 30 cm (12") spacing of three rows and wide row at 60 cm (24") of two rows. Three market class dry beans, two varieties of 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 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/m<sup>2</sup> for narrow row production and 25 plants/m<sup>2</sup> for wide row production. Planting rates for each system were adjusted for variety seed size and per cent 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 Stress Shield 600 (imidacloprid) for wireworm control. Both trials at CSIDC and at Riverhurst were seeded May 27, 2016.

At CSIDC, weed control consisted of a pre-plant soil-incorporated application of granular Edge (ethalfluralin) and a post-emergent application of Basagran (bentazon) + Assure II (quizalofop-P-ethyl), supplemented by one in-season cultivation for wide row trials, and periodic in-row hand weeding. The trial received a tank-mix application of Priaxor DS (fluxapyroxad & pyraclostrobin) and Copper 53W (tribasic copper sulphate) fungicide at flowering for white mold, anthracnose and bacterial blight control.

At Riverhurst weed control consisted of a pre-plant soil-incorporated application of granular Edge (ethalfuralin) and a post-emergent application of Basagran (bentazon) + Solo (imazimox) on June 20, supplemented by one in-season cultivation for wide row trials on July 5, and periodic in-row hand weeding. The trial received a fungicide application of Lance WG (boscalid) on July 18, Kocide (copper hydroxide) on July 20, and tank-mix application of Allegro (fluazinam) and Kocide (copper hydroxide) on July 31 for white mold, anthracnose, and bacterial blight control.

All plots were undercut to facilitate harvest at CSIDC. At Riverhurst, narrow row plots were swathed on August 30 and wide row plots were undercut on September 12 to facilitate harvest. Plots were harvested September 28 at CSIDC and September 15 at Riverhurst.

In-season irrigation at CSIDC involved two applications in June for a total of 30 mm (1.2"). At CSIDC, total precipitation was 407 mm (16"). In-season irrigation at Riverhurst involved five applications between July 9 and July 25, for total of 63.5 mm (2.5"). Total precipitation at Riverhurst was 432 mm (17").

## Results

Complete results are shown in Table 1. Yield results from both sites showed a substantial yield increase for solid seeded that is statistically significant. Excellent performance was shown by all varieties for both wide and narrow row production. Statistics for agronomic attributes were evaluated at the Outlook site and no parameters were found to be statistically significant.

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

Treatment	CSIDC Yield		Riverhurst Yield	
	kg/ha	lb/ac	kg/ha	lb/ac
<b>Row Spacing</b>				
Solid	3760	3354	4361	3890
Wide	2440	2177	3198	2854
Row Spacing LSD (0.05)	351	386	339	302
CV	13.7	13.7	9.2	9.2
<b>Variety</b>				
<b>Pinto</b>				
AC Island	2949	2631	3489	3112
CDC WM-2	2937	2620	3224	2876
<b>Black</b>				
CDC Blackstrap	3240	2890	3866	3448
CDC Jet	3701	3301	4177	3726
<b>Navy</b>				
Envoy	2458	2192	3726	3324
Portage	3317	2958	4194	3741
Variety LSD (0.05)	433	386	355	317
<b>Row Spacing x Variety</b>				
LSD (0.05)	S	S	S	S

S = Significant; NS = Not Significant

## Final Discussion

Irrigated dry bean in Saskatchewan has primarily been grown in wide row production to facilitate inter-row cultivation and undercutting. Wide row production has been proven to be successful in the production of dry beans, but the exponential cost of owning specialized row crop equipment,

such as planters, inter-row cultivators, and under-cutters, creates a barrier for including dry beans in crop rotation.

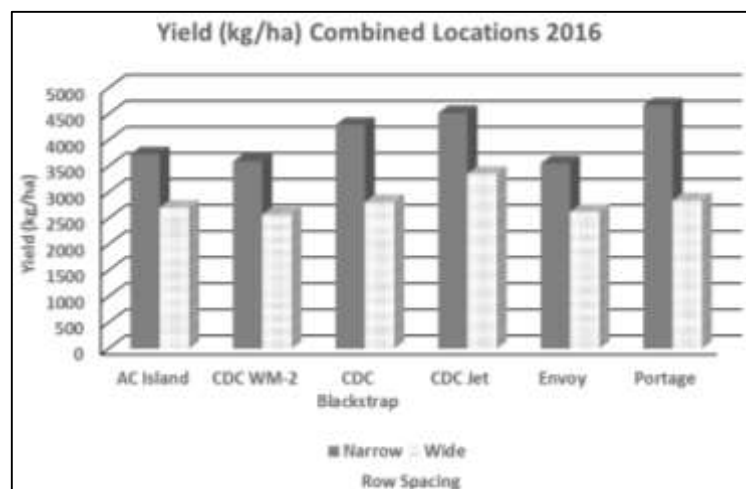
**Table 2. Dry Bean Agronomic Characteristics Observed at CSIDC.**

<b>Treatment</b>	<b>Test Weight (kg/hl)</b>	<b>Flower (days)</b>	<b>Maturity (days)</b>	<b>Lodge Rating 1=upright 5=flat</b>	<b>Pod Clearance (%)</b>	<b>Height (cm)</b>	<b>Plant Stand (plants /m<sup>2</sup>)</b>
<b>Row Spacing</b>							
Solid	78.6	48	95	1.7	76	53	26
Wide	79.0	47	95	1.6	76	54	19
Row Spacing LSD (0.05)	NS	NS	NS	NS	NS	NS	6
CV	2.1	2.1	1.7	37.1	7.1	11.1	15.7
<b>Variety</b>							
<b>Pinto</b>							
AC Island	80.1	45	94	3.0	66	60	27
CDC WM-2	77.5	45	92	1.6	78	51	15
<b>Black</b>							
CDC Blackstrap	76.2	48	94	1.2	81	48	15
CDC Jet	78.1	53	98	1.1	79	57	35
<b>Navy</b>							
Envoy	80.6	49	94	1.9	74	50	23
Portage	80.4	46	97	1.1	80	55	19
Variety LSD (0.05)	1.7	1.0	1.7	0.6	5.6	6.1	4
<b>Row Spacing x Variety</b>							
LSD (0.05)	NS	2.1	NS	NS	NS	NS	NS

S = Significant; NS = Not Significant

Narrow row production is common in other parts of Western Canada for growing dry beans, primarily on dryland fields in Southern Manitoba. Narrow row production allows producers to use common dryland farming equipment such as air seeders and swathers. The use of common dryland farm equipment already available results in lower production costs.

The results from this demonstration show that narrow-row production is equivalent or even more productive than the traditional wide row production in almost all different classes and varieties.



**Figure 1. Yield—CSIDC & Riverhurst Combined.**

ICDC intends to continue evaluating wide row vs. narrow row dry bean production in 2017. The goal will be to move to field scale demonstration in the next couple of years if similar trends continue with this demonstration.

## Acknowledgements

- CDC and the technicians and summer staff who helped with the project.

# Foliar Application of Alpine Molybdenum to Irrigated Lentil

## Funding

- Irrigation Crop Diversification Corporation

## Project Lead

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

## Co-operators

- Anthony Eliason, Grower, Broderick, SK
- Larry Kendall, Grower, Macrorie, SK
- Greg Oldhaver, Grower, Cabri, SK
- Blake Weatherald, District Sales Manager, Alpine Plant Foods

## Project Objective

The project investigated the potential seed yield benefit of applying sodium molybdate dissolved with G22 Alpine liquid to lentil foliage during herbicide application. The micronutrient is typically applied in furrow with seedrow placed liquid fertilizer when planting lentil on soils with a pH of less than 5.6.

## Project Background

The enzyme nitrogenase biologically fixes nitrogen gas from the atmosphere as ammonia within the root nodules of legumes. Molybdenum is an essential component in the enzyme. Molybdenum is taken up by plant roots following release into the soil solution by weathering of soil minerals. It is considered adequate for most Saskatchewan soils. Molybdenum is the only micronutrient whose availability increases as soil pH increases; its solubility increases 100 fold with each pH unit increase. Acidic soils with sandy texture are prone to molybdenum deficiency when planted to legumes

## Demonstration Plan

In Idaho, plant tissue levels of molybdenum between 0.1 and 1.2 ppm are known to be adequate for annual legumes and safe for animal consumption. For alfalfa grown in California, plant tissue levels under 0.3 ppm are considered deficient. In this demonstration, plant tissue samples were collected from the lentil fields during the seedling stage prior to herbicide and fertilizer application to determine levels of molybdenum.

For this demonstration, Alpine sodium molybdate was dissolved in water and added to the recommended quantity of liquid G22 fertilizer for either in-row seed placed or foliar applied demonstrations. Seed row placed molybdenum was applied after being dissolved in water and adding to 3 L G22 liquid fertilizer/ac with 20 g/ac sodium molybdate applied in the seed row at the time of seeding. Molybdenum was applied at 20 g sodium molybdate fertilizer per acre, which equates to 8 g Mo/ac. For the foliar post emergent treatments, G22 fertilizer is applied at 2 L/ac

tank mixed with Odyssey herbicide. Molybdenum was applied at the same rate of 20 g sodium molybdate dissolved in water and tank mixed with the G22 liquid fertilizer and Odyssey herbicide.

## Demonstration Site

Three sites were selected for this demonstration. No irrigated growers using the Alpine delivery system for in furrow nutrient placement on lentils could be identified. Instead, a grower using this system for dryland production of lentil was chosen for this demonstration. The legal location of this demonstration was SH32-19-18 near Cabri, SK. The soils are mapped as Sceptre heavy clay formed on lacustrine parent material.

Two irrigated demonstrations were conducted at Broderick and Macrorie with the foliar applied molybdenum tank mixed with Odyssey herbicide and Alpine G22 fertilizer. Legal locations for the demonstrations were 14-30-6-W3 and SE22-27-8-W3 respectively. Soils for the Broderick site were Hanley to Trossach loam formed on moderately fine textured moderately saline calcareous silty glacio lacustrine deposits. Soils for the Macrorie site were Weyburn Orthic Dark Brown formed on medium to moderately fine-textured glacial till.

## Project Methods and Observations

The soil test collected for Cabri demonstration was analyzed by PRS probe with the following fertilizer recommendation: 8-10-14-6 as a granular blend plus 16 liter G22/ac. Molybdenum as sodium molybdate was applied at 20 g/ac tank mixed with the Alpine G22 applied at 2 L/ac.

The soil test taken from SE22-27-8-W3 at the Kendall Farm near Macrorie showed a pH of 6.6 with electrical conductivity of 0.4 on a clay loam soil. Soil test levels for a 0-12" sampling depth were 41 lb NO-N, 34 lb Modified Kelowna P, 1080 lb Modified Kelowna K and 77 lb SO<sub>4</sub>-S. Fertilizer recommendations for 25 bu/ac lentils at this site were 25 lb P<sub>2</sub>O<sub>5</sub>/ac.

Plant tissue samples were collected from each field before herbicide timing (just prior to first flower of the lentil). These results are reported in Tables 1 and 2. The nutrient status of the plants was adequate at all three locations. Molybdenum concentrations in lentil at Broderick and Macrorie appear low, but the intensity of green color in the plants did not improve from the application of the mixture of liquid fertilizer and Odyssey herbicide. Boron tissue levels were also low at this site. The lack of seed yield response also points toward holding off adopting this practice until further demonstration has proven its effectiveness.

**Table 1. Plant Tissue Analysis of Lentil Samples Collected at 9 Node Stage at Cabri Lentil Mo Demonstration: Sodium Molybdate Added in Furrow with the Seed (June, 2016)**

Treatment (Fertilizer/ac)	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g	Mo ug/g
None	2.3	0.26	2.1	0.20	1.0	0.26	8	363	39	21	9	0.65
Seed placed Mo	ND	0.28	2.0	0.19	0.9	0.24	7	75	41	22	9	
<b>Threshold</b>	<b>2.5</b>	<b>0.25</b>	<b>2.0</b>	<b>0.20</b>	<b>0.5</b>	<b>0.20</b>	<b>5</b>	<b>100</b>	<b>20</b>	<b>15</b>	<b>20</b>	<b>0.10</b>



**Table 2. Plant tissue analysis of lentil above ground growth collected from demonstration site at the 6 node stage (June, 2016)**

Treatment (Fertilizer/ac)	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g	Mo ug/g
<b>Broderick</b>												
None	4.0	0.35	3.3	0.30	1.00	0.33	7	386	46	34	10	0.05
<b>Macrorie</b>												
None	4.3	0.39	3.6	0.31	1.23	0.37	6	254	62	47	13	0.05
<b>Threshold</b>	<b>2.5</b>	<b>0.25</b>	<b>2.0</b>	<b>0.20</b>	<b>0.5</b>	<b>0.20</b>	<b>5</b>	<b>100</b>	<b>20</b>	<b>15</b>	<b>20</b>	<b>0.10</b>

Seed yields of lentil were not increased by foliar application of liquid fertilizer or molybdenum. The data suggests that the liquid fertilizer and molybdenum may have reduced the lentil seed yield. None of the quality parameters measured (bushel weight, grade, or thousand kernel weight) showed an improvement with the foliar product application to lentil. One dramatic observation from this growing season was the virtual failure of seed yield when several inches of rainfall occurred in a single event. Yields dropped from 20–25 bu/ac (Broderick) to below 10 bu/ac (Macrorie) when the roots were subjected to waterlogging from heavy rainfall. The moist growing season likely played a role in the lack of increased seed yield from the treatments.

**Table 3. Seed yield of lentil determined at harvest**

Treatment (Fertilizer/ac)	Yield (lb/ac)	Bu Weight (lb/bu)	Grade	g/1000 seeds
<b>Broderick</b>				
Control	1510	49.7	X3	ND
G22	1490	43.7	X3	ND
Mo	1470	ND	X3	ND
G22 + Mo	1270	47.4	X3	ND
<b>Macrorie</b>				
Control	730	52.0	Sample	21.8
G22	600	52.3	Sample	21.9
Mo	590	53.7	Sample	22.3
G22 + Mo	610	53.8	Sample	22.3
<b>Cabri</b>				
G22	1975	ND	ND	ND
G22 + Mo	2055	ND	ND	ND

## Final Discussion

Lentil does not respond well to pampered treatment. The rainfall and limited irrigation applied to both irrigated sites provided adequate moisture in 2016. The yield data suggests that Mo levels in the soils were adequate to meet the needs of irrigated lentil even though plant tissue levels at an early growth stage suggested that the quantity of molybdenum in the seedling lentil was low. The application of G22 with the Odyssey did not improve lentil grain yield.

Soils prone to deficiency of molybdenum are sandy with a pH of less than 5.5. There are no soils in the irrigated region surrounding Lake Diefenbaker with soil pH this low. The irrigated region is characterized by soils with pH higher than 7.0. The demonstrations did not meet the yield expectations of the irrigators, but they also show the negative impact of significant rainfall when

lentils do not require additional moisture. Both sites received more moisture than was required. Yields at the Macrorie site were hurt by a four inch downpour, leading to temporary waterlogging. Lentil roots are not able to tolerate such moisture levels when the moisture pattern stays wet.

### **Acknowledgements**

Alpine Plant Food supplied the sodium molybdate and the G22 for application to the lentils at both sites. ICDC provided the tissue testing and use of a weigh wagon to measure the seed yield for the strip trials. Anthony Eliason, Larry Kendall, and Greg Oldhaver supplied the sites and performed the field operations to conduct the demonstration.

# **Evaluation of Granular Zinc Applied to Low Soil Test Levels on Irrigated Lentils**

## **Funding**

- Irrigation Crop Diversification Corporation

## **Project Lead**

- Jeff Ewen, AAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture

## **Co-operators**

- Lorne Jackson, Grower, Riverhurst Irrigation District

## **Project Objective**

The objective was to evaluate the response of irrigated lentils to zinc fertilizer based soil tests showing low levels of zinc.

## **Project Plan**

A field in Riverhurst Irrigation District identified as having low soil test zinc levels was seeded to lentil in 2016. Soil testing prior to seeding evaluated zinc levels on three different slope positions of the field. Granular zinc was applied in the seed row to one half of the 130 acre centre pivot field and the other half was left untreated to compare treated versus untreated yield. Yield mapping was used to evaluate treatment success. Soil testing was completed again in the fall to evaluate whether the different slope positions showed increased nutrient levels compared to the spring test results.

## **Demonstration Site**

Soil samples were taken in the spring from the different application areas for testing to determine residual nutrients and to determine required zinc application. The red lentil variety, Maxim, was seeded May 3 and 4. Granular zinc was applied in the seed row at a rate of 3.3 lbs/ac. Agronomic details are shown in Table 1. Extensive monitoring occurred weekly throughout the growing season and water needs were predicted using the feel method and weather forecast. Visual differences between treatments were also evaluated. A harvest yield map was used to evaluate treated versus untreated areas.

## **Final Discussion**

Zinc is an important micronutrient and is linked to producing high yielding, high quality lentil. Low soil test levels occur in Saskatchewan fields, mostly due to soil erosion. Zinc deficiencies can be difficult to detect because small areas of the field, such as eroded knolls, may show the deficiency, while mid slopes and depression areas may not. This means that general composite soil sampling will not necessarily detect the deficiency.

For this project, soil samples were taken from the three different slope positions and on the north and south sides of the field in the spring to evaluate zinc levels. Both halves of the field were seeded identically, except 3.3 lb/ac of zinc was applied with the seed on the north half of the field. The field was evaluated throughout the growing season; no visual differences were detected. The field was harvested on September 3, 2016, and a yield map was produced to evaluate the treated versus untreated areas. No yield differences were detected, as both sides had an average yield of 30 bu/ac. Fall soil samples were planned, but due to the abnormal wet field conditions this fall, soil samples were not collected.

This project was designed as a single-year evaluation and will not be continued. ICDC will continue to evaluate micronutrient-deficient soils under irrigation in future demonstrations.

**Table 1. Crop Management.**

Location of Soil Test (0–6")	Nutrients (lbs/ac)				
	N	P	K	S	Zn (ppm)
N ½ (Top Slope)	12	42	580	10	0.3
N ½ (Mid Slope)	14	22	540	180	0.4
N ½ (Bottom Slope)	11	19	560	9	0.3
S ½ (Top Slope)	15	17	600	12	0.2
S ½ (Mid Slope)	14	24	500	15	0.3
S ½ (Bottom Slope)	24	62	1080	28	1.1
Seeding					
Date	May 3–4, 2016				
Variety	Maxim				
Rate	55 lbs/ac				
Harvest					
Date	September 3, 2016				
Available Moisture					
	mm	inches			
Rainfall	431.8	17.0			
Irrigation	0	0			
Herbicide					
Date	June 2, 2016				
Product	Solo and Assure II				
Fungicide					
Date	June 27, 2016		July 8, 2016		
Product	Priaxor		Delaro		

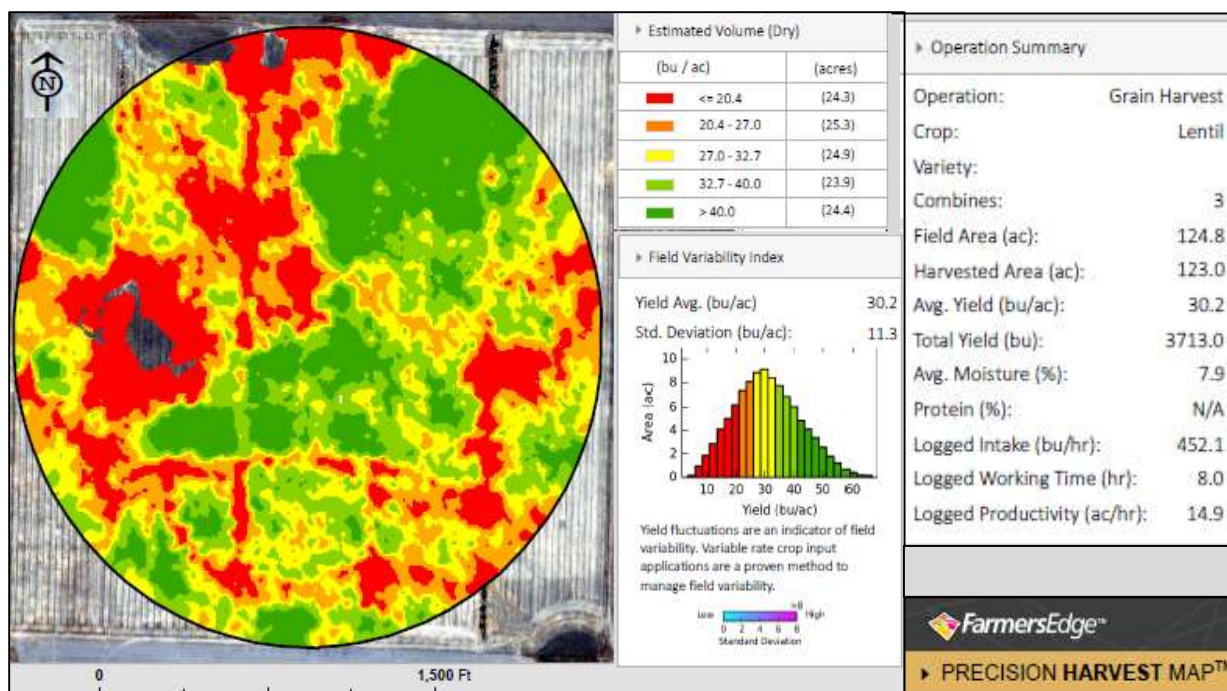


Figure 1. Farmers Edge Yield Analysis Map.

## Acknowledgements

- Farmers Edge – Soil Sampling and Yield Analysis.

# **Demonstration of Potential Irrigated Crops: Quinoa, Hemp, Borage, Marrowfat Pea, Niger**

## **Funding**

- Agricultural Demonstration of Practices and Technologies (ADOPT) GF2

## **Project Lead**

- Joel Peru, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture
- Garry Hnatowich, PAg, Research Director, ICDC (Project Lead)
- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture

## **Organizations**

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

## **Project Objective**

This demonstration was undertaken to provide producers with the opportunity to view unfamiliar crops and compared different varieties to help producers decide how to incorporate new crops into their rotation. Producers are interested in new crop opportunities to potentially capitalize on favorable markets and for agronomic reasons, such as managing disease and pest problems. Recent trends have shown that irrigating farmers in the Lake Diefenbaker Development Area are slowly adopting new crops, but the majority of acres are still seeded to wheat and canola.

This demonstration also intended to show variances between the different crop varieties available in Saskatchewan. It is important to know what varieties are available and how they perform in a specific area so producers can make informed decisions when choosing crops. The project also demonstrated how well adapted the crops are for growing under irrigation as opposed to dryland.

Producers seeking to control disease and pests consider new types of crops to add to their rotation. New specialty crops are becoming available and markets for them are being, or have already been established. However, there is limited agronomic knowledge about these crops when grown under irrigation. This demonstration evaluated the growing potential of several crops and also provided producers with a side-by-side comparison of dryland and irrigated production.

The crops in this demonstration have been tested on dryland and/or irrigated land in the past and have successfully matured and been harvested in Saskatchewan. Quinoa is currently grown commercially in Saskatchewan under contract. Bill May has studied Niger at the Indian Head Agricultural Research Foundation for over a decade. Small acres of borage is currently grown in Saskatchewan and has marketing opportunities in Saskatoon. Marrowfat peas are currently being marketed by a pulse processor near Outlook and have a price premium over standard yellow peas.

## Project Plan

Five crops were selected for this trial: two varieties of quinoa, one variety of Japanese bean, one variety of Niger with two seeding rates, two varieties of borage, and two varieties of marrowfat peas. The seeding date, depth, and rate for each crop are described in Table 1. Hand weeding was done throughout the growing season, as there are few or no in-crop herbicide options for these crops. The agronomic information for each trial is also shown in Table 1.

**Table 1. Crops, Varieties, and General Agronomy for this Demonstration.**

Crop	Variety	Seeding Date	Harvest Date	Seeding Depth	N rate (kg/ha)	P <sub>2</sub> O <sub>5</sub> (kg/ha)
Quinoa	Norquin NQ94PT	May 20	Sept 27	¾ inch	80	25
Quinoa	Norquin Black	May 20	Sept 27	¾ inch	80	25
Niger (rate 1)	NA	May 20	Sept 27	¾ inch	80	25
Niger (rate 2)	NA	May 20	Sept 27	¾ inch	80	25
Borage	Variety 1	May 20	Sept 27	¾ inch	50	25
Borage	Variety 2	May 20	Sept 27	¾ inch	50	25
Marrowfat Pea	Hitomi	May 15	Sept 20	¾ inch	Inoc	25
Marrowfat Pea	Midori	May 15	Sept 20	¾ inch	Inoc	25
Japanese Bean	NA	May 27	Sept 20	¾ inch	none	25

## Demonstration Site

This demonstration was seeded with a no-till drill on field 9 at the CSIDC farm. Each treatment had a dimension of 6 x 1.5 m with 6 rows and guard rows were included at the end of the demonstration. The trial was replicated under irrigation managed by a pivot with variable rate irrigation and dryland. The irrigated trial was irrigated with a pressure pivot system to maintain soil moisture above 60% by weight throughout the growing season.

## Results

This is the second year that quinoa has been grown at CSIDC. In 2015, both varieties, black and golden, failed to produce any harvestable yield. It was hypothesized that heat blast sterilization or excess water stress may have been the cause. This year, the harvest was successful despite very high precipitation throughout the growing season. The quinoa variety, Golden, which was bred for Saskatchewan conditions, produced 1498 kg/ha (1336 lb/ac) under the irrigated trial (Table 2). This is a 15% yield advantage over dryland yield and a 24% advantage over the black variety.

**Table 1. Yield Results of Irrigated Crops Compared to Dryland**

Crop	Yield (kg/ha)	
	Irrigated	Dryland
Quinoa N Black	1144	933
Quinoa S Golden	1498	1274
Japanese Beans	5398	4843
Niger N	850	603
Niger S	718	707
Borage S	924	889
Borage N	987	902
Midori Peas	518	758
Hitomi Peas	518	846

The irrigated Japanese bean crop produced 5398 kg/ha (4815 lb/ac), giving it a 10% greater yield than the dryland trial. The Niger produced 850 kg/ha (758 lb/ac) at the high seeding rate and 718

kg/ha (641 lb/ac) at the lower seeding rate in the irrigated trials. This gave the two Niger plots a 29% and 1% yield advantage over the dryland trials respectively. The two borage varieties performed roughly the same in this demonstration producing 924 kg/ha (824 lb/ac) and 867 kg/ha (773 lb/ac) respectively. The irrigated response compared to the dryland trials was better by a modest 4% and 8% respectively. The two varieties of marrowfat peas, Midori and Hitomi, performed poorly under irrigation, producing 518 kg/ha (462 lb/ac) under irrigation. Irrigation gave the two varieties a yield disadvantage of 32% and 39% respectively compared to the dryland trial.

## Final Discussion

### *Quinoa*

Quinoa is a crop grown for seed and is native to the Andes Mountains of Bolivia, Chile, and Peru. It has been eaten as a grain for well over 5,000 years. It has recently received much attention in North America due to its high nutritional value. Quinoa contains all the essential amino acids that humans require and is therefore considered a complete plant protein. This makes it a great alternative to meat for vegetarians. It is also gluten free, so it can be used as a side dish for people with Celiac disease and those who follow a gluten free diet.



**Figure 1. Quinoa on August 2, 2016.**



**Figure 2. Quinoa on August 22, 2016.**

Contact Northern Quinoa at (306) 933-9525 for information.

Production is expanding in Western Canada, around 15,000 acres was contracted in 2016. Currently, Northern Quinoa sells all seed, buys all grain, and processes all quinoa grown in Saskatchewan. Quinoa yields are highly variable and can range from 300 to 2,000 lbs/acre. This trial received over 16 inches of rain before it was harvested, which is not ideal for quinoa. The yields achieved in this trial demonstrated that quinoa can perform well in the Lake Diefenbaker area of Saskatchewan, even under very moist conditions. If a producer sold this crop at the typical price (\$0.60/lb), he would gross \$801/acre based on the data from this year's trial. Further investigation of quinoa production in Saskatchewan will be continued in 2017.



### *Japanese Beans*

The Japanese beans grown in this trial are used for human consumption, mainly to make a bean paste. This crop is currently marketed through Rudy Agro near Outlook. The 5398 kg/ha yield achieved in this demonstration shows that this crop can handle high moisture environments and produce high yields under irrigation in Saskatchewan. Contact Rudy Agro at (306) 867-8667 for more information.



**Figure 3. Small Japanese Beans on August 11.**

### *Niger*

Niger is a grain crop. Most commercial production of Niger occurs in Ethiopia. It is a high water user, requiring about 25 inches of water in a year to achieve optimum yields. Bill May at the research farm in Indian Head has researched it as a potential crop for the local bird seed market. Yields at Indian Head average from 250–500 lbs/acre under dryland conditions. The yield for the irrigated plot in this trial was 758 lb/ac, showing that this crop has potential to perform very well under irrigation in Saskatchewan.



**Figure 4. Niger in Bloom on August 11.**

### *Borage*

Borage is an annual spice crop grown for the gamma-linoleic acid content contained in its seed. The crop does not tolerate drought, making irrigation mandatory to prevent crop loss and achieve optimum yields. There are two Canadian borage exporters in Saskatchewan: Bioriginal Food & Science Corp. (Saskatoon) and Northern Nutraceuticals Inc. (Spalding). Currently, about 200 acres of borage is planted annually in Saskatchewan and all acres are marketed by these two companies. The yields in this demonstration suggest that further evaluation is required before determining the merit of this crop under irrigation in Saskatchewan.



**Figure 5. Borage in Bloom on August 11.**

### *Marrowfat Peas*

Marrowfat peas are flat, large-seeded peas used in specialty snack food markets in Asia and the United Kingdom. These peas contain slightly more fat and sugar than regular field peas and typically yield is 10–20% lower. Rudy Agro currently markets this crop and pays a premium for these peas. The plots in this trial had excessive moisture, which severely damaged the stand.



**Figure 6. Marrowfat Peas Flat on the Ground after Severe Precipitation.**

At the time of harvest, the peas were lying flat on the ground (Figure 6). In a year that had average precipitation, the yield would be much higher than was achieved in this demonstration.

### **Acknowledgements**

- CSIDC and ICDC staff who assisted with the field and irrigation operations for this project.
- Colin Dutcheshen, Northern Quinoa Corp., for supplying quinoa seed and agronomic guidance and for speaking at the CSIDC Field Day.
- Bill May, Agriculture and Agri-Food Canada, who supplied the Niger seed.
- Carl Lynn, Bioriginal, for supplying the borage seed.
- Wes Walker, Rudy Agro, for supplying the Japanese small bean and marrowfat pea seed.

# Improving Fusarium Head Blight Management in Durum Wheat in Saskatchewan

## Funding

- Agriculture Development Fund (ADF) and Western Grains Research Foundation

## Project Lead

- Project Principal Investigator: Randy Kutcher (University of Saskatchewan)
- Garry Hnatowich, PAg, Research Director, ICDC (Project Lead)

## Objectives

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

The trial was seeded on May 17; 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/m<sup>2</sup> designated low seeding rate and 400 plants/m<sup>2</sup> designated as high seeding rate. CDC Desire seed was packaged to account for a germination of 86% with an assumed seedling survival of 90%. Nitrogen fertilizer was applied at a rate of 110 kg N/ha as 46-0-0 as a sideband application and 25 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0 seed placed. Weed control consisted of a post-emergence tank mix application Bison (tralkoxydim) and Badge II (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
- BBCH 61 – beginning of flowering
- BBCH 65 – full flowering, 50% anthers mature
- BBCH 69 – end of flowering
- BBCH 61 for first fungicide application followed by a second 20 days later
- 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, number of spikes at fungicide application times, 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.

Reglone (diquat) desiccant was applied September 5 and plots were harvested on September 15. 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 irrigation at CSIDC consisted of a single application of 12.5 mm on June 8.

## **Results**

Trial results will be made available once tabulated with the results of additional trials being conducted at Saskatoon, Scott, and Indian Head. This project is part of a graduate degree program and ICDC will only release results at a time mutually agreed to by both ICDC and the University of Saskatchewan.

# Winter Wheat Variety Evaluation for Irrigation versus Dryland Production

## Funding

- Agricultural Demonstration of Practices and Technologies (ADOPT) GF2
- Irrigation Crop Diversification Corporation (ICDC)

## Principal Investigator

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

## Organizations

- Irrigation Crop Diversification Corporation (ICDC)

## Objectives

The objectives were 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.

## Research Plan

Seed of fourteen registered winter wheat varieties were acquired from winter wheat breeder Dr. R. Graf, AAFC Lethbridge. Varieties were direct seeded into canola stubble on September 10, 2015. 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 dryland systems. At seeding, each trial received 80 kg N/ha as urea side banded and 25 kg P<sub>2</sub>O<sub>5</sub>/ha seed placed monoammonium nitrate; in the spring, upon regrowth, an additional 40 kg N/ha was broadcast on the irrigated trial. Weed control involved a single fall pre-seed application of glyphosate, no other herbicide was required. No foliar fungicides were applied for either leaf disease or Fusarium Head Blight. 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 July 22, 2016. Total in-season precipitation from May through July was 284.4 mm. Total in-season irrigation at CSIDC consisted of a single application of 12.5 mm on June 8.

## Results

Results obtained for the irrigated trial are shown in Table 1, the dryland trial in Table 2.

The 2016 winter wheat growing season (May–July) was very wet, with total precipitation received at 171% of the normal thirty-year average for these three months. This trial was established on a field located at CSIDC equipped with a pivot irrigation system and has tile drainage installed. Though both irrigated plots and dryland plots were adjacent, it became apparent throughout the growing period

that drainage was influencing the trial, notably in the dryland production system. It was observed, and measured through agronomic measurements such as plant height, that winter wheat growth within replicates was rep 1 > rep 2 > rep 3 . Though we did not trench to confirm, it is thought that replicate 1 of the dryland test was positioned immediately over a tile drain, as plant growth and yield in this replicate was the greatest; replicate 3, the furthest from the tile drain, had the least growth and yield and also produced the greatest variation in measurements recorded between varieties within the rep.

It is assumed that replicate 1 enjoyed the benefit of better drainage, and hence greater oxygenation, throughout this extremely wet growing season. Replicates 2 and 3 were influenced by drainage and the influence intensified the further a plot was positioned from a tile drain.

Consequently, analysis of variance procedures indicated that the results tabulated and shown in Table 2 for the dryland study are deemed unusable due to the high level of variability within the trial for yield. Data in Table 2 and Table 3 (irrigated versus dryland comparison) is provided simply for record keeping and posterity. The data generated and recorded within these two tables will not be used in any fashion within ICDCs varietal evaluation database, nor for extension purposes.

Results obtained for the irrigated trial are shown in Table 1. The irrigated production system analysis of variance procedures indicate that the results generated are considered a true reflection of variety performance under the testing conditions and are valid. Statistical procedures concluded that no variety was significantly different from another with respect to yield. Median yield was 7361 kg/ha (109.4 bu/ac). While no direct comparison can be made to the dryland winter wheat yield, it is interesting to note that the yields obtained for the dryland system, as well as the yields obtained and reported elsewhere in this report for spring wheat varieties, are far lower than those obtained in Table 1.

Grain protein ranged from a low of 10.3% (Pintail), to a high of 12.5% (AC Emerson). Median test weight and seed weights for all evaluated varieties were 81.9 and 36.6, respectively. Heading of all varieties occurred within a period of 6 days from earliest to latest, maturity was spread over a duration of 4 days. AC Flourish was the earliest maturing variety, AAC Wildfire the latest. AAC Icebreaker was the shortest variety, Swainson the tallest variety. The tallest varieties, Swainson and CDC Chase, had the greatest degree of lodging.

ADOPT funding to repeat this experiment for the 2016-17 growing season was applied for and funding granted, so the study will be continued.

**Table 1. Winter Wheat Variety Evaluation, Irrigated Site, 2016.**

Variety	Yield (kg/ha)	Yield (% of CDC Buteo)	Protein (%)	Test Weight (kg/hl)	Seed Weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
<b>CDC Buteo*</b>	<b>7388</b>	<b>100</b>	<b>11.4</b>	<b>82.0</b>	<b>37.0</b>	<b>June 4</b>	<b>July 14</b>	<b>97</b>	<b>1.0</b>
Emerson	6076	82	12.5	85.8	34.8	June 5	July 14	87	1.0
Flourish	8121	110	11.7	80.5	37.3	June 2	July 13	87	1.0
Radiant	6856	93	11.2	82.4	42.0	June 3	July 17	88	1.0
AAC Elevate	6582	89	10.9	78.4	36.1	June 6	July 15	87	1.0
AAC Gateway	8089	109	12.0	82.0	37.7	June 4	July 15	75	1.0
AAC Icebreaker	7279	99	11.0	82.1	34.2	June 5	July 15	84	1.0
AAC Wildfire	7212	98	11.5	78.4	36.5	June 8	July 17	94	1.0
CDC Chase	7338	99	11.9	82.8	34.0	June 3	July 15	102	2.0
Moats	7649	104	12.2	82.4	37.4	June 4	July 14	97	1.3
Pintail	7472	101	10.3	79.1	31.2	June 7	July 15	92	1.3
Swainson	7731	105	11.0	80.8	44.6	June 6	July 14	110	1.7
Sunrise	8040	109	10.7	79.2	34.3	June 4	July 14	93	1.0
W520	8158	110	11.3	83.2	38.0	June 7	July 15	90	1.0
LSD (0.05)	NS		0.4	3.6	NS	1.8 days	0.9 days	5.4	0.6
CV (%)	12.5		2.1	2.6	11.7	0.7	0.3	3.5	30.3

NS = not significant

\* Check Variety

**Table 2. Winter Wheat Variety Evaluation, Dryland Site, 2016.**

Variety	Yield (kg/ha)	Yield (% of CDC Buteo)	Protein (%)	Test Weight (kg/hl)	Seed Weight (mg)	Heading (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
<b>CDC Buteo*</b>	<b>3865</b>	<b>100</b>	<b>13.3</b>	<b>76.5</b>	<b>28.1</b>	<b>June 5</b>	<b>July 9</b>	<b>73</b>	<b>1.0</b>
Emerson	4694	121	13.3	78.6	28.9	June 5	July 10	79	1.0
Flourish	3970	103	13.1	74.6	30.7	June 2	July 8	68	1.0
Radiant	5248	136	11.5	78.2	32.7	June 3	July 12	77	1.0
AAC Elevate	3677	95	11.7	75.1	33.0	June 2	July 11	68	1.0
AAC Gateway	4376	113	13.5	76.5	30.5	June 2	July 11	69	1.0
AAC Icebreaker	3805	98	12.3	75.1	26.9	June 5	July 11	67	1.0
AAC Wildfire	4430	115	13.6	72.8	28.7	June 7	July 13	66	1.0
CDC Chase	4646	120	12.7	78.1	31.4	June 5	July 11	80	1.3
Moats	4047	105	13.0	74.9	28.1	June 3	July 9	82	1.3
Pintail	5597	145	11.6	76.5	29.9	June 6	July 11	75	1.0
Swainson	6492	168	11.1	78.4	34.5	June 5	July 8	86	1.3
Sunrise	4055	105	12.0	72.9	26.5	June 3	July 9	71	1.0
W520	4815	125	12.6	76.4	27.8	June 5	July 10	74	1.0
LSD (0.05)	NS		1.1	3.3	3.5	1.6 days	0.6 days	9.8	NS
CV (%)	25.5		5.2	2.6	6.9	0.6	0.2	7.9	23.0

NS = not significant

\* Check Variety

**Table 3. Winter Wheat Variety Evaluation, Irrigated versus Dryland, 2016.**

<b>Variety</b>	<b>Yield (kg/ha)</b>	<b>Yield (% of CDC Buteo)</b>	<b>Protein (%)</b>	<b>Test Weight (kg/hl)</b>	<b>Seed Weight (mg)</b>	<b>Heading (days)</b>	<b>Maturity (days)</b>	<b>Height (cm)</b>	<b>Lodging 1=erect; 9=flat</b>
Trial Site									
Irrigated	7428		11.4	81.4	36.8	July 5	July 15	92	1.2
Dryland	4551		12.5	76.0	29.8	July 4	July 10	74	1.1
LSD (0.05)	1722		NS	NS	NS	NS	1 day	14.9	NS
CV	17.6		4.1	2.6	10.1	0.7	0.2	5.7	27.2
Variety									
<b>CDC Buteo*</b>	<b>5627</b>	<b>100</b>	<b>12.3</b>	<b>79.3</b>	<b>32.6</b>	<b>June 4</b>	<b>July 11</b>	<b>85</b>	<b>1.0</b>
Emerson	5385	96	12.9	82.2	31.9	June 5	July 12	83	1.0
Flourish	6046	107	12.4	77.6	34.0	June 2	July 10	77	1.0
Radiant	6052	108	11.3	80.3	37.4	June 3	July 14	82	1.0
AAC Elevate	5130	91	11.3	76.8	34.6	June 4	July 13	78	1.0
AAC Gateway	6233	111	12.7	79.3	34.1	June 3	July 13	77	1.0
AAC Icebreaker	5542	98	11.6	78.6	30.6	June 4	July 13	76	1.0
AAC Wildfire	5821	103	12.6	75.6	32.6	June 8	July 15	80	1.0
CDC Chase	5992	106	12.3	80.4	32.7	June 3	July 13	91	1.7
Moats	5848	104	12.6	78.7	32.8	June 3	July 12	90	1.3
Pintail	6534	116	11.0	77.8	30.5	June 7	July 13	84	1.2
Swainson	7111	126	11.1	79.6	39.6	June 5	July 11	98	1.5
Sunrise	6048	107	11.4	76.1	30.4	June 4	July 12	82	1.0
W520	6487	115	11.9	79.8	32.9	June 6	July 13	82	1.0
LSD (0.05)	NS		0.6	2.4	3.9	1.2 days	0.5	5.4	0.4
Location x Variety Interaction									
LSD (0.05)	NS		S	NS	NS	NS	S	S	NS

S = significant

NS = not significant

\* Check Variety



# Demonstration of Fall Rye as an Irrigated Crop

## Funding

- Agricultural Demonstration of Practices and Technologies (ADOPT) GF2
- Irrigation Crop Diversification Corporation

## Project Lead

- Joel Peru, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture (Project Lead)
- Garry Hnatowich, PAg, Research Director, ICDC
- Co-investigator: Jamie Larson, AAFC Lethbridge Research Centre

## Organizations

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

## Objectives

The objectives of this project were to provide local producers with a yield and visual comparison of fall rye production under irrigated and dryland conditions in central Saskatchewan and how new hybrid varieties performed compared to conventional varieties. The project was designed to help determine the top-producing or best-adapted varieties of fall rye for irrigated production.

## Project Background

Producers are looking for new crops to add into their rotation to help control disease and pest issues. New hybrid varieties are making rye a higher-yielding crop that could be a fit for irrigation. There is limited agronomic knowledge about this crop when grown under irrigation. This demonstration evaluated the crop's growing potential and provided producers with a side-by-side comparison of dryland and irrigated production. This demonstration was also intended to show the increase in performance of a hybrid rye compared to conventional rye varieties when scarcity of water and nutrients are not limiting factors.

Including a fall-seeded crop in a crop rotation plan can help producers with time management due to the different seeding and harvest dates when compared to spring-seeded crops. Recent trends indicate that irrigators in the Lake Diefenbaker Development Area are slowly adopting new crops, but the majority of acres are still seeded to wheat and canola.

This demonstration also showed the differences between the different varieties of fall rye that are available in Saskatchewan. It is important for producers to know what varieties are available to them and how they perform in their area so they can make better, informed decisions when choosing their crops.

## Research Plan

Seed for the seven 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 10, 2015. At seeding, each trial received 80 kg N/ha as urea side banded and 25 kg P<sub>2</sub>O<sub>5</sub>/ha as seed placed monoammonium nitrate. 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. Harvest occurred on July 26, 2016.

## Results

Results obtained of the irrigated trial are shown in Table 1 and the dryland trial in Table 2.

### *Irrigated Trial*

The hybrid variety, Brasetto, yield was highest under irrigation (table 1), and the conventional variety Danko was lowest. Yields of the 7 varieties ranged from 7342 kg/ha to 10020 kg/ha (109–149 bu/ac), with the median being 7559 kg/ha (112 bu/acre). The yields for the hybrid varieties (Brasetto, Guttino and Bono) were significantly greater than the conventional varieties under irrigation. Grain protein was as low as 10.4 (Brasetto) to a high of 12.9 (AC Rifle). Median test weight and seed weight for all evaluated varieties was 71 kg/hl and 31.5 mg respectively. Maturity was spread over a period of 6 days among the varieties, with Prima being the earliest and Guttino being the latest. Lodging was not a major factor during this trial, but Prima did have the worst rating.

### *Dryland Trial*

The dryland trial in this demonstration had critical value of 19.1 for yield. This could be due to the trial's location, which may have been on a drainage tile or a salinity gradient. Median test weight and seed weight for all evaluated varieties was 70.7 kg/hl and 30.7 mg respectively. Grain protein was as low as 10.6 (Brasetto), to a high of 12.5 (Prima). Maturity occurred over a 4-day period, with Prima being the earliest and Bono, Guttino and Hazlet all maturing the latest.

**Table 1. Fall Rye Variety Evaluation, Irrigation Site, 2016.**

Variety	Yield (kg/ha)	Yield (bu/ac)	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
Brasetto	10020	159.6	10.4	71.0	31.5	July 24	95	1.0
Guttino	9080	144.6	10.8	69.4	30.0	July 25	80	1.0
Bono	8805	140.3	11.0	71.0	32.6	July 24	86	1.0
Prima	5604	89.3	12.5	69.6	27.6	July 20	103	2.7
AC Rifle	6716	107.0	12.9	69.9	27.4	July 23	82	1.3
Danko	7342	117.0	11.8	72.1	33.7	July 22	104	1.0
Hazlet	7559	120.4	11.4	72.2	34.9	July 24	98	2.0
LSD (0.05)	2123	33.8	0.5	1.4	3.4	1.0	12.9	0.8
CV (%)	15.2	15.2	2.4	1.1	6.1	0.3	7.9	31.8

**Table 2. Fall Rye Variety Evaluation, Dryland Site, 2016.**

<b>Variety</b>	<b>Yield (kg/ha)</b>	<b>Yield (bu/ac)</b>	<b>Protein (%)</b>	<b>Test weight (kg/hl)</b>	<b>Seed weight (mg)</b>	<b>Maturity (days)</b>	<b>Height (cm)</b>	<b>Lodging 1=erect; 9=flat</b>
Brasetto	8124	129.7	10.6	70.4	32.6	July 22	91	1.3
Guttino	7427	118.3	10.9	70.5	30.2	July 23	84	1.3
Bono	7161	114.3	10.9	70.7	30.7	July 23	86	1.0
Prima	5650	90.0	12.5	60.9	29.6	July 20	116	2.7
AC Rifle	6430	102.3	12.4	70.4	29.7	July 21	90	1.0
Danko	6596	105.3	12.1	71.9	35.6	July 22	100	1.0
Hazlet	6702	106.7	11.5	71.5	34.8	July 23	105	1.0
LSD (0.05)	NS	NS	0.4	NS	NS	0.8 days	15.1	0.7
CV (%)	19.1	19.1	1.8	9.3	10.1	0.2	8.9	29.9

### **Acknowledgements**

- The project lead would like to acknowledge CSIDC and ICDC staff who assisted with the field and irrigation operations for this project.
- Jamie Larson, AAFC Lethbridge Research Centre, who organized and sourced seed for this project.

# Demonstration of Plant Growth Regulator Application in Irrigated Wheat Production

## Funding

- Irrigation Crop Diversification Corporation

## Project Lead

- Garry Hnatowich, PAg, Research Director, ICDC (Project Lead)
- Jeff Ewen, AAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture

## Co-operator

- Canada Saskatchewan Irrigation Diversification Center (CSIDC)

## Project Objective

The objective of this project was to demonstrate the effect of an application of a plant growth regulator on irrigated hard red spring wheat and durum wheat. This project demonstrated the optimal stage for application and fertility levels. This project built on results from 2014 and 2015.

## Project Plan

This project was located on fields 4 and 5 under a centre pivot at the Canada Saskatchewan Irrigation Diversification Centre (CSIDC) in Outlook. It demonstrated two different application timings: growth stage 32 and flag leaf stage. Three different nitrogen levels were used, based on soil test recommendations: 100%, 125%, and 150% of recommended nitrogen.

## Project Methods

Detailed agronomics are shown in Table 1. Extensive monitoring occurred throughout the growing season to ensure that irrigation kept soil moisture above 50% available water. Monitoring plant stage progress was also important for staging PGR. Following PGR application, the field was monitored and any differences between treated and untreated plots were noted.

**Table 1. Crop Management.**

Nutrients (kg/ha)		N	P
Recommended		120	35
125%		150	35
150%		180	35
Seeding			
Date		May 17, 2016	
HRSW Variety		Unity VB	
Durum Variety		Brigade	
Precipitation		mm	inches
Rainfall		407.0	16.0
Irrigation		12.5	0.5

Herbicide		
Date		June 16, 2016
Product		Bison/ Badge II
Plant Growth Regulator		
Applied Growth Stage		32
Applied Growth Stage		Flag leaf
Product		Manipulator
Fungicide		
None Applied		
Harvest		
Date		September 15, 2016

## Results

Complete results are recorded below in Tables 2 and 3. No significant differences in the parameters measured were found between the hard red spring wheat and durum. Visually, throughout the plots, plant height differences were observed where only based on the genetic difference between the HRSW and Durum. No lodging occurred in either the durum or HRSW plots. No yield differences were noted between the plant growth regulator treatments in either the durum or HRSW.

**Table 2. Effect of N Fertility & PGR Application on Durum – Combined Site Analysis.**

Treatment	Yield (kg/ha)	Yield (bu/ac)	Protein (%)	Test weight (kg/hl)	Seed weight (mg)	Maturity (days)	Height (cm)	Lodge 1=upright 9=flat
<b>Nitrogen Fertilizer Rate</b>								
1.00 X	4370	65.0	15.0	73.1	37.0	100	103	1
1.25 X	4259	63.3	15.2	73.3	38.1	101	99	1
1.50 X	4118	61.2	15.5	72.6	37.1	101	102	1
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS
CV	7.7	7.7	1.6	0.8	3.1	0.6	4.0	0
<b>Seed Treatment</b>								
Control	4242	63.1	15.2	73.4	38.3	101	106	1
GS 32	4339	64.5	15.3	72.5	36.7	101	100	1
Flag Leaf	4166	61.9	15.3	73.1	37.1	100	97	1
LSD (0.05)	NS	NS	NS	0.5	1.0	0.5	3.4	NS
<b>Seeding Date x Seed Treatment</b>								
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS

S = significant; NS = not significant

**Table 3. Effect of N Fertility & PGR Application on CWRS Wheat – Combined Site Analysis.**

Treatment	Yield (kg/ha)	Yield (bu/ac)	Protein (%)	Test Weight (kg/hl)	Seed Weight (mg)	Maturity (days)	Height (cm)	Lodge 1=upright 9=flat
<b>Nitrogen Fertilizer Rate</b>								
1.00 X	5324	79.2	14.8	78.9	33.2	101	84	1
1.25 X	5436	80.8	15.0	78.8	33.0	101	85	1
1.50 X	5014	74.5	15.0	78.8	32.4	102	83	1
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS
CV	8.4	8.4	1.1	0.5	5.8	0.5	4.7	0
<b>Seed Treatment</b>								
Control	5342	79.4	15.07	79.1	32.7	101	88	1
GS 32	5015	74.6	14.75	78.7	32.6	101	81	1
Flag Leaf	5417	80.5	14.92	78.8	33.2	101	83	1
LSD (0.05)	NS	NS	0.14	NS	NS	NS	3.3	NS
<b>Seeding Date x Seed Treatment</b>								
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS

S = significant; NS = not significant

## **Final Discussion**

Lodging is a major issue in cereal production under irrigation. When the crop lodges, it becomes much more difficult to harvest and there is potential for yield loss. A plant growth regulator has the potential to shorten the crop and thus reduce the possibility that the crop will lodge.

This demonstration was built on similar projects carried out in 2014 and 2015 on irrigated hard red spring wheat and durum wheat. As in those years, this project used two nitrogen rates above recommended values and two different PGR application timings. In 2016, we decided to remove increased irrigation intensity and only consider normal irrigation application.

No significant differences were found in either the hard red spring wheat or the durum for any of the parameters measured. Plant height differences were only noted between the HRSW and the durum due to variety. No significant lodging was measured in either the durum or hard red spring wheat at both of the plant growth regulator timings. There was no yield response detected in the durum or hard red spring wheat in 2016. Increased nitrogen had no effect on any of the parameters for either the durum or hard red spring wheat.

Different varieties and classes of wheat respond differently to plant growth regulators. We have found it is difficult to simulate results in small plots that would be obtained in a production-sized field. This work carried out on the research station also proved to be difficult due to the amount of residual nutrients, lack of variability, and lack of exposure to climatic elements that may occur in a producer's field.

ICDC will no longer continue with this demonstration in small plots and when established maximum residue limits for the product Manipulator have been established in the United States, larger scale field demonstrations can be pursued.

## **Acknowledgements**

- The project lead would like to acknowledge Engage Agro, Phil Bernardin, for providing PGR Manipulator.

# **Contans Control of Sclerotinia for Irrigated Canola**

## **Funding**

- Irrigation Crop Diversification Corporation

## **Project Lead**

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture
- Dale Ziprick, Product Manager, United Agri Products, Winnipeg, MB
- David Jessiman, Territory Manager, UAP, Lucky Lake, SK

## **Co-operators**

- Marc Gravelle, Irrigator, Riverhurst, SK

## **Project Objective**

This project compared control of Sclerotinia using a biological control product and a foliar fungicide.

## **Demonstration Plan**

Many cropping options open to irrigated producers are susceptible to Sclerotinia. Close to 60% of crops seeded on irrigated land are hosts for Sclerotinia. Research has shown that crop rotation is only marginally successful in controlling sclerotinia on irrigated fields.

Contans was applied to the soil in early spring. The recommendation for best results is to apply the fungal organism, *Coniothyrium minitans*, in fall—the earlier the better. If rain follows application, it can improve the survival of the organism as it seeks out Sclerotia bodies in the soil to infect.

The project will be conducted from spring 2016 until fall 2018 to demonstrate the advantage of multi-year management using both biological and foliar fungicide treatments.

## **Demonstration Site**

The project is located at NE14-22-7-W3 on canola and NW24-22-7W3 on wheat for 2016.

## **Project Methods and Observations**

Last fall, urea (46-0-0) was banded at 115 N/ac. The Contans was sprayed on the soil surface and incorporated with a light harrow. During seeding, 120 lb 16-20-0 was placed with the canola. Another 100 lb of 46-0-0 was topdressed in crop and incorporated with irrigation. The canola variety, Invigor 252, was seeded May 16, 2016, at 5 lb/ac with a Bourgault airdrill. Emergence was good.

During the growing season, Sclerotinia and blackleg infection of the canola was rated about 5 days prior to swathing as the crop was filling. Twenty random plants were selected from two locations within the Contans and fungicide treated areas of the field. The crop was rated for Sclerotinia as follows:

Rank	Description	Rank	Description
0	no symptoms	3	moderate symptoms on upper main stems
1	symptoms on pods only	4	severe symptoms on upper main stems
2	mild symptoms on upper main stems	5	plant kill with symptoms on main lower stem.

Cut sections taken from the base of the plant were also evaluated for blackleg infection. The average severity rating for the two areas was determined as the number of infected plants divided by the total number of plants evaluated. The field portion treated with early fungicide had an average severity index of 3.4 and incidence of 43% for Sclerotinia. The area treated with Contans and an early fungicide had an average severity of 2.5 and incidence of 78%. The grower did not want to leave a check strip with no Sclerotinia control. Irrigators grow Sclerotinia-sensitive crops for a high proportion of the rotation and need a control measure for Sclerotinia to protect against this risk and its associated serious yield loss. Seventeen per cent of the plants showed blackleg infection at a low level on both areas evaluated.

The NDVI image of the field shows a delay in development where boron was tank mixed with the first fungicide application. This is indicated by the darker green color in the NDVI image (Figure 1). The longer period of development where boron was applied represents at least 3 bu/ac more canola on this site. The Contans treatment also shows up in the NDVI image, but not as sharply as the boron application. The harvest data does not show a yield advantage for the Contans treatment. Reasons for this may include application of the product in spring rather than the recommended practice of fall application. More time for the Contans organism to infect the resident Sclerotia bodies should increase its effectiveness.

**Table 1. Yield of Canola as Affected by Fungicide Treatment.**

Treatment (Fertilizer/ac)	Description	Grade	TKW	% Oil	Bu/ac
One application Delaro	One early application	Canada 1	4.24	46.2	68.6
Contans + Delaro	Contans + one early application	Canada 1	3.55	45.7	65.4
Contans + Overall 240	Contans + one late application	Canada 1	ND	ND	63.6
Delaro + Overall 240	One early application + one late application	Canada 1	3.70	45.3	65.9
Delaro + Boron	One early application + boron	Canada 1	3.97	45.9	71.7

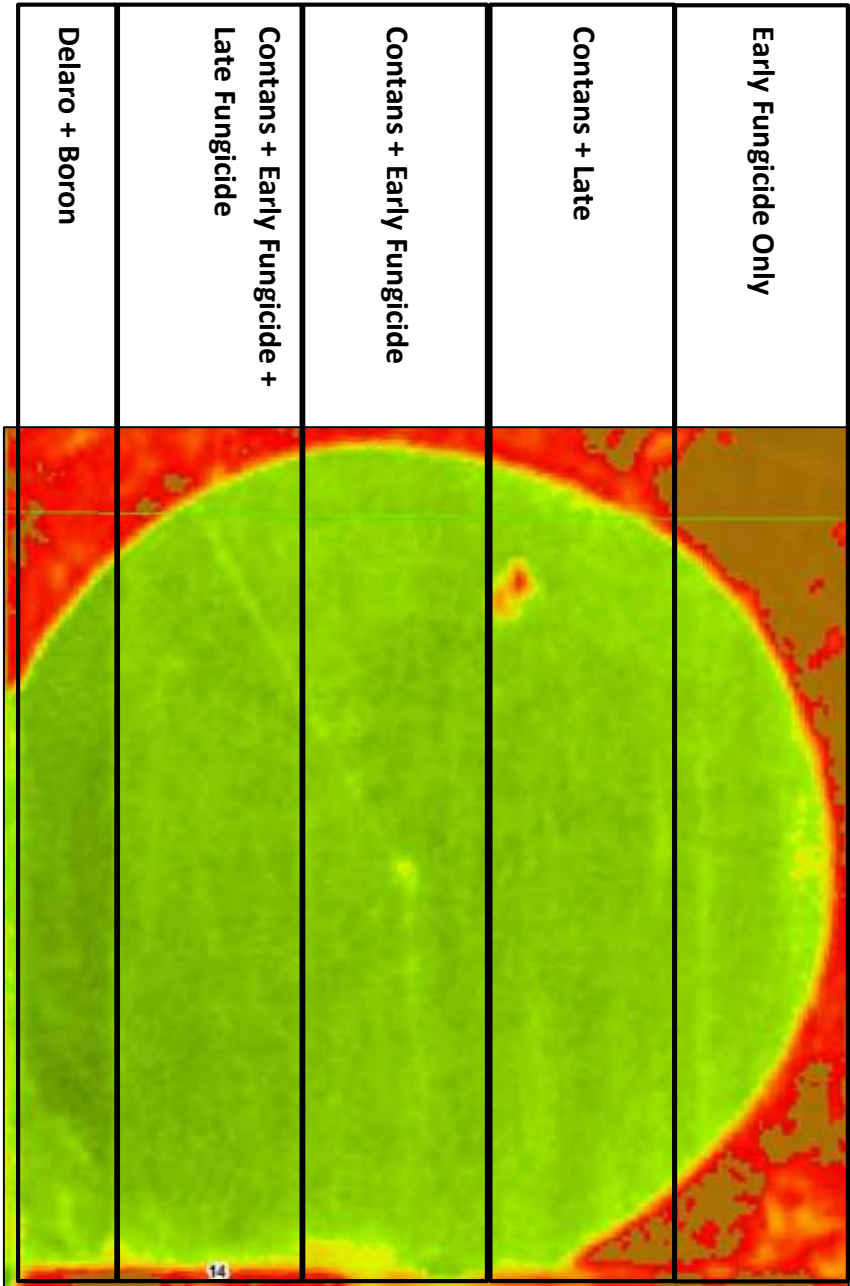
## Final Discussion

Control of Sclerotinia is crucial for irrigated crop production. In any given year, about 60% of irrigated acres in Saskatchewan is sown to Sclerotinia-sensitive crops. Contans shows promise as a control option for these conditions. This first year of this three-year project attempts to demonstrate that control efficacy and simplicity are provided both by including a biological control mechanism in the control program for Sclerotinia. Contans also confers an advantage for the irrigation producer in terms of reducing labor constraints during the summer irrigation season by perhaps reducing one fungicide application. Contans could also be incorporated by irrigation if it can be applied to the field in the fall prior to irrigation system shutdown in the fall.



**Acknowledgements**

United Agri Products and Bayer Cropscience both contributed Contans for this project. Thanks to Dale Ziprick with UAP for his support. Thanks to David Jessiman, Territory Manager with United Agri Products, for his efforts to coordinate product for the demonstration. Marc Gravelle graciously committed to contributing the labour, land, and equipment to implement the project for a three year period.



**Figure 1. Aerial Image of Canola at Gravelle Site with Contans and Fungicide Applications.**

# **Yield Response of Canola with Foliar Boron Applied at Early Bolting Stage**

## **Funding**

- Agricultural Demonstration of Practices and Technologies (ADOPT) GF2

## **Project Lead**

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

## **Organizations**

- Peter, Frank, and Ferdinand Hiebert, Riverhust, SK
- Nigel Oram, Central Butte, SK
- Mark Gravelle, Riverhurst, SK
- Derek Derdall, Crop Production Services, Outlook, SK

## **Project Objectives**

This project demonstrated the impact that the application of foliar boron fertilizer has on irrigated canola yield when the boron is applied at the early bolting stage and is tank mixed with the first fungicide application.

## **Project Background**

The project was conducted at three locations in 2016:

1. Gravelle – located in the southern portion of Riverhurst Irrigation District (W14-22-7-W3) on Fox Valley loam developed on calcareous silty glaciolacustrine parent material.
2. Hiebert – Located in the northern portion of the Riverhurst Irrigation District (WH6-24-6-W3) on Hatton sandy loam developed on coarse textured, moderately calcareous sandy glaciofluvial parent material.
3. Oram – SW9-23-4-W3 on Hatton sandy loam developed on coarse textured moderately calcareous sandy glaciolacustrine deposits.

The plant tissue analysis for two of the replications is reported in Table 1. The project relied on plant tissue analysis to guide selection of potential responsive sites because the effectiveness of a soil test has been inconsistent for predicting canola yield response to boron. However, a soil test was done for the Hiebert site as contrast.

## **Project Methods**

This project evaluated the yield response of foliar boron applied at 20% bloom stage as a piggy back application tank mixed with fungicide to control Sclerotinia in irrigated canola. Omex 10% boron was applied to the Oram and Hiebert sites. At 0.5 L/ac, 1.43 lb B was applied to the canola foliage. At 1.0

L/ac, 2.86 lb B was sprayed on the canola foliage. The product applied to the Gravelle site was manufactured by ATP Nutrition and applied at 1 L/ac with the fungicide.

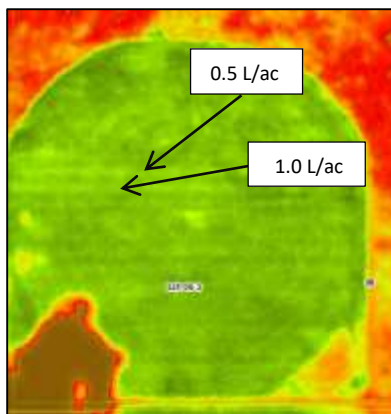
Plant tissue samples were collected from the Oram and Hiebert sites at the rosette stage and are reported in Table 2. Both samples contained just under 20 ppm boron. No visual differences were noticed at the sites at any time during the growing season. NDVI imagery was obtained from Farmers Edge in Outlook for the Gravelle and Hiebert sites. The area that received boron shows up clearly in the Gravelle images as a darker area, but as lighter colored areas in the Hiebert image. On the basis that this was a single-year field demonstration, 20 ppm boron in the plant tissue at the rosette stage is suggested as a potential critical level at which to recommend boron application to canola at 20% bloom.

**Table 1. Soil analysis of Hiebert Field Selected for Irrigated Foliar Boron Demonstration on Canola (0–6").**

Legal Location	OM (%)	pH	EC (dS/m)	Nutrient (ppm)								
				N	P	K	S	Cu	Fe	Mn	Zn	B
WH6-24-6-W3	1.2	7.7	0.3	10	25	165	18	0.9	41	63	1.8	0.9

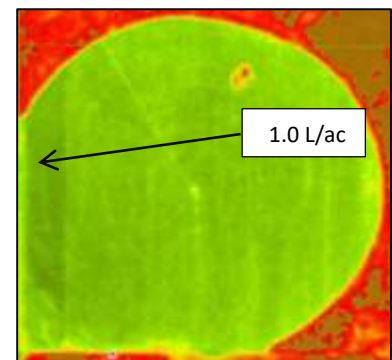
**Table 2. Plant Tissue Analysis of Canola Samples Collected at the Rosette Stage Prior to the Application of Foliar B Fertilizer Applied with Fungicide at the 20% Bloom Stage of Canola.**

Treatment (Fertilizer/ac)	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g
Hiebert	5.5	0.42	4.3	0.66	2.5	0.52	6.0	131	89	39	18
Oram	6.0	0.50	3.8	0.77	2.2	0.46	5.0	89	102	9	19
<b>Target</b>	<b>4.0</b>	<b>0.25</b>	<b>2.0</b>	<b>0.30</b>	<b>0.5</b>	<b>0.20</b>	<b>4.5</b>	<b>40</b>	<b>20</b>	<b>15</b>	<b>30</b>



**Figure 1. Hiebert site – boron strips are evident as two narrow light green strips north of the pivot point. The color difference disappears toward the east side of the pivot point. Image courtesy Kris Ewen, Farmers Edge, Outlook.**

The canola yield for the three sites is summarized in Table 3. Yields were strong in 2016. Yield response to the boron application at the Gravelle and Oram sites was 5–6 bu/ac. The increase in seed yield appears to come from larger seed size at the Gravelle site. Oil content of the seed may also be increased by the practice. The response is linked to the above average rainfall patterns Saskatchewan has been experiencing. The higher rainfall reduces the need for irrigation water. Previous water analysis showed that each acre-inch of Lake Diefenbaker water contains 0.005 lb boron. If weather patterns become drier,



**Figure 2. Gravelle site - boron strip is the darker green area along the west side of the pivot circle. Image courtesy Kris Ewen, Farmers Edge, Outlook.**

leading to greater application of irrigation water, there will be an increased uptake of boron from soil reserves and an increase in boron from applied irrigation water may correct the deficiency,

which would result in a decline in the yield response. Higher rainfall is also associated with an increase in soil pH, which reduces the availability of boron. The lower yield for the Hiebert site is due in part to the seeding date near the end of May.

On a cautionary note, boron is a strong cleanser. For cases where the sprayer has not been thoroughly cleaned, boron fertilizer may act as a cleanser of contaminants on sprayer tank walls and lead to unintended application of pesticide product that can injure the canola crop.

**Table 3. Canola Grain Yield.**

<b>Treatment</b>	<b>Canola Yield (bu/ac)</b>	<b>Oil Content (%)</b>	<b>TKW (g)</b>
<b>Gravelle</b>			
Control (average of 3 reps)	65.9	45.7	3.83
Boron foliar	71.7	45.9	3.97
<b>Oram</b>			
Control	69.3	ND	ND
0.5 L/Ac	71.3	ND	ND
1.0 L/Ac	74.6	ND	ND
<b>Hiebert</b>			
Control	47.9	43.8	2.70
0.5 L/Ac	43.7	45.1	2.66
1.0 L/Ac	44.5	42.7	2.49

## Acknowledgements

- Derek Derdall provided assistance with boron plant tissue testing data.
- Nigel Oram, Peter, Ferd and Frank Hiebert, and Mark Gravelle provided the sites for the boron fungicide applications.
- Kris Ewen of Farmers Edge provided NDVI images to evaluate the boron application to the fields.

# Reclamation of Na Affected Soils

## Funding

- Irrigation Crop Diversification Corporation

## Project Lead

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture
- Joel Peru, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture
- Craig Gatzke, Agro Environmental Services Branch, Agriculture and Agri-Food Canada
- Ken Wall, PAg, Senior Hydrology Technician, Semiarid Prairie Agricultural Research Centre, Agriculture and Agri-Food Canada (retired)

## Co-operators

- Andre Perrault, Grower, Ponteix, SK, Ponteix Irrigation District
- Greg Oldhaver, Grower, Cabri, SK, Miry Creek Irrigation District

## Project Objective

The project was initiated to demonstrate three alternatives for replacement of sodium with calcium on the soil exchange complex of heavy textured irrigated soils.

## Demonstration Plan

Sodium, a monovalent cation, does not effectively neutralize the negative charge associated with soil colloids because of its large hydrated radius. When this occurs, the clay particles repel each other and damage the continuity of pores for water infiltration. Water can only flow into the soil profile at a reduced rate. Calcium can displace sodium from the cation exchange sites and after the sodium is flushed from the soil profile, restores healthy soil structure and adequate water infiltration. Three calcium products, calcium chloride, calcium nitrate, and calcium sulphate, differ in ionic size and solubility. They were broadcast on the surface of sodium-affected soils to evaluate their impact on soil properties and crop yield. The application rate selected for the sites was 100 lb calcium per acre, which is substantially less than the needed rate predicted by the theoretical gypsum requirement. Four applications were made by the end of the 2016 calendar year.

## Demonstration Site

Two sites were selected for the demonstration. The Ponteix site is situated on alluvium soils along the edge of Netekeu Creek. Plot 22 in Ponteix Irrigation District is clay textured and in the past was irrigated with high sodium absorption ration (SAR) water from Gouveneur Reservoir.

The Miry Creek site is located on orthic Willows-Sceptre lacustrine soils that show reduced water infiltration (ponding following irrigation) compared to the adjacent area. Plot 13 in Miry Creek Irrigation District is near the bay, at the edge of the South Saskatchewan River. The soil is heavy

textured and suffers from waterlogging in a low lying area. High levels of sodium have been confirmed in the soil profile through soil analysis.

Prior to application of the calcium amendments, soil samples were collected in spring 2014 from each of the two replicates at three depths: 0–12", 12–24", and 24–36". Detailed salinity analysis was conducted on each sample to determine the soil chemical properties at the locations. These soil results are reported in Table 1.

**Table 1 a. Soil Properties Determined for the Sodium-Affected Soils from the Ponteix Site Sampled in Spring 2014.**

Parameter	Ponteix Plot 22 - South Plot			Ponteix Plot 22 - North Plot		
	0-12"	12-24"	24-36"	0-12"	12-24"	24-36"
pH	7.26	7.59	8.05	7.29	7.82	8.34
Conductivity (dS/m)	2.25	1.42	5.17	2.74	1.10	1.40
% Saturation	81.70	84.90	113.00	81.60	83.80	75.50
Calcium (mg/L)	53.20	17.50	138.00	58.60	11.20	9.80
Magnesium (mg/L)	31.90	8.80	84.00	37.70	4.90	5.70
Potassium (mg/L)	21.20	6.20	23.00	47.40	4.35	3.10
Sodium (mg/L)	361.00	257.00	1280.00	416.00	190.00	222.00
Sulphate (mg/L)	245.00	264.00	2740.00	252.00	128.00	204.00
Chloride(mg/L)	79.20	29.10	29.00	114.00	27.70	20.20
<b>SAR</b>	<b>10.70</b>	<b>13.60</b>	<b>19.90</b>	<b>11.50</b>	<b>13.00</b>	<b>16.00</b>
TGR(sodic) (t/ha)	3.44	5.99	14.20	4.14	5.42	7.01

**Table 1 b. Soil Properties Determined for the Sodium-Affected Soils from the Miry Creek Site Sampled in Spring 2014.**

Parameter	Miry Creek Plot 13—Southside			Miry Creek Plot 13—Northside		
	0-12"	12-24"	24-36"	0-12"	12-24"	24-36"
pH	7.79	8.13	8.11	7.79	8.30	8.17
Conductivity (dS/m)	1.04	3.05	11.10	1.12	1.98	7.37
% Saturation	80.50	99.20	97.40	80.80	98.30	98.70
Calcium (mg/L)	49.30	66.10	509.00	63.90	26.50	221.00
Magnesium (mg/L)	27.40	67.70	479.00	28.50	22.90	258.00
Potassium (mg/L)	3.57	5.30	< 19.00	3.69	2.90	< 20.00
Sodium (mg/L)	112.00	619.00	2100.00	110.00	410.00	1450.00
Sulphate (mg/L)	91.00	1060.00	6510.00	218.00	491.00	3950.00
Chloride(mg/L)	24.50	157.00	286.00	16.60	63.30	152.00
<b>SAR</b>	<b>3.50</b>	<b>12.80</b>	<b>16.20</b>	<b>3.20</b>	<b>14.20</b>	<b>15.90</b>
TGR(sodic) (t/ha)	< 0.10	6.30	9.22	< 0.10	7.49	9.01

At the Ponteix site, barley was grown in 2014, field pea in 2015, and barley again in 2016. The Miry Creek site is currently sown to alfalfa, but rotates to annual crops when productivity of the alfalfa

stand tapers off as the stand ages. The plan is to terminate the alfalfa stand at the end of the 2016 season.

## **Project Methods and Observations**

The amendments were applied to two replicates at each site on May 20, 2014, November 8, 2014, November 13, 2015, and November 3, 2016. The rate of calcium applied was 100 lb/acre for each application. The application rate was based on gypsum rates applied to cultivated potato fields to improve harvest conditions for potato. The calcium in the amendment improves flocculation of the clay in the soil texture, which reduces occurrence of soil lumps to simplify potato harvest. The approach also attempts to reduce water infiltration issues at a lower cost than rapid remediation practices typical for contaminated oilfield sites. The rate in this demonstration is less than 10% of the calculated theoretical gypsum requirement determined from the detailed salinity analysis.

The results of the first two years were reported in the 2014 and 2015 ICDC *Research and Demonstration Reports* available on the ICDC website. The calcium nitrate and calcium sulphate amendments also supply plant nutrients. This effect must be considered when interpreting the results. For 2014 and 2015, 70 lbs/ac of nitrogen was applied to the calcium chloride and calcium sulphate treatments to compensate for the nitrogen applied with the calcium nitrate treatment. Unfortunately, no N was applied to the control area adjacent to the research area. A control with added N was not included in the experimental design, which complicates assessment of the observations for these two years. This shortcoming was corrected for the 2016 project and was applied in fall, 2016.

No yield data was collected in 2016.

The calcium products used for the demonstration are quite costly. If an agronomic benefit can be demonstrated with the lower rate of calcium application, less expensive product sources would be needed for the practice to become practical.

## **Final Discussion**

The calcium applications will be continued for fall 2016. Yield measurements for the crops grown at the sites in 2017 will be collected.

# FORAGE CROPS

## Copper and Zinc Fertilization of Alfalfa

### Funding

- Agricultural Demonstration of Practices and Technologies (ADOPT) GF2

### Project Lead

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture
- Dale Tomasiewicz, Irrigation Agronomist, Agriculture and Agri-Food Canada
- Joel Peru, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture

### Co-operators

- Jeff Schoenau, Professor of Soil Science, University of Saskatchewan, Saskatoon, SK
- Rigas Karamanos, Research Scientist, Koch Fertilizers
- Barry Vestre, Farm Manager, Agriculture and Agri-Food Canada

### Project Objective

The objective of this demonstration was to determine the forage yield response of alfalfa to fertilization with copper (Cu) and zinc (Zn) when phosphorus (P), potassium (K), and sulfur (S) are adequately supplied.

### Project Background

Adequate Zn and Cu are both required for high-performance nitrogen (N) fixation. Cu and Zn are removed by crops from soil in small quantities and generally remain available to plants with excellent residual value following soil application. Relative to other crops, forages remove high quantities of these nutrients from soil because the total above-ground growth is removed from the field with each harvest. With grains and oilseeds, the straw is returned to the field, replenishing the soil with the nutrients contained in the straw. Cu (5 lb/ac) and Zn (4 lb/ac) fertilization is generally a one-time practice, with one treatment being sufficient for 10–20 years. This factor is important when a grower is evaluating the economics of the practice

### Demonstration Plan

Composite soil samples were collected from the 0–6" depth from each of the five replications of the demonstration in fall 2014 and submitted to ALS Laboratories for analysis. These values are reported in Table 1. A subsequent analysis completed in fall 2015 showed similar results for an adjacent research area and are reported in Table 2.

### Demonstration Site

The project is located at NW12-29-8-W3 on Asquith fine sandy loam. The site has been prone to wind erosion when farmed with conventional tillage. The site is punctuated with areas of buried



topsoil throughout the demonstration site because of this erosion. Each of the five reps for the demonstration were sampled separately at the 0–6" depth in fall 2014.

**Table 1. Soil Analysis of Each Replication for Alfalfa Copper and Zinc Demonstration (0–6").**

Rep	pH	EC (dS/m)	OM (%)	Nutrients (ppm)								
				N	P	K	S	Cu	Fe	Mn	Zn	B
Rep 1	7.9	0.2	1.3	2	22	125	6	0.1	12	2.2	0.5	0.6
Rep 2	7.9	0.2	1.5	3	17	117	10	0.1	8	2.1	0.4	0.6
Rep 3	7.9	0.2	1.0	5	15	137	3	0.1	5	1.5	0.3	0.5
Rep 4	8.0	0.2	0.8	3	12	119	3	0.1	5	1.2	0.3	0.4
Rep 5	8.0	0.2	1.0	3	13	116	2	0.1	5	1.4	0.3	0.5

**Table 2. Soil Analysis of Research Site Adjacent to the Alfalfa Demonstration in Fall, 2015.**

Crop	Depth	pH	TOC (%)	Nutrients (ppm)								
				N	P	K	S	Cu	Fe	Mn	Zn	B
Wheat	0-15	8.0	0.7	1.5	11	138	4	0.1	6	1.3	0.3	0.3
	15-30	8.0	0.7	1.5	5	100	3	0.2	5	0.9	0.3	0.2
	30-45	7.8	1.0	1.0	2	132	4	0.3	6	1.1	0.3	0.3
	45-60	7.9	0.8	0.5	2	150	4	0.4	6	1.0	0.2	0.3
Barley	0-15	8.3	0.8	1.0	8	138	4	0.1	5	1.4	0.2	0.3
	15-30	7.9	1.0	1.5	2	102	3	0.3	7	1.2	0.2	0.4
	30-45	7.9	0.8	1.5	2	124	4	0.4	6	0.9	0.2	0.4
	45-60	8.0	0.7	1.0	2	121	8	0.5	5	0.8	0.1	0.4

## Project Methods and Observations

The project experimental design was a factorial with five replications. Cu and Zn fertilizer were broadcast on an established alfalfa stand with a 16 foot Valmar pneumatic applicator at rates of 5 lb/ac and 4 lb/ac actual nutrient on April 20, 2015. The products chosen for the demonstration were Pestell Copper Sulphate 10XL and Agrium Zink-Gro MAXI-Granular 35.5% Zinc Sulphate Monohydrate. The copper source was a coarse blue crystalline product with guaranteed analysis of 25.2% Cu and 12% S. The Zn source was a granular grey-white product with 35.5% Zn and 16.5% S. Ammonium sulphate was also broadcast to supply 20 lb S as sulphate-S on April 20, 2015, to ensure adequate S for the alfalfa. The retail cost of Cu is \$11.52 per lb and Zn is \$4.60 per lb. The one time applications of Cu and Zn would be \$57.60 and \$18.20 per acre respectively. This cost should be amortized over 20 years to get a realistic picture of the true cost of the practice.

## Irrigation

In 2016, good precipitation fell early in spring and July, but May and June were quite dry. Rainfall and irrigation quantities for 2016 are reported in Table 3.

**Table 3. Precipitation and Irrigation for 2016 at CSIDC on Knapik Quarter.**

Month	Rainfall (mm)	Irrigation (mm)	Total (mm)
April	10		10
May	36	8	44
June	61	36	97
July	189	0	189
August	95	0	95
September	2	0	2
Total	393	44	437

Plant tissue samples were collected from replicates 1 and 4 from the first cut growth at early bloom on June 15. The plant tissue sampling prior to the second cut was omitted for 2016. These results are reported in Table 4. The plant tissue level of Cu and molybdenum (Mo) was low in early June. Other nutrients tested adequate with the exception of Mo for two of the four treatments.

**Table 4. Plant Tissue Analysis of Alfalfa Samples Collected from Fertilizer Treatments for Cut 1 at the Early Flower Stage at Knapik Alfalfa Demo (June, 2016)**

Treatment (Fertilizer/ac)	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g	Mo ug/g
<b>Replicate 1</b>												
None	5.6	0.54	2.5	0.57	2.1	0.45	5	226	50	31	31	1.5
5 lb Cu	5.3	0.46	2.2	0.49	2.1	0.43	4	168	43	25	33	0.9
4 lb Zn	5.7	0.42	2.1	0.51	2.1	0.40	4	100	39	23	36	0.9
5 lb Cu + 4 lb Zn	5.7	0.41	2.5	0.44	2.0	0.40	6	85	32	26	32	1.3
<b>Threshold</b>	<b>4.5</b>	<b>0.25</b>	<b>2.0</b>	<b>0.30</b>	<b>0.5</b>	<b>0.25</b>	<b>8</b>	<b>50</b>	<b>20</b>	<b>20</b>	<b>30</b>	<b>1.0</b>
<b>Replicate 4</b>												
None	5.4	0.47	2.3	0.51	1.9	0.32	4	88	24	24	29	2.3
5 lb Cu	5.5	0.39	2.3	0.45	2.0	0.32	3	90	28	20	31	1.4
4 lb Zn	5.7	0.44	2.6	0.48	2.1	0.31	4	89	23	25	29	1.5
5 lb Cu + 4 lb Zn	5.8	0.43	2.8	0.50	2.0	0.38	6	96	29	24	33	2.4
<b>Threshold</b>	<b>4.5</b>	<b>0.25</b>	<b>2.0</b>	<b>0.30</b>	<b>0.5</b>	<b>0.25</b>	<b>8</b>	<b>50</b>	<b>20</b>	<b>20</b>	<b>30</b>	<b>1.0</b>

The forage yield is presented in Table 5. Due to rain, harvest of hay was delayed during June and July, and only two cuts were harvested from the site during 2016. A difference of nearly 0.5 t/ac between the two cuts was observed for the Cu treatment, but this was not significant because of variability in the replicates of the yield.

**Table 5. Alfalfa forage yield**

Treatment	1st Cut (ton/ac)	2nd Cut (ton/ac)	2016 Forage Yield (ton/ac)
Check	2.83	2.14	4.97
Cu	3.11	2.35	5.46
Zn	3.02	2.08	5.10
Cu Zn	2.98	1.98	4.96
Harvest Date	June 23	Aug 10	
Days of Growth	39	48	
Proportion of Yield	0.58	0.42	

Statistical analysis of the forage yields was completed using the program Statistix 10.0.

Feed analysis of the first and second cuts were completed and are summarized in Table 6. The protein trends observed in the feed quality in 2015 were not observed in 2016. Only a small increase in protein content of the alfalfa was observed in 2016. In 2016, a higher level of Cu was shown in the feed analysis, compared to 2015 results. The improvement in relative feed value observed in 2015 was not evident in the 2016 harvests. The fall P and K applications to the site did not occur in 2015. Nutrient stress from inadequate P or K may have contributed to the smaller crude protein improvement observed in 2016.

**Table 6. Feed Analysis of 1st Cut and 2nd Cut Alfalfa (Average of 5 Replicates).**

Treatment	1 <sup>st</sup> Cut Alfalfa Samples				2 <sup>nd</sup> Cut Alfalfa Samples			
	Check	Cu	Zn	Cu & Zn	Check	Cu	Zn	Cu & Zn
Moisture (%)	10.51	11.07	11.21	11.36	7.60	7.92	8.15	7.10
Dry Matter (%)	85.09	88.93	88.79	88.64	92.40	92.08	91.85	92.90
Crude Protein (%) <sup>1</sup>	19.35	19.81	19.43	20.19	20.53	20.88	20.45	20.65
Calcium (%) <sup>1</sup>	1.64	1.66	1.65	1.65	1.56	1.56	1.52	1.44
Phosphorus (%) <sup>1</sup>	0.27	0.28	0.28	0.29	0.32	0.31	0.31	0.32
Magnesium (%) <sup>1</sup>	0.33	0.31	0.33	0.33	0.27	0.29	0.27	0.27
Potassium (%) <sup>1</sup>	2.54	2.70	2.52	2.65	2.75	2.68	2.81	2.72
Copper (mg/kg) <sup>1</sup>	4.75	4.01	4.60	3.63	5.52	7.14	5.88	6.86
Sodium (%) <sup>1</sup>	0.07	0.07	0.09	0.08	0.05	0.07	0.08	0.07
Zinc (mg/kg) <sup>1</sup>	17.60	17.46	15.42	19.17	16.07	15.25	18.17	18.38
Manganese (mg/kg) <sup>1</sup>	24.01	22.91	21.60	23.96	21.50	23.35	22.00	22.33
Iron (mg/kg) <sup>1</sup>	55.04	66.26	58.28	65.77	85.77	79.28	83.19	104.89
Acid detergent fiber (%) <sup>1</sup>	39.74	38.75	39.01	38.10	38.64	40.08	41.51	40.58
Neutral detergent fiber (%) <sup>1</sup>	46.65	45.75	47.08	45.69	46.53	47.50	48.59	49.16
Non fiber carbohydrate (%) <sup>1</sup>	23.21	23.63	22.69	23.32	22.14	20.81	20.15	19.39
Total digestible nutrients (%) <sup>1</sup>	56.19	57.24	56.96	57.93	57.35	55.82	54.29	55.29
Relative feed value (%) <sup>1</sup>	116	121	116	122	119	115	108	109

<sup>1</sup> DM basis

## Final Discussion

In this demonstration, alfalfa showed no significant forage yield response to Cu, Zn, or the combined application. Crude protein content was slightly higher for both forage cuts, but was not as high as in 2015. Non-fiber carbohydrates increased with the first cut, but not with the second cut. Collection of yield and forage quality data will continue next year to evaluate the residual value of the applied Cu and Zn for an alfalfa forage crop for one more year.

# Application of Foliar K<sub>2</sub>O S to Irrigated Alfalfa Grown for Forage

## Funding

- Irrigation Crop Diversification Corporation

## Project Lead

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

## Co-operators

- Greg Oldhaver, Producer, Cabri, SK
- James Bateman, Alpine Plant Food, Shaunavon, SK

## Project Objective

The project demonstrated the impacts of foliar potassium (K) and sulfur (S) fertilization of alfalfa with Alpine K<sub>2</sub>O S. Foliar K<sub>2</sub>O S is commonly used in Eastern Canada to improve productivity and stand longevity of alfalfa. The fertilizer contains 0.089 lb N, 0.593 lb K, and 0.237 lb S per litre of product and is applied at 3 L/ac at green-up of the alfalfa in spring and again following harvest of the first cut.

## Demonstration Plan

The alpine product, K<sub>2</sub>O S was applied to actively growing alfalfa in early May at 3 L/ac. Frequent rainfall delayed harvest of the first cut. The subsequent application of K<sub>2</sub>O S following the first cut could not be applied.

## Demonstration Site

The project is located at Plot 9 of NE19-21-18-W3 (Miry Creek Irrigation District) on mainly orthic Willows soils with significant grumic Sceptre soils formed in clayey lacustrine parent material with clay to heavy clay surface textures. A soil sample could not be collected from the site prior to commencing the project.

## Project Methods and Observations

The foliar fertilizer treatment was applied to the new alfalfa growth.

## Irrigation

The level of water in Lake Diefenbaker is usually too low in spring to apply water to the Miry Creek Irrigation District until late June. Water is applied to all fields in the district at the same time. Each field requires 24 sets of 12 hours each to complete an irrigation. Ideally, the district completes 5 irrigations per season, but has reduced irrigations in recent years due to above average rainfall. In 2016, no irrigation water was applied in the district.

Plant tissue samples of the top six inches of growth were collected from the alfalfa at early bloom stage just prior to the first cut. The results of the analysis are reported in Table 1. The levels of almost all nutrients were normal. The check sample tested at the threshold level for both samples. Based on soil samples from nearby fields in previous years, the pH at the site is fairly high. The adjacent field had a pH of 8.5 in 2010. The frequent rainfall in 2016 would maintain the pH at a relatively high value. Molybdenum availability at this site should not impact nodulation negatively.

**Table 1. Plant Tissue Analysis of Alfalfa Samples Collected Prior to Foliar Fertilizer Treatments at Plot 9, Miry Creek Irrigation District for Cut 1 at the Early Flower Stage at Knapik Alfalfa Demo (June, 2015).**

<b>Treatment</b>	<b>N (%)</b>	<b>P (%)</b>	<b>K (%)</b>	<b>S (%)</b>	<b>Ca (%)</b>	<b>Mg (%)</b>	<b>Cu ug/g</b>	<b>Fe ug/g</b>	<b>Mn ug/g</b>	<b>Zn ug/g</b>	<b>B ug/g</b>	<b>Mo ug/g</b>
Check	5.0	0.28	2.1	0.37	2.0	0.35	8.0	80	30	21	33	0.7
Foliar K <sub>2</sub> S	4.7	0.32	2.0	0.41	2.2	0.40	9.0	207	36	25	33	2.0
<b>Threshold</b>	<b>4.5</b>	<b>0.25</b>	<b>2.0</b>	<b>0.30</b>	<b>0.5</b>	<b>0.25</b>	<b>4.5</b>	<b>50</b>	<b>20</b>	<b>20</b>	<b>30</b>	<b>0.3</b>

The forage yield is presented in Table 2. Yields were strong in 2016. In a normal year, the first cut represents over half of the annual yield, a third from the second cut and only about one-tenth from the third cut. Second cut yields in 2016 were higher than normal. Four bales were weighed and the area they represented was measured to estimate the forage yield for the two treatments in this project. The first cut yields for the two treatments were similar. The foliar application was not effective in improving hay yield on the site. A forage sample was collected from each of the weighed bales and composited to determine the forage quality changes introduced by the foliar fertilizer application.

**Table 2. Forage Yield and Feed Analysis of Cut 1 Alfalfa from Plot 9 at Miry Creek Irrigation District.**

<b>Analytical Trait</b>	<b>Control</b>	<b>Foliar Application</b>
Forage Yield (t/ac)	2.69	2.64
Moisture (%)	16.70	12.50
Dry Matter (%)	83.30	87.50
Crude Protein (%) <sup>1</sup>	16.10	13.00
Calcium (%) <sup>1</sup>	2.10	1.40
Phosphorus (%) <sup>1</sup>	0.20	0.20
Magnesium (%) <sup>1</sup>	0.40	0.40
Potassium (%) <sup>1</sup>	2.50	2.40
Sodium (%) <sup>1</sup>	0.10	0.10
Acid detergent fiber (%) <sup>1</sup>	41.80	44.60
Neutral detergent fiber (%) <sup>1</sup>	55.60	60.00
Non fiber carbohydrate (%) <sup>1</sup>	17.50	16.10
Total digestible nutrients (%) <sup>1</sup>	54.00	51.00
Relative feed value (%) <sup>1</sup>	94.00	84.00

<sup>1</sup> DM basis

The sample collected for the foliar application had lower crude protein, lower calcium, but higher acid detergent fiber and neutral detergent fiber compared to the control. According to the feed analysis, it is of lower quality compared to the control. The treatment was not effective in increasing the yield or the relative feed value of the alfalfa at this site. Possible reasons for this may be the salinity level of the soil. The field is also relatively young, having been sown in 2014. Alpine reports more success with this treatment for yield and quality improvements with older stands of alfalfa.

## Final Discussion

The demonstration was unsuccessful in improving the yield or forage quality of the alfalfa stand.

## Acknowledgements

- Alpine Plant Food supplied the K<sub>2</sub>OS for the demonstration.

- ICDC provided the tissue testing and a bale scale to measure the hay yield for the strip trials.
- Greg Oldhaver performed the field operations to conduct the demonstration.

# Phosphate, Potassium & Zinc Demo at Lodge Creek

## Funding

- Agricultural Demonstration of Practices and Technologies (ADOPT) GF2.

## Project Lead

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Ministry of Agriculture
- Andre Bonneau, PAg, Regional Forage Specialist, Saskatchewan Ministry of Agriculture
- Trevor Lennox, PAg, Regional Forage Specialist, Saskatchewan Ministry of Agriculture

## Co-operators

- Mike Lessmeister, Producer, Consul, SK
- Randy Stokke, Producer, Consul, SK

## Project Objective

This project demonstrated the potential for improved forage production with increased fertilizer inputs in gravity-irrigated alfalfa fields in Southwest Saskatchewan.

## Project Plan

A local producer noticed a distinct line between two sides of his flood-irrigated field in the Lodge Creek Irrigation District. Soil samples were collected from both sides of the flood-irrigated site to determine differences in soil quality and the nutrient status of the two sides.

## Demonstration Plan

Different blends of fertilizer were broadcast on border dykes to measure the impact of phosphate, potassium, and zinc on forage production on the flood-irrigated project. The forage yield of the entire area of pairs of border dykes was measured

## Demonstration Site

The project was located on Plot #17 on SE12-2-30-W3 within the Lodge Creek Irrigation District on Kindersley clay. This soil association has pockets of sodium-affected soil across the landscape, but the surface soil is non-saline. The site has been in forage since the irrigation dykes were constructed. Soil analysis for the two areas is reported in Table 1. The irrigation district is entirely sown to forage, mainly alfalfa and grass. The proportion of grass in the stand was higher than originally thought. It was suspected that the visual line observed in the stand was due to soil fertility effects introduced when the site was leveled for irrigation. But, further investigation indicated that the observed growth difference was due to a grass species. A relatively small difference in soil fertility and soil quality was noted for the two areas, but the change in grass species, smooth brome grass versus meadow brome grass, better explains the visual effect.

**Table 1. Soil Analysis of Two Areas with Differential Productivity at Lodge Creek Irrigation District.**

Site	Depth	pH	OM (%)	Minerals (ppm)								
				N	P	K	S	Cu	Fe	Mn	Zn	B
Poor	0–6	7.5	3.1	1	2	217	11	1.3	16	4.9	0.6	1.1
Poor	6–12	8.3	N/A	1	N/A	N/A	24	N/A	N/A	N/A	N/A	N/A
Better	0–6	7.4	4.3	6	3	300+	8	1.1	13	5.0	0.6	1.7
Better	6–12	8.0	N/A	1	N/A	N/A	11	N/A	N/A	N/A	N/A	N/A

## Project Methods and Observations

The recommended fertilizers for alfalfa hay, based on a comparative soil test shown in Table 1, were essentially equal, consisting of 40 lb P<sub>2</sub>O<sub>5</sub> per acre and 4 lb Zn with 15 lb K<sub>2</sub>O per acre and 10 lb S per acre and are considered discretionary. The side with better growth had slightly higher organic matter levels, slightly higher extractable potassium, but lower extractable sodium, all consistent with the observed differences in growth. Available sulphur was slightly higher for the area with poorer growth. Given the need for land leveling to establish the grade for managing the irrigation, it was surprising that available zinc was equal on both sides. Differences in micronutrients were small.

Fertilizer was broadcast with a spin spreader on November 2, 2015, applied to dry ground on a sunny day (temperature: 10° C). The fertilization plan is outlined in Table 2. It was not possible to calibrate the spreader prior to applying the fertilizers, so judgment was used to approximate the settings using the bulk density of the products and the rate chart on the spreader.

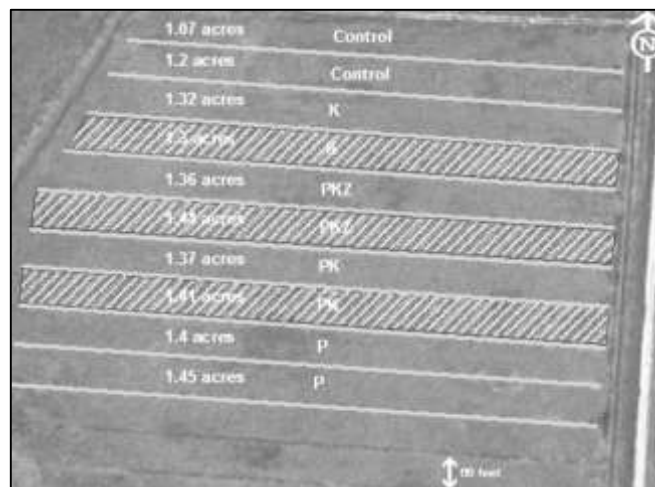
**Table 2. Fertilizer Applications to Field 17, Lodge Creek Irrigation District**

Treatment	Fertilizer Applied	Rate of Blend
Control	None	None
Phosphorus	50 lb P <sub>2</sub> O <sub>5</sub>	115 lb 11-51-0/ac
Potassium	80 lb K <sub>2</sub> O	128 lb 0-0-60/ac
Phosphorus/Potassium	50 lb P <sub>2</sub> O <sub>5</sub> + 80 lb K <sub>2</sub> O	243 lb 5-22-35-0/ac
Phosphorus/Potassium/Zinc/Sulphur	50 lb P <sub>2</sub> O <sub>5</sub> + 80 lb K <sub>2</sub> O + 4 lb Zn + 4 lb S	835 lb 5-22-35-0/ac + 16 lb Zn/ac

The plan was to apply each blend to three border dykes. The spreader was driven down the centre of each of two border dykes and emptied out while doubling back on the first border dyke of each treatment, as shown in Figure 1. Each treatment consisted of two border dykes. It was presumed that melting snow would move the fertilizer into the root zone.

## Irrigation

Water for irrigation was supplied by gravity flow from an irrigation canal fed from nearby Altawan Reservoir in early

**Figure 2. Project Layout–Field 17, Lodge Creek ID.**



May. The site was irrigated on May 9. The hay fields saturated with water fairly quickly in 2016 compared to other springs. The water provided from the reservoir is excellent irrigation water. The water sample collected in early May had an electrical conductivity of 793  $\mu\text{S}/\text{cm}$ , and a sodium absorption ratio (SAR) of 1.74. Lake Diefenbaker reservoir water has similar electrical conductivity and half the SAR, but Altawan reservoir water is still excellent quality for irrigation.

The total precipitation recorded at the Environment Canada weather station at Altawan Reservoir was 287 mm for the growing season (Table 2). Rainfall was consistent over the growing season at the site until August.

**Table 3. Precipitation Recorded at Altawan Reservoir on SE12-2-30-W3 during 2016 (data courtesy Dan Selinger, Environment Canada, Regina, SK).**

Month	Rainfall (mm)
April	51
May	61
June	56
July	50
August	28
September	25
October	16
Total	287

The hay was cut and baled in early July. Each border dyke was baled separately. The bales were left on the field until they were weighed with the ICDC bale scale during the last week of July. Two core samples were collected from each bale and composited for each border dyke. Each border dyke sample was analyzed for feed quality; the average feed quality for each treatment is reported in Table 4.

The forage yields for the fertilizer treatments are reported in Table 3. The forage yield increased with each fertilizer nutrient blend applied to the site. The greatest individual yield response occurred with the addition of potassium, but an increase in yield occurred with each supplementary nutrient application. When phosphorus, potassium, and zinc were all applied, the greatest yield response (almost 0.5 ton/acre) was achieved. The hypothesis when the project was initiated was that the greatest yield increase would occur with phosphorus application. Phosphorus improved the yield, but potassium provided the greatest individual yield increase for a single nutrient. Because no fertilizer had been applied to the site prior to the project, harvest of the forage at the site represents a continual removal of nutrients from the field. Fertilizer application increased not only yield, but also crude protein in the forage by close to 1%. There was limited impact on other forage quality parameters measured.

**Table 4. Forage Yield Response from Fertilization at Field 17, Lodge Creek Irrigation District.**

Treatment	Hay Yield (t/ac)	Increase in Yield Above Control (t/ac)	Fertilizer (cost/ac)	Cost/Ton Increase	Amortization
Control	1.94	N/A	N/A	N/A	N/A
Phosphorus (+N)	2.06	0.12	\$18.24	\$152.01	3 yr
Potassium (+N)	2.17	0.23	\$12.94	\$56.25	3 yr
P + K (+N)	2.19	0.25	\$31.18	\$124.71	3 yr
P + K + Zn (+S)	2.39	0.45	\$41.79	\$92.86	3 yr PK, 10 yr Zn

The project was designed with the assumption that alfalfa represented the majority of the species in the stand. Since grass represents 80–85% of the forage stand, nitrogen would likely provide a better yield boost. Much of the yield response is likely due to the nitrogen supplied from the ammonium

phosphate fertilizer. Some, or even potentially all, of the yield boost observed for the zinc fertilizer is attributable to sulphur included with the zinc fertilizer. Yet, the strongest response in this demonstration was to potassium. Putting this field on an annual program of 50 lb P<sub>2</sub>O<sub>5</sub>, 50 lb K<sub>2</sub>O, and 10 lb S/ac until soil test levels show nutrients are above the minimal levels would improve the yield and quality of the forage. The cost of this level of fertilization would be about \$50 per acre. The benefit of this type of fertilization program would be improved productivity and quality of hay produced from the irrigated flats. Micronutrient content of the forage changed little in the demonstration. The health of the beef herd would be improved once the microelement content of the forage shows improvement. Longevity of the stand would be improved if the K status increased. The persistence of alfalfa in the stand would be improved once this occurred.

A meeting to report these results to the irrigators will be held January 25, 2017, at Consul in conjunction with the South of the Divide Conservation Action Program.

**Table 4. Feed Analysis of Hay from Fertilizer Treatments Applied to Border Dykes at Lodge Creek Irrigation District.**

	Control	Phosphorus	Potassium	P + K	P + K + Zn
Moisture (%)	5.87	4.23	5.36	5.42	5.45
Dry Matter (%)	94.10	95.80	94.60	94.60	94.50
Crude Protein (%) <sup>1</sup>	9.00	9.90	9.80	10.30	9.50
Calcium (%) <sup>1</sup>	0.60	0.73	0.69	0.74	0.64
Phosphorus (%) <sup>1</sup>	0.17	0.18	0.18	0.20	0.20
Magnesium (%) <sup>1</sup>	0.17	0.19	0.18	0.20	0.17
Potassium (%) <sup>1</sup>	1.76	1.85	1.92	1.98	1.93
Copper (mg/kg) <sup>1</sup>	6.10	4.90	5.40	7.60	5.00
Sodium (%) <sup>1</sup>	0.05	0.06	0.06	0.06	0.04
Zinc (mg/kg) <sup>1</sup>	64.00	21.00	28.00	25.00	21.00
Manganese (mg/kg) <sup>1</sup>	34.00	33.00	33.00	34.00	32.00
Iron (mg/kg) <sup>1</sup>	84.00	61.00	61.00	65.00	54.00
Acid detergent fiber (%) <sup>1</sup>	37.00	37.00	39.00	37.00	37.00
Neutral detergent fiber (%) <sup>1</sup>	57.00	57.00	57.00	57.00	59.00
Non fiber carbohydrate (%) <sup>1</sup>	24.00	22.00	22.00	22.00	22.00
Total digestible nutrients (%) <sup>1</sup>	60.00	60.00	58.00	59.00	60.00
Relative feed value (%) <sup>1</sup>	99.00	98.00	96.00	98.00	97.00

<sup>1</sup> DM basis

## Final Discussion

Application of phosphorus, potassium, and zinc to an irrigated hay flat near Govenlock did increase forage yields by close to 0.5 ton/ac on a stand that contained about 80% meadow brome. If the infrastructure to support fertilization of the forage stand at this site was easier to access, the hay production could be improved in both quantity and quality.

## Acknowledgements

- Mike Leismeister for hosting the demo on Field 17 at Lodge Creek Irrigation District.
- Randy Stokke for providing emergency boosting service to staff stranded at the site.

# Defining Agronomic Practices for Forage Corn Production in Saskatchewan

## Funding

- Agriculture Development Fund

## Project Leads

- Dr. Joy Agnew, PAMI
- Co-investigators:
  - Garry Hnatowich, PAg, Research Director, 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:

- Develop and refine seeding and fertility recommendations for corn silage production; and
- 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 feedstock and feeding practices.

The silage trial was established in the spring of 2016 at CSIDC. 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 0–60 cm as 20 kg N/ha, so supplemental N fertilizer, as 46-0-0, was applied in a side banded position at rates of 92, 148, and 204 kg/ha (82, 132, and 182 lb N/ac) to achieve target N levels. 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 18. Fertilizer N was broadcast and incorporated prior to seeding, along with an additional 58 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0. 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 harvested September 21.

Growing season rainfall (May through September) and irrigation was 373 mm and 30 mm, respectively. Cumulative Corn Heat Units (CHU) were 2379 for the period May 15–September 21. Climatic conditions in 2016 were slightly warmer and much wetter than historic norms. The irrigation applications taking place occurred in early June.

## Results

Agronomic data collected in the study is tabulated in Table 1 (Analysis of Variance procedures were conducted on the 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 no treatment was statistically significant different from one another with respect to either dry or wet yield. However, factorial analysis of variance procedures indicate that seeding rate did result in yield differences as shown in Figure 1. Though number of cobs per plot were not recorded, the yield gain associated with a mid and high seeding rate can likely be attributed to higher plant counts associated with higher plant density per plot. Yield differences between the two hybrids and nitrogen (N) fertilization rates were not statistically different (Figure 1). The lack of yield response to N is surprising, given that the spring soil test analysis indicated a marginal level of available N in the soil. Dry matter yields obtained were high and can be associated, in part, to the high amount of

precipitation; the soil test laboratory fertilizer N recommendation was for 45–56 kg N/ha (40–50 lb N/ac) based on grain corn. Based on the yields obtained, it is possible that the lowest rate of N application (92 kg N/ha) was sufficient to provide optimal silage yield. It is also possible that a significant amount 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 hybrid evaluated and N fertilizer application rates had no impact on any agronomic measurement captured in 2016. Seeding rate did not impact harvest moisture content nor days to anthesis. However, seeding rate tended to lengthen days to silking and plant height as seeding rate increased. Established plant populations were approximately 87% of target seeding rate.

These results are from the first year of an intended three year study. PAMI will combine this data with the results from four other locations and a complete report prepared at project completion.

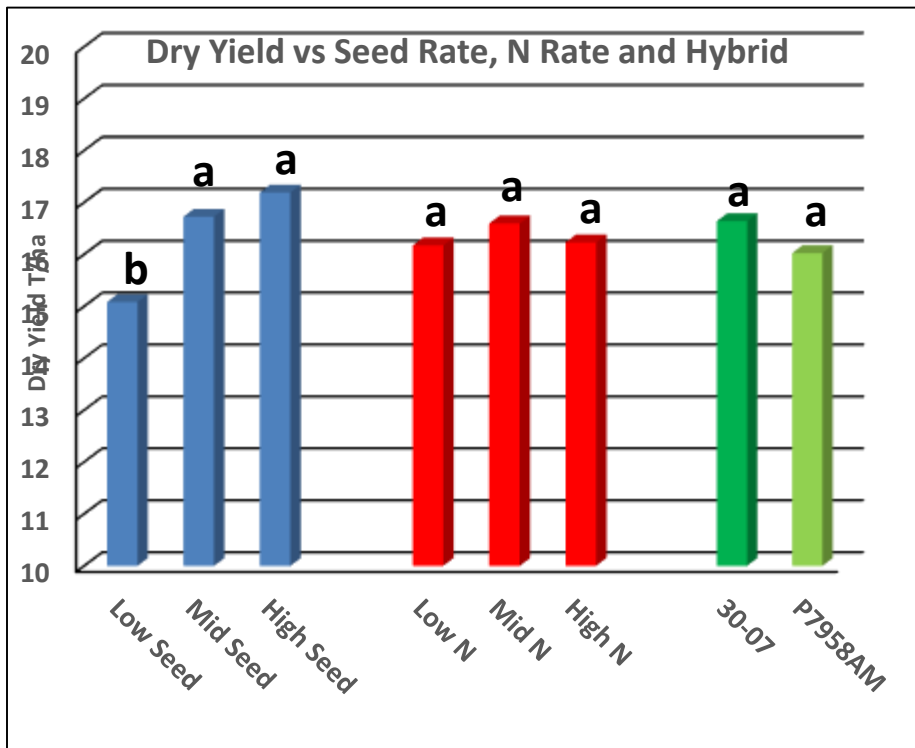
**Table 1. Defining Agronomic Practices for Forage Corn Production – CSIDC site.**

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	15.64	44.70	68.7	71,272	70	73	276
2. P7958AM	Low	Mid	16.21	46.32	66.7	86,257	69	74	322
3. P7958AM	Low	High	16.00	45.71	67.5	100,146	70	74	314
4. P7958AM	Mid	Low	13.77	39.34	67.3	69,810	70	73	303
5. P7958AM	Mid	Mid	17.64	50.41	67.1	84,795	70	74	310
6. P7958AM	Mid	High	16.98	48.52	67.5	104,532	70	75	272
7. P7958AM	High	Low	13.55	38.72	67.0	63,962	71	75	294
8. P7958AM	High	Mid	16.80	47.99	67.0	72,734	70	75	319
9. P7958AM	High	High	17.64	50.39	67.7	105,629	69	74	311
10. 30-07	Low	Low	16.65	47.57	68.1	73,465	70	75	300
11. 30-07	Low	Mid	16.18	46.24	66.2	92,471	70	75	306
12. 30-07	Low	High	16.36	46.74	68.2	115,863	73	76	308
13. 30-07	Mid	Low	15.06	43.02	66.8	67,982	69	71	299
14. 30-07	Mid	Mid	17.41	49.75	67.6	88,085	70	76	286
15. 30-07	Mid	High	18.72	53.49	66.0	108,187	71	75	305
16. 30-07	High	Low	15.83	45.24	67.7	68,348	69	73	303
17. 30-07	High	Mid	16.11	46.04	66.9	82,968	70	75	305
18. 30-07	High	High	17.45	49.84	67.5	101,608	70	75	310
LSD (0.05)			NS	NS	NS	9756	NS	NS	NS
CV (%)			11.6	11.6	1.9	6.8	2.2	2.4	6.4

NS = not significant

**Table 2. Factorial Analysis of Variance for Agronomic Parameters of Forage Corn 2016.**

Treatment	Dry Yield (T/ha)	Wet Yield (65% Moisture T/ha)	% H <sub>2</sub> O	Plant Stand (#/ha)	Days to Anthesis	Days to Silk	Plant Height (cm)
<b>Hybrid</b>							
P7958AM	16.03	45.79	67.4	84,349	70	74	302
30-07	16.64	47.55	67.2	88,775	70	74	302
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS
CV (%)	12.4	12.4	1.9	19.7	2.2	2.5	6.9
<b>Seeding Rate</b>							
Low	15.08	43.10	67.6	69,140	70	73	296
Mid	16.73	47.79	66.9	84,552	70	75	308
High	17.19	49.12	67.4	105,994	71	75	303
LSD (0.05)	1.23	3.51	NS	4,754	NS	1.2	NS
CV (%)	11.2	11.2	1.8	8.2	2.2	2.4	6.8
<b>Nitrogen Fertilizer Rate</b>							
Low	16.17	46.21	67.6	89,912	70	75	304
Mid	16.60	47.42	67.1	87,232	70	74	296
High	16.23	46.37	67.3	82,541	70	75	307
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS
CV (%)	12.6	12.6	1.9	19.7	2.3	2.5	6.8



**Figure 1. Effect of Seeding Rate, N Fertilizer and Hybrid Selection on Yield, 2016.**

# Corn Variety Demonstration for Silage and Grazing

## Funding

- Agricultural Demonstration of Practices and Technologies (ADOPT) GF2.

## Project Lead

- Sarah Sommerfeld, PAg, Regional Forage Specialist, Saskatchewan Agriculture

## Co-investigators

- Garry Hnatowich, PAg, Research Director, ICDC

## Industry Co-operators

- Glenda Clezy, DuPont Pioneer
- Andrew Chilsom, Monsanto
- Neil McLeod, Northstar Seeds Ltd.

## Project Objective

The objective of this project was to evaluate corn varieties suitable to growing conditions in the Lake Diefenbaker Development Area for silage yield potential under dryland and irrigation management. Results of this trial are added to a variety performance database and are included in ICDCs annual *Crop Varieties for Irrigation* publication.

## Project Background

Growing corn for silage or winter grazing can be an alternate winter feeding strategy for Saskatchewan beef producers. The challenge with corn production in Saskatchewan is that it is not a crop adapted to Western Canadian growing conditions. Variety selection is an integral component of ensuring success when growing corn, and producers must know which varieties are available locally and how those varieties perform under local growing conditions.

## Project Plan

The project was designed as a small plot randomized and replicated demonstration. Corn varieties were planted to both dryland and irrigation treatments, with 75 cm (30 inch) row spacing. Each plot consisted of two corn rows. A seeding rate of 79,000 plants/ha (32,000 plants/acre) for irrigated plots and 69,000 plants/ha (28,000 plants/acre) for dryland plots 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. Data collection included plant population, corn heat units (CHU) accumulated, days to 10% anthesis, days to 50% silk, and dry matter yield.

## Demonstration Site

The trial was established at CSIDC on medium to moderately coarse-textured soil, classified as a Bradwell loam to silty loam.

## Project Methods and Observations

The trials were seeded on May 20. Fertilizer was broadcast and incorporated prior to seeding at a rate of 200 kg N/ha and 100 kg N/ha as urea (46-0-0) for irrigated and dryland production respectively. An additional 40 kg N/ha was side banded at seeding in both trials. As well, phosphorus fertilizer was seed placed at a rate of 20 kg P<sub>2</sub>O<sub>5</sub>/ha as 12-51-0 during the seeding operation. Weed control consisted of spring pre-plant and a post emergence application of glyphosate.

Eleven corn hybrids were planted in each production system. All seeding operations were conducted using a specially designed small plot, six row, double disc press drill with two sets of discs. One set of discs was used for seed placement. The second set of discs allowed for sideband placement of fertilizer. Hybrid selection was made by seed companies. Each variety selected was recommended for the corn heat units accumulated in the Lake Diefenbaker area (Table 1).

Cumulative Corn Heat Units (CHU) from May 15 to September 22 was 2429. Cumulative growing season

**Table 1. Corn Varieties Included in Dryland and Irrigation Treatments.**

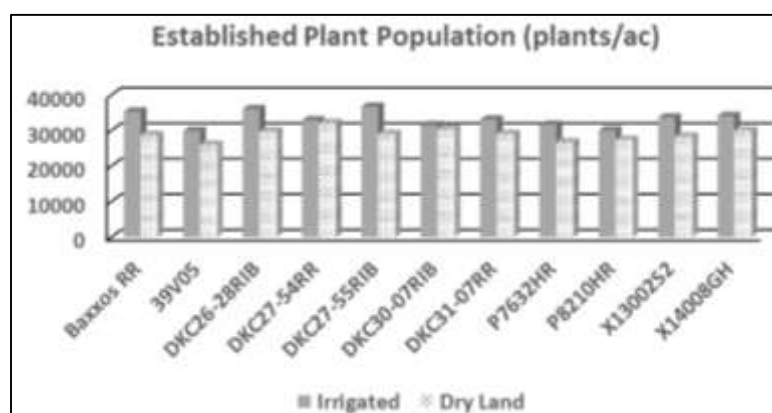
Company	Variety	Corn Heat Unit Rating
Dekalb	DKC 30-07RIB	2325
Dekalb	DKC 31-07RIB	2375
Dekalb	DKC 26-28 RIB	2150
Dekalb	DKC 27-54 RR	2175
Dekalb	DKC 27-55 RIB	2200
Dupont	39v05	2250
Dupont	P8210HR	2475
Dupont	P7632AM	2225
Dow Agro Sciences	X13002S2	not available
Dow Agro Sciences	Baxxos	2300

precipitation from May 15 to September 30 was 373 mm. Irrigation plots received an additional 30 mm of applied water. Climatic conditions in 2016 were slightly warmer and wetter than long term normal. All silage plots were harvested on September 22. The silage trials were harvested with a Hegi forage harvest combine, wet field yield was recorded, and subsamples of chopped material sampled for processing.

## Results and Discussion

The average established plant population of irrigated plots was 33,221 plants/acre. Average established plant population of dryland plots was 28,899 plants/acre (Table 2). Established plant populations of each corn hybrid within the two production systems are shown in Figure 1.

The dryland treatment produced greater dry matter (DM) silage yields compared to the irrigation treatment (Table 2 and Figure 2) by an average of 0.8 T/acre (9.1% higher). This yield result was not



**Figure 1. Established plant population by hybrid; irrigated vs dryland.**

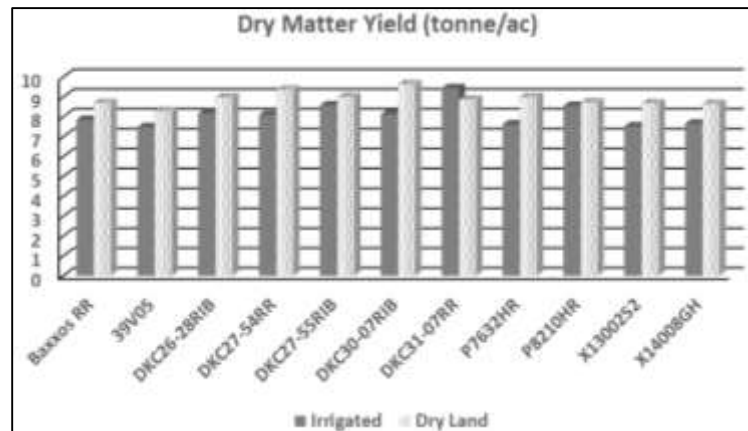


expected. However, this yield discrepancy is likely a cause of wet field conditions and soil waterlogging. The irrigation treatment plots were situated in an area of the field with poor drainage.

**Table 2. Agronomic Data of Irrigated versus Dryland Silage Corn.**

Production System	Wet Yield (T/ha)	Dry Yield (T/ac)	Plant Stand (plants/ac)	Harvest Whole Plant Moisture (%)	10% Anthesis (days)	50% Silking (days)
Irrigated	20.0	8.10	33221	69.9	70	74
Dryland	22.0	8.90	28899	68.3	69	73
LSD (0.05)	NS	NS	2169	0.8	2.0	NS
CV (%)	8.8	8.8	11.9	2.1	2.0	2.4

Based on the 2016 yield data, the variety that performed the best under irrigated conditions was DKC31-07RIB (Table 3 and Figure 2). Under dryland conditions, the variety that performed the best was DKC30-07RIB (Table 4 and Figure2). Baxxos RR was used as the check variety to which all other corn varieties were compared.



**Figure 2. Dry matter yield of hybrids; irrigated vs dryland.**

**Table 3. Agronomic Data of Irrigation Silage Corn, 2016.**

Hybrid	Wet Yield (T/ha)	Dry Yield (T/ac)	Plant Stand (plants/ac)	Harvest Whole Plant Moisture (%)	10% Anthesis (days)	50% Silking (days)
BAXXOS RR*	19.40	7.85	35396	67.9	67	69
39V05	18.46	7.48	29890	66.0	70	73
DKC26-28 RIB	20.19	8.17	36071	69.9	68	74
DKC27-54RR	20.00	8.10	32924	69.1	66	71
DKC27-55 RIB	21.21	8.58	36745	69.2	67	73
DKC30-07 RIB	20.08	8.13	31576	71.3	74	76
DKC31-07RR	23.33	9.44	33149	69.3	73	76
P7632HR	18.83	7.62	31688	70.2	73	77
P8210HR	21.13	8.55	30115	68.4	72	74
X13002S2	18.58	7.52	33711	74.0	72	78
X14008GH	18.92	7.66	34161	73.2	75	77
LSD (0.05)	2.2	0.88	NS	1.5	2.5	2.9
CV (%)	7.5	7.5	13.4	1.5	2.4	2.8

NS = not significant

\* Baxxos RR is check variety.

**Table 4. Agronomic Data of Dryland Silage Corn, 2016.**

<b>Hybrid</b>	<b>Wet Yield (T/ha)</b>	<b>Dry Yield (T/ac)</b>	<b>Plant Stand (plants/ac)</b>	<b>Harvest Whole Plant Moisture (%)</b>	<b>10% Anthesis (days)</b>	<b>50% Silking (days)</b>
BAXXOS RR*	21.49	8.70	28767	66.4	67	68
39V05	20.49	8.29	26070	66.8	68	74
DKC26-28 RIB	22.22	8.99	29778	67.6	67	72
DKC27-54RR	23.15	9.37	32138	67.0	66	70
DKC27-55 RIB	22.25	9.01	29104	65.0	66	70
DKC30-07 RIB	23.83	9.65	30452	69.0	69	74
DKC31-07RR	21.91	8.87	29104	70.1	70	74
P7632HR	22.23	9.00	26744	68.0	68	72
P8210HR	21.58	8.73	27418	68.2	71	74
X13002S2	21.45	8.68	28317	71.6	70	75
X14008GH	21.38	8.65	30003	71.1	73	76
LSD (0.05)	NS	NS	NS	2.6	1.5	2.1
CV (%)	9.6	9.6	9.5	2.6	1.5	2.0

NS = not significant

\* Baxxos RR is check variety.

# FRUIT & VEGETABLE CROPS

## Demonstration of Sweet Potato Production in High Tunnels

### Funding

- Irrigation Crop Diversification Corporation
- Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bilateral agreement

### Project Lead

- Joel Peru, PAG, Irrigation Agrolgist, Saskatchewan Ministry of Agriculture

### Organizations

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

### Project Objective

Sweet potatoes are grown commercially in Ontario, but there is potential for high tunnel production in Saskatchewan. Saskatchewan hobbyists have had some success growing sweet potatoes, although commercial production has never been attempted. Traditionally, sweet potatoes are a tropical crop. Recent increased demand has led to the development of new varieties with a shorter time to maturity. These varieties have not been evaluated in Saskatchewan's short growing season until this year. This project compared seven varieties of sweet potato for yield and quality characteristics required by the retail market. The purpose of this project was to show Saskatchewan growers the economic potential of growing sweet potato in high tunnels with a trickle irrigation system.

### Project Plan

This demonstration was implemented in one 96 foot long high tunnel (Figure 1) and a trickle irrigation system was installed. The plots utilized 3 rows of mulch, taking up an area of



Figure 1. High tunnel production of sweet potato. Left: crop cover installed in the spring. Right: plots at mid-season.

approximately 90 x 14.5 feet. Each of the 7 sweet potato varieties demonstrated was replicated 3 times in 20 foot plots. Each plot was seeded with 10 sweet potato seedlings 2 feet apart from each other. The varieties included Covington, Carver, Japanese Yam, Tainung 65, Beauregard, Superior and Frazier White. The sweet potato seedlings were planted in the high tunnel on May 31 into plastic mulch for weed control.

## Demonstration Site

This project was located in the orchard area at the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC). The seedlings were planted into rows of plastic located in a high tunnel. The crop was irrigated using trickle irrigation and was fertilized using an all-purpose 20-20-20 water-soluble fertilizer. The plots were irrigated on a daily basis, which provided sufficient water for the crops to reach yield potential. A crop cover was installed temporarily in spring and fall to prevent frost damage and increase heat units (Figure 1, right).

## Results

The results of this demonstration are shown in Table 1. Harvest occurred on October 11. Yield and quality results varied significantly by variety. The shapes were not uniform and ranged from a long, thin carrot-like tubers to round tubers (Figure 2). Japanese Yam had the highest plant survival rate and produced the greatest total weight (a total of 17.3 kg of marketable yield from all 3 reps). Ginseng Red produced the highest number of marketable sweet potatoes (a total of 61 among the three plots).



**Figure 2. Tuber shapes vary by variety.**

**Table 1. Sweet Potato Harvest Results**

Variety	Total Surviving Plant Count	Total Harvested Tuber Count	Total Weight of Harvested Tubers (kg)
Japanese Yam	21	57	17.30
Superior	11	51	14.41
Ginseng Red	24	61	14.54
Beauregard	14	25	7.23
Frazier White	16	49	9.85
Covington	16	31	11.46
Carver	5	11	4.47

## Final Discussion

This project demonstrated the economic feasibility of growing sweet potatoes in a high tunnel using trickle irrigation in Saskatchewan. An economic analysis (Table 2) shows the potential gross profit per acre that this crop can generate when grown in a high tunnel. The market price for sweet potato is around \$4.00/kg in grocery stores. These numbers can vary greatly based on the season's supply and demand. Yield was converted to plants/acre and harvested kg/acre to determine the potential value for a producer. The prices shown in Table 3 are the gross values if sold directly to the consumer (e.g., at a farmer's market). The results of this trial suggest that growing sweet potato using the protocols of this project (i.e., high tunnel with trickle irrigation) may not be economically feasible in Saskatchewan. More work on the most productive varieties (Japanese Yam, Superior and Ginseng Red) will be evaluated further for economic feasibility of production under other conditions.

For more information regarding this crop and the equipment, supplies and labour required, contact Connie Achtymichuk, Provincial Vegetable Specialist, at (306) 867-5526 or by email at [connie.achtymichuk@gov.sk.ca](mailto:connie.achtymichuk@gov.sk.ca).

**Table 2. Gross Economic Analysis of Sweet Potato Production**

Variety	Extrapolated Harvest Weight (kg/acre)	Gross Profit Per Acre (based on \$4/kg)
Japanese Yam	1732	6930
Superior	1442	5772
Ginseng Red	1456	5824
Beauregard	724	2896
Frazier White	986	3945
Covington	1147	4590
Carver	447	1791

## Acknowledgements

The project lead would like to acknowledge:

- Connie Achtymichuk, Provincial Vegetable Specialist, for help setting up and maintaining the project, providing agronomic guidance, and completing the economic analysis.
- Ken Achtymichuk, ICDC Seasonal Agronomy Research Technician, for set up and field work.
- ICDC staff for assisting in set up and field work.
- LCBI grade 11 class for assistance during the harvest.
- CSIDC staff who assisted with the field and irrigation operations.

# Demonstration of Fingerling Potatoes

## Funding

- Irrigation Crop Diversification Corporation
- Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bilateral agreement

## Project Lead

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

## Organizations

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

## Project Objective

Fingerling potatoes are grown in specialty production around the world. They tend to be smaller, longer, and narrower than traditional potato varieties and are therefore more difficult to harvest. Now that creamer potatoes are more popular, equipment has been developed to harvest these potatoes, making them more viable to harvest in large volumes.

The Prairie Fresh Food Corporation has grown substantially with production and marketing of new potatoes into retail across the prairie provinces. They are also growing into the creamer potato market. Fingerlings are a specialty item that would fit well with other smaller potatoes and help increase use of equipment purchased and increase income for producers. There are numerous varieties available for this market; this project aimed to help screen varieties most suited to the Saskatchewan retail market.

This project demonstrated a comparison of registered fingerling potatoes under an irrigated crop system. The purpose was to demonstrate the potential for growing fingerling potatoes commercially in Saskatchewan and provide opportunities for producers and buyers to see the different varieties available for production.

## Project Plan

The trial consisted of 8 rows, each 3 meters long, which allowed 5 varieties to be replicated 4 times. The rows were combined, which created 6 m plots for each rep. The middle row was considered the treatment row. The potatoes were seeded and harvested using small plot equipment and irrigated with a low pressure pivot system. Hilling was done on June 22 and again on June 28. The disease and management system for this demonstration is illustrated in Table 1.

## Demonstration Site

This project was located on field 8 at the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC) (Figure 1). This site has a sandy loam texture and was cultivated and rototilled prior to seeding. Irrigation was applied throughout the season to meet water use requirements of the fingerling potatoes. This site received 406 mm (19 inch) of rainfall and 46 mm (1.8 inch) of irrigation.

**Table 1. Pesticide Regime for Fingerling Potato Project.**

Product Type	Product Name	Date of Application
Herbicide	Eptam 8-E	May 5
Insecticide	Ripcord	July 20
Insecticide	Ripcord	August 13
Fungicide	Bravo 500	July 9
Fungicide	Curzate DF	July 20
Fungicide	Tattoo C	July 31
Fungicide	Acrobat MZ	August 13
Fungicide	Bravo 500	September 2

## Results

This project was flailed on September 8 and desiccated with 1 L/acre of Reglone on September 9 and 13. Harvest took place on September 28; the average results from the 4 reps are shown in Table 2. Annabelle produced the greatest total weight of potatoes, although many did not meet marketable specifications. Violet Queen produced the largest number of marketable potatoes and marketable weight, with an average of 577 and 23.4 kg, respectively. Visual differences between the varieties can be seen in figures 2–6.



**Figure 1. Fingerling Potato Plots at CSIDC.**

**Table 2. Average Results of the Fingerling Potato Trial.**

Variety	Total Yield (kg)	Marketable	
		Potato (#)	Weight (kg)
AmaRosa	25.8	422	20.9
Annabelle	48.4	388	19.0
Banana	17.2	459	16.5
French Fingerling	37.8	331	15.9
Violet Queen	35.8	577	23.4



**Figure 2. Violet Queen.**

## Final Discussion

This demonstration was conducted to demonstrate the economic feasibility of growing fingerling potatoes under irrigation in Saskatchewan. An economic analysis (Table 3) determined the gross dollar per acre that this crop can generate. The market price for fingerling potatoes is around





**Figure 3. AmaRosa.**



**Figure 4. Annabelle.**



**Figure 5. Banana.**



**Figure 6. French Fingerling.**

\$5.90/kg, but can vary based on current supply and demand. Yield was converted to potatoes/acre and kg/acre to determine the potential value to a producer. Values shown in Table 3 are gross values when sold directly to consumers (i.e., at a farmer's market).

**Table 3. Gross Economic Analysis of fingerling potato Production**

Variety	Marketable Potato /acre	Tonne/Acre	Gross \$/Acre (retail value)
AmaRosa	349939	17.3	\$102,254
Annabelle	321745	15.8	\$92,958
Banana	380621	13.7	\$80,727
French Fingerling	274478	13.2	\$77,791
Violet Queen	478471	19.4	\$114,484

This project demonstrated that all varieties are able to produce a significant amount of gross return under an irrigated cropping system in Saskatchewan.

For more information regarding this crop and the equipment, supplies and labour required, contact Connie Achtymichuk, Provincial Vegetable Specialist at (306) 867-5526 or by email at [connie.achtymichuk@gov.sk.ca](mailto:connie.achtymichuk@gov.sk.ca).



## **Acknowledgements**

- Connie Achtymichuk, Provincial Vegetable Specialist, for help setting up and maintaining this project, providing agronomic guidance, and completing the economic analysis.
- Ken Achtymichuk, ICDC Seasonal Agronomy Research Technician, for set up and field work.
- ICDC staff for assisting in set up and field work.
- CSIDC staff who assisted with the field and irrigation operations.

# Green and Chili Pepper Trial

## Funding

- Irrigation Crop Diversification Corporation
- Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bilateral agreement

## Project Lead

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

## Co-operators

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

## Project Objective

Green and chili peppers are grown commercially in greenhouses and sometimes in the field in locations such as Ontario. Most of Saskatchewan's supply is currently imported from Alberta. Doug Waterer, Associate Professor at the University of Saskatchewan, has proven that they can be successfully grown in the field using trickle irrigation and plastic mulch.

This demonstration compared bell and chili (hot) peppers grown in high tunnels and field conditions. The objectives of this demonstration were to demonstrate the potential of commercial production of peppers in Saskatchewan, provide opportunities for producers and buyers to see the different varieties available for production, and compare production quality and yield in high tunnel versus low tunnel systems.

## Project Plan

This demonstration was implemented in one 96 foot high tunnel (Figure 1, left) and in the field using low tunnels (Figure 1, right). The plots utilized an area of 90 x 19.33 feet in both the high tunnel and



**Figure 3. Different tunnel systems with plastic mulch used to grow peppers in this project. Left: High tunnel; Right: low tunnel in the field.**

in the field. The high tunnel and field plots each contained 4 rows of plastic mulch and a trickle irrigation was installed underneath the plastic mulch. Four bell pepper varieties and four hot pepper varieties were replicated four times. Each row was 22.5 feet long and consisted of 4 reps of 15 plants each. The bell pepper varieties included King Arthur, Tomcat, Archimedes, and Excursion. Chili pepper varieties included Dulce, Major League, Monet, and SV7017HJ. The bell peppers were seeded in a greenhouse on April 30, and the hot peppers on April 25. Once the seedlings were sufficiently mature enough (June 8), they were transplanted into plastic mulch in both the high tunnel and field.

## **Demonstration Site**

This project was located in the orchard area at the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC). The project took place in the greenhouse for development of the seedlings and the high tunnels and field for the duration of the growing season. The seedlings were planted into rows of plastic mulch to control weeds and reduce evaporation. The crop was irrigated using trickle irrigation and was fertilized using an all-purpose 20-20-20 water-soluble fertilizer. The plots were irrigated daily, which provided sufficient water for the crops to reach yield potential. Two rows of the field plots were covered with low tunnels on June 10, which were removed when daily temperatures became too hot.

## **Results**

### *Bell Pepper Trial*

The results of this trial are shown in Table 1. Harvest occurred between August 4 and October 11. The bell peppers in the high tunnel produced a significantly higher marketable yield (a total of 240.86 kg) compared to the low tunnel and no tunnel plots (a total of 20.64 kg and 10.66 kg were produced respectively). The Archimedes variety produced the highest marketable yield in the high tunnel (413 peppers weighing 64.37 kg). All varieties produced similar yields in the high tunnel and the average plant produced 14 peppers through the growing season. There was little loss due to quality issues, with 93% of the crop deemed marketable.

### *Chili Pepper Trial*

The results of this trial are shown in Table 2. Harvest occurred between August 4 and October 11. The hot peppers in the high tunnel produced a significantly higher marketable yield (a total of 233.64 kg) compared to the low tunnel and no tunnel plots (a total of 31.69 kg and 30.05 kg were produced respectively). The SV7017HJ variety produced the highest marketable yield by weight (65.25 kg) in the high tunnel. The Major League variety produced the greatest quantity in the high tunnel (a total of 2240 peppers). All varieties produced similar yields in the high tunnel and the average plant produced 74 peppers throughout the growing season. There was little loss due to poor quality, with 98% of the crop deemed marketable.

## Final Discussion

### *Bell Pepper Trial*

This demonstration was conducted to demonstrate the economic feasibility of growing bell peppers with different production systems in Saskatchewan. Economic yields were not achieved using a low tunnel or no tunnel system. Economically feasible production in Saskatchewan requires use of a high tunnel. An economic analysis (Table 3) determined the gross profit per acre that a bell pepper crop can generate in a high tunnel. The market price for bell peppers is around \$6.00/kg in grocery stores. These numbers can vary greatly based on the season's supply and demand. Yield was converted to plants/acre and kg/acre to determine the potential value to a producer. The values shown in Table 3 are the gross values if sold directly to the consumer (i.e., at a farmers market). The results of this trial suggest that growing bell peppers in Saskatchewan using high tunnel production and trickle irrigation can be very profitable. Table 2. Chili Pepper Results—high tunnel, low tunnel and no tunnel plots.

**Table 1. Bell Pepper Results—High Tunnel, Low Tunnel and No Tunnel Plots.**

Variety	Plant Count	Total Count	Total Yield (kg)	Mktable Count	Mktable Yield (kg)	Avg. Count Per Plant	Avg. Yield per Plant (kg)	Mktable Count Per Plant	Mktable Yield Per Plant (kg)
<b>High Tunnel</b>									
King Arthur	28	447	67.87	410	63.40	16	2.42	15	2.26
Tomcat	28	364	57.20	351	56.15	13	2.04	13	2.01
Archimedes	28	444	68.27	413	64.37	16	2.44	15	2.30
Excursion	28	396	60.67	361	56.93	14	2.17	13	2.03
<b>Total</b>	<b>112</b>	<b>1651</b>	<b>254.01</b>	<b>1535</b>	<b>240.85</b>	<b>15</b>	<b>2.27</b>	<b>14</b>	<b>2.15</b>
<b>Low Tunnel</b>									
King Arthur	14	45	4.88	24	3.11	3	0.35	2	0.22
Tomcat	14	66	9.11	29	8.33	5	0.65	2	0.60
Archimedes	14	67	7.46	49	6.09	5	0.53	4	0.44
Excursion	14	45	4.88	24	3.11	3	0.35	2	0.22
<b>Total</b>	<b>56</b>	<b>223</b>	<b>26.33</b>	<b>126</b>	<b>20.64</b>	<b>4</b>	<b>0.47</b>	<b>2</b>	<b>0.37</b>
<b>No Tunnel</b>									
King Arthur	14	15	2.38	15	2.38	1	0.17	1	0.17
Tomcat	14	17	2.39	13	1.90	1	0.17	1	0.14
Archimedes	14	40	5.04	28	4.00	3	0.36	2	0.29
Excursion	14	15	2.38	15	2.38	1	0.17	1	0.17
<b>Total</b>	<b>56</b>	<b>87</b>	<b>12.19</b>	<b>71</b>	<b>10.66</b>	<b>2</b>	<b>0.22</b>	<b>1</b>	<b>0.19</b>

### *Chili Pepper Trial*

This demonstration was conducted to demonstrate the economic feasibility of growing hot peppers with different production systems in Saskatchewan. Economic yields were not achieved using a low tunnel or no tunnel system. Economically feasible production in Saskatchewan requires use of a high tunnel. An economic analysis (Table 4) determined the gross profit per acre that chili peppers can generate in a high tunnel. The market price for hot peppers is around \$16.00/kg in grocery stores.

These numbers can vary greatly based on the season's supply and demand. Yield was converted to plants/acre and kg/acre to determine the potential value to a producer. The values shown in Table 3 are the gross values if sold directly to the consumer (at farmers market,). The results of this trial suggest that growing chili peppers in Saskatchewan using high tunnel production and trickle irrigation can be very profitable.

For more information regarding this crop, equipment, supplies, and labour required, contact Connie Achtymichuk, Provincial Vegetable Specialist, at (306) 867-5526 or by email at [connie.achtymichuk@gov.sk.ca](mailto:connie.achtymichuk@gov.sk.ca).

**Table 2. Chili Pepper Results—High Tunnel, Low Tunnel and No Tunnel Plots.**

	Plant Count	Total Count	Total Yield (kg)	Mktable Count	Mktable Yield (kg)	Avg. Count Per Plant	Avg. Yield per Plant (kg)	Mktable Count Per Plant	Mktable Yield Per Plant (kg)
<b>High Tunnel</b>									
Dulce	28	2000	57.37	1952	56.44	71	2.05	70	2.02
Major League	28	2333	62.39	2240	61.91	83	2.23	80	2.21
Monet	28	1860	50.15	1843	50.04	66	1.79	66	1.79
SV7017HJ	28	2199	65.68	2174	65.25	79	2.35	78	2.33
<b>Total</b>	<b>112</b>	<b>8392</b>	<b>235.59</b>	<b>8209</b>	<b>233.64</b>	<b>75</b>	<b>2.10</b>	<b>73</b>	<b>2.09</b>
<b>Low Tunnel</b>									
Dulce	14	445	11.35	435	11.17	32	0.81	31	0.80
Major League	12	135	2.82	135	2.82	11	0.24	11	0.24
Monet	13	234	4.93	227	4.87	18	0.38	17	0.37
SV7017HJ	14	476	12.94	468	12.83	34	0.92	33	0.92
<b>Total</b>	<b>53</b>	<b>1290</b>	<b>32.04</b>	<b>1265</b>	<b>31.69</b>	<b>24</b>	<b>0.60</b>	<b>24</b>	<b>0.60</b>
<b>No Tunnel</b>									
Dulce	14	282	6.69	274	6.58	20	0.48	20	0.47
Major League	14	276	6.47	268	6.36	20	0.46	19	0.45
Monet	14	357	8.64	351	8.59	26	0.62	25	0.61
SV7017HJ	14	315	8.52	315	8.52	23	0.61	23	0.61
<b>Total</b>	<b>56</b>	<b>1230</b>	<b>30.32</b>	<b>1208</b>	<b>30.05</b>	<b>22</b>	<b>0.54</b>	<b>22</b>	<b>0.54</b>

**Table 3. Gross Per Acre Economic Analysis of Bell Pepper Production Based on Retail Market Price of \$6/kg**

Variety	Yield (kg/acre)	Gross Profit/Acre
King Arthur	6349	\$38,092
Tomcat	5623	\$33,736
Archimedes	6445	\$38,675
Excursion	5701	\$34,205

**Table 4. Gross Per Acre Economic Analysis of Chili Pepper Production Based on Retail Market Price of \$16/kg**

Variety	Yield (kg/acre)	Gross Profit/Acre
Dulce	5651	\$90,428
Major League	6199	\$99,192
Monet	5011	\$80,174
SV7017HJ	6534	\$104,544

## Acknowledgements

The project lead would like to acknowledge the following people for their assistance:

- Connie Achtymichuk, Provincial Vegetable Specialist, for help setting up and maintaining this project, providing agronomic guidance, and completing the economic analysis.
- Ken Achtymichuk, ICDC Seasonal Agronomy Research Technician, for set up and field work.
- ICDC staff for assisting in set up and field work.
- CSIDC staff who assisted with the field and irrigation operations.

# Demonstration of Field Grown Slicing Cucumbers

## Funding

- Irrigation Crop Diversification Corporation
- Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bilateral agreement

## Project Lead

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

## Co-operators

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

## Project Objective

This demonstration evaluated registered slicing cucumber varieties for potential commercial production of slicing cucumbers in Saskatchewan. The project provided opportunities for Saskatchewan producers and buyers to see this crop being grown using trickle irrigation.

The Grocery People have been requesting local field-grown slicing cucumbers for their retail markets. The slicing cucumber industry in Canada is centred mainly in Ontario, although Alberta grows large volumes of both field and greenhouse cucumbers. The greenhouse industry in Canada produces blemish-free seedless cucumbers year round. Field cucumbers have a thicker skin and more flavour, but sell for a lower price compared to slicing cucumbers.

## Project Plan

This demonstration consisted of four 98 foot rows of slicing cucumbers. Rows were spaced 6 feet apart to allow for field work to occur without risk of damaging the plastic mulch used in this project. Each row contained randomized replicates of all 4 varieties tested. The plants were direct-seeded with 1 foot of spacing, allowing for 10 plants to be seeded per rep. This demonstration was conducted under a trickle irrigation system in an open-air environment.

## Demonstration Site

This project was located in the orchard area at the Canada-Saskatchewan Irrigation Diversification Centre (Figure 1). This site has a sandy loam texture and was cultivated and rototilled prior to seeding. The seeds were planted into rows of plastic mulch to control weeds and reduce evaporation. The plants were fertilized periodically with all purpose 20-20-20 fertilizer throughout the growing season. Irrigation was applied throughout the season to meet the water-use requirements of the slicing cucumbers.

## Results

Beginning July 21 until September 13, produce was harvested 18 times. The results of the slicing cucumber harvest are shown in Table 1. Yields peaked in mid-August and began to decrease in September. Speedway performed the best, producing 445 kg of cucumbers in a 98 foot row. Perseus had a high yield per plant, but had the lowest total yield due to poor germination. Fanfare had the highest germination, but the lowest yield per plant. Darlington produced the greatest yield per plant, but had a fairly low germination rate.



Figure 4. Slicing Cucumber plots at CSIDC

Table 1. Results of Slicing Cucumber Harvest

Variety	Plant Count	Total Count	Total Yield (kg)	Mrktble Count	Mrktble Yield (kg)	Total Count Per Plant	Total Yield Per Plant (kg)	Mrktble Count Per Plant	Mrktble Yield (kg) Per Plant
Darlington	36	1708	325.59	1529	299.14	47	9.04	42	8.31
Fanfare	102	1978	426.04	1895	406.43	19	4.18	19	3.98
Perseus	25	945	215.11	845	195.77	38	8.60	34	7.83
Speedway	93	2259	477.14	2089	444.98	24	5.13	22	4.78
Total	256	6890	1443.88	6358	1346.32	27	5.64	25	5.26

## Final Discussion

This demonstration was conducted to demonstrate the economic feasibility of growing slicing cucumbers under trickle irrigation in Saskatchewan. An economic analysis (Table 2) determined the gross dollar per acre that this crop can generate. The market price for slicing cucumbers is around \$1.50 per cucumber, but can vary based on current supply and demand. Yield was converted to plants/acre and tonnes/acre to determine the potential value to a producer. The values shown in Table 2 are gross values if produce is sold directly to the consumer (i.e., at a farmer's market).

Table 2. Gross Per Acre Economic Analysis of Slicing Cucumber Production: Retail Price of \$1.50/Cucumber.

Variety	Marketable Cucumbers/Acre	Tonne/Acre	Gross Profit/Acre (retail value)
Darlington	113,271	22.16	\$169,906
Fanfare	140,384	30.11	\$210,577
Perseus	62,599	14.50	\$93,898
Speedway	154,756	32.97	\$232,135

This project demonstrated that all varieties can produce a significant gross return under a trickle irrigation system in Saskatchewan. Using the 18 harvest occasions achieved in this project, a producer could sell their entire crop within a 3-month period, but inconsistency in yield per harvest might affect consistency of supply to a market, something a retail buyer looks for.



For more information regarding this crop and the equipment, supplies and labour required, contact Connie Achtymichuk, Provincial Vegetable Specialist at (306) 867-5526 or by email to [connie.achtymichuk@gov.sk.ca](mailto:connie.achtymichuk@gov.sk.ca)

## **Acknowledgements**

The project lead would like to acknowledge the following people for their assistance:

- Connie Achtymichuk, Provincial Vegetable Specialist, for help setting up and maintaining this project, providing agronomic guidance, and completing the economic analysis.
- Ken Achtymichuk, ICDC Seasonal Agronomy Research Technician, for set up and field work.
- ICDC staff for assisting in set up and field work.
- CSIDC staff who assisted with the field and irrigation operations.

# Varieties for Tomato and Cucumber Production in High Tunnels

## Funding

- Irrigation Crop Diversification Corporation
- Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bilateral agreement

## Project Lead

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

## Co-operators

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

## Project Objectives

The demand for locally grown tomatoes and cucumbers is currently not being met in most Saskatchewan markets. Demand is increasing faster than the industry is expanding. Tomatoes and cucumbers are well suited to high tunnel production. This project was undertaken to provide a comparison of greenhouse and field varieties for yield and quality grown in a high tunnel to help producers decide which varieties to use and to bring awareness about this opportunity.

This project compared registered greenhouse and field tomato and cucumber varieties for commercial production in Saskatchewan. This demonstration provided opportunities to producers and buyers to see this crop being grown using trickle irrigation in a high tunnel system.

Questions considered during this demonstration were:

- 1) When grown in a high tunnel environment, do greenhouse varieties have greater yields than the field varieties that bred to be subjected to less than optimum conditions compared to conditions in a greenhouse?
- 2) Are greenhouse varieties too specialized to handle fluctuations in the growing environment (i.e., can crop losses be avoided)?
- 3) Do field varieties provide sufficiently high yields to justify an investment in high tunnels?.

## Project Plan

This demonstration was implemented using two 96 foot high tunnels, one for the tomato portion of this project and the other for the cucumber portion. Each high tunnel contained 4 rows of mulch with trickle irrigation installed underneath. There were 4 varieties demonstrated for each crop and they were replicated 4 times and randomized in each row. Each rep consisted of 22.5 foot rows with 15 plants for both the cucumber and tomato trial. The cucumber varieties included Darlington

(field), Speedway (field), Camaro (greenhouse), and Jawell (greenhouse). The tomato varieties included Trust (greenhouse), Cobra (greenhouse), Defiant (field), and celebrity (field). Both the cucumbers and tomatoes were seeded into pots in a greenhouse on April 25 and April 18 respectively (Figure 1, left). Once the seedlings were mature enough, they were transplanted in plastic mulch in the high tunnels on May 20 (Figure 1, right).



**Figure 5. Tomato and Cucumber Seedlings in the Green House (left) and Transplanted into the High Tunnel (right).**

### **Demonstration Site**

This project was located in the orchard area at the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC). The project was initiated in the greenhouse for development of the seedlings and moved to the high tunnels for the remainder of the season. The seedlings were planted into rows of plastic mulch in the high tunnels to control weeds and reduce evaporation. The drip line irrigation for this project was equipped with fertilizer injectors to facilitate fertigation with soluble 20-20-20 throughout the growing season. The plots were irrigated on a daily basis, which provided sufficient water for the crops to reach yield potential. Heavy duty trellis systems (Figure 2) were installed to support the weight of the crop.



**Figure 6. Trellis System of Cucumbers (left) and Tomatoes (right).**

## Results

### *Cucumber Trial*

The first harvest occurred on June 24; only the Jawell variety had marketable cucumbers ready. By June 30, harvest of all varieties was occurring 3 times per week until July 27. The only variety that had harvestable yields after July 27 was Darlington variety, which produced until August 5. The results of the cumulative harvests for the 4 reps of each variety are shown in Table 1. The mini cucumber greenhouse variety, Jawell, produced the most marketable cucumbers. The field variety, Speedway, produced the greatest marketable weight yield. The long English greenhouse variety, Camaro, produced the lowest number of marketable cucumbers and the lowest marketable weight yield. In terms of total cucumber material produced, the greenhouse varieties outperformed the field varieties, although, after grading, the Darlington and Speedway (both field varieties) came out on top.

**Table 1. Results of Cucumber Harvest**

Variety	Plant Count	Total Count	Total Yield (kg)	Mrktable Count	Mrktable Yield (kg)	Avg. Count per Plant	Avg. Yld per Plant (kg)	Mktable Count per Plant	Mktable Yield per Plant (kg)
Darlington	59	2533	442.19	2236	393.18	43	7.49	38	6.66
Camaro	59	1541	547.90	828	300.88	26	9.29	14	5.10
Speedway	59	2471	448.23	2265	420.16	42	7.60	38	7.12
Jawell	58	3160	455.03	2570	365.38	54	7.85	44	6.30

### *Tomato Trial*

There were a total of 15 harvests spanning from August 4 to September 9. The results of the cumulative harvests for the 4 reps of each variety are shown in Table 2. The field variety, Defiant, produced the greatest number of marketable tomatoes (4,830 tomatoes for all four 22.5 foot reps). The greenhouse varieties, Trust and Cobra, produced significantly fewer marketable tomatoes compared to the field varieties. Celebrity produced the greatest number of tomatoes per plant (41) and Trust produced the fewest.

**Table 2. Results of Tomato Harvest**

Variety	Plant Count	Total Count	Total Yield (kg)	Mrktable Count	Mrktable Yield (kg)	Avg. Count per Plant	Avg. Yield per Plant (kg)	Mrktable Count per Plant	Mrktable Yield per Plant (kg)
Trust	15	1267	300.15	1171	272.18	84	20.01	78	18.15
Cobra	15	1348	325.04	1267	302.69	90	21.67	84	20.18
Defiant	15	5494	544.66	4830	507.4	366	36.31	322	33.83
Celebrity	15	3957	621.73	3448	580.77	264	41.45	230	38.72

## Final Discussion

### *Cucumber Trial*

This project was conducted to demonstrate the economic feasibility of growing field and greenhouse cucumber varieties using irrigated high tunnel production in Saskatchewan. An economic analysis (Table 3) determined the gross dollar per acre that this crop can generate. The market price for slicing (field) cucumbers is around \$1.50 per cucumber, \$1.70 for long English and \$0.60 for mini cucumbers. These values can vary greatly based on the season's supply and demand. Yield was converted to plants/acre and tonnes/acre to determine the potential value to producers. The values shown in Table 3 are the gross values when produce is sold directly to consumers (i.e., at a farmer's market). The results of this trial suggest that production of field varieties of cucumbers in high tunnels is far more profitable than greenhouse varieties.

**Table 3. Gross per Acre Economic Analysis of High Tunnel Cucumber Production Based on Retail Market Price.**

Variety (Price per Cucumber)	Marketable Number of Cucumbers Produced/Acre	Tonnes/Acre	Gross Profit per Acre
Darlington (\$1.50)	223,908	39.37	\$335,863
Camaro (\$1.70)	82,914	30.13	\$140,954
Speedway (\$1.50)	226,812	42.07	\$340,219
Jawell (\$0.60)	257,354	36.59	\$154,413

### *Tomato Trial*

This project was conducted to demonstrate the economic feasibility of growing field and greenhouse tomatoes using irrigated high tunnel production in Saskatchewan. An economic analysis (Table 4) determined the gross dollar per acre that this crop can generate. The market price used for this economic analysis is \$3.30/kg, although this can vary greatly depending on the supply and demand of the season. The prices shown in Table 4 are the gross values for produce sold directly to consumers (i.e., at a farmer's market). The results of this trial suggest that growing field varieties in high tunnel production is more profitable than greenhouse varieties.

**Table 4. Gross Economic Analysis of High Tunnel Tomato Production.**

Variety	Tonne/acre	Gross \$/acre (retail value)
Trust	27.26	\$89,943
Cobra	30.31	\$100,025
Defiant	50.81	\$167,672
Celebrity	58.16	\$191,918

For more information regarding this crop and the equipment, supplies and labour required, contact Connie Achtymichuk, Provincial Vegetable Specialist at (306) 867-5526 or by email at [connie.achtymichuk@gov.sk.ca](mailto:connie.achtymichuk@gov.sk.ca).

## Acknowledgements

The project lead would like to acknowledge the following people for their assistance:

- Connie Achtymichuk, Provincial Vegetable Specialist, for help setting up and maintaining this project, providing agronomic guidance, and completing the economic analysis.
- Ken Achtymichuk, ICDC Seasonal Agronomy Research Technician, for set up and field work.
- ICDC staff for assisting in set up and field work.
- CSIDC staff who assisted with the field and irrigation operations.

# Demonstration of Field Grown Bunching Onion

## Funding

- Irrigation Crop Diversification Corporation
- Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bilateral agreement

## Project Lead

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

## Organizations

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

## Project Objective

Bunching onions are easily grown in Saskatchewan, although they are not yet commercially produced. The Grocery People have requested locally grown bunching onions for retail markets, representing a demand for this crop. This project compared six varieties of bunching onion for yield and quality characteristics demanded by the retail market. This project evaluated the economic feasibility of growing bunching onions using pivot irrigation in Saskatchewan's climate. Sequential plantings were planned to determine how many harvests could be generated in a year. Harvesting multiple times throughout the growing season allows a producer to market their crop over a longer period of time.

## Project Plan

This demonstration consisted of six varieties of bunching onions planted in 26 ft rows with a target of 3120 plants per row with 2 ft row spacing. There were six sequential plantings of each variety, all using the same plot dimensions. The project was seeded using a single row seeder with a target of 0.1" between each plant. The plots were in an open field environment and watered using a low pressure pivot irrigation system.

## Demonstration Site

This project was located in the orchard area at the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC). This site has a sandy loam texture and was cultivated and rototilled prior to seeding. Fertilizer was side banded at the time of seeding to meet crop fertility requirements. Irrigation was applied throughout the season to meet the water use requirements of bunching onions. The test plots were planted between guard rows to provide accurate results.

## Results

Although there were six plantings, only three were harvestable. The first planting was aborted due to failed emergence caused by fertilizer burn. To avoid this issue from occurring again, the later seedings implemented side banded fertilizer. The second seeding occurred on May 16 and was harvested on August 13 (Table 1). Tokyo performed the best, producing 486 marketable onion bunches with a total weight of 11.71 kg. The other varieties in the harvest produced less than 5 kg of marketable onion bunches. The third seeding occurred on June 2 and was harvested on August 18 (Table 2). This harvest was very poor for all varieties tested compared to the second harvest. White Lisbon produced the most onion bunches (35 for a total weight of 4.37 kg). The fourth seeding occurred June 14 and was harvested September 1. This harvest was greater in total weight than the third harvest. White Lisbon produced the largest quantity of onion bunches (349 for a total weight of 5.25 kg). The variety Evergreen provided the highest total yield weight in this harvest (9.62 kg of marketable onion bunches). The fifth and sixth plantings were unsuccessful with no viable harvest.

**Table 1. Results of May 16 Seeding Date.**

Variety	Total Count	Total Yield (kg)	Marketable Count	Marketable Yield (kg)
White Lisbon	32	1.86	32	1.74
White Gem	57	1.8	53	1.69
Tokyo	499	12.18	486	11.39
Southport	141	7.21	131	6.3
Evergreen	101	2.39	97	2.38
Ishikura	334	4.21	316	4.16

**Table 2. Results of June 2 Seeding Date.**

Variety	Total Count	Total Yield (kg)	Marketable Count	Marketable Yield (kg)
White Lisbon	78	4.39	73	4.37
Southport	39	1.74	38	1.74
Evergreen	67	1.45	66	1.44
Tokyo	111	2.02	101	2.01
White Gem	66	1.33	59	1.33
Ishikura	91	1.96	85	1.95

**Table 3: Results of June 14 Seeding Date.**

Variety	Total Count	Total Yield (kg)	Marketable Count	Marketable Yield (kg)
White Lisbon	371	5.29	349	5.25
Southport	345	7.19	340	7.19
Evergreen	187	9.66	183	9.62
Tokyo Long	220	6.13	217	6.13
White Gem	162	4.02	159	4.01
Ishikura	124	5.76	117	5.14

## Final Discussion

This demonstration was conducted to demonstrate the economic feasibility of sequential plantings of bunching onions under irrigation in Saskatchewan. An economic analysis (Table 4) determined the gross dollar per acre that this crop can generate. The market price for bunching onion is around \$7.20/kg, but can vary based on current supply and demand. Yield was converted to plants/acre and kg/acre to determine potential value to a producer. Values shown in Table 3 are gross values if produce is sold directly to the consumer (i.e., at a farmer's market). This chart compiles the yields of the three successful harvests and uses the dimensions of the 3 plots (156<sup>2</sup> feet).

**Table 3. Gross Economic Analysis of Bunching Onion Production.**

Variety	Marketable Bunches/Acre	Tonnes/Acre	Gross \$/Acre (retail value)
White Lisbon	885735	3.1	\$22,839
White Gem	548127	1.9	\$14,134
Tokyo	1522748	5.5	\$39,264
Southport	1187478	4.3	\$30,619
Evergreen	1047912	3.8	\$27,020
Ishikura	877159	3.1	\$22,618

This project demonstrated that all varieties can produce a high gross return under a pivot irrigation system. Returns could potentially be much greater if all six seed plantings were successful. The Tokyo variety showed the best economic potential in this trial, with Southport having the next best potential.



**Figure 2. Harvest Yield from First Harvest.**



**Figure 3. Measuring and Grading Yield.**

For more information regarding this crop and the equipment, supplies and labour required, contact Connie Achtymichuk, Provincial Vegetable Specialist at (306) 867-5526 or by email at [connie.achtymichuk@gov.sk.ca](mailto:connie.achtymichuk@gov.sk.ca).

## Acknowledgements

- Connie Achtymichuk, Provincial Vegetable Specialist, for help setting up and maintaining this project, providing agronomic guidance, and completing the economic analysis.
- Ken Achtymichuk, ICDC Seasonal Agronomy Research Technician, for set up and field work.
- ICDC staff for assisting in set up and field work.
- CSIDC staff who assisted with the field and irrigation operations.



# Demonstration of Field Grown Spanish Onions

## Funding

- Irrigation Crop Diversification Corporation
- Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bilateral agreement

## Project Lead

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

## Co-operators

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

## Project Objective

Yellow onions are grown commercially in Saskatchewan. Spanish onions, which are slightly less hardy, are grown commercially in Alberta and Manitoba. The Grocery People are looking for locally grown Spanish onions for retail markets, representing a demand for this crop.

This project compared six varieties of Spanish onion for yield and quality characteristics to meet retail demand. The economic feasibility of growing Spanish onions using pivot irrigation in Saskatchewan's climate was considered. Sequential planting was planned to determine how many harvests were feasible. Harvesting multiple times throughout the growing season allows a producer to market their crop over a longer period.

## Project Plan

The six varieties of Spanish onion used in this demonstration were planted into 26 foot rows with a target of 208 plants per row in 2-foot row spacing. A total of six sequential plantings were accomplished for each variety, with all plots of the same dimensions. A single-row seeder was used, with a target of 1.5 inches between each plant (Figure 1). The plots were in an open field and watered using a low-pressure pivot irrigation system.

## Demonstration Site

Located in the orchard area of the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC), the site has a sandy loam texture and was cultivated and rototilled prior to seeding. Fertilizer was side banded at the time of seeding to meet the crop's fertility requirements. Irrigation was



**Figure 1. Seeding of Spanish onions with a single-row seeder.**

applied throughout the season to meet water use requirements of the Spanish onions. The test plots were planted between guard rows to ensure accurate results.

## Results

Although there were six plantings, only three varieties of the Spanish onions were harvestable. The first planting was aborted due to failed emergence caused by fertilizer burn. The later seeding events used side banded fertilizer instead of seed-placed fertilizer to avoid fertilizer burn. The second seeding occurred on May 15 and was harvested on August 10 (Table 1). The Riverside variety performed best, producing 109 onions for a total weight of 11.71 kg. Walla produced the largest onions, with 74% of its yield having a diameter of over 1½ inches. The third seeding occurred on June 2 and was harvested on August 18 (Table 2). This harvest was very poor compared to the first two harvests, producing less than 10 kg of onions. Sierra produced the most onions for the third harvest, with 35 onions and a total weight of 2.67 kg. The fourth seeding date occurred on June 14 and was harvested on September 1. This was another low-yield harvest; Riverside produced the greatest quantity (70 onions) for a total weight of 4.6 kg. The fifth and sixth planting dates were unsuccessful and did not produce a harvest.



Figure 2. Walla Walla Spanish onions after harvest.

Table 1. Harvest Results of May 15 Seeding Date.

Variety	< ½"		½" – 1"		1" – 1½"		> 1½"		Total	
	Count	Wt. (kg)	Count	Wt. (kg)	Count	Wt. (kg)	Count	Wt. (kg)	Count	Wt. (kg)
Riverside	5	0.04	21	0.9	70	8.51	13	2.26	109	11.71
Walla	0	0.00	1	0.02	17	0.67	50	6.35	68	7.04
Vision	0	0.00	2	0.02	27	2.15	29	3.17	58	5.34
Ailsa	1	0.00	2	0.05	8	0.55	13	1.96	24	2.56
Sierra	0	0.00	1	0.00	5	0.27	11	1.43	17	1.70
Candy	0	0.00	0	0.00	2	0.13	16	2.99	18	3.12

Table 2. Harvest Results of June 2 Seeding Date.

Variety	< ½"		½" – 1"		1" – 1½"		> 1½"		Total	
	Count	Wt. (kg)	Count	Wt. (kg)	Count	Wt. (kg)	Count	Wt. (kg)	Count	Wt. (kg)
Candy	2	0.01	7	0.31	12	1.43	3	0.55	24	2.3
Walla	0	0	3	0.16	4	0.41	5	0.67	12	1.24
Sierra	2	0	17	0.93	16	1.74	0	0	35	2.67
Riverside	0	0	2	0.04	2	0.11	5	0.63	9	0.78
Vision	1	0.01	1	0.01	10	0.46	9	0.89	22	1.36
Ailsa	0	0	0	0	5	0.31	6	0.83	11	1.14

**Table 3. Harvest Results of June14 Seeding Date.**

Variety	< ½"		½" – 1"		1" – 1½"		> 1½"		Total	
	Count	Wt. (kg)	Count	Wt. (kg)	Count	Wt. (kg)	Count	Wt. (kg)	Count	Wt. (kg)
Walla	0	0	5	0.08	14	0.66	18	1.80	37	2.54
Candy	0	0	0	0.00	5	0.27	8	1.13	13	1.40
Ailsa	0	0	0	0.00	9	0.58	2	0.21	11	0.79
Sierra	0	0	1	0.00	3	0.09	1	0.10	5	0.19
Riverside	0	0	3	0.01	61	3.81	6	0.78	70	4.60
Vision	0	0	0	0.00	10	0.56	2	0.31	12	0.87

## Final Discussion

This project demonstrated the economic feasibility of sequential plantings of Spanish onion under irrigation in Saskatchewan. An economic analysis (Table 4) determined the gross profit (in dollar per acre) that this crop can generate. The market price for sweet onion is around \$2.50/kg, but can vary dependent on current supply and demand. Yield was converted to plants/acre and kg/acre to determine the potential benefit to a producer. Table 4 shows gross values based on sales directly to consumers (i.e., at the farmer's market). This chart is a compilation of the yield from three successful harvests and is based on the dimensions of the 3 plots in this demonstration (i.e., 156 square feet).

**Table 4. Gross Economic Analysis of Spanish Onion Production**

Variety	Marketable Onions/Acre	Tonnes/Acre	Gross Retail Sales/Acre
Candy	15,358	1.90	4,760
Walla	32,670	3.02	7,553
Sierra	15,916	1.27	3,183
Riverside	52,495	4.77	11,930
Vision	25,689	2.11	5,284
Ailsa	12,845	1.25	3,134

This project demonstrated that all varieties produce a reasonable gross return under a pivot irrigation system. Returns could potentially be much greater if all six seed plantings were successful. The variety Riverside had the greatest economic success in this trial with Walla coming in second place.

For more information regarding this crop and the equipment, supplies and labour required, contact Connie Achtymichuk, Provincial Vegetable Specialist at (306) 867-5526 or by email at [connie.achtymichuk@gov.sk.ca](mailto:connie.achtymichuk@gov.sk.ca).

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# 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 (Growing Forward 2)
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
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

[www.irrigationsaskatchewan.com](http://www.irrigationsaskatchewan.com)

The Irrigation Saskatchewan website at [www.irrigationsaskatchewan.com](http://www.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 ICDC office or the Ministry of Agriculture's Irrigation Branch office, both in Outlook, SK, or on the ICDC website at [www.irrigationsaskatchewan.com/icdc](http://www.irrigationsaskatchewan.com/icdc).



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