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Irrigation Crop Diversification Corporation

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.

Irrigation Crop Diversification Corporation

BOARD OF DIRECTORS

Director	Position	Irrigation District	Development Area Represented	Election Year (# of terms)
Kevin Plummer	Chairman	Moon Lake	NDA	2012 (1)
David Bagshaw	Director	Luck Lake	LDDA	2013 (1)
Jay Anderson	Alt. Vice Chair	SSRID#1	LDDA	2014 (1)
Greg Oldhaver	Director	Miry Creek	SWDA	2014 (1)
Russell Swihart	Director	Vidora	SWDA	2013 (1)
	Vacant		SEDA	2012 ( )
Colin Ahrens	Director	Individual Irrigators	Non-District	2012 (1)
Larry Lee	Director	Macrorie	SIPA rep	Appointed
Rob Oldhaver	Vice Chair	Miry Creek	SIPA rep	Appointed
John Babcock	Director		SA rep.	Appointed
Doug Billett	Director		SA rep.	Appointed

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

Northern (NDA),

South Western (SWDA),

South Eastern (SEDA) and

Lake Diefenbaker (LDDA).

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

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

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

Irrigation Crop Diversification Corporation

Saskatchewan Ministry of Agriculture

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FIELD CROPS

Dry Bean Fungicide Timing Survey*

Project Lead

- Rory Cranston, PAg, Regional Crop Specialist, Saskatchewan Agriculture

Co-operators

- Grant Carlson, SSRID, Outlook, SK
- Gary Ewen, RID, Riverhurst, SK
- Mark Gravale, RID, Riverhurst, SK
- Garth Weiterman, SSRID, Outlook, SK

Project Objective

The purpose of this project was to develop a critical control period for white mold in dry beans by surveying several irrigated dry bean fields in the Lake Diefenbaker Development Area.

Project Plan

White mold is a serious disease that is of concern to all dry bean producers throughout the prairies. In the past, producers have had trouble identifying to apply fungicide in dry beans. In many cases, producers will apply a fungicide after the crop has been infected and a yield loss has already occurred. This project surveyed white mold incidence and severity in four dry bean fields in the South Saskatchewan River and Riverhurst Irrigation Districts. This project used the equation below to determine severity.

$$\sum ((\text{severity class x number of plants in class}) \times 100) / \text{number of plants}$$

Severity classes

0 = No disease
1 = Small lesions less than 5 cm in the longest dimension
2 = Expanding lesions on branches or stem
3 = Up to half of the branches or stem colonized
4 = More than half of the branches colonized
5 = Main stem colonized or plant is dead

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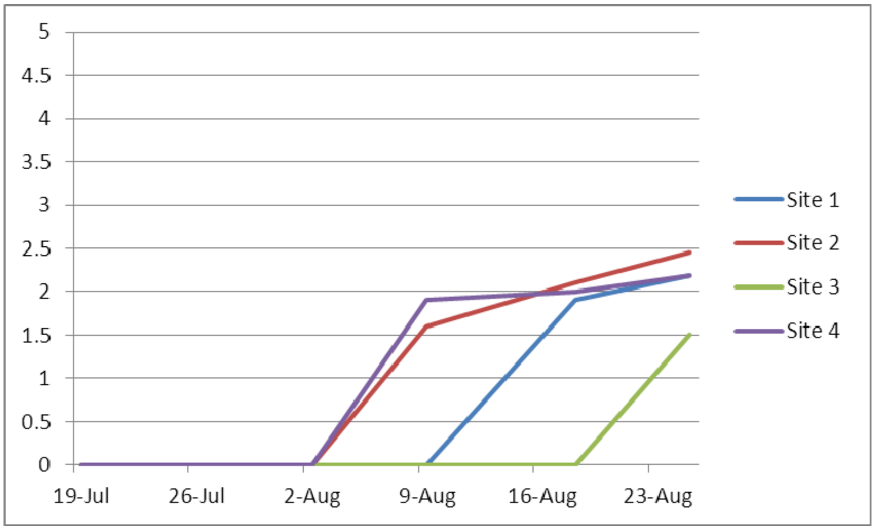
* Project 2012-04



Adapted from Roland, G.J., Hall, R., 1987. Epidemiology of white mold of white bean in Ontario. *Canadian Journal of Plant Pathology* 9: 218-224

1 = minor disease severity, 5= extreme disease severity

At the beginning of July, each field was surveyed once per week until late August. One hundred plants were inspected for white mold in each survey.

Demonstration Sites

The survey sites are listed in Table 1.

Table 1 Survey sites for white mold disease survey

Riverhurst Irrigation District		South Saskatchewan Irrigation district	
Site 1	SE 26-22-7 W3M	Site 3	SE 16-31-7 W3M
Site 2	NW 22-22-7 W3M	Site 4	SW 23-30-7 W3M

Disease Survey

Complete survey results are shown in Table 2 and Figure 1.

Table 2 2011 White mold disease severity at all sites

Date	Site 1	Site 2	Site 3	Site 4
19-Jul	0	0	0	0
26-Jul	0	0	0	0
2-Aug	0	0	0	0
9-Aug	0	1.6	0	1.9
18-Aug	1.9	2.1	0	2
25-Aug	2.18	2.45	1.5	2.18

Figure 1. 2013 White mold disease severity at all sites

White mold was first observed in 2012 at Sites 2 and 4 on August 9 and was present at all sites by August 25.

White mold levels in 2012 were lower than previous years. In 2011, white mold infection was earlier. In 2011, white mold was first observed in the middle of July and was present at all sites by August. Weather conditions also contributed to reduced white mold levels. All sites experienced high winds in 2012. These winds caused plant leaves to beat against and damage each other. As a result, vegetative growth was slowed. The slowed vegetative growth resulted in little to no row closure in the 2012 dry bean crops. The open rows allowed the plant canopy and soil surface to dry quickly after water events. The dry canopy and soil surface was not an ideal environment for white mold infection. This, combined with fungicide application, significantly reduced the incidence of white mold in 2012.

Graphs of individual site disease severity can be seen in Figures 2-5 The vertical red line represents a fungicide application to control white mold.

Figure 2. Disease severity at Site 1

Application of Acapela on July 20 and August 2 kept Site 1 free of white mold until the middle of August. White mold was first notice on August 18 after the fungicide had lost its efficacy and there was a lower severity increase after that.

Figure 3. Disease severity at Site 2

An application of Lance at Site 2 on July 26 prevented infection and disease development until early August. White mold was first noticed at Site 2 on August 9 after the first fungicide application had lost its efficacy. A second application of Lance on August 8 prevented further infection.

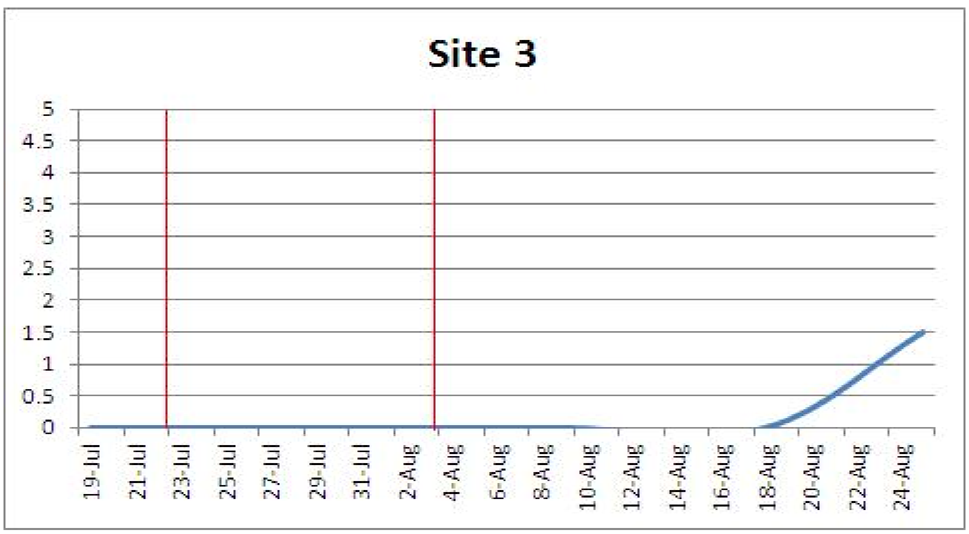


Figure 4. Disease severity at Site 3

Lance was applied July 20 and August 3 at Site 3. White mold was observed in the field on August 25. White mold severity was low at this site.

Figure 5. Disease severity at Site 4

Lance was applied at Site 4 on July 18. A small amount of white mold was observed on August 2 when the first application of fungicide was losing efficacy. A second application of Lance on August 2 prevented further infection for the remainder of the season.

Final Discussion

White mold is a disease that thrives in cool, moist conditions, and once it infects a dry bean crop there are no practices to remove it. All fungicides available to control white mold will only prevent an infection. A fungicide application will not cure the disease once it has established itself in a susceptible crop.

During 2012, there was relatively low and late disease infection compared to previous years. In 2011, white mold was present at all sites by August 2, but showed up as early as July 19. In 2012, white mold was first noticed August 9 and was present at all sites by August 25. This is mainly due to weather and the lack of row closure. The open dry rows that were characteristic of dry crops in 2012 were not favorable to a white mold infection.

A fungicide application in mid to late July was found to be effective for preventing an early infection. An application of fungicide after infection occurred stopped further development of white mold at Sites 2 and 4.

From observations in the white mold disease surveys conducted in 2011 and 2012, a fungicide application during the middle of July followed by another 10 to 14 days afterward was effective in controlling white mold in dry beans. If the crop was planted early or there was high disease pressure, a third application in early August could be beneficial.

Dry Bean Fungicide Products Demonstration*

Project Lead

- Rory Cranston, PAg, Regional Crop Specialist, Saskatchewan Agriculture

Co-operators

- Grant Carlson, SSRID, Outlook, SK
- Mark Gravale, RID, Riverhurst, SK

Project Objective

The purpose of this project was to demonstrate the efficacy of the fungicides Lance, Allegro, Acapela and Propulse for control of white mold (*Sclerotionia sclerotiorum*) in dry beans.

Project Plan

White mold is a serious disease concern for all dry bean producers throughout the prairies. In past years, the only fungicide available for control was Lance (Boscalid). Recently, Allegro (Fluazinam) and Acapela (Picoxystrobin) have been registered for use in dry beans. Propulse (Fluopyram & Prothiconazole) is a fungicide that is currently going through the registration process and will be available to producers in the near future.

This project compared the four fungicides in a two-application treatment. Each treatment covered at least 20 acres. Yield and disease severity were measured and recorded. This demonstration took place at two locations and White Mountain 2 pinto dry beans were planted at both. The Gravale site in Riverhurst was seeded May 19 and the Carlson site near Outlook was seeded May 21. The Gravale site received the first application of fungicides on July 20 and the second application on August 2. The Carlson site received the first application on July 18 and the second application on August 2.

Demonstration Site

The Gravale demonstration site is located in the Riverhurst Irrigation district at SE 26-22-7 W3. The soil texture is a sandy clay loam and the field was planted to potatoes the previous year. The Carlson demonstration site was located in the South Saskatchewan Irrigation District at SW 23-30-7 W3. The soil texture is a loam and the field was planted to wheat the previous year.

* Project 2012-05

Crop Management

The Gravale site had great plant stand establishment and excellent weed control. This site experienced several high winds throughout the growing season. The winds damaged the plants and slowed vegetative growth. Agronomic management is shown in Table 1.

The Carlson site had some flooded-out areas due to the wet spring and as a result, establishment was uneven throughout the field. The Carlson site also experienced several high winds and two minor hail events. The winds caused plant damage that slowed vegetative growth and knocked off some of the flowers and developing pods. The hail events shredded some of the plant leaves and knocked off developing pods and flowers. Agronomic management can be seen in Table 2

Table 1. Agronomic management of the Gravale demonstration site.

Nutrients (0-12")	**N**	**P**	**K**
Residual	30 lb/acre	20 lb/acre	> 800 lb/acre
Applied	45 lb/acre	23 lb/acre	00 lb/acre
Variety	White Mountain 2		
Seeding	May 19		
Herbicide	Viper & Basagran June 26		
Fungicide	Acapela, Propulse, Lance, Allegro July 19		
	Acapela, Propulse, Lance, Allegro August 2		
Available Moisture from May 1 to September 10			
Irrigation	65 mm (2.5 inches)		
Rainfall	231 mm (9.09 inches)		
Undercutting	August 28		
Harvest	September 10		

Table 2. Agronomic management of the Carlson demonstration site.

Nutrients (0-12")	**N**	**P**	**K**
Soil residual	30 lb/acre	20 lb/acre	> 800 lb/acre
Applied	65 lb/acre	30 lb/acre	00 lb/acre
Variety	White Mountain 2		
Seeding	May 21		
Herbicide	Edge pre-plant incorporated		
	Assure & Basagran June 25		
Fungicide	Acapela, Lance, Allegro, Propulse July 18		
	Acapela, Lance, Allegro, Propulse August 2		
Available Moisture from May 1 to September 10			
Irrigation	77 mm (3 inches)		
Rainfall	278 mm (10.9 inches)		
Samples harvested	August 31		

Irrigation

The Gravale site was a late addition. As a result, no monitoring equipment was installed. Moisture was monitored throughout the year using the feel method. Both sites received above-average rain in the spring and as a result, irrigation was delayed to later in the summer and a lower-than-average water amount was applied. Irrigation was halted in mid-August at both sites.

Disease Severity

Disease severity was determined on Aug. 27 at both sites by the equation below:

$$\sum ((\text{severity class x number of plants in class}) \times 100) / \text{number of plants}$$

Severity classes

0 = No disease
1 = Small lesions less than 5cm in the longest dimension
2 = Expanding lesions on branches or stem
3 = Up to half of the branches or stem colonized
4 = More than half of the branches colonized
5 = Main stem colonized or plant is dead

Adapted from - Roland, G.J., Hall, R., 1987. Epidemiology of white mold of white bean in Ontario. Canadian Journal of Plant Pathology 9: 218-224

Results of the disease rating can be seen in Table 3. One hundred plants were sampled from each of the treatments at both sites. 1 = minor disease severity; 5= extreme disease severity.

Table 3 Disease Severity

Site	Acapela	Propulse	Lance	Allegro
Gravale	2.30	2.18	2.05	1.99
Carlson	2.49	2.65	2.18	1.69

Harvest

The Gravale site was undercut August 28 and harvested September 10. Each treatment had a 5.25 acre sample weighted to determine yield. At this site there was a small range between treatments. The beans treated with Allegro yielded the highest followed by Lance, Propulse and Acapela. Results can be seen in Table 4.

Due to the variability in the flooded out areas and hail at the Carlson site, taking a large harvest sample from the treatments was not possible. As a result, harvest results were not reported for this site.

Table 4. Harvest results at the Gravale

Site	Acapela	Propulse	Lance	Allegro
Gravale	2553 lb/acre	2569 lb/acre	2591 lb/acre	2605 lb/acre

Final Discussion

The area treated with Allegro yielded the highest, followed by Lance, Propulse and Acapela. However, there was not a large range between the highest and lowest yielding treatments. The area treated with Allegro also had the lowest disease rating at both sites.

White mold disease levels were significantly lower in 2012 than in previous years. The dry bean crops in 2012 had little to no row closure due to the weather events that slowed vegetative growth. The open rows allowed the plant canopy and soil surface to dry quickly after water events. The dry canopy and soil surface was not an ideal environment for white mold infection. This, combined with fungicide application, significantly reduced the incidence of white mold in 2012. Due to the growing conditions in 2012, this demonstration should be repeated to verify results.

Acknowledgments

The project lead would like to thank the following contributors:

- BASF – For donating the fungicide Lance
- Bayer CropScience – For donating the fungicide Propulse
- Dupont – For donating the fungicide Acapela
- Syngenta – For donating the fungicide Allegro

Flax Fungicide Demonstration*

Project Lead

- Rory Cranston, PAg, Regional Crop Specialist, Saskatchewan Agriculture

Co-operators

- Roy King, LLID, Outlook, SK

Project Objective

The purpose of this project was to demonstrate the efficacy and economics of a single and a double fungicide application of Headline to control disease in high-yielding flax under high management irrigation conditions.

Project Plan

This project was designed to demonstrate a single and a double application of Headline to control Pasmo in high-yielding irrigated flax. However, applying Headline to flax twice in a season was deregistered in June of 2012 and as a result, the double application treatment was eliminated from the demonstration.

On July 21, 40 acres of flax were treated with Headline. The rest of the field was left untreated and used for comparison. Disease severity and yields were recorded to determine efficacy of the treatment. Disease severity was determined by a visual assessment and yield was determined by the use of a weigh wagon.

Demonstration Site

The demonstration site was located at SW 25-24-7 W3M in the Luck Lake Irrigation District on a field with a 132-acre low pressure pivot. The soil texture is clay and the field was cropped with wheat the previous year.

Crop Management

Bethune flax was seeded on May 16. After several early rains, the soil was saturated but establishment was good. See Table 1 for agronomic management of the site.

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* Project 2012-06

Table 1. Agronomic management of the King demonstration site

Nutrients (0-12")	N	P	K
Soil residual	30 lb/acre	50 lb/acre	800 lb/acre
Applied	110 lb/acre	25 lb/acre	00 lb/acre
Variety	Bethune		
Seeding	May 16, 2012,		
Herbicide	Badge June 23		
	Glyphosate Sept 5		
Fungicide	Headline July 21		
Available Moisture from May 1 to September 10			
Irrigation	50 mm (2 inches)		
Rainfall	267 mm (10.5 inches)		
Harvest	Sept 20		

Irrigation

Soil moisture was monitored throughout the year with the use of Watermark™ sensors and gravimetric analysis. Watermark™ sensors were installed at 12- and 24-inch depths. Rainfall and irrigation were recorded with the use of rain gauges and a WeatherBug station in the area.

Fungicide Evaluation

Headline was applied to a 40-acre area on July 21. Throughout most of the growing season there was no visual difference between the treated and untreated areas. Approaching and during harvest, it was observed that the straw in the treated area stayed green longer than in the untreated area. The differences can be seen in Figures 1 and 2

Figure 1. Untreated

Figure 2. Treated with Headline

Harvest

Harvest yield measurements were taken on September 20. See Table 2 for results. Yields were determined by taking two samples from the treated and untreated areas. The area treated with

Headline showed a yield response compared to the untreated check. The producer also noted that he had to travel slower when cutting in the treated area. The need to be cut slower was due to a thick plant stand and tougher plant stems. Figures 3 and 4 demonstrate the difference in plant stand density.

Figure 3. Treated with Headline

Figure 4. Untreated

Table 2 Harvest results from the King demonstration site

	Yield	Thousand seed weight
Headline	45 bu./acre	6.34 g
Untreated	35 bu./acre	5.22 g

Final Discussion

BASF has conducted similar demonstrations on dry land and found that a yield gain of 5 to 6 bu/acre can be achieved. With irrigation, the area treated with Headline demonstrated a yield increase of 10 bu/acre. It was also noted that the treated area had a thicker plant stand and remained green longer. This indicates that flax treated with Headline may be more resistant to lodging.

Assuming a bushel of flax is worth $14, and the cost of chemical and application is $15/acre for an application of Headline on flax, a 10 bu/acre yield increase, as seen in this demonstration, would have a positive economic return.

Untimely rain events in 2012 increased disease levels across all crops. The increased disease levels could have affected the efficacy of the fungicide. This demonstration should be repeated to verify the fungicide's effectiveness for use in irrigated flax production. A disease survey protocol should be added in the future to determine disease severity.

Acknowledgements

The project lead would like to thank the following contributor:

- BASF – For donating the fungicide Headline

Fungicide Application Timing on Wheat Demonstration*

Project Lead

- Rory Cranston, PAg, Irrigation Agrologist, Saskatchewan Agriculture

Co-operators

- Grant Pederson, SSRID, Outlook, SK

Project Objective

The purpose of this project was to demonstrate the best timing for fungicide application to control diseases in high yielding wheat under high management irrigation conditions.

Project Plan

This project compared a fungicide application at the flag leaf stage to control leaf disease with an application of fungicide at flowering to control Fusarium Head Blight (FHB), and the combination of the two on high yielding irrigated wheat. Forty acres of Quilt was donated by Syngenta. This fungicide is applied at the flag leaf stage and controls leaf disease. Forty acres of Prosaro was donated by Bayer CropScience. This fungicide is applied at flowering and is used to control FHB.

On July 7, Quilt was applied to a 40-acre area on a field that was planted to hard wheat. On July 16, Prosaro was applied to a 40-acre area. When Prosaro was applied, 20 acres of the application overlapped the area that was previously treated with Quilt. This created three 20 acre treatments. The treatments were fungicide application at flag leaf timing to control leaf disease, fungicide application at flowering to control FHB and the combination of the two. A 10 acre area was left untreated for comparison.

Demonstration Site

The demonstration site was located at NW 21-28-7 W3M in the South Saskatchewan River Irrigation District on a field with a 130-acre high pressure pivot. This field has been irrigated for many years. The soil texture is a loam and the field was planted to canola the previous year.

Crop management

Kane Hard Red Spring Wheat was seeded on May 15. Establishment was very good. See Table 1 for agronomic management of the site.

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* Project 2012-08

Table 1. Agronomic management of the G.Pederson demonstration site

Nutrients (0-12")	**N**	**P**	**K**
Soil residual	30 lb/acre	20 lb/acre	>800 lb/acre
Applied	110 lb/acre	30 lb/acre	00 lb/acre
Variety	Kane		
Seeding	May 15, 2012, 120 lb/acre		
Herbicide	Thumper and Puma June 16		
Fungicide	Quilt, July 7		
	Prosaro, July 16		
Available Moisture from May 1 to September 1			
Irrigation	50 mm (2 inches)		
Rainfall	278 mm (10.9 inches)		
Harvest	August 31		

Irrigation

Soil moisture was monitored throughout the year with the use of Watermark™ sensors and gravimetric analysis. Watermark™ sensors were installed at 12- and 24-inch depths. Rainfall and irrigation were recorded with the use of rain gauges and a WeatherBug station in the area.

Fungicide Evaluation

Quilt was applied on July 7 and Prosaro was applied on July 16. Irrigation was managed to minimize frequency after fungicide application but without lowering soil moisture below 50 per cent. Pictures taken of the canopy on August 9 showed a visual difference between the fungicide-treated areas and the untreated areas (see Figures 1- 4). Areas that had had a fungicide application at flag leaf timing had the cleanest crop canopy. The area treated with fungicide at flowering only had disease pressure on the lower leaves. The area left untreated was heavily infected with leaf disease.

Flag leaf samples taken on August 15 showed a difference between the fungicide treated areas and the untreated areas (see Figures 5- 8). The areas treated with both fungicides had the largest flag leaves with the lowest disease incidence, followed by the flowering and flag leaf treatment. The untreated flag leaves were small, heavily diseased and had very little green area left.

Figure 1. Crop canopy of the area treated with fungicide application at flowering timing

Figure 2. Combination treated crop canopy

Figure 3. Crop canopy of the area treated with fungicide application at flowering timing

Figure 4. Untreated crop canopy

Figure 5. Flag leaves treated with both fungicides

Figure 6. Flag leaves from the flowering timing treatment

Figure 7. Flag leaves from the flag leaf timing treatment

Figure 8. Untreated flag leaves

Harvest

This demonstration site received a significant hail event on August 24. The damage to the crop was severe. Collecting yield results and grain samples would not be representative of the treatments' effects and therefore yield was not reported and samples were not taken.

Final Discussion

This project was built on a similar demonstration completed in 2011 to verify its results. But without yield results, it is tough to determine the efficacy of each of the treatments made in 2012. Return on investment is impossible to determine without yield results.

The observations noting the health of the crop canopy and condition of the flag leaf samples indicate that the combination treatment provided plant health potential to produce the highest yield. Spraying a fungicide at flowering protected the sample from fusarium head blight infection and protected the flag leaf as well, although the lower canopy was diseased. Spraying at flag leaf timing created an entire canopy that had low disease incidence. These results indicate that disease is present early in irrigated wheat production and that disease infection can occur after a flag leaf fungicide has lost efficacy. The plant health in each of the treatments compared to the untreated sample indicates that applying a fungicide would result in a yield benefit. In previous years, ICDC has implemented several projects to demonstrate the efficacy of fungicide use on wheat and this project is consistent with those previous demonstrations.

ICDC will continue to investigate and demonstrate ways of crop protection in irrigated production.

Acknowledgements

The project lead would like to acknowledge the following contributors:

- Bayer CropSciences – for donating the fungicide Prosaro
- Syngenta – for donating the fungicide Quilt

Crop Varieties for Irrigation – ICDC 2012

Principal Investigators

- Garry Hnatowich, PAg, ICDC, Project Lead
- Harvey Joel, ICDC
- Don David, CSIDC

Organization

- Irrigation Crop Diversification Corporation (ICDC)
- Canada-Saskatchewan Irrigation Diversification Centre (CSIDC)
- Agri-Environmental Services Branch (AESB) of Agriculture and Agri-Food Canada (AAFC)

Objectives

(1) To evaluate crop varieties for intensive irrigated production.
(2) To update the Crop Varieties for Irrigation guide.

Research Plan

The CSIDC locales (on-station and Knapik fields) were used as test locations in 2012 for conducting variety evaluation trials under intensive irrigated conditions. The sites selected included a range of soil types (Table 3) and agro-climatic conditions. Crop and variety selection for the project were made in consultation with plant breeders from AAFC, universities, the private sector and associated producer groups.

Trials were conducted for registered varieties of cereals (spring wheat, barley and corn), oilseeds (canola and flax) and pulses (pea, dry bean and faba bean). Further, pre-registration co-op trials were conducted for selected crops to assess the adaptability of new lines to irrigated conditions. This project was conducted in collaboration with the federal government, academic institutions and industry partners including AAFC research centres, the Crop Development Centre, University of Saskatchewan, among others (see Table 3).

Data collection included days-to-flower and maturity, plant height, lodge rating, seed yield, protein (cereals), test weight, seed weight and any observed agronomic parameters deemed of benefit to the studies. All field operations, including land preparation, seeding, herbicide, fungicide and insecticide application, irrigation, data collection and harvest were conducted by ICDC and CSIDC staff.

The trials consisted of small plots (1.2 m x 4 m; 1.2 m x 6 m; 1.5 m x 4 m; 1.5 m x 6 m), which were appropriately designed (RCBD, Lattice, etc.) with multiple replications (three or four reps) so that statistical analyses could be performed to determine differences among varieties and to determine the variability of the data at each site.

ICDC staff also assisted in the establishment and maintenance of numerous CSIDC and CDC projects in 2012.

Results

The 2012 variety trials were established within recommended seeding-date guidelines for the selected crops (Table 3). Climatic conditions in 2012 were abnormal during the growing season (May – September) with respect to precipitation and accumulated heat units (Tables 1 & 2) resulting in adverse effects in the growth and development of some crop species. May and June were also cooler than normal as reflected in the lower number of accumulated Growing Degree Days for these two months.

Table 1. 2012 Growing Season Precipitation vs Long-Term Average

Month	Year		% of Long-Term
	2012	1931-2009	
May	115.2 (4.5)	36.5 (1.4)	316
June	135.4 (5.3)	64.4 (2.5)	210
July	53.4 (2.1)	51.3 (2.0)	104
August	43.6 (1.7)	36.7 (1.4)	119
Total	347.6 (13.7)	188.9 (7.4)	184

Table 2. 2012 Growing Degree Days (Base 0° C) vs Long-Term Average

Month	Year		% of Long-Term
	2012	1931-2009	
May	177	227	78
June	666	711	94
July	1286	1305	99
August	1848	1861	99

Early Season Trial Establishment

Both flax regional trials were lost early in the growing season. The trial located at the Knapik location suffered wind damage resulting in the seed furrows being filled in with drifting soil and “sand blasting” of emerging seedlings further reduced plant populations. At the CSIDC location, emergence was less than desired. Both trials were deemed unusable.

Field pea trials (Prairie Regional Pea Trials) were also adversely affected in the early seedling stages of development. Emergence was sporadic with certain varieties. However, it could not be determined whether this was due to seed source or was a function of environmental conditions. In general, the very wet and cool conditions experienced in May and June were not conducive to field pea development. Evidence of some seed rot was observed, plots also were showing evidence of damping-off or root rot by the 6 to 8 node stage.

Dry beans, though seeded in the latter part of May, were very slow to develop with very little growth until well into July. Wireworm activity and damage was observed in the CSIDC dry bean trials.

Canola and emergence was generally fine and all plots were seeded mid-May. Again, environmental conditions influenced growth and development. In 2012, between three trials (ICDC Irrigated Canola Evaluation Trial, Canola Coop and the Canola Performance Trial; seeTable 3), a total of 90 canola varieties or candidate entries seeking registration were evaluated. The vast majority of these varieties developed atypically. Seedling growth was very slow, plant leaves were unusually small and thin and no variety really "cabbaged" prior to bolting (including hybrids, which generally express vigorous growth and large leaf surface areas) and plant heights were very short.

Cereals were the bright spot in early-season development, all wheat classes, durum, barley and oat trials emerged well and though seedling growth was likely slower than normal, plant growth and development continued unabated. Corn, planted in late May, was the only cereal in which very slow growth and development was apparent.

Midseason to Harvest

During the latter part of the growing season, crops were progressing but were further handicapped by two hail events, the first on June 22 and the second on August 4. Both the CSIDC and Knapik locations were affected. All crop species were affected by these events. With respect to the June 22 event, pulse crops suffered shredded leaves and in the case of peas, flower loss. Oilseeds were similarly affected. Cereals also experienced leaf damage but recovered quickly; corn trials were certainly set back. The project lead was required to inform the respective crop agencies (eg. Canola Growers, SMA) of any adverse events that might compromise trial results. Unfortunately, thereafter, the Canola Performance Trial was deemed invalid and cancelled by the responsible agency. However, a decision was made to continue on with the trial for our own purposes as it was hoped the plots would recover sufficiently to provide useful data for the *Crop Varieties for Irrigation* guide. Under the existing fee structure for this project, ICDC received only 25% of the contract value.

The event of August 4 was of greater magnitude; all crops were affected. Pulse crops lost pods in the case of peas and flower buds and petals with dry bean. Canola had, in general, completed flowering and was into pod development, plants suffered broken stems and branches, leaf and pod damage. Heads on the cereal trials were in some instances broken off or bent to horizontal. Corn leaves were severely shredded and torn.

A foliar fungicide application to reduce potential pathogenic infection as a result of damaged plant tissue was conducted after each hail event.

Aster yellows were present in canola at levels previously not seen. Although difficult to quantify, it was estimated that the disease incidence exceeded 5%. Aster yellows were also deemed to have occurred in wheat trials, particularly in CWRS varieties. Sclerotinia was not observed in pulses or canola. Although foliar fungicide applications were applied for foliage leaf disease prevention and then at heading for Fusarium Head Blight, cereals did have tan spot (wheat), scald (barley) and spot blotch (wheat and barley), some durum varieties were affected by loose smut and Fusarium Head Blight was present in both wheat and barley. Aphids were found in high numbers during kernel fill development. Numbers as high as 60-80 per plant were found on numerous wheat heads.

Lastly, and certainly the most disappointing event of the season, occurred approximately 6 days after the Canola Coop trials were swathed. Very high winds carried and combined individual plot swaths. The remnants of 51 canola varieties can presently be found in the tree shelter belt separating fields 7 and 12 at CSIDC. The entire Coop trial was lost just days before combining.

At the time of printing, quality analysis and data interpretation is still underway on harvested trials. The data from these trials will be analyzed and only data that meet minimum statistical criteria for variability will be used to update the CSIDC variety database. The *Crop Varieties for Irrigation* guide will be updated with the addition of the new data collected and printed in time for distribution at the 2013 Crop Production Show. As well, the variety guide will be mailed to all irrigators early in 2013.

A list of projects conducted in 2012 is outlined in Table 3. This work provides current and comprehensive variety information to assist irrigators in selecting crop varieties suited to intensive irrigated production conditions.

Table 3. 2012 variety trial locations, soil type and trial title and collaborators

Site	Legal Location	Soil Type
CSIDC main	SW15-29-08 W3	Bradwell very fine sandy loam
CSIDC off station (Knapik)	NW12-29-08 W3	Asquith sandy loam

Cereal Trials	Varieties/Entries Evaluated	Collaborators	Location
1. Irrigated Wheat Regional	30 each location	ICDC	CSIDC - main CSIDC - off station
2. SVPG CWRS Wheat Regional	25	Dr. R. Depauw, AAFC M. Japp, SA S. Piche, SVPG	CSIDC - main CSIDC – off station
3. SVPG High Yield Wheat Regional	16	Dr. R. Depauw, AAFC M. Japp, SMA S. Piche, SVPG	CSIDC - main
4. SVPG CWAD Wheat Regional	10 each location	Dr. R. Depauw, AAFC M. Japp, SMA S. Piche, SVPG	CSIDC - main CSIDC - off station
5. Soft White Spring Wheat Coop	16	Dr. H. Randhawa, AAFC	CSIDC - main

Cereal Trials	Varieties/Entries Evaluated	Collaborators	Location
6. SVPG Barley Regional 7. (2-row & 6-row)	22 2-row 14 6-row	Dr. A. Beattie, CDC M. Japp, SMA S. Piche, SVPG	CSIDC - main
8. ICDC Hybrid Silage Corn Performance Trials	8	B. Beres, AAFC	CSIDC - main
9. Durum Wheat Seeding Rate Trial	2 varieties 5 seeding rates	ICDC	CSIDC - main

Oilseed Trials	Varieties/Entries Evaluated	Collaborators	Location
1. ICDC Irrigated Canola Evaluation Trial	17 each location	ICDC	CSIDC - main CSIDC - off station
2. Canola Coop (XNL1 & XNL2)	51	R. Gadoua, CCC	CSIDC - main
3. Canola Performance Trial	22	Dr. R. Gjuric, Halpotech	CSIDC - main
4. Canola Seeding Rate Trial	2 hybrids 7 seeding rates	ICDC	CSIDC - main
5. Flax Regional Trial	8 each location	ICDC	CSIDC - main CSIDC - off station

Pulse Trials	Varieties/Entries Evaluated	Collaborators	Location
1. Dry Bean Narrow Row Regional (Saskatchewan)		Dr. K. Bett, CDC ICDC	CSIDC - main CSIDC - off station
4. Irrigated Prairie Regional Variety Trial	30 each location	Dr. T. Warkentin, CDC ICDC	CSIDC - main CSIDC - off station

Abbreviations:

AAFC = Agriculture and AgriFood Canada

ACC = Alberta Corn Committee

CCC = Canola Council of Canada

CDC = Crop Development Centre, U of S

CSIDC = Canada-Saskatchewan Irrigation Diversification Centre

ICDC = Irrigation Crop Diversification Corporation

MAFRI = Manitoba Agriculture, Food and Rural Initiatives

SMA = Saskatchewan Ministry of Agriculture

SVPG = Saskatchewan Variety Performance Group

Nitrogen Rate for Irrigated Oats on Terminated Alfalfa*

Principal Investigators

- Garry Hnatowich, PAg, Research Agronomist, Irrigation Crop Diversification Corp., Outlook, SK
- Gary Kruger, PAg, Provincial Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Barry Vestre, Farm Manager, Canada Saskatchewan Irrigation Diversification Centre, Outlook, SK

Project Objective

To determine adequate N fertilization practices for irrigated oats.

Project Background

When alfalfa is taken out of production on dryland, the major release of nitrogen from crop residues is delayed until the second year because soil moisture needs recharging before micro-organisms can begin their decomposition work. Irrigation removes variability by supplying the moisture needed by the micro-organisms to transform the nitrogen in the decomposing roots to nutrients that the growing crop can absorb in the year of breaking. This demonstration was initiated to better understand the effect of nitrogen dynamics on oat production on alfalfa breaking under irrigation.

Demonstration Plan

An alfalfa field was terminated in spring with glyphosate. A second burnoff treatment with Cleanstart was applied just prior to seeding the trial on May 31. Two varieties of oats, Triactor, a milling oat variety and CDC Haymaker, a forage variety, were sown with a zero till drill. Both varieties were fertilized with 0, 25, 50, 75, 100 and 125 lb N/ac at the time of seeding. The experimental design was a split plot design with varieties as main plots and fertilizer N rates as subplots, randomized and replicated 4 times. Grain yield will indicate the most suited N rate for irrigated oat for this crop rotation. Grain protein content will evaluate the nitrogen impact on grain quality.

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* Project 2012-19

Demonstration Site

The demonstration was conducted at the Canada-Saskatchewan Irrigation Diversification Center on the southwest portion on Field 12. The texture at the site is sandy loam on the surface. A spring 2012 soil test (0 to 6, 6 to 12 and 12 to 24 inch depths) was submitted to ALS Laboratory Group in Saskatoon. Residual nutrients per ac were 26 lb N, 39 lb P, 206 lb K, and > 192 lb S. Fertilizer recommendations for 140 bu oats/ac were 125 lb N/ac, 20 lb P_2O_5/ac and 20 lb K_2O /ac.

Project Methods and Observations

The alfalfa variety demonstration was taken out of production in spring 2012 with a 2 L/ac application of glyphosate and a clean-up application of Cleanstart at 1 L/ac. The demonstration was seeded on May 31. The forage yield was determined on August 20 and the grain yield was harvested on September 19. The field received 13.7 inches of rainfall from May to August, 2012. A watermark sensor at 76 cm depth indicated adequate moisture for the entire season. No irrigation was applied during the growing season in 2012.

Oat N-Fertility on Alfalfa Breaking 2012

Oat Variety	YIELD	Test Weight	TKW	Forage Yield
	(kg/ha)	(kg/hl)	(gm)	(kg/ha)
Triactor	4374 a[1]	55.56 a	35.9 b	13955 a
CDC Haymaker	4580 a	52.78 a	40.5 a	13542 a
LSD (0.05)	NS	NS	3.5	NS
N Applied				
(kg/ha)				
0	4827 a	55.48 a	38.5 a	12282 a
25	4598 ab	55.25 ab	39.1 a	14494 a
50	4642 ab	52.96 c	38.8 a	13513 a
75	4328 bc	53.71 bc	38.1 a	14332 a
100	4340 bc	53.10 c	37.8 ab	14237 a
125	4127 c	54.51 abc	36.8 b	13631 a
LSD (0.05)	421	1.75	1.4	NS
Variety x N Applied Interaction				
LSD (0.05)	NS	NS	NS	NS
CV (%)	9.2	3.2	3.4	18.2

[1] Means followed by the same letter at not significantly different at P = 0.05

Final Discussion

No increase in yield was observed with increasing rates of N for either Triactor or CDC Haymaker oats on first year alfalfa breaking in 2012. In fact, the additional N produced a significant decrease in grain yield. The lack of response to N application was unexpected.

The main uncertainty for the release of nitrogen from alfalfa residues is how quickly the soil is wetted after the alfalfa plants are killed with herbicides. Irrigation and abundant rainfall, by thoroughly wetting the alfalfa stubble, reduce variability in nitrogen release from alfalfa residues to growing crops. The moisture applied to the soil allows decomposing organisms to multiply rapidly, break down the organic residues and release nitrogen and other nutrients. This demonstration shows that this process will meet the entire requirement of oats for nitrogen under irrigation. Additional nitrogen reduced seed yield. This technique for reducing crop inputs for irrigated production would be useful to maintain feed production and cash flow for irrigated producers.

This demonstration will be continued in 2013 to determine if the nitrogen release during the second year of decomposition after alfalfa breaking is sufficient for maximum yield of oats.

Red Lentils – Irrigation Versus Dryland Evaluation

Principal Investigators

- Garry Hnatowich, PAg, ICDC
- Gary Kruger, PAg, Provincial Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- CSIDC

Project Objective

To determine the response of lentil to irrigation.

Demonstration Plan

Two plots of lentil were sown. One was irrigated during the flowering stage to reduce flower drop and pod abortion due to moisture stress. The plants were irrigated to maintain at least 50% of field capacity within the rooting zone.

Demonstration Site

The demonstration was conducted on Field 7 at CSIDC. The soil is sandy loam texture.

Project Methods and Observations

CDC Maxim lentil was sown on Field 7 in two plots on May 26, 2012. The irrigated plot received supplemental water when the moisture status dropped below 50 % of field capacity. Rainfall patterns were consistent during 2012 and supplied the crop's water requirements throughout the season (Table 1). No irrigation was required. Early growth of the crop was slower than normal because May and June rainfall was above average and May and June growing degree days were cooler than normal (Table 2).

Table 1: 2012 Growing Season Precipitation at CSIDC

Month	2012	1931-2009 Average	% of Long Term
May	115	37	316
June	135	64	210
July	53	51	104
August	44	37	119

Total	347	189	184

Table 2: Cumulative Growing Degree Days (Base 0 C) at CSIDC

Month	2012	1931-2009 Average	% of Long Term
May	177	227	78
June	666	711	94
July	1286	1305	99
August	1848	1861	99

Table 3 summarizes the lentil seed yield harvested from the demonstration. The differences between the treatments were not significant. Yields were average for 2012.

Table 3: Yield and Grain Quality for 2012 Irrigated Lentil Project

Treatment	Yield (lb/ac)	Thousand Kernel Weight (g/ 1000 seeds)
Irrigated	**1252**	**32.9**
Dryland	**936**	**31.8**
Significance	**NS**	**NS**

Final Discussion

Frequent rainfall during the early portion of the growing season maintained soil reserves of available water so that irrigation was not required during the flowering period of the lentil. The project achieved average yields of lentil that are common for dryland fields. No conclusion on the benefits of irrigation for lentil can be drawn using this information as the irrigated plot did not receive supplemental water in 2012. The project will be conducted again next year in hope of finding some drier weather.

Liebig's Law Fertility Demonstration*

Project Lead

- Gary Kruger, PAg, Provincial Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Roy King, Birsay, SK

Project Objective

To apply the principles of Liebig's Law of the Minimum to an irrigated field of wheat.

Project Background

Growers continually seek to increase the yield threshold on their farms. Irrigation potentially removes one constraint from the list of limiting factors in crop production. Crop nutrition is another major potential constraint that is within the control of a farm manager. This project evaluates some fertility practices that could improve irrigator yields.

Demonstration Plan

A crop nutrient plan was developed using conventional and ion exchange membrane soil testing techniques. The process identified possible nutrient management practices which would increase yield potential.

Demonstration Site

The demonstration was conducted on SW29-24-7-W3 southeast of Birsay during the 2012 growing season. The site is relatively level and was developed for pivot irrigation in 2008. Soil samples were collected April 3. Rainfall during 2012 consisted of 117 mm in May, 86 mm in June, 43 mm in July, 10 mm in August, and 3 mm in September. Only one circle of 0.5 inches was applied during the 2012 growing season.

Project Methods and Observations

The conventional and plant root simulator soil analysis methodology identified no weakness in the grower's fertility management. One of the main challenges faced by the grower was lodging of cereals on years when extra nitrogen was applied to obtain a higher yield. An additional 20 lb K_20/ac was applied with the extra 20 lb N/ac to check if added K could counteract lodging associated with higher N rates.

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*Project 2012-13

The seed treatment Awaken ST was applied to the wheat seed to test if this product has benefit under irrigation. Awaken ST consists of zinc ammonium acetate with potash and a broad spectrum micronutrient seed treatment including boron, copper, iron, manganese, molybdenum and zinc. The PRS soil analysis from Western Ag Labs did not indicate any likely response to these nutrients. Midwest Labs is known to recommend micronutrients more frequently than the local lab.

Midwest Labs' analysis is included in Table 1. The grower had banded 120 N/ac as urea in fall, 2011 and seed placed 30 lb P_20_5/ac at seeding. He was concerned that 20 lb extra N would be enough to cause lodging on the field under normal growing conditions.

Table 1: Conventional soil analysis of SW29-24-7-W3 (Midwest Lab Nebraska)

pH (1:1 soil:water)	7.7		Soluble salts (1:1 soil:water)	0.5 mmhos/cm		
Organic Matter (%)	2.5		Excess lime	L		
CEC (meq/100g)	22.9					
Nitrate-N (0-6")(ppm)	21	M				
Sulphate S (ppm)	34	VH		Micro Analysis		
Available P (ppm)	12	M	Base Saturation %	Zn	0.6 ppm	L
Available K (ppm)	410	VH	4.6	Mn	4 ppm	VL
Available Mg (ppm)	623	VH	22.9	Fe	24 ppm	H
Available Ca (ppm)	3279	H	71.5	Cu	0.7 ppm	L
1 N NH4OAc Na (ppm)	63	H	1.2	B	0.6 ppm	L

Fertilizer recommendations based on a target yield of 90 bu wheat/ac from this analysis included:

180 N, 35 lb P_20_5, 3.2 lb Zn, 2.6 lb Mn, 3.5 lb Cu.

Table 2: Plant Root Simulator Nutrient Analysis and Recommendations

pH (1:2 soil:water) 5.4 **PRS Probe Analysis**	**Measured Soil Supply (lb nutrient)**	**Wheat Nutrient Rating**	**Rec for Opt. Yield 73 bu lb nutrient**	**Nutrient Uptake Max. Yield 77 bu lb nutrient**
NO3-N + NH4-N	72.00	M	50	162.00
Phosphate	10.00	M	17	53.00
Potassium	127.00	H	---	124.00
Sulphur	50.00	H	---	20.00
Calcium	852.00	H	---	14.00
Magnesium	163.00	H	---	19.00
Copper	0.34	H	---	0.12
Zinc	0.49	H	---	0.39
Manganese	37.30	H	---	0.46
Iron	7.30	H	---	0.39
Boron	0.30	H	---	0.05

Available moisture assumptions for PRS soil analysis:

2.4" stored soil moisture, 6.3" growing season precipitation, 7.5" irrigation

Available moisture assumptions for PRS soil analysis:

2.4” stored soil moisture,
6.3” growing season precipitation,
7.5” irrigation

The field was sown on May 20 with a Bourgault air drill with 25 cm row spacing. Two hard spring wheat varieties were sown in the field - Carberry and Glenn. Emergence counts were taken at the two leaf stage and are reported below in Table 3 below

Table 3: Seedling emergence counts at Birsay Liebig’s Law Demonstration

Treatment	Seedling Emergence (plants/m^2)
Awaken 20 N 20 K_20	312
Awaken	350
20 N 20 K_20	300

These emergence counts indicate that the extra N + K fertilizer reduced seedling emergence by 10-15%. Even though this injury occurred, seedling counts were still adequate to obtain high yields.

Weed control on the HRS wheat was Harmony K applied at 40 ac per case. Fungicides applied to the crop included Tilt (propiconazole) at the flagleaf stage (100 ml/ac) and Quash (metconazole) (405 ml/ac) at the early flowering stage. The crop was straight combined on September 25. The grower commented that the crop had green kernels and seemed to be delayed in ripening. Some of this effect was evident in the grading results (Table 4).

Harvest samples were collected from the treatments and graded at two terminals. Downgrading factors are listed in Table 4. Awaken treated seed, when harvested, produced a sample that graded #3. Where the extra N and K was applied, results were similar with a 1.8 bu/ac increase in yield over the Awaken treatment alone. When Awaken seed treatment and N + K fertilizer were implemented, bushel weight, yield and grade were all reduced with the sample grading feed.

Table 4: Production statistics from Liebig's Law Demonstration

Treatment	Grade	Grading Factors	Bushel Wt (lb/bu)	Protein (%)	Yield (bu/ac)
Awaken	#3	0.002 Ergot 2.1 Immature 1.4 Fusarium 3.2 Midge 89% HVK	62	16.0	55.5
20N20K	#3	No Ergot 2.3 Immature 1.3 Fusarium 1.1 Midge 1.0 Smudge 86% HVK	64	16.0	57.3
Awaken 20N20K	Feed	0.003 % Ergot 2.2 Immature 2.4% Fusarium 3.2% Midge 1.7% Grass green 82% HVK	56	16.3	54.7

Final Discussion

The demonstration indicated that crop nutrition is a complex management practice. Nutrients have interactions with other nutrients and with environmental factors. Implementing several practices at once to a wheat crop can produce counterproductive results under certain conditions. On its own, a treatment may produce favourable results, but when combined with other practices, it may delay maturity, reduce yield or reduce grade. When using these types of products or practices, early seeding is one practice a grower can implement to limit the risk of reduced yield due to delayed maturity.

In this trial, Awaken and N + K produced both the lowest yield and poorest quality. Since all treatments were sprayed with fungicide at the same time, the possibility exists that the combination of all of these products enhanced the growth and delayed maturity slightly, causing the fungicide treatment to be less effective than expected.

Foliar Copper for Ergot Control Evaluation*

Project Lead

- Gary Kruger, PAg, Provincial Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Garth Weiterman, SSRID, Outlook, SK

Project Objective

The objective of this project was to evaluate the copper status of a wheat field with significant downgrading from ergot contamination.

Project Background

The agricultural community was plagued with significant levels of ergot in wheat fields throughout the irrigated region during the 2011 harvest. Producers are questioning if low copper fertility is contributing to the higher levels of ergot that have been observed. An Australian reference suggests the grain with more than 2.5 ppm copper is not deficient. It is hypothesized that such criteria could be used to determine whether copper fertility played a role in the high ergot levels observed in irrigated fields in 2011and whether foliar copper application at flagleaf will reduce ergot infection in their harvested wheat samples. Copper soil test levels in the area are in the marginal range.

Demonstration Plan

The producer applied foliar copper to his spring wheat field at the flagleaf stage. Samples of grain were collected from the check and treated areas of the harvested field. The levels of ergot infection and copper level in the grain samples were determined.

Demonstration Site

The demonstration was conducted on SW16-31-7-W3 north of Outlook during the 2011 growing season.

Project Methods and Observations

The field was sown to the spring wheat variety 5602HR in early May, 2011. The crop was fertilized according to soil test. The field was foliar fertilized with Nexus Ag liquid copper 5% at the flagleaf stage in late June. A test strip was left untreated with copper as control for the demonstration. A grain sample was collected from the field and the control area for nutrient analysis to determine the copper concentration in the grain. Both the foliar copper treatment and the control had significant

* Project 2012-15

levels of ergot requiring special cleaning in order to market the wheat without major downgrading. The ergot level in the control was 0.02% and the ergot level in the foliar copper treated grain was 0.08%. The demonstration was unsuccessful in preventing ergot development throughout the general field.

Grain companies report that grain is extremely variable in ergot contamination and farmers comment that ergot infestation seems general throughout the field and is not limited to the outside rounds as has been the case in the past.

The elemental analysis for the two grain samples is reported in Table 1. Both samples contained more than 2.5 ppm Cu. Although this interpretative criteria was developed in Australia and has not been used in Western Canada, it provides an indication that the ergot observed is most likely caused by environmental conditions and tillage practices. Copper fertilization is unlikely to reduce the ergot infection levels.

Table 1: Nutrient levels in wheat grains harvested in fall 2011.

Nutrient (ug/g)	Control	Copper Foliar Applied
Nitrogen (%)	2.89	2.89
Phosphorus (%)	0.359	0.384
Potassium (%)	0.343	0.341
Sulphur (%)	0.177	0.176
Calcium (%)	0.048	0.049
Magnesium (%)	0.163	0.155
Copper (ug/g)	2.89	3.26
Iron (ug/g)	42.5	47.6
Manganese (ug/g)	46.1	44.6
Iron (ug/g)	42.5	47.6
Zinc (ug/g)	28.5	27.3

Final Discussion

Application of foliar copper to the wheat field at flagleaf was not effective in preventing the incidence of ergot in 2011. Grain analysis confirmed that the concentration of copper in the grain samples collected from the South Saskatchewan River Irrigation District was above the critical level for copper determined for wheat in Australia in 1975. This critical concentration of copper in wheat needs locally calibrated research to confirm its utility in diagnosing the copper status of soils for wheat production in Saskatchewan.

Liquid and Granular Phosphate Demonstration*

Project Lead

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Glen Erlandson, SSRID, Outlook, SK

Project Objective

To quantify the advantage of liquid ortho phosphate fertilizer for canola production.

Demonstration Plan

The grower decided to apply 13 L/ac of ortho phosphate fertilizer along with 20 lb P205/ac to the general field. This follows the general recommendation from the supplier for normal practice. The demonstration tested rates of no ortho phosphate liquid, 13 L/ac ortho phosphate liquid and 22 L/ac ortho phosphate liquid both with and without the 20 lb P205 granular/ac. Each of the strips consisted of about 0.84 acres. No replication was possible for the treatments at this site.

Demonstration Site

The demonstration was conducted on wheat stubble on SW20-30-7-W3. The site was soil sampled on April 3 for both conventional and plant root simulator analysis. The results from Midwest Labs in Nebraska and Western Ag Labs in Saskatoon are reported in Tables 1 and 2 respectively.

Table 1: Conventional soil analysis of SW20-30-7-W3 (Midwest Lab Nebraska)

pH (1:1 soil:water)	7.3		Soluble salts (1:1 soil:water)	0.6 mmhos/cm		
Organic Matter (%)	2.8		Excess lime	L		
CEC (meq/100g)	18.5					
Nitrate-N (0-6”)(ppm)	8	L				
Sulphate S (ppm)	14	M		Micro Analysis		
Available P (ppm)	7	L	Base Saturation %	Zn	0.9 ppm	L
Extractable K (ppm)	364	VH	5.0	Mn	4 ppm	VL
Extractable Mg (ppm)	632	VH	28.5	Fe	19 ppm	H
Extractable Ca (ppm)	2414	M	65.2	Cu	0.6 ppm	L
Extractable Na (ppm)	57	L	1.3	B	0.8 ppm	M

Fertilizer recommendations for 100 bu canola were 290 N/ac, 50 P205/ac, 6 lb S/ac, 6.4 lb Zn/ac, 6.5 lb Mn/ac, 2.7 lb Cu/ac, and 1.0 lb B/ac.

* Project 2012-16

Project Methods and Observations

The canola field was sown June 6 with a John Deere 1610 airseeder. The variety was Invigor L130. Liquid nitrogen was applied as 28-0-0 at 80 lb N/ac at seeding time. The general field was fertilized with liquid 6-22-2 at 13 L/ac. Weeds were controlled with Liberty herbicide. Plant tissue samples were collected at late bud stage to assess the relative nutrient status of the six treatments. The plant tissue analysis is reported in Table 3. The analyses indicate all nutrients were at optimum level in the canola plants at time of sampling. The grower had intended to top dress the canola field at the late rosette stage. With the delay in seeding until June, the grower decided against extra N on the field in the interest of speeding up maturity.

Table 2: Plant Root Simulator Nutrient Analysis and Recommendations

pH (1:2 soil:water) 6.0 **PRS Probe Analysis**	**Measured Wheat Soil Supply (lb nutrient)**	**Opt. Nutrient Rating**	**Rec for Nutrient Uptake Yield 64 bu lb nutrient**	**Max. Yield 78 bu lb nutrient**
NO3-N + NH4-N	7.00	L	125	235.00
Phosphate	35.00	M	25	76.00
Potassium	340.00	H	---	188.00
Sulphur	16.00	M	18	47.00
Calcium	1,040.00	H	---	42.00
Magnesium	164.00	H	---	59.00
Copper	0.15	H	---	0.19
Zinc	0.50	H	---	0.39
Manganese	8.01	H	---	0.47
Iron	2.00	H	---	0.47
Boron	0.63	H	---	0.38

Available moisture assumptions for PRS soil analysis:

2.4” stored soil moisture, 6.3” growing season precipitation, 7.1” irrigation

Table 3: Nutrient status of canola grown on soils treated with fertilizer treatments

Treatment	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g
No granular No liquid	5.76	0.54	4.65	1.00	2.20	0.52	8.2	103	56	55	39
No granular 13 L liquid	5.58	0.47	4.43	0.89	1.75	0.49	9.1	143	57	51	37
No granular 22 L liquid	6.10	0.63	5.87	0.85	1.64	0.50	7.1	91	42	48	34
20 $P_2 0_5$ granular No liquid	6.26	0.73	4.98	1.31	1.87	0.68	8.5	98	55	55	40
20 $P_2 0_5$ granular 13 L liquid	5.51	0.76	4.71	1.24	1.95	0.67	8.5	96	50	54	39

20 P_20_5 granular 22 L liquid	5.50	0.61	3.59	0.83	1.74	0.50	8.9	87	54	51	36
Threshold	**3.00**	**0.25**	**2.0**	**0.40**	**0.50**	**0.20**	**4.5**	**40**	**20**	**15**	**30**

Table 4: Canola yield of phosphate treatments at Erlandson site

Treatment	Canola Yield (bu/ac)
No granular No liquid	33.5
No granular 13 L liquid	33.9
No granular 22 L liquid	33.9
20 P_20_5 granular No liquid	33.1
20 P_20_5 granular 13 L liquid	20.4*
20 P_20_5 granular 22 L liquid	33.4

* The yield of this treatment was reduced due to waterlogging in the field.

Final Discussion

The demonstration showed that the yield response of canola to phosphate at this site was less than one bushel/ac, if any at all. The June seeding date is likely part of the reason for the limited yield response to P at this site. P mineralization and supply increases once the soil temperature rises. Visual growth responses as well as yield increases due to phosphate are more dramatic with early seeding and cold springs. The lower soil temperature reduces the diffusion of phosphate to the root surface for nutrient uptake and slows the growth rate of roots to unexplored soil.

Canola Seeding Rate Trial 2012

Project Investigators

- Garry Hnatowich, PAg, ICDC, Project Lead
- Harvey Joel, ICDC
- Don David, CSIDC

Project Objective

The objective is to determine the appropriate seeding rates for canola under irrigation production.

Project Plan

This study was initiated to evaluate the agronomic implications of seeding canola at rates both below and above present suggested seeding rates for irrigation production. Present guidelines for canola suggest a target population of 110 plants per square meter (plants/m^2). Two canola hybrids, 45H21 and 5440 where evaluated within the trial. The trial was seeded at rates of 50, 75, 100, 150, 200 and 300 plants/m^2. Plant stand densities at the three- to five-leaf stage and harvest yield were measured.

Demonstration Site

This project was located at CSIDC to limit field and equipment variation and to allow for greater ease of management. CSIDC staff assisted ICDC staff in seeding of the trial; pesticide and irrigation applications; and collection of harvest data. Soils on the project site are classified as a very fine sandy loam to a loam.

Project Methods and Observations

Establishment and Crop Management

Seeding rate (kg/ha) = Target plant density/m^2 x TKW (g) ÷ Seedling survival (in decimal form such as 0.90) ÷ 100

Where TKW = thousand kernel weight

Seeding rate (lb/ac) = Seeding rate (kg/ha) x 1.121

The seeding rate for each treatment was calculated using the formula:

Pioneer Roundup Ready canola variety 45H21 and Bayer InVigor 5440 were chosen for the test. The TKW of 45H21 was measured 4.8 g, 5440 weighed 4.0 g. Seedling germination and survival was estimated to be 90 per cent. The seeding rate of each treatment is shown in Table 1.

The trial was seeded on May 18 at a 1.3 cm seeding depth. Plot size was 1.5 m by 4.0 m with 25 cm row spacing. Seed was treated with Helix XTra. A bulk blend of 34-8-6 was side-band applied at 294 kg product/ha supplying 112 lb N/acre, 27 lb P_2O_5/acre and 20 lb K_2O/acre. An additional 22 lb P_2O_5/acre as 11-52-0 was also side-banded at seeding. Plots were maintained weed free with chemical herbicide applications and hand weeding. A fungicide application of Proline was applied on July 19.

Table 1. Plant density treatments and seeding rates.

Seeding Rate (plants/m^2)	45H21 Seeding Rate kg/ha (lb/acre)	5440 Seeding Rate kg/ha (lb/acre)
50	2.7 (3.0)	2.2 (2.5)
75	4.0 (4.5)	3.3 (3.7)
100	5.3 (5.9)	4.4 (4.9)
150	8.0 (9.0)	6.7 (7.5)
200	10.7 (12.0)	8.9 (10.0)
250	13.3 (14.9)	11.1 (12.4)
300	16.0 (17.9)	13.3 (14.9)

Harvest

Plots were swathed on August 22 and harvested August 29 by ICDC and CSIDC staff.

Table 2. Yield data for 2012.

Treatment	Yield kg/ha	Yield bu/ac
Hybrid		
45H21	2417	43.1
5440	3209	57.2
LSD (0.05)	626	11.2
CV (%)	11.9	11.9
Seeding Rate (plants/m^2)		
50	2452	43.7
75	2669	47.6
100	2706	48.3
150	2998	53.5
200	2837	50.6
250	3056	54.5
300	2974	53.1
LSD (0.05)	339	6.0
Hybrid x Seeding Rate Interaction		
LSD (0.05)	NS	NS

NS = not significant

Note on Harvest Data values and statistical analysis

Values listed for each hybrid are the means obtained from combining all seed rates observations. For example, the yield of 43.1 bu/ac for hybrid 45H21 is the overall average obtained by combining all yields at each seeding rate of 45H21. Likewise the mean yield of 43.7 bu/ac for the 50 seeds/m^2 seeding rate is the average of both 45H21 and 5440 yields harvested at this seeding rate. Data for each hybrid at each seeding rate is not shown, however the "Hybrid x Seeding Rate Interaction" is provided at the bottom of Table 2. Yield results are statistically not significant (NS). This means, both hybrids responded in a similar manner to increased seeding rates. Least Significant Difference (LSD) denotes the numerical difference required between treatments to be statistically significant. For example, if the difference between seeding rates exceeds 6.0 bu/ac the seeding rates are significantly different from each other. The Coefficient of Variation (CV) is a numerical value describing the amount of variation between and within treatments, the higher the CV the less confidence is associated with the reliability of the results to be reproduced in future identical experiments. In general, CV values less than 15 are deemed acceptable.

Final Discussion

Mean yields of hybrids and seeding rates are summarized in Table 2. Mean yield of hybrid 5440 was significantly greater than that of 45H21; 5440 had a 33% higher yield. This wide gap in yield between the two hybrids differs significantly from the 13% yield advantage listed in *"Crop Varieties For Irrigation"*. Hybrid 5440 did seem to have more vigorous growth during early season seedling growth.

As seeding rate increased so did yield up to the 150 plants/m^2 treatment. No statistical yield benefit occurred to seeding rates above this treatment. Present recommendations suggest that producers target a plant density of 110 plants/m^2. Results of this season's trial suggest the present recommendation is likely adequate for achieving optimal, or close to optimal, canola yield. The effect of seeding rates on the yield of each hybrid was statistically not significant, meaning both responded in a similar manner with respect to yield when increasing seeding rates. This relationship is illustrated in Figure 1.

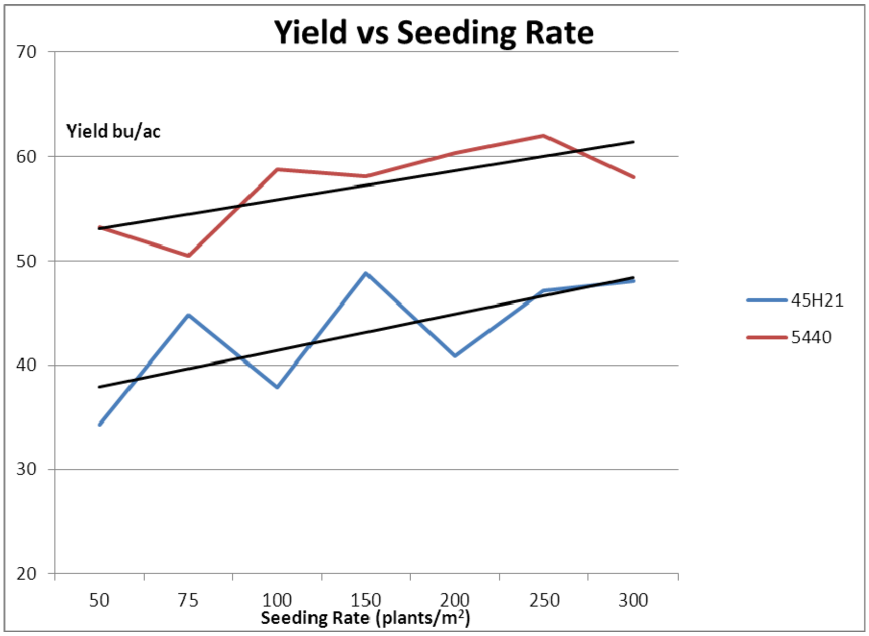

Figure 1. Effect of Increasing Seeding Rates on Seed Yield of Canola Hybrids.

Seeding rate had no effect on seed test weight, plant height nor maturity (data not shown).

This trial has been conducted over two seasons and a combining of site years needs to be conducted. A decision to repeat, or not, this experiment will be made prior to the 2013 field season.

Durum & Soft White Wheat Seeding Rate Trial 2012

Project Investigators

- Garry Hnatowich, PAg, ICDC, Project Lead
- Harvey Joel, ICDC
- Don David, CSIDC

Project Objective

The objective is to determine the appropriate seeding rates of durum and soft white wheat under irrigation production.

Project Plan

This study was initiated to evaluate the agronomic implications of seeding durum wheat at rates both below and above present suggested planting rates for irrigation production. Present guidelines for durum suggest a target population of 250 plants per square meter (plants/m^2). The trial was expanded in 2012 to include a soft white wheat variety in addition to the durum wheat. Each variety was seeded at rates of 100, 200, 300, 400 and 500 plants/m^2.

Demonstration Site

This project was located at CSIDC to limit field and equipment variation and to allow for greater ease of management. CSIDC staff assisted in the seeding of the trial; pesticide and irrigation applications; and collection of harvest data. Soils on the project site are classified as a very fine sandy loam to a loam.

Project Methods and Observations

Establishment and Crop Management

> Seeding rate (kg/ha) = Target plant density/m^2 x TKW (g) ÷ Seedling survival (in decimal form such as 0.90) ÷ 100
>
> Where TKW = thousand kernel weight
>
> Seeding rate (lb/ac) = Seeding rate (kg/ha) x 1.121

The seeding rate for each treatment was calculated using the formula:

Durum variety cv. Strongfield and Soft White Wheat variety cv. Sadash were chosen for the test. The TKW of Strongfield was 46 g, Sadash was 36 g. Seedling survival was estimated to be 90 per cent for each. The seeding rate for each treatment is shown in Table 1.

The trial was seeded on May 15 at a 3.0 cm seeding depth. Plot size was 1.5 m by 4.0 m with 25 cm row spacing. A bulk blend of 34-8-6 was side-band applied at 294 kg product/ha supplying 112 lb N/acre, 27 lb P_2O_5/acre and 20 lb K_2O/acre. An additional 22 lb P_2O_5/acre as 11-52-0 was also side-banded at seeding. Plots were maintained weed free with chemical herbicide applications and hand weeding. Fungicide applications of Headline and Proline were applied on July 6 and July 13, respectively.

Harvest

Plots were harvested on August 29 by ICDC and CSIDC staff. Yield and other agronomic determined parameters are summarized in Table 2.

Table 1. Plant density treatments and seeding rates for 2012.

Seeding Rate (plants/m^2)	Strongfield Seeding Rate kg/ha (lb/acre)	Sadash Seeding Rate kg/ha (lb/acre)
100	51 (57)	40 (45)
200	102 (114)	80 (90)
300	153 (172)	120 (135)
400	204 (229)	160 (179)
500	256 (287)	200 (224)

Table 2. Harvest Data for 2012.

Treatment	Yield (kg/ha)	Yield (bu/ac)	Protein (%)	Test Weight (gm/hl)	TKW (gm)	Maturity (days)	Plant Height (cm)	Lodging (1-9)
Variety								
Strongfield	3990	59.3	16.8	75.3	37.5	100	90	4.2
Sadash	6018	89.5	12.5	76.3	33.7	100	85	2.4
LSD (0.05)	392	5.8	0.7	0.8	NS	NS	4.0	0.7
CV (%)	5.6	5.6	3.9	0.8	16.7	0.9	4.4	27.4
Seeding Rate								
100 seed/m^2	4030	59.9	15.5	75.0	33.0	103	81	1.1
200 seed/m^2	4842	72.0	14.6	75.8	37.5	100	87	2.0
300 seed/m^2	5130	76.3	14.4	76.0	36.2	100	90	3.5
400 seed/m^2	5422	80.6	14.4	76.2	36.1	99	90	4.4
500 seed/m^2	5597	83.2	14.3	76.0	35.4	99	91	5.5
LSD (0.05)	288	4.3	0.6	0.6	NS	1	4.0	0.9
Variety x Seeding Rate Interaction								
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	S

S = Significant; NS = Not Significant

Note on Harvest Data values and statistical analysis

Values listed for each variety are the means obtained from combining all seed rates observations. For example, the yield of 59.3 bu/ac for Strongfield is the overall average obtained by combining all yields at each seeding rate of Strongfield. Likewise the mean yield of 59.9 bu/ac for the 100 seeds/m^2 seeding rate is the average of both Sadash and Strongfield yields harvested at this seeding rate. Data for each variety at each seeding rate is not shown, however the "Variety x Seeding Rate Interaction" is provided at the bottom of Table 2. Other than lodging, all measured observations (yield, protein, etc.) are statistically not significant (NS). This means, for example in terms of yield, both varieties responded in a similar manner to increased seeding rates. Least Significant Difference (LSD) denotes the numerical difference required between treatments to be statistically significant. For example, if the difference between seeding rates exceeds 4.3 bu/ac the seeding rates are significantly different from each other. The Coefficient of Variation (CV) is a numerical value describing the amount of variation between and within treatments; the higher the CV, the less confidence is associated with the reliability of the results to be reproduced in future identical experiments. In general, CV values less than 15 are deemed acceptable; exceptions to this are measurements that are evaluated subjectively. For example, in rating an agronomic parameter such as lodging, values recorded for each treatment are based on the judgement of the researcher. As such, higher CV values are commonly associated with subjective measurements.

Discussion

Not surprisingly, the soft white variety was higher in yield and protein content than the durum variety. Strongfield plots exhibited a greater degree of lodging compared to those of Sadash (in agreement with Lodge Rating's found in *Crop Varieties for Irrigation*).

The mean yield was statistically increased with each increasing seeding rate up to 400 kg/m^2. There was no statistical difference between 400 and 500 seed/m^2 seeding rate, although numerical yields continued to rise to the 500 seeds/m^2 rate.

Statistical analysis procedures indicate that the two varieties included in the study responded in a similar manner to increased seeding rates. This is illustrated in Figure 1 (data not included in Table 2). Present recommendations suggest that producers target a plant density of 250 plants/m^2 as illustrated by the vertical line positioned at 250 seeds/m^2 in Figure 1. Yield trends to seeding rates of the two varieties paralleled each other.

As might be expected, protein content of the durum variety was greater than that of the soft white variety. Increased seeding rates tended to lower protein content and can be expected due to the inverse relationship between yield and protein. As yield increases, protein decreases.

As seeding rates increased, test weight and plant height increased, while days to maturity decreased.

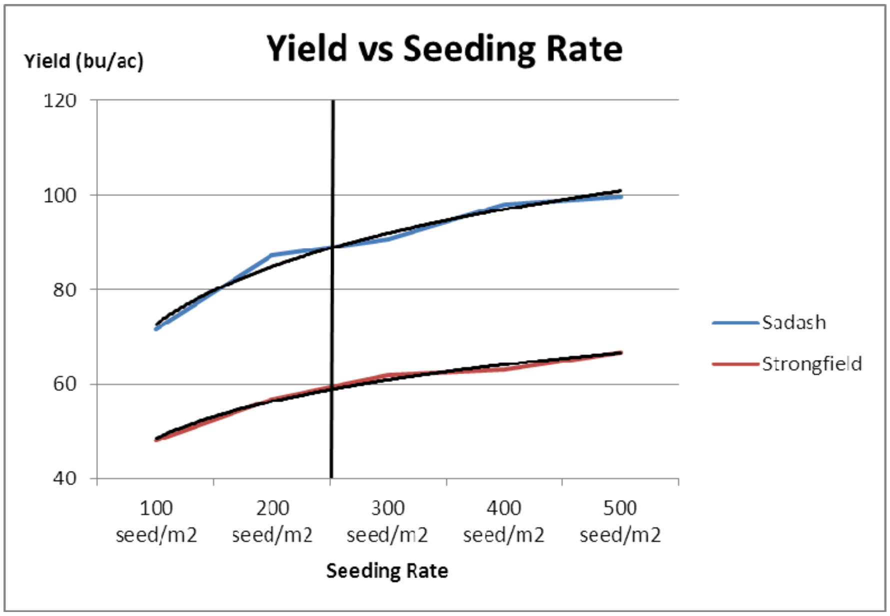

Figure 1. Effect of Seeding Rates on Yield of Strongfield (durum) and Sadash (soft white) wheat in 2012

The only significant interaction between varieties and seeding rates occurred with lodging. The durum variety Strongfield lodged to a greater extent than the soft white variety Sadash at all seeding rates. As seeding rates increased, Strongfield lodged in a straight line linear fashion; with each increase in seeding rate lodging increased in a constant manner. With the soft white wheat variety Sadash; lodging increased slowly until the 300 seeds/m2 seeding rate and then increased rapidly with each subsequent increase in seeding rate (Figure 2).

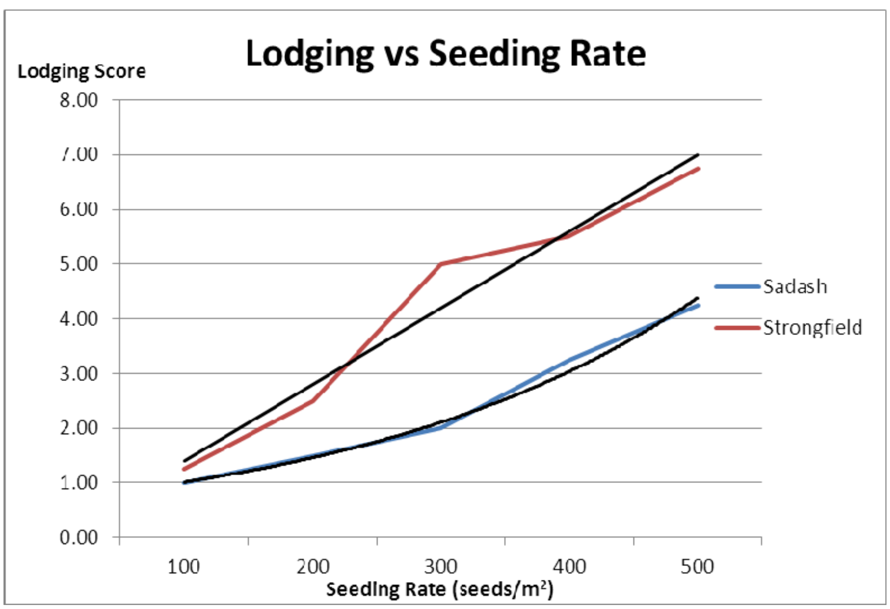

Figure 2. Effect of Seeding Rates on Lodging of Strongfield (durum) and Sadash (soft white) wheat, 2012

Future Evaluation

Seeding rates with a durum wheat variety have been conducted in 2010, 2011 and 2012. However, seeding rates were not constant over the three year period. A review and assessment of these trials will be evaluated in order to determine, whether additional trials should be contemplated. Once assessment is complete an economic analysis should be conducted on the results, if seeding rates above the recommended rate of 250 seeds/m^2, appear beneficial. Economics and risk analysis need to be coupled in considerations to seeding rate. For example, do yield gains obtained by increasing seeding rates warrant the increased delay in refilling seed tanks during planting, does the risk of possible difficulties in harvesting a wheat crop lodged to a greater degree because of higher seeding rates warrant those seeding rates, etc.

Assesment of Arbuscular Mycorrhizal Inoculants for Flax Production

Project Lead

- Dr. Fran Walley, Dept. of Soil Science, University of Saskatchewan

Co-investigator

- Garry Hnatowich, ICDC

Project Objective

1. Assess the growth promotion characteristics of commercially available arbuscular mycorrhizal fungi (AMF) inoculants in flax production.
2. Assess the impact of AMF inoculation on colonization success in flax in soils containing indigenous AMF species.
3. Examine the impact of AMF inoculation rate on growth promotion of flax, and competition with other indigenous AMF.
4. Determine the economic feasibility of using an AMF inoculant for improved P uptake and yield of flax.

Project Background

The ability of flax to respond to phosphorus (P) fertilizer is often inconsistent and less pronounced than other annual crops. This may in part be due to flax's sensitivity to seed-placed fertilizer and its limited ability to proliferate roots in a banded fertilizer application. Flax tends to prefer scavenging soil P from P fertilization of previous crops. AMF are a group of fungi capable of colonizing and forming symbiotic relationships with most annual crops (exceptions are canola and mustard). These fungi infect plant roots and develop hypha networks that extend into the soil environment. This effectively extends the plants root surface area and increasing the zone of soil exploration. Fungi transfer soil moisture and nutrients (particularly relatively immobile nutrients such as P) to plants, resulting in direct and indirect benefits. Flax is strongly influenced by AMF.

Recent AMF inoculants have been developed and introduced into the market place. However, the efficacy of these inoculants is unknown, with little information regarding application rates, placement and economic feasibility of using AMF inoculants in flax production. This study is intended to address these issues.

Project Plan

This trial was established at CSIDC and designed in a randomized small plot design replicated four times. Three rates of AMF (Myke Pro GR); control, 1X and 2X recommended rates (1X rate = 8.4 lb/acre, seed placed), were applied with or without P fertilizer. For P fertilizer treatments, P was applied as a side-band application at a rate of 19 lb P_2O_5/acre.

Seed packaging and AMF inoculants were packaged by U of S staff. ICDC and CSIDC staff conducted soil testing and identified an appropriate site location for the trial, conducted site preparation, seeding, plot maintenance and harvest operations. U of S staff conducted above and below ground plant sampling twice during the growing season.

Results and Discussion

No information is available at this time. Molecular analysis of plant and soil samples are presently being conducted by graduate students involved in the project. These are laborious and time consuming procedures. Grain yield samples have yet been processed.

FORAGE CROP PROJECTS AT CSIDC IN 2012

Evaluation of Commercial Pasture Blends – Final Report*

Project Lead

- Sarah Sommerfeld, PAg, Regional Forage Specialist, Saskatchewan Agriculture
- Eric Stalwick, ICDC summer student

Co-investigators

- Charlotte Ward, PAg, Regional Forage Specialist, Saskatchewan Agriculture
- Dr. Bruce Coulman, PAg, University of Saskatchewan
- Brian Champion, Canada-Saskatchewan Irrigation Diversification Centre (CSIDC)

Industry Co-operators

- Neil Mcleod, Northstar Seeds Ltd.
- Art Klassen, BrettYoung Seeds
- Chad Keisig, Pickseed
- Shawn Keyowski, Viterra

Project Objectives

The objectives of this project are:

- To evaluate commercial and custom forage blends for overall yield, persistence and species composition.
- To monitor changes in forage yield, species composition and individual species persistence within each blend over time.
- To determine whether irrigation provides a yield benefit to justify increased costs and management in comparison to dryland production.

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* Project #2009-02

Research Plan

A randomized replicated plot design of six pasture blends was managed to simulate intensive grazing. Forage was cut at the vegetative stage, corresponding to the three- to four-leaf stage or 20 to 25 cm (8 to 10 in.) in plant height. Data collected includes overall yield and composition on a dry matter (DM) basis. Forage blend composition and change in composition was measured by hand harvesting a quarter-meter quadrant, separating the vegetation according to species and drying and weighing the dry sample of each individual species. Overall plot yield is determined by mechanical harvest in addition to the hand-harvested yield. Harvest timing is dependent on forage growth.

Demonstration Site

CSIDC provided the land and facilities to carry out this project.

Project Methods and Observations

Variety Selection

Pasture blend selection was made on the basis of selecting a blend suitable for intensive grazing under irrigated conditions. The four pasture blends provided by industry were selected at the supplier's discretion. The custom blends were developed by the project lead and co-investigator.

The selection process provided a combination of simple and complex pasture blends with varying composition for comparison. Table 1 provides an overview of the forage species, varieties and proportion of species within each blend.

Table 1. Summary of pasture blend description and composition.

Species	Variety	Proportion in Blend by Seed Weight
Custom Blend #1		
Alfalfa	AC Grazeland BR	20%
Meadow bromegrass	Fleet	80%
Custom Blend #2		
Cicer milkvetch	Oxley II	30%
Meadow bromegrass	Fleet	70%
Brett-Young Super Pasture Blend		
Meadow bromegrass	Fleet	50%
Crested wheatgrass	Fairway	25%
Tall fescue	Kokanee	15%
Alfalfa	Survivor	10%
Pickseed HayGraze Blend		
Alfalfa	AC Grazeland Br	60%
Meadow bromegrass	Fleet	30%
Orchardgrass	OKAY	10%
Northstar Custom Blend #1		
Meadow bromegrass	Fleet	40%
Smooth bromegrass	Carlton	10%
Tall fescue	Courtenay	15%

Species	Variety	Proportion in Blend by Seed Weight
Orchardgrass	Early Arctic	15%
Alfalfa	Stealth	20%
Viterra Ranchmaster Blend		
Meadow bromegrass	hps brand	50%
Intermediate wheatgrass		15%
Pubescent wheatgrass		15%
Tall fescue	hps brand	15%
Alfalfa	Spredor	5%

Establishment

The target plant population for each treatment was designed to reflect the soil characteristics and moisture conditions of the trial area. Seeding of the irrigated and dry land treatments occurred on June 2, 2009.

The irrigation treatment targeted a plant population of 35 pure live seeds per square foot (PLS/ft^2). The dryland treatment targeted a plant population of 25 PLS/ft^2, but failed to successfully establish and was later removed from the trial.

Table 2 describes the seeding rate for the irrigation treatment. The seeding rate was calculated using the formula stated in the table which adjusts for the percentage of PLS for each forage variety. Plot dimensions were 1.2 m by 5.0 m with row spacing of 20 cm or eight inches.

Table 2. Recommended seeding rate of irrigation treatment.

ICDC Perennial Pasture Blend Trial - IRRIGATION		
Plot size = 1.2 m x 5 m = 6 m² =	*0.0015*	*acres*
Seeding Rate Calculation:		
Seeding rate (lb./acre) = seeds/ft² x ft²/acre / PLS seeds/lb.		
Species	Proportion in blend by seed weight	Recommended seeding rate (lb. per acre) IRRIGATION
Custom Blend #1		
Alfalfa	20%	1.86
Meadow bromegrass	80%	19.40
		21.26
Custom Blend #2		
Cicer milkvetch	30%	3.74
Meadow bromegrass	70%	16.97
		20.72
BrettYoung Super Pasture Blend		
Meadow bromegrass	50%	10.45
Crested wheatgrass	25%	2.48
Tall fescue	15%	1.07
Alfalfa	10%	0.97
		14.97
Pickseed HayGraze Blend		
Alfalfa	60%	5.53
Meadow bromegrass	30%	6.40
Orchardgrass	10%	0.30
		12.23
Northstar Custom Blend #1		
Meadow bromegrass	40%	8.36
Smooth bromegrass	10%	1.40
Tall fescue	15%	1.12
Orchardgrass	15%	0.39
Alfalfa	20%	1.77
		13.04
Viterra Ranchmaster Blend		
Meadow bromegrass	50%	11.62
Intermediate wheatgrass	15%	3.17
Pubescent wheatgrass	15%	2.79
Tall fescue	15%	1.23
Alfalfa	5%	0.46
		19.27

Crop Management

Phosphorus fertilizer was broadcast, as 12-51-0 at 50 lb P_2O_5/acre on October 18, 2011. Potassium fertilizer, as 0-0-62 at a rate of 15 lb K_2O/acre, was broadcast April 24, 2012.

No herbicide applications were made.

A total of 381 mm (15 inches) of rainfall was received from April 1 to September 30, 2012 and 159 mm (6.25 inches) of irrigation was applied to the trial area from June 5 to September 4, 2012.

Data Collection

Two quarter-metre harvests were clipped from each plot on May 30, 2012. The species were separated, dried and weighed to determine the composition and contribution for each pasture blend (Table 3). Following the clipping harvest, a total plot harvest was completed to a height of 7.5

cm. Total plot harvest was completed on June 1, June 26, July 31 and Aug. 27. Dry matter (DM) yield (Table 4) and grazing days per acre (Table 5) were calculated for each blend.

Discussion

The data in Table 3 shows the contribution to yield by the different forage species within each pasture blend in 2012. When Table 3 data is compared to 2011 composition data (*ICDC Research and Demonstration Program Report 2011*), the alfalfa, smooth brome, crested wheatgrass and intermediate wheatgrass contributions to yield increased. The total DM yield (Table 4) and grazing days per acre(Table 5) when compared to 2011 total DM yield and grazing days per acre (*ICDC Research and Demonstration Program Report 2011*) are similar or lower in all pasture blends except Custom Blend #1.

The statistical analysis of yield data from 2010 to 2012 (Table 6) shows that at the 90 per cent confidence level (p-value 0.0524), Custom Blend #2 had a significantly lower yield than the Northstar Custom Blend, Brett Young Super Pasture Blend and Pickseed Haygraze Blend. An explanation as to why the performance of Custom Blend #2 was significantly different from the three other noted blends may come from the observation that the cicer milkvetch component of the blend did not establish well and therefore did not significantly contribute to plot yield. This is supported by the results shown in Table 3. The project lead does recognize that the influence of animal impact and grazing pressure are missing from this project. Therefore, the results of the project may not truly reflect the performance of these forage species when subjected to grazing.

In summary, based on this project's results, selection of the Northstar Custom Blend, Brett Young Super Pasture Blend or the Pickseed Haygraze Blend for an intensive rotational grazing operation under irrigation would be suitable. However, given that alfalfa contributed to over half of the yield produced by these blends, a concern for bloat incidence is warranted. A producer may choose to consider a blend with a non-bloat legume or the use of an anti-bloat agent, such as poloxalene.

Table 3. Average percent species composition at clipping harvest May 30, 2012 (DM basis).

Plot	Blend	Total Dry Wt (g)	Alfalfa	Meadow Brome	Smooth Brome	Cicer Milkvetch	Crested Wheatgrass	Tall Fescue	Orchard Grass	Intermediate Wheatgrass
1	Custom Blend #1	87	47.8%	52.2%						
2	Northstar Custom Blend	57.2	52.6%	1.4%	19.5%			8.3%	18.3%	
3	Custom Blend #2	45.4		99.6%		0.4%				
4	BrettYoung Super Pasture Blend	75	58.6%	5.0%			24.3%	12.1%		
5	Viterra Ranchmaster Blend	53.1	74.9%	5.3%				9.8%		9.9%
6	Pickseed Haygraze Blend	67.1	64.4%	2.7%					32.9%	
7	Northstar Custom Blend	66.1	76.6%	12.2%	2.5%			5.3%	3.4%	
8	BrettYoung Super Pasture Blend	56.4	39.1%	13.4%			34.9%	12.6%		
9	Custom Blend #1	104.7	59.4%	40.6%						
10	Pickseed Haygraze Blend	67.5	55.0%	19.3%					25.7%	
11	Viterra Ranchmaster Blend	54.5	58.3%	11.2%				5.6%		24.9%
12	Custom Blend #2	82.8		98.1%		1.9%				
13	Custom Blend #2	93.3		99.6%		0.4%				
14	BrettYoung Super Pasture Blend	62.9	65.4%	7.3%			19.0%	8.2%		
15	Custom Blend #1	122.2	74.6%	25.4%						
16	Viterra Ranchmaster Blend	56.7	60.2%	7.3%				8.2%		24.3%
17	Pickseed Haygraze Blend	55.8	79.6%	6.1%					14.3%	
18	Northstar Custom Blend	59.6	70.1%	2.1%	7.6%			7.9%	12.2%	
19	Northstar Custom Blend	80.3	53.8%	0.9%	7.4%			8.3%	29.6%	
20	Pickseed Haygraze Blend	76.7	85.6%	2.9%					11.6%	
21	Custom Blend #1	95.3	56.2%	43.8%						
22	Custom Blend #2	66	50.0%	48.6%		1.4%				
23	Viterra Ranchmaster Blend	64.7	70.7%	9.7%				9.7%		9.9%
24	BrettYoung Super Pasture Blend	54.4	63.7%	13.0%			15.3%	8.0%		0.0%

Table 4. 2012 irrigation treatment harvest data.

Blend	Average DM Yield (ton/acre)				Average DM Yield per Cut (ton/acre)	Total DM Yield (ton/acre)
	Cut 1	Cut 2	Cut 3	Cut 4		
	May-30	Jun-26	Jul-31	Aug-27		
Custom Blend #1	1.23	0.70	1.60	0.62	1.04	4.15
Northstar Custom Blend	1.17	0.66	1.49	0.71	1.01	4.05
Custom Blend #2	1.30	0.56	0.99	0.27	0.78	3.13
Brett-Young Super Pasture Blend	1.12	0.62	1.32	0.61	0.92	3.67
Proven-Viterra Ranchmaster Blend	1.31	0.74	1.27	0.53	0.96	3.85
Pickseed Haygraze Blend	1.04	0.69	1.63	0.68	1.01	4.05

Table 5. Calculated grazing yields.

Blend	2010 Total Yield (ton DM/acre)	2011 Total Yield (ton DM/acre)	2012 Total Yield (ton DM/acre)	Total Mean Yield (ton DM/acre)
Custom Blend #1	4.0	3.8	4.1	11.8 ab
Northstar Custom Blend	4.6	4.8	4.0	13.4 a
Custom Blend #2	4.4	3.2	3.1	10.6 b
Brett Young Super Pasture Blend	4.6	4.8	3.6	13.1 a
Viterra Ranchmaster Blend	4.2	3.9	3.8	11.9 ab
Pickseed Haygraze Blend	4.0	3.9	4.0	12.9 a
Mean	4.45	4.06	3.76	12.27
CV (%)	17.41	14.09	11.19	9.99
LSD	1.17	0.86	0.63	1.85
p-value	0.5377	0.0065	0.0379	0.0524

Table 6. 2010-2012 dry matter yield summary

Blend	Total DM Yield (ton/acre)	Total DM Yield (lb./acre)	Total DM Pasture Yield (lb./acre)	Grazing days (AUM/ac)	Grazing days (AU days/acre)
Custom Blend #1	4.15	9143	6400	7.0	213
Northstar Custom Blend	4.05	8917	6242	6.8	208
Custom Blend #2	3.13	6892	4825	5.3	161
Brett-Young Super Pasture Blend	3.67	8092	5664	6.2	189
Viterra Ranchmaster Blend	3.85	8477	5934	6.5	198
Pickseed Haygraze Blend	4.05	8927	6249	6.8	208
Assumptions:					
Pasture yield calculated as total DM yield with a 70% utilization rate					
3% of body weight DM requirement = 30 lb DM/AU/day * 30.5 days = 915 lb DM/AUM					
1 AU = one 1000 lb cow with or without calf					

Acknowledgements

The project lead would like to acknowledge Garry Hnatowich, PAg, ICDC Research Scientist and Harvey Joel, ICDC Technician for their assistance with management and data collection for the 2012 project year. Their efforts are greatly appreciated.

References

Irrigation Crop Diversification Corporation. 2011. *ICDC Research and Demonstration Program Report 2011*.

Perennial Forage Biomass Measurement for Ethanol Production*

Project lead

- Sarah Sommerfeld, PAg, Regional Forage Specialist, Saskatchewan Agriculture
- Eric Stalwick, ICDC summer student

Co-investigators

- Charlotte Ward, PAg, Regional Forage Specialist, Saskatchewan Agriculture
- Dr. Bruce Coulman, PAg, University of Saskatchewan
- Brian Champion, CSIDC

Project Objective

The objective of this research project was to measure the forage biomass production of 10 perennial grass species for cellulolytic ethanol production. The potential also exists for the use of the biomass in other renewable fuel production technology such as gasification and combustion. Debate exists as to whether or not it is ethical to produce renewable fuels using a human food source. Biomass production offers an alternative to producing renewable fuels utilizing feed grains.

Research Plan

A randomized replicated small-plot trial, including 10 perennial grass species, was managed to achieve a single-cut harvest. Harvest timing occurred when the species reached physiological maturity, but prior to September 15. Total plot yield was recorded and a dry matter (DM) yield was calculated.

Demonstration Site

CSIDC provided the land and facilities to pursue this project.

Project Methods and Observations

Species Selection and Establishment

Nine cool-season perennial grass species and one warm-season perennial grass were selected for this trial. Seeding occurred on June 2, 2009, with a target plant population of 35 pure live seeds (PLS) per square foot. Plot dimensions were 1.2 m by 5.0 m with row spacing of 20 cm (eight inches). Table 1 summarizes the selected species, variety and seeding rates.

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* Project #2009-03

Table 1. Perennial grass species, variety and seeding rate.

Species	Variety	Recommended seeding rate (lb per acre)
Tall wheatgrass	Orbit	22.4
Russian wildrye (diploid)	Swift	10.2
Switchgrass	Dakota	5.6
Intermediate wheatgrass	Chief	18.2
Smooth bromegrass	Signal	11.8
Crested wheatgrass (tetraploid)	AC Goliath	9.2
Hybrid bromegrass	AC Success	17.7
Slender wheatgrass	Adanac	10.0
Meadow bromegrass	Paddock	20.1
Western wheatgrass	Walsh	14.6

Crop Management

The trial area received broadcast application of 12-51-0 on October 18, 2011 at 50 lbP_20_5/acre. On April 18, 2012, 46-0-0 and 0-0-62 were broadcast at rates of 100 lb N/acre and 15 lb K_20/acre. The total rainfall received from April 1 to September 30, 2012, was 381 mm (15 inches) and 108 mm (4.25 inches) of irrigation was applied from June 4 to August 21, 2012.

Harvest Data

A single total biomass cut was harvested on August 22, 2012. Average dry matter yields for each species are reported in Table 2.

Table 2. Average DM yield data collected on August 22, 2012.

Species	Yield (t DM/acre)
Russian Wildrye	4.19
Meadow Bromegrass	4.57
Switchgrass	5.19
Western Wheatgrass	5.46
Slender Wheatgrass	5.82
Crested Wheatgrass	6.04
Tall Wheatgrass	6.56
Intermediate Wheatgrass	7.15
Hybrid Bromegrass	7.18
Smooth Bromegrass	7.34

Discussion

The yield data collected in 2012 (Table 2) indicates that tall wheatgrass, intermediate wheatgrass and smooth bromegrass produced the largest amount of biomass. The statistical analysis of yield data from 2010 to 2012 (Table 3) shows that the yields of smooth bromegrass and intermediate wheatgrass are significantly different from the yields of six other grass species in the project. Based on these results, selecting smooth bromegrass or intermediate wheatgrass would be recommended for the purpose of biomass production under irrigation in Saskatchewan.

Table 3. 2010-2012 species yield summary

Species	Total Mean Yield (t DM/acre)
Smooth bromegrass	7.99 a
Intermediate wheatgrass	7.66 a
Hybrid bromegrass	7.05 ab
Tall wheatgrass	6.88 ab
Slender wheatgrass	5.95 bc
Crested wheatgrass	5.87 bc
Meadow bromegrass	5.34 cd
Western wheatgrass	4.52 de
Russian wildrye	4.30 de
Switchgrass	3.99 e
cv (%)	26.76
LSD	1.2943
p-value	0.0000

Acknowledgements

The project lead would like to acknowledge Garry Hnatowich, PAg, ICDC Research Scientist, and Harvey Joel, ICDC Technician, for their assistance with trial management and data collection in the 2012 program year. Their efforts are greatly appreciated.

Demonstration of Perennial Forage Crops*

Project Lead

- Sarah Sommerfeld, PAg, Regional Forage Specialist
- Eric Stalwick, ICDC summer student

Project Objective

The objective of this project was to provide a side-by-side demonstration of new and unique forage varieties in comparison to those that have been more commonly used. The intent of this project was to also demonstrate any differences in establishment, growth habit, maturity and yield of 36 different perennial forages, including both grass and legume species.

Project Background

Perennial forage crops are a vital component of the livestock industry in Saskatchewan, providing forage and feed through either grazing or hay production. Forage and livestock producers need forage species and forage varieties that will establish easily, provide adequate forage production and persist under varying management systems.

Forage specialists are asked to respond to inquiries regarding performance of specific forage species and varieties and suitability for different soil zones and growing conditions. As establishment success, yield and persistence varies with moisture conditions and soil types, it is beneficial for side-by-side comparisons of perennial forages to occur at the local level.

Project Plan

The project was designed as a small-plot demonstration with no replication or randomization to allow for inclusion of several legume and grass species (Tables 1 and 2) and to minimize cost and land requirements. The project plan included seeding plots in May 2012 following a pre-seed burnoff application of glyphosate. In-crop herbicide applications to control broadleaf or grassy weeds would be performed, if necessary, following label guidelines. Data collection in the establishment year was to include visual assessment of establishment success, evaluation of plant populations and plot mechanical harvest in early August.

Demonstration Site

CSIDC is providing the land and facilities to accommodate this multi-year project. Soil texture of the site is a fine sandy loam in the 0-12 inch profile. All plots are irrigated.

* Project #2012-01

Table 1. Grass Species

Grass Species	Variety	Company
Meadow Brome	AC Armada	Secan
Meadow Brome	AC Admiral	Secan
Meadow Brome	MBA	Pickseed
Hybrid Brome	AC Knowles	Northstar
Hybrid Brome	AC Success	Pickseed
Hybrid Brome	Bigfoot	Brett-Young
Smooth Brome	Carlton	Northstar
Smooth Brome	AC Rocket	Viterra
Creeping Red Fescue	Boreal	Brett-Young
Sheep fescue	common	Northstar
Tall fescue	Courtenay	Northstar
Crested Wheatgrass	Fairway	Brett-Young
Crested Wheatgrass	Kirk	Pickseed
Crested Wheatgrass	AC Goliath	Brett-Young
Intermediate Wheatgrass	Chief	Pickseed
Pubescent Wheatgrass	Greenleaf	Northstar
Slender Wheatgrass	common	Northstar
Tall Wheatgrass	common	Northstar
Northern Wheatgrass	common	Northstar
Western Wheatgrass	common	Northstar
Russian Wildrye	Swift	Pickseed
Altai Wildrye	common	Viterra
Dahurian wildrye	common	Northstar
Timothy	AC Pratt	Secan
Meadow Foxtail	common	Northstar
Creeping Foxtail	Garrison	Northstar
Reed Canarygrass	Venture	Northstar
Green Needle Grass	common	Northstar
Kentucky Bluegrass	Troy	Brett-Young
Orchardgrass	AC Kootenay	Secan
Orchardgrass	AC Killarney	Secan
30 total grasses		

Table 2. Legume Species

Legumes	Variety	Company
Alfalfa (Tap)	AC Grazeland Br	Northstar
Alfalfa (Tap)	AC Dalton	Secan
Alfalfa (Tap)	Stealth	Northstar
Alfalfa (Tap)	Equinox	Viterra
Alfalfa (Hybrid)	HB 2410	Brett-Young
Alfalfa (Creeping)	Spreader 4	Viterra
Alfalfa (Branched Root)	4010 BR	Brett-Young
Alfalfa (Multifoliate)	PS3006	Pickseed
Alfalfa (Saline Tolerant)	Rugged	Northstar
Alfalfa (Saline Tolerant)	Halo	Viterra
Aflalfa (Yellow-flowered)	AC Yellowhead	Secan
Cicer Milk Vetch	Oxley II	Northstar
Cicer Milk Vetch	AC Veldt	Northstar/Viterra
Birds Foot Trefoil	Leo	Brett-Young
Sainfoin	common	Northstar
Single Cut Red Clover	Altaswede	Pickseed
Double Cut Red Clover	Belle	Pickseed
Double Cut Red Clover	Wildcat	Brett-Young
Alsike Clover	common	Northstar
White Dutch clover	common	Northstar
20 Total legumes		

Project Methods and Observations

The demonstration site received an application of glyphosate and carfentrazone (CleanStart) on May 30, 2012. All plots were direct seeded into wheat stubble using an eight-row small-plot seeder with eight-inch row spacing on May 30, 2012 with 20 lb/P_20_5 as 11-52-0 side-banded at the time of seeding. Establishment of both legume and grass plots was significantly hindered by grassy weeds and volunteer wheat competition. Hand weeding of the grass plots was not a realistic solution. Quizalofop (Assure II) was applied to legume plots at 0.15 L/acre rate, on June 8. Following this herbicide application, the observation was made that the demonstration site contained group-1 resistant millet. At that time, the decision was made to abandon this site and re-seed the project at an alternate, more suitable location on the CSIDC site in 2013.

Acknowledgements

The project lead would like to acknowledge Garry Hnatowich, ICDC Research Scientist, for his agronomic guidance and support on this project. The lead would also like to acknowledge CSIDC staff members Barry Vestre, Don David and Darryl Jacobson, who assisted with the field and irrigation operations for this project.

Phosphorus, Potassium and Sulphur Fertilization of a New Alfalfa Stand*

Project Lead

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

Co-investigators

- Gary Kruger, PAg, Provincial Irrigation Agrologist, Saskatchewan Agriculture
- Garry Hnatowich, PAg, ICDC Research Scientist

Project Objective

The objective of this project was to demonstrate forage responses to phosphorus, potassium and sulphur fertilizer applications alone and in combination on a new alfalfa stand.

Project Background

Previous research work performed under irrigation by Les Henry showed that a response to phosphorus fertilization at levels up to 200 lb per acre of applied phosphate can be observed in forages on land that is severely deficient (gravity developed) in phosphorus. Results show that the applied phosphate was utilized by the alfalfa crop, as determined by higher phosphate levels in tissue samples in the treated versus untreated plots, but in greater yield. Applications of K and S did not show a plant tissue or yield response. Providing consideration for previous research results, the project lead believed that there was merit in revisiting the effects of P, K and S applications on irrigated alfalfa. The response of alfalfa to nutrients applied alone or in combination under irrigation in a banded application is not well documented in Saskatchewan. This project was designed as an opportunity to provide information to producers through extension events and publications.

Project Plan

The project is located at an off-station CSIDC site and is approximately three acres in size. The project plan included seeding an alfalfa variety suitable for a three-cut system in May 2012. A soil analysis of the project area was planned to be completed prior to seeding. No fertilizer was to be applied at the time of establishment. Weed control would include a pre-seed burnoff application of 1 L/acre glyphosate. In-crop herbicide applications would occur if required and would be applied according to product label guidelines. An establishment year harvest was to be taken in late July. No forage samples were to be submitted for forage quality analysis in the establishment year.

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* Project #2012-02

Fertilizer treatments were to be applied in the fall, beginning in 2012, as a banded application using a JD 750 drill. Each fertilizer treatment will be replicated three times. Data collection is planned to begin in 2013 following establishment in 2012. Data collection will include both yield and forage quality analysis information. One forage sample per fertilizer treatment per year would be submitted for forage quality analysis.

The fertilizer treatments to be applied are noted in Table 1 and may be amended to reflect soil test recommendations in future years.

Table 1. Fertilizer treatments

Control	0-0-0-0
P only	0-75-0-0
K only	0-0-75-0
S only	0-0-0-15
P and K	0-75-75-0
P and S	0-75-0-15
K and S	0-0-75-15
P, K and S	0-75-75-15

Demonstration Site

The project area is located at an off-station CSIDC site and is irrigated with a Valley pivot system. The soil texture of the plot area is classified as a loam at the 0-91 cm (0-36 inches) depth and clay loam at the 91-121 cm (36-48 inch) depth.

Project Methods and Observations

A pre-seeding burnoff application of glyphosate at 1 L/acre was completed on May 15. Alfalfa variety Pioneer Hi-Bred 53Q30 was direct seeded into wheat stubble on May 16 using a JD 750 drill with nine-inch row spacing. No fertilizer was applied at the time of planting.

Unfortunately, establishment of the plot area failed due to localized flooding. The project will be restarted in 2013.

Acknowledgements

The project lead would like to acknowledge Garry Hnatowich, ICDC Research Scientist, for his agronomic guidance and support on this project. The lead would also like to acknowledge CSIDC staff members Barry Vestre and Darryl Jacobson who assisted with the field and irrigation operations for this project.

Corn Variety Demonstration for Silage and Grazing*

Project Lead

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

Co-investigators

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- Harvey Joel, ICDC
- Donald David, CSIDC

Industry Co-operators

- Kent Clark, Rack Petroleum Ltd., Broderick, SK
- Neil Mcleod, Northstar Seeds Ltd., Rosetown, SK

Project Objective

The objective of this project was to evaluate corn varieties suitable for growing conditions in the Lake Diefenbaker development area for silage yield potential under dryland and irrigation management. Results of this trial will also be used to create a database of variety performance for future inclusion in *Crop Varieties for Irrigation*.

Project Background

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

Project Plan

The project was located at CSIDC and was designed as a small-plot randomized and replicated demonstration. Eight corn varieties were planted to both dryland and irrigation treatments at 30-inch row spacing. Each plot would consist of two corn rows. A target seeding rate of 32,000 seeds/acre for irrigated plots and 28,000 seeds/acre for dryland plots would be planted. Weed control would include a pre-plant burnoff application of 1 L/acre glyphosate. In-crop herbicide applications would be performed, if necessary, following label guidelines. Data collection would

* Project #2012-03

include plant population, corn heat units (CHU) accumulated, days to 10 per cent anthesis, days to 50 per cent silk and dry matter yield.

Demonstration Site

The trial was established at CSIDC, on loam textured soil. Soil analysis prior to trial establishment indicated the following nutrient levels;

- NO_3-N = 129 lb/acre to 24 inches
- P = 105 lb/acre to 12 inches
- K = 315 lb/acre to 12 inches
- SO_4-S = >193 lb/acre to 24 inches

Project Methods and Observations

The trial was seeded on May 26, 2012 into good seedbed conditions. Dryland plots received a broadcast and incorporated application of 100 lb/acre N as 46-0-0 and 50 lb/acre P_2O_5 side band application as 12-51-0. Irrigated plots received a broadcast and incorporated application of 200 lb/acre N as 46-0-0 and 50 lb/acre P_2O_5 side band application as 12-51-0. Eight corn hybrids were planted in each production system. Hybrid selection was done by seed companies, in consultation with local retail suppliers, with the criteria being that each variety selected was recommended for the Lake Diefenbaker irrigation area. (Table 1). Weed control included a pre-plant application of Eradicane and in-season tank-mix application of Accent/Oracle/Agral 90 at recommended rates and periodic hand weeding. Both irrigation and dryland plots were harvested on October 9. Cumulated Corn Heat Units (CHU) from planting to harvest was 2,460. Cumulative precipitation from planting to harvest was 10.4 inches. Irrigated plots received an additional five inches through periodic irrigation.

Table 1. Corn varieties included in dryland and irrigation treatments

Variety	Company	Corn Heat Unit (CHU) Rating of Variety	Purpose
P7443R RR	Pioneer	2100	Silage
39m26 RR	Pioneer	2100	Grazing
Silex BtRR	Pickseed	2200	Silage/grain
Baxxos RR	Hyland	2300	Grain
2501 RR	Pickseed	2300	Silage/grain
HL R219 RR	Hyland	2375	Silage/grain
HL SR22 RR	Hyland	2400	Silage
HL 3085 RR	Hyland	2400	Grain

Results and Discussion

Plant population establishment of irrigation plots was targeted at 32,000 plants/acre and 28,000 plants/acre for dryland plots. Seeding rates were adjusted assuming a germination rate of 90 per cent for planted seed. The established mean-plant population of irrigated plots (average of all eight hybrids) was slightly less than the target of 31,000 plants/acre, while dryland plots exceeded the target at just less than 29,000 plants/acre (Table 2). Three hybrids in the irrigation treatment, Baxxos RR, HL 3085 RR and Silex BtRR, failed to achieve close-to-target plant population. The ambiguity of these three hybrids in achieving intended plant populations within the irrigated plots is not known. Both irrigated and dryland plots were established in very close proximity to each other. 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. Seeding depth was uniform throughout planting of both irrigated and dryland plots. Therefore, the failure of the three hybrids to achieve desired plant populations is uncertain. Future observations are required. Established plant populations of each corn hybrid within the two production systems are illustrated in Figure 1.

Table 2. Agronomic data of irrigated vs dryland silage corn

Treatment	**Plant Population (plants/ac)**	**Dry Yield (t/ac)**	**Whole Plant Moisture (%)**	**Days to Tassel**	**Days to Silk**
Production System					
Irrigation	31,010	7.7	60.1	71	75
Dryland	28,809	6.5	58.5	72	77
LSD (0.05)	889	0.7	NS	NS	1.0
CV (%)	5.5	6.6	2.5	1.1	1.1
Hybrid					
P7443R RR	30,364	6.8	55.1	69	75
39m26 RR	30,364	6.6	52.6	63	73
SilEX BtRR	29,205	7.5	63.1	73	77
Baxxos RR	28,677	6.1	59.2	67	74
2501 RR	31,155	8.0	59.9	75	77
HL R219 RR	30,364	7.6	59.4	74	77
HL SR22 RR	30,206	7.6	64.4	78	80
HL 3085 RR	28,941	7.0	60.5	74	78
LSD (0.05)	NS	0.8	2.4	1.2	1.3
Production System vs. Hybrids					
LSD (0.05)	S	S	S	NS	NS

S = Significant; NS = Not Significant

The irrigation treatment produced greater dry matter (DM) silage yields compared to the dryland treatment (Figure 2) by an average of 2.2 t/acre or 18.5 per cent. However, for both treatments, the DM yields are less than historic small-plot silage yields previously recorded at CSIDC. Lower yield could be attributed to less than average temperatures during June and subsequent slow seedling growth. The most significant factor causing yield loss were the two hail events occurring on June 26 and August 4. Both storm events resulted in damage to the plant leaves, causing shredding along the plant leaf length. Both treatments were equally damaged, and as such, the hail damage was not a source of yield difference between the treatments.

Based on the 2012 yield data (Table 2 and Figure 2), the variety that performed the best under irrigated conditions for silage production was HL SR22. Under dryland conditions, the variety that performed the best for silage production was 2501 RR. Statistical analysis indicated a significant yield difference between irrigation and dryland yields (Figure 2). However, the irrigation yields of two hybrids, 39m26 and Baxxos RR, show little difference from the dryland yields. The hybrid 39m26 is rated as a 2,100 CHU variety, and therefore has a lower yield potential. The hybrid Baxxos RR is a variety designed for grain production and this may affect its total plant yield potential. As this is only one year of data collection, caution should be taken when considering these results. Further trials are required to determine hybrid yield potential and suitability for silage production within the Lake Diefenbaker area.

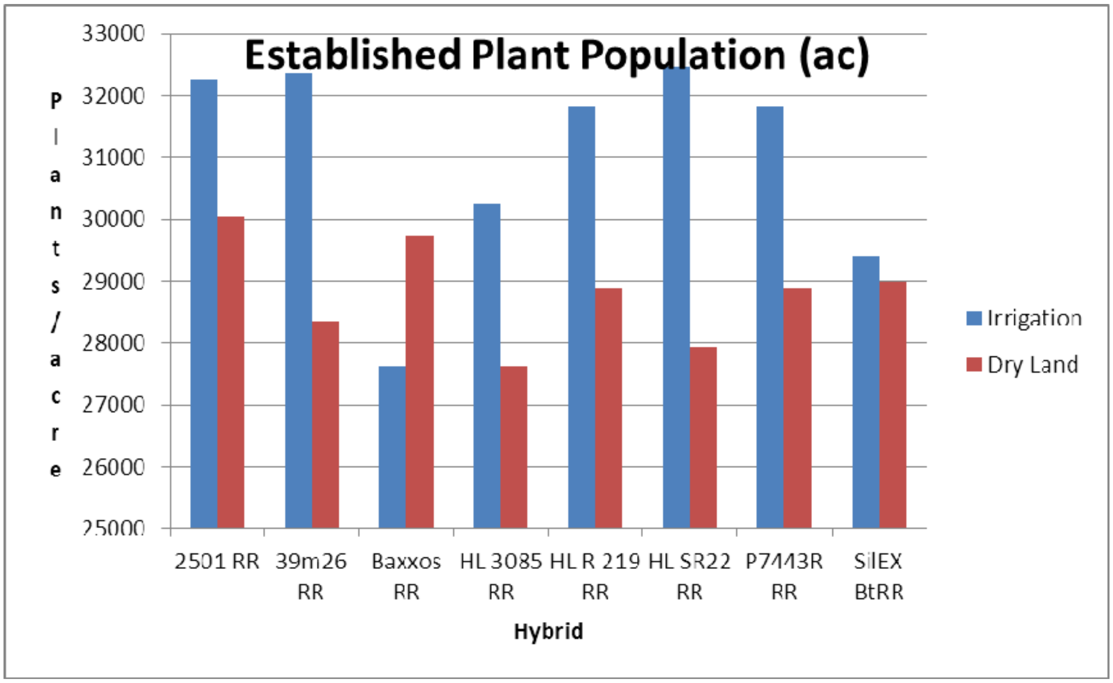

Figure 1. Established plant population by hybrid; irrigated vs dryland.

Whole plant moisture content did not differ between irrigation and dryland treatments (Figure 3). Considering the greater than historic precipitation received through the growing season, (for summary see report *"Crop Varieties for Irrigation - ICDC 2012",* Table 1), and the relative lack of difference in maturation of hybrids between treatments, these results are not unexpected.

No difference between the two treatments was observed with respect to days to corn tasselling. Differences between hybrids with days to tassel did occur. In general, early tasselling hybrids were also the lowest yielding and had the lowest in plant moisture content at harvest. Irrigation or dryland treatment did not influence time to tassel within individual hybrids

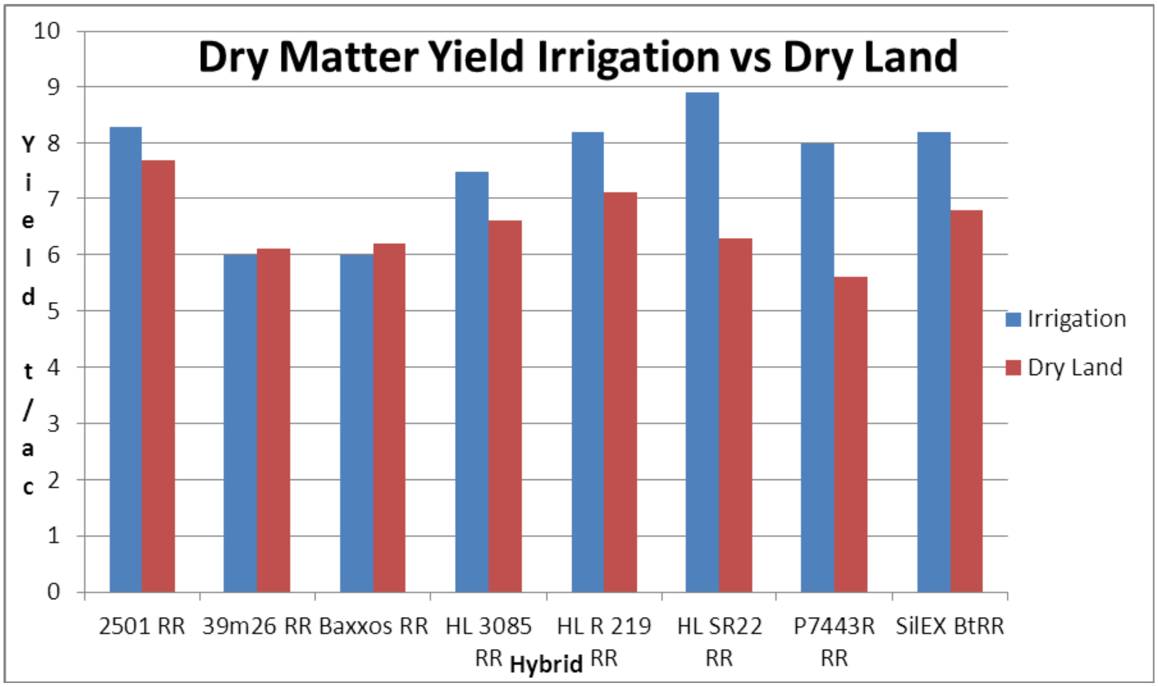

Figure 2. Dry matter yield of hybrids; irrigated vs dryland.

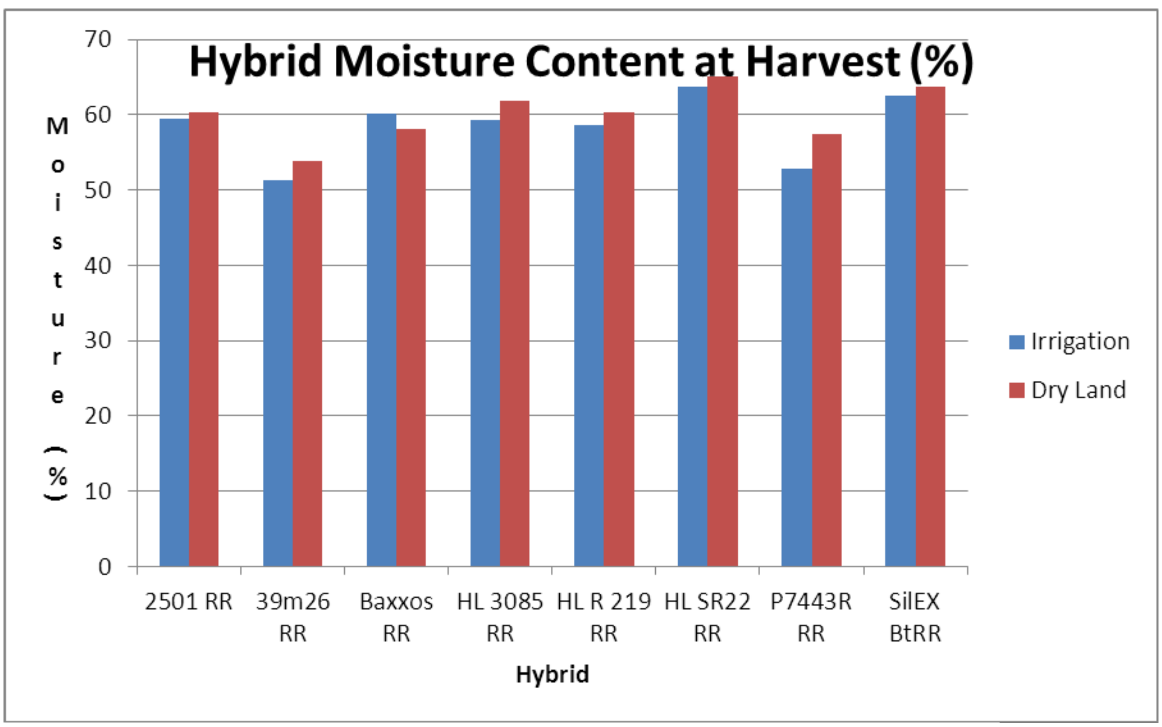

Figure 3. Whole plant moisture content

Irrigation did decrease the time between tassel and silking, shortened on average by two days. Within hybrids, mean days to silking differed. As in tasselling, hybrids Baxxos RR and 39m26 RR were earliest to silk. Despite lower temperatures recorded in June, total cumulative corn heat units of 2,460 from planting to harvest favored higher CHU maturing varieties as expressed by higher dry silage yields obtained with these hybrids.

Future Evaluation

The 2012 crop year was the initiation year for this project. It is suggested this study be repeated and an expanded the number of corn hybrids be considered. Further corn silage and grazing studies, in conjunction with grain corn hybrids in separate trials, should include time of planting, plant populations and fertilizer application rates.

Irrigated Salt Tolerant Alfalfa Variety Demonstration*

Project Lead

- Gary Kruger, PAg, Provincial Irrigation Agrologist, Saskatchewan Agriculture

Co-Investigators

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- Garth Weiterman, PAg, Senior Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Barry Vestre, Field Operations Supervisor, CSIDC

Industry Support

- Don Miller, Producer's Choice Seeds, Nampa, Idaho, USA
- Jonathan M. Reich, Cal/West Seeds, Woodland, California, USA

Project Objective

The objective of this project was to demonstrate the performance of several alfalfa lines that offer improved salt tolerance.

Project Background

Alfalfa is grown on many acres in Saskatchewan because of its ability to tolerate salinity and produce excellent quality forage where other crops struggle to survive. Preliminary testing at the Semiarid Prairie Agricultural Research Center (SPARC) by Dr. Harold Steppuhn identified three varieties with superior salt tolerance: Bridgeview, Halo, and CW064027. These varieties, along with AC Blue J as the control, were grown in the field demonstration at CSIDC.

AC Blue J is a proven alfalfa variety widely grown under irrigation. Bridgeview was developed at Agriculture and Agri-Food Canada, Lethbridge from salt-tolerant selections of Apica, AC Blue J, Barrier, Beaver, Heinrichs, Rangelander and Roamer alfalfa. This line was initially known as L4039 SC Salt until it received registration in 2011. Halo was developed by Calwest Seeds based in Woodland, California and is currently marketed by Viterra Seed. As a research line, it was known as CW34024. CW064027 is another research line from the Calwest Seeds program that has not received registration for production in Canada.

* Project 2012-14

Demonstration Plan

The salt-tolerant alfalfa demonstration consists of narrow plantings of each variety on soils with a range of salinity ratings. The design allows comparison of the performance of alfalfa varieties over a wide range of salinity readings in the field.

Demonstration Site

The site was located on Field 12 at CSIDC and was irrigated with a Valley pivot system. Prior to planting the alfalfa, the field had grown triticale green feed for two years. The north side of the field is heavier textured, lower lying and more prone to waterlogging.

In October 2010, the site was mapped by the Irrigation Environmental Unit to record changes in soil salinity over time. The survey was used to prepare a salinity contour map of the plot area. This survey was repeated again in the fall of 2012.

Project Methods and Observations

The alfalfa varieties were seeded June 29, 2010 with a six-row disk research drill with 25 cm row spacing. The four varieties were sown in long narrow strips 1.5 m wide by 600 m long across the field. The strips were sown in two blocks with the restriction that each variety be adjacent to each of the other varieties between the two blocks. The seeding rate was 9 kg seed/ha. The seeds were planted at a depth of 1.5 cm.

Yield data was collected in 2011 and 2012 using two methods. Please refer to the *2011 ICDC Research and Demonstration Report* for details from 2011. A series of eight transects were selected using the results of the salinity gradient map to identify areas representing the different salinity ratings. Forage yield was determined with quadrats harvested from each variety on each transect at early bloom stage on June 28, August 7 and September 26, 2012. The soil salinity was determined for each sampling point along the transects using an EM38

Table 1 shows that the average alfalfa yield declines with increasing salinity. The data gives an indication of the yield loss associated with a salinity rating.

Table 1: Average salinity reading and rating for the forage yields harvested from each transect

Transect	Average Vertical EM38 Reading	Salinity Interpretation	2012 Yield (t/ac)
1	162	Severe	3.642
2	150	Severe	3.884
3	133	Severe	3.981
4	112	Moderate	4.129
5	106	Moderate	3.569
6	106	Moderate	4.119
7	98	Moderate	4.209
8	99	Moderate	4.086

Table 2 summarizes the alfalfa forage yield for each variety over the three cuts using the quadrat sampling technique along a transect. Halo was the highest yielding variety in this demonstration with AC Blue J also yielding very well. The performance of CW064027 was surprising. Based on the lower shoot counts in spring, this variety was expected to yield considerably less. With the growing conditions experienced in 2012, the variety recovered and yielded well. The result indicates that assessment of winter injury using spring shoot counts is not the only factor to consider before forage stands are removed. Perhaps the 2013 season will reflect a further decline in the production of this variety. The recovery of the injured variety to support reasonable production in 2012 was an important observation from this year's demonstration.

Table 2: Quadrat yield measurements in 2012 for variety demonstration in Field 12 at CSIDC (2nd year of production)

Variety	Winter Injury Assessment[1] (Shoots/m^2)	1st cut Yield June 28 (t/ac)	2nd cutYield Aug 7 (t/ac)	3rd cut Yield Sept 18 (t/ac)	2012Yield 3 cuts (t/ac)
Halo	428	1.696	1.994	0.712	4.402
CW064027	280	1.471	1.664	0.489	3.624
Bridgeview	475	1.580	1.836	0.323	3.739
AC Bluejay	461	1.718	1.838	0.489	4.045

[1] Shoots per m^2 in early June

The forage yield for each variety was also determined with the forage harvester. Because the size of the sample area is larger, these yield assessments are likely more representative of the yield. The varieties AC Blue J and Halo broke the 4 ton/acre benchmark in 2012.

Table 3: Harvester yield measurements in 2012 for variety demonstration in Field 12 at CSIDC (2nd year of production)

Variety	Winter Injury Assessment[1] (Shoots/m^2)	1st cut Yield June 28 (t/ac)	2nd cutYield Aug 7 (t/ac)	3rd cut Yield Sept 19 (t/ac)	2012Yield 3 cuts (t/ac)
Halo	428	1.928	1.571	0.536	4.035
CW064027	280	1.600	1.235	0.517	3.352
Bridgeview	475	1.923	1.517	0.360	3.800
AC Bluejay	461	2.168	1.620	0.484	4.272

[1] Shoots per m^2 in early June

The second cut was delayed in 2012 due to inclement weather. This decision increased the yield of the second cut, but had a negative impact on the potential yield for the third cut. The quality of the second cut was likely also impacted by the delay in harvesting. The third cut yield also suffered from a change to drier weather in late August. Attention to irrigation requirements for forage crops during the entire growing season is necessary when changes in weather patterns occur.

A second determination of forage yield was made with the forage harvester from a severely saline and a moderately saline area of the field. These two yields were compared for the three forage harvests and are summarized in Table 4. The chart suggests that salinity impact on alfalfa is more significant during the early portion of the growing season. The EM38 is an excellent, relatively low-cost method of assessing salinity levels in a field and can be used to evaluate areas within a field that may have lower yield.

Table 4: Effect of salinity on forage yield during the growing season

Forage harvest	Moderate Salinity Yield (t/ac)	Severe Salinity Yield (t/ac)	Relative Yield (Moderate/Severe)
First cut	2.23	1.58	1.40
Second cut	1.65	1.32	1.25
Third cut	0.46	0.49	0.93

Final Discussion

The demonstration shows that alfalfa variety selection is a valuable tool for maximizing production from salt-affected portions of a hay stand. Further work is needed to understand the impact of salinity on alfalfa forage yields. The interaction of weather conditions with salinity may impact forage growth in more ways than is currently understood.

FORAGE CROP PROJECTS IN SOUTH WEST SASKATCHEWAN IN 2012

P and K Fertilization of Irrigated Alfalfa Demonstration at Miry Creek*

Project Lead

- Gary Kruger, PAg, Provincial Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Greg Oldhaver, Cabri, SK

Industry Co-operators

- Dr. Rigas Karamanos, PAg, Agronomy Manager, Viterra (fertilizer)

Project Objective

To evaluate the nutrient needs of newly seeded and established alfalfa for improved yield, stand longevity and competition with weeds (dandelion).

Project 2010-13

Demonstration Plan

The demonstration field was divided into six strips testing the following fertilizer treatments: phosphorus alone; potassium alone; phosphorus, potassium and zinc together; phosphorus and potassium together; and control treatments.

Demonstration Site

The demonstration was located on Plot 13 of SE19-21-18-W3 of the Miry Creek Irrigation District. The soil is clay texture. The field had been sown to annual cereals for several years to improve the soil tilth and prepare a seedbed for planting alfalfa.

Project Methods and Observations

* Project 2010-13

A 0-6” soil sample was collected from the plot area in the fall of 2010 prior to fertilization. The soil was analyzed at Midwest Laboratories, Calgary.

Table 1: Soil analysis of Plot 13, Miry Creek Irrigation District

pH (1:1 soil:water)	8.5	Soluble salts (1:1 soil:water)	0.6 mmhos/cm
Organic Matter (%)	2.2	Excess lime	M
CEC (meq/100g)	32.8		

Nitrate-N (0-6”)(ppm)	17	L				
Sulphate S (ppm)	12	L			Micro Analysis	
Available P (ppm)	12	M	Base Saturation %	Zn	1.0 ppm	L
Extractable K (ppm)	322	H	2.5	Mn	2 ppm	VL
Extractable Mg (ppm)	1061	VH	27.0	Fe	15 ppm	M
Extractable Ca (ppm)	4476	H	68.1	Cu	2.3 ppm	VH
Extractable Na (ppm)	183	H	2.4	B	1.9 ppm	VH

Fertilizer recommendations based on a target yield of 3 ton alfalfa/ac from this analysis:

40 lb P_20_5, 9 lb S, 1.8 lb Zn, 2.3 lb Mn and 20 lb elemental S/ac.

The fertilizer treatments were banded November 6, 2010. The field was divided into six strips which included phosphorus alone; potassium alone; phosphorus and potassium together; phosphorus, potassium, and zinc together; and two controls, one each on the east and west side of Plot 13. The site at Miry Creek was seeded to Stealth alfalfa on June 12, 2011 with a cover crop of Morgan oats sown at 35 lb/ac. The Stealth alfalfa was sown by splitting the seed in half and double seeding the field at 45^o to the direction the cover crop was sown. The alfalfa had excellent emergence and establishment in 2011.

Alfalfa tissue samples were collected in mid-June to evaluate the nutrient status of the alfalfa stand and the effectiveness of the banded fertility treatments. Phosphorus was applied to the field at about double the recommended rate suggested by the November 2010 soil analysis. The top 15 cm of 25 alfalfa plants were collected from each of the six fertility treatments in the field and the nutrient levels are reported in Table 2. Note that phosphorus fertilization reduces Zn uptake in the alfalfa. Zinc levels in the P alone and PK treatments were lowered to marginal levels in the alfalfa tissue. The higher level of Zn in the PKZn treatments may have contributed to the darker green color of the alfalfa noted in this treatment.

Table 2. Plant tissue analysis of alfalfa samples collected from the fertilizer treatments at the early bud stage of development.

Treatment (Fertilizer/ac)	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g
None	4.2	0.32	2.20	0.35	1.93	0.37	10	140	38	26	42
100 lb P_2O_5	4.3	0.35	2.20	0.37	2.31	0.48	9	85	34	21	42
120 lb K_2O	3.5	0.32	2.33	0.33	2.14	0.43	8	81	29	24	38
100 lb P_2O_5 + 120 lb K_2O	4.3	0.37	2.37	0.37	2.32	0.44	9	85	32	20	43
100 lb P_2O_5 + 120 lb K_2O + 4 lb Zn	4.4	0.38	2.25	0.38	2.49	0.47	8	84	34	28	42
None	5.1	0.33	2.34	0.35	2.37	0.43	9	79	32	24	43
Threshold	4.5	0.25	2.00	0.30	0.50	0.25	8	50	20	20	30

Table 3: Alfalfa yields in 2012 at Miry Creek Irrigation District, Field 13

Treatment	Rate of Nutrient (lb/ac)	Shoot Counts (shoots/m^2)	1st Cut Alfalfa Yield (ton/ac)	2nd Cut Alfalfa Yield (ton/ac)	2012 Total Alfalfa Yield (ton/ac)
Control West	None	559	2.28	1.33	3.61
Phosphorus	100 P_2O_5	535	2.54	1.14	3.68
Potassium	120 K_2O	531	2.50	1.06	3.56
Phosphorus & Potassium	100 P_2O_5 + 120 K_2O	500	2.68	1.19	3.87
Phosphorus, Potassium, & Zn	100 P_2O_5 + 120 K_2O + 4 Zn	571	2.95	1.09	4.08
Control East	None	480	2.43	-	-

Yields responded to the fertilizer applications at Miry Creek for the first cut. There was a 0.52 ton/ ac increase in hay yield when P, K and Zn were banded prior to seeding. Differences in yield were minor for the second cut. Over the growing season, the banded PKZn fertilizer treatments increased alfalfa hay yield by 0.5 ton/ac compared to no fertilizer yeilds.

One concern from the analysis is the nitrogen content of the alfalfa. The seed had been inoculated and protected from desiccation with a coating, but it needed to be stored for an extra year before sowing. The grower had re-inoculated the seed with a slurry prior to seeding with his airdrill. The nodulation of the alfalfa needs examination.

Final Discussion

Soil testing is an important component for guiding fertilization of irrigated alfalfa. General guidelines are not adequate to indicate the fertility requirements for optimum irrigated alfalfa production. Flood irrigated fields are land leveled to control the flow of water over the landscape. This disturbance introduces variability in the depth of topsoil and introduces subsoil to the surface of the soil which is similar to erosion of soils. Soil testing is an essential management practice to guide investment in fertilizer on these fields.

Cost of fertilizer is an important management consideration for application of immobile residual nutrients. The effective return for investment in these fertilizers is not limited to the year of application. They will provide increased yields for more than one year and the cost of these applications needs to be amortized over the years that the benefit is observed.

Irrigated Annual Forage Cereal Demonstration at Val Marie*

Project Lead

- Gary Kruger, PAg, Provincial Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Pat Hayes, Val Marie, SK

Industry Co-operators (Seed Suppliers)

- Trawin Seeds, Melfort, SK
- Shaun Fraser, Pambrun, SK
- Ardell Seeds, Vanscoy, SK

Project Objective

- To evaluate the forage yield and quality of annual cereals on flood irrigated fields of the Val Marie irrigation district.

Project Background

Alfalfa residues have an allopathic effect on the re-establishment of new stands of alfalfa. The decomposition of the alfalfa residues releases a chemical that inhibits the germination of new alfalfa seedlings. Growers traditionally rotate to annual cereals as a break crop between alfalfa stands to avoid these problems to establishment of new stands of alfalfa. Annual cereals maintain a feed supply for the cattle herd during the period in which alfalfa stands are being re-established. The sod of the established alfalfa crop can also make shallow seed placement with good seed-to-soil contact difficult. Growers need current information on the best choices for annual cereal cropping during the break crop seasons.

Demonstration Plan

Four types of annual cereals – barley, oats, triticale and rye - were sown on individual border dykes at Val Marie. The variety chosen for each species is listed in Table 1.

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* Project 2011-12

Table 1. Varieties included in the annual cereal demonstration.

Variety	Crop Type	Seed Supplier
CDC Cowboy	Two row feed barley	Ardell Seeds
Gazelle	Spring rye	Trawin Seeds
Pinnacle	Feed oats	Ardell Seeds
Tyndal	Spring triticale	Scott Frazer

Demonstration Site

The demonstration site was located on SW29-3-13-W3, Plot 100 of the Val Marie Irrigation District. Twelve border dykes were broken by removing a perennial bromegrass/alfalfa mixture during the fall of 2009. The grower attempted to seed annual cereals into this field in the springs of 2010 and 2011. The persistent wet conditions in spring followed by intense sunshine created crusting. Only 10% emergence of the cereals occurred in 2010. No window for seeding during spring 2011 was available. The relatively mild dry winter of 2011-12 created a suitable opportunity for cereal establishment in April of 2012.

Project Methods and Observations

The soil was fertilized in the fall of 2010 with a heavy dose of manure. Due to continual precipitation during May and June of 2011, the demonstration was not sown. The winter of 2011-12 was mild and the snow melted early. The field was seeded on April 24 using a 15 foot 6200 International drill. Each crop type was planted at a depth of 5 cm. Thousand kernel weights were determined as reported in Table 2.

Plant emergence counts were collected on May 23 and are reported in Table 2. The higher seedling count observed for Gazelle rye mirrors its smaller seed size. Some weeds were also present at the site. Stinkweed, kochia, curled dock and lamb's quarters were noted at the time of the emergence counts. No herbicide was applied to control these weeds in the stand. These weeds were visible in the bales at harvest time.

Observation of the relative competition of each crop with the weeds was made on June 22. The CDC Cowboy barley was in the flag to early boot growth stage. The barley had tillered strongly and was taller than the flowering stinkweed present in the stand. The barley covered the stinkweed and was effectively competing with it. The triticale Tyndal was a shorter crop with no tillering. It was in the flag leaf stage but competed poorly with the stinkweed. It seemed less tolerant of flooding. Gazelle, the spring rye, was in head, but had not yet begun flowering. It was taller than the stinkweed and was competing with it. The barley seemed more effective at competing with the stinkweed than the rye. Pinnacle, the oat variety, was slower jointing and did not hide the stinkweed in the field as the barley and rye did.

The bales from each border dyke were weighed on July 24. Forage quality samples were also collected. The yields of annual cereal green feed were ranked in decreasing order as follows: CDC Cowboy barley > Pinnacle oats > Gazelle rye > Tyndal triticale.

Each bale was sampled for a composite feed quality analysis for each crop type. Both the feed yield and quality is summarized in Table 2. All of the feeds have total digestible nutrients around 60. The feed analysis is important for a beef producer because it allows adjustment of feed rations to supply the required protein and energy for the cow during the various stages of gestation.

Final Discussion

This demonstration showed that with excellent soil fertility and under heavy weed pressure, CDC Cowboy barley produced more feed under flood irrigated conditions than the other crop types in the demonstration.

Table 3 provides information on the nutrient requirements of beef cattle. All of the annual cereals included in the trial met the minimum nutrient requirements provided in the chart except for the lactation stage.

Table 2: Green feed yield and quality analysis of the forage produced at Val Marie reported on a dry matter basis.

Crop Type	Barley	Oats	Rye	Triticale
Variety	CDC Cowboy	Pinnacle	Gazelle	Tyndal
Thousand kernel weight (g)	55.85	36.45	30.85	40.85
Seedling density (plants/m^2)	151	154	199	155
Green feed yield (ton/ac)	2.16	2.06	1.71	1.50
Moisture (%)	8.7	8.7	6.7	7.9
Dry Matter (%)	91.3	91.3	93.3	92.2
Crude Protein (%)	12.4	13.3	11.3	14.5
Calcium (%)	0.33	0.27	0.38	0.41
Phosphorus (%)	0.32	0.29	0.26	0.29
Magnesium (%)	0.33	0.29	0.40	0.45
Potassium (%)	2.59	3.16	2.97	3.09
Copper (mg/kg)	8.2	6.9	7.1	7.6
Molybdenum (mg/kg)	2.46	2.09	1.76	2.52
Sodium (%)	1.20	1.26	0.36	0.47
Zinc (mg/kg)	20.5	19.4	21.5	23.0
Manganese (mg/kg)	18.8	22.7	15.4	22.0
Iron (mg/kg)	0.01	0.02	0.02	0.02
Acid detergent fiber (%)	36.6	35.1	29.0	39.2
Neutral detergent fiber (%)	57.4	60.9	60.3	56.9
Non fiber carbohydrate (%)	19.4	15.0	17.6	17.9
Total digestible nutrients (%)	59.9	60.6	63.7	58.6
Metabolizable energy (Mcal/kg)	2.16	2.19	2.30	2.11
Digestible energy (Mcal/kg)	2.64	2.67	2.80	2.58
Relative feed value	98	94	102	96

Table 3: Cow Feed Requirements for a Healthy Herd

Stage of gestation	% Required Crude Protein	% Required TDN (Energy)
Mid Pregnancy	8	55
Late Pregnancy	9-10	60
Lactation	11-12	65

(Sarah Sommerfeld, personal communication)

Conclusion

Farmers in the flood irrigation projects in southwest Saskatchewan are reluctant to remove established alfalfa stands due to re-establishment difficulties. Unlike sprinkler irrigation projects, operators on gravity projects do not have the option of irrigating a crop as an establishment aid. On gravity fields, the soil is exposed to risks of erosion and crusting when the surface is not protected by an established crop.

In 2010 and 2011, this project demonstrated the difficulty farmers face re-establishing annual crops on the heavy textured soils. In 2012, precise timing of field operations showed that these soils can be productive, but they require careful attention to soil and weather conditions by the producer to successfully provide the needed feed.

Annual cereals do play a significant role in providing feed in years when alfalfa is unavailable and in producing a good seedbed for the re-establishment of forage stands. This demonstration showed that under difficult establishment conditions, such as soil crusting and excess moisture, and where weed competition is an issue, barley appeared to be superior to oats, spring rye and spring triticale.

Timing and Placement of P Fertilizer on Flood Irrigation at Consul*

Project Lead

- Gary Kruger, PAg, Provincial Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Russ Swihart, Consul, SK

Project Objective

To determine the most efficient approach of different timings and placements of P application for flood irrigated established alfalfa.

Project Background

The goal of this demonstration was to increase alfalfa yield through phosphorus fertilizer application. Different timings of P fertilization were tested. The demonstration field was divided into four fertilizer treatments: broadcast phosphorus prior to flood, broadcast phosphorus as soon as possible after flood, disk banded phosphorus prior to flood and a control with no fertilizer.

Demonstration Plan

Phosphorus was to be broadcast and banded on separate border dykes prior to flood irrigation. Phosphorus would also be broadcast as soon as possible after the flood irrigation. Yield of forage will be measured on each of the strips using bale scale and measuring wheel to determine the best approach for fertilization of established alfalfa.

Demonstration Site

The demonstration was located on NW34-4-26-W3 in the Vidora Irrigation District. The soil texture is clay. The alfalfa stand on this field is about 8 years old and has never been fertilized or sprayed.

Project Methods and Observations

A 0-6" soil sample was collected from the plot area in spring 2011 for analysis at Midwest Laboratories, Calgary.

pH (1:1 soil:water)	7.9	Soluble salts(1:1 soil:water)	1.7	M
Organic Matter (%)	1.8	Excess lime	L	

* Project 2011-14

CEC (meq/100g) 31.6

Nitrate-N (0-6”)(ppm) 5 L

Available P (ppm)	**7 L**	**Base Saturation (%)**	**Micro Analysis**	
Extractable K (ppm)	284 H	2.3	Zn 0.5 ppm	VL
Extractable Mg (ppm)	895 VH	23.6	Mn 3 ppm	VL
Extractable Ca (ppm)	4629 H	73.4	Fe 16 ppm	M
Extractable Na (ppm)	54 L	0.7	Cu 1.4 ppm	H
Sulphate S (ppm)	627 VH		B 1.7 ppm	H

Fertilizer recommendations based on a target yield of 4 t alfalfa/ac from this analysis

80 P_20_5, 3.6 lb Zn and 2.8 lb Mn

Fertilization was applied to groups of border dykes according to the following regime.

1) 50 lb P205/ac surface broadcast prior to application of irrigation water
2) 50 lb P205/ac surface broadcast as soon as possible after application of irrigation water
3) 50 lb P205/ac disk banded prior to application of irrigation water.
4) Control with no fertilizer application

Irrigation water was applied once annually in late May.

The treatment schedule was not implemented as planned. The post-irrigation P treatment was applied to only a portion of a border dyke because the fertilizer spreader became stuck in the mud. The disk banded treatment was not applied in spring because a suitable disk implement was not locally available. Because this is a three year project, the missing treatments were applied in October 2011.

With the issues that occurred during implementation of the fertilizer treatments, the usefulness of the data and extension value of the conclusions became limited. As a result, the project was discontinued.

P, K B & S Fertilization of Older Established Alfalfa Stands at Consul*

Project Lead

- Gary Kruger, PAg, Provincial Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Scott Sanderson, Consul, SK

Project Objective

The objective was to determine the impact on yield of balanced fertilizer application for flood irrigated established alfalfa.

Project Background

Soil testing on flood irrigated fields is seldom practiced. Most fields are fertilized with the traditional approach – either 50 lb of 11-52-0 or none. Some growers have observed improved crop growth with application of sulphur to their dryland cereal crops. The growers want to know if sulphur can provide an economic return for forage crops.

Demonstration Plan

Broadcast applications of potassium and sulphur to identify the potential benefit of balanced fertilization for irrigated alfalfa were applied to irrigated alfalfa. A key component of this strategy is soil testing to target input resources.

Demonstration Site

The demonstration was located on NW13-4-27-W3 in the Consul Irrigation Project. The soil texture is clay. The Beaver alfalfa stand on this field is 8 years old and has been fertilized infrequently with 50 lb P_20_5 in spring. Fertilization practices followed by producers depend on the hay supply, the price of hay, the price of fertilizer, the availability of irrigation water and soil moisture. When hay is abundant, growers tend to reduce the fertilizer applied. When moisture supplies are short or the price of fertilizer is relatively high, growers reduce their investment in fertilizer.

A 0-6" soil sample was collected from the plot area in spring 2011 for analysis at Midwest Laboratories, Calgary.

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* Project 2011-15

pH (1:1 soil:water)	8.2		Soluble salts (1:1 soil:water)	0.9	L	
Organic Matter (%)	2.9		Excess lime	L		
CEC (meq/100g)	35.6					
Nitrate-N (0-6")(ppm)	20 L					
Available P (ppm)	**10**	**L**	**Base Saturation (%)**	**DTPA Micro Analysis**		
Extractable K (ppm)	467	VH	3.4	Zn 0.7 ppm		L
Extractable Mg (ppm)	1331	VH	31.2	Mn 3 ppm		VL
Extractable Ca (ppm)	4558	M	64.0	Fe 22 ppm		H
Extractable Na (ppm)	111	L	1.4	Cu 1.9 ppm		VH
Available S (ppm)	15	M		B 2.6 ppm		VH

Fertilizer recommendations based on a target yield of 4 t alfalfa/ac from this analysis was:

50 P_2O_5, 9 lb S, 3.1 lb Zn and 2.8 lb Mn

Project Methods and Observations

The treatment schedule could not be implemented in spring 2011. Heavy and frequent rainfall in early May and June prevented field traffic. The application of fertilizer was delayed until fall for this project. The treatments were broadcast October 17, 2011 to groups of border dykes according to the following treatment schedule. Each treatment was applied to 5 ac of border dyke.

Treatments applied to evaluate balanced nutrient application to forage stands:

1) 75 lb P_2O_5/ac surface broadcast
2) 75 lb P_2O_5/ac + 75 K_2O/ac surface broadcast
3) 75 lb P_2O_5/ac + 75 K_2O/ac + 15 lb S/ac surface broadcast
4) 75 lb P_2O_5/ac + 15 S/ac surface broadcast

Ammonium sulphate also supplies nitrogen. Although alfalfa fixes its own supply of nitrogen and is not generally fertilized with this nutrient, the blends were adjusted for the nitrogen supplied by the sulphur fertilizer. All treatments received equal rates of nitrogen so the benefit of adding an additional nutrient could be observed.

Boron was initially considered as an additional fertilizer treatment for this demonstration. Soil test results from another laboratory had suggested the need for boron for alfalfa production at this site. Soil test results from Midwest Labs in spring 2011 did not indicate a need for boron. Montana field research with soils testing low in boron observed minimal alfalfa yield response from boron. This treatment was omitted from the demonstration for 2011.

Irrigation water was applied only once in early May 2011 to the established alfalfa stand. The plot area yielded 3.6 ton/ac in 2011, an exceptional yield for single cut alfalfa hay.

Table 1. Schedule of treatments applied to the Consul site in fall of 2011

Treatment	Product Applied	N	P_2O_5	K_2O	S	Yield (ton/ac)
		lb nutrient/ac				
P Broadcast	17-34-0 @ 173 lb/ac	29	75	0	0	2.37
PK Broadcast	10-25-25-0 @ 298 lb/ac	29	75	75	0	2.69
PKS Broadcast	9-23-22-4 @332 lb/ac	29	75	75	15	2.48
PS Broadcast	14-36-0-7 @ 207 lb/ac	29	75	0	15	2.76

Table 2. Plant tissue analysis of alfalfa samples collected from the fertilizer treatments at the early bud stage of development.

Treatment	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g
P Broadcast	4.0	0.33	2.70	0.34	1.85	0.49	8	99	40	31	37
PK Broadcast	4.0	0.34	2.88	0.38	1.84	0.46	9	92	35	32	46
PKS Broadcast	4.2	0.35	3.00	0.34	1.68	0.46	9	67	31	32	42
PS Broadcast	4.2	0.32	2.91	0.36	1.71	0.44	9	68	30	32	43
Threshold	4.5	0.25	2.00	0.30	0.50	0.25	8	50	20	20	30

Table 3. Plant tissue analysis of grass samples collected from the fertilizer treatments at heading stage of development.

Treatment (Fertilizer/ac)	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g
P Broadcast	3.1	0.31	2.40	0.26	0.69	0.22	11	61	27	28	15
PK Broadcast	1.7	0.23	1.83	0.16	0.21	0.10	13	54	24	21	4
PKS Broadcast	2.3	0.29	1.89	0.21	0.34	0.11	14	58	30	28	4
PS Broadcast	2.3	0.33	2.10	0.27	0.33	0.12	16	60	31	29	5
Threshold	2.0	0.25	1.5	0.15	0.2	0.15	5	20	15	15	5

Final Discussion

Balanced fertilization of irrigated alfalfa has potential to stabilize yields of hay and improve the quality of the forage produced on the irrigated hay fields. The hay yield and plant tissue analysis for this demonstration indicated that sulphur deficiency was not a limiting factor on flood irrigated alfalfa production. The ability of alfalfa roots to source sulphate in the soil during the growing season is adequate under flood irrigated conditions. Between the sulphur provided by irrigation water and the sulphur stored in the soil, flood irrigated projects in Southwestern Saskatchewan are unlikely to respond to sulphur fertilizer applications. Alfalfa fields on dryland, however, are likely candidates for sulphur deficiency, especially in years of frequent rainfall.

Irrigated Barley Forage Fertility Demonstration at Eastend*

Project Lead

- Gary Kruger, PAg, Provincial Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Larry Verpy, Eastend, SK

Project Objective

To compare traditional fertilization practices of annual cereal forage production with fertilization based on soil testing and evaluate its impact on forage production and profitability

Demonstration Plan

CDC Cowboy barley would be grown using conventional fertility practices and guided by soil testing. The soils from both treatments were sampled in January and submitted to Midwest Labs in Omaha, Nebraska. The conventional half of the field will be fertilized with 100 lb 28-28-0 per traditional practice. The other half would be fertilized with a balanced blend according to the soil analysis. Yield will be assessed with a bale scale and measuring wheel. This approach has continued for two years.

Demonstration Site

The demonstration was located on SE31-6-21-W3 on the Eastend Irrigation Project. The soil texture is sandy loam. The field was taken out of alfalfa production in fall of 2009 and is currently under a rotation of annual crops (oats 2010, barley 2011, barley 2012) to control perennial weeds, predominantly dandelion. The predominant cultural tools practiced to bring the dandelions under control are tillage between forage crops and delayed seeding. Soil tests sampled in early January are reported in Table 1.

* Project 2012-12

Table 1: Soil analysis of irrigation plot that was split into two management zones

	Traditional	Balanced	Soluble Salts			Traditional	Balanced
pH(1:1 soil:water)	7.8	8.0	(1:1 soil:water) mS/cm			0.7	0.5
Organic Matter (%)	2.8	2.6	Excess Lime			L	L
CEC(meq/100g)	19.6	16.4	Trad	Bal			
NO_3-N (0-6”) (ppm)	56H	43H	Base			Traditional	Balanced
Available P (ppm)	22H	19H	Saturation (%)		Micro Analysis (ppm)		
Extractable K (ppm)	210H	183H	2.7	2.9	Zn	1.6 M	1.2 M
Extractable Mg (ppm)	657VH	550VH	27.9	27.9	Mn	2 VL	1 VL
Extractable Ca (ppm)	2686H	2232H	68.5	68.2	Fe	34 VH	19 H
Extractable Na (ppm)	41L	37L	0.9	1.0	Cu	0.9 M	0.8 L
Available S (ppm)	28VH	20H			B	0.8 M	0.8 M

Fertilizer recommendations for greenfeed associated with 100 bu/ac grain yield of barley were: 55 lb N/ac, 10 lb P2O5/ac, 40 lb K2O/ac, 3 lb S/ac, 1.8 lb Zn/ac, 3 lb Mn/ac and 1.2 lb Cu/ac.

The site was gravity irrigated twice in 2012, once prior to seeding in early May and a second time in early July.

Demonstration Plan

The field at Eastend was split into two sections with one fertilized according to tradition with 100 lb 34-17-0 applied. The second section was fertilized according to recommendations from Midwest Labs, which called for 20-6-24-3 @ 167 lb/ac. A 50 lb bag of Zn fertilizer and a 50 lb bag of Mn fertilizer were also added to the blend.to supply these micronutrients to the field.

Demonstration Site

The demonstration was located on SE31-6-21-W3 in the Eastend Irrigation Project. The soil texture is sandy loam. The field was taken out of alfalfa production in the fall of 2009 and is currently under a rotation of annual crops (oats 2010, barley 2011) to control perennial weeds, predominantly dandelion. Tillage between forage crops and delayed seeding are the predominant cultural tools practiced to bring the dandelions under control.

Project Methods and Observations

The blends were prepared at the Crop Production Services in Outlook and banded to the field through the grain boxes of a double disk IH drill on May 20, 2012. Once the fertilizer had been banded, field was sown to CDC Cowboy barley at the rate of 72 lb/ac. The barley emerged evenly and quickly. Visual differences in growth between the two treatments were small. An estimate of plant density was measured on June 8 when the stand was in the 3-leaf stage as reported in Table 2. The forage from each area was baled and all bales were weighed with a truck mounted Elias bale scale to determine the production from each area. Because the field size was small and its shape was irregular, the area of the treatments was measured with a Garmin GPSmap76S hand-held device. Table 1 summarizes the fertilizer applications and forage yield from the field.

Forage samples were collected from each bale. The samples from each treatment were composited and analyzed for forage quality at a forage testing laboratory.

Table 1: Comparison of forage yield with alternate management strategy at Eastend

	Traditional Fertility	**Balanced Fertililty**
Fertility Program	34-17-0 @ 99 lb/ac	20-6-24-3 @ 167 lb/ac
Nutrients Applied	34 N-17 P_20_5 -0 K_20 -0 S (lb/ac)	34 N -10 P_20_5 -40 K_20 - 5 S lb/ac plus 8 lb Zn/ac and 5 lb Mn/ac
Total Forage Yield	5.64 ton forage (10 bales)	4.80 ton forage (8 bales)
Treatment Area	3.28 acres (south)	2.12 acres (north)
Forage Yield /Ac	3439 lb/ac (1.72 ton/ac)	5321 lb/ac (2.26 ton/ac)
Program Cost/ac	$39.16	$71.42
Fertilizer cost/ton feed	$6.94	$14.88

Table 2: Green feed yield and quality analysis of the forage produced at Eastend reported on a dry matter basis.

Crop Type	**Barley**	**Barley**
Variety	CDC Cowboy	CDC Cowboy
	Traditional	Improved
Seedling density (plants/m^2)	74	78
Green feed yield (ton/ac)	1.72	2.26
Moisture (%)AR	10.04	10.10
Dry Matter (%)AR	89.96	89.9
Crude Protein (%)	8.95	9.3
Calcium (%)	0.36	0.35
Phosphorus (%)	0.24	0.26
Magnesium (%)	0.26	0.27
Potassium (%)	2.00	2.03
Copper (mg/kg)	6.58	6.26
Molybdenum (mg/kg)	1.89	2.19
Sodium (%)	0.07	0.07
Zinc (mg/kg)	29.03	28.01
Manganese (mg/kg)	17.07	16.84
Iron (mg/kg)	60.87	62.46
Acid detergent fiber (%)	34.57	31.00
Neutral detergent fiber (%)	55.57	54.36
Non fiber carbohydrate (%)	24.68	25.55
Total digestible nutrients (%)	60.90	62.68
Metabolizable energy (Mcal/kg)	2.20	2.26
Digestible energy (Mcal/kg)	2.68	2.76
Relative feed value	104	111

Final Discussion

The yield from the balanced fertility plot was significantly higher than the site with traditional fertilization. The increase in yield of 0.5 ton/ac using a balanced blend was not sufficient to pay for the cost of the applied fertilizer alone. The cost of the bag of ZnS04 (about $65) and the bag of Ultra Yield Broadman 20% Mn (about $75) was not included in the economic calculations because these applications will provide benefit over several years. The feed analyses did not reflect the addition of zinc and manganese fertilizer to the blend, possibly due to dilution of plant growth.

The feed value of the more heavily fertilized sample was higher but was unlikely to pay for the extra fertilizer input cost. If fertilizer input was continued for several years, the soil might improve in nutrient supplying power and the difference in cost per ton between the two approaches might become less as the soil is improved.

Forage Establishment Demonstration in the South West Region[*]

Project Lead

- Gary Kruger, PAg, Provincial Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Lynn Grant, Val Marie, SK
- Darren Steinley, Rush Lake, SK
- Bob Stuart, Cabri, SK

Project Objective

The objective of this project was to demonstrate an alternate approach for re-establishing forages on flood irrigated soils.

Project Background

Hardpans associated with waterlogging potentially limit yields on flood irrigated projects. The Salford CTS implement is designed to fracture tillage hardpans below the depth of tillage to improve water infiltration and increase forage yields.

Project Plan

A forage stand was to be terminated with glyphosate in fall 2011. Annual crop will be sown directly into the sod spring 2012 using a single disk opener drill. Following two years of annual forage production, the field will be sown to alfalfa using a low disturbance drill. Trash will be conserved on the soil surface using low disturbance tillage tools. Three co-operators will be identified.

Test areas at Val Marie, Rush Lake, and Miry Creek Irrigation Districts were worked with a Salford Conservation Tillage System (CTS) implement. The fields were sown to CDC Cowboy barley at Val Marie, AC Saltlander at Rush Lake, and a triticale variety at Cabri. Measurements of forage yield were collected from the unworked control as well as the tilled area at Val Marie and Miry Creek to indicate potential yield benefits from the deep tillage.

Demonstration Site

The demonstrations were located on Plot 220 at Val Marie, Plot 46 at Rush Lake and Plot 7 at Miry Creek Irrigation District near Cabri. The Val Marie site was heavy clay texture on barley stubble. The

[*] Project 2011-18

Rush Lake site was heavy clay texture on two year old alfalfa hay that had been replaced with a wild barley infestation. The Miry Creek site had been sprayed with glyphosate 8 days prior to tillage with the CTS implement. All three sites were very wet.

Fields selected for this demonstration included Plot 219 in the Val Marie Irrigation Project, Plot 144 in the Rush Lake Irrigation District and Plot 7 in the Miry Creek Irrigation District. All three sites were clay to heavy clay in texture.

Table 1: Soil moisture status of tilled and no-till soils in the Salford CTS demonstation

Treatment	Depth (cm)	Val Marie Available Water (mm)	Miry Creek Available Water (mm)
CTS Tilled	0-30	53	47
	30-60	43	63
	60-90	26	71
	Total	122	181
No Till	0-30	53	44
	30-60	50	50
	60-90	50	53
	Total	153	147
		(+31)	(-34)

Soil moisture status prior to seeding was measured at Val Marie (May 15) and Miry Creek (June 2). The relative moisture status between the treatments at the two sites indicated opposing trends. At Val Marie, the undisturbed border dyke contained about 30 mm more available water compared to the border dykes tilled with the Salford CTS. This was verified by penetrometer readings. The penetrometer measured over 90 cm of moist soil on the undisturbed border dyke, but only 40-45 cm of moist soil on the worked border dykes. Soils were very dry in fall. Lack of soil disturbance at Val Marie maintained the deep soil cracks which allowed for rapid infiltration of over winter and spring meltwater on the control border dyke. In the tilled area (treatment area), the cracks were closed by the tillage and water infiltration was reduced.

At Miry Creek, the undisturbed control strip contained about 34 mm less available water than the tilled portions of the field. Miry Creek Irrigation District applies about 75 mm of irrigation water in mid-September just prior to freeze-up. This was completed prior to the tillage. This practice effectively closes any deep cracks that may have existed in the soil profile in fall. The tillage was conducted October 20. The winter of 2011-12 was mild with less-than-normal snowfall. The loss of vertical cracks in the heavy clay soil because of the deep tillage may have limited potential for water infiltration during snowmelt, while the thin and patchy snow cover over winter and the rough open field condition permitted more evaporation of water from the surface soil layers.

Project Methods and Observations

The field at Val Marie was seeded to barley for green feed prior to tillage and was sown to barley for green feed again in 2012. The site consisted of seven border dykes. Six of these dykes were tilled with the CTS unit. A curious observation in spring 2012 was the seemingly improved soil moisture on the unworked portion of the field. Following seeding, Val Marie led the province in precipitation for the month of May. Any impact on soil moisture reserves from the fall tillage on these heavy-textured soils was masked by the frequent May and June rainfall. The green feed yields at Val Marie in 2012 are summarized in Table 2. They were determined by weighing the production from each of the border dykes.

Table 2: Yield observations from field treated with Salford CTS vertical tillage tool at Val Marie

Treatment	Depth of moist soil in spring (cm)	Green Feed Yield (ton/ac)
Worked 25 cm deep	35	2.77
Worked 18 cm deep	40	2.50
Unworked	90	2.47

The worked field at Rush Lake was alfalfa that had been overtaken by foxtail barley. The tilled area was sprayed with glyphosate in spring and seeded to AC Saltlander in May, 2012. Very few plants of the forage established in 2012. No yield assessment was possible for this site because of the poor forage establishment.

The field at Miry Creek was sprayed with glyphosate in fall 2011. The field was worked with the Salford CTS tillage tool to a depth of 7 inches. The site was in extremely rough condition in spring, but was sown to triticale in 2012. A check strip was left across the field. The field was cut with a haybine before square meter samples could be collected. The yield was determined by collecting eight paired one-meter samples from the swath within the check strip and beside the check strip on the worked portion across the 40 ac field. Half of the paired samples were collected from the worked portion to the east of the undisturbed strip and half were collected to the west of the undisturbed strip.

Treatment	Greenfeed Yield (ton/ac)	Spring Soil Stored Water (mm)
Tillage with Salford CTS	2.46	181
Undisturbed in fall	2.56	147

Final Discussion

This demonstration provided preliminary information for the potential benefits of deep tillage on flood irrigated soils. The fall of 2011 was very dry. The winter was mild and dry with less intense freeze-thaw cycles. The spring of 2012 was unusually wet in May. The site at Miry Creek was irrigated with 3 inches of water prior to tillage with the CTS tool. The demonstration provided a learning experience for evaluating the suitability of a soil for this technique. Fracturing of hardpans with tillage is more effective during dry falls when the force of the tillage travels a greater distance downward into the soil. When soils are dry, they are less malleable. The tillage is likely to provide greater benefit.

In selecting a site for this type of demonstration, several criteria are required. A hard soil layer within the top foot of the soil needs to be identified in the soil. A penetrometer is helpful for this assessment. The fracturing technique is more effective when the tillage is applied to dry soil. The fall irrigation applied at Miry Creek made this site undesirable for the demonstration. The deep cracks at Val Marie may have provided greater benefit than the tillage, but the wet spring masked the differences in water infiltration that natural deep cracking of heavy clay soil permitted. The demonstration should be conducted again implementing these guidelines.

Fall Phosphate and Potassium Fertilization of Irrigated Alfalfa at Chesterfield*

Project Lead

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Co-operator

- William Coventry, Mantario, SK

Project Objective

The objective of this project was to improve the yield and quality of the forage stand through banded placement of diffusion-supplied nutrients and balanced fertility. This would enhance the vigor of the alfalfa plants and enable alfalfa to compete more effectively with weeds.

Project Background

Growers are seeking ways to improve forage productivity, to increase stand duration and vigour and enable forages to compete more effectively with weeds.

Demonstration Plan

This demonstration will increase alfalfa yield through balanced fertilizer application. The demonstration field was divided into six fertilizer treatments: control, broadcast phosphorus, broadcast phosphorus and potassium, banded phosphorus, banded potassium, and banded phosphorus and potassium together. A 5 ton/ac alfalfa crop removes 70 lb P_2O_5 and 300 lb K_2O. The nutrient rates applied to the demonstration were considered more than adequate.

Demonstration Site

The demonstration was located on Plot 11A in EH8-23-27-W3 of the Chesterfield Irrigation District. The soil is sandy loam texture.

Project Methods and Observations

The original plan was to band the fertilizer in fall using a disk banding implement to minimize the disturbance to the established alfalfa and move the field operation to a less busy time of year. Unfortunately, no disk banding equipment was identified during fall of 2010 to apply the phosphorus and potassium. In spring 2011, flooding at the original site selected forced transfer of

* Project 2010-20 2012

the demonstration to the Chesterfield Irrigation District. A 0-6" soil sample was collected from plot 11A at the Chesterfield Irrigation District in spring 2011 for analysis at Midwest Laboratories.

No sulphur or boron was applied because the irrigation water was assumed to supply more than adequate quantities. Zinc and manganese application was also ignored for this demonstration.

The treatments applied to the site, as listed in Table 1, were applied on May 2, 2011. Broadcast treatments were applied with a Willmar ground driven dual spin spreader and banded treatments were applied with a John Deere LL24 6A 12 ft double disk press drill. The disks penetrated 1.5 cm into the loamy soil.

Table 1. Schedule of treatments and fertilizer applications made to Plot 11A in the Chesterfield Irrigation Project near Leader

Treatment	Application Method	N	P_20_5	K_20	1st Cut Hay Yield (t/ac)	2nd Cut Hay Yield (t/ac)
Check	None	0	0	0	2.49	2.91
6-28-28 @ 270 lb/ac	Broadcast	16	75	75	3.08	2.75
6-28-28 @ 270 lb/ac	Band	16	75	75	3.33	3.03
11-52-0 @ 144 lb/ac	Broadcast	16	75	0	3.48	2.58
11-52-0 @ 144 lb/ac	Band	16	75	0	3.29	2.71
10-0-47 @ 160 lb/ac	Band	16	0	75	3.40	2.10

Table 2: Soil analysis of Plot 11A, Chesterfield Irrigation District

pH (1:1 soil:water)	8.1		Soluble salts (1:1 soil:water)	0.3 mmhos/cm		
Organic Matter (%)	3.3		Excess lime	L		
CEC (meq/100g)	19.0					
Nitrate-N (0-6")(ppm)	6	L				
Sulphate S (ppm)	10	L		Micro Analysis		
Bicarbonate P (ppm)	8	L	Base Saturation %	Zn	1.7 ppm	M
1 N NH4OAc K (ppm)	92	L	1.2	Mn	3 ppm	VL
1 N NH4OAc Mg (ppm)	478	VH	21.0	Fe	36 ppm	VH
1 N NH4OAc Ca (ppm)	2940	H	77.2	Cu	1.1 ppm	M
1 N NH4OAc Na (ppm)	26	L	0.6	B	0.6 ppm	L

Fertilizer recommendations based on a target yield of 4 t alfalfa/ac from this analysis:

75 P_20_5, 180 K_20, 14 S, 0.7 lb Zn, 2.8 lb Mn and 1.2 lb B

Irrigation

The pump site for the Chesterfield Irrigation District is located west of Leader just downstream of the confluence of the South Saskatchewan and the Red Deer Rivers. In 2011, the first irrigation was completed in late May. No second irrigation was applied to the plot in 2011. The plots in the Chesterfield Irrigation District were irrigated in late June 2012.

Plant tissue samples were collected from the swath in summer 2011 to aid in interpreting the yield measurements. These results are reported in Table 2 below. The sulphur concentration was below adequacy for both grass and alfalfa. This observation was unexpected because the field was flood irrigated with water that supplies 4-5 lb S/ac-in of applied irrigation water. This quantity of sulphur should have been adequate for production of alfalfa. Full yield response from the phosphorus and potassium may have been reduced in 2011 because of the impact of the suspected inadequate soil sulphur on plant growth.

This raises the issue of S fertility for irrigated crops under conditions where exceptional rainfall substitutes for normal irrigation. For crops that have high S requirements, the S supplied by irrigation needs to be replaced when soil test levels indicate a requirement for S.

Table 3. Plant tissue analysis of hay in swath in 2011

Treatment	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g
Check	2.73	0.15	2.00	0.13	0.53	0.14	8.3	144	17	22	13
75 K_20 Band	3.00	0.14	2.09	0.14	0.48	0.11	7.0	68	18	24	12
75 P_20_5 Band	2.30	0.18	1.63	0.09	0.38	0.11	6.7	112	31	16	11
75 P_20_5 + 75 K_20 Band	2.25	0.19	2.10	0.10	0.40	0.13	6.6	72	23	15	9

Table 4: Sufficiency levels of nutrients in alfalfa and grass plant tissue (Sask. Soil Testing Laboratory, 1992)

Crop	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g
Alfalfa	2.5	0.25	2.0	0.25	0.5	0.3	8	30	25	20	30
Grass	2.0	0.25	1.5	0.15	0.2	0.15	5	20	15	15	5

Ammonium sulphate at 100 lb/ac was broadcast in February 2012 to the bare ground as no snow was present because of the mild winter. In addition to this treatment, the producer broadcast 120 lb/ac of a custom blend, 8-33-13-6, in April. Forage yields were determined on July 20, 1012 after a number of rain delays.

Table 5: Plant tissue analysis of alfalfa sampled at pre-bloom stage (mid-June) at Plot 11A at Chesterfield Irrigation District.

Treatment	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g
0-0-0	4.36	0.34	2.30	0.33	2.12	0.35	8.3	89	24	37	31
16-75-0 Broadcast	4.04	0.32	1.80	0.30	2.17	0.30	6.6	91	19	27	25
16-75-0 Band	4.16	0.32	1.84	0.29	1.62	0.29	7.0	81	19	29	18
16-75-75 Broadcast	4.40	0.32	1.95	0.31	2.09	0.29	7.0	87	21	27	28

16-75-75 Band	3.56	0.28	1.88	0.23	1.13	0.21	12.8	90	32	30	16
16-0-75 Band	4.34	0.34	2.46	0.33	2.02	0.31	7.4	84	22	34	32
Nutrient AdequateAlfalfa	2.5	0.25	2.0	0.25	0.5	0.3	8	30	25	20	30

Table 6: Plant tissue analysis of smooth bromegrass sampled at stem elongation stage (mid-June) at Plot 11A at Chesterfield Irrigation District.

Treatment	N (%)	P (%)	K (%)	S (%)	Ca (%)	Mg (%)	Cu ug/g	Fe ug/g	Mn ug/g	Zn ug/g	B ug/g
0-0-0	1.68	0.22	1.74	0.16	0.27	0.12	9.7	97	27	23	7
16-75-0 Broadcast	2.14	0.26	1.80	0.18	0.32	0.13	13.0	81	29	27	8
16-75-0 Band	2.40	0.29	1.68	0.17	0.24	0.12	12.6	89	30	25	7
16-75-75 Broadcast	2.98	0.29	2.11	0.34	1.39	0.42	9.4	1930	112	37	27
16-75-75 Band	2.30	0.26	1.53	0.20	0.33	0.14	20.7	108	43	37	9
16-0-75 Band	2.13	0.26	2.36	0.17	0.35	0.13	9.9	66	23	23	7
Grass	2.0	0.25	1.5	0.15	0.2	0.15	5	20	15	15	5

Final Discussion

The yield of first cut hay in 2011 did not vary consistently with either phosphorus or potassium fertilization (Table 1). Hay yields increased between 0.5-0.9 ton/acre through fertilization, but which nutrient provided the largest increase was not evident. Phosphorus and potassium applications, both individually and in combination, increased hay yields similarly. The yield response of all fertilizer treatments averaged together was 33% (3.32 ton/ac vs 2.49 ton/ac for the control). The average of the two broadcast treatments was very similar to the average of the two equal banded treatments (3.28 ton/ac for broadcast vs 3.31 ton/ ac for banding). The 2011 forage harvest showed no advantage for banding fertilizer as compared to broadcasting fertilizer.

The yield of first cut hay in 2012 did not respond consistently to the residual phosphorus and potassium fertilization (Table 3). The phosphorus treatment alone yielded an average of 2.89 ton/ac, the potassium treatment alone yielded substantially less at 2.10 ton/ac. and the combined P and K treatments yielded an average of 2.65 ton/ac. The average yield for banded P and banded P + K treatments was 0.2 ton/ac higher than the average yield of the broadcast P and broadcast P + K treatments. This result indicated a slight advantage for banding nutrients that move by diffusion to plant roots. The highest yield in 2012 was observed for the banded phosphate alone treatment. The second best hay yield in 2012 was observed for the check. The other four treatments produced less hay than the check.

Application of sulphur to the stand in February 2012 did not increase yields of hay as anticipated, but the concentration of sulphur for the alfalfa and bromegrass did increase to greater than marginal levels during 2012. With the improvement in sulphur fertility, phosphorus concentrations in the alfalfa also increased above the marginal levels. The exception to this comment is the control treatment, which received no supplemental phosphorus or potassium.

An observation at the site in 2012 was the visual reduction in prominence of alfalfa within the aging stand. A typical assessment would be that root decline and depleted fertility were contributing to the natural decline of the alfalfa. As the alfalfa declined, the bromegrass occupied this vacancy in the stand. Gravity irrigated fields typically have areas where water tends to pond. Alfalfa is adversely affected by temporary ponding and results in grasses replacing the alfalfa in the stand.

Plant tissue sampling for alfalfa and bromegrass from each of the treatments provided another possible explanation for the decline of the alfalfa. The data suggests that manganese was inadequate for alfalfa production for a large proportion of the site. Levels of manganese in the grass show that it was less affected than the alfalfa because alfalfa is more sensitive to manganese deficiency than smooth bromegrass. The author believes that the frequent rainfall in spring on the light textured soils at Chesterfield raised the soil pH of the surface. This induced a temporary deficiency of manganese for alfalfa growth. The alfalfa within the stand appeared stunted and dwarfed. It showed symptoms of interveinal chlorosis, which is consistent with manganese deficiency as indicated by the plant tissue analysis. This stress could have reduced the vigour of the alfalfa and contributed to its decline in prominence within the field. Application of manganese foliar fertilizer at the onset of these symptoms would likely have reduced the decline in alfalfa prevalence. When the decision to apply Mn foliar fertilizer was made, it was too late to save many of the weakened alfalfa plants. When the manganese foliar fertilizer was applied, the frequent rains had stopped and the prolonged dry period had restored solute to the upper soil profile, which lowered the soil pH.

It is believed that the hay yields obtained in 2012 reflected a residual response to the fertilizer nutrients applied in spring 2011. Once sulphur was removed as a limiting nutrient, the expected result was a strong response to either phosphate or potassium, or possibly both. The soil test had indicated that both of these nutrients needed to be applied for alfalfa production. This expectation did not occur. Perhaps another nutrient has become limiting at this site.

Phosphorus and potassium are strongly attracted to soil particles; however, potassium may be prone to leaching losses in sandy soils such as those in the Chesterfield Irrigation District, especially under flood irrigation. Application of both nutrients in a band minimizes the potential for leaching losses. The practice will also maximize root uptake by increasing the actual concentration of each nutrient in the soil, which enhances the rate of diffusion to plant roots.

Yields for the first cut in 2012 averaged 84% of the first cut yields observed in 2011. However, the reduction in overall yield reflected issues associated with rain delays in 2012.

Liebig's Law of the Minimum suggests that as each limiting nutrient is corrected, the next most limiting nutrient will restrict yield. For 2012, on this field, the correction of phosphorus, potassium and sulphur was suspected of inducing deficiency of manganese at this site.

Conclusion

Phosphorus and potassium fertilizer application to irrigated alfalfa increased the hay yield by 0.5 – 0.9 ton/ac in 2011. Phosphorus and potassium applications were equally beneficial for hay yield when banded or broadcast. There was no indication that either nutrient was more effective at increasing the hay production at this site. For those treatments where phosphate was applied, sulphur concentrations in the forage dropped below the critical level for both alfalfa and grass. Even at relatively high rates of phosphate application, the phosphate concentration in the forage did not increase above marginal concentrations in 2011.

The yield of first cut hay in 2012 did not demonstrate a consistent response to either phosphorus or potassium fertilization. There was a slight indication that banding was more effective than broadcasting for phosphorus and potassium in 2012. The average yield for banded P and banded P + K was 0.2 ton/ac higher than the average yield of the broadcast P and broadcast P + K treatments.

Figure 1: Yellowing, dwarfing, and stunting symptoms observed on alfalfa plants at Chesterfield Irrigation District during June of 2012. The symptoms were suspected as deficiency of manganese on the basis of the visual symptoms and plant tissue analysis. These symptoms became less prominent as the growing season continued and had disappeared toward fall.

IRRIGATION SCHEDULING PROJECTS 2012

Irrigation Water Management Practices 2012*

Project Lead

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Project Objective

The objective was to familiarize producers with the Alberta Irrigation Management Model (AIMM) and to eliminate the difference between the current on-farm irrigation water management practices and the optimal irrigation levels predicted through AIMM.

Project Plan

This project builds on similar projects from 2010 and 2011. This project was conducted on producer fields in the Riverhurst (RID), Luck Lake (LLID) and South Saskatchewan River Irrigation districts (SSRID). Three fields were selected in the RID and LLID in 2010. The same fields were used in 2011 and 2012. Three fields from the SSRID were added in 2012 as well. A weather station was installed in each district to collect appropriate weather data required for AIMM. Weather data was downloaded weekly into the model. Graphical printouts of soil moisture as developed by AIMM were delivered to co-operating producers.

Fields were monitored weekly. Each field was equipped with dryland and irrigation rain gauges and two Watermark™ sensors at the depths of 30 cm (12 in) and 60 cm (24 in). Soil moisture content was determined following seeding by taking soil samples for gravimetric analysis. Actual crop water use was calculated using the Water Balance formula (Figure 1). The actual irrigation management

* Project 2012-07

and crop water use data was compared to a modeled optimum irrigation management scenario for the fields as determined through AIMM.

$ET = (P + I) - R - D \pm \Delta S$

Where ET = actual crop water use or evapotranspiration

P	=	precipitation
I	=	effective irrigation
R	=	runoff
D	=	deep percolation
ΔS	=	change in soil moisture

Figure 1. Water balance formula

Demonstration sites

Crops monitored in the LLID were canola and hard spring wheat. Soil textures of these fields range from clay loam to silty clay. Seeding occurred on May 15 for canola and May 19 for hard spring wheat. The third field was eliminated from the demonstration due to early spring flooding.

In the RID, canola (two sites) and hard red spring wheat were planted on the selected field sites. The soil texture of these sites ranged from sandy clay loam to sandy clay. Seeding of these crops occurred on May 8 and 15 for the canola and May 16 for the wheat.

In the SSRID, two fields of hard red spring wheat and one field of potatoes were selected for monitoring. The soil texture of these sites ranged from loam to sandy clay loam. Seeding of the wheat occurred on May 15 and 17 and the potatoes were planted on May 17.

Project Methods and Observations

Actual Crop Water Use and Irrigation Management

Spring soil moisture levels were determined by gravimetric analysis for all field sites. Samples were collected as close to seeding as possible. Fields were monitored on a weekly basis following seeding to check soil moisture levels, irrigation application amounts, rainfall and crop development

Field, crop information and crop moisture use for each field was tracked. The actual crop water use for each field was calculated using the water balance method stated in Figure 1.

Actual crop water use, or evapotranspiration amount, was calculated from the date of spring soil sampling to September 10. Effective irrigation, runoff and deep percolation were calculated in AIMM. Graphs generated by the AIMM model depicting moisture use based on producer irrigation management practices can be seen in Figures 2 and 4.

The optimum irrigation scheduling plan was developed in AIMM based on the field, crop information, and local weather data. Irrigation events were added to the model as required, keeping available soil moisture at an optimum level of 60 per cent or greater. Irrigation applications were added in increments of 25 mm effective irrigation (30.2 mm total irrigation), with a minimum of three days between applications. Graphs generated by the AIMM model depicting moisture use based on optimum irrigation management can be seen in Figures 3 and 5.

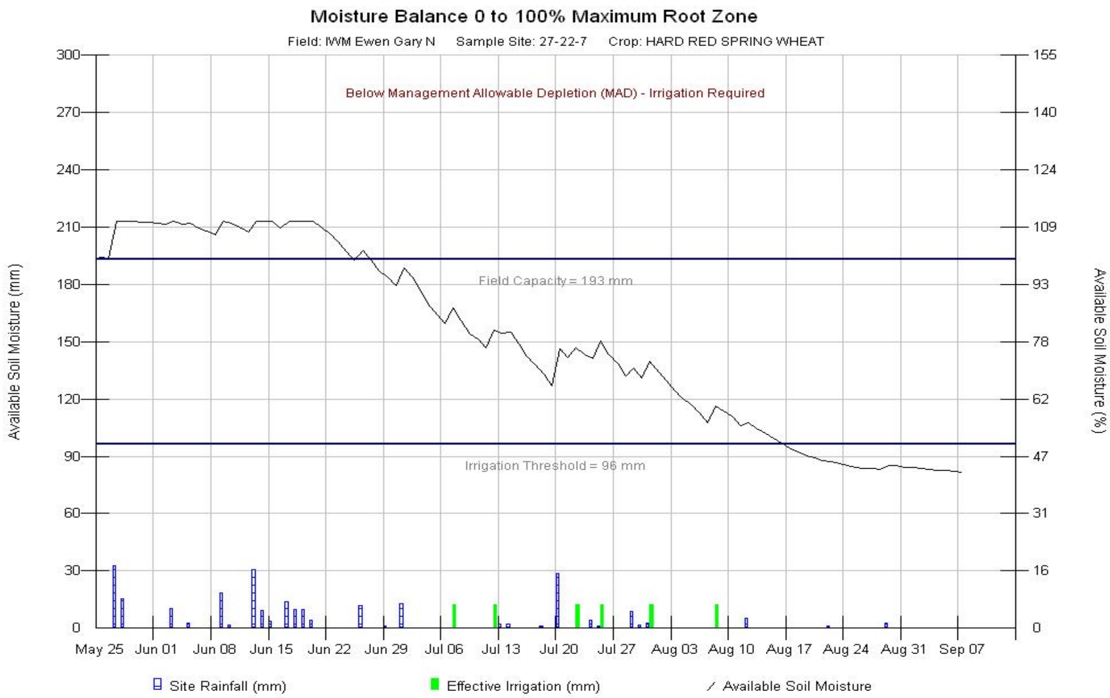

Figure 2 AIMM moisture-use curve of durum based on actual producer irrigation management

Figure 2 is a graph of the moisture-use curve of hard red spring wheat based on actual producer irrigation management. Figure 3 is a moisture curve for hard red spring wheat based on optimum irrigation management. Early spring rains saturated the soil and there was no need for irrigation until mid-July. AIMM predicted that the optimum amount of irrigation required was 125 mm, the actual amount applied was 75mm.

Figure 4 is a graph of the moisture-use curve of canola based on actual producer irrigation management. Figure 5 is a moisture curve for canola based on optimum irrigation management. Early spring rains saturated the soil and there was no need for irrigation until mid-July. AIMM predicted the optimum amount of irrigation required was 75 mm, the actual amount applied was 63mm.

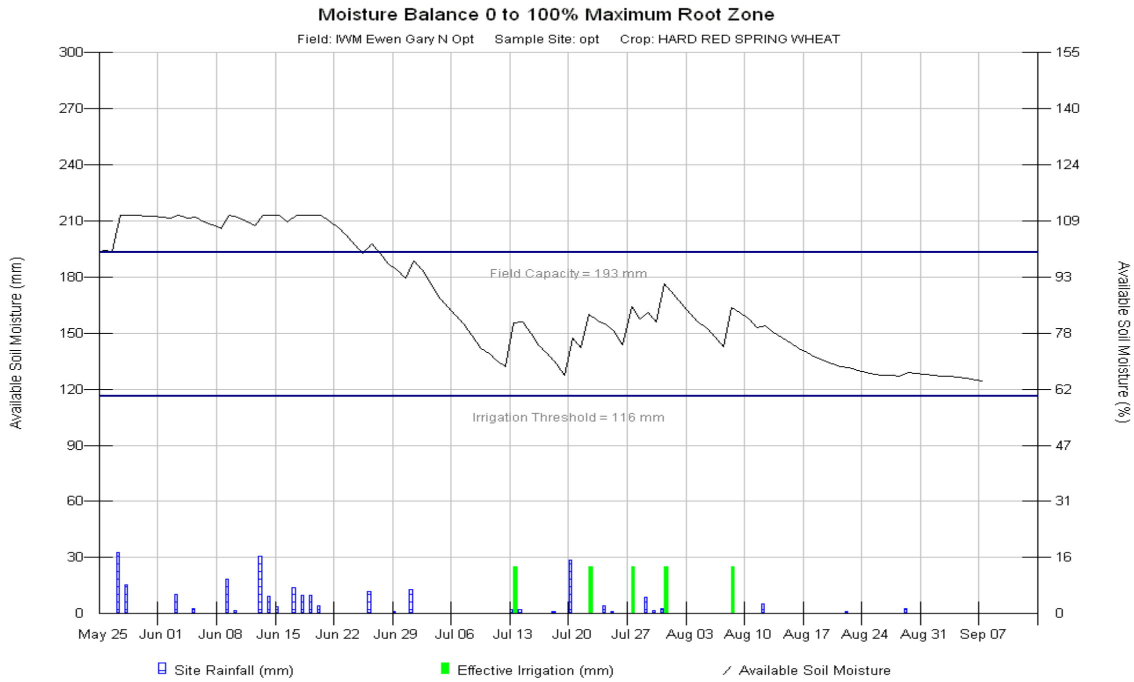

Figure 3 AIMM moisture use curve of durum based on optimum irrigation management

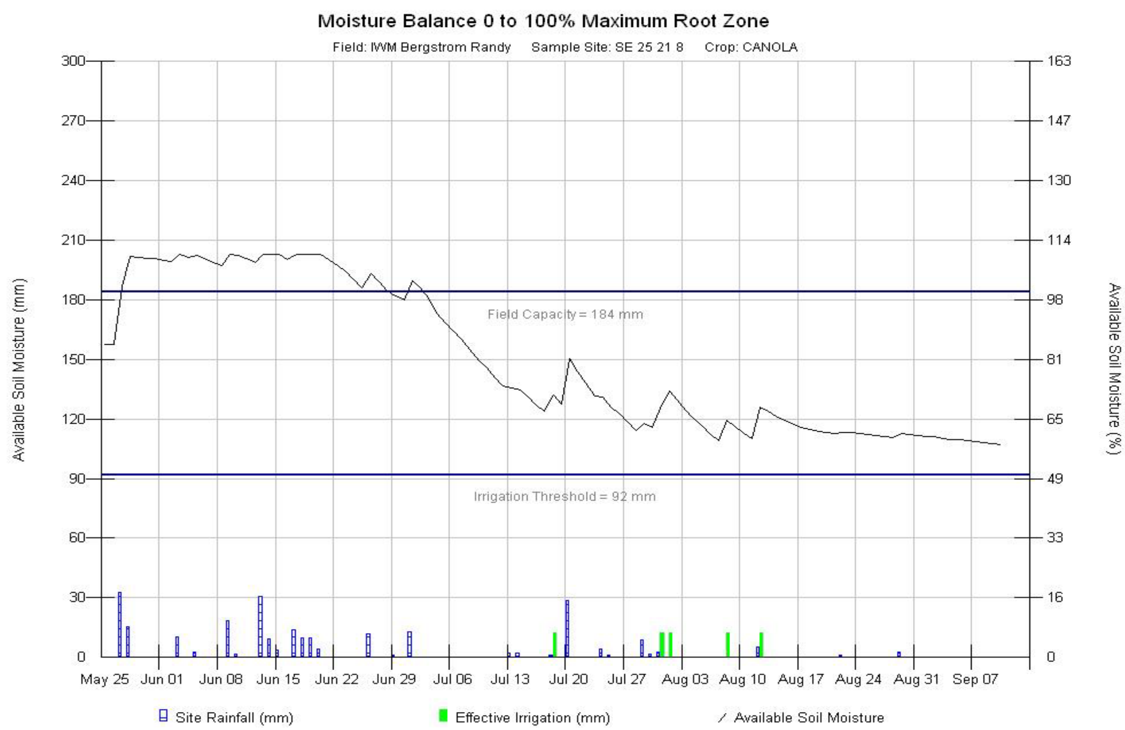

Figure 4 AIMM moisture-use curve of canola based on actual producer irrigation management

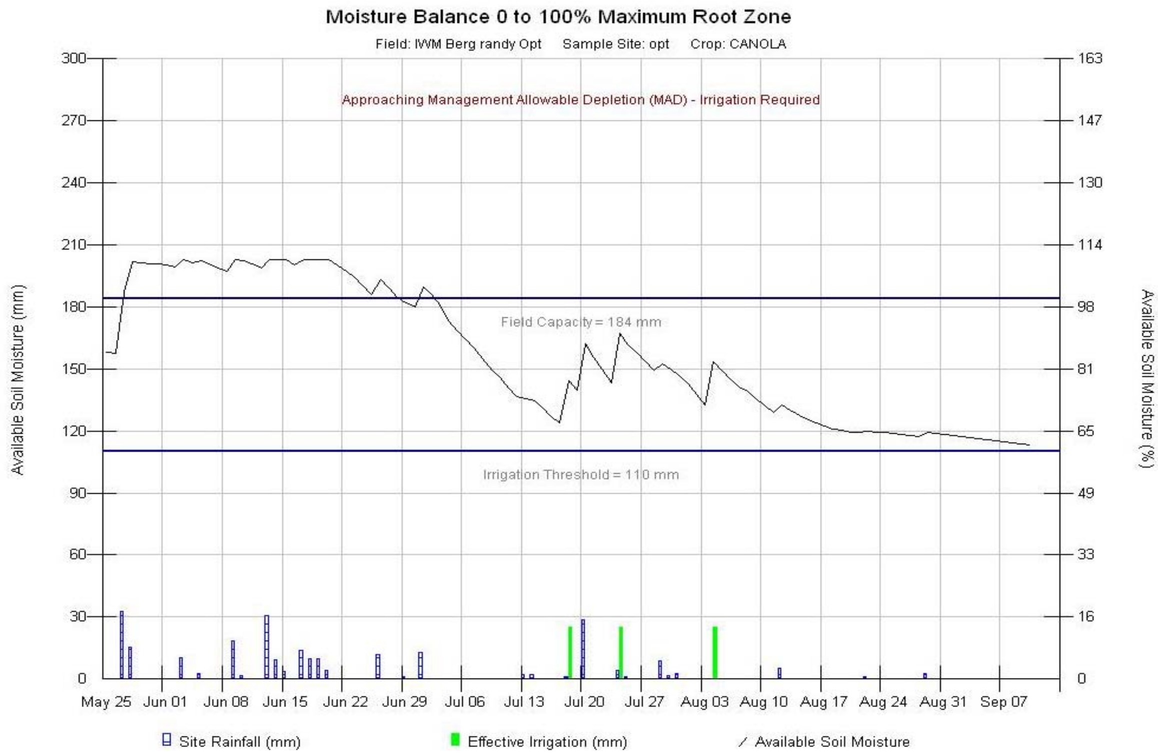

Figure 5 AIMM moisture-use curve of canola based on optimum irrigation management

Final Discussion

The actual crop water use for all fields was lower than the optimum crop water use modeled in AIMM indicating that total season crop water use was not met (Table 1).

The AIMM-modeled fields were managed to maintain a soil moisture level of 60% field capacity throughout the growing season to simulate optimal production levels. The difference between actual and optimal effective irrigation can be seen in Table 2. The difference between actual and optimally effective irrigation indicates that farmers typically irrigate less than what is required by the crop for maximum production.

Table 3 Actual crop water use compared to AIMM- modeled optimum crop water use .

District	Crop	Crop Water Use		Difference (mm)
		Actual (mm)	Optimum (mm)	
Riverhurst	Canola	298	297	-1
	Canola	327	331	7
	Wheat	335	342	4
Luck Lake	Canola	279	285	6
	Wheat	317	322	5
SSRID	Wheat	278	292	14
	Wheat	278	292	14
	Potato	316	324	8
			All sites average	7

Table 4 Actual effective irrigation compared to AIMM- modeled optimum effective irrigation.

District	Crop	Crop Water Use		Difference (mm)
		Actual (mm)	Optimum (mm)	
Riverhurst	Canola	50	75	25
	Canola	75	125	50
	Wheat	75	100	25
Luck Lake	Canola	63	75	12
	Wheat	50	100	50
SSRID	Wheat	0	75	75
	Wheat	0	75	75
	Potato	63	100	37
			All sites average	44

Conclusions and Recommendations

The results of this project indicate that there is a difference between optimal irrigation management practices predicted by AIMM and actual on-farm irrigation practice. AIMM indicates that producers are not irrigating sufficiently.

In 2012, producers were hesitant to irrigate for two reasons. At all sites there were early season rains that saturated the entire soil profile. At all field sites soil moisture remained above field capacity until late June. Producers reduced irrigation as a result of the full soil profile. In July, there were some untimely rains that increased disease incidence. The wet canopy created by the rain in combination with the heat at this time of the growing season created an environment conducive to disease infection. As a result, producers avoided irrigation at that time of the year to allow canopy dry down.

On an applied millimeter basis, optimum effective irrigation, as predicted by AIMM, and actual on-farm irrigation were close. This indicates that AIMM is a viable irrigation water management tool for producers in Saskatchewan.

ICDC will continue to investigate and demonstrate irrigation water management tools in the future.

Irrigation Water Management Workshops*

Project Lead

- Rory Cranston, PAg, Regional Crop Specialist, Saskatchewan Agriculture

Project Objective

To educate Saskatchewan irrigation producers about irrigation water management.

Project Summary

Two workshops with the learning objective of increasing producer knowledge of irrigation water management were organized in the Lake Diefenbaker Development Area (LDDA). One workshop was hosted at the Mainstay Inn in Riverhurst on July 10 and the other was hosted at the Heritage Centre in Outlook on July 11.

Both workshops featured presentations from Dr. Shelly Woods from Alberta Rural Development (ARD)and Len Hingley (ARD) as well as hands-on learning sessions with Dave Hyland(ARD) and Rory Cranston from the Saskatchewan Ministry of Agriculture.

Figure 1. Shelly Woods presenting about sprinkler efficiency at Outlook

Dr. Shelly Woods, a Soil and Water Scientist with ARD, delivered a 45 minute presentation (Figure 1) focusing on irrigation systems, irrigation efficiency, soil characteristics, soil-water interaction, plant-water interaction and crop water use.

* Project 2012-09

Len Hingley, a Soil and Water Technologist with ARD, delivered a 30 minute presentation (Figure 2) on Variable Rate Irrigation (VRI). The presentation focused on application, equipment, potential and current VRI demonstrations in Alberta and use of VRI technology

Figure 2. Len Hingley presenting at Riverhurst.

Dave Hyland, an Irrigation Management Technologist with ARD, led a 45 minute hands-on session (Figure 3) that demonstrated the Alberta Irrigation Management Model (AIMM). The AIM model is a decision support tool software package that assists irrigation producers with irrigation scheduling decisions.

Figure 3. Dave Hyland demonstrating the AIMM software in Outlook.

Rory Cranston led a 30 minute hands-on session (Figure 4) that taught attendees how to determine soil texture and soil moisture by the feel method. This session also included demonstrations of infiltration rates and capillary action in different soils.

Figure 4. Hands on soil session in Riverhurst.

Both workshops were well attended. The workshop at Riverhurst filled the basement conference room at the Mainstay Inn with 15 attendees. The Outlook workshop had 21 attendees at the Heritage Centre. Both workshops were attended by producers and industry agronomists.

Both ICDC and the Saskatchewan Ministry of Agriculture see this project as an important element of the ongoing objective of educating irrigators about the benefits and importance of effective and efficient irrigation water management through irrigation scheduling. The Saskatchewan Ministry of Agriculture has an Irrigation Scheduling Manual available to irrigation producers of Saskatchewan to aid them in their irrigation scheduling decisions.

ICDC will continue to work and synergize with staff from ARD to extend and increase Saskatchewan's irrigation producers' knowledge of irrigation water management.

TECHNOLOGY TRANSFER 2012

MINISTRY OF AGRICULTURE AGROLOGIST EXTENSION EVENTS

Field Days

- CSIDC Irrigation Field Day and Tradeshow, July 12, 2012
    - Tour leader, morning tour, Gerry Gross, Ministry of Agriculture
    - Corn Trials stop, Garry Hnatowich, ICDC & Sarah Sommerfeld, Ministry of Agriculture
    - Lentil Production, Irrigation versus Dry Land stop, Garry Hnatowich, ICDC & Gary Kruger, Ministry of Agriculture
    - Drainage stop, Garth Weiterman, Ministry of Agriculture
    - Ministry representative on the Field Day Committee, Gerry Gross
- Forage Field Day, August 21, 2012
    - Event organizer and tour leader, Pasture Blends and Demonstration of Perennial Forages field stop, Sarah Sommerfeld, Ministry of Agriculture
    - Corn variety demonstration stop, Garry Hnatowich, ICDC
    - Salt tolerant alfalfa varieties and Nitrogen fertility on Oat Production, Gary Kruger, Ministry of Agriculture

Booth Display

- Crop Production Week, Saskatoon, Jan. 9-12, 2012
- CSIDC Irrigation Field Day and Tradeshow, Outlook, July 12, 2012
- ICDC/SIPA Annual Conference, Moose Jaw, Dec. 4-5, 2012

Publications

- Crop Varieties for Irrigation, 2012
- Irrigation Economics and Agronomics, February 2012
- The *Irrigator*, March 2012

Presentations

Gary Kruger

- ICDC report to Riverhurst Irrigation District AGM, March 20, 2012
- ICDC report to Macrorie Irrigation District AGM, March 28, 2012
- ICDC report to Ponteix Irrigation District AGM, March 30, 2012
- ICDC report to South Saskatchewan River Irrigation District AGM, April 4, 2012
- ICDC report to Luck Lake Irrigation District AGM, April 4, 2012
- ICDC report to Miry Creek Irrigation District AGM April 9, 2012
- ICDC report to North Waldeck Irrigation District AGM, April 17, 2012
- Radio spot on CJWW on sulphur fertility for irrigation, September, 2012
- 2012 ICDC Field Project Program Report, ICDC annual conference, December 5, 2012

Rory Cranston

- Presentation on ICDC structure and operation changes and potential projects for 2012 at the Riverhurst Irrigation District annual general meeting, March 2012
- Presentation on ICDC structure and operation changes in 2012 at the Luck Lake Irrigation District annual general meeting, April 2012
- Presentation on ICDC structure and operation changes in 2012 at the South Saskatchewan River Irrigation District annual general meeting, April 2012
- Taped a Farmgate interview re: Irrigated research and demonstration in Saskatchewan, July 2012
- Hosted an Irrigation Management Workshop in Riverhurst, July 2012.
- Hosted an Irrigation Management Workshop in Outlook, July 2012
- Spoke to a SIAST class about irrigation scheduling and weather monitoring, July 2012.
- Spoke about Sclerotinia in canola and ICDC research on fungicide use in irrigated canola at the GDT field day in Elbow, July 2012
- Disease, Fungicides, and Irrigation Water Management, ICDC annual conference, December 2012

Gerry Gross

- Intensive irrigation opportunities presentation to the annual Saskatchewan Stock Growers Association, May 2012
- Radio spot on CJWW on CSIDC Field Day and the irrigation industry in Saskatchewan, June 2012
- Radio spot on CKRM on the condition of irrigation crops, July 2012

- SIPA Qu'Appelle South Showcase Tour, July 2012
- Radio spot on CJWW on the ICDC/SIPA Annual Conference, November 2012

Sarah Sommerfeld

- Kindergarten C class tour at CSIDC, May 2012
- Field scouting techniques, Perennial Weed Workshops, June & July 2012
- Corn agronomy, CSIDC Field Day, July 2012
- CJWW radio spot on Forage Field Day, August 2012
- Forage species selection and establishment presentation, Forage Field Day, August 2012
- Managing salinity using forages presentation, Optimizing Production: Forage and Crop Management Update, November 2012
- Forage Projects at CSIDC, ICDC Annual Conference, December 2012

Agriview Articles 2012

Gary Kruger

- Effects of Cover Crop Fertilization on Under-sown Forage Crops, March 2012
- Is Sulphur Adequate for Irrigated Crop Production, October 2012
- Managing Nitrogen for Oats, December 2012

Rory Cranston

- Irrigation Scheduling: New Tools and Old Methods, January 2012
- Staging Your Wheat for Disease control, April 2012

Gerry Gross

- Irrigation Crop Varieties for 2012, February 2012
- CSIDC Field Day, July 2012
- ICDC/SIPA 2012 Conference, November 2012

Sarah Sommerfeld

- Discover the 2012 Forage Field Day, July 2012
- Fall Fertilization of Established Forage Stands, October 2012

Other Articles 2012

Gary Kruger

- Is Sulphur Adequate for Irrigated Crop Production?, *The Irrigator*, March 2012

- The Southwestern Soil Fertility Program for 2012, *The Irrigator*, March 2012

Rory Cranston

- Created a two page handout detailing some of the Saskatchewan irrigation publications, January 2012
- 2011: A year in Review, *The Irrigator*, March 2012
- 2012 Project possibilities, *The Irrigator*, March 2012

Sarah Sommerfeld

- Selecting the right forage species, *The Outlook* and *West Central Crossroads* newspaper articles, February 2012
- Corn agronomics, *The Outlook* and *West Central Crossroads* newspaper articles, March 2012
- Tame hay management, *The Outlook* and *West Central Crossroads* newspaper articles, May 2012
- Direct seeding annual crops into sod, *The Outlook* and *West Central Crossroads* newspaper articles, July 2012
- Management of irrigated alfalfa, *Saskatchewan Hay & Pasture Report*, July 2012
- Fall fertilization of forage stands, *The Outlook* and *West Central Crossroads* newspaper articles, September 2012

Surveys (2012)

- Fusarium head blight and cereal leaf disease survey — Rory Cranston, PAg
- Canola disease survey — Rory Cranston, PAg
- Bertha army worm survey — Rory Cranston, PAg
- Diamondback moth survey — Rory Cranston, PAg
- Alfalfa insect survey— Sarah Sommerfeld, PAg

www.irrigationsaskatchewan.com Report 2012

The Irrigation Saskatchewan website at www.irrigationsaskatchewan.com is designed so that site visitors have access to irrigation topics related to ICDC, SIPA and the Ministry of Agriculture.

The new site directs visitors to an ICDC subsection, a SIPA subsection or 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. All 2012 activities and publications were uploaded to the site.

ABBREVIATIONS

AAFC	Agriculture and Agri-Food Canada
ac	acre or acres
ACC	Alberta Corn Committee
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