Irrigation Crop Diversification Corporation

ICDC Research and Demonstration Program Report 2010

ICDC – Delivering "value for money R&D" to Saskatchewan irrigators

www.irrigationsaskatchewan.com

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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

Directors of ICDC in 2010 were:

Name	Position	Irrigation District	Development Area Represented	Election Year (# terms)
Rick Swenson	Director	Baildon ID	SEDA	1 year appt.
Randy Bergstrom	Alt. Vice Chair	Luck Lake ID	LDDA	2010 (2)
Keith Forrest	Director	Private Irrigator	SIPA rep.	Appt.
Kevin Plummer	Director	Moon Lake ID	NDA	1 year appt.
Paul Heglund	Chair	Vidora ID	SWDA	2010 (2)
Colin Ahrens	Director	Rosetown	Non-District	2012 (1)
Neil Stranden	Director	SSRID	LDDA	2011 (2)
Jan Kőnst	Director	SSRID	SIPA rep.	Appt.
Rob Oldhaver	Vice Chair	Miry Creek ID	SWDA	2011 (2)
John Babcock	Director		SA rep.	Appt.
Abdul Jalil	Director		SA rep.	Appt.

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 to the Annual Meeting. Each Irrigation District is entitled to send one ICDC Delegate per 5,000 irrigated acres or part thereof. 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.

The ICDC board must, by law, have irrigators in the majority.

Irrigation Crop Diversification Corporation

Staff support from the
Saskatchewan Ministry of Agriculture

Outlook
Box 609, Outlook, SK
S0L 2N0
Fax: (306) 867-9868

Gerry Gross, PAg
867-5523
gerry.gross@gov.sk.ca

Sarah Sommerfeld, PAg
867-5521
sarah.sommerfeld@gov.sk.ca

Garth Weiterman, PAg
867-5528
garth.weiterman@gov.sk.ca

Rory Cranston, AAg
867-5512
rory.cranston@gov.sk.ca

Gary Kruger, PAg
867-5524
gary.kruger@gov.sk.ca

Janice Bennett, Admin
867-5500
janice.bennett@gov.sk.ca

Melanie Nadeau, Admin
867-5502
melanie.nadeau@gov.sk.ca

Field Crops

Fusarium head blight (FHB) fungicide efficacy demonstration 2010

Project Lead

- Rory Cranston, AAg, Irrigation Agrologist, Saskatchewan Agriculture

Co-investigators

- Sarah Butler, ICDC Summer Student

Co-operators

- Kelvin Bagsahw, Birsay, Sask.
- Gary Ewen, Riverhurst, Sask.
- Kevin Langer, Riverhurst, Sask.
- Clint Ringdal, Outlook, Sask.

Industry Co-operators

- Carmen Watson and Jeff Ewen, BASF
- Marc Delage and Tim Gardener, Bayer CropScience
- Deb Oram, Gardiner Dam Terminal

Project Objective

The objective of this project was to work with industry co-operators to demonstrate the efficacy of fungicide application to control Fusarium head blight (FHB) in high yielding wheat under high-management irrigation conditions.

Project Plan

Folicur, Proline, Prosaro and Caramba were applied to irrigated wheat crops to control FHB and leaf disease. The types of wheat being used in this demonstration were hard red spring, soft white spring, and durum.

The fungicide treatments were 40 acres in size. Bayer CropScience donated 160 acres of Prosaro, 80 acres of Proline, and 40 acres of Folicur. BASF donated 40 acres of Caramba. The remaining 80 acres of Folicur was purchased with funding provided by the Agricultural Demonstration of Practices and Technologies (ADOPT) program.

Yield, grade, and Fusarium infection were determined for each of the treatments and compared to an untreated area. The samples were graded by Gardiner Dam terminal and levels of Fusarium were determined Discovery Seed Labs.

Irrigation
Soil moisture was monitored throughout the year with the use of Watermark™ sensors installed at 12- and 22-inch depths. Rainfall and irrigation were recorded with the use of rain gauges and WeatherBug stations in the area.

The FHB demonstration sites

Hard wheat sites: G. Ewen and K. Langer

G. Ewen hard wheat demonstration site (SW 27-22-7 W3M)

This demonstration site was located in the Riverhurst Irrigation district under a 113-acre low-pressure pivot. This was the second year the site has been in irrigated production. The soil texture is a fine sandy clay loam and the field was cropped to canola the previous year.

Crop Management
Unity Canada Western Red Spring Wheat was seeded on May 31, 2010. The seed was treated with Dividend XL RTA prior to seeding. Establishment was very good. Weeds were effectively controlled with a post emergence application of Signal D. See Table 1 for agronomic management of this demonstration site.

Table 1. Agronomic management of G. Ewen hard wheat demonstration site.

Nutrients (0-12”)	N	P	K
Soil residual	18 lb. /acre	15 lb. /acre	>800 lb./acre
Applied	112 lb. /acre	54 lb. /acre	22 lb. /acre
Variety	Unity		
Seeding	May 31, 2010; 120 lb. /acre treated with Dividend XL RTA		
Herbicide	Signal D 93 ml/acre, June 21		
Fungicide	Caramba, Folicur, and Prosaro applied on July 21		
Available Moisture from May 1 to Oct. 1			
Irrigation	60 mm (2.33 inches)		
Rainfall	408 mm (16.06 inches)		
Harvest	Sept. 30		

Soil moisture rarely dropped below 50 per cent of field capacity throughout the year. Irrigation was stopped the first week of August because the crop was beginning to lodge. The soil reserve was then drawn down through August and September.

Caramba, Folicur, and Proline were applied on July 21. Irrigation was managed to minimize frequency during the flowering period. Leaf samples taken on Aug. 19 showed a significant visual difference between the Prosaro treated area and the untreated area. The Prosaro treatment had significantly less leaf disease.

Harvest yield measurements were taken on Sept. 30 (Table 2). Three yield-samples were taken from each treatment and control area. Folicur and Prosaro demonstrated a yield benefit. Caramba did not demonstrate any yield benefit.

Table 2. Harvest results for G. Ewen hard wheat demonstration site.

Treatment	Prosaro	Folicur	Untreated	Caramba
Yield	75 bu./acre	73 bu./acre	68 bu./acre	67 bu./acre
Total fusarium **†**	1.5%	1.5%	2.5%	2.5%
Thousand kernel weight	35.16 g	33.12 g	33.14 g	30.64 g
Grade*	1	1	1	1

† *Fusarium graminearum* values were all less than one per cent.
*According to fusarium damage

K. Langer hard wheat demonstration site (SW 06-23-6 W3M)
This demonstration site was located in the Riverhurst Irrigation district under a 130-acre high pressure pivot. This field has been irrigated since 1990. The soil texture was a sandy clay loam and the field was cropped to canola the previous year.

Crop Management
Lillian Canada Western Red Spring Wheat was seeded in early June 2010. Establishment was very good. Weeds were effectively controlled with a post emergence application of Horizon and DyVel. See Table 3 for agronomic management of this demonstration site.

Table 3. Agronomic management of K. Langer hard wheat demonstration site.

Nutrients (0-12")	N	P	K
Soil residual	50 lb. /acre	40 lb. /acre	>800 lb./acre
Applied	46 lb. /acre	23 lb. /acre	
Variety	Lillian		
Seeding	Early June 120 lb./acre		
Herbicide	PrePass 0.04L/acre preseeding Clodinafop 474 ml/acre June 25 DyeVel 0.51L/acre June 25		
Fungicide	Proline, and Prosaro applied on August 4		
Available Moisture from May 1 to Oct. 1			
Irrigation	0mm (0 inches)		
Rainfall	408 mm (16.06 inches)		
Harvest	Oct. 7		

This field was a late addition to the demonstration program. As a result, no Watermark™ sensors were installed. As a result, field moisture was monitored by the feel method. With the exception of a few knolls field moisture stayed above 50 per cent field capacity after monitoring began. Irrigation was stopped in July because of a mechanical breakdown in the pivot.

Proline and Prosaro were applied on Aug. 4 and harvest measurements were taken on Oct. 7 (Table 4). Three yield samples were taken from each treatment area. Due to uneven topography only one sample was taken from the untreated area. Proline and Prosaro had a small yield benefit.

Table 4. Harvest results for K. Langer demonstration site.

Treatment	Prosaro	Proline	Untreated
Yield	54 bu./acre	52 bu./acre	49 bu./acre
Total Fusarium **†**	1%	3.5%	6.5%
Thousand kernel weight	32.5 g	34.04 g	30.48 g
Grade*	2	2	2

† *Fusarium graminearum* values were all less than one per cent.
* According to fusarium damage

Soft wheat site

C. Ringdal soft wheat demonstration site (SW 6-30-05 W3M)

This demonstration site was irrigated from the Saskatoon South East Water System (SSEWS) under a 130-acre high pressure pivot. This field has been under irrigation for several years. The soil texture is a clay loam and the field was cropped to canola the previous year.

Crop Management

AC Andrew was seeded on June 5, 2010. Establishment was very good except for a few areas in the field that were flooded out. Weeds were effectively controlled with a post emergence application of Target and Horizon. See Table 5 for agronomic management of this demonstration site.

Table 5. Agronomic management of C. Ringdal soft wheat demonstration site.

Nutrients (0-12")	N	P	K
Soil residual	30 lb. /acre	20 lb. /acre	>800 lb./acre
Applied	110 lb. /acre	50 lb. /acre	
Variety	AC Andrew		
Seeding	June 5, 2010; 120 lb. /acre		
Herbicide	Clodinafop 474 ml /acre June middle of June		
	Dicamba/ Mecoprop/MCPA 0.5 l. /acre		
Fungicide	Folicur, and Prosaro applied on Aug. 4		
Available Moisture from May 1 to Oct. 1			
Irrigation	0 (0 inches)		
Rainfall	444 mm (17.4 inches)		
Harvest	Oct. 14		

The soil profile in the top foot was saturated at the start of the year. At the end of July and beginning of August, soil moisture went below 50 per cent field capacity and stayed below for the rest of the year. The second and third foot remained above 50 per cent field capacity. This area had above-average precipitation and, as a result, there was no irrigation.

Folicur and Prosaro were sprayed on Aug. 4. Harvest yield measurements were taken on Oct. 14 (Table 6). Three-acre samples were taken from each of the treated and control areas. Prosaro and Folicur demonstrated a significant yield benefit.

Table 6. Harvest results for C. Ringdal demonstration site.

Treatment	Prosaro	Folicur	Untreated
Yield	81 bu./acre	77 bu./acre	68 bu./acre
Total Fusarium **†**	5%	4%	13.4%
Thousand kernel weight	38.60 g	33.36 g	29.64 g
Grade	feed	feed	feed

† *Fusarium graminearum* values were all less than one per cent.

Durum Site

K. Bagshaw durum demonstration site (NW 16-23-07 W3M)

This demonstration site was located in the Luck Lake Irrigation District under a 300-acre high pressure pivot. This field has been under irrigation for many years. The soil texture is a fine sandy loam and the field was cropped to potatoes the previous year.

Crop Management

Strongfield Canada Western Amber Durum was seeded in the middle of May establishment was very good. Weeds were effectively controlled with a post emergence application of Horizon and Thumper. See Table 7 for agronomic management of this demonstration site.

Table 7. Agronomic management of K. Bagshaw durum demonstration site.

Nutrients (0-12”)	N	P	K
Soil residual	50 lb. /acre	30 lb. /acre	>800 lb./acre
Applied	54 lb. /acre	24lb. /acre	
Variety	Strongfield		
Seeding	Middle of May; 120 lb./acre		
	Seed placed fertilizer 30 P lb./acre , 15 K lb./acre		
Herbicide	Clodinafop 474 ml /acre June middle of June		
	Bromoxynil/ 2,4-D Ester 0.4 l./acre		
Fungicide	Proline, Folicur, and Prosaro applied on July 21		
Available Moisture from May 1 to Oct. 1			
Irrigation	76 mm (3 inches)		
Rainfall	445 mm (17.52 inches)		
Harvest	Oct. 4, 2010		

Soil moisture was maintained around 50 per cent field capacity throughout the year. Towards the end of the year and after irrigation was stopped, the soil moisture fell below 50 per cent field capacity. Irrigation was stopped in early August. The soil reserve was drawn down through August and September.

Proline, Folicur and Prosaro were applied on July 21. Irrigation was managed to minimize frequency during the flowering period. Harvest yield measurements were taken on Oct. 4 (Table 8). Three yield samples were taken from each of the treatments and the untreated area. Each of the treatments demonstrated a yield benefit. Prosaro demonstrated the greatest benefit.

Table 8. Harvest results for K. Bagshaw demonstration site.

Treatment	Prosaro	Proline	Folicur	Untreated
Yield	88 bu./acre	87 bu./acre	78 bu./acre	67 bu./acre
Fusarium graminearum	8.5 %	6%	11%	12.5%
Total Fusarium	36	40.5	38.5	32
Thousand kernel weight	36.54	33.86	28.76	30.58
Grade *	3	3	3	3

*According to fusarium damage

Final Discussion

FHB thrives in a wet and hot environment. The above-average rainfall caused a high-level fusarium threat this year.

In all the demonstration sites, Prosaro had the greatest yield benefit. Prosaro, Proline and Folicur all demonstrated a yield benefit. Caramba did not demonstrate any yield benefit.

The yield benefits from using fungicide on durum and soft white wheat were significant. The benefits in durum and soft white wheat ranged from a 21-bushel advantage from a Prosaro application to a nine-bushel advantage from applying Folicur.

There was a small yield benefit demonstrated in the hard wheat sites. The yield benefit in hard wheat ranged from eight bushels (Prosaro) to three bushels (Proline).

These demonstrations show that wheat treated with Prosaro had fewer fusarium-infected kernels, followed by Proline, Folicur and Caramba. The only exception was the K. Bagshaw demonstration. This site treatments had a higher total fusarium per cent than untreated wheat. However, the *Fusarium graminearum* levels were lower in the treatments compared to the untreated.

There were some grade differences between the fungicide treatments. In the G. Ewen site the Folicur was graded as two and everything else was graded as one. The grade difference was primarily caused by frost damage. Frost damage in the treatments likely was compounded by the fungicides keeping the flag leaf green longer and potentially lengthening the days to maturity.

This demonstration has shown that fungicide application can significantly increase yields in durum and soft-white wheat. Producers should considered applying fungicides when growing these two types of wheat. This project also has shown that fungicides have some yield benefits in hard wheat. Producers should examine the economics of the situation before applying fungicide to hard wheat.

FHB is a growing issue among irrigators in Saskatchewan. Controlling FHB will continue to be a part of the ICDC program in the future.

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Foreword bilateral agreement.

Dry Bean Fungicide Demonstration 2010

Project Lead

- Rory Cranston, AAg, Irrigation Agrologist, Saskatchewan Agriculture

Co-investigators

- Sarah Butler, ICDC Summer Student

Co-operators

- Rodney Kent, Outlook, Sask.

Project Objective

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

Project Plan

White mold is a serious disease concern for all dry bean producers through out the prairies. Over the past years, only the fungicide Lance (boscalid) was available for control. Recently Allegro (fluazinam) has been registered for use in dry beans.

This project compared the two fungicides to an untreated check. Yield and disease severity were be measured and recorded. Winchester pinto dry beans were planted on June 8, 2010. On Aug. 4, the field was sprayed with Lance and Allegro. Allegro was applied to 50 acres in the field. Lance was applied to the rest of field leaving a small untreated area for comparison. The Allegro was purchased with funds from the Agricultural Demonstration of Practices and Technologies (ADOPT) program and the Lance was provided to the demonstration by the co-operator

Demonstration site

The demonstration site was located in the Riverhurst Irrigation district on a 127-acre high pressure pivot. This field has been under irrigation since 1990. The soil texture is a fine sandy loam and the field was cropped durum the previous year.

Crop management

Winchester pinto dry beans were seeded on June 8. Establishment was very good. Weed control was effective with a pre-seeding application of Edge, post-seed application of Basagran and Assure, as well as inter-row tillage. See Table 1 for agronomic management of the site.

Table 1. Agronomic management of R. Kent demonstration site.

Nutrients (0-12")	N	P	K
Soil residual	16 lb./acre	36 lb. /acre	448 lb. /acre
Applied	80 lb./acre	55 lb. /acre	00 lb. /acre
Variety	Winchester		
Seeding	June 8, 2010, 96000 plants/acre		
Herbicide	Edge 8.9 kg/acre, May 16/ pre-plant incorporated Basagran 0.91 L/acre, June 20 Quizalofop 0.15 L/acre, June 20		
Fungicide	Lance 300 g/acre, Aug. 4 Allegro 405 ml/acre, Aug. 4		
Available Moisture from May 1 to Oct. 1			
Irrigation	77 mm (3 inches)		
Rainfall	408 mm (16.06 inches)		
Undercutting	Oct. 7		
Harvest	Oct. 18		

Irrigation

This site was a late addition. As a result, no monitoring equipment was installed. Moisture was monitored though out the year using the feel method. After monitoring began on the site, moisture levels stayed at or above 60 per cent of field capacity until August when irrigation was halted.

Disease rating

Disease rating was determined on Aug. 31 by the equation provided below:

$$\text{Disease rating} = \frac{(\sum \text{Severity Class x number of plants in class}) \times 100}{\text{divided by the number of plants}}$$

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 branches or stem colonized
4= More than half of the branches or stem colonized and/or plant dead

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

Result of the disease rating check: 100 plants were sampled from each of the treatments. It was found that Allegro had a disease rating of 59, Lance 120 and untreated 233.

Harvest
The site was undercut on Oct. 7. At that time, there were visual differences between the treated and untreated areas see Figures 1 and 2. The site was harvested on Oct. 18. Both the Lance and Allegro treatments demonstrated a yield benefit. Lance demonstrated a greater yield benefit in a single fungicide application system. See Table 2 for harvest results

Table 2. Harvest results for R. Kent demonstration site.

Treatment	Lance	Allegro	Untreated
Yield	2376 lb./acre	2310 lb./acre	1639 lb/acre

Figure 1. Lance treatment.

Figure 2. Allegro treatment.

Final Discussion
To justify the cost of applying fungicide at the current price of fungicide and dry beans, the crop needs to yield about 500 lb. /acre extra to have an economic benefit. Both fungicide treatments yielded significantly higher than 500 lb. /acre threshold. The two treatments were not significantly different in yields.

After disease rating was taken on Aug. 30, it was expected that the Allegro-treated beans would yield higher than the Lance treated beans. The rating of 59 with Allegro compared to the rating of 120 with Lance indicates that the Lance-treated beans had twice as much disease present.

There are many factors that could have influenced this result. These fungicides use two active ingredients. Lance (boscalid) has a long protection window, but has no immediate effect. Allegro (fluazinam) has an immediate effect, but a shorter window. Boscalid is an anilid fungicide that provides systemic protection for 10 to 14 days. Fluazinam is a pyridinamine fungicide with contact protection that lasts seven to 10 days.

This could explain the observed differences when there is only one fungicide application during the season. White mold thrives in a wet cool environment. The above-average precipitation in 2010 created a perfect situation for white-mold infection throughout the year.

With a high disease presence whenever the window of protection ends and with no second application to prolong the protection period, the disease will be able to move in. If the window is shorter in one of the products, the disease could move in sooner. These results could indicate that Lance is more susceptible to infection early, whereas Allegro is susceptible later.

In the future, ICDC will continue to examine ways to control white mold in dry beans. Two application systems will be examined using different combination of available fungicides in combination with seed treatments and cultural practices to determine how to best control this disease.

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Foreword bi-lateral agreement.

Dry Bean Variety Demonstration 2010

Project Lead

- Rory Cranston AAg, Irrigation Agrologist, Saskatchewan Agriculture

Co-investigator

- Sarah Butler, ICDC Summer Student

Co-operators

- Jake Boot, Outlook, Sask.
- Grant Carlson, Outlook, Sask.
- Gordon Kent, Riverhurst, Sask.

Industry Co-operators

- Larry Doherty, Viterra

Project Objective

The objective of this project was to evaluate four of the popular pinto dry bean varieties in a field-scale environment.

Project Plan

This demonstration examined two types of pinto dry bean, two with a non-darkening gene present (White Mountain 1, and White Mountain 2) and two with the non-darkening gene absent (Winchester and AC Island).

These are four of the more popular varieties grown in Saskatchewan. AC Island is the newest bean developed by the AAFC dry bean breeding program. It has a five per cent yield advantage over Othello and better plant structure. Othello has been considered the yield standard for dry beans for years. Winchester has been described as a very tough bean and is quickly becoming the new standard in Saskatchewan.

White Mountain 1 and White Mountain 2 are both produced by Walker Seeds. The White Mountain bean varieties posses a genetic trait that prevents the beans from darkening in color after harvest. The White Mountain 2 bean variety was released for production this year. The White Mountain 2 has better plant structure and yield than its predecessor, White Mountain 1.

Sixty-five acres of AC Island and Winchester were planted side-by-side on two fields and were compared to each other. With the release of White Mountain 2, no one grew White Mountain 1 in 2010. Therefore, the 2010 White Mountain 2 data will be compared with historical data of White Mountain 1.

Disease resistance, maturity, and ease of harvest were observed throughout the course of this season. Yields were measured for each variety in the fields. Watermark™ sensors and rain gauges were placed in each field to monitor soil moisture and record rain fall.

Irrigation
Soil moisture was monitored throughout the year with the use of Watermark™ sensors installed at 12- and 22-inch depths. Rainfall and irrigation were recorded with the use of rain gauges and WeatherBug stations in the area

The AC Island and Winchester demonstration sites

G. Kent 1 site (SW 10-22-7 W3M)
This demonstration site was located in the Riverhurst Irrigation district under a 131-acre low pressure pivot. This field has been under irrigation since 2005. The soil texture is a fine sandy loam and the field was cropped to wheat the previous year.

Crop Management
AC Island and Winchester dry beans were seeded over the dates of May 31 to June 4. The west half of the pivot was seeded to Winchester and the east side was seeded to AC Island. Establishment was very good for both varieties. There was a minor thistle problem. The thistle and other weeds were effectively controlled with a post emergence application of Basagran and Quizalofop as well as cultivation. See Table 1 for agronomic management of this demonstration site.

Table 1. Agronomic management of G. Kent 1 demonstration site.

Nutrients (0-12')	N	P	K
Soil residual	32 lb./acre	56 lb./acre	502 lb./acre
Applied	85 lb./acre	50 lb./acre	
Variety	AC Island and Winchester		
Seeding	May 31- June 4, 2010 120 lb. 96000 plants/acre		
Herbicide	Edge 8.9 kg/acre, June May 16/ Pre-plant incorporated		
	Basagran 0.91 L/acre, June 20		
	Quizalofop 0.15 L/acre, June 20		
Fungicide	Lance 300 g/acre, July 28		
	Allegro 405 ml/acre, August		
Available Moisture from May 1 to Oct. 1			
Irrigation	77 mm (3 inches)		
Rainfall	408 mm (16.06 inches)		
Undercutting	Oct. 6		
Harvest	Oct. 18		

Soil moisture content was low at the beginning of the season. Prior seeding there was a significant amount of rainfall that brought soil moisture above 60 per cent field capacity. They remained above 60 per cent field capacity until early August when irrigation was stopped. The soil reserve was drawn down through August and September

Harvest was Oct. 18. A 2.5-acre sample was harvested and weighed from each of the varieties. The Winchester yielded 2475 lb. /acre and the AC Island yielded 1942 lb./acre

G. Kent 2 site (SE 9-22-7 W3M)
This demonstration site was located in the Riverhurst Irrigation district under a 129-acre high pressure pivot. The field has been under irrigation since 1998. The soil texture is a sandy clay loam and the field was cropped to potatoes the previous year.

Crop Management
Crop management and agronomic practices are the same as the G. Kent 1 site. The only difference is that this site had no thistle problem.

Soil moisture was low at the beginning of the season. Prior to seeding there was a significant amount of rainfall which raised soil moisture above 60 per cent field capacity. Due to a mechanical problem with the pivot the field did not receive any irrigation for June and part of July. During that time soil moisture dipped significantly below 60 per cent field capacity. Once the pivot was repaired the soil moisture was raised to 60 per cent until irrigation stopped in mid-August.

Harvest occurred on Oct. 18. A 2.5-acre sample was harvested and weighed from each of the varieties. The AC Island yielded 3,285 lb./acre and the Winchester yielded 3,142 lb./acre

The White Mountain 2 demonstration sites

G. Carlson site (W 8-31-7 W3M)
This demonstration site was located in the South Saskatchewan Irrigation District (SSRID) under a 250-acre low pressure pivot. This field has been under irrigation for several years. The soil texture is a fine sandy loam and the field was cropped to corn silage the previous year.

Crop Management
White Mountain 2 dry beans were seeded between May 25 and 31, 2010. Establishment was very good. Weeds were effectively controlled with a post-emergence application of Basagran and Quizalofop, as well as cultivation. See Table 2 for agronomic management of this demonstration site

Table 2. Agronomic management of the G. Carlson demonstration site.

Nutrients (0-12")	N	P	K
Soil residual	20 lb. /acre	27 lb. /acre	630 lb./acre
Applied	70 lb. /acre	30 lb. /acre	00 lb. /acre
Variety	White Mountain 2		
Seeding	May 25-31, 2010. 120 lb. 96000 plants/acre		
Herbicide	Treflan (Trifluralin), Fall 2010 Basagran 0.91 L/acre, June 26 Quizalofop 0.15 L/acre, June 26		
Fungicide	Lance 300 g/acre, July 24 Lance 300 g/acre, Aug 4		
Available Moisture from May 1 to Oct. 1			
Irrigation	120 mm (5 inches)		
Rainfall	408 mm (16.06 inches)		
Undercutting	Sept. 10		
Harvest	Sept. 21		

Soil moisture content was low at the beginning of the season. Prior seeding there was a significant amount of rainfall that brought soil moisture above 60 per cent field capacity. They remained above 60 per cent field capacity until early August when irrigation was stopped. The soil reserve was drawn down through August and September

Harvest occurred on Sept. 21, 2010. The site was harvested and weighed. The White Mountain 2 yielded 3000 pounds per acre (lb./acre).

J. Boot Site (SE 30-30-6 W3M)

This demonstration site was located in the South Saskatchewan Irrigation District (SSRID) under a 110-acre low-pressure pivot. This field has been under irrigation for several years. The soil texture is a loam and the field was cropped to potatoes the previous year.

Crop Management

White Mountain 2 dry beans were seeded on June 7. Establishment was very good. There were very few weeds present at this site. Those that were present were effectively controlled with a post-emergence application of Viper as well as cultivation. See Table 3 for agronomic management of this demonstration site.

Table 3. Agronomic management of J. Boot demonstration site.

Nutrients	N	P	K
Soil residual	26 lb. /acre	59 lb. /acre	787 lb./acre
Applied	60 lb. /acre	20 lb. /acre	00 lb. /acre
Variety	White Mountain 2		
Seeding	June 7 2010 120 lb. 96000 plants/acre		
Herbicide	Edge 8.9 kg/acre, middle of May / / pre-plant incorporation Viper(Solo 11.7 g/acre, Basagran Forte 0.36 l/acre) late June		
Fungicide	Lance 300 g/acre, July 28 Serenade Max 1.2 kg/acre, July 28		
Available Moisture from May 1 to October 1			
Irrigation	77mm (3 inches)		
Rainfall	408mm (16.06 inches)		
Undercutting	Early October		
Harvest	Middle October		

Soil moisture was low at the beginning of the season. Prior to seeding there was a significant amount of rainfall that brought soil moisture above 60 per cent field capacity. The soil at the site was loam and it dried very quickly, as a result soil moisture dropped below 60 per cent field capacity several times.

Harvest occurred in the middle of October. The site was harvested and weighed. The White Mountain 2 yielded 2600 lb./acre.

Final Discussion

AC Island and Winchester demonstration

AC Island had both the highest and lowest yields in this demonstration:

AC island yielded 3285 lb. /acre at the SE 9-22-7 W3M site and 1942 lb. acre at the SW 10-22-7 W3M site.

Winchester yielded 3142 lb. /acre at the SE 9-22-7 W3M site and 2475 lb. /acre on the SW 10-22-7 W3M site.

The fields sown to these crops were adjacent and had few, but significant differences. The fields had different soil textures: the higher yielding field had a sandy clay loam and the other had fine sandy loam.

The higher yielding field had potatoes as the previous crop and the other field had durum preceding it. The higher yielding field also had some drought stress due to mechanical problem with the pivot.

Winchester has been described as being a “tougher” plant, being able to still produce well in less than ideal situations, whereas AC Island has the potential to produce the highest yield, but it does not perform as well in poor conditions. AC Island is a bean that is suited to an experienced bean grower that can identify and deliver all of the plants needs. Winchester is a tough bean that can be grown with some neglect.

White Mountain 2 demonstration

The variety White Mountain 2 yielded 3000 lb. /acre at the G. Carlson site and 2600 lb. /acre at the J. Boot site. The average White Mountain 1 yield is about 2300 lb. / acre.

The White Mountain 1 bean plant is a determinate bush type plant. Once it grows to a certain point it will stop producing flowers, thus limiting bean production.

The White Mountain 2 bean plant is an indeterminate bush plant. This means it will keep producing flowers throughout the season. This will maximize bean production.

The average yield of the White Mountain 2 in the 2010 projects demonstrated the benefit of the indeterminate plant over the determinate plant structure. White Mountain 1 is better suited to narrow row dry land production. White Mountain 2 will yield high in irrigated wide-row production

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Foreword bi-lateral agreement.

Irrigated Lentils, Canaryseed, and Oats Demonstration 2010

Project Lead

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Canada-Saskatchewan Irrigation Diversification Centre (CSIDC)
- Barry Vestre, Field Operations Supervisor, CSIDC
- Alan McDonald, Field Operations, CSIDC
- Industry support – fertilizer
  Rigas Karamanos, PAg, Agronomy Manager, Viterra; and
  Joe Tindall, Nexus Ag, Saskatoon.
- Industry support – seed
  Nakonechny Seeds, Ruthilda, Sask. ;
  M&M Seed Cleaning, St. Denis, Sask.; and
  Van Burch Seeds, Star City, Sask.

- Industry support – soil analysis
  Dale Hicks, Western Ag Labs, Outlook, Sask.

Project Objective

The objective of this project was to demonstrate the potential of irrigated production of lentils, canaryseed, and oats.

Project Background

Some crops do not respond with growth and yield to the application of water and the associated reduction in moisture stress. Yet, when market conditions are appropriate, these crops can be attractive to grow under irrigation even though they are not considered traditionally as irrigated crops. Three crops that fall into this category are:

1. oats,
2. canaryseed, and
3. lentils.

Oats are grown on dryland in regions of the province that have more moisture. The attraction of oats is the crop's ability to produce a relatively high yield with significantly reduced crop inputs. Irrigated soil often has higher residual nutrients because irrigated production has higher yield potential. These two factors interact to make oat an attractive irrigated crop when the price prospects for oats are favourable.

Lentils are one of the most profitable dryland crops. If crop pricing options are weak, some growers are willing to assume the extra cropping risk associated with disease during the reproductive stage, and delayed seed set from excessive vegetative growth.

Canaryseed has been described by some as the crop that yields poorly when the stand looks very good. If the crop appears weak, the seed set can compensate and the crop can still yield well. Canaryseed often responds poorly to good crop fertility. Growers receive little yield response from fertilization.

Demonstration Plan

Small, one-acre plots of lentils, canaryseed, and oats were sown at CSIDC to evaluate whether these crops can be grown under irrigation by modifying traditional irrigated practices. The strategy involved reduction of inputs and less frequent irrigation compared to usual irrigated crop management. This tactic was difficult to achieve in 2010. Soil fertility was managed using ion exchange technology and a computer model marketed by Western Ag Labs.

Demonstration Site

The demonstrations were located toward the southern side on NW12-29-8-W3 on a wind-eroded portion of the Knapik quarter of the CSIDC research farm. The texture of the soil was loamy sand with portions of the site having a buried topsoil layer at a depth of 25 cm. Rainfall received from April 1 to Sept. 16, 2010, was 460 mm and 64 mm of irrigation was applied.

Project Methods and Observations

Soil samples were collected in spring from the plot area and submitted to Western Ag Labs for analysis. This laboratory analyzes the soil using ion exchange membrane technology known as the Plant Root Simulator. The modeling program, the Forecaster, was used to determine the appropriate rates of nutrient application for the three crops. The nutrients supplied by the soil to each of these crops are summarized in Table 1.

Table 1. Soil nutrient levels at soil sampling points as measured by PRS probe for irrigated crop production (lb. nutrient/ac)

Crop	N	P	K	S	Ca	Mg	Cu	Zn	Mn	Fe	B
Oats	19	232	331	5.3	1048	180	0.14	0.30	4.03	2.82	0.44
Red Lentils	4	102	127	1.0	206	35	0.03	0.06	0.79	0.55	0.09
Canaryseed	7	86	123	2.0	389	67	0.05	0.11	1.50	1.05	0.16

The supply of nutrient varies among crops because the model interprets the effect of differing rooting systems among crop types on nutrient uptake. For the crops in this trial, oats has a much more aggressive root system than red lentil and canaryseed as far as nutrient acquisition and soil exploration are concerned.

The three crops were sown June 1, 2010, with a Salford single-disc air drill. CDC Minstrel oats, CDC Maxim lentils and CDC Bastia canaryseed were sown at three centimetre (cm) depth with 19 cm row spacing. The target population for the three crops was 25, 40, and 12 plants per ft^2 using the per cent germination of the seed and an assumed 90 per cent plant establishment. The crops were seeded first followed by a second pass applying the fertilizer. The fertilizers applied are summarized in Table 2.

In addition to N-P-K-S applied, copper and zinc were also applied using Frit Industries F212G copper from Walnut Ridge, Arkansas, USA, (12.5 per cent Cu, 4.5 per cent Zn) and Kronos Micronutrient zinc (35.5 per cent Zn) from Moxee, Washington, USA. Due to operator error, the rate of micronutrient applied was double the intended rate, but the crop growth was not injured.

Table 2. Nutrient applications for crop demonstrations in 2010

Crop	Nutrient applied (lb/ac)	Micronutrient Blend (lb nutrient/ac)	Target Yield (bu/ac)	Observed Yield (bu/ac)	Bushel Weight (lb/bu)
Oats	50-0-0-20	10 Cu & 12 Zn	110	162	35.0
Red Lentils	0-0-0-7	10 Cu & 12 Zn	40	None	60.5
Canaryseed	35-0-0-4	10 Cu & 12 Zn	31	22	52.0

Crop emergence was assessed on June 15 by counting the emerged plants in one metre of row in 20 locations within each crop. The counts were completed two weeks after seeding and are summarized in Table 3. Seedling loss was higher than expected given the frequent rainfall.

Table 3. Crop emergence two weeks after seeding

Crop	Growth Stage	Plant Density (seedlings/ft^2)	Target Plant Density (seedlings/ft^2)	% of Target
Oats	1-2 leaf	21.9	25	87.6
Red Lentils	4 node	9.9	12	82.5
Canaryseed	1 leaf	35.1	40	87.8

The harvested yields from the one-acre demonstrations are shown in Table 4. Clearly, lentil is more difficult to manage as an irrigated crop than oats or canaryseed.

Table 4. Harvest yields, 2010

Crop	Yield (bu./ac.)	Bushel weight (lb./bu.)	Moisture content (%)	Target yield
Oats	162 bu./ac.	35.0	11.9	111 bu./ac.
Red Lentils	None	----	----	40 bu./ac.
Canaryseed	22 bu/ac	52.0	11.7	31bu./ac.

Conclusion

Oats

The oats performed best among the three crops demonstrated. The oats looked impressive all season long and developed a rich-green color with minimal applied fertility.

Oat leaf disease pressure was low because of the low frequency of oats in the crop rotation.

CDC Minstrel was chosen as the oat variety because of its ability to withstand lodging.

The untimely rains in late August and early September 2010 arrived just prior to the intention to swath the oats. The crop lodged badly, but this allowed the crop to ripen without shatter loss until it was straight combined on Oct. 4.

The demonstration showed that oats can be grown profitably on irrigated land.

Red Lentils

The lentil plot was abandoned due to disease, weed pressure and lack of podding. This demonstration was not a good indication of the potential for lentil production under irrigation because of high rainfall this year and logistical problems involved with weed control and disease control. Irrigated fields are frequently cropped to canola so sclerotinia spores are common on these fields and the surrounding area. Control of this disease is essential to grow lentils successfully as a dryland crop in irrigated areas.

Figure 1: Lentil disease appearing in irrigated plot in July. White mold fungal ball forms on outside of lentil stem because the stem is too narrow to allow the usual development of the black schlerotia body inside the stem. Anthracnose lesions are also present.

Canaryseed
The canaryseed plot showed severe nutrient stress especially at the southern end of the plot area. The predominant symptom was withering of the oldest leaf on the two to three leaf canaryseed plants. Due to the lack of topsoil on this portion of the field, the soil fertility was very low. To address this issue, two different fertilizers were applied July 16. One strip received 100 lb. 20-0-0-24 and the second strip received 110 lb. 0-0-62. The strip receiving the extra nitrogen greened up slightly but the entire area of poor growth improved significantly about July 25 presumably because the roots of the plants began to grow into the layer of buried topsoil located at 25 cm depth. The impact of the additional fertilizer application is shown in Table 5.

Table 5: Impact of N and K on canaryseed yield

Plot yield	Yield (bu/ac)
Control	10.0
Plot yield	22.0
Plus 20 N	17.8
Plus 62 K_20	16.0

Figure 2: Nutrient deficiency of canaryseed observed during early growth on site. Note the withering oldest leaf on some of the plants. This symptom is consistent with either potassium deficiency or possibly nitrogen deficiency.

Both fertilizers improved the growth and yield of the canaryseed. The yield was reduced, however, by the nutrient stress during June and early July.

Canaryseed is an elastic crop that can respond in yield to an improvement in growing conditions by late tillering. The crop did not respond with increased yield to abundant moisture.

This demonstration did not show an advantage to growing canaryseed under irrigation. Given the correct shifts in crop input and grain prices, canaryseed may be a suitable crop for production under irrigation.

Crop Varieties for Irrigation – CSIDC 2010

Principal Investigators

- Terry Hogg, PAg, CSIDC
- Don David, CSIDC

Organization

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

Co-Investigators from Saskatchewan Ministry of Agriculture

- Gerry Gross, PAg
- Sarah Sommerfeld, PAg
- Rory Cranston, AAg
- Gary Kruger, PAg

Objectives

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

Research Plan

The CSIDC and selected producer sites were used as test locations in 2010 for conducting variety evaluation trials under intensive irrigated conditions. The sites selected included a range of soil types (Table 1) 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, triticale, corn), oilseeds (canola, flax, soybean, sunflower) and pulses (pea, dry bean, 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 federal government, academic institutions, and industry partners including AAFC research centres, the Crop Development Centre, University of Saskatchewan, among others (see Table 2).

Data collection included days to flower and maturity, plant height, lodge rating, seed yield, protein (cereals), test weight and seed weight. All field operations including land preparation, seeding, herbicide, fungicide and insecticide application, irrigation, data collection and harvest were conducted by CSIDC staff. Irrigation applications were conducted by the farmer co-operator at the producer sites.

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.

Results
The 2010 variety trials were established within recommended seeding date guidelines for the selected crops (Table 2). Climatic conditions in 2010 were cooler during the growing season (May – September) than the long-term average.

Precipitation was greater than the long-term average for all months except July, when precipitation was just below the long-term average. May and September were particularly wet with recorded precipitation four times the long-term average. Total growing season precipitation was 445 mm in 2010 compared to the long-term average of 219 mm.

The very wet conditions in May resulted in flooding of some plots for short periods of time. The cool and wet conditions during the growing season resulted in delayed maturity for all crops. Accumulated heat units (2107) were lower than the long-term average (2354) due to the cooler than average growing conditions. The later maturing crops, in particular corn, soybean and some dry bean varieties, did not reach physiological maturity prior to the first killing frost of -2^0 C that occurred on Sept. 18. Harvest conditions were poor for the early part of September, but improved conditions later in September and into October allowed for completion of harvest.

Overall, yields were generally good for most of the 2010 trials. Insect damage was minimal. Disease varied among the crops and sites. The dry bean trials had some white mold damage on specific varieties.

Yields for the canola trials were excellent. One canola trial had reduced yield due to excess moisture stress in May.

Wheat yields were high at all sites with highest yield occurring at the CSIDC and Pederson sites. There was a fair bit of disease present on the cereal trials and in particular durum varieties were hit the hardest.

The variability in the yields for pea and flax among the four sites was probably due to differences in site management and disease levels.

For the warm season crops, dry bean had average yields for some early maturing varieties and below-average yields for some of the later maturing varieties. As well, there were some issues with emergence with some of the dry bean varieties, probably due to the cool and wet soil conditions at seeding.

The corn silage and corn grain had average to below average yields respectively. The corn grain yields were very low with shrivelled kernels resulting in reduced test weight and seed size.

The soybean yields were average even though none of the varieties reached physiological maturity prior to the first fall killing frost.

The data from the trials was analyzed and only data that met minimum statistical criteria for variability were 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 2011 Crop Production Show. As well, the variety guide will be mailed to all irrigators early in 2011.

This work provides current and comprehensive variety information to assist irrigators in selecting crop varieties suited to intensive irrigated production conditions.

Table 1. 2010 variety trial locations and soil type.

Site	**Legal Location**	**Soil Type**
CSIDC main	SW15-29-08-W3	Bradwell very fine sandy loam
CSIDC off station	NW12-29-08W3	Asquith sandy loam
Pederson	NE17-28-07-W3	Elstow loam
Weiterman	SE & SW16-31-07-W3	Asquith sandy loam - fine sandy loam

Table 2. 2010 CSIDC variety trials and collaborators.

Trial	Collaborators	Location	Seeding Date
I. Cereals			
1. Irrigated Wheat Regional	ICDC	CSIDC - main CSIDC - off station Pederson Weiterman	May 17/10 May 13/10 May 14/10 May 14/10
2. SVPG CWRS Wheat Regional	Dr. R. Depauw, AAFC B. Recksiedler, SA J. Downey, SVPG	CSIDC - main	May 18/10
3. SVPG High Yield Wheat Regional	Dr. R. Depauw, AAFC B. Recksiedler, SA J. Downey, SVPG	CSIDC - main	May 18/10
4. SVPG CWAD Wheat Regional	Dr. R. Depauw, AAFC B. Recksiedler, SA J. Downey, SVPG	CSIDC - main CSIDC - off station	May 18/10 May 13/10
5. Soft White Spring Wheat Coop	Dr. H. Randhawa, AAFC	CSIDC - main	May 17/10
6. Soft White Spring Wheat Regional	Dr. H. Randhawa, AAFC	CSIDC - main	May 17/10
7. Triticale Variety Trial	ICDC	CSIDC - main	May 17/10
8. SVPG Barley Regional (2-row & 6-row)	Dr. B. Rossnagel, CDC B. Recksiedler, SA J. Downey, SVPG	CSIDC - main	May 18/10
9. Annual Cereal Forage (Barley, Triticale & Oats)	ICDC	CSIDC - main	May 18/10
10. ACC Hybrid Grain & Silage Corn Performance Trials	B. Beres, AAFC ACC	CSIDC - main	May 19/10
II. Oilseeds			
1. Irrigated Canola Regional	ICDC	CSIDC - main CSIDC - off station Pederson Weiterman	May 17/10 May 13/10 May 14/10 May 14/10
2. Canola Coop	R. Gadoua, CCC	CSIDC - main	May 17/10
3. SVPG Flax Regional	Dr. H. Booker, CDC B. Recksiedler, SA J. Downey, SVPG ICDC	CSIDC - main CSIDC - off station Pederson Weiterman	May 17/10 May 13/10 May 14/10 May 14/10
4. Soybean Variety Adaptation Trial	B. Brolley, MAFRI ICDC	CSIDC - main	May 18/10
5. Sunflower Hybrid Variety Trial	W. May, AAFC	CSIDC - main	May 18/10

Table 2 (continued)			
Trial	**Collaborators**	**Location**	**Seeding Date**
III. Pulses			
1. Irrigated Bean Variety Trial - Wide Row (Alberta)	Dr. P. Balasubramanian, AAFC ICDC	CSIDC - main CSIDC - off station	May 27/10 May 27/10
2. Dry Bean Wide Row Co-op	Dr. P. Balasubramanian, AAFC	CSIDC - main	May 27/10
3. Dry Bean Narrow Row Regional (Saskatchewan)	Dr. A. Vandenberg & Dr. K. Bett, CDC ICDC	CSIDC - main CSIDC - off station	May 27/10 May 27/10
4. Irrigated Bean Variety Trial – Narrow Row (Alberta)	Dr. P. Balasubramanian, AAFC ICDC	CSIDC - main CSIDC - off station	May 27/10 May 27/10
5. Dry Bean Narrow Row Co-op A&B	Dr. A. Vandenberg & Dr. K. Bett, CDC	CSIDC - off station	May 27/10
6. Irrigated Pea Regional	Dr. T. Warkentin, CDC ICDC	CSIDC - main CSIDC - off station Pederson Weiterman	May 17/10 May 13/10 May 14/10 May 14/10
7. Pea Coop A&B	Dr. D. Bing, AAFC Dr. T. Warkentin, CDC	CSIDC - off station	May 13/10
8. Faba Bean Co-op	Dr. A. Vandenberg, CDC	CSIDC - off station	May 13/10

Abbreviations:

CSIDC = Canada-Saskatchewan Irrigation Diversification Centre;
ICDC = Irrigation Crop Diversification Corporation;
SA = Saskatchewan Agriculture;
SVPG = Saskatchewan Variety Performance Group;
AAFC = Agriculture and AgriFood Canada;
CDC = Crop Development Centre,
U of S; ACC = Alberta Corn Committee;
CCC = Canola Council of Canada;
MAFRI = Manitoba Agriculture, Food and Rural Initiatives.

Forage Crops

Evaluation of Commercial Pasture Blends

Project lead
- Sarah Sommerfeld, PAg, Irrigation Specialist, Saskatchewan Agriculture
- Sarah Butler, 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; and
- To determine if irrigation provides a yield benefit to justify increased costs and management in comparison to dryland.

Research Plan
A randomized, replicated plot design of six pasture blends is managed to simulate intensive grazing. Forage is cut at the vegetative stage, corresponding to the three-to four-leaf stage or 20 to 25 cm (eight to 10 in.) in plant height. Data collected includes overall yield, persistence and species composition on a dry matter (DM) basis. Species persistence is evaluated prior to clipping by counting the number of plants. Species composition and change in composition is measured by hand harvesting a quarter meter quadrant, separating the vegetation according to species, drying the sample 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 provides the land and facilities to facilitate 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%
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 dryland 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 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 pure live seed for each forage variety. Plot dimensions are 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 m^2 = ***0.001482632*** ***acres***

Seeding Rate Calculation:

$$\text{Seeding rate (lb./acre)} = \frac{\text{seeds/ft}^2 \times \text{ft}^2\text{/acre / PLS}}{\text{seeds/lb.}}$$

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 11-52-0 at 50 lb. P_2O_5/acre, in October 2009.

Spring 2010 soil analysis indicated available nutrient levels of

19 lb. /acre NO_3-N,
43 lb./acre P, and
204 lb./acre K at the 0-30 cm depth.

Potassium fertilizer, as 0-0-62 at a rate of 15 lb. K_2O/acre, was broadcast April 20, 2010.

Nitrogen fertilizer was applied only to the cicer milkvetch and meadow bromegrass plots. These plots received 46-0-0 broadcast at 50 lb. N/acre on May 27, June 24 and Aug. 9. No herbicide applications were made.

A total of 460 mm of rainfall was received from April 1 to Sept. 16 and 112 mm of irrigation was applied to the trial area for 2010 growing season.

Data Collection

Two quarter-metre harvests were clipped from each plot on May 19. The species were separated, dried and weighed to determine the species 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 performed on May 26, June 23, July 26 and Aug. 16. Dry matter (DM) yield (Table 4) and grazing days per acre (Table 5) were calculated for each blend.

Discussion

Alfalfa is contributing, on average, approximately half of the biomass produced within each blend. In comparison to the 2009 establishment year data, the alfalfa contribution has declined in all blends with the exception of the Pickseed Haygraze Blend. The lowest average percentage of alfalfa contribution was found in the BrettYoung Super Pasture Blend at 44 per cent. The Pickseed Haygraze Blend recorded the highest average alfalfa contribution at 94 per cent.

The pasture blend that recorded the highest grazing days per acre was the BrettYoung Super Pasture blend, which provided 312 grazing days per animal unit per acre. It is important to remember that this is the first year of data collection and that the results should be interpreted as such.

Table 3. Per cent species composition at clipping harvest May 19, 2010.

Rep	Plot	Blend	Total Dry Wt (g)	Alfalfa	Meadow Brome	Smooth Brome	Cicer Milkvetch	Crested Wheatgrass	Tall Fescue	Orchard Grass	Intermediate Wheatgrass
1	1	Custom Blend #1	97.1	67.2%	32.8%						
	2	Northstar Custom Blend	31.7	89.0%	3.5%	0.3%			0.6%	6.5%	
	3	Custom Blend #2	31.35		99.8%		0.2%				
	4	BrettYoung Super Pasture Blend	28.4	74.7%	13.8%			7.5%	4.1%		
	5	Viterra Ranchmaster Blend	30.55	50.7%	21.2%				8.2%		19.9%
	6	Pickseed Haygraze Blend	54.45	94.8%	1.0%					4.2%	
2	7	Northstar Custom Blend	50.1	83.9%	6.6%	2.0%			0.6%	6.8%	
	8	BrettYoung Super Pasture Blend	37.6	45.1%	48.7%			1.9%	4.2%		
	9	Custom Blend #1	46.4	63.6%	36.4%						
	10	Pickseed Haygraze Blend	48.05	97.9%	0.2%					1.9%	
	11	Viterra Ranchmaster Blend	26.85	35.2%	38.8%				6.1%		19.8%
	12	Custom Blend #2	57.9		99.5%		0.5%				
3	13	Custom Blend #2	68.55		99.9%		0.1%				
	14	BrettYoung Super Pasture Blend	29.2	10.5%	46.5%			31.6%	11.5%		
	15	Custom Blend #1	83.5	34.7%	65.3%						
	16	Viterra Ranchmaster Blend	23.1	51.4%	31.2%				0.7%		16.7%
	17	Pickseed Haygraze Blend	122	96.2%	2.5%					1.3%	
	18	Northstar Custom Blend	34.65	36.5%	12.9%	7.6%			4.8%	38.3%	
4	19	Northstar Custom Blend	33.8	78.4%	4.9%	0.7%			2.0%	14.0%	
	20	Pickseed Haygraze Blend	59.4	87.6%	11.6%					0.8%	
	21	Custom Blend #1	54.8	56.1%	43.9%						
	22	Custom Blend #2	50.95		99.5%		0.5%				
	23	Viterra Ranchmaster Blend	51.75	64.7%	18.4%				7.8%		9.1%
	24	BrettYoung Super Pasture Blend	30.1	44.0%	26.6%			20.9%	8.5%		

Table 4. 2010 irrigation treatment harvest data.

Blend	Average DM Yield (ton/acre)				Average DM Yield per Cut (ton/acre)	% Chance of Achieving Average DM Yield per Cut*	Total DM Yield (ton/acre)
	Cut 1 May-26	Cut 2 Jun-23	Cut 3 Jul-26	Cut 4 Aug-16			
Custom Blend #1	0.99	0.83	1.39	0.86	1.02	68.76	4.07
Northstar Custom Blend	1.64	0.67	1.61	0.71	1.16	98.58	4.63
Custom Blend #2	1.34	0.97	1.20	0.94	1.11	89.90	4.44
Brett-Young Super Pasture Blend	2.75	1.16	1.19	0.97	1.52	99.80	6.06
Proven-Viterra Ranchmaster Blend	1.23	1.15	1.22	0.63	1.06	99.80	4.22
Pickseed Haygraze Blend	1.65	0.90	1.52	1.00	1.27	97.36	5.07

*Within half ton of cut average

Table 5. Grazing yields.

Blend	Total DM Yield (ton/acre)	Total DM Yield (lb./acre)	Total DM Pasture Yield (lb./acre)	Grazing days (AUM/acre)	Grazing days (AU days/acre)
Custom Blend #1	4.07	8978	6285	6.9	209
Northstar Custom Blend	4.63	10209	7146	7.8	238
Custom Blend #2	4.44	9788	6852	7.5	228
Brett-Young Super Pasture Blend	6.06	13363	9354	10.2	312
Viterra Ranchmaster Blend	4.22	9307	6515	7.1	217
Pickseed Haygraze Blend	5.07	11178	7824	8.6	261

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

Perennial Forage Biomass Measurement for Ethanol Production 2010

Project lead

- Sarah Sommerfeld, PAg, Irrigation Agrologist, Saskatchewan Agriculture
- Sarah Butler, 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)

Project Objective

The objective of this research project is 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 fuels 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 is managed to achieve a single cut harvest. Harvest timing occurs when the species reach physiological maturity or by Sept. 15. Total plot yield is recorded and a dry matter (DM) yield is calculated.

Demonstration Site

CSIDC provides the land and facilities to facilitate 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 are 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.

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 11-52-0 in October 2009 at 50 lb.P_20_5/acre.

Spring soil test nutrient levels indicated 21 lb. NO_3, 54 lb. P, and 224 lb. K available per acre at the 0-30 cm depth.

On April 20, 2010, 46-0-0 and 0-0-62, were broadcast at rates of 100 lb. N/acre and 15 lb. K_20/acre. No herbicides were applied in 2010. The total rainfall received from April 1 to Sept. 16, 2010, was 460 mm and 112 mm of irrigation was applied.

Harvest Data

A single total biomass cut was harvested on July 26, 2010. Average DM yields for each species are reported in Table 2.

Table 2. Average DM harvest yield data for each grass species.

Species	Average DM Yield (ton/acre)	% Chance of Achieving Average Yield*
Smooth Bromegrass	8.03	25.1
Intermediate Wheatgrass	7.94	67.8
Hybrid Bromegrass	7.18	91.6
Tall Wheatgrass	6.77	35.4
Crested Wheatgrass	5.85	84.7
Slender Wheatgrass	5.74	34.7
Meadow Bromegrass	4.90	41.1
Western Wheatgrass	4.38	39.7
Russian Wildrye	3.75	82.6
Switchgrass	1.96	50.9

*Within 1 ton

Discussion

The 2010 yield data indicates that smooth bromegrass, intermediate wheatgrass and hybrid bromegrass were the three most productive perennial forage species with hybrid bromegrass producing the most consistent plot yield. An average yield increase was documented for all grass species in comparison to the 2009 establishment year harvest data. Data collection will continue in 2011.

Alfalfa Management Trial 2010

Project Lead

- Sarah Sommerfeld, PAg, Provincial Irrigation Agrologist, Saskatchewan Agriculture
- Sarah Butler, ICDC summer student

Co-Investigators

- Charlotte Ward, PAg, Regional Forage Specialist, Saskatchewan Agriculture
- Barry Vestre, Canada-Saskatchewan Irrigation Diversification Centre (CSIDC) Field Operations

Industry Co-operators

- Neil Mcleod, Northstar Seeds Ltd.
- Ellis Clayton, Pioneer Hi-Bred
- Peter Novak, Viterra
- Art Klassen, BrettYoung Seeds
- Kevin Dunse, Pickseed
- Nicole Tanner, FarmPure Seeds*
  **Since the establishment of this trial, FarmPure Seeds has been acquired by Pickseed. Pickseed now places two varieties in this trial.*

Project Objective

The objective of this research project is to compare the yield performance of seven alfalfa varieties under an intensive three-cut management system.

Research Plan

A randomized field-scale trial of seven alfalfa varieties replicated three times is managed to harvest three cuts. Cut timing is based on calendar dates of June 15, Aug. 1, and Oct. 1. Fertility management includes annual applications of phosphorus and potassium, at 75 lb. /acre actual nutrient. Irrigation applications are scheduled through weekly monitoring of soil moisture and daily crop water use by an irrigation agrologist. Harvest protocol requires the plots to be cut and weighed with a forage harvester.

Demonstration Site

The project site is located at CSIDC, which provides land and staff to perform the field operations necessary to conduct this research trial.

Project Methods and Observations

Variety Selection

Variety selection was targeted at providing a fair market representation of current alfalfa varieties that were specific to intensive management under irrigation. All varieties, except AC Blue J, were provided by industry. These variety descriptions were taken from product resource materials.

Secan

AC Blue J is a taprooted variety, suited for hay or pasture use, that also serves as the irrigated check for the trial.

Pioneer

53Q30 is a high performance variety exhibiting good forage quality and winter hardiness.

Viterra

Equinox alfalfa variety is suited for an intensive management system with rapid re-growth, high yield and winter hardiness characteristics.

Northstar Seeds Ltd.

Stealth SF is a multifoliate variety with high overall feed quality. This variety carries the unique Standfast™ trait, a feature that is claimed to promote a faster recovery rate following cutting. Multifoliate varieties exhibit a proportion of leaves with five to eleven leaflets per leaf rather than the three leaflets per leaf in trifoliate varieties. Multifoliate leaf expression provides for higher forage quality.

BrettYoung Seeds

Hybriforce 400 alfalfa features improved establishment, winter hardiness and rapid re-growth. It is the only hybrid alfalfa variety available on the market.

Pickseed

2065 MF is a multifoliate variety that exhibits rapid regrowth, excellent winter hardiness and persistence in the stand.

AC Longview has excellent regrowth capability, good stand longevity and winter hardiness.

Establishment and Crop Management

This field scale plot trial was direct seeded into stubble on June 4, 2008, at a seeding rate of 12.6 lb./acre for each variety. The Equinox variety was re-seeded on July 2, 2008, due to a seeding equipment malfunction.

A fall soil analysis in September 2009 showed levels of seven lb.NO_3-N/acre, 30 lb. P/acre and 392 lb. K/acre available in the 0-30 cm depth. A broadcast application of 11-52-0 was applied in October 2009 at 75 lb.P_20_5/acre.

On April 20, 2010, 0-0-62 was applied at 75 lb. K_20/acre. No herbicides were applied. Site rainfall was recorded at 460 mm from April 1 to Sept. 16 and 77mm of irrigation was applied from May to September.

Data Collection

Forage harvest occurred on June 23, July 28 and Sept. 24, 2010. Two yield measurements were recorded for each plot per cut. The average dry matter (DM) yield per cut for each variety is reported in Table 1. The total average DM yield is summarized in Table 2.

Table 1. 2010 average dry matter (DM) yield per cut.

Cut 1	Jun-10	Cut 2	Jul-28	Cut 3	24-Sep-10
Variety	DM Yield (t/acre)	Variety	DM Yield (t/acre)	Variety	DM Yield (t/acre)
Hybriforce 400	2.20	AC Longview	1.82	Hybriforce 400	0.87
AC Longview	2.24	Stealth	1.93	Stealth	0.87
AC Blue J	2.29	54Q30	2.03	AC Blue J	0.93
54Q30	2.41	AC Blue J	2.05	Equinox	0.93
Equinox	2.42	Equinox	2.08	54Q30	0.98
2065MF	2.42	Hybriforce 400	2.23	AC Longview	0.99
Stealth	2.42	2065MF	2.36	2065MF	1.04

Table 2. 2010 total average dry matter (DM) yield.

Variety	Total Average DM Yield (t/acre)
AC Longview	5.05
Stealth	5.22
AC Blue J	5.27
Hybriforce 400	5.30
54Q30	5.42
Equinox	5.43
2065MF	5.82

Final Discussion

Total average DM yields have increased in all varieties in comparison to the 2009 harvest data, as reported in the ICDC Program Final Report 2009. The range of increases in average yields was from a low of 0.21 t/acre in the variety AC Longview up to a high of 1.8 tonnes/acre (t/ac.) in the variety 2065 MF.

The specific reasons for the yield increases are not completely understood. Possible explanations could be that the crop benefited from the additional growing season rainfall and that moisture stress was not as prevalent. Other possible explanations include that the varieties are at the peak stage of their production cycle and that the fertility plan is optimal. This is the second year of data collection and data collection will continue in 2011.

References

Irrigation Crop Diversification Corporation. 2009. ICDC Program Final Report.

Irrigated Salt Tolerant Alfalfa Variety Demonstration 2010

Project Lead
- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Agriculture, Outlook, Sask.

Co-Investigator
- Dr. Harold Steppuhn, PAg, Research Scientist, Salinity Hydrologist, Semiarid Prairie Agricultural Research Centre (SPARC), Agriculture and Agri-Food Canada, Swift Current, Sask.
- Garth Weiterman, PAg, Senior Irrigation Agrologist, Saskatchewan Agriculture, Outlook, Sask.

Co-operator
- Barry Vestre, Field Operations Supervisor, Canada-Saskatchewan Irrigation Diversification Centre (CSIDC), Outlook, Sask.

Industry support
- Don Miller, Director of Product Development, Producer's Choice Seeds, Nampa, Idaho, USA
- Dale Hicks, Western Ag Labs, Outlook, Sask.

Project Objective

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

Project Background

Alfalfa is grown on many acres in Saskatchewan because of its ability to tolerate salinity and to produce excellent quality forage where other crops struggle to survive. Preliminary testing done by Dr. Harold Steppuhn of the Salt Testing Laboratory, located at SPARC, identified three varieties with superior salt tolerance:

1) L4039 SC Salt;
2) CW34024; and
3) CW064027.

AC Bluejay was chosen as the control for the comparisons. AC Bluejay is a proven forage alfalfa variety widely grown under irrigation.

CW34024 developed by Calwest Seeds is currently marketed by Viterra Seed under the variety name, Halo.

L4039 SC Salt was developed at Lethbridge and CW064027 was developed by Calwest Seeds.

Demonstration Plan
The salt-tolerant alfalfa demonstration was sited at CSIDC in Outlook. The site for the demonstration was selected using a Global Positioning System (GPS) referenced soil salinity reconnaissance map prepared by the Soils Unit of Saskatchewan Agriculture in 2007 (Figure 1). Another preliminary salinity survey using a hand-held EM38 was conducted in spring of 2010. A third survey was conducted in October 2010 to monitor changes in the soil salinity.

Demonstration Site
The site is located on Field 12 at CSIDC. The field is irrigated with a Valley irrigation pivot. The field had been planted to triticale for green feed for two years prior to planting to alfalfa in June 2010. Soil samples were collected in spring 2010 and submitted to Western Ag Labs, Outlook, for analysis. The results are reported in Table 1. The reports indicate that, for alfalfa production, potassium is recommended for the north side and sulphur is recommended for the south side.

Project Methods and Observations
The varieties were seeded in 2010 and persistence and yield data will be collected in 2011 to compare the salt tolerance of the varieties. The four varieties were sown in long narrow strips across Field 12 of the research farm at the CSIDC. The strips were 1.5 m wide x 600 m long. They were sown with a six-row research drill on June 29, 2010. The seeding rate was nine kg seed/ha and the seeding depth was 1.5 cm. The strips were sown in two blocks of the four varieties with the restriction that each variety be adjacent to each of the other varieties between the two blocks.

The demonstration area was sprayed with Cobutox 400 at one L/ac. on July 30, 2010, to control redroot pigweed and shepherd's purse and other broadleaf weeds on the site. The site was cut for hay following frost on Sept. 18, 2010. A salinity investigation was conducted on Oct. 21 and a map of the salinity observations was completed.

In the year following establishment, a field verification technique will identify spots where a difference in growth and /or salt tolerance is observed. One of the difficulties of working with soil salinity is the extent that it varies over an area. For the purposes of this experiment, the field verification technique assumes that soil salinity within a two m^2 area is uniform but may be known only approximately.

Locations along the variety borders will be identified where the alfalfa varieties respond differently on the basis of plant vigour and persistence presumably due to the salinity in the soil. At these points, dry matter yield will be measured and a soil sample will be collected. The electrical conductivity of the soil at the dry matter yield sampling sites will allow the relative salt tolerance of the varieties to be documented.

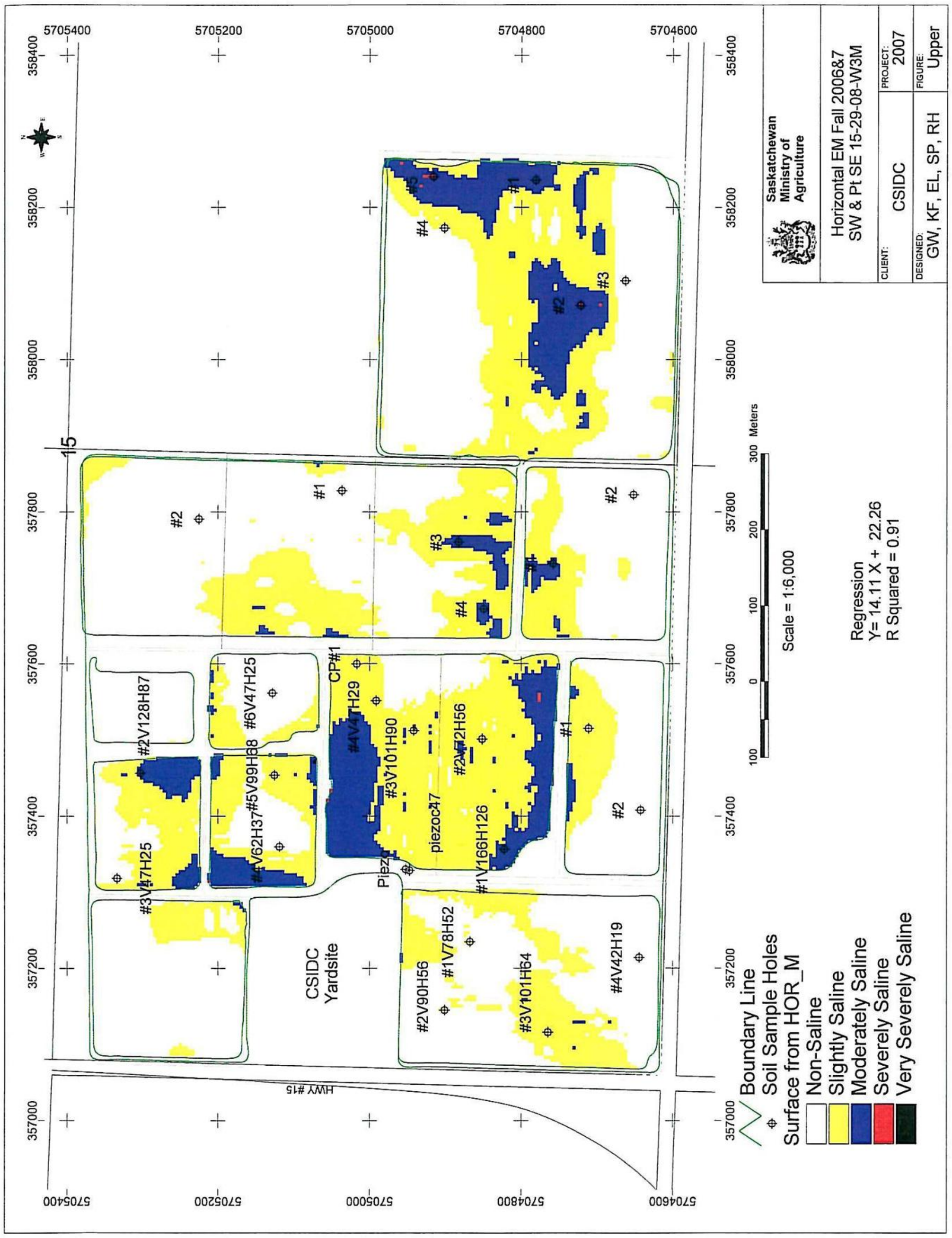

Figure 1: Salinity reconnaissance conducted in fall 2007.

Final Discussion

A field technique has been developed to evaluate the salt tolerance of alfalfa varieties. This work acts as a field verification for preliminary research conducted at the Salt Testing Laboratory at SPARC.

The project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bilateral agreement.

P and K Fertilization of Irrigated Alfalfa Demonstration 2010

Project Lead

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Producer – Greg Oldhaver, Cabri
- Industry support
  - Dr. Rigas Karamanos, PAg, Agronomy Manager, Viterra (fertilizer);
  - Dale Hicks, Western Ag Labs, Outlook, Sask. (soil analysis); and
  - ALS Laboratories, Saskatoon.

Project Objective

The objective was to evaluate the nutrient needs of newly seeded and established alfalfa for improved yield, stand longevity, and competition with weeds (dandelion). The purpose of the fertilization was to improve the yield and quality of the forage stand so as to enhance the vigor of the alfalfa plants and compete more effectively with weeds.

Project Background

Soil testing of established, heavy-textured, irrigated alfalfa fields indicates different fertilization priorities depending on how the soil is analyzed. Conventional soil testing suggests established alfalfa fields require predominantly phosphorus application while Western Ag Labs' plant root simulator analysis tends to recommend application of potassium.

Demonstration Plan

This demonstration intends to increase alfalfa yield through balanced fertilizer application. The demonstration field was divided into four strips for application of the following fertilizer treatments: phosphorus alone, potassium alone, phosphorus and potassium together, and a control.

Demonstration Site

The demonstration was located on Plot 10 of NE19-21-18-W3 of the Miry Creek Irrigation District. The soil is clay texture. This field was originally leveled for flood irrigation in 1977.

After the growers recognized the improvement in water-use efficiency possible with sprinkler irrigation, the district's water delivery system was converted from flood to wheel line irrigation in 1988.

During these construction changes, soil at the west end of Plot 10 was moved into the middle section of the field while the soil at the east side was relatively intact. The western end of the field was essentially scalped into the middle section to provide a relatively level irrigation field. The fertilizer strips were oriented east and west to minimize the impact of this variability on the demonstration.

Project Methods and Observations
Soil samples were collected from plot 10 in spring of 2009 for analysis at ALS Laboratories and fall of 2009 for analysis at Western Ag Labs. The original plan was to band the fertilizer using a disk banding implement to minimize the disturbance to the established alfalfa.

With delays in implementing the project in spring, the alfalfa was tall before the fertilizer could be applied to the field. To avoid harm to the hay stand from driving in the field, fertilizer application was delayed until after the first cut was harvested. The fertilizer treatments were broadcast July 26.

Table 1 describes the nutrient treatments. Table 2 shows the results of the two methods of soil analysis. The two methods are based on different principles of measurement, and are, therefore, not directly comparable. The conventional soil test measures the concentration of nutrient in the soil. The plant root simulator probe measures the rate of diffusion of nutrient to a root surface.

Table 1. Schedule of treatments and fertilizer applications made to Plot 10 at Miry Creek Irrigation Project.

Treatment	Nutrient Applied	Blend Analysis
P_20_5	21-100-0-0	11-52-0 @192 lb/ac
K_20	0-0-120-0	0-0-60 @ 200 lb/ac
$P_20_5 + K_20$	21-100-120-0	5-26-31-0 @ 392 lb/ac
Control	Control	0-0-0-0

Table 2. Soil analysis of samples collected from Field 10 at Miry Creek Irrigation District (lb nutrient /ac)

Soil Analysis	N	P	K	S	Ca	Mg	Cu	Zn	Mn	Fe	B
Conventional	22	5	784	82+	-	-	-	-	-	-	-
Plant Root Simulator Probe	4	88	30	230	1994	246	0.66	0.47	43.3	15.2	3.7

The hay at this site was baled on Oct. 11 and weighed Oct. 13. Yields for the treatments were determined by calculating the area harvested for three bales from each treatment. The hay yields reported in Table 3.

Table 3. Hay yields produced for the second cut when fertilizer was broadcast following the harvest of the first cut at Miry Creek Irrigation

Treatment	Nutrient Applied (lb./ac.)	Blend Analysis	Second Cut Forage Yield (t./ac.)
P_20_5	21-100-0-0	11-52-0	1.54
K_20	0-0-120-0	0-0-60	1.09
$P_20_5 + K_20$	21-100-120-0	5-26-31-0	1.57
Control	0-0-0-0	None	1.16

The hay yields harvested from the second cut at Miry Creek are reasonable yields for a single cut, but demonstrate that this aged alfalfa stand benefited from broadcast phosphorus fertilizer much more than from potassium fertilizer.

Economic evaluation of the benefit shown in this demonstration for phosphorus and potassium fertilization on aged alfalfa stands indicates that the hay yield increase at these rates does not justify the cost.

A tonne of $500/tonne fertilizer will fertilize 11 acres at 200 lb. /acre. A yield increase of 0.4 tonnes/acre is worth $24/acre or under $300 for 11 acres. The price of hay would need to double with no corresponding increase in the price of fertilizer to justify its use on the hay field. This assumes that the quality of the feed and weight gain of the cattle is comparable between the unfertilized and fertilized stands. This assumption is not practical. The quality of hay with a significant proportion of alfalfa will be more nutritious than one with little alfalfa in the stand.

A second assumption is that the benefit from fertilization does not last beyond the current hay harvest. This assumption is also not true. Phosphorus and potassium fertilizer is not all used by the first crop but will have residual effect and contribute to increased hay yield for several growing seasons. An application of 50 pounds of P_20_5/acre would likely provide a similar yield response to the observation in this demonstration.

The new seeding of alfalfa was planned for Plot 13 at the Miry Creek Irrigation District in 2010. The alfalfa was not able to be seeded before early July so the producer decided to delay seeding the stand until 2011. The fertilizer was applied with a knife banding implement on Nov. 6, 2010.

The treatment schedule is similar to the fertilizer applications to the established stand with the exception that the strip with both P and K applied will be split into two portions with four pounds Zn/acre blended with the PK blend applied to half of the PK strip (Table 4). The demonstration will evaluate whether potassium is more beneficial when applied earlier in the life of the hay stand.

Table 4: Treatment schedule for new seeding which has been delayed until spring 2011

Treatment	Nutrient Applied	Blend Analysis
P_20_5	21-100-0-0	11-52-0 @192 lb/ac
K_20	0-0-120-0	0-0-60 @ 200 lb/ac
$P_20_5 + K_20$	21-100-120-0	5-26-31-0 @ 392 lb/ac
$P_20_5 + K_20$ + Zn	21-100-120-0 + 4 lb. Zn/ac	5-26-31-0 @ 392 lb/ac + 11 lb. Zn fertilizer /ac
Control	Control	0-0-0-0

Final Discussion

This demonstration illustrates that irrigated alfalfa on aged stands respond well to applications of phosphate fertilizer.

The rates of application in this demonstration were relatively high and the cost of the high rates is a factor in the marginal cost benefit.

An increase in the longevity of a stand by fertilization is an added benefit that needs to be considered when evaluating the benefit of an agronomic practice.

The project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.

Irrigated Annual Forage Cereal Demonstration 2010

Project Lead

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Producer – Pat Hayes, Val Marie, Sask.
- Industry support

Fertilizer

– Rigas Karamanos, Agronomy Manager, Viterra
– Joe Tindall, Manager, Nexus Ag

Seed

– Bill Latrace, Caronport, Sask.
– Chris Churko, Cereals and Special Crops, Viterra, Regina, Sask.
– Embryo Seeds Inc., Mannville, AB
– Medernach Farms, Cudworth
– Wes Woods, Secan
– White Mud Trading Co. Inc., Frontier, Sask.

Soil analysis

– Dale Hicks, Western Ag Labs, Outlook, Sask.

Project Objective

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

Project Background

Annual cereals are an important component of crop rotation for flood irrigated districts. Annual forages are grown to maintain feed supply for cattle production while long term perennial forage stands are being re-established.

Demonstration Plan

Seven varieties of annual cereals were sown on individual border dykes (Table 1). The annual cereals were not able to be harvested because of poor establishment.

Table 1. Varieties included in the annual cereal demonstration.

Variety	Crop Type	Seed Supplier
Xena	Two row feed barley	Viterra Seed
Sundre	Six row feed barley	Bill Latrace
Meredith	Two row malt barley	Kim Medernach
CDC Copeland	Two row malt barley	Kim Medernach
CDC Cowboy	Two row feed barley	White Mud Trading Co. Inc.
Champion	Two row feed barley	Viterra Seed
AC Ultima	Spring triticale	Embryo Seeds

Demonstration Site

The demonstration site was located on SW29-3-13-W3 on Plot 100 of the Val Marie Irrigation District. Twelve border dykes were broken removing a perennial bromegrass/alfalfa mixture during the fall of 2009. The producer planned to seed annual cereals during 2010 to provide forage for his livestock operation during the interim in preparation for re-establishment of perennial alfalfa on these plots. The heavy clay soil was very difficult to manage.

Soil samples were collected in spring 2010 to assess nutrient requirements for planting annual cereals. Flood irrigated fields are typically established with a land leveler to develop adequate grade from the top to the bottom of the field. Soil is usually dragged from the drain to the head ditch. This practice generally causes the topsoil at the head ditch end of the field to be thicker than at the drain end.

Two soil samples were collected from the field – one from the drain and the second from the head ditch end. Each sample was a composite of subsamples collected from five border dykes selected at random.

The samples were analyzed at Western Ag Labs using Plant Root Simulator probes and the nutrient supply rates processed using the PRS Forecaster modeling program to interpret the analysis. For barley production, the analysis recommended application of N, P, and K. Zinc was not recommended for barley on the basis of either soil sample, but was included in the fertilizer blend as a precaution. Soils which have been disturbed are prone to inadequate supply of zinc and barley is sensitive to zinc deficiency on such soils.

The nutrients measured by ion exchange resin membrane during a 24-hour incubation and modeled by the PRS Forecaster from Western Ag Lab are shown in Table 2. The more significant differences show the upper slope of the border dykes have better N, P, S and micronutrient supply rates compared to the drain end of the border dykes. Potassium and boron supply rates are exceptions to this observation and are contrary to what was expected.

Table 2: Soil nutrient levels at Val Marie measured by the PRS probe for alfalfa production (lb/ac)

Sampling area	N	P	K	S	Ca	Mg	Cu	Zn	Mn	Fe	B
Head ditch	43	14	50	286	620	202	0.99	0.50	3.77	4.12	0.16
Drain	19	7	55	146	517	189	0.41	0.17	2.20	2.59	0.19

Project Methods and Observations

The field was fertilized with a blend based on the upper slope sample. The nutrient rate applied, 50 N – 20 P_20_5 – 50 K_20, was broadcast to the border dykes and incorporated by cultivation. The blend included four pounds Zn/acre (11 pounds Zn fertilizer) as prilled zinc sulphate (35.5 per cent Zn).

Precipitation at Val Marie during 2010 was not unusually high (Tables 3 and 4). Frequent rainfall, however, kept the soil very wet and obtaining a desirable soil structure for seeding was difficult. The heavy clay soil is suitable for tillage over a narrow moisture range. In an attempt to prepare a satisfactory seedbed, a roller filled with water for ballast was pulled over the border dykes to firm the soil. The sun quickly dried the soil and the surface formed a crust that was difficult for the seeding equipment to penetrate (Figure 1).

Seeding of the demonstration was attempted on June 28, 2010. An IH 6200 double disk drill failed to penetrate into the soil. A 3.66 m. Haybuster 1206 drill was able to penetrate the soil to a depth of about 1.5 inches, but uniform seed placement over the width of the drill was not achieved. The 12 border dykes were planted to the annual cereals at 2.3 bushels of seed per acre. Following seeding, several light showers fell on the site, but due to the heavy soil texture and difficult soil structure, rainfall was insufficient to moisten the heavy clay soil enough to germinate the seeds.

The soil formed a tough crust and emergence was very poor. Emergence was estimated at three plants per square foot (plants/ft^2) compared to a desired plant density of 25 plants per ft^2 (Figure 2). The field was irrigated during the second flood period at the beginning of August but few new seedlings established. The stands on Sept. 17 were too sparse and inconsistent to collect a meaningful square meter sample from the demonstration.

Table 3: Precipitation and growing degree days at Val Marie over the past decade.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Precipitation (mm)	123	245	231	284	369	329	313	251	207	312
GDD (5^oC)	1695	1500	1629	1302	1196	1571	1578	1564	1377	1409

Table 4: Distribution of precipitation at Val Marie during the 2010 growing season

Month (2010)	April	May	June	July	August	September	October
Precipitation (mm)	39	88	59	43	49	28	6

Source: www.farmzone.com


Figure 1 (left): The drill had difficulty penetrating the soil and many of the seeds were sitting on top of the soil following seeding.

Figure 2 (right): Cereal establishment was too inconsistent to harvest a meaningful sample from the site.

Conclusion

Farmers on the flood irrigation projects in southwest Saskatchewan are reluctant to remove established forage stands due to re-establishment difficulties. Unlike sprinkler irrigation projects, gravity projects do not provide the option of irrigating a crop as an establishment aid. On gravity fields, the flooding operation can cause erosion and crusting when the area is not protected by an established crop.

In 2010, this project demonstrated the difficulty farmers have faced in the past. The objective of this project was to evaluate forage yield and quality of annual cereals and this objective still has merit. However, the untimely absence of rain – at the critical establishment stage for the crops to be evaluated – ruined the project.

A decision to retry this project again in 2011 has not been made as yet.

Waldeck Irrigated Alfalfa Variety Demonstration 2010

Project Lead

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Producer, Lane Wilms, Waldeck, Sask.
- Industry support

Seed – Art Klassen, BrettYoung Seeds
– Kevin Dunse, Pickseed
– Vern Turchyn, Viterra
Fertilizer – Rigas Karamanos, PAg, Agronomy Manager, Viterra
Soil analysis – Dale Hicks, Western Ag Labs, Outlook, Sask.

Project Objective

The objective was to evaluate the yield of several varieties of established alfalfa for improved yield, stand longevity, and competition with weeds (dandelion).

Project Background

Demonstration Plan

The field was sown to alfalfa in 2006. The cooperator was disappointed with the alfalfa yield in 2009 and planned to fertilize to increase the forage yield in 2010. Yield was evaluated by baling the strips and weighing bales to estimate alfalfa hay yield. Quality evaluation of the forage was to be conducted on core samples collected from the hay bales if the fertilization was effective in improving the yield.

Demonstration Site

The demonstration site was located northeast of Swift Current on NE27-16-12-W3 on Plot 55 in the Waldeck Irrigation District. The field is irrigated by flood only in spring for 2010 and the soil is located in the Brown Soil Zone and has a clay texture.

Project Methods and Observations

Soil samples were collected from the field in spring of 2010 and analyzed at Western Ag Labs. According to this analysis, phosphorus was adequate but the alfalfa stand required 110 lb K_20/ac and 11 lb S/ac.

The blend of 4-0-49-4 was to be banded at 225 lb/ac. This application was not able to be completed in spring or following the harvest of the first cut of alfalfa.

As in 2009, the first cut produced a respectable forage yield, but the second cut did not yield very well. Only four bales were harvested from the second cut in 2010 and the individual strips did not yield enough to measure the yield using a truck mounted bale scale.

Table 1. Soil analysis of area sown to alfalfa variety demonstration at Waldeck Irrigation District (lb nutrient/ac)

Sampling area	N	P	K	S	Ca	Mg	Cu	Zn	Mn	Fe	B
Variety plots	50	106	58	14	1260	400	0.24	0.28	5.06	3.72	0.69

The forage yield for two cuts in 2008 and the first cut in 2009 and 2010 is summarized in Table 2. Second cuts were harvested in all years but the yields were too low in 2009 and 2010 to obtain at least one bale from each border dyke. The reduced second cut yield in 2010 is likely related to the irrigation district decision to not irrigate following the first cut.

The highest yielding variety in 2010 was the lowest yielding variety in 2009. The highest yielding variety in 2009 had the lowest yield in 2010.

An important consideration when looking at relative forage yields for varieties is whether the field has received regular fertilization. For this particular demonstration, no fertilizer was applied over the course of the four years that the stand was in production. If a stand is fertilized, those varieties which are more responsive to fertilizer will perform well. Those which are able to mine nutrients because of a more aggressive root system may perform relatively poorer when compared to other varieties which have a less aggressive root system when grown in a situation where adequate fertilizer is applied. Root development will respond to fertilization and affect growth of varieties differentially. This demonstration did not receive fertilization so varieties which need good fertility to perform well may be disadvantaged in this demonstration.

Table 2: Summary of forage yield at North Waldeck, 2008-10

Variety	2008	2009	2010	Three year total
Conroy	3.69	1.43	2.61	7.73
Equinox	3.18	1.8	2.48	7.46
Spredor 4	2.95	1.88	2.35	7.18
Ameristand 201	3.03	1.81	2.28	7.12
Geneva	3.17	1.56	2.36	7.09
Magnum 3801	3.28	1.54	2.22	7.04
Gala	2.78	1.76	2.47	7.01
Starbuck	2.91	1.81	2.27	6.99
AC Longview	2.74	1.89	2.09	6.72
Hybriforce 400	1.94	1.64	2.14	5.72
# of cuts	2 cuts	1 cut[1]	1 cut[1]	

[1] The second cut was harvested, but the yield was too low to obtain at least one bale from a single border dyke.

Final Discussion

Irrigation improves consistency of forage yield, but other environmental factors such as temperature and humidity affect the growth of alfalfa as well.

The demonstration found that Conroy and Equinox are two varieties that yield well on flood irrigated heavy textured soils. Yields vary from year to year with changes in environmental conditions.

Consul Forage Demonstration 2010

Project Lead

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Producer – Scott Sanderson, Consul
- Industry support

Seed — Art Klassen, Brett-Young Seeds, Regina, Sask.
— Neil McLeod, Northstar Seeds, Rosetown, Sask.
— Kevin Dunse, Pickseed, Lethbridge, Alta.
— Christy Nyholt, Pioneer, Saskatoon, Sask.
— Vern Turchyn, Viterra Seed, Lethbridge, Alta.
Variety advice — Trent Whiting, Secan, Lamont, Alta.
Soil analysis — Dale Hicks, Western Ag Labs, Outlook, Sask.

Project Objective

The objective was to demonstrate 17 alfalfa varieties on a field scale to irrigation farmers in the Consul area of Saskatchewan

Demonstration Plan

The plan was to collect yield data from an established forage demonstration. Each variety was planted side-by-side on adjacent border dykes.

Demonstration Site

The demonstration site was located north of Consul on NW13-4-27-W3. The field was irrigated by spring flood irrigation. The stand was seeded in June 2007 using a mixture of eight pounds (lb.) of alfalfa, 20 lb. of wheat, and ¾ lb. crested wheatgrass.

Project Methods and Observations

The alfalfa varieties established well in 2007, but no yield data was collected during 2008 and 2009 because no irrigation was allocated to this field. The growing season of 2009 was particularly dry. With the change in rainfall and an allocation of irrigation water, the growth of hay in 2010 was excellent.

The hay was swathed July 11, 2010, and baled July 16. The bales were weighed July 27. Yields were excellent for alfalfa managed in a one-cut system under flood irrigation. The summary of the hay yield is presented in Table 1.

The top performing variety in this one replicate demonstration was Equinox. Rangelander was a close second. The slower regrowth of creeping rooted-alfalfa varieties was evident in the plots when the bales were weighed on July 27. The site has received no fertilizer since it was seeded in 2007. Prior to seeding, 11-52-0 was broadcast and incorporated at a rate of 10 lb. P_20_5/ac.

Table 1. Forage yield of alfalfa varieties at Consul Demonstration Site.

Variety	Root Type	Leaf Type	Yield t/ac	Seed Provider
Equinox	tap root	tri-foliate leaf	2.58	Viterra
Rangelander	creeping root	tri-foliate leaf	2.52	Secan
Beaver	tap root	tri-foliate leaf	2.49	Public
53V52	tap root	tri-foliate leaf	2.46	Pioneer
53Q30	tap root	tri-foliate leaf	2.36	Pioneer
AC Longview	tap root	tri-foliate leaf	2.27	Pickseed
Spredor 4	creeping root	tri-foliate leaf	2.26	Viterra
Ameristand 201+Z	sunken crown	tri-foliate leaf	2.23	Viterra
AC Grazeland*	tap root	tri-foliate leaf	2.16	Pickseed
Starbuck*	tap root	multi-foliate	2.14	Pickseed
3006	creeping root	multi-foliate	2.11	Pickseed
2065MF*	tap root	multi-foliate	2.03	Pickseed
Hybriforce 400	tap root	hybrid tri-foliate leaf	2.03	BrettYoung
Runner	creeping root	tri-foliate leaf	2.02	Northstar
Tophand	tap root	multi-foliate	2.02	Northstar
Algonquin	tap root	tri-foliate leaf	1.98	Public
54V46	tap root	tri-foliate leaf	1.96	Pioneer
Rhino	tap root	tri-foliate leaf	1.68	Northstar

As a preliminary investigation into the variability of yield within the alfalfa stand, a set of four soil samples were collected June 24 from the border dyke seeded to Hybriforce 400. The collection started near head ditch and ended toward the drain of the same border dyke.

The alfalfa growth was visually taller and more vigorous at sites #1 and #2 compared to sites #3 and #4. The soil analysis of these sites is summarized in Table 2.

Table 2. Soil nutrient levels at soil sampling points as measured by PRS probe for alfalfa production (lb. /ac.)

Sampling site	N	P	K	S	Ca	Mg	Cu	Zn	Mn	Fe	B
#1	31	470	62	6	1180	191	0.25	0.31	5.33	2.76	1.70
#2	75	796	86	12	1120	161	0.33	0.38	4.76	2.16	0.10
#3	27	1330	93	10	1300	212	0.23	0.18	11.89	1.85	0.11
#4	8	847	62	7	850	254	0.30	0.25	10.57	2.60	0.11

Dry matter forage samples were collected as paired quarter square meters Sept. 24 from the same locations as the soil samples were sampled in late June. The forage samples were dried in a forced air dryer for four days and weighed. These yields are reported in Table 3.

Table 3. Dry matter yield (t/ac) harvested at soil sampling points

Sampling site	Dry Matter Yield (t/ac)
#1	**1.60**
#2	**1.39**
#3	**0.75**
#4	**0.86**

The dry matter yield for each sampling location was analyzed by regression against all 11 nutrient measurements determined with the PRS probe. Nutrients with a higher R^2 rating have a greater impact on the forage yield produced from the sampling site. The analysis shows that manganese, phosphorus, and zinc had the greatest influence on the observed dry matter yield. (Table 4)

Table 4. Relationship of PRS soil nutrient level with forage yield.

Nutrient	R^2
Mn	0.92
P	0.74
Zn	0.67
B	0.54
Mg	0.49
N	0.28
Fe	0.28
K	0.12
Cu	0.05
S	0.02
Ca	0.02

Manganese in soils becomes more available when less oxygen is present. The manganese adsorbed by the PRS probe is an indication of how waterlogged the border dyke is at the sampling site. The strong negative relationship of manganese with dry matter yield indicates that alfalfa grows much better when the soil is not waterlogged. (Figure 1)

Phosphorus and zinc both have relatively high R^2 values. (Figures 2 and 3) These two nutrients have an antagonistic effect on plant growth. When phosphorus availability is high, uptake of zinc may be inhibited.

If zinc availability is very high, phosphorus uptake will be reduced as well. High applications of phosphorus to soils have induced zinc deficiency in wheat on dryland clay soils near Saskatoon. Conventional soil tests commonly indicate applications of 50-100 lb P_20_5/ac for irrigated alfalfa fields.

Although the response of alfalfa to phosphorus has been very good on many irrigated hay fields, this response of alfalfa to phosphorus may also be limited by the availability of zinc if the zinc becomes the limiting nutrient to the alfalfa. This risk needs to be assessed when applying relatively high rates of phosphorus to soils.

For the four soil and forage samples collected at Consul in 2010, yield declined as the level of soil phosphorus increased. Although this appears to contradict the response of hay yield to phosphate fertilizer application, these sites also had lower supply rates of zinc. It is not known what mechanism is at play. The higher phosphate may be increasing the need for zinc which the soil may not be able to provide. Higher moisture soils may be limiting the ability of the alfalfa roots to find the extra zinc the alfalfa requires.

The plant root simulator probe (PRS) soil analysis processed with the PRS Forecaster model suggests an appropriate nutrient application to this alfalfa stand would be no N or P_20_5. It does suggest 75 lb K_20/ac and 12 S/ac.

Application of manure to alfalfa fields is a cost effective approach to meeting the fertility needs of an alfalfa stand. Although alfalfa does not require the nitrogen applied with manure, the manure could meet the P, K, and S requirements of the alfalfa.

Technology Transfer

A field day was held July 9, 2010, to demonstrate the alfalfa varieties to the Consul producers. Twelve growers attended a discussion of the relative merits of the alfalfa varieties.

The key message delivered was that a grower needs to decide the purpose for which the alfalfa is grown and to select a variety that will meet is need. Alfalfa varieties may be grown targeted to feed dairy or beef cattle. The variety may be harvested once, twice, or three times per growing season. Depending on the intended purpose and the production approach taken by the grower, the best suited variety will vary.

Alfalfa grown for a dairy producer is harvested at the early bud stage to maximize the nutrient content of the forage. A high producing dairy cow requires this kind of feed to meet its nutritional needs so that it can maintain the high level of milk production achieved at modern dairies. It is likely harvested two or even three times per growing season to maximize the nutritional quality of the forage.

Alfalfa grown for a beef producer may be harvested at full bloom to maximize the forage yield. Quality of the forage suffers when harvested once flowering has begun, but the hay will still have adequate nutrition to meet the needs of a beef cow. The purpose of the feed supply for most of the producers at Consul is to sustain a beef cow to provide adequate milk for rapid healthy growth of a calf. Each alfalfa seed company has a variety that will fulfill each of these niches.

Final Discussion
Alfalfa is an important crop for the irrigated producers in the Consul and Vidora Irrigation Projects. The alfalfa variety demonstration at Consul produced an excellent crop in 2010. Yields were two to three times the production that growers normally harvest as hay. The top yielding variety in the demonstration was Equinox with Rangelander and Beaver as close second and third place varieties.

Assessment of the soil with the PRS Forecaster Soil analysis with the PRS probe and interpreted using the PRS Forecaster suggested that the yields could be improved by application of potassium and sulphur. Regression of dry matter yields harvested from the same location as soil sampling sites suggest that manganese, phosphorus and zinc have the greatest impact on the quantity of hay produced. Future work will look at these issues.

Special thanks is extended to Eric Lamb, Assistant Professor, Dept. of Plant Sciences, College of Agriculture and Bioresources, University of Saskatchewan, Saskatoon, Sask., for technical advice on project statistical analysis.

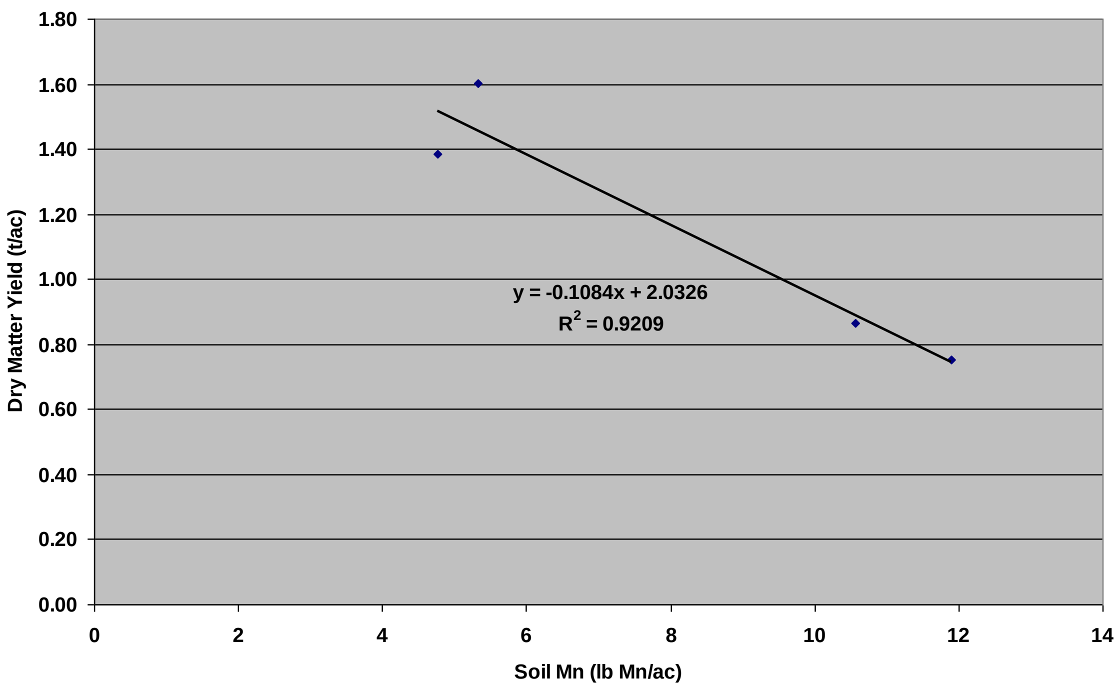

Figure 1. Relationship between dry matter yield of alfalfa and soil manganese measured by the PRS probe on Consul soil samples.

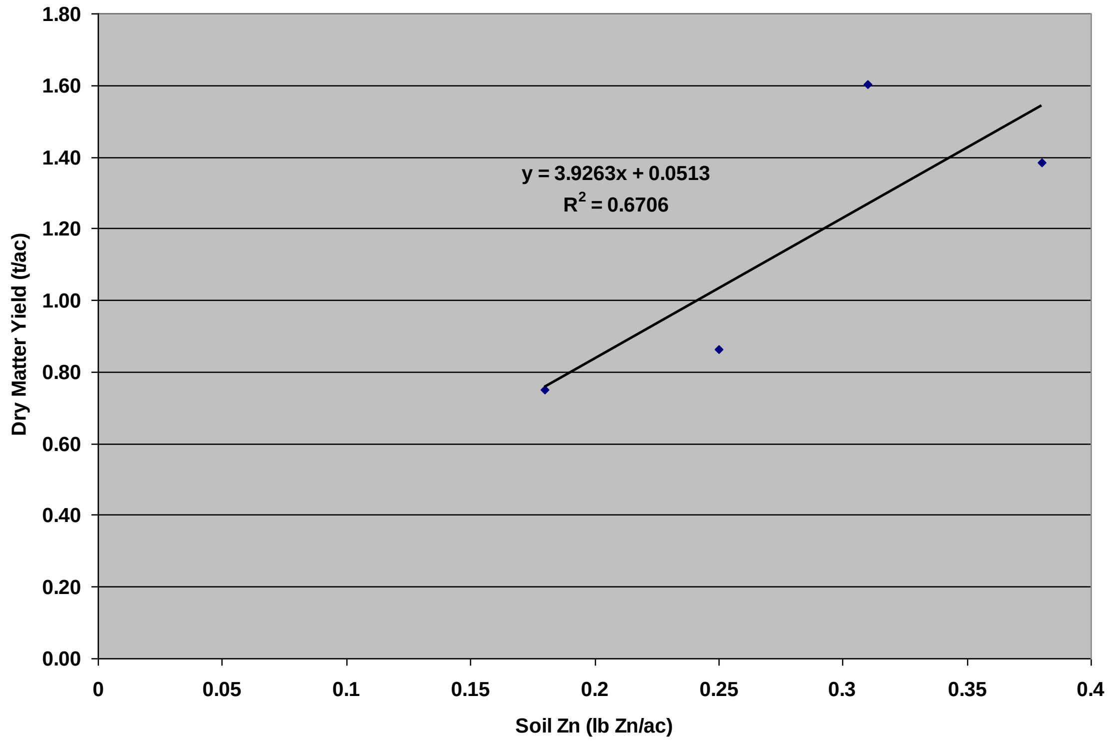

Figure 2. Relationship between dry matter yield of alfalfa and soil zinc measured by the PRS probe on Consul soil samples.

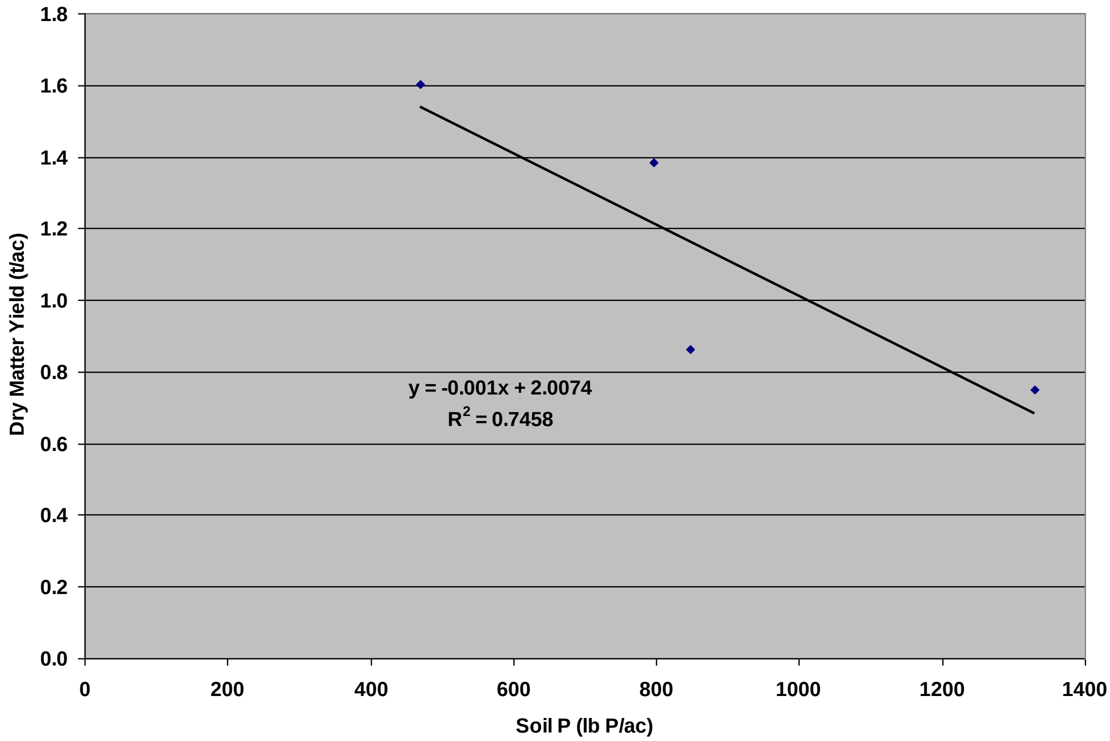

Figure 3. Relationship between dry matter yield of alfalfa and soil phosphorus measured by the PRS probe on Consul soil samples.

Agronomic Trials

Canola Establishment Demonstration 2010

Project Lead

- Sarah Sommerfeld, PAg, Irrigation Agrologist, Saskatchewan Agriculture, and
- Sarah Butler, ICDC summer student

Project Objective

The objective is to demonstrate the plant population and yield differences in canola seeded at specific target plant densities.

Project Plan

The project plan is to establish six treatments of canola seeded at plant densities of three, six, nine, 12, 15 and 18 plants per square foot (plants/ft^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 in the design and 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

Six plant density treatments of three, six, nine, 12, 15 and 18 plants/ft^2 were selected to demonstrate and compare. The seeding rate for each treatment was calculated using the formula:

$$\text{Seeding rate (lb./acre)} = \frac{\text{Target plant density/ft}^2 \times \text{TKW (g)}}{\text{Seedling survival (\%)}}$$

Where TKW = thousand kernel weight

Pioneer Roundup Ready canola variety 45H28 was chosen for the test. The TKW of the variety measured 4.1 g and seedling survival was estimated to be 70 per cent. The seeding rate of each treatment is shown in Table 1.

The trial was seeded on May 17 at a 1.3 cm seeding depth. Plot size was 1.5 m by 6.0 m with 20 cm row spacing. Seed was treated with Helix XTra. Nitrogen fertilizer was applied as 46-0-0 at 125 lb. N/acre, phosphorus as 11-52-0 at 40 lb.P_20_5/acre and potassium as 0-0-62 at 15 lb. K_20/acre. All fertilizers were side-banded at seeding.

Weed control included a fall 2009 soil-incorporated application of granular Edge (ethalfluralin) and an in-crop herbicide application of Muster (ethametsulfuron-methyl) at eight g/acre, Poast Ultra (sethoxydim) at 0.45 L/acre, and Lontrel 360 (clopyralid) at 0.17 L/acre on June 22, 2010.

The trial was grown in a plot area with non-herbicide tolerant canola, therefore requiring the use of the abovementioned herbicides to facilitate ease of plot management.

A fungicide application on July 8 of Proline 480 SC (prothioconazole) at 126 mL/acre was completed for sclerotinia stem rot control. Rainfall received from April 1 to Sept. 16 was 460 mm. Irrigation of 44 mm was applied.

Table 1. Plant density treatments and seeding rates.

Treatment (plants/sq ft)	Seeding Rate (lb./acre)
3	1.7
6	3.4
9	5.1
12	6.7
15	8.4
18	10.1

Data Collection

Plant Stand Density Measurement

Plant stand density of each plot was measured at the 3 to 5 leaf stage on June 14. Table 2 summarizes the average plant density of each treatment.

Harvest

Plots were harvested on Sept. 21 by CSIDC staff.
Yields are summarized in Table 3.

Table 2. Average plant density as measured on June 14.

Treatment (plants/sq ft)	Average Density (plants/sq ft)	% Density Achieved
3	4.1	136%
6	6.7	111%
9	8.7	97%
12	9.0	75%
15	11.7	78%
18	13.3	74%

Table 3. Harvest data collected Sept. 21, 2010.

Treatment (plants/sq ft)	Average Plant Height (cm)	Lodge Rating 1=erect 5=flat	Average Yield* (grams)	Average Yield (bu./acre)
3	107	1	3935	78
6	107	1	4509	89
9	108	1	4850	96
12	104	1	4775	95
15	104	1	5274	105
18	105	1	5385	107

*Clean weight at 10% moisture

Final Discussion

Industry recommends that producers target a plant density range of seven to 14 plants/ft^2 and ideally try to reach eight to 10 plants/ft^2 (Canola Council of Canada, 2010). Results of this trial were inconclusive.

Data from this trial suggests that there is a benefit from increasing the target density when seeding canola but the higher yields realized by the increased seeding rates were not consistent across the trial. It is premature to assume that increasing the seeding rate beyond the current recommendation would be economical.

Producers should assess the growing conditions and equipment of their individual farms to determine what seeding rate works best for their farming operation. Choosing a lower seeding rate may reduce seed costs but does expose a producer to a higher level of risk. There are fewer plants in the field to compensate for risks such as poor seeding conditions, seeding equipment malfunctions, weed competition, disease or insects, poor irrigation management or frost. Lower plant density can also result in uneven or delayed crop maturity, making harvest operations difficult.

For irrigators, the risks to consider when seeding canola are seeding date relative to spring frosts, soil temperature relative to rapid emergence and seed placement dependent upon the seeding equipment used. Producers should adjust seeding rates based on the TKW and seed at a rate which addresses the conditions of their farms each spring.

References

Canola Council of Canada. 2010. Website: www.canolacouncil.org.

Controlled-Release Fertilizer and Irrigated Canola Demonstration 2010

Project Lead
- Sarah Sommerfeld, PAg, Irrigation Agrologist, Saskatchewan Agriculture
- Sarah Butler, ICDC summer student

Industry Co-operator
- Mandy Huska, Market and Agronomic Support Specialist, Taurus Technology

Project Objective
The objective of this demonstration project was to determine if a controlled-release fertilizer, such as ESN Smart Nitrogen, can replace the in-crop fertilizer application in irrigated canola.

Project Plan
The project plan was to apply four fertility treatments to irrigated canola plots. The four treatments included:
- 100 per cent of the total fertilizer requirement as spring banded urea (100 per cent Urea);
- 60 per cent of the total fertilizer requirement as spring banded urea plus remaining 40 per cent as in-crop fertigation application of 28-0-0 (60 per cent Urea + 40 per cent Fertigate);
- 100 per cent of total fertilizer requirement spring banded as 60 per cent urea and 40 per cent ESN (60 per cent Urea + 40 per cent ESN); and
- 100 per cent of total fertilizer requirement spring banded as ESN (100 per cent ESN).

An additional treatment of no-nitrogen fertilizer (Control) was added to the fertility treatments to serve as a project control. Harvest yield was measured and the cost of each treatment was compared.

Demonstration Site
This project was located at the off-site station of the CSIDC to limit field variation and optimize project management. CSIDC staff assisted in trial design, seeding, pesticide and irrigation applications and plot harvest. Soils at the project site are a fine sandy loam. Spring soil analysis indicated available nutrient levels of 41 lb. NO_3-N/acre, 36 lb. P/acre and 338 lb. K/acre at the 0-30 cm depth.

Project Methods and Observations

ESN Fertilizer

ESN fertilizer is a polymer-coated urea granule that permits nitrogen to be available to the crop over a sustained period of time. The polymer coating allows water to diffuse into the granule, dissolving the nitrogen inside. As the nitrogen dissolves into a solution, it is kept contained by the polymer coating and is released through soil temperature controlled diffusion mechanism (Agrium Advanced Technologies, 2010)

Establishment and Crop Management

Pioneer Roundup Ready canola variety 45H28 was selected for the trial. Plant density was targeted at 12 plants/ft^2 and the seeding rate was 6.75 lb. /acre.

The trial was seeded on May 19, 2010, at 1.3 cm seeding depth. Plot size was 1.5 m by 6.0 m with 20 cm row spacing. Seed was treated with Helix XTra. Nitrogen fertilizer application rate was 125 lb. NO_3-N/acre for all treatments except the control treatment. The nitrogen treatments, products and application timing are stated in Table 1.

The in-crop fertilizer treatment of UAN was applied on June 30 by hand as a 10:1 water UAN solution to prevent crop burning.

Phosphorus fertilizer as 11-52-0 at 40 lb.P_2O_5/acre and potassium as 0-0-62 at 15 lb. K_2O/acre were side-banded at seeding.

Weed control included a spring pre-plant soil incorporated application of granular Edge (ethalfluralin) at 8.9 kg/acre on April 27 and an in-crop application of Maverick III (glyphosate) at 0.24 L/acre on June 25.

Proline 480 SC (prothioconazole) fungicide was applied at 120 mL/acre on July 8 for sclerotinia stem rot control.

Rainfall received from April 1 to Sept. 16 was 460 mm and 64 mm of irrigation was applied.

Table 1. Nitrogen fertilizer treatments, products and application timing.

Treatment	Product	Application
Control	none	n/a
100 % Urea	Urea	Side-band, seeding
60 % Urea + 40 % Fertigate	Urea	Side-band, seeding
	UAN	In-crop fertigation at bolting
60 % Urea + 40 % ESN	Urea	Side-band, seeding
	ESN	Side-band, seeding
100 % ESN	ESN	Side-band, seeding

Data Collection

Harvest

Plots were harvested on Sept. 21. Yield data is summarized in Table 2.

Table 2. Harvest data collected Sept. 21, 2010.

Treatment	Average Plant Height (cm)	Lodge Rating 1=erect 5=flat	Average Yield* (grams)	Average Yield (bu./acre)
0 Control	94	2	3042.4	60.3
60% Urea + 40% ESN	107	2	3898.1	77.3
60% Urea + 40% Fertigate	103	2	3940.1	78.1
100% ESN	108	2	3980.0	78.9
100% Urea	110	2	4042.7	80.2

Clean weight at 10% moisture

Final Discussion

The yield data indicates that there was a response to nitrogen fertilizer, shown as the yield difference between the control treatment and the four nitrogen treatments. However, there was no yield difference between the four nitrogen treatments. The yield data also shows that the ESN fertilizer treatments performed to the same level as the urea fertilizer treatments.

With respect to the objective, this year's data shows that there is no significant yield benefit to using ESN over an in-crop fertilizer application and that there is no yield benefit of either treatment over 100 per cent Urea side-banded at seeding.

The choice for the producer is to compare the cost of the ESN to the cost of the in-crop fertilizer application. ESN fertilizer is priced, on average, at a $0.12 per pound premium to urea, but if the in-crop application cost is more than $0.12 per pound for the producer than perhaps ESN could be a logical alternative.

Previous research by Malhi et al. (2006) concluded that controlled release urea (CRU) side-banded in the spring produced a higher seed yield in comparison to spring side-banded uncoated urea. In the same study, researchers suggested that a 50:50 blend of CRU and uncoated urea, spring side-banded, produced a higher seed yield than urea alone.

This project undertaken at CSIDC provided only one year of data. Due to spring growing conditions, one replicate of the trial was lost to flooding. Based on only one year of limited data, this trial was inconclusive. However, it did demonstrate that in 2010 there were no significant differences among the treatments.

References

Agrium Advanced Technologies. 2010. ESN Controlled Release Fertilizer Canola Use Recommendations. Website www.agriumat.com.

Malhi, S.S., C.A.Grant and R. Lemke. 2006. Influence of Controlled-Release Urea (Polymer-Coated ESN) on Seed Yield, Nitrate-N and Nitrous Oxide Gas Emissions in Northeastern Saskatchewan. Poster.

Irrigation Scheduling

Irrigation Water Management Practices 2010

Project Lead

- Sarah Sommerfeld PAg, Irrigation Agrologist, Saskatchewan Agriculture
- Sarah Butler, ICDC summer student

Project Objective

The objective was to demonstrate and compare the current on-farm irrigation water management practices of irrigators, by documenting actual crop water use, irrigation application volumes and irrigation management, to optimal production recommendations that could be obtained by using the Alberta Irrigation Management Model (AIMM).

Project Plan

This project was conducted on producer fields in the Riverhurst and Luck Lake irrigation districts. Three field sites were selected in each irrigation district. A weather station was assembled in each district to collect the appropriate weather data required for use within AIMM. Weather data was downloaded weekly into the model.

Fields were monitored weekly. Each field was equipped with dryland and irrigation rain gauges. Spring soil moisture was determined following seeding and was monitored weekly. Actual crop water use was calculated using the Water Balance formula (Figure 1). The actual irrigation management 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 Luck Lake district were canola, flax and hard spring wheat. Soil texture of these fields range from sandy clay loam to silty clay. Due to the wet spring conditions, seeding was delayed until June 6 for canola, June 2 for flax and June 5 for the hard spring wheat.

In the Riverhurst district, canola, hard spring wheat and dry beans were planted on the selected field sites. The soil texture of these sites ranges from fine sandy clay loam to sandy clay. Seeding dates of these crops were May 16 for canola, May 31 for hard spring wheat and June 2 for dry beans.

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 early and as close to the seeding date as possible, as weather permitted. Fields were monitored on a weekly basis following seeding to check soil moisture levels, irrigation application amounts, rainfall and crop development.

Installation of the Canadian Wheat Board WeatherBug weather stations was delayed due to weather and schedule conflicts. The Luck Lake station, Birsay 2, was installed May 21, 2010, and the Riverhurst station, Riverhurst 2, was installed June 2. Weather data in the appropriate format was not available for use in AIMM until early August.

When weather data for Riverhurst and Luck Lake was accessible, field and crop information was added and moisture use for each field was tracked. The actual crop water use for each field was calculated using the water balance method as stated in Figure 1.

Actual crop water use, or evapotranspiration amount, was calculated from the date of spring soil sampling to the date of fall soil sampling. Effective irrigation, runoff and deep percolation were calculated in AIMM. Soil moisture change was determined as the difference between spring and fall soil moisture levels. Effective irrigation is the irrigation water that is available for crop use which is affected by the irrigation system type and efficiency rating.

The optimum irrigation scheduling plan was developed in AIMM based on the field, crop and local weather information. Irrigation events were added into the model, as required, keeping soil moisture at an optimum level of 70 per cent or greater available soil moisture. Irrigation applications were added at increments of 25 mm effective irrigation (30.2 mm total irrigation), with a minimum of three days between applications. For dry beans, irrigation was added at 19 mm effective irrigation (23.2 mm total irrigation) to avoid over irrigating a shallow rooted crop.

Final Discussion

The actual crop water use for all fields was higher than the optimum crop water use modeled in AIMM indicating that total season crop water use needs were met. However irrigators applied 44 per cent of the optimum effective irrigation requirement (Table 1), meaning that, the actual crop water use requirements were met through the increased rainfall received throughout the growing season.

The total amount of water (irrigation and rainfall) the crop received may have met the total use requirements, but the timing of application amounts may not have been best for optimal production levels.

The differences between actual and optimal effective irrigation requirements reflect that the AIMM-modeled fields were managed to maintain a soil moisture level of 70 per cent field capacity throughout the growing season to simulate optimal production levels.

Table 1: Actual crop water use and actual effective irrigation compared to AIMM-modeled optimum crop water use and optimum effective irrigation.

District	Crop	Crop Water Use			Effective Irrigation		
		Actual (mm)	Optimum (mm)	Act/Opt	Actual (mm)	Optimum (mm)	Act/Opt
Riverhurst	Canola	373	338	110%	98	150	65%
	Wheat	305	328	93%	47	200	23%
	Dry bean	334	244	110%	42	161	26%
Luck Lake	Canola	346	296	116%	83	150	55%
	Flax	352	317	111%	74	200	37%
	Wheat	367	314	117%	96	175	55%
All sites		**346**	**306**	**110%**	**73**	**173**	**44%**

Examples of two fields modeled through AIMM to reflect actual growing conditions and optimum irrigation management are shown as Figures 1a, 1b and 2a, 2b.

Conclusions and Recommendations

The greatest limitation to this project in 2010 was that the uncharacteristically high amount of rainfall created a situation where irrigation management was not as critical as in past years.

The second constraint to the project was that access to the weather data in a format suitable for AIMM was delayed until mid-August. However, this project and its results do serve as an initial step in showing irrigators that irrigation management is critical during all growing conditions and that access to local weather data and use of the AIM model can assist in scheduling irrigation applications.

This project will continue on the Riverhurst and Luck Lake irrigation districts in 2011 and serve to re-enforce the importance of irrigation management.

Acknowledgements

The project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bilateral agreement.

Figure 1a. AIMM moisture use curve of canola field based on actual producer irrigation management.

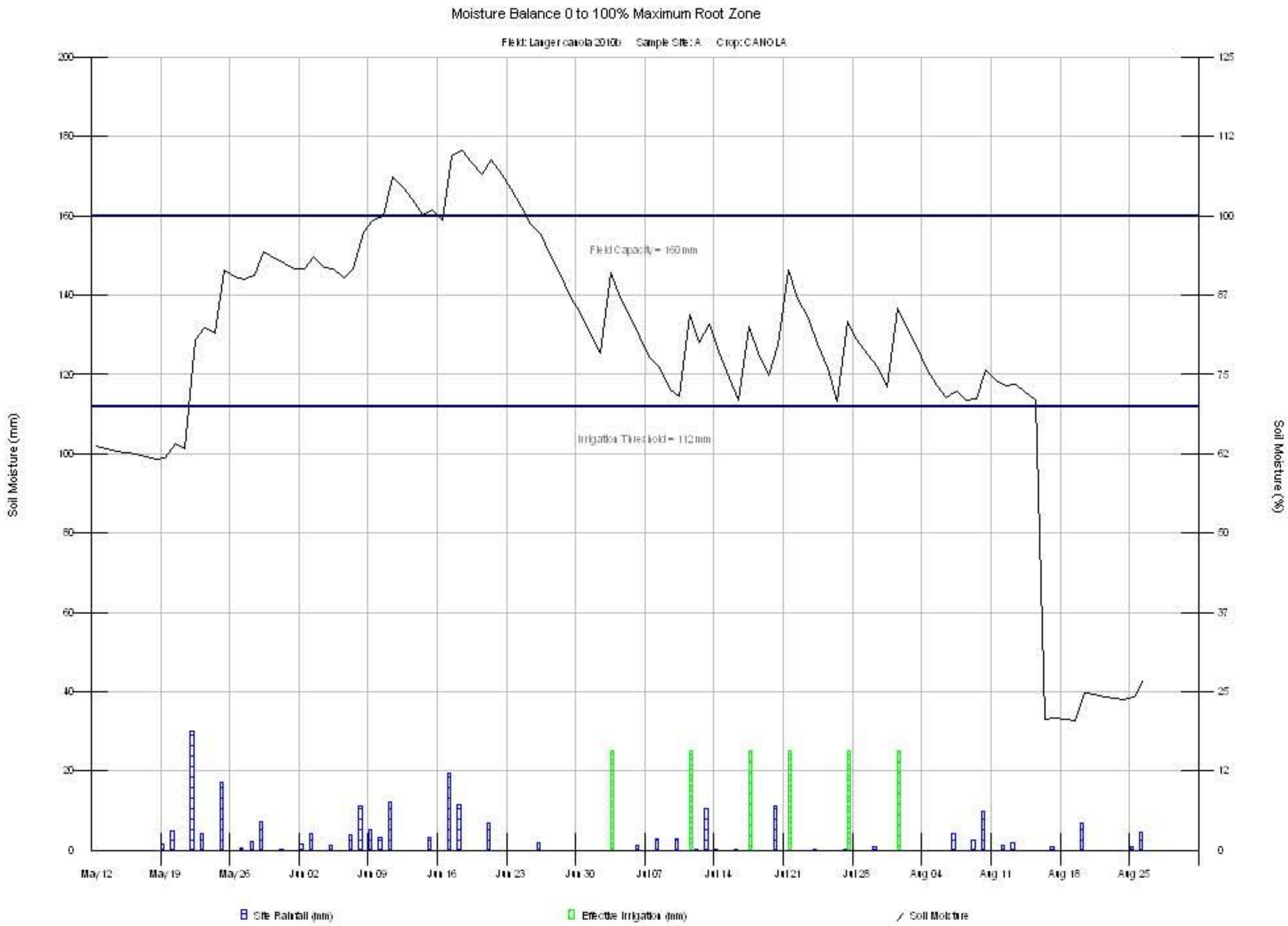

Figure 1b. AIMM moisture use curve of canola field based on optimal irrigation management.

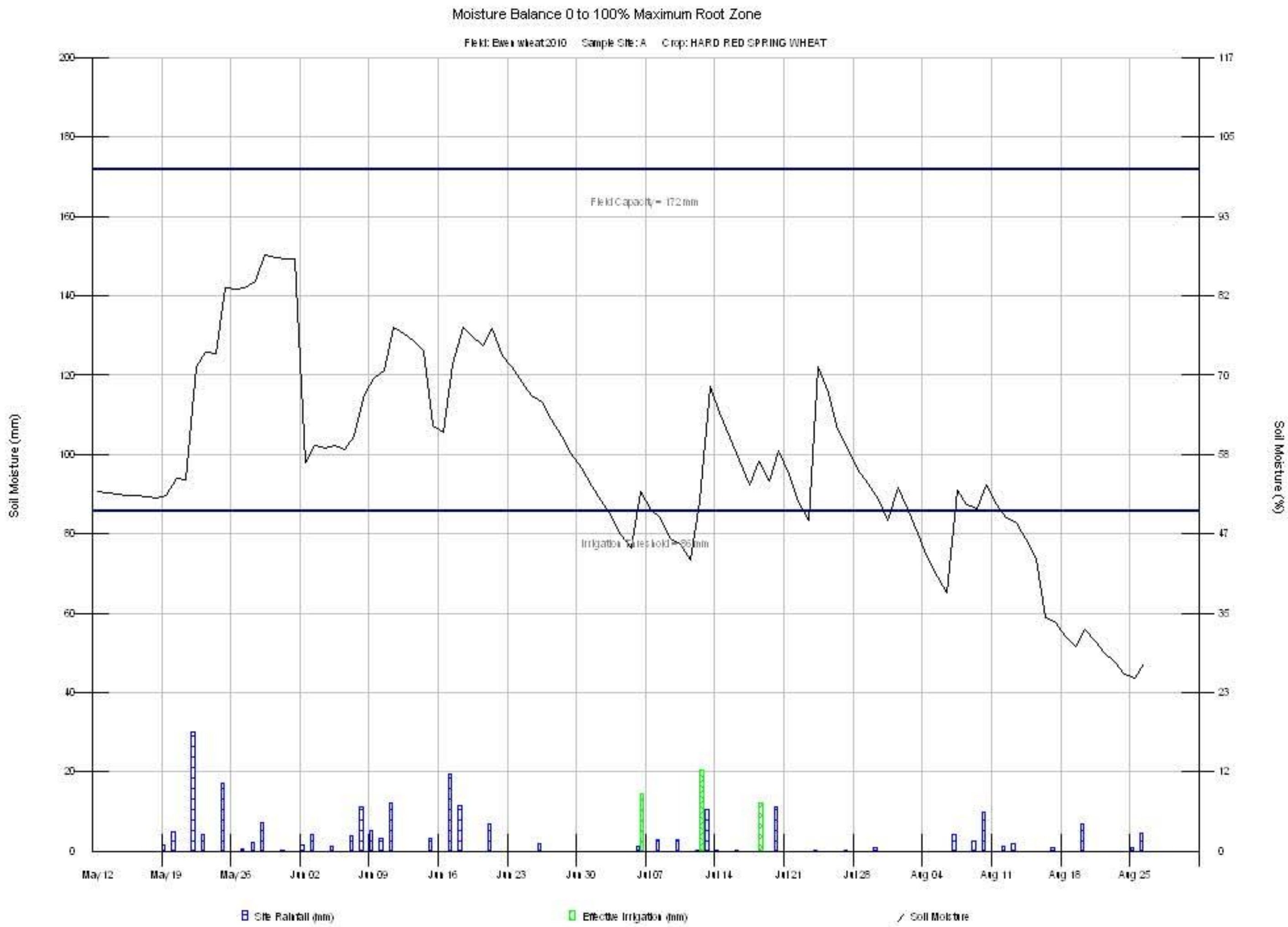

Figure 2a. AIMM moisture use curve of a hard spring wheat field based on actual producer irrigation management.

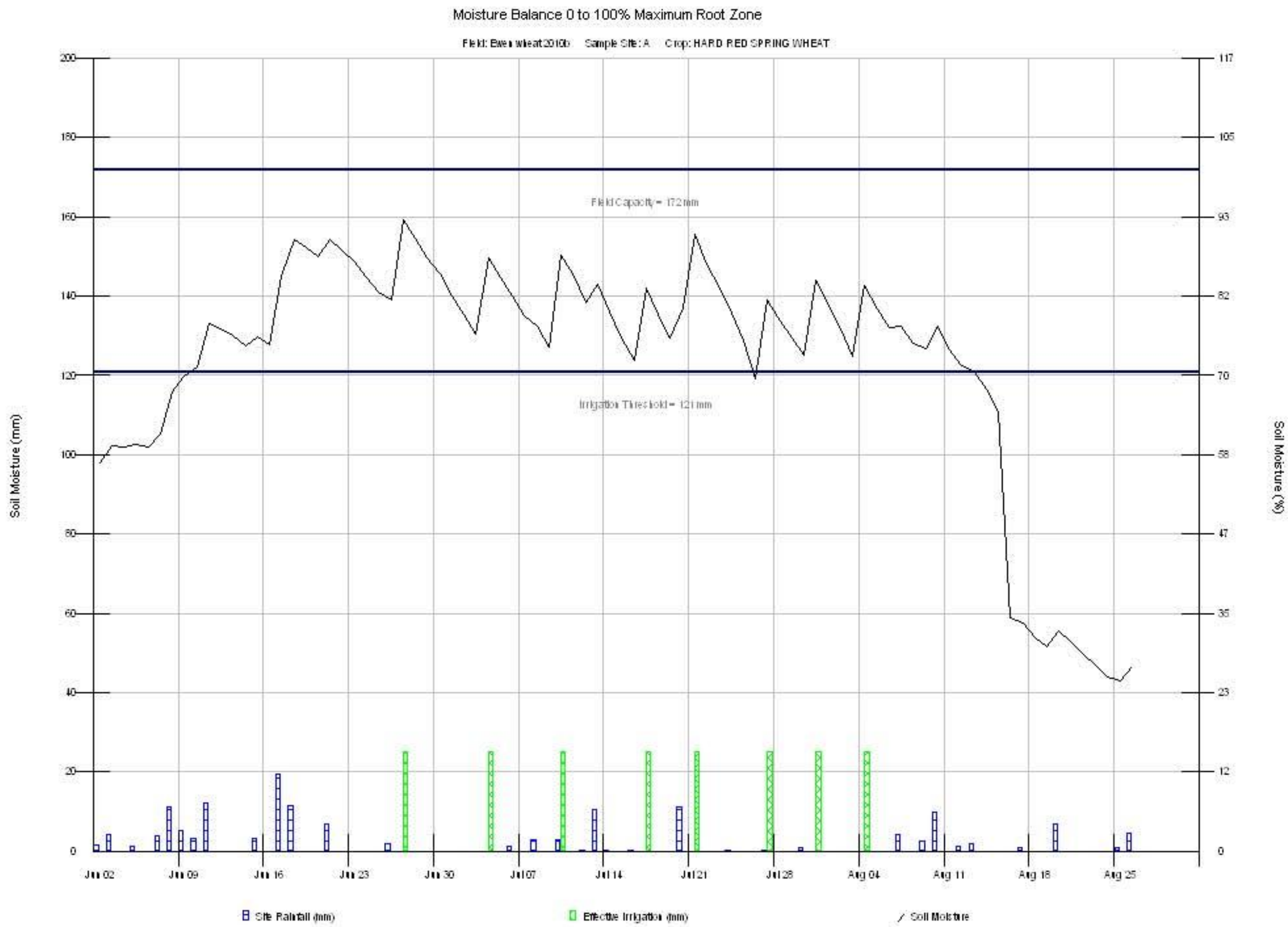

Figure 2b. AIMM moisture use curve based on optimal irrigation management.

Irrigation Scheduling and Irrigation System Automation 2010

Project Lead

- Sarah Sommerfeld PAg, Irrigation Agrologist, Saskatchewan Agriculture
- Sarah Butler, ICDC summer student

Project Objective

The objective of this project was to show irrigators how the Alberta Irrigation Management Model (AIMM) can be used to assist in on-farm irrigation scheduling and to demonstrate the operation of an irrigation system through automation. AIMM is a software program that provides farmers with a prediction of the crop water requirements and irrigation timing for a near future time period (Alberta Agriculture and Rural Development, 2010).

Project Plan

This project was conducted at CSIDC under a centre pivot irrigation system that is fully automated. The plan used AIMM to predict and determine when an irrigation application is required and operate the system by automation. Following seeding, spring soil moisture levels to the 1.2 m depth were determined by gravimetric analysis. Field size; crop type and seeding date; irrigation system type; soils information; crop root zone and allowable soil moisture depletion information were entered into AIMM.

Meteorological data from the Environment Canada weather station at CSIDC was uploaded into AIMM on a regular schedule for calculating evapotranspiration (ET) and crop water requirements. Each week, the available soil moisture was determined in field by using the "Feel Method" (Saskatchewan Ministry of Agriculture, 2008) and compared to the irrigation scheduling prediction as forecasted by AIMM.

Demonstration Site

The field site for this project was located at CSIDC under a centre pivot irrigation system equipped with automated operation controls. Soil texture of the field is classified as loam over clay loam.

Project Methods and Observations

Crop Management

Soft white spring wheat, variety AC Andrew, was seeded on May 13, 2010, following a pre-seeding broadcast application of 70 lb. /ac. of nitrogen and 75 lb./ac. of potassium.

Twenty-five pounds per acre (25 lb. /ac.) of phosphorus was applied at seeding.

Weeds were effectively controlled with applications of Avadex and Rival post-seeding/pre-emergent and Axial and Buctril M in-crop.

Irrigation Management

The 2010 growing season could be summarized as unusually wet. The Environment Canada weather station at CSIDC recorded 398 mm of rainfall from April 4 to Sept. 6 (Figure 1). The long-term average annual rainfall for the Outlook area is calculated to be 260.2 mm (Environment Canada, 2010). As the growing season rainfall exceeded the normal average, the need for irrigation was reduced. From May 14 to Aug. 4, 67 mm of irrigation was applied to the field site. Total accumulated ET from May 14 to Sept. 6 was 352 mm (Figure 2).

Soil moisture levels, as predicted by AIMM and the Feel Method were compared to assess if the model was accurate and consistent to soil moisture changes occurring in the field (Table 1). The results show that the model does effectively predict the available soil moisture of the field within an average difference of nine per cent from the Feel Method.

Table 1: Available soil moisture comparison between AIMM prediction and the Feel Method.

Date	Soil Moisture Prediction (0-60 cm)			
	AIMM		"Feel" Method	
	mm Available	% Available	mm Available	% Available
Jun-25	81	90	68	75
Jun-28	73	81	68	75
Jul-07	71	79	68	75
Jul-12	80	88	63	70
Jul-22	75	83	81	90
Jul-26	72	80	59	65
Aug-04	72	80	63	70

Final Discussion

The moisture use curve, shown as Figure 3, shows the allowable soil moisture depletion threshold and the field capacity for the site soil texture. To maximize crop yield, irrigation and rainfall are needed to keep the moisture use curve above the allowable depletion limit. Figure 3 shows that the field site was kept above 50 per cent field capacity or above the 50 per cent allowable depletion limit. Field capacity of the soil was exceeded due to rainfall accumulation. Table 1 shows that both AIMM and the Feel Method are accurate and reliable methods of determining available soil moisture. As such, a producer could confidently use AIMM as a tool to schedule irrigation applications.

AIMM can predict moisture use for an upcoming time period based on historic weather data collected for a specific weather station. This allows a producer to forecast an irrigation requirement. The vertical line labeled “Prediction” shown on the graph in Figure 3, and area to the right of that line, represent the predicted moisture use forecasted by AIMM based on the historical meteorological data for the Outlook site.

The operation of an irrigation system by automation becomes a valuable tool when producers use AIMM to schedule the irrigation applications from their computers and can also operate their irrigation systems with that same device, without having to travel to the field.

Conclusions and Recommendations

The AIM model is an effective and practical irrigation scheduling tool that could be used by irrigators. The greatest constraint that limits the adoption of this tool is proximity to a limited number of weather stations that collect the data required to run the model.

Attempts are ongoing to increase the number of weather stations in the Lake Diefenbaker irrigation area that collect the required data for use with AIMM and to encourage the use of AIMM as a scheduling tool. As irrigators become more comfortable with using the scheduling and automation technology available, the incorporation of these management tools will increase on irrigation farms in Saskatchewan.

Acknowledgements

The project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bilateral agreement.

Literature Cited

Alberta Agriculture and Rural Development. 2010. AIMM Technical Information Document. Website: www.imcin.net/aimm_tech_doc.PDF.

Environment Canada. 2010. Climate Normals and Averages 1971-2000. Website: www.climate.weatheroffice.gc.ca/climate_normals/results_e.html?Province=ALL&StationName=Outlook&SearchType=BeginsWith&LocateBy=Province&Proximity=25&ProximityFrom=City&StationNumber=&IDType=MSC&CityName=&ParkName=&LatitudeDegrees=&LatitudeMinutes=&LongitudeDegrees=&LongitudeMinutes=&NormalsClass=A&SelNormals=&StnId=3318&&autofwd=1.

Saskatchewan Ministry of Agriculture. 2008. Irrigation Scheduling Manual.

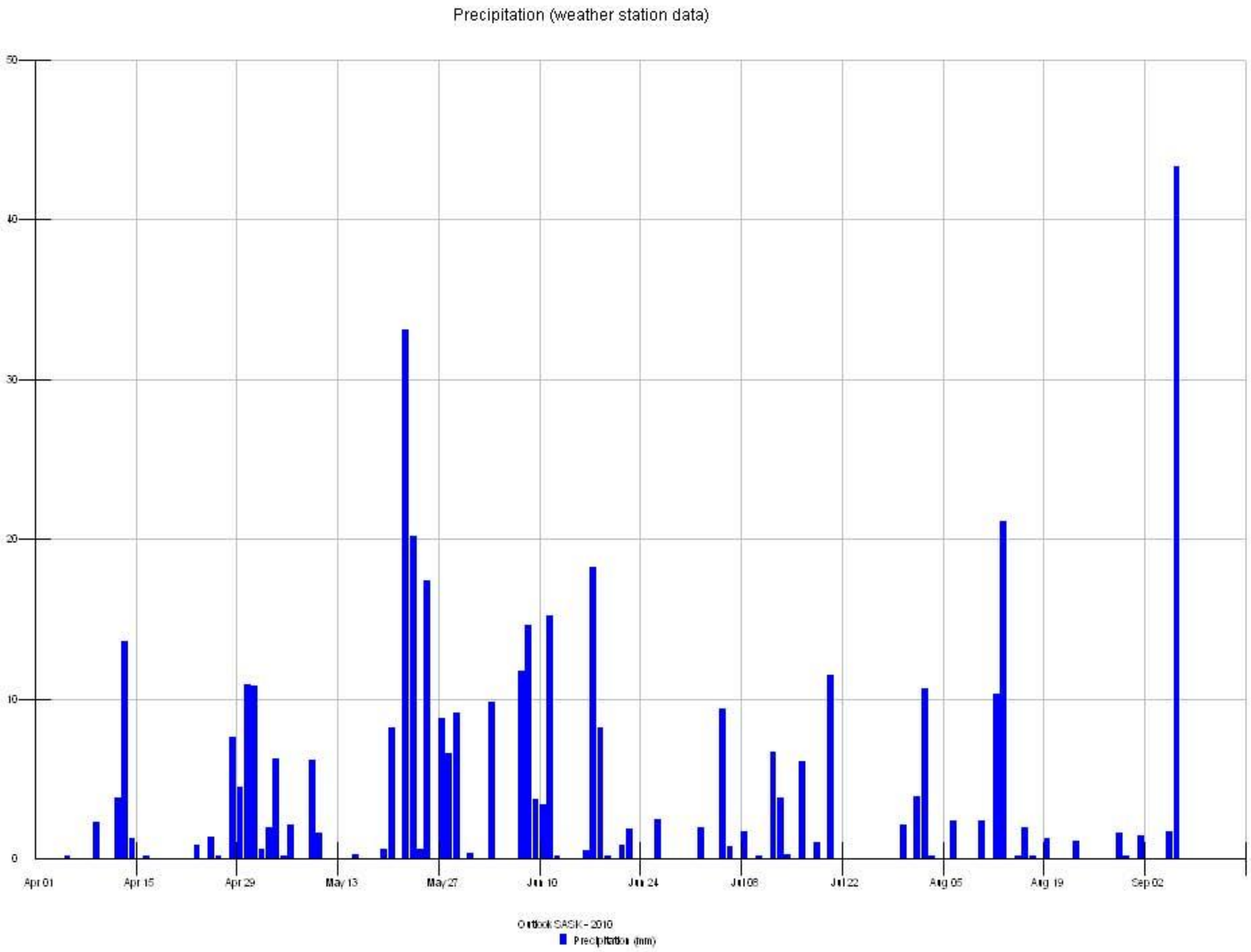

Figure 1. Accumulated rainfall at CSIDC from April 4 to Sept. 6, 2010.

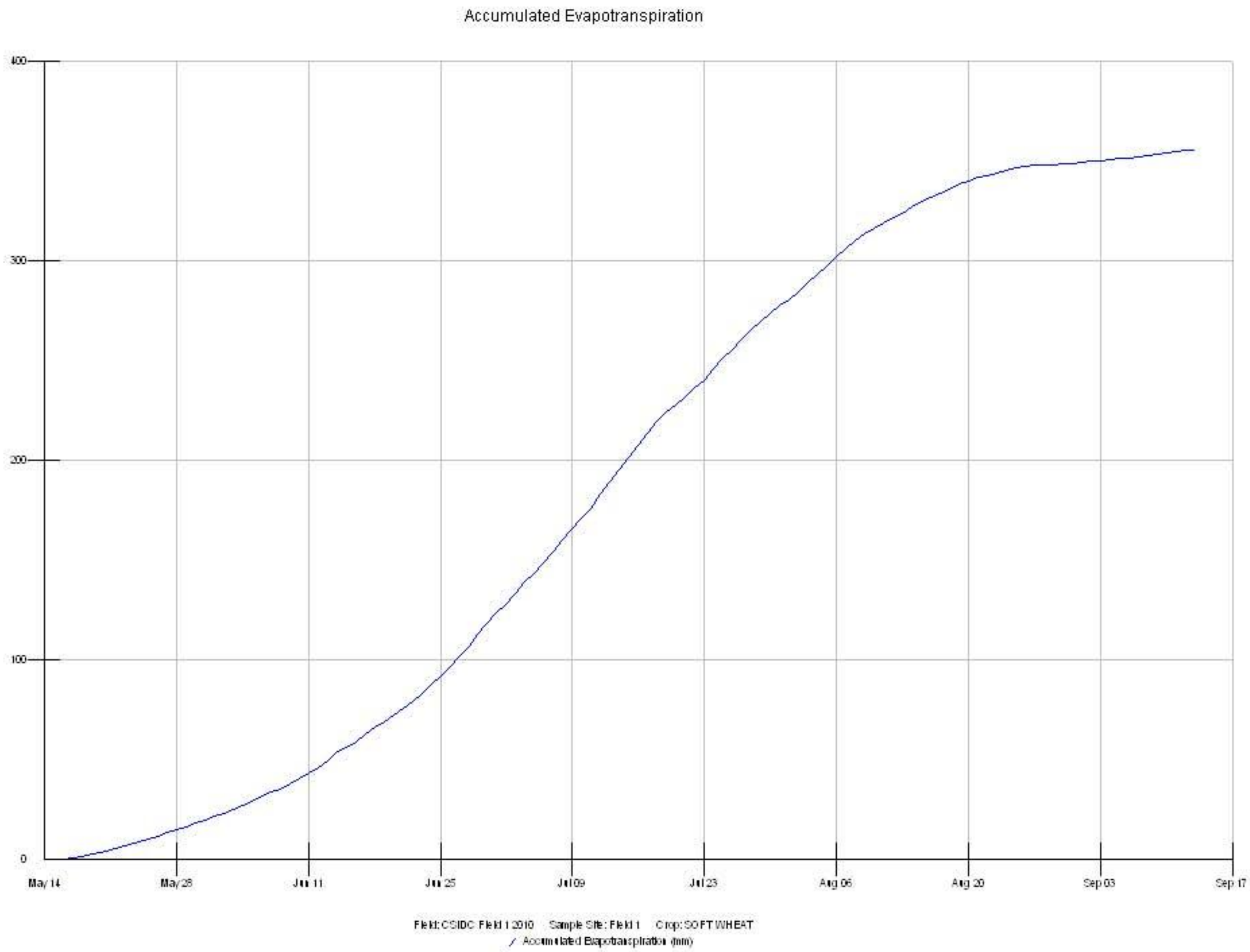

Figure 2. Accumulated evapotranspiration of soft white wheat from May 14 to Sept. 6, 2010.

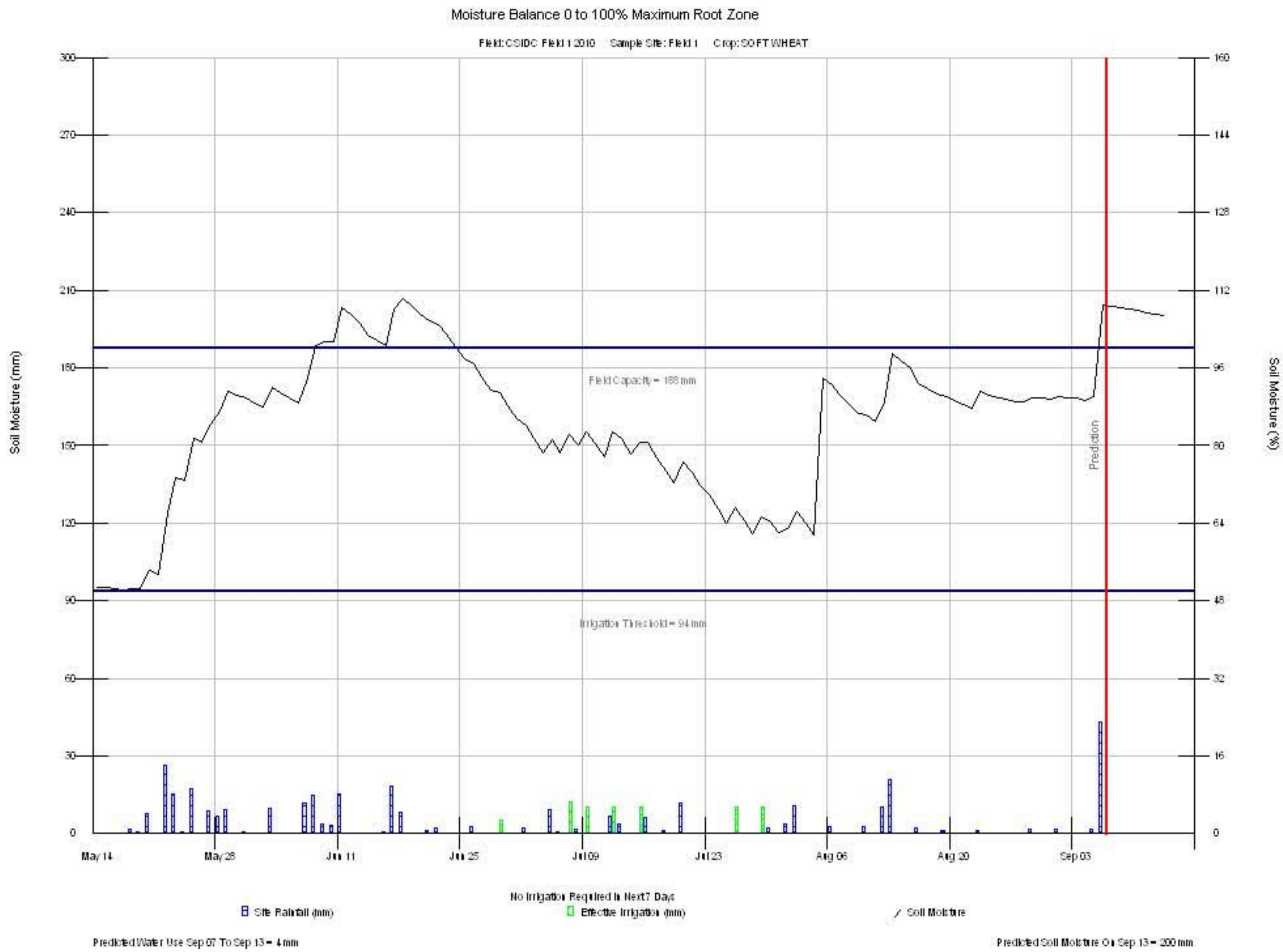

Figure 3. Moisture use curve of soft white wheat from May 14 to Sept. 6.

Dry Bean Irrigation Scheduling Demonstration

Project Lead

- Rory Cranston, AAg, Irrigation Agrologist, Saskatchewan Agriculture

Co-investigators

- Terry Hogg, CSIDC
- Sarah Butler, ICDC Summer Student

Industry Co-operators

- Larry Doherty, Viterra
- Keg Agro

Project Objective

The objective of this project was to demonstrate the differences between the two different irrigation scheduling strategies used in production of dry beans in Saskatchewan and Alberta.

Project Plan

Two irrigation strategies were compared on four varieties of dry beans. One strategy provided adequate water during the vegetative growth stage of the plant. The other strategy drought stresses the plant during the vegetative stage and irrigates the beans during the flowering stage. Both strategies will be compared to a dry land check.

The dry bean varieties used in the demonstration are White Mountain 2, Winchester, AC Island and Othello.

Plots will be four rows wide (60 cm row spacing) and four metres (m) long. The plots were replicated four times. Viterra donated the AC Island and Winchester seed. Keg Agro donated the White Mountain 2 seed.

Demonstration Site

This project was located at CSIDC, which provided the land, facilities and staff to conduct this project. The soil at the site was a very fine sandy loam. The plots were seeded on May 27, 2010. Establishment was good, except in the fourth replication of the dry land plots. This area was drowned by flooding and eliminated from the project.

See Table 1 for agronomic management of the site.

Table 1. Agronomic management of the demonstration site.

Nutrients (0-12")	N	P	K
Soil residual	30 lb. /acre	20 lb. /acre	>800 lb./acre
Applied		42 lb. /acre	
Varieties	White Mountain 2, Winchester, AC Island, Othello Granular Inoculants SP at seeding		
Seeding	May 27, 2010; 25 plants / sq m or 101000 plants/ acre		
Herbicide	Edge 8.9 kg/acre, May 20/pre-plant incorporated		
Fungicide	Lance/Headline/Kocide July 24, 2010 Lance/Headline/Kocide Aug. 5, 2010		
Available Moisture from May 1 to Oct. 1			
Irrigation	See irrigation section		
Rainfall	444 mm (17.4 inches)		
Undercut	Sept. 14		
Harvest	Oct. 6		

Irrigation

Due to the above average rainfall which the area received this year it was very difficult to fulfill the irrigation requirements of this project. In the adequately irrigated plots irrigation began on July 16 and ended Aug. 10, applying a total of 62.5 mm. In the deficit irrigation plots irrigation began July 30 and was ended on Aug. 10 applying a total of 37.5mm in the deficit plots.

Harvest

The plots were harvested on Oct. 6, 2010. The results can be seen in Table 2 below.

Table 2. Harvest results for the demonstration site

Yield lb./acre	AC Island	Othello	White Mountain 2	Winchester
Adequate (507 mm)	1884	1385	1806	1769
Deficit (482 mm)	2032	1354	1616	1745
Dry land (444 mm)	1820	1420	1628	1360

Final Discussion

In the adequate irrigation treatment the varieties Winchester and White Mountain 2 yielded the highest. Deficit irrigation yielded highest in the AC Island variety, and the Othello produced their highest yield in the dry land treatment AC Island had the highest overall yield.

It was expected that the newer varieties (AC Island, White Mountain 2 and Winchester) would yield highest in the adequate irrigation treatment and that Othello would yield the highest in the deficit treatment. However, due to the above-average rainfall, the irrigation strategies did not go as planned.

Typically in Saskatchewan dry bean production requires 12 to 15 inches of water from May 1 to Oct. 1. The average rainfall is about nine to 10 inches; the rest of the water is supplemented by irrigation. This year the demonstration site received 17.4 inches in rainfall alone, well over the crop water usage of dry beans.

Since the demonstration site received this much water, it was impossible to irrigate the trials properly. This demonstration will be performed again in the future to see how these strategies perform in a year more typical of Saskatchewan weather.

Herbert Irrigation Scheduling Demonstration 2010

Project Lead

- Gary Kruger, PAg, Irrigation Agrologist, Saskatchewan Agriculture

Co-operator

- Producer – Ken Falk, Herbert
- Industry – Rigas Karamanos, PAg, Agronomy Manager, Viterra
  – Dale Hicks, Western Ag Labs, Outlook, SK

Project Objective

The objective was to monitor the irrigation applications for several pivots in the Herbert Irrigation District.

Project Background

Demonstration Plan

Five field sites were selected in the Herbert irrigation district. A weather station was established to collect the appropriate weather parameters required for use within the Alberta Irrigation Management Model (AIMM). Weather data was downloaded to the model. Fields were monitored on a weekly basis. Each field was equipped with rain gauges under the irrigation system to measure irrigation amounts. Precipitation was also measured by rain gauges located in a dryland corner. Spring soil moisture was determined following seeding and was monitored weekly.

Demonstration Site

The demonstrations were located on five fields located within the Herbert Irrigation District. The fields monitored included canola on SW11 and NH11-17-10-W3, lentil on SW14-17-10-W3, and HRS wheat on SE14 and NE14-17-10-W3. The fields are managed under a direct seeded minimum tillage system.

Project Methods and Observations

Soil samples were collected in spring from each of the five fields and submitted to Western Ag Labs for analysis by ion exchange membrane technology. The data were input into a computer modeling program called the Forecaster to determine the appropriate rates of nutrient application for the crop grown on each field.

Irrigation scheduling was monitored by placing a rain gauge in each field under the irrigation pivot inside the second tower from the outer end of the pivot water line. A second rain gauge placed on the dryland corner recorded the rainfall at the field. The difference between the two measurements is the effective irrigation delivered to the field.

A soil sample collected at seeding time served as a benchmark starting position for the soil moisture in the field. The agrologist made weekly visits to each field to record rainfall and irrigation as well as estimate the per cent saturation of each soil depth in the soil profile. Recommendations were made weekly to the grower for management of irrigation water application.

The soil, moisture and weather data was input into the model to provide season-long monitoring of the moisture status in the soil. The goal for management of the irrigation system is to maintain the moisture status of the soil above 50 per cent of field capacity.

The rainfall during the 2010 growing season was frequent enough to keep the soil profile above this level for the month of June. During the later part of July, however, the soil moisture profile was drawn down below this target. The grower was having difficulty with the pivot becoming mired down in mud and decided to cease irrigation in later July. He also was concerned about delayed maturity from irrigation reducing the quality of the grain.

The grower chose to reduce his risk of frost injury to his wheat by stopping the irrigation pivot. The figures for the two wheat fields illustrate the impact of a delay in seeding for five days has on water use by the crop and the amount of moisture stress endured by the crop.

The following charts summarize the moisture status of the root zone for the crops:

Figure 1 – canola SH11;
Figure 2 – canola NH11;
Figure 3 – lentil SW14;
Figure 4 – HRS wheat SE14; and
Figure 5 – HRS wheat NE14.

Final Discussion

Rainfall during the 2010 growing season was sufficient to keep the moisture status of the canola, lentil, and wheat fields within the adequate range for May and June.

Irrigation in July to the canola kept the moisture status within the desired range on one of the two canola fields.

The lentil field suffered significant moisture stress toward the last half of July, but this is desirable to force the crop to mature in a timely fashion.

The wheat fields were under irrigated during August to hasten maturity and improve the harvest quality of the grain samples.

Technology Transfer 2010

Ministry of Agriculture Agrologist Extension Events

Field Days

- CSIDC Irrigation Field Day and Tradeshow, July 15, 2010
  - Tour leaders, morning tour, Warren Helgeson, Ph.D., PAg, and Roger Pederson, Chairman, SIPA
  - Water Use Efficiency stop, Sarah Sommerfeld, PAg, and Steve Sager
  - Dry Bean Irrigation stop, Rory Cranston, AAg
  - Tour leaders, afternoon tours, Jazeem Wahab, Ph.D., Special Crops, and Gerry Gross, PAg, Field Crops
  - Field Crop Agronomy and Irrigation Technology tour highlights
    - Variety Trials, Terry Hogg, PAg, CSIDC
    - Annual Forages and Canola Seeding Rate and Use of ESN Fertilizers, Sarah Sommerfeld, PAg
    - Fungicide Use in Cereals and Dry Beans, Rory Cranston AAg
    - Saline Tolerant Alfalfa and Non-Traditional Irrigated Field Crops, Gary Kruger, PAg
    - Annual Forages Demonstration, barley, triticales, Gary Kruger, PAg
- Riverhurst Irrigation Crop Tour, Rory Cranston, AAg, Aug. 20
- Consul Irrigated Alfalfa Variety Field Tour, July 9, 2010, Gary Kruger, PAg, and Gerry Gross, PAg

Booth Display

- Crop Production Week, Saskatoon, Jan. 11-14, 2010
- CSIDC Irrigation Field Day and Tradeshow, Outlook, July 15, 2010
- ICDC/SIPA Annual Conference, Saskatoon, Dec. 7-8, 2010

Publications

- Irrigation Economics and Agronomics, February 2010
- The *Irrigator*, March 2010
- Corn Factsheet, May 2010

Presentations

Gary Kruger

- Feb. 2, 2010 – R&D Unit Report, Chesterfield Annual Meeting
- Feb. 24 – Lake Diefenbaker Investment Opportunity, Soils and Crops Workshop, Saskatoon
- Feb. 25 – Irrigation in Southwest Saskatchewan, Soils and Crops Workshop, Saskatoon
- April 6 – R&D Unit Report, Miry Creek Annual Meeting
- April 8 – R&D Unit Report, Rush Lake Annual Meeting
- April 9 – R&D Unit Report, Ponteix Annual Meeting
- April 20 – R&D Unit Report, North Waldeck Annual Meeting

- April 28 – R&D Unit Report, Lodge Creek Annual Meeting
- April 30 – R&D Unit Report, Consul Annual Meeting

Rory Cranston

- Feb. 3, 2010 – Management of irrigated dry beans, Weyburn
- Feb. 4 – Management of irrigated dry beans, Yorkton
- Feb. 5 – Management of irrigated dry beans, Outlook
- March 25 – Controlling fusarium head blight, Bayer Crop Maximizers' meeting, Outlook

Sarah Sommerfeld

- Dec. 1, 2009 – Canola Insects, Saskatchewan Canola Growers' Fall Meeting
- Dec. 4, 2009 – Irrigation Scheduling and Crop Water Use, Soil Conservation Association of Saskatchewan (SSCA) Crop Advisors' Workshop
- Feb. 24, 2010 – Irrigation Scheduling, University of Saskatchewan Soil and Water Workshop

Agriview Articles

Gary Kruger, PAg

- Banding P in Established Alfalfa Stands, March 2010
- Liebig's Law of the Minimum, October 2010

Rory Cranston, AAg

- Agroforestry and Effluent Utilization, January 2010
- Dry Bean Production Update, April 2010
- Combat Fusarium Head Blight, June 2010
- Control White Mold in Dry Beans, June 2010

Sarah Sommerfeld, PAg

- Irrigated Organic Crops in Rotations, March 2010
- CSIDC Annual Irrigation Field Day and Tradeshow, July/August 2010
- Irrigation Water Management, July/August 2010

Gerry Gross, PAg

- Irrigation Crop Varieties for 2010, March 2010
- Irrigation Extension Program is Accountable to Producers, October 2010

Surveys

- **Fusarium head blight and cereal leaf disease survey**
  Rory Cranston, AAg
  Sarah Sommerfeld, PAg
  Gary Kruger, PAg

- **Canola Disease Survey**
  Sarah Sommerfeld, PAg
  Garry Kruger, PAg
  Gerry Gross, PAg

ICDC Website Report 2010

The Irrigation Saskatchewan website at www.irrigationsaskatchewan.com is designed so that site visitors can 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 an 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.

Abbreviations

CSIDC	Canada-Saskatchewan Irrigation Diversification Centre
ICDC	Irrigation Crop Diversification Corporation
SVPG	Saskatchewan Variety Performance Group
AAFC	Agriculture and Agri-Food Canada
CDC	Crop Development Centre, University of Saskatchewan
ACC	Alberta Corn Committee
CCC	Canola Council of Canada
MAFRI	Manitoba Agriculture, Food and Rural Initiatives
SPARC	Semiarid Prairie Agricultural Research Centre
bu.	bushel or bushels
ac.	acre or acres
lb.	pound or pounds
m	metre
cm	centimetre
mm	millimetre
L	litre
t	tonne
FHB	Fusarium head blight
DM	dry matter
GPS	Global Positioning System