Canada-Saskatchewan
Irrigation Diversification Centre

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Annual Review
April 1, 2004 to March 31, 2005

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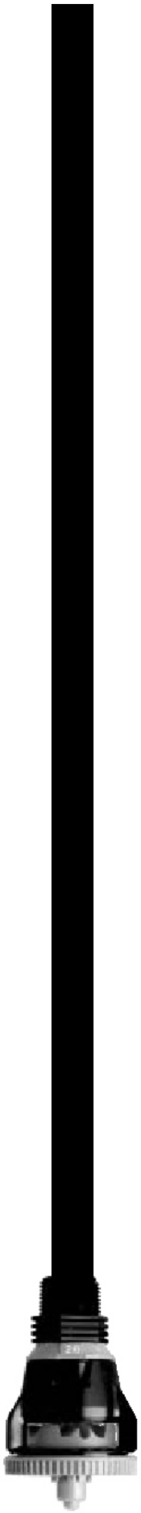
This report and other CSIDC publications are available at our internet address:
http://www.agr.gc.ca/pfra/csidc/csidc.htm



Introduction

Manager's Report

On behalf of the Executive Management Committee (EMC) and the Centre staff, it gives me great pleasure in presenting the Annual Report for Canada-Saskatchewan Irrigation Centre (CSIDC). This report summarizes the activities conducted by the Centre during the period covering April 1, 2004 to March 31, 2005.

CSIDC is managed through a partnership between the federal government (Agriculture and Agri-Food Canada-AAFC); provincial government (Saskatchewan Agriculture and Food-SAF); and industry (Irrigation Crop Diversification Corporation-ICDC; and Saskatchewan Irrigation Projects Association-SIPA). Representatives from each group at the EMC offer CSIDC a coordinated approach for priority setting while addressing industry needs. This includes the development of Best Management Practices and efficient technology transfer approaches to promote economically viable and environmentally sustainable irrigated crop production.

The Centre receives financial support from several sources. The primary funding source for CSIDC is through the AAFC A-Base resource. Additional funding was also received from Saskatchewan Agriculture and Food, Canada-Saskatchewan Agri-Food Innovation Fund (AFIF), AAFC Matching Investment Initiative (MII), AAFC National Agri-Environmental Health Analysis and Reporting Program (NAHARP), SAF Agriculture Development Fund (ADF), and ICDC. Securing appropriate funding is always challenging. Every effort is being made to procure sufficient funding to achieve our strategic goals focussed on developing and disseminating high quality information to the irrigator and to the agricultural industry.

During the 2004 growing season, a wide range of research, demonstration, and technology transfer projects were conducted on a variety of crops and irrigation practices. Cultivar evaluation and agronomic studies were conducted for cereals, oilseeds, pulses, forages, potato and vegetables. Production of warm-season vegetables utilizing season extension technology and growing traditional vegetables using trickle irrigation were also demonstrated.

Several advanced irrigation technologies were also demonstrated at CSIDC targeted at improving irrigation application efficiency, cost effectiveness, and environmental sustainability. This included Low Elevation Spray Application (LESA) and solar powered centre-pivot irrigation systems. Further, the NAHARP project examined water conservation methodologies and water use efficiency indicators in relation to irrigation scheduling.

The 2004 growing season (April - September) was relatively cool and wet. The current season recorded 1909 Corn Heat Units compared to the long-term average of 2254. The Growing Degree days (Base 0°C) was 1990 relative to the long-term average of 2077. This season received 319 mm of rainfall compared to an average of 234 mm. The months of July and August were considerably wetter than normal. Irrigation amounts, which varied with crops and soil type, ranged from 105 mm for durum wheat and 190-210 mm for forages and potato. Yield potentials for the various crops were average.

Technology transfer is a major function at CSIDC. The Annual Field Day was held on July 8, 2004. This event attracted approximately 300 participants. Several commodity-specific field days including Potato Field Day, Vegetable Industry Day, and Corn Field Day were also conducted. For the first time, field tours were given to students from the Outlook and district elementary and high schools with the idea of educating the younger generation about agriculture, agricultural research, and CSIDC activities. These tours culminated in a visit to the corn maze that was specifically built to attract youngsters. The school tours were a major success and attracted about 375 students. Tours were also given to several community groups.

International work is another aspect of the Centre's activities. This is largely through staff involvement in Canadian International Development Agency projects and irrigation organizations. The Centre staff provided management and technical training for specific projects and also trained foreign trainees on principles and practices of irrigation at CSIDC

My sincere thanks are due to CSIDC staff; the EMC; Mr. Laurie Tollefson, A/Manager, Irrigation and Diversification, Ag-Water Directorate, AAFC/PFRA; and Dr. David Wall, A/Science Director, Crop Production Systems, AAFC for their support and guidance in managing the Centre.

The Executive Management Committee:

Carl Siemens, ICDC
Larry Lee, SIPA
Carl Neggers, AAFC
Dr. David Wall, AAFC
Laurie Tollefson, AAFC
Dr. Scott Wright, SAF
Donn Farrer, SAF
John Linsley, SAF/ICDC
Dr. Jazeem Wahab, A/Manager, CSIDC, AAFC

Objectives

The Canada-Saskatchewan Irrigation Diversification Centre (CSIDC) is a Federal-Provincial-Industry partnership between Agriculture and Agri-Food Canada; Saskatchewan Agriculture and Food; the Irrigation Crop Diversification Corporation (ICDC); and the Saskatchewan Irrigation Projects Association (SIPA). Its mandate is to provide irrigation based applied research and demonstration activities with the following objectives:

- To identify higher value cropping opportunities to help target the Centre's research and demonstration programs for maximum benefit;
- To conduct, fund, and support irrigated research and demonstration to meet the needs of irrigation producers and industry in Saskatchewan;
- To co-operate with other agencies to develop, test, and refine means of diversifying and intensifying irrigated crop production in a sustainable manner;
- To demonstrate sustainable irrigated crop management practices on the Centre;
- To extend and deliver information on sustainable irrigation management to producers and irrigation stakeholders;
- To determine the impact of irrigation on the natural and physical resources; and
- To promote a Western Canadian approach to irrigation sustainability by co-operating with similar institutions and with industry in support of increased crop diversification and value-added processing.

Staff

Jazeem Wahab, MSc, PhD
Acting Manager, CSIDC
Potato, Herb, Spice, and Specialty crops agronomy

Laurie Tollefson, MSc
Acting Manager, Irrigation & Diversification
Project Manager, National Water Quality and Availability Project (NAWQAM), Egypt

Barry Vestre, Dip. Ag.
Field Operations Supervisor
Field operations; Grounds; Vegetable demonstration

Allen MacDonald
Maintenance
Equipment operation and maintenance; Fabrication and repair

Marlene Martinson
Administrator
CSIDC general operations, NAWQAM

Debbie Greig
Clerical
NAWQAM

Terry J. Hogg, MSc
Irrigation Agronomist
Field crop agronomy; Water management; Irrigation and the environment

Greg Larson, BSA
Acting Special Crops Agronomist
Potato, Herb, Spice, and Specialty crops agronomy; Water management

Don David
Field Crops Technician
Field crops agronomy

Darryl Jacobson, Dip. Ag.
Irrigation
Irrigation systems operation and maintenance

Judy Clark
Reception/Clerical

ICDC Agrologists

John Linsley, PAg
Manager, ICDC

Korvin Olfert, PAg
Agrologist

Lana Shaw, PAg
Agrologist

Grant McLean, PAg
Agrologist
(April - August)

Les Bohrson, PAg
Senior Agrologist

Clint Ringdal, AAg
Agrologist

Glenn Barclay, PAg
Agrologist
(April - August)

Activities

Presentations

CSIDC staff delivered presentations at numerous meetings and conferences. These included:

Date	Event
2004	
June 16	"Irrigation Opportunities in Saskatchewan". CWRA conference - Montreal.
September 4	"Irrigation in Canada". ICID conference - Moscow.
September 19-24	"Irrigation & Water Use in Canada". Fredericton, Charlottetown, Kentville and St. Johns.
November 8	"NAWQAM Egypt". PFRA - Regina.
November 9	"CSIDC Operations". AAFC - Outlook.
December 13	"Results Based Management in NAWQAM project". PFRA - Regina.
2005	
January 7	"Operation & History of the Canadian Committee on Irrigation & Drainage". CANCID - Montreal.
January 13	"Medicinal Plants: 2004 Research and Development". Saskatchewan Herb & Spice Association Annual Conference - Saskatoon.
January 18	"Irrigation Centre & Potential Role in NAES". Ag Water Directorate conference - Ottawa.
March 7	"Water Use & Water Use Efficiency for Irrigation". NAHARP - Ottawa.

Trade shows and industry events

CSIDC presented a display at the following events:

Date	Event
2004	
November 4	Agrivision's "Drought Proofing the Saskatchewan Economy" Conference
November 12-14	Saskatchewan Vegetable Growers Association Conference
December 2	Saskatchewan Seed Potato Growers Association Conference
December 6-7	SIPA / ICDC 9th Annual Conference - Swift Current
2005	
January 10-15	Crop Production Show - Saskatoon

International Training and Development

Date	Activity
2004	
June 7 - July 9	Training of Ethiopian irrigation agronomists. CSIDC.
July 5-17	Toured senior Egyptian delegates at CSIDC and Water Conference in Lethbridge.
July 10-18	Wuchan County, Inner Mongolia Autonomous Region: Expert advice on potato agronomy for the Canada/China Small Farmers Adapting to Global Markets project
2005	
February 14-20	Irrigation agronomy and agricultural research methodology training for the CIDA / Water Harvesting and Institutional Strengthening for Tigray, Ethiopia
March 10	Development of irrigation material for training in Iran
March 10-22	Agronomic research training on vegetable production under drip irrigation for the CIDA / Water Harvesting and Institutional Strengthening for Tigray, Ethiopia

Tours

Date	Group	No. in tour
2004		
April 29	Dept. of Foreign Affairs, Industry and Trade	15
June 2	Canadian Society of Agricultural Engineers	11
June 15	Saskatchewan Agriculture and Food Policy Branch	26
July 8	Annual CSIDC Field Day	250
July 9	Ethiopian Irrigation Trainees	4
July 22	Pesticide Management Review Agency	24
July 30	Communities in Bloom	3
August 5	ICDC Bean Industry Tour	30
August 10	ICDC Argentinian tour	3
August 12	CSIDC Potato Field Day	45
August 17	Lethbridge Research Centre Research Scientists	n/a
September 14	CSIDC Corn Field Day	80
September 21	Provincial Water Management Board	15
2005		
March 4	University of Saskatchewan Engineering Students	7

Additional tours were held for private industry, producers, associations and other visitors upon request.

Factsheets

The following factsheets are available from CSIDC. Please contact the Centre at (306) 867-5400 for copies, or visit the website at *www.agr.gc.ca/pfra/csidc/csidc.htm*.

Cereals:

- Decision Guide for Foliar Disease Control in Irrigated Wheat
- Early Seeding of Irrigated Cereals
- Late Nitrogen to Increase Protein in Durum

Forages:

- Alfalfa Establishment under Irrigated Conditions
- Alfalfa Seed Production under Irrigation
- Effect of Cutting Height on Alfalfa Yield and Quality
- Forage Manager Report
- Irrigated Timothy Trials at CSIDC
- Kentucky Bluegrass Establishment for Seed Production

Herbs and Spices:

- Agronomic Practices for Commercial Scale Production of *Echinacea angustifolia*
- Agronomic Practices for Commercial Scale Production of Feverfew
- Agronomic Practices for Commercial Scale St. John's Wort Production
- Agronomic Practices for Commercial Scale Stinging Nettle Production
- Agronomic Practices for Mechanized Production of Milk Thistle in Saskatchewan
- Annual Caraway Trials at CSIDC
- Coriander Trials at CSIDC
- Dill Seed Trials at CSIDC
- Ginseng Production and Marketing on the Prairies
- Herbs, Spices and Essential Oils Research & Demonstration
- Irrigated Scotch Spearmint Production in Saskatchewan
- Production Practices for *Echinacea angustifolia*
- Production Practices for Feverfew

Oilseeds:

- Crop Management for Sclerotinia Control in Canola
- Date of Seeding, Seed Rate, and Row Spacing of Irrigated Flax
- Innovations in Canola Production
- Seeding Rate and Row Spacing for Irrigated Canola

Potatoes:

- Agrochemicals in Soil and Groundwater under Irrigated Potato Production
- Cultivar Specific Fertility Management
- Irrigation Scheduling for Potatoes
- Micronutrients in Potato Production
- Potato Petiole Sap NO_3-N and K Monitoring
- Processing Potato in Saskatchewan: Potential and Opportunities

Factsheets (cont.)

Pulse Crops:

- Dry Bean - Fertility Management under Irrigation
- Dry Bean - Optimum Seeding Rate and Row Spacing
- Faba Bean Trials at CSIDC
- Field Pea - Optimum Seeding Rates
- Field Pea - Selecting a Variety
- Intercropping Pea with Oilseeds under Irrigation
- Irrigated Chickpea Trials at CSIDC
- Irrigated Dry Bean Production Package
- Management of Field Pea under Irrigation
- Management of Irrigated Lentil

Soils and Fertilizers:

- Canola Fertilization Trials at CSIDC
- Fertility Management of Irrigated Alfalfa
- Hog Effluent Research and Demonstration
- Rate and Placement Effects of P and K Fertilizer on Peas
- Reclamation of a Saline Field using Subsurface Drains

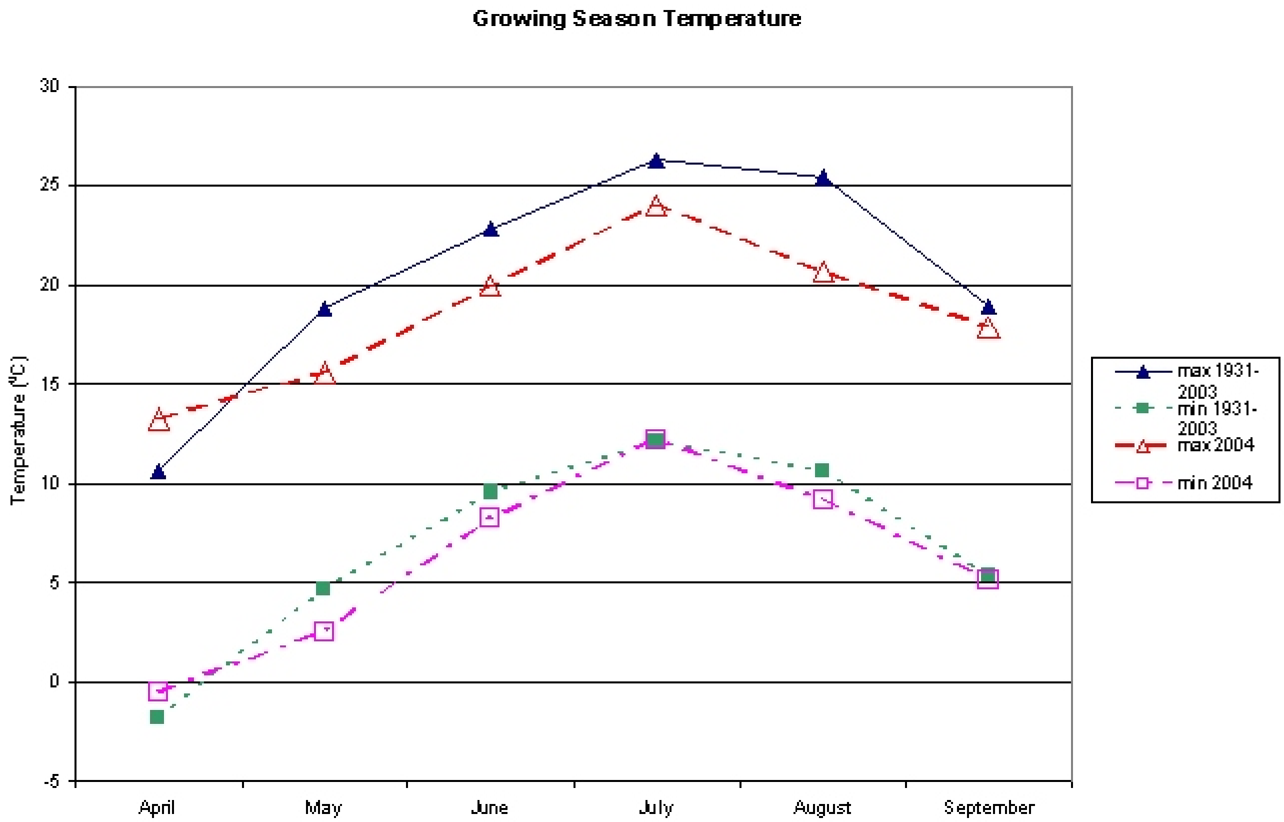
Vegetables:

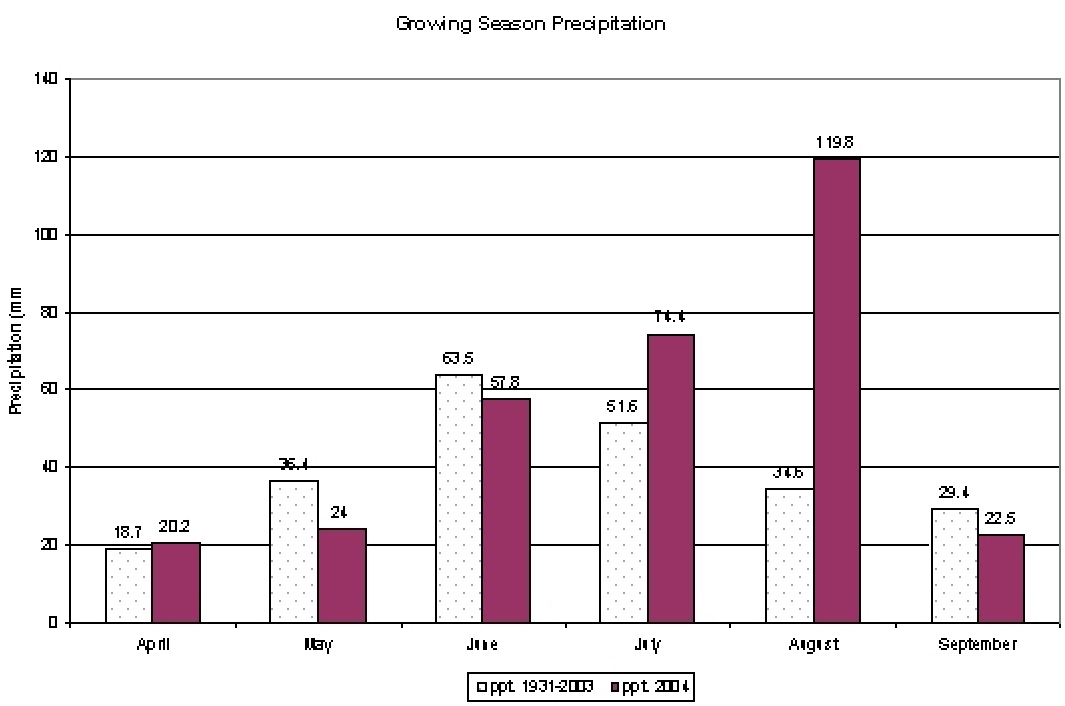
- Cabbage: Post-harvest handling and Storage
- Carrots: Post-harvest handling and Storage
- Demonstration of Improved Vegetable Production Techniques in Saskatchewan
- Melons: Post-harvest handling and Storage
- Onions: Post-harvest handling and Storage
- Peppers: Post-harvest handling and Storage
- Pumpkin Production
- Vegetables: A Growing Industry

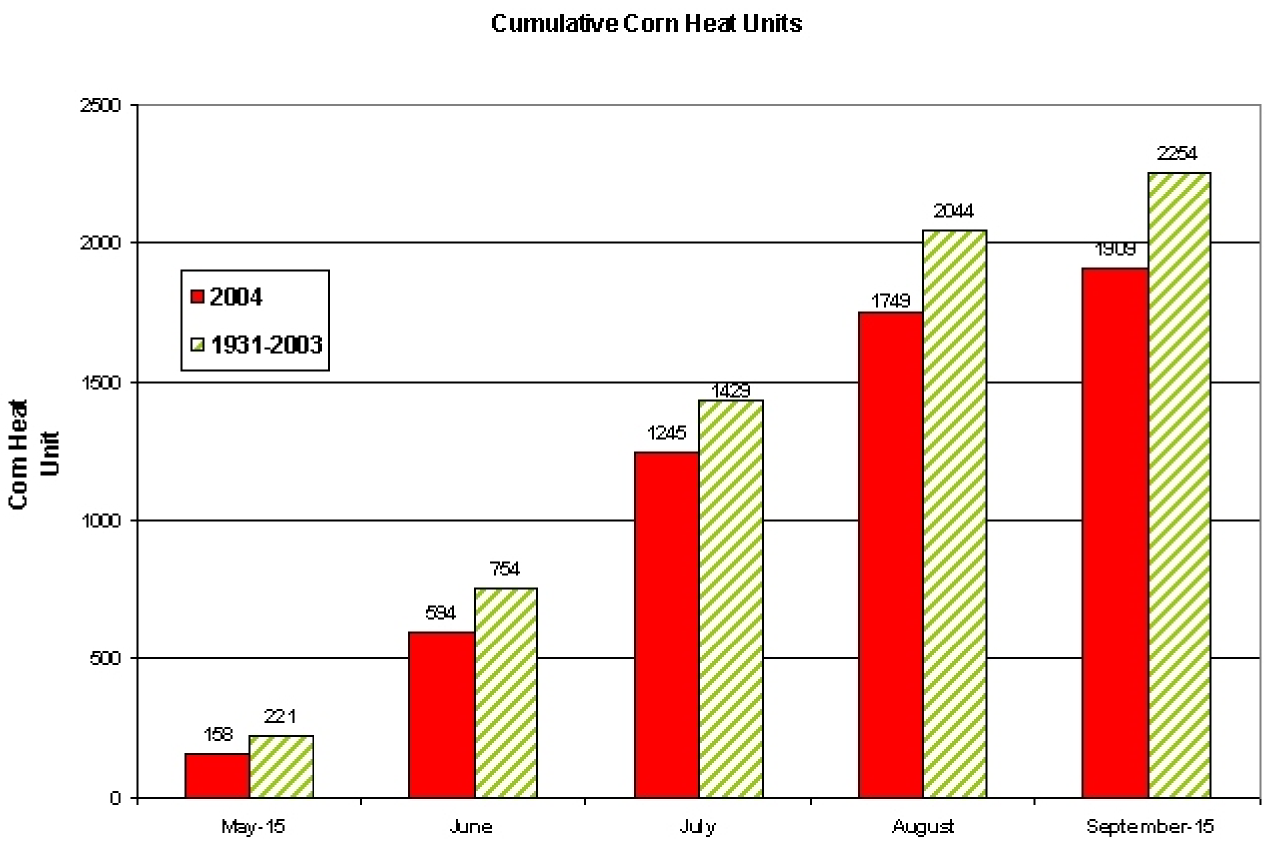
Other:

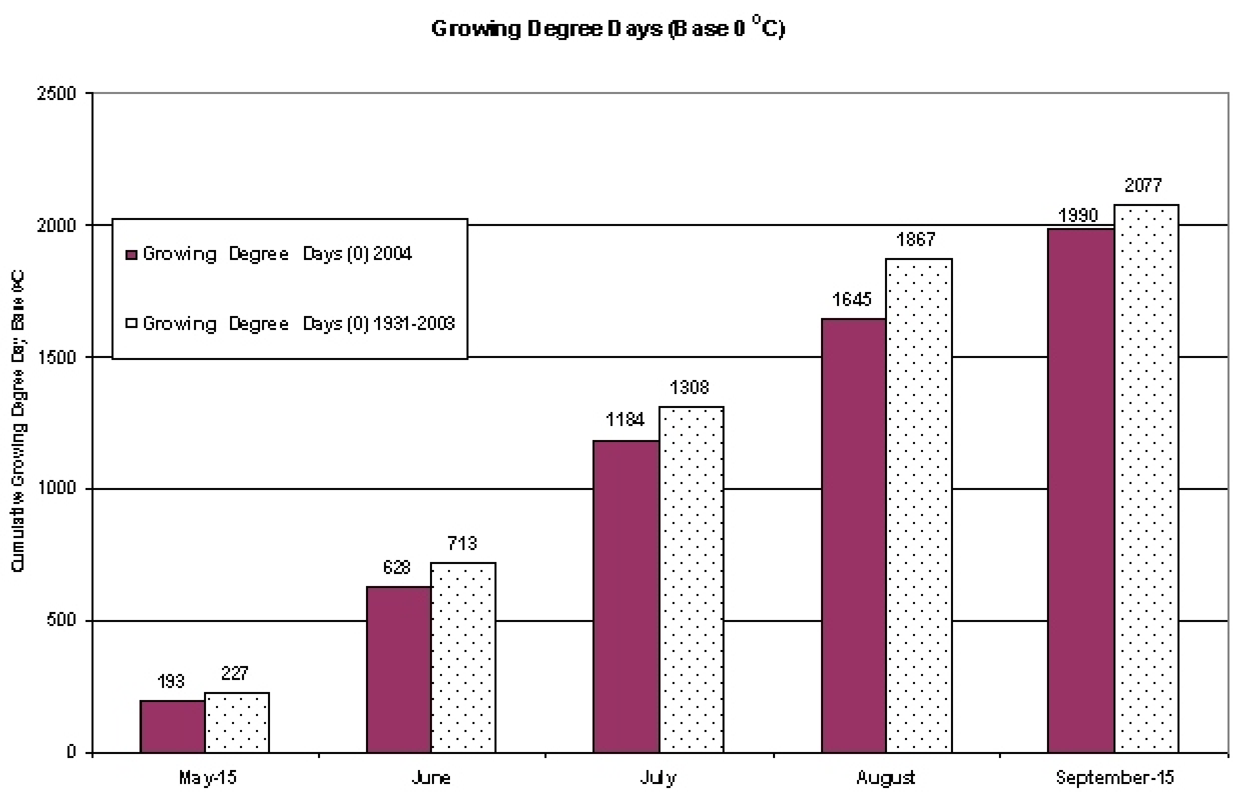
- Crop Varieties for Irrigation
- Ethanol: Fact or Fiction
- Fruit Crops in Saskatchewan
- ICDC Crop Manager Report
- ICDC Irrigation Economics and Agronomics
- Irrigation in Saskatchewan
- Northern Vigor™ in Seed Potato
- Prairie Province Trickle Irrigation Manual
- Plastic Mulches for Commercial Vegetable Production
- Xeriscape Demonstration Project at CSIDC

2004 Weather Summary






Cumulative Corn Heat Units
Corn Heat Unit
2004
1931-2003
0
500
1000
1500
2000
2500
158
221
594
754
1245
1429
1749
2044
1909
2254
May-15
June
July
August
September-15


Growing Degree Days (Base 0 °C)
Growing Degree Days (0) 2004
Growing Degree Days (0) 1931-2003
0
500
1000
1500
2000
2500
193
227
628
713
1184
1308
1645
1867
1990
2077
May-15
June
July
August
September-15

2004 Irrigation Summary

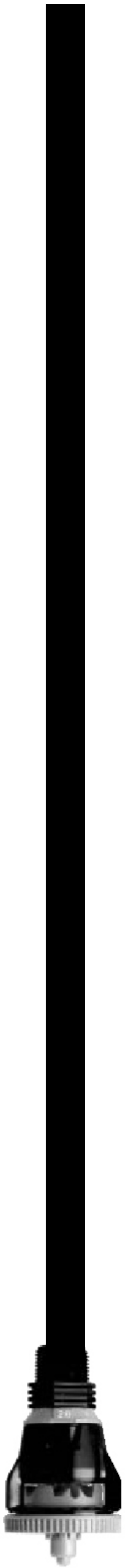
Irrigation applications were lower than normal due to the cool, cloudy growing season. Irrigation amounts by field and crop are presented in Table 1 and Table 2. The tile drained fields 4 and 5 received an additional 250 mm of irrigation applied post-harvest as part of a leaching study.

Table 1. Irrigation depth applied on fields 1 to 9 by crop, 2004 season, CSIDC, Outlook.

Field	Crop	Irrigation Depth Applied (mm)					Total Irrigation (mm)
		May	Jun	Jul	Aug	Sep	
1	Durum wheat	15	25	65	0	0	105
1	Corn	15	25	75	25	0	140
2B	Cabbage	0	25	74	25	0	124
2B	Celery	0	25	74	25	0	124
2B	Chinese Vegetables	0	25	74	25	0	124
2B	Carrot	15	25	74	25	0	139
2B	Strawberry	0	25	74	25	0	124
2B	Oats	15	25	74	25	0	139
3	Durum wheat	0	50	0	0	0	50
4	Canola	15	15	75	25	0	130
5	Canola	15	15	75	25	0	130
6	Potato	25	25	75	25	0	150
6	Oats	25	50	50	25	0	150
7	Corn trials	10	80	90	65	0	245
7	Durum wheat	10	80	40	0	0	130
8	Durum wheat	15	75	40	25	0	155
8	Canola trials	25	75	60	25	0	185
8	Sugar Beet	25	75	60	40	0	200
8	Herb and spice trials	15	60	40	25	0	140
9	Durum trials	15	60	60	25	0	160
9	Cereal plots	15	60	60	25	0	160
9	Flax	15	60	60	25	0	160

Table 2. Irrigation depth applied on fields 10 to 12 and off-station demonstration site by crop, 2004 season, CSIDC, Outlook.

Field	Crop	Irrigation Depth Applied (mm)					Total Irrigation (mm)
		May	Jun	Jul	Aug	Sep	
10	Grass/Alfalfa	65	85	40	20	0	210
10	Forage trials	65	85	20	20	0	190
11	Potato	30	0	75	25	0	130
11	Corn	30	0	75	25	0	130
11	Oats	15	0	50	25	0	90
12	Potato	15	50	100	40	0	205
12	Dry Bean	15	50	100	40	0	205
12	Durum wheat (NE)	15	50	75	25	0	165
12	Alfalfa	15	60	75	25	0	165
12	Timothy	25	75	75	65	0	240
12	Durum wheat	25	75	75	50	0	225
Demo	NW quadrant	15	45	15	0	0	75
Demo	NE quadrant	15	60	90	15	0	180
Demo	SE quadrant	15	45	45	0	0	105
Demo	SW quadrant	15	45	15	0	0	75



Field Crops Program

Terry J. Hogg, Irrigation Agronomist
Canada-Saskatchewan Irrigation Diversification Centre
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Don David, Field Crops Technician
Canada-Saskatchewan Irrigation Diversification Centre
Outlook, Saskatchewan

Crop Variety Trials

Oilseeds

Cereals

Pulses

Agronomic Trials

Cereals

Pulses

Variety Development

Crop Variety Trials

Western Canada Irrigated Canola Co-operative Tests NI1 and NI2

Ongoing project. Funded by the Canola Council of Canada and Agriculture and Agri-Food Canada, PFRA to evaluate potential new canola varieties under irrigated conditions in western Canada.

The canola co-operative tests were conducted on an irrigated site at CSIDC. The NI1 and NI2 tests were seeded on May 19. Plot size was 1.5 m x 6 m. Nitrogen was applied at 112 kg N/ha as 46-0-0 and phosphorus was applied at 56 kg P_2O_5/ha as 12-51-0. All fertilizer was side-banded at the time of seeding.

In the NI1 trial, approximately 25% of the new lines had high yield and good lodge resistance comparable to or greater than the check variety 46A65 (Table 3). Lines PHS03-591 and PHS03-599 had significantly high yield compared to the check variety. In the NI2 trial, 20% of the new lines had high yield and good lodging resistance comparable to or greater than the check 46A65 (Table 4). Line RHY03/460 had yield significantly higher than the check. Most new lines in both tests had similar maturity to the check and were shorter than the check.

Prairie Canola Regional Variety Trial NL1 and NL2

Ongoing project. Funded by the Canola Council of Canada, Irrigation Crop Diversification Corporation and Agriculture and Agri-Food Canada, PFRA to evaluate new canola varieties under irrigated conditions in western Canada.

The PCVT canola regional tests were conducted on an irrigated site at CSIDC. The NL1 and NL2 tests were seeded on May 19. Plot size was 1.5 m x 6 m. Nitrogen was applied at 112 kg N/ha as 46-0-0 and phosphorus was applied at 56 kg P_2O_5/ha as 12-51-0. All fertilizer was side-banded at the time of seeding.

In the NL1 trial, 50% of the entries had high yield and good lodging resistance comparable to or greater than the check variety 46A65 (Table 5). In the NL2 trial, 9 out of 16 entries had high yield and good lodge resistance comparable to or greater than the check variety 46A65 (Table 6). Most entries in both tests had similar maturity to the check and were taller than the check. Entry 45H21 in the NL1 trial (Table 5) and entries 5070 and 5030 in the NL2 trial (Table 6) had yield significantly higher than the check variety. The results from these trials are used to update the irrigation variety database at CSIDC and provide information to irrigators on the best canola varieties suited to irrigation conditions.

Table 3. Yield and agronomic data for the 2004 Irrigated Canola Co-operative test NI1.						
Entry	Yield (kg/ha)	Yield % of 46A65	Flower (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
46A65	4295	100	51	106	142	4.5
Q2	3820	89	54	103	131	6.8
LOLINDA	3523	82	53	102	144	4.8
02N372R	4286	100	51	103	143	5.5
02N385R	4131	96	53	103	146	6
03H631	3823	89	51	102	141	5.5
03N203I	4211	98	51	102	148	5.5
03N206I	4373	102	51	102	141	4.8
A03-14NI	3975	93	52	102	143	4.8
NRO1-3826	3779	88	52	102	127	5.8
NIO2-03040	3535	82	48	102	124	5.8
PR7267	3816	89	52	103	129	4.8
PR8193	3615	84	52	102	134	6.5
PR8991	2930	68	51	102	127	6.5
PR9020	3704	86	50	100	134	5
PR9024	3649	85	51	102	131	5.8
PR9033	3295	77	53	101	140	5.3
PR9034	3780	88	51	100	132	6.3
PHS02-568	4275	100	51	102	145	5
PHS03-591	4979	116	53	105	146	3.8
PHS03-596	4591	107	53	105	141	4.3
PHS03-599	4734	110	51	104	139	5.3
SW G5231 RR	3732	87	48	100	120	4.3
SW G5242 RR	3737	87	52	102	134	6
SW G5234 RR	3845	90	54	102	139	5.3
SW-PL H00-8937	4207	98	50	101	134	5.8
LSD (0.05)	433	-	1	1	8	
CV(%)	7.8	-	1.4	1	4.3	

Table 4. Yield and agronomic data for the 2004 Irrigated Canola Co-operative test NI2.						
Entry	Yield (kg/ha)	Yield % of 46A65	Flower (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
46A65	4379	100	51	105	141	3.8
Q2	4164	95	54	104	132	4.3
02N272R	4487	102	51	103	151	3.3
02N342R	4443	101	51	102	137	4
02N386R	4512	103	52	104	142	5
03N205I	4230	97	51	102	128	3.3
NIO2-04431	4117	94	50	103	113	2.5
NIO2-04962	3418	78	55	105	145	4.5
NRO1-5660	3443	79	54	104	136	5.5
PR8207	3682	84	54	104	150	4.3
PR8220	4145	95	52	104	132	4
PR8248	4040	92	52	105	138	2.5
PR9039	3706	85	49	103	129	5
PR9040	3842	88	52	104	140	4.3
PR9067	3751	86	49	102	127	5.5
PR9068	3709	85	50	102	128	5.3
PR9188	3799	87	51	102	125	4.3
RHY03/460	4791	109	50	102	131	4
RHY03/461	4663	106	53	103	143	3.5
SW G5235 RR	4220	96	51	103	144	3.5
SW G5246 RR	4070	93	52	102	134	4.5
SW 5251 RR	3939	90	53	104	150	3.5
SW-PL H99-6072	3905	89	51	101	136	5.3
LSD (0.05)	396	-	1	1	11	
CV(%)	6.9	-	1.5	0.8	5.5	

Table 5. Yield and agronomic data for the 2004 PCVT Irrigated Canola Regional test NL1.						
Entry	Yield (kg/ha)	Yield % of 46A65	Flower (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
46A65	4946	100	52	106	148	3.5
43A56	4279	87	50	100	134	6.5
45H21	5402	109	52	105	147	4.3
45H24	5187	105	52	104	152	3.8
45H72	5055	102	51	105	147	4.5
46H02	5103	103	52	105	142	2.5
5020	5170	105	51	103	132	4.3
CNH1501R	4823	98	52	104	147	3.5
Fortune RR	4906	99	51	103	139	3.8
LBD 588RR	4073	82	52	104	136	5.3
SP Banner	4661	94	52	103	138	3
SW F5205 RR	4770	96	51	103	140	5
SW F5207 RR	4556	92	52	102	139	5.3
SW F5208 RR	4572	92	51	103	147	5.8
SW 98-7888	4973	101	51	102	137	3.5
SW 98-7897	5075	103	53	103	145	4.3
LSD (0.05)	298	-	1	1	9	
CV(%)	4.3	-	1.5	0.7	4.3	

Table 6. Yield and agronomic data for the 2004 PCVT Irrigated Canola Regional test NL2.						
Entry	Yield (kg/ha)	Yield % of 46A65	Flower (days)	Maturity (days)	Height (cm)	Lodging 1=erect; 9=flat
46A65	4734	100	52	106	134	3.8
46A76	4187	88	57	106	133	4
46H23	4764	101	52	103	135	4
46H70	4696	99	52	105	138	3.8
1841	4658	98	55	104	136	2.5
3140_01	4354	92	56	104	140	5.5
3458_01	4672	99	57	104	132	5
34-55	4773	101	55	104	136	5
35-85	4767	101	55	104	127	5
5030	5295	112	53	103	146	2.5
5070	5355	113	56	105	143	3.3
9550	4282	90	53	104	131	5.3
CNH1604R	5087	107	52	105	143	4.5
HYOLA 505RR	4172	88	57	105	142	3.5
NEX 824CL	4443	94	56	104	132	3.5
NEX 830CL	4527	96	57	105	143	3.5
LSD (0.05)	481	-	1	1	10	
CV(%)	7.2	-	1	1	5.1	

Irrigated Canola Regional Variety Trial

Ongoing project. Funded by the Irrigation Crop Diversification Corporation to evaluate registered canola varieties under irrigation on three soil types in the Lake Diefenbaker area.

The irrigated canola regional tests were conducted at four locations in the Outlook area. Each site and soil type are as follows:

CSIDC (SW15-29-08-W3): Bradwell loam
CSIDC off-station (NW12-29-08-W3): Asquith sandy loam
Weiterman (SE16-31-07-W3): Asquith sandy loam - fine sandy loam
Pederson (NE17-28-07-W3): Elstow loam

Canola varieties were tested for their agronomic performance under irrigation. The CSIDC, Weiterman, CSIDC Off-station and Pederson sites were seeded on May 13, 13, 14 and 18, respectively. Plot size was 1.5 m x 4.0 m. All plots received 112 kg N/ha as 46-0-0 and 56 kg P_2O_5/ha as 12-51-0. All fertilizer was side-banded at the time of seeding. Yields were estimated by harvesting the entire plot.

Irrigated canola yield, height and lodging rating varied among the four sites (Table 7). The majority of the canola varieties tested had higher yield than the check variety 46A65 averaged over the four test sites. The varieties 5030, 5070, 2663, 46H02 and SW Hymark 3955 had exceptionally high yield compared to the check.

The results from these trials are used to update the irrigation variety database at CSIDC and provide information to irrigators on the best canola varieties suited to irrigation conditions.

Irrigated Flax and Solin Regional Variety Trial

Ongoing project. Funded by the Irrigation Crop Diversification Corporation to evaluate registered flax and solin varieties under irrigation on three soil types in the Lake Diefenbaker area.

The irrigated flax and solin regional tests were conducted at three locations in the Outlook area. Each site and soil type are as follows:

CSIDC (SW15-29-08-W3): Bradwell very fine sandy loam
Weiterman (SE16-31-07-W3): Asquith sandy loam - very fine sandy loam
Pederson (NE20-28-07-W3): Elstow loam

Flax and solin varieties were tested for their agronomic performance under irrigation. The CSIDC, Weiterman and Pederson sites were seeded May 14, 13 and 15, respectively. Plot size was 1.5 m x 4.0 m. All plots received 112 kg N/ha as 46-0-0 and 56 kg P_2O_5/ha as 12-51-0. All fertilizer was side-banded at the time of seeding. Yields were estimated by harvesting the entire plot.

Irrigated oilseed flax and solin yield, height and lodging rating varied among the three sites (Table 8). All varieties except Vimy had good lodging tolerance. All oilseed flax and solin varieties had yield lower than the check variety CDC Bethune averaged over the three test sites. The lowest yielding entries were Vimy oilseed flax and CDC Gold solin. The results from these trials are used to update the irrigation variety database at CSIDC and provide information to irrigators on the best oilseed flax and solin varieties suited to irrigation.

Irrigated Sunflower Co-op LMTS & EMSS Variety Trial

Ongoing project. Funded by Agriculture and Agri-Food Canada to evaluate oilseed sunflower varieties under irrigation in the Lake Diefenbaker area of Saskatchewan.

The sunflower Co-op was conducted on an irrigated site at CSIDC. The test was seeded on May 17. The Late Maturing Tall Stature (LMTS) entries and the single Early Maturing Short Stature (EMSS) entry 63A21 were grown in a single trial with plant populations of 50,000 and 115,000 plants/ha, respectively. All varieties were seeded at a 60 cm row spacing with two rows/plot except for EMSS entry 63A21 which was solid seeded at a 20 cm row spacing with six rows/plot. Plot size was 1.2 m x 6 m. Nitrogen was broadcast and soil incorporated at a rate of 112 kg N/ha urea (46-0-0) prior to seeding. Phosphorus was side banded at a rate of 56 kg P_2O_5/ha as 12-51-0 during the seeding operation. Yields were estimated by harvesting the entire plot.

Two varieties, 63A70 and L91627, yielded significantly higher than the check and four varieties, 62H81, 63A21, XF202 and YF3423, yielded significantly lower than the check variety AV6111 (Table 9). The entry 63A21 yielded significantly lower when seeded on a wide row spacing (LMTS) as compared to solid seeding (EMSS). Most LMTS entries had plant height greater than the EMSS entry 63A21. Four entries, 62H81, XF3311, 63M52, and 63A21, had seed weight significantly greater than the check while only one entry (63M02) had seed weight significantly less than the check. Test weight varied from 32 to 39 kg/hl with five entries significantly less than the check. Ten entries had an oil content of 50% or greater.

The results from these trials are used to update the irrigation variety database at CSIDC and provide information to irrigators on the best oilseed sunflower variety suited to irrigation conditions.

Table 7. Yield and agronomic data for the 2004 irrigated Canola Regional Variety trial.

Variety	Pederson site				Weiterman site				CSIDC site				CSIDC Off-station site				Mean yield	
	Yield (Kg/ha)	Maturity (days)	Height (cm)	Lodging rating[1]	Yield (Kg/ha)	Maturity (days)	Height (cm)	Lodging rating[1]	Yield (kg/ha)	Maturity (days)	Height (cm)	Lodging rating[1]	Yield (kg/ha)	Maturity (days)	Height (cm)	Lodging rating[1]	kg/ha	% of 46A65
46A65 (check)	3462	106	114	4.5	3560	107	123	4.8	4175	105	132	4.5	5305	110	124	3.8	3376	100
1841	4292	104	136	3	4254	108	137	2.3	4973	107	143	3.5	5171	108	134	3	4673	138
1849	3303	102	112	3.3	3309	106	115	3	3719	104	129	3	4814	108	122	3.3	3043	90
34-55	3727	104	124	4.8	3629	108	124	3.5	4488	105	129	5	4893	107	131	4	4184	124
35-85	3724	106	120	5.3	3324	109	122	3.5	4218	105	135	5	4509	110	125	5.3	3944	117
2663	5143	104	132	3.8	4485	106	131	3.8	4662	105	134	4	5344	108	137	4.8	4909	145
5020	4116	103	112	3.5	4493	106	122	4.3	4290	104	130	3	5720	107	124	3	4655	138
5030	5154	103	137	2.3	4290	108	141	3.5	4467	105	142	3.5	6529	108	132	2.3	5110	151
5070	5274	105	128	4	4429	107	139	3.8	4891	105	146	4.3	5732	109	137	3.8	5082	151
45H21	4416	105	126	5	3939	108	125	5.3	4965	103	133	4.5	5517	108	132	5	4709	139
46A76	3847	106	122	4.5	3724	110	124	4.3	3934	106	136	4.5	4891	109	126	4.3	4099	121
46H02	4416	104	116	3.3	4443	107	122	4	4918	105	132	3.3	5543	108	129	3	4830	143
46H23	3679	104	116	5.3	3889	104	115	3.8	4543	104	132	4.8	5424	107	120	3.8	4134	122
505 RR	3993	107	135	5.3	3415	110	137	4.8	3843	106	149	5	4800	109	142	4	4013	119
512 RR	3684	107	127	6	2655	107	128	6.8	4312	105	149	4	4436	109	135	5.8	3772	112
Fortune RR	3471	103	122	4	3651	105	118	4	3612	105	135	4	5255	106	127	3.8	3997	118
LBD588RR	3174	102	119	5.5	3201	106	120	5.5	4127	103	134	5.8	4493	106	123	5.3	3749	111
Millennium 03	2623	102	102	6.5	2254	105	113	8.3	2800	103	115	6.7	4058	106	108	7.8	2934	87
SP 442CL	3317	103	120	6.3	2612	107	120	8	3604	104	132	5.3	3495	105	124	8	3007	89
SP Banner	3602	103	117	4.3	3207	107	126	4	4228	105	126	4.8	5186	107	124	3.8	4056	120
SP Craven	2889	104	106	5.3	3237	107	112	4.8	3649	105	131	6.3	4937	108	116	4.8	3678	109
SP Desirable RR	4534	101	115	3.8	3548	105	121	2.8	4604	103	134	3.8	5360	106	121	3.5	4512	134
SP Distinction CL	2640	108	121	3.3	2897	113	111	3.8	3422	106	112	3	3907	110	111	3.8	3217	95
SW 6802	3689	103	122	5.3	2820	105	125	6.3	4103	105	140	5.3	4409	106	124	6.8	3255	96
SW Gladiator	3648	101	118	3	3919	105	125	3.5	3876	103	133	3.3	5098	106	116	3.5	4135	122
SW Hymark 3955	4304	103	125	3	4208	108	131	2.5	4777	105	142	2.3	5593	107	130	2.5	4721	140
v1030	3830	102	122	3	3579	107	128	5	4336	103	148	5	4775	108	134	4.5	4130	122
v1031	4225	104	132	4.8	3123	106	130	7.3	4714	105	150	4.8	5654	108	130	5.8	4429	131
LSD (0.05)	595	1	8	1	777	2	9	2	555	2	10	-	853	1	9	1	-	-
CV (%)	11	0.8	4.6	17	15.5	1.1	5.2	27.9	9.3	1.2	5.5	18.8	12.1	0.8	5	19.8	-	-

[1] - lodge scale (1=erect, 9=flat)

Variety	Pederson site Yield (Kg/ha)	Pederson site Height (cm)	Pederson site Maturity (days)	Pederson site Lodging rating[1]	Weiterman site Yield (Kg/ha)	Weiterman site Height (cm)	Weiterman site Maturity (days)	Weiterman site Lodging rating[1]	CSIDC site Yield (kg/ha)	CSIDC site Height (cm)	CSIDC site Lodging rating[1]	Mean yield kg/ha	Mean yield % of CDC Bethune
Oilseed Flax													
CDC Bethune (FP1026)	3977	63	130	1	3993	73	126	1.3	3444	59	1	3805	100
AC Carnduff (FP998)	2992	63	129	1	3835	75	126	1	3063	59	1	3297	87
AC McDuff (FP900)	3523	59	131	1	3732	71	129	1	2730	54	1	3328	87
CDC Arras (FP1030)	3337	65	128	2	3969	69	126	1.7	2993	59	1.3	3433	90
CDC Mons (FP2044)	3756	59	131	1	3730	68	127	1.3	3524	59	1	3670	96
Hanley (FP1094)	3599	58	129	1.3	3790	66	127	1.3	2874	54	1	3421	90
Lightning (FP1069)	3584	65	131	1	3613	73	128	1.7	2648	60	1	3282	86
Macbeth (FP1096)	3629	62	130	1	3368	71	126	1.3	3335	61	1	3444	91
Prairie Blue (FP2024)	3430	61	131	1	3784	74	129	1	3164	62	1	3459	91
Taurus (FP1092)	4146	60	131	1	2839	72	126	1.7	3366	58	1	3450	91
Vimy (FP800)	2488	64	129	7.3	2108	72	124	7.7	2965	64	2.7	2520	66
FP2102	3457	67	132	1.3	3161	72	129	1.3	3289	61	1	3302	87
FP2107	4058	69	130	1	3762	74	128	1.3	3227	61	1	3682	97
FP2112	3613	59	130	1	3852	73	126	1.7	2909	57	1	3458	91
FP2119	3098	60	130	1.3	3283	65	127	2	3127	54	1	3169	83
Solin													
1084 (SP1084)	2921	61	130	1.3	3446	77	126	4	3378	58	1	3248	85
2047 (SP2047)	3642	61	131	1	3446	69	129	1	2671	53	1	3253	85
2090 (SP2090)	3109	55	131	1	3357	66	128	1.3	2892	62	1	3119	82
CDC Gold (SP2100)	2986	54	129	1	2866	67	127	2	2634	53	1	2829	74
SP2126	3545	58	130	1.7	3312	67	127	1.3	3117	52	1	3325	87
LSD (0.05)	716	5	NS	1	503	5	2	1	544	6	1	-	-
CV (%)	12.6	4.7	1.33	31.2	8.8	4.1	1.2	40.9	10.7	6.8	43.3	-	-

Table 8. Yield and agronomic data for the 2004 Irrigated Flax Regional Variety trial.

[1] lodge rate (1=erect, 9 = flat)

Table 9. Yield and agronomic data for the 2004 Irrigated Sunflower Co-operative LMTS and EMSS Variety trial.

Variety	Yield (kg/ha)	First Flower (days)	Plant Height (cm)	Seed Weight (mg)	Test Weight (kg/hl)	Oil (%)
LMTS						
AV6111 (check)	3230	77	132	69.3	37.8	51.4
4540NS	3390	85	137	65.5	34	49.1
511NS	3572	77	120	67.5	36.8	50.3
62H81	2691	75	116	88.3	39.3	50
63A21	2363	71	113	76.3	36.5	45.6
63A70	4063	81	148	71.8	37.5	53.8
63M02	3550	77	143	62.3	38.5	53.8
63M52	3435	81	140	78	34.3	52.8
63M80	3367	82	143	66.8	36	53.7
L91627	3733	81	136	64.5	38	50.2
XF202	2650	76	111	70.5	34	46
XF3311	3339	80	147	79.5	36	54.9
YF3423	2693	79	142	68.5	34	49.3
YF3424	3405	78	131	68.5	32.5	52.9
EMSS						
63A21 EMSS	3144	71	119	65.8	38.8	47.7
LSD (0.05)	405	2	7	5.6	1.8	1.5
CV (%)	10.5	1.7	4.4	6.6	4.1	2.5

Western Canada Soft White Spring Wheat Co-operative Test

Ongoing project. Funded by Agriculture and Agri-Food Canada, PFRA to evaluate potential new Soft White Spring Wheat varieties under irrigated conditions in western Canada.

Co-investigator: R.S. Sadasivaiah, Lethbridge Research Centre, Lethbridge, Alberta

The Soft White Spring Wheat co-operative test was seeded May 14 in 1.5 m x 4.0 m plots. Nitrogen was applied at a rate of 112 kg N/ha as 46-0-0 and phosphorus was applied at a rate of 45 kg P_2O_5/ha as 12-51-0. All fertilizer was side-banded at the time of seeding. The entire plot was harvested for yield estimation.

Results of the test are as presented in Table 10. All lines combine high yield comparable to or greater than the check variety with good lodging resistance and short stature. The lines 03-B03, 02-B40 and 02-B06 had exceptionally high yield compared to the check variety AC Phil.

The results from this trial are used to assist in the registration decision process for Canada Western Soft White Spring Wheat (CWSWS) varieties.

Irrigated Wheat Variety Trials

Ongoing project. Funded by the Irrigation Crop Diversification Corporation to evaluate registered wheat varieties under irrigation on four soil types in the Lake Diefenbaker area.

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

CSIDC (SW15-29-08-W3): Bradwell very fine sandy loam
CSIDC off-station (NW12-29-08-W3): Asquith sandy loam
Weiterman (SE16-31-07-W3): Asquith sandy loam - fine sandy loam
Pederson (NE17-28-07-W3): Elstow loam

Wheat varieties for the different market classes were tested for their agronomic performance under irrigation. The CSIDC, Weiterman, CSIDC off-station and Pederson sites were seeded on May 12, 13, 14 and 18, respectively. Plot size was 1.5 m x 4.0 m. All plots received 112 kg N/ha as 46-0-0 and 45 kg P_2O_5/ha as 12-51-0 as a side band application during the seeding operation. Yields were estimated by harvesting the entire plot. The results are presented in Table 11.

Irrigated wheat yield, height and lodge rating varied among the four sites (Table 11). The highest yielding varieties averaged over the four test sites were AC Andrew and AC Meena, both Canada Western Soft White Spring market class wheat. Bhishaj, a CWSWS variety also yielded higher than the check variety AC Barrie. In the Canada Western Red Spring market class, Prodigy, 5602HR, McKenzie and Superb yielded equal to or greater than the check variety AC Barrie. All varieties in the Canada Western Amber Durum market class except AC Morse yielded greater than AC Barrie. For the Canada Prairie Spring market class all varieties tested yielded equal to or greater than AC Barrie. The Canada Western Hard White wheat class varieties Snowbird and Kanata had yield lower than the check AC Barrie. The results from these trials are used to update the irrigation variety database at CSIDC and provide information to irrigators on the best wheat varieties suited to irrigation conditions.

Table 10. Yield and agronomic data for the 2004 Irrigated Soft White Spring Wheat Co-operative test.					
Entry	Yield (kg/ha)	Yield % of AC Phil	Maturity (days)	Height (cm)	Lodging rating[1]
AC Phil (SWS89)	8030	100	111	78	1
AC Reed (SWS87)	7659	95	111	77	1
02B-06	9168	114	115	92	1
02B-30	8387	104	111	83	1
02B-39	8782	109	113	90	1
02B-40	9282	116	114	83	1
03B-03	9551	119	116	90	1
03B-05	7625	95	113	87	1.5
03B-07	8049	100	111	80	1
03B-09	8875	111	114	83	1
03B-10	8614	107	110	79	1
03B-15	8469	105	113	81	1
03B-16	8158	102	117	90	1.8
03B-21	8259	103	111	81	1
03B-22	8355	104	113	81	1
03B-23	8703	108	112	82	1
03B-24	8493	106	112	83	1
03B-45	8714	109	114	84	1
03B-46	7877	98	113	81	1
03B-50	8001	100	111	80	1
03B-56	8049	100	114	90	1.3
03B-57	8526	106	116	91	1
03PR-321	8552	107	116	90	1
03PR-325	8072	101	113	89	1
03PR-415	8280	103	115	85	1
LSD (0.05)	580	-	3	5	0.1
CV (%)	4.9	-	1.6	3.9	17.4

[1] lodge rate (1=erect, 9 = flat)

Table 11. Yield and agronomic data for the 2004 irrigated Wheat Variety trial.

	Pederson Site			Weiterman site				CSIDC Off-station site				CSIDC site				Mean yield	
Variety	Yield (kg/ha)	Height (cm)	Maturity (days)	Yield (kg/ha)	Height (cm)	Maturity (days)	Lodging rating[1]	Yield (kg/ha)	Height (cm)	Maturity (days)	Lodging rating	Yield (kg/ha)	Height (cm)	Maturity (days)	Lodging rating	kg/ha	% AC Barrie
Canada Western Red Spring																	
AC Barrie	5225	90	115	6117	91	113	1.5	6522	94	113	1.3	5268	86	111	1	5783	100
CDC Bounty	5086	94	118	5865	98	113	2.3	5910	99	113	1.8	5205	86	110	2	5517	95
CDC Imagine	5346	93	118	5651	89	111	1.3	5756	90	113	1	4917	82	111	1.3	5418	94
Harvest	4679	90	113	5431	87	111	2	5483	87	111	1	4519	80	109	1.3	5028	87
Lillian	5295	84	117	5972	91	111	2.8	6465	96	113	2	4517	80	108	1.8	5562	96
Lovitt	5198	90	117	5972	93	111	1.5	5833	96	112	1.3	5142	87	109	1.3	5536	96
Journey	5237	90	120	5672	87	113	1.3	5747	87	115	1	5221	80	112	1	5469	95
McKenzie	5076	99	114	6340	93	112	2	6292	94	112	1.5	5665	85	108	1.8	5843	101
Prodigy	5552	92	119	7107	98	113	1	6901	99	114	1.5	4916	87	108	1	6119	106
Superb	5419	86	120	5697	87	114	1	6258	90	115	1	5502	77	114	1	5719	99
5601HR	5541	93	120	5846	93	117	1.3	5693	97	116	1.3	4998	86	112	1	5520	95
5602HR	5626	95	125	6379	92	116	1	6394	96	115	1	5139	84	112	1	5885	102
Canada Western Hard White Spring																	
Kanata	4394	91	113	5509	87	113	1	5019	91	112	1	3870	78	108	1	4698	81
Snowbird	5127	96	119	5967	95	114	2	5834	95	115	1.5	4478	83	112	1	5352	93
Canada Western Amber Durum																	
AC Avonlea	5330	79	127	7213	96	118	1	6196	96	117	1	4433	78	114	1	5793	100
AC Morse	4637	83	128	6290	84	118	1	6232	88	118	1	4928	73	113	1	5522	95
Commander	5432	71	126	6502	70	116	1.3	5999	79	116	1	5115	66	112	1	5762	100
Napolean	5802	84	127	7074	93	118	1	6810	95	117	1.3	5947	84	113	1	6408	111
Navigator	5476	84	128	6673	83	117	1	6112	85	117	1.3	5070	71	115	1	5833	101
Strongfield	6243	85	127	7200	90	117	1.3	6326	91	117	1.5	4982	80	111	1	6188	107
Canada Prairie Spring - Red																	
AC Crystal	6352	84	120	6976	85	114	1.3	6883	86	114	1	5957	74	113	1	6542	113
5701PR	5727	90	119	6086	82	115	1.8	5720	83	114	1	5355	76	111	1	5722	99
Canada Prairie Spring - White																	
AC Vista	6525	82	117	7119	87	114	2	6399	85	113	1.3	4953	78	111	1	6249	108
Canada Western Extra Strong																	
Burnside	5706	101	120	6093	101	114	3	6431	103	115	2	5297	91	109	2	5882	102
CDC Walrus	5057	94	125	6659	98	113	2.8	5911	99	115	2	5611	94	111	1.8	5810	100
CDC Rama	5639	101	119	6377	98	114	1.8	6083	103	116	1.3	5374	93	113	1.5	5868	101
Glenavon	5483	100	124	6540	104	115	3.5	6171	107	117	2.3	6019	96	113	2	6053	105
Canada Western Soft White Spring																	
AC Andrew	7286	87	125	7245	83	112	1	6866	86	114	1	6879	75	112	1	7069	122
AC Meena	6926	89	125	7479	88	115	1	6583	89	115	1	7041	82	113	1	7007	121
Bhishaj	5537	79	120	7031	86	113	1.3	6695	85	115	1	6055	76	111	1	6330	109
LSD (0.05)	744	333	2	708	4	1	0.5	725	4	2	0.5	785	6	3	0.4	-	
CV (%)	9.6	8.4	1	7.9	3.2	1	21.7	8.4	3.3	1	26.8	10.6	5.1	1.7	23.6	-	

[1] lodge rate (1=erect, 9 = flat)

Saskatchewan Advisory Council
Irrigated Wheat and Barley Regional Variety Tests

Ongoing project. Funded by Agriculture and Agri-Food Canada, PFRA to evaluate wheat and barley varieties in various regions of the province.

The Saskatchewan Advisory Council wheat regional and barley regional tests were seeded on May 14 and May 12, respectively. Plot size was 1.5 m x 4.0 m. All plots received 112 kg N/ha as 46-0-0 and 45 kg P_2O_5/ha as 12-51-0 as a side band application during the seeding operation. Each market class was conducted as a separate test. Yields were estimated by harvesting the entire plot.

Results for the CWRS, CWAD, CWSWS, CPS and CWES market classes are shown in Tables 12-16, respectively. All wheat market classes showed good lodging resistance and short stature. The CWRS (Table 12) and CWES (Table 16) market classes had lines with the highest plant height while the highest lodging ratings were observed for some CWRS lines and Kyle CWAD. AC Barrie yielded higher than all CWRS lines except BW814, Lovitt, 5602HR and PT211 (Table 12). All CWAD lines except AC Avonlea yielded higher than the check variety Kyle (Table 13). The two new CWAD lines Commander and Strongfield had exceptionally high yield. All CWSWS lines had yield equal to or greater than the check variety AC Phil (Table 14). All CPS (Table 15) and CWES (Table 16) lines had yield equal to or greater than the check variety AC Barrie. All CWSWS lines had yield equal to or greater than the check variety AC Phil (Table 14).

Results for the 2-row and 6-row barley tests are shown in Tables 17 and 18, respectively. Harrington was used as the check for the 2-Row Barley Test while CDC Sisler was used as the check for the 6-Row Barley Test. In the 2-Row Test, all varieties tested except the hulless variety CDC Freedom had higher yield than the check variety Harrington (Table 17). The 2-row Malt varieties CDC Copeland and the Feed varieties CDC Trey, Ponoka and Rivers had exceptionally high yield. All 2-Row entries had better lodging resistance than the check variety Harrington. In the 6-Row test all entries tested, except the hulless variety AC Bacon, had yields higher than the check variety CDC Sisler (Table 18). The Malt variety CDC Tisdale and the Feed variety Vivar were the highest yielding varieties tested. As well, most 6-Row lines had lodging resistance equal to or greater than the check variety CDC Sisler.

Table 12. Saskatchewan Advisory Council 2004 Irrigated Canada Western Red Spring Wheat (CWRS) Regional Variety test, Outlook.					
Variety	Yield (kg/ha)	Yield % of AC Barrie	Height (cm)	Maturity (days)	Lodging rating[1]
AC Barrie (BW661)	6881	100	91	109	1.8
5601HR (BW256)	6771	98	93	114	1.3
5602HR (BW297)	7035	102	94	111	1
CDC Go (BW781)	6002	87	83	112	1
CDC Imagine (BW758)	6655	97	92	109	1
CDC Osler (PT555)	6161	90	90	109	2.3
Infinity (BW799)	6843	99	90	111	2.8
Harvest (BW259)	6417	93	92	108	1.3
Journey (BW243)	6573	96	88	112	1
Kanata (BW263)	6515	95	89	109	1
Lillian (BW776)	6406	93	90	111	3.8
Lovitt (PT205)	7066	103	94	109	1.5
Snowbird (BW264)	6520	95	93	110	2.3
Superb (BW252)	6726	98	84	113	1.3
BW301	6780	99	94	108	3.3
BW307	6170	90	100	109	2.5
BW334	6221	90	95	113	3
BW811	6375	93	93	112	2.8
BW814	7181	104	94	112	1
PT211	6967	101	90	108	2.3
PT425	6531	95	92	105	2.8
PT559	6382	93	94	109	2
LSD (0.05)	814	-	4	2	1
CV (%)	8.7	-	3	1.5	34.4

[1] lodge rate (1=erect, 9 = flat)

Table 13. Saskatchewan Advisory Council 2004 Irrigated Canada Western Amber Durum Wheat (CWAD) Regional Variety test, Outlook.					
Variety	Yield (kg/ha)	Yield % of Kyle	Height (cm)	Maturity (days)	Lodging rating[1]
Kyle (DT375)	6156	100	99	112	3.5
Commander (DT722)	7425	121	73	113	1
AC Avonlea (DT661)	5960	97	87	114	1.3
AC Navigator (DT673)	7409	120	78	114	1
AC Napolean (DT494)	7433	121	91	115	1.5
Strongfield (DT712)	6984	113	86	113	1.8
DT724	7209	117	88	117	1.8
LSD (0.05)	550	-	3	2	1
CV (%)	5.3	-	2.5	1.2	30.5

[1] lodge rate (1=erect, 9 = flat)

Table 14. Saskatchewan Advisory Council 2004 Irrigated Soft White Spring Wheat (CWSWS) Regional Variety test, Outlook.					
Variety	Yield (kg/ha)	Yield % of AC Phil	Height (cm)	Maturity (days)	Lodging rating
AC Phil (SWS89)	7937	100	79	111	1
AC Reed (SWS87)	7911	100	77	111	1
AC Nanda (SWS179)	7953	100	89	115	1
AC Meena (SWS234)	8940	113	86	115	1
AC Andrew (SWS241)	8629	109	82	113	1
Bhishaj (SWS285)	8119	102	83	112	1
LSD (0.05)	610	-	4	2	-
CV (%)	4.9	-	3.6	1.2	-

[1] lodge rate (1=erect, 9 = flat)

Table 15. Saskatchewan Advisory Council 2004 Irrigated Canada Prairie Spring Wheat (CPS) Regional Variety test, Outlook.					
Variety	Yield (kg/ha)	Yield % of AC Barrie	Height (cm)	Maturity (days)	Lodging rating[1]
AC Barrie (check)	6098	100	86	109	1
AC Vista (HY413)	6866	113	81	108	1.3
AC Crystal (HY417)	6478	106	89	106	1
5701PR (HY962)	6718	110	77	108	1
HY475	6508	107	81	108	1
HY476	7008	115	78	109	1
LSD (0.05)	449	-	3	2	0.3
CV (%)	4.5	-	2.5	1.4	19.6

[1] lodge rate (1=erect, 9 = flat)

Table 16. Saskatchewan Advisory Council Irrigated Canada Western Extra Strong Wheat (CWES) Regional Variety test, Outlook.					
Variety	Yield (kg/ha)	Yield % of AC Barrie	Height (cm)	Maturity (days)	Lodging rating[1]
AC Barrie (check)	6265	100	91	109	1
Glenavon (ES13)	6405	102	101	113	2.5
CDC Rama (ES21)	6638	106	98	112	1.5
CDC Walrus (ES41)	6189	99	95	111	2.8
Burnside (ES54)	6675	107	97	111	1.5
ES74	6618	106	81	111	1.3
LSD (0.05)	664	-	4	1	1
CV (%)	6.8	-	3.2	0.8	53.2

[1] lodge rate (1=erect, 9 = flat)

Table 17. Saskatchewan Advisory Council 2004 Irrigated 2-Row Barley Regional Variety test, Outlook.					
Variety	Yield (kg/ha)	Yield % of Harrington	Height (cm)	Maturity (days)	Lodging rating[1]
Malting					
Harrington (TR441)	6885	100	73	98	3.7
AC Metcalfe (TR232)	7404	108	80	101	2
Calder (TR262)	7840	114	78	98	1.7
CDC Copeland (TR150)	8776	127	85	99	1
CDC Select (TR153)	7601	110	78	98	2
Newdale (TR258)	8061	117	77	99	1.7
Feed					
CDC Bold (SD422)	7920	115	72	97	1.3
CDC Helgason (TR346)	7796	113	75	95	1.7
CDC Trey (TR359)	8474	123	81	98	2
Niobe (TR651)	7771	113	79	100	2
Ponoka (TR01656)	8470	123	77	99	2
Rivers (TR256)	8399	122	80	97	1.7
TR710	8131	118	68	98	2
Xena (TR475)	8193	119	76	100	1.3
Hulless					
CDC Freedom (TR329)	6213	90	83	102	1
LSD (0.05)	795	-	7	1	2
CV (%)	6.1	-	5.6	0.7	58.9

[1] lodge rate (1=erect, 9 = flat)

Table 18. Saskatchewan Advisory Council 2004 Irrigated 6-Row Barley Regional Variety test, Outlook.					
Variety	Yield (kg/ha)	Yield % of CDC Sisler	Height (cm)	Maturity (days)	Lodging rating[1]
Malting					
CDC Sisler (BT433)	7520	100	90	103	2.7
CDC Battleford (BT456)	8338	111	83	104	2.7
CDC Springside (BT478)	7576	101	86	107	2.3
CDC Tisdale (BT462)	8540	114	88	102	1.7
CDC Yorkton (BT459)	8362	111	77	105	1.7
Legacy (BT950)	7807	104	83	103	2
Tradition (BT954)	7892	105	81	101	2
Feed					
Lacey (BT965)	8084	108	78	105	1.3
Manny BT562)	8104	108	75	108	1
Vivar (SD516)	8848	118	76	104	1.7
Hulless					
AC Bacon (HB105)	6589	88	77	107	2
LSD (0.05)	1148	-	5	3	1
CV (%)	8.5	-	3.7	1.8	31.9

[1] lodge rate (1=erect, 9 = flat)

Alberta Corn Committee Hybrid Performance Trials

Ongoing project. Funded by the Alberta Corn Committee and Agriculture and Agri-Food Canada, PFRA to determine the grain and silage production potential of selected corn hybrids in the Lake Diefenbaker Area of Saskatchewan.

Co-investigators: L. Bohrson, ICDC, Swift Current, Saskatchewan;
B. Beres, Lethbridge Research Centre, Lethbridge, Alberta

The Alberta Corn Committee grain and silage hybrid performance trials were established in the spring of 2004 at CSIDC located on the SW15-29-08-W3. The soil, developed on medium to moderately coarse-textured lacustrine deposits, is classified as Bradwell loam to silty loam.

All seeding operations were conducted using a specially designed small plot six row double disc press drill with two sets of discs. One set of discs was used for seed placement while the second set of discs allowed for side band placement of fertilizer. Treatments consisted of selected corn hybrids with varying corn heat unit maturity ratings. The corn was seeded on an 80 cm (32") row spacing using single row cones. Two rows were seeded per pass. The grain corn plots consisted of four rows and measured 2.4 m x 6 m while the silage corn plots consisted of two rows and measured 1.2 m x 6 m. A seeding rate of 47 kernels/row (59,304 plants/ha) and 56 kernels/row (74,130 plants/ha) were used for grain and silage corn, respectively. Separate trials were established for grain and silage corn hybrids. All plots received a soil incorporated broadcast application of 112 kg N/ha applied as urea (46-0-0) prior to seeding and a side band application of 12-51-0 at a rate of 45 kg P_2O_5/ha during the seeding operation. The treatments were arranged in a randomized complete block design and replicated four times.

The trials were seeded on May 17 and harvested on October 6 and October 25 for the silage and grain trials, respectively. Growing season rainfall (May 1 to September 30) and irrigation was 299 mm and 220 mm, respectively. Cumulative Corn Heat Units (CHU) were 2073 from May 15 until the first frost of -2^{0}C or greater which occurred on September 30. Growing season conditions in 2004 at CSIDC were wetter and cooler than the long term mean resulting in poor growing conditions for corn production. Soil analysis of samples collected in the spring prior to plot establishment indicated soil available NO_3-N (0-24") was 100 kg/ha and P (0-12") was 99 kg/ha. Current soil test recommendations indicated the requirement of 140-150 kg N/ha and 22-28 kg P_2O_5/ha for irrigated corn. An additional 50 kg N/ha applied as ammonium nitrate (34-0-0) was broadcast at the 6 leaf stage and watered in with an irrigation application.

Grain Corn

Eight hybrids were tested with CHU maturity rating varying from 2,150 to 2,350 (Table 19). Plant stand varied among the hybrids ranging from a low of 62,041 plants/ha to a high of 72,712 plants/ha. All plots exceeded the targeted plant population of 59,304 plants/ha.

Days to 10% anthesis (range: 80-88 days), days to 50% silking (range: 85-92 days) and grain yield @ 15.5% moisture content (range: 1888-4177 kg/ha) showed a general trend of decreasing as the CHU maturity rating increased (Table 19). Corn grain test weight ranged from a low of 38.4 kg/hl to a high of 56.0 kg/hl but showed no specific trend in relation to CHU maturity rating or grain yield. The grain corn did not mature properly resulting in small, shrivelled kernels with low test weight.

Silage Corn
Forty hybrids were tested with CHU maturity rating varying from 2000 to 2700 (Table 20). Plant stand varied among the hybrids ranging from a low of 74,675 plants/ha to a high of 90,825 plants/ha. All plots exceeded the targeted plant population of 74,130 plants/ha.

Days to 10% anthesis (range: 72-101 days) and days to 50% silking (range: 80-101 days) showed a general trend of increasing as the CHU rating increased. Dry yield (range: 9.9-15.0 t/ha) showed no trend in relationship to CHU maturity rating (Table 20). The cobs did not mature properly and as a result silage yields were low.

The cool growing season resulted in poor growing conditions and low yields for both the silage and grain corn.

Results from these trials are posted on the Alberta Corn Committee website at www.albertacorn.com.

Table 19. ACC 2004 Grain Hybrid Performance trial, Outlook.

Company	Hybrid	CHU Maturity Rating	Plant Stand (#/ha)	10% Anthesis (days)	50% Silking (days)	Harvest Grain Moisture (%)	Yield @ 15.5% moisture (kg/ha)	Test weight (kg/hl)
Hyland	HL 2093	2225	65515	84	90	9.4	2365	51.3
Hyland	HL 2017	2200	68741	82	85	10.6	4177	56
Hyland	Bixxio	2200	69238	80	87	12	2189	46.9
Maizex	MZ 119	2300	64274	85	90	9.8	2365	49.2
Maizex	MZ 130	2350	71223	88	92	7.5	1888	43.8
Maizex	EX 1033	2250	62041	85	89	12.1	2572	44.5
Monsanto	DKC26-78	2150	72712	80	85	10	3876	38.4
AAFC	03TC5-50760	-	69982	81	86	8.1	3519	50.3
		LSD (0.05)	5433	2	1	-	-	-
		CV (%)	5.4	1.5	1.1	-	-	-

Table 20. ACC 2004 Silage Hybrid Performance trial, Outlook.							
Company	Hybrid	CHU Maturity Rating	Plant Stand (#/row)	10% Anthesis (days)	50% Silking (days)	Harvest Whole Plant Moisture, (%)	Dry Yield (t/ha)
Garst	8905 RR	2700	88096	93	98	73.2	12.8
Garst	8961 RR	2105	79350	92	97	71.8	11.8
Hyland	HL S007	2150-2350	85018	83	91	69.8	11.8
Hyland	HL S009	2150-2400	84514	95	98	69.8	12.7
Hyland	HL S011	2200-2450	84514	94	97	69.4	15.2
Hyland	HL S014	2200-2400	82243	93	93	67.6	10.5
Maizex	MZ18-02RR	2450	87541	87	91	72.7	13.2
Maizex	MZ27-10RR	2700	83252	97	100	69.6	12.2
Maizex	MZ27-77RR	2650	84514	92	97	71.6	10.5
Maizex	LF 753	2350	83000	89	90	69.7	10
Maizex	LF 793	2400	80729	94	97	69.9	12.8
Maizex	LF 802	2500	82495	94	92	70.1	11.6
Maizex	LF 850RR	2650	85018	101	101	70.3	11.5
Monsanto	DKC26-78	2150	83505	81	86	65.6	9.9
Monsanto	DKC27-12	2250	89812	80	86	66.4	11.5
Monsanto	DKC30-02	2550	84514	87	91	70.1	11.5
Monsanto	DKC32-59	2475	85523	88	92	73.6	11.4
Pioneer	39D80	2550	80023	88	93	70.3	12.5
Pioneer	39F45	2000	76693	72	80	60.8	12.5
Pioneer	39F59	2200	85775	84	88	66.1	14.5
Pioneer	39H83	2450	86523	84	90	70.7	15
Pioneer	39K40	2600	81738	91	97	72.5	11.1
Pioneer	39P78	2050	82377	79	85	64	10.2
Pioneer	39T67	2200	83757	83	87	71.3	11
Pioneer	39T68	2250	82748	80	85	68.1	12.9
Pioneer	39T71	2250	78711	82	87	69.6	13.3
Syngenta	G4043	2600	83252	89	94	72.8	11.6
Syngenta	N05-C7	2250	83252	86	89	68.1	11.4
Syngenta	N11-F4	2475	85523	85	90	72.5	12.7
Syngenta	N16-N7	2600	82495	88	91	71.4	10.3
Syngenta	NX1212	2450	76693	88	92	71.9	12
Syngenta	NX1822	2600	83000	87	91	71.8	11.2
Elite	46T05	2300	84261	85	88	69.7	12.2
Pickseed	1424RR		74675	89	94	70.2	11.3
Pickseed	2365RR	2300	90821	85	91	71.5	11.2
Pickseed	ExAlt	2400	84009	95	98	75.4	12.3
Pickseed	ExLeafy		85018	97	100	73.7	13.9
Pickseed	ExPress	2550	89559	95	98	69.4	12.1
Pickseed	ExSile	2300	81234	92	98	71.2	11.1
Pickseed	SilEx Bt	2200	81738	87	90	69	14.6
		LSD (0.05)	6187	2	2	2.3	2.7
		CV (%)	5.3	1.9	1.8	2.3	17.8

Short Season Narrow Row Dry Bean Co-operative Trials A & B

Ongoing project. The objective is to evaluate new dry bean germplasm under irrigated narrow row conditions in western Canada.

Co-investigator: A. Vandenberg, Crop Development Centre, Saskatoon, Saskatchewan

The Short Season Narrow Row Dry Bean Co-operative Trial in Western Canada consisted of Trial A (black and navy types) with 18 entries and trial B (great northern, pink, pinto, small red and other market classes) with 36 entries. For the pinto and navy market classes, both determinate and indeterminate checks were included. All trials had three replicates. All plots were grown at a row spacing of 30 cm. On August 20-21, damage from frost caused unacceptably high variability for yield evaluation, maturity and seed quality. No data is presented.

Dry Bean Narrow Row Regional Variety Trial

Ongoing project. The objective is to assess the dry bean production of targeted environments within Saskatchewan using current and newly released varieties.

Co-investigator: A. Vandenberg, Crop Development Centre, Saskatoon, Saskatchewan

The potential for development of the dry bean sector of Saskatchewan's pulse industry has been limited by the lack of adapted varieties. Adapted breeding lines from the Crop Development Centre (CDC), U of S, Saskatoon, Saskatchewan, are at the stage of recommendation for registration. The next step in the development process is regional testing of new varieties. Regional performance trials provide information on the various production regions available in Saskatchewan to assess productivity and risk. This information is used by extension personnel, pulse growers and researchers across Saskatchewan to become familiar with these new pulse crops.

A Dry Bean Narrow Regional variety trial was established in the spring of 2004 at the CSIDC and CSIDC off-station sites. The 2004 Narrow Row Dry Bean Regional Trial (20 cm/8 in. row spacing) included mainly varieties that were specifically bred for narrow row production systems.

Nineteen dry bean varieties consisting of six market classes (pinto, great northern, navy, black, small red and bay) were evaluated. Yields were variable between the two sites but tended to show the same trends (Tables 21 and 22). Resolute great northern, AC Redbond and 737-22 small red and CDC Pintium pinto bean produced the highest yield of all varieties while CDC Jet black bean produced the lowest yield at both sites.

Most bean varieties flowered within a range of 50 - 60 days. CDC Pintium pinto bean and CDC Expresso black bean were the earliest varieties to flower taking 53 and 52 days, respectively.

CDC Pintium pinto bean matured 7-10 days earlier than most varieties. Most varieties required 115-125 days to mature. Some of the later maturing navy and black bean varieties froze prior to onset of maturity resulting in low yield and poor seed quality.

Pod clearance was generally good among the varieties indicating the progress being made in dry bean breeding programs to produce varieties with upright structure and pods held high on the plant. The majority of the varieties tested had pod clearance greater than 70%.

The highest seed weight was obtained for CDC Minto pinto bean. Smallest seed weight was obtained for CDC Jet black bean. The low seed weight for CDC Jet and other varieties was due in part to the cool growing season conditions and frost damage that occurred.

Plant height varied among the market classes as well as among varieties within a market class. Generally, the shortest variety was CDC Expresso black bean while the tallest variety varied between the two sites.

Due to the cool growing season, conditions experienced in 2004 all performance data for the dry bean narrow row variety trials should be interpreted with caution.

Short Season Wide Row Irrigated Bean Co-operative Registration Trial

Ongoing project. Funded by Agriculture and Agri-Food Canada, PFRA to evaluate new dry bean germplasm under irrigated wide row conditions in western Canada.

This project evaluates dry bean germplasm for its adaptation to western Canada under irrigated row crop production conditions. The germplasm sources include advanced lines from the AAFC Lethbridge Research Centre and the Crop Development Centre, University of Saskatchewan. These lines are compared to registered varieties within each market class.

An irrigated site was conducted at CSIDC. Standard fertilizer, weed control and irrigation practices for irrigated dry bean production were followed. The test consisted of 36 entries in a 6 x 6 lattice design that included 7 checks from 5 standard market classes (Pinto, Small Red, Great Northern, Black and Pink) and 29 advanced breeding lines (22 from AAFC-Lethbridge and 7 from CDC-Saskatoon). Individual plots consisted of two rows with 60 cm row spacing and measured 1.2 m x 3.7 m. All rows of a plot were pulled to simulate under-cutting before being harvested to determine yield.

Cool wet conditions during the 2004 growing season extended maturity of some entries resulting in fall frost damage which affected performance data. For this reason, all performance data for the Short Season Wide Row Irrigated Bean Co-operative Registration Trial should be interpreted with caution.

Generally, all pinto lines flowered earlier and matured earlier than Othello (Table 23). Six lines (L01B647, L01B544, L01B635, L01B518, L02B662 and L01B570) yielded higher and 12 lines yielded lower than Othello. In the great northern market class, all lines yielded higher than the check variety AC Polaris. In the black class, AC Black Diamond had higher yield than all entries. UI 906 black bean seemed to be affected by the cool growing season conditions to the greatest extent. The two small red entries yield similar to the check AC Redbond. In the pink market class, the single entry, 1333S-1, yielded higher than the check Viva.

Table 21. 2004 Irrigated Dry Bean Narrow Row Regional Variety trial, CSIDC.								
Variety	Yield (kg/ha)	Yield % of Pintium	Seed Weight (mg)	Days to Flower	Days to Maturity[1]	Plant Height (cm)	Lodge Rating (0=erect; 5=flat)	Pod Clearance[2] (%)
Pinto								
CDC Pintium	2889	100	321	53	109	44	1	85
Othello	2036	70	281	60	123	46	2.3	53
CDC Minto	2381	82	347	58	119	50	1.3	70
HR99	1770	61	272	59	118	49	1	67
Great Northern								
AC Polaris	2609	90	274	59	123	44	1.7	75
CDC Polar Bear	2525	87	330	58	118	44	3	77
Resolute	3206	111	314	58	113	51	1	82
Navy								
Envoy	1934	67	169	57	114	42	1	75
CDC Whitecap	1506	52	157	60	-	52	1	77
AC Cruiser	1896	66	141	59	122	52	1	73
T9601	2187	76	169	58	122	46	1.3	70
T9803/Cirrus	2184	76	158	58	125	49	1	72
Morden 003	1796	62	180	58	125	36	1	70
Black								
CDC Expresso	2213	77	172	52	113	41	1	70
CDC Jet	639	22	141	69	-	52	1	77
316-13	1364	47	164	59	-	43	1	67
Small Red								
AC Redbond	3176	110	280	59	115	52	1	77
737-22	2859	99	267	59	116	52	1	73
Bay								
610-23	2242	78	259	58	125	47	1	77
LSD (0.05)	428	-	15	1	-	4	1	6
CV (%)	11.9	-	3.9	1.2	-	5	28.8	5

[1] 50% of pods at buckskin stage
[2] % of pods >5 cm above soil surface

Table 22. 2004 Irrigated Dry Bean Narrow Row Regional Variety trial, CSIDC off-station site.								
Variety	Yield (kg/ha)	Yield % of Pintium	Seed Weight (mg)	Days to Flower	Days to Maturity[1]	Plant Height (cm)	Lodge Rating (0=erect; 5=flat)	Pod Clearance[2] (%)
Pinto								
CDC Pintium	4093	100	339	53	104	40	1	83
Othello	2693	66	307	59	117	51	3.3	55
CDC Minto	2873	70	360	58	120	59	2.7	70
HR99	1369	33	294	59	120	49	1	73
Great Northern								
AC Polaris	3144	77	320	57	119	49	3.3	75
CDC Polar Bear	3138	77	337	57	118	46	5	72
Resolute	4225	103	347	53	112	53	1	77
Navy								
Envoy	2071	51	173	57	113	45	1.3	70
CDC Whitecap	2350	57	165	59	124	55	1	73
AC Cruiser	2593	63	160	58	124	52	1	73
T9601	2068	51	196	55	123	44	1.3	70
T9803/Cirrus	2720	66	219	57	121	48	1	70
Morden 003	2398	59	186	56	120	38	1	72
Black								
CDC Expresso	2270	55	188	52	116	41	1	70
CDC Jet	554	14	149	64	-	55	1.3	73
316-13	1348	33	175	59	-	49	1	72
Small Red								
AC Redbond	4088	100	291	55	116	53	1	75
737-22	3303	81	263	59	113	51	1.3	72
Bay								
610-23	2612	64	283	56	119	43	1	75
LSD (0.05)	715	-	41	2	-	6	1	4
CV (%)	16.5	-	9.8	2	-	7.7	27.6	3.5

[1] 50% of pods at buckskin stage
[2] % of pods >5 cm above soil surface

Table 23. 2004 Short Season Wide Row Irrigated Bean Co-operative Registration trial.						
Variety	Yield (kg/ha)	Yield % of check	Seed Weight (mg)	Days to Flower	Days to Maturity[1]	Plant Height (cm)
Pinto						
Othello (check)	2783	100	282	60	120	46
L01B488	2546	91	378	54	112	41
L01B518	2866	103	391	54	109	39
L01B524	2527	91	399	54	111	37
L01B544	2935	105	401	54	107	39
L01B558	2755	99	401	54	105	40
L01B561	2709	97	401	54	111	39
L01B570	2825	102	403	55	109	38
L01B579	2585	93	371	55	108	38
L01B600	2616	94	394	54	108	38
L01B605	2594	93	380	54	109	40
L01B635	2869	103	414	54	110	40
L01B638	2565	92	381	55	110	40
L01B647	3041	109	343	54	109	40
L01B651	2602	93	390	54	110	39
L02B662	2858	103	288	60	118	56
97028-11	2341	84	299	60	115	53
1236M-18	2730	98	348	56	113	50
1073M-32	2290	82	334	60	119	52
Small Red						
AC Redbond (check)	3255	100	306	55	115	51
L02D366	3231	99	302	55	118	51
1142M-7	3239	100	255	58	122	51
Great Northern						
AC Polaris (check)	2123	100	313	58	119	47
US1140	2289	113	310	60	126	43
L01E294	2376	112	381	54	117	46
L02E297	2888	136	268	56	116	43
L02E317	2575	121	283	56	114	43
1389-3	3360	158	380	54	122	48
1006S-1	3565	168	347	54	118	46
Black						
AC Black Diamond (check)	2692	100	230	60	121	47
UI 906	1319	49	138	63	127	48
L02F130	2294	85	212	57	117	51
LO2F132	2128	79	227	61	123	49
L02F140	2179	81	193	59	120	45
Pink						
Viva (check)	2723	100	218	58	121	47
1333S-1	3592	132	324	58	122	52
LSD (0.05)	535	-	34.2	2.5	4.6	4.3
CV (%)	11.2	-	5.6	2.6	2.3	5.9

[1] 50% of pods are buckskin color

Dry Bean Wide Row Regional Variety Trial

Ongoing project. The objective is to assess dry bean varieties for production under irrigated wide row conditions in western Canada.

Co-investigators: H. Mundel, and J. Braun, Lethbridge Research Centre, Lethbridge, Alberta

A Dry Bean Wide Regional variety trial was established in the spring of 2004 at CSIDC and CSIDC off-station sites. The 2004 Wide Row Dry Bean Regional Trial (60 cm/24 in. row spacing) included mainly varieties that were specifically bred for wide row production systems.

Sixteen dry bean varieties consisting of five market classes (pinto, great northern, pink, black, small red) were evaluated. Yields were variable between the two sites but tended to show the same trends (Tables 24 and 25). Yield varied among the market classes and varieties within the market classes. The highest yielding variety in each market class was CDC Minto pinto bean, AC Polaris great northern bean, Early Rose pink bean, AC Black Diamond black bean and AC Redbond small red bean. AC Redbond small red bean was the highest yielding variety while Black Violet black bean was the lowest yielding variety at both sites.

Most bean varieties flowered within a range of 53 - 63 days. Earlier flowering generally meant earlier maturity. Maturity varied from 104 days for CDC Pintium pinto bean to 127 days for US1140 great northern bean. Black Violet black bean did not fully mature before the first fall killing frost. Maturity was delayed compared to previous years probably due to the cool conditions during the growing season.

Plant height varied between sites and among varieties within a market class within each site ranging from 42 cm for CDC Pintium pinto bean to 55-59 cm for Alert great northern bean. Plant height for most other varieties was in the range of 45 to 50 cm.

Seed weight varied among the market classes and among varieties within a market class. The highest seed weights were observed for the pinto and great northern market classes while the lowest seed weighs were observed for the black market class. The overall largest seed weight was observed for CDC Minto pinto bean while the smallest seed weight was observed for UI 906 black bean at both sites.

Due to the cool growing season conditions experienced in 2004, all performance data for the dry bean wide row variety trials should be interpreted with caution.

Table 24. 2004 Irrigated Dry Bean Wide Row Regional Variety trial, CSIDC.						
Variety	Yield (kg/ha)	Yield % of check	Seed Weight (mg)	Days to Flower	Days to Maturity[1]	Plant Height (cm)
Pinto						
Othello (check)	2958	100	314	60	117	44
CDC Pintium	2407	81	343	53	104	42
CDC Pinnacle	2371	80	333	60	117	46
CDC Minto (958310)	3120	106	382	58	117	47
Great Northern						
US 1140 (check)	2398	100	310	61	121	42
AC Polaris	3004	125	281	59	117	45
CDC Polar Bear	2756	115	333	59	117	44
Alert	2048	85	324	61	119	55
Pink						
Viva (check)	2646	100	237	60	120	43
Early Rose (L94C356)	2844	108	283	59	113	47
Black						
UI 906 (check)	1658	100	136	62	121	48
AC Black Diamond	2920	176	252	59	116	46
CDC Jet (315-18)	1847	111	155	62	124	47
Black Violet (L95F025)	1578	95	146	63	-	47
Small Red						
NW63	2493	100	278	60	120	44
AC Redbond	3130	126	300	59	114	50
LSD (0.05)	280	-	15	1	2	4
CV (%)	6.4	-	3.7	0.9	0.8	5.4

[1] 50% of pods are buckskin color

Table 25. 2004 Irrigated Dry Bean Wide Row Regional Variety trial, CSIDC off-station site.

Variety	Yield (kg/ha)	Yield % of check	Seed Weight (mg)	Days to Flower	Days to Maturity[1]	Plant Height (cm)
Pinto						
Othello (check)	3104	100	305	60	120	46
CDC Pintium	3253	105	362	55	105	43
CDC Pinnacle	2068	67	361	60	126	50
CDC Minto (958310)	3265	105	382	59	119	52
Great Northern						
US 1140 (check)	2387	100	306	60	127	44
AC Polaris	3387	142	294	56	119	49
CDC Polar Bear	3330	140	367	55	119	44
Alert	2187	92	332	62	122	59
Pink						
Viva (check)	3029	100	232	58	121	46
Early Rose (L94C356)	3163	104	282	57	113	44
Black						
UI 906 (check)	1754	100	143	63	129	49
AC Black Diamond	3014	172	237	60	120	49
CDC Jet (315-18)	1606	92	152	61	130	51
Black Violet (L95F025)	1529	87	154	62	-	52
Small Red						
NW63	2551	100	267	59	123	49
AC Redbond	3701	145	304	57	115	51
LSD (0.05)	485	-	27	2	3	5
CV (%)	10.2	-	6.7	2.2	1.5	5.8

[1] 50% of pods are buckskin color

Field Pea Co-operative Registration Test A and Test B

Ongoing project. The objective is to evaluate new pea germplasm for cropping conditions in western Canada.

Project Leads: T. Warkentin, Crop Development Centre, Saskatoon, Saskatchewan
D. Bing, Lacombe Research Centre, Lacombe, Alberta
A. Sloan, Morden Research Centre, Morden, Manitoba

This project evaluates pea germplasm for growing conditions in western Canada. The germplasm sources included advanced lines from the AAFC Morden Research Centre; Crop Development Centre , University of Saskatchewan; Crop Diversification Centre North, Alberta Agriculture and private seed companies. Forty-six candidate entries were divided into two equal tests with 23 entries in each test. Each test had three yellow check varieties, Cutlass, Eclipse and CDC Mozart. Test A also had two green check varieties, CDC Striker and Nitouche.

An irrigated site was conducted at the CSIDC. Standard fertilizer, weed control and irrigation practices for irrigated pea production were followed. Each test was arranged as a randomized complete block design with three replicates. Individual plots measured 1.2 m x 3.7 m. All rows were harvested to determine yield.

In test A, six yellow lines and one green line had yield higher than the check variety Eclipse (Table 26). All green lines had yield higher than the green check Nitouche. All yellow lines except CDC985-14 and CDC985-23 had maturity equal to or less than the yellow check Eclipse. All green lines had maturity less than the green check Nitouche. Only one yellow line (MP1824) had lodging rating lower than the yellow check variety Eclipse while one green line (CEB1093) had lodging rating equal to the green check variety Nitouche. All other yellow and green lines had lodging ratings higher than the respective checks. Highest seed weight was recorded for the yellow lines CEB4132 and SWB5016 and the green lines APCM76522, CEB1093 and CEB1090. Most other lines had seed weight that was less than the checks. The yellow line CDC1097-22 and the green lines CDC1111-8 and CDC672-4 had exceptionally low seed weight compared to the checks.

In test B, only two lines tested (MP1831 and SWB5104) yielded less than the check variety Eclipse (Table 27). Three lines CEB4149, MP1826 and CEB4143 had exceptionally high yield. Most lines had maturity less than the checks. The majority of the lines tested had lodge rating greater than the check variety Eclipse. Most lines had seed weight less than the check variety Eclipse except for lines APCM78341, APCM76504, CEB4147, CEB4152 and SWB5104. The highest seed weights were recorded for lines APCM78341 and APCM76504.

Table 26. 2004 Pea Co-operative Registration Test A.						
Entry	Yield (Kg/ha)	Yield % of check	Pre-Harvest Lodging 1=erect; 9=flat	Vine Length (cm)	Days to Maturity	Seed Weight (mg)
Yellow						
Eclipse (check)	7378	100	7	88	111	250
Cutlass	7274	99	7.3	86	110	224
CDC Mozart	7446	101	8	84	111	229
CEB4132	8763	119	8	79	110	284
CEB4136	7112	97	7.3	107	106	238
MP1824	8009	109	6.7	99	109	229
CDC728-8	8467	115	9	86	110	255
CDC1101-14	6302	86	7	92	112	206
CDC985-36	7599	103	8.7	89	114	211
CDC1097-22	5622	76	7	89	114	155
CDC985-14	5666	77	8.7	92	111	186
CDC985-23	7924	108	8.3	86	110	219
SWB5016	6026	82	7	88	105	273
DP68-38877	5579	89	8.3	96	105	246
DP68-38910	6077	83	7.7	88	103	240
Green						
Nitouche	4477	61	6.3	81	114	257
CDC Striker	7285	99	8	90	109	250
CEB1090	7632	104	7	94	113	291
CEB1093	6423	87	6.3	79	111	307
CDC672-4	4934	67	7.3	96	116	158
CDC1111-8	4947	67	7.7	95	110	151
CDC1314-4	6631	90	8.7	92	110	191
CDC1271-11	6467	88	7.3	82	112	191
SWA6145	5722	78	9	81	109	209
SWA6154	5579	76	7.7	84	111	200
SWA6141	6854	93	8	84	107	247
SWA6153	6266	85	7	80	106	204
APCM76522	5648	77	7.7	86	110	326
LSD (0.05)	795	-	-	-	-	-
CV (%)	7.3	-	-	-	-	-

Table 27. 2004 Pea Co-operative Registration Test B.						
Entry	Yield (Kg/ha)	Yield % of check	Pre-Harvest Lodging 1=erect ; 9=flat	Vine Length (cm)	Days to Maturity	Seed Weight (mg)
Yellow						
Eclipse (check)	6052	100	6.7	87	111	239
Cutlass	6314	104	7.3	90	110	206
CDC Mozart	6722	111	8	88	111	191
CEB4133	6083	101	8	99	110	226
CEB4134	6395	106	7.7	88	106	238
CEB4142	6836	113	8.7	86	108	231
CEB4143	7485	124	8	92	108	228
CEB4147	6716	111	6.7	103	106	262
CEB4148	7127	118	7.3	94	110	187
CEB4149	8080	134	8	95	110	216
CEB4150	6843	113	6.7	96	107	233
CEB4151	6536	108	7.3	96	109	231
CEB4152	6943	115	6	94	108	258
MP1826	7268	120	5.7	92	114	202
MP1829	6450	107	7.3	87	109	187
MP1830	6076	100	6.7	93	109	202
MP1831	5316	88	8.3	99	113	203
CDC1007-6	6411	106	8.3	100	105	203
CDC985-25	6370	105	9	91	108	197
CDC1308T-10	6691	111	8.7	92	108	197
SWA5122	6383	105	6	90	109	190
SWA5130	6663	110	8.7	95	106	213
SWA5126	6413	106	7.3	88	109	183
SWB5104	5822	96	8	85	107	246
APCM76504	6904	114	7.3	84	107	285
APCM78341	6417	106	6.3	103	110	288
LSD (0.05)	1221	-	-	-	-	-
CV (%)	11	-	-	-	-	-

Irrigated Field Pea Regional Variety Trial

Ongoing project. Funded by the Irrigation Crop Diversification Corporation to evaluate the agronomic performance of current and newly registered pea varieties under irrigation.

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

CSIDC (SW15-29-08-W3): Bradwell very fine sandy loam
CSIDC off-station (NW12-29-08-W3): Asquith sandy loam
Weiterman (SE16-31-07-W3): Asquith sandy loam - fine sandy loam
Pederson (NE17-28-07-W3): Elstow loam

Pea varieties were tested for their agronomic performance under irrigation. The CSIDC, Weiterman, CSIDC off-station and Pederson sites were seeded on May 11, 13, 18 and 18, respectively. Plot size was 1.5 m x 4.0 m. All plots received 50 kg N/ha as 46-0-0 and 45 kg P_2O_5/ha as 12-51-0 as a side band application during the seeding operation. Yields were estimated by harvesting the entire plot. The results are presented in Table 28.

Irrigated pea yield, height and lodging rating (Table 28) as well as seed weight (Table 29) varied among the four sites. The Weiterman site in particular had lower yields and lower seed weights probably due to the higher incidence of foliar disease at this site. Maturity was similar among the four sites for each variety. The yellow variety Alfetta and the green variety Nessie produced high yields with highest overall yield obtained for the yellow variety Alfetta averaged over the four sites.

The results from these trials are used to update the irrigation variety trial database at CSIDC and provide recommendations to irrigators on the best pea varieties suited to irrigation conditions.

Irrigated Soybean Regional Variety Trial

Ongoing project. Funded by Agriculture and Agri-Food Canada to evaluate soybean varieties under irrigation in the Lake Diefenbaker Development Area of Saskatchewan.

A soybean variety trial was established in the spring of 2004 at the CSIDC. Soybean varieties were tested for their agronomic performance under irrigation. Plot size was 1.5 m x 4.0 m. All plots received 50 kg N/ha as 46-0-0 and 45 kg P_2O_5/ha as 12-51-0 as a side band application during the seeding operation. Yields were estimated by harvesting the entire plot.

Ten soybean varieties with a range in heat unit maturity ratings were evaluated. Yields were low and variable (Table 30) probably a result of the cool growing season conditions experienced in 2004. None of the varieties tested reached full maturity prior to the first fall frost. Seed size was small with many frost damaged seeds (wrinkled, shrivelled and discolouration) present.

The cool wet conditions during the 2004 growing season extended maturity of all entries resulting in fall frost damage which affected performance data. For this reason, all performance data for the soybean variety trial should be interpreted with caution.

Table 28. Yield and agronomic data for the irrigated field pea regional variety trial (2004).

Variety	Pederson Site				Weiterman site				CSIDC Off-station site				CSIDC site				Mean yield	
	Yield (kg/ha)	Height (cm)	Maturity (days)	Lodge rating[1]	Yield (kg/ha)	Height (cm)	Maturity (days)	Lodge rating[1]	Yield (kg/ha)	Height (cm)	Maturity (days)	Lodge rating[1]	Yield (kg/ha)	Height (cm)	Maturity (days)	Lodge rating[1]	kg/ha	% of Alfetta
Yellow																		
Alfetta	7182	71	104	9	4176	72	103	9	7766	75	103	9	6999	72	103	9	6531	100
CDC Bronco	5554	87	109	8	2794	90	107	5.7	4299	94	107	6.7	6478	84	111	7.3	4781	73
CDC Golden	5264	94	107	6.3	3711	97	106	6.3	4961	93	104	7	6063	82	110	7	3750	57
CDC Mozart	5753	78	107	9	2633	83	103	8.7	5907	83	105	7.3	6486	73	108	9	5195	80
Carneval	6107	91	106	6.7	3493	84	107	5.7	6114	97	104	7	5960	90	106	6.7	5419	83
Carrera	6576	68	105	9	3823	80	103	9	6804	74	104	9	6720	70	106	9	5981	92
Cutlass	5715	84	108	7.7	2852	90	107	6.7	5096	100	106	7	6153	85	10	7.3	4954	76
Eclipse	5552	91	109	6.7	3218	90	107	6	5591	93	105	7.3	6434	86	110	6.3	5199	80
Miser	4512	90	110	7.3	2537	90	106	6	3701	95	105	6.3	5237	87	110	7.3	3997	61
SW Cabot	6051	80	107	7	5092	82	106	6.3	6582	81	104	7.3	5343	84	109	6.3	5767	88
SW Carousel	5661	94	108	7	3755	96	105	6.3	5965	99	104	7	6252	92	108	8	5408	83
SW Midas	5908	85	106	7	4020	88	103	7.3	5645	86	103	8	4144	83	109	7.3	4929	75
SW Salute	5135	78	106	7.7	3387	96	104	7.7	5112	85	104	7.7	5808	84	109	8.3	4861	74
Topeka	6111	75	105	9	3046	76	103	9	5580	83	103	8.3	6557	75	104	9	5324	82
Tudor	5433	102	112	6	4383	105	111	4.7	4824	94	106	6	6672	90	110	6.3	5328	82
CDC 653-8	6453	90	106	6.7	4837	95	106	5.3	6240	92	104	6.3	6614	95	108	6.7	6036	92
CDC 715-4	6347	88	110	9	3239	87	107	7.3	5905	95	106	7.3	7114	80	109	8	5651	87
Green																		
Nitouche	6202	84	111	7.3	4096	94	111	5	5233	92	105	7	5735	85	108	6	5317	81
Camry	6386	76	110	7.3	3814	80	106	6.3	5981	84	105	8	7210	78	110	8	5848	90
Cooper	5828	94	113	6.3	3481	89	107	6	6227	91	107	6.7	7517	91	111	5.6	5763	88
CDC Striker	6127	84	106	7	5146	88	106	6.3	6063	83	105	7	5933	83	107	7	5817	89
Nessie	6202	70	105	7.7	4315	81	104	8.7	7170	87	103	7.7	6734	81	108	7.1	6105	93
Stratus	5613	84	108	9	2753	83	106	7.7	5927	88	106	8.3	5959	77	107	9	5063	78
SW Parade	5991	80	111	7.3	3832	90	106	6	5761	92	106	7.3	6631	76	108	8.7	5554	85
Vortex	5395	84	105	8	3704	90	103	8	5398	93	102	8.3	6045	84	105	8.7	5136	79
CDC Sage	5776	79	107	7	3791	85	106	7	4356	96	107	7	5369	83	109	7	4823	74
LSD (0.05)	917	10	2	1	907	11	3	1	798	10	1	1	1539	10	3	1	-	-
CV (%)	9.5	7.5	1.3	7	15	7.8	1.6	10	8.5	7	0.6	6.3	15	7.6	1.7	10.5	-	-

[1] lodge rating (1 = erect, 9 = flat)

Table 29. Seed weight data for the 2004 Irrigated Field Pea Regional Variety trial.				
Variety	Seed weight (mg)			
	Pederson site	Weiterman site	CSIDC Off-station site	CSIDC site
Yellow				
Alfetta	276	216	257	288
CDC Bronco	179	158	166	196
CDC Golden	181	155	162	190
CDC Mozart	202	182	192	229
Carneval	178	157	175	180
Carrera	237	193	221	261
Cutlass	200	151	181	206
Eclipse	212	190	198	239
Miser	170	143	147	179
SW Cabot	228	201	232	240
SW Carousel	222	171	196	236
SW Midas	183	151	165	183
SW Salute	186	165	178	197
Topeka	219	179	209	229
Tudor	243	213	193	295
CDC 653-8	175	162	169	216
CDC 715-4	211	175	196	240
Green				
Nitouche	236	213	214	263
Camry	232	193	202	267
Cooper	242	196	225	257
CDC Striker	227	205	211	249
Nessie	273	224	263	299
Stratus	234	195	213	254
SW Parade	168	150	159	190
Vortex	166	133	155	207
CDC 672-1	185	153	142	181
LSD (0.05)	14	16	15	32
CV (%)	4.1	5.6	4.8	8.5

Table 30. Yield data for the 2004 Irrigated Soybean Regional Variety trial.			
Variety	Heat unit rating	Yield (kg/ha)	Seed weight (mg)
OAC Vision	2375	556	119
OAC Prudence	2450	252	82
AC Orford	2500	790	120
Gaillard	2400	828	109
Gentleman	2400	731	122
90B11	2600	85	81
Gowan 3506	-	498	129
Gowan 3513	-	586	117
GG 469	-	213	80
Napean	-	637	113
	LSD (0.05)	383	14
	CV (%)	43.1	7.7

Agronomic Trials

Liberty Efficacy: Tolerance Minor Use Research Registration Herbicide Trial for Liberty Link Corn

2004 only. Funded by the AFIF/PCAB Minor Use Steering Committee to develop data for Saskatchewan conditions in support of the minor use registration of Liberty herbicide for weed control in Liberty Link corn.

Liberty herbicide weed control (efficacy) and crop tolerance trials were established in the spring of 2004 at CSIDC located on the SW15-29-08-W3. The soil, developed on medium to moderately coarse-textured lacustrine deposits, was classified as Bradwell loam to silty loam.

All seeding operations were conducted using a specially designed small plot six row double disc press drill with two sets of discs. One set of discs was used for seed placement while the second set of discs allowed for side band placement of fertilizer. Treatments consisted of a range of Liberty 200SN (200 g a.i./L glufosinate ammonium) rates. The Liberty Link corn variety 39T71 (CHU rating = 2250) was seeded on an 80 cm (32") row spacing using single row cones. Two rows were seeded per pass. The plots consisted of two rows and measured 1.2 m x 6 m. A seeding rate of 56 kernels/row (74,130 plants/ha) was used. Separate trials were established for the Weed Efficacy and Crop Tolerance trials. All plots received a soil incorporated broadcast application of 100 lbs N/ac applied as urea (46-0-0) prior to seeding and a side band application of 12-51-0 at a rate of 45 kg P_2O_5/ha during the seeding operation. The treatments were arranged in a randomized complete block design and replicated four times.

Herbicide treatments were applied at the 3-4 leaf stage for the first application and before the 8 leaf stage for the second application for the Weed Efficacy trial. For the Crop Tolerance trial, the herbicide treatments were applied at the 6 leaf stage. Weed control and crop tolerance ratings were conducted at three time intervals after the herbicide treatments were applied.

The trials were seeded on May 17 and harvested on October 25. Growing season conditions in 2004 at CSIDC were wetter and cooler than the long term mean. Cumulative Corn Heat Units were 2,073 from May 15 until the first frost of -2^{0}C or greater which occurred on September 30. These cool and wet conditions resulted in poor cob development and low corn silage yield for irrigated growing conditions. Thus, the corn variety used in these trials, with a CHU rating of 2,250, did not attain its full yield potential.

Weed pressure was high in both trials. The main weed present was redroot pigweed. Other weeds present included lambs quarters, wild tomato, kochia and wild oats.

Weed Efficacy

All herbicide treatments reduced weed growth compared to the weedy check treatment as indicated by the weed control ratings observed at the three rating times (Table 31). Weed control increased as the rate of Liberty 200 SN was increased. The Liberty 200 SN applied twice (500 + 300 g a.i./ha) and Accent + Banvel II + Agsurf treatments provided the best weed control and the least weed re-growth of all the herbicide treatments over the entire growing season.

Corn silage dry matter yield was higher for the herbicide treatments compared to the weedy check (Table 31). There was no significant difference in silage dry matter yield among the treatments where herbicide was applied.

The results from this trial indicate that the Liberty 200SN herbicide provides excellent weed control when applied at the 500 + 300 g a.i./ha rate.

Crop Tolerance

All plots were hand weeded to remove weeds not controlled by the herbicide applications later in the growing season after the crop tolerance ratings were completed. This was done so that any effects of the herbicide treatments on the corn crop could be measured without the confounding effects of weed growth.

All herbicide treatment applications resulted in slight burning and discolouration of some leaves on the corn plants at the first crop tolerance rating time 7-24 days after herbicide application (Table 32). The corn plants outgrew the burning and dicolouration by the second crop tolerance rating time 21-35 days after application. There were no visual differences among the treatments later in the growing season.

Corn silage dry matter yield showed no significant differences between the weed-free check and any of the herbicide application treatments (Table 32). Applying the Liberty 200 SN at the 1X or 2X rate with or without the addition of ammonium sulphate did not affect corn silage dry matter yield. As well, corn silage dry matter yield showed no significant difference between any of the Liberty 200 SN treatments and the commercial standard herbicide application Accent + Banvel II + Agsurf.

The results from this trial indicate that the Liberty 200SN herbicide did not adversely affect the growth of the Liberty Link corn crop.

Table 31. Treatments, weed control ratings and silage dry matter yield for the Liberty Link MURR Weed Efficacy trial (2004).				
Treatment	Weed Control Rating[1](%)			Silage Dry Matter Yield (kg/ha)
	Time 1 7-14 DAA[2] (Jul. 2/04)	Time 2 21-35 DAA (Jul. 20/04)	Time 3 42-63 DAA (Aug. 18/04)	
Weedy check	0	0	0	10630
Liberty 200SN 300 g a.i./ha	45	17	11	14832
Liberty 200SN 400 g a.i./ha	67	35	24	14552
Accent 25 g a.i./ha Banvel II 288 g a.i./ha Agsurf 0.2% v/v	92	79	73	13061
Liberty 200SN 500 g a.i./ha - 1st Liberty 200SN 300 g a.i./ha - 2nd	95	90	86	14532
CV (%)	19	40.6	39.3	12.9
LSD (0.05)	6	24	13	2697

[1] Very good to excellent = 91-100; Good to very good = 81-90; Suppression = 60-79; Poor = < 60.
[2] Days after application

Table 32. Treatments, crop tolerance ratings and silage dry matter yield for the Liberty Link MURR Crop Tolerance trial - application at the 6 leaf stage.				
Treatment	Crop Tolerance Rating[1](%)			Silage Dry Matter Yield (kg/ha)
	Time 1 7-14 DAA[2] (Jul. 9/04)	Time 2 21-35 DAA (Jul. 29/04)	Time 3 42-56 DAA (Aug. 18/04)	
Weed-free check (hand weed)	0	0	0	14191
Liberty 200SN 1X rate 500 g a.i./ha	2	0	0	12757
Liberty 200SN 2X rate 1000 g a.i./ha	1	0	0	14190
Liberty 200SN 1X rate 500 g a.i./ha Ammonium Sulphate (49% solution) 6 L/ha	3	0	0	13041
Liberty 200SN 2X rate 1000 g a.i./ha Ammonium Sulphate (49% solution) 12 L/ha	2	0	0	13245
Accent 25 g a.i./ha Banvel II 288 g a.i./ha Agsurf 0.2% v/v	1	0	0	13293
CV (%)	33.3	-	-	8.7
LSD (0.05)	0.3	-	-	NS[3]

[1] Slight discolouration/stunting=0-9; Just acceptable=10; Not acceptable=11-30; Severe=>30.
[2] Days after application.
[3] Not significant

Annual Cereal Forage Yield Potential Trials

Year two. Funded by Agriculture and Agri-Food Canada, PFRA to evaluate the forage production potential of selected spring seeded barley, oat and triticale varieties under irrigated conditions.

A spring seeded annual cereal forage trial was established in the spring of 2004 at CSIDC. Treatments consisted of selected barley, oat and triticale varieties. A seeding rate of 250 seeds/m^2 was used for all crops. Separate trials were established for each crop. The entire plot area received a pre-seeding broadcast, soil incorporated application of urea (46-0-0) at a rate of 100 kg N/ha. All plots received a side band application of 12-51-0 at a rate of 45 kg P_2O_5/ha during the seeding operation. The treatments were arranged in a randomized complete block design and replicated four times. Each treatment measured 1.2 m x 6 m.

The trials were seeded on May 17 and harvested at the early flower growth stage for triticale and the soft dough growth stage for barley and oats. Harvest dates were July 29, August 4 and August 16 for the triticale, barley and oats, respectively.

Barley

Barley treatments consisted of nine varieties representing three types: malt (2), feed (4) and forage (3). Highest forage dry matter yield was obtained for AC Ranger, a 6-row, smooth awned, normal height forage barley while the lowest forage yield was obtained for Dillon, a 6-row, awnless/hooded, normal height forage barley (Table 33). AC Bold, Vivar and AC Hawkeye also had high yield similar to AC Ranger. Overall, barley forage dry matter yield for all varieties tested was high ranging from 11,090 to 14,826 kg/ha.

Plant height ranged from a high of 104 cm for AC Hawkeye (forage) to a low of 85 cm for CDC Bold (semi-dwarf feed). There were significant plant height differences between barley varieties; however, the differences did not show any trend in relation to forage yield. Most varieties had plant height in the range of 85-95 cm.

Days to first head emergence varied from 59 to 65 days for the barley varieties tested; however, days to the soft dough growth stage were similar among the varieties tested (77 to 79 days).

Lodging resistance of the majority of the barley varieties tested was poor as indicated by the high lodging rating scores recorded. This was probably a result of the cooler than normal growing season conditions. CDC Bold had the lowest lodging score of all varieties tested.

All barley varieties tested showed leaf disease incidence. The greatest extent and severity of leaf disease as indicated by the visual estimations was shown for Vivar, CDC Battleford, Trochu, AC Hawkeye and AC Ranger. CDC Bold and Dillon had the lowest disease ratings.

Forage quality analysis for the barley varieties tested indicated that the feed barley varieties had the best combination of CP, low NDF, low ADF and high TDN (forage quality indicators) desirable for feed. The malt barley varieties tested had the poorest combination of forage quality indicators.

Oat

Oat treatments consisted of five varieties representing three types: general purpose (1), milling/feed (2) and forage (2). Highest forage dry matter yield was produced by CDC Baler (forage type) while the lowest forage yield was produced by Calibre (general purpose type) (Table

34). No significant differences in dry matter yield were observed among the oat varieties tested. Overall, oat forage dry matter yield for all varieties tested was high ranging from 14,769 to 17,202 kg/ha.

Plant height ranged from a high of 124 cm for CDC Baler and CDC Bell (forage) to a low of 114 cm for Pinnacle (milling/feed). There were significant plant height differences between oat varieties; however, the differences did not show any trend in relation to forage yield.

Days to first head emergence varied from 62 to 67 days for the oat varieties tested; however, days to the soft dough growth stage showed very little difference (89 to 93 days).

Lodging resistance of the majority of the oat varieties tested was poor as indicated by the high lodging rating scores recorded for all varieties except AC Morgan which had an exceptionally low lodging score. The high degree of lodging was probably a result of the cooler than normal growing season conditions.

All oat varieties tested showed leaf disease incidence. However, disease was minimal with little distinction between the varieties tested.

Forage quality analysis for the oat varieties tested indicated that the milling/feed barley varieties had the best combination of CP, low NDF, low ADF and high TDN (forage quality indicators) desirable for feed. All other varieties tested had similar CP, slightly higher NDF and ADF and lower TDN.

Triticale

Triticale treatments consisted of five varieties. Highest forage dry matter yield was produced by Viking while the lowest forage yield was produced by AC Ultima (Table 35). Viking produced significantly higher dry matter yield than all the other varieties. Overall, triticale forage dry matter yield for all varieties tested was low ranging from 7,284 to 10,713 kg/ha. The low yields were probably due to cutting at the early flower growth stage and to the herbicide damage early in the growing season.

Plant height ranged from a high of 134 cm for Viking and Comet to a low of 98 cm for AC Ultima. There were significant plant height differences between triticale varieties with a trend of taller varieties producing higher forage yield.

Days to first head emergence varied from 61 to 63 days for the triticale varieties tested.

Lodging resistance of the majority of the triticale varieties tested was good as indicated by the low lodging rating scores recorded. The low lodging rating scores was probably due to the fact that the varieties were harvested at the early flower growth stage prior to kernel development.

All triticale varieties tested showed leaf disease incidence; however, the disease was minimal with little distinction between the varieties tested.

Forage quality analysis for the triticale varieties tested indicated that AC Ultima had the best combination of CP, low NDF, low ADF and high TDN (forage quality indicators) desirable for feed. All other varieties tested had similar CP, slightly higher NDF and ADF and lower TDN.

Table 33. Agronomic data for the irrigated barley forage trial.

Variety	2 or 6 row	Awn Type[1]	Straw[2]	Dry Matter Yield (kg/ha)	Height (cm)	Head Emergence (days)	Soft Dough (days)	Lodging rating (1=erect; 9=flat)	Disease		Forage Quality Analysis[3]			
									Extent (0-5)	Severity (0-5)	CP	NDF	ADF	TDN
Malt														
CDC Copeland	2	R	N	12705	93	65	79	6.5	2	1.8	11.3	54.4	34.3	61.4
CDC Battleford	6	S	N	12702	93	60	77	7.8	2.3	2.8	11.6	50.1	36.2	59.3
Feed														
Trochu	6	S	N	12491	91	59	78	8.8	2.3	2.5	12.8	53.3	32.9	62.9
Vivar	6	R	SD	14156	87	60	78	8.5	3	2.8	11.2	51.2	31.7	64.2
AC Rosser	6	S	N	13275	89	59	77	8.5	2	1.8	13.4	53.2	33.5	62.2
CDC Bold	6	R	SD	14310	85	64	77	3.8	1.3	1.5	12.7	50.6	31.5	64.3
Forage														
AC Ranger	6	S	N	14826	89	60	78	8.5	2	2.3	12.5	55.2	35.1	60.6
AC Hawkeye	6	S	N	14136	104	60	78	8.5	2.3	2.3	13.4	61.2	36.8	58.7
Dillon	6	A/H	N	11090	90	62	77	5.8	1.3	1.3	12.1	55.1	34.9	60.6
LSD (0.05)				2103	4	1	1	2.2	0.6	0.6	-	-	-	-
CV(%)				10.8	2.8	0.7	0.8	20.6	19.3	18.6	-	-	-	-

[1] R = rough; S = smooth; A/H = awnless/hooded.
[2] N = normal; SD = semi-dwarf.
[3] CP = crude protein; NDF = neutral detergent fibre; ADF = acid digestible fibre; TDN = total digestible nutrients.

Table 34. Agronomic data for the irrigated Oat Forage trial.											
Variety	Dry Matter Yield (kg/ha)	Height (cm)	Head Emergence (days)	Soft Dough (days)	Lodge rating (1=erect; 9=flat)	Disease		Forage Quality Analysis[1]			
						Extent (0-5)	Severity (0-5)	CP	NDF	ADF	TDN
General Purpose											
Calibre	14769	120	63	90	6.5	2.8	2.5	10.6	58.8	41.1	54.2
Milling/Feed											
Pinnacle	16646	114	62	89	6.5	2.3	2.3	9.9	57.9	38	57.4
AC Morgan	16670	115	63	90	1.8	2.8	2.5	10.7	56.4	36.3	59.2
Forage											
CDC Bell	15371	124	67	92	6.5	2	1.5	10.6	61.8	41.2	54.1
CDC Baler	17202	124	67	93	6.5	2	1.3	10.9	59.3	39.1	56.3
LSD (0.05)	NS[1]	3	0.3	1	2.1	0.6	0.9	-	-	-	-
CV(%)	8.1	1.5	0.4	0.6	24.5	17.8	29.2	-	-	-	-

[1] not significant

[2] CP = crude protein; NDF = neutral detergent fibre; ADF = acid digestible fibre; TDN = total digestible nutrients.

Table 35. Agronomic data for the Irrigated Triticale Forage trial.

Variety	Dry Matter Yield (kg/ha)	Height (cm)	Head Emergence (days)	Lodging rating (1=erect; 9=flat)	Disease		Forage Quality Analysis[2]			
					Extent (0-5)	Severity (0-5)	CP	NDF	ADF	TDN
Viking[1]	10713	134	61	1.5	1.8	1.8	12.3	66.2	45.6	49.4
Banjo	7678	109	63	1	1	1	14.2	66.1	43.5	51.6
Comet[1]	9683	134	61	1	1.8	1.8	12.6	65.2	44.2	50.9
Pronghorn	9322	110	63	1	1.3	1.3	14.3	65.5	42.9	52.3
AC Ultima	7284	98	62	1	1	1	13.1	62.2	39.9	55.4
LSD (0.05)	1038	5	1	0.4	0.5	0.5	-	-	-	-
CV(%)	7.5	2.9	0.5	23.5	24.4	24.4	-	-	-	-

[1] Varieties not registered in Canada. Available only for forage or feed production.
[2] CP = crude protein; NDF = neutral detergent fibre; ADF = acid digestible fibre; TDN = total digestible nutrients.

Dry Bean Nitrogen Management of Contrasting Growth Habit Pinto Bean Cultivars Under Irrigated Conditions

Year three. The objective is to determine the merits of using starter nitrogen with granular inoculant in pinto bean production.

Dry bean is generally considered a poor nitrogen fixing species and, as such, requires the application of starter nitrogen fertilizer in order to produce optimum yield. Large nitrogen applications may reduce the nitrogen fixing capacity. Thus, optimizing dry bean yield requires the proper balance between nitrogen fertilizer applications and nitrogen fixation through inoculation with the appropriate *Rhizobium* inoculant.

A dry bean nitrogen and granular inoculant trial was established in the spring of 2003 at the CSIDC. Treatments included two pinto bean cultivars (Othello and CDC Pintium pinto bean) and four starter nitrogen rates (0, 25, 50 and 75 kg N/ha) applied as granular urea (46-0-0) in combination with or without granular inoculant. The nitrogen was side banded, while the granular inoculant was seed placed during the seeding operation. The dry bean cultivars were seeded at a target plant population of 30 plants/m^2 using a 40 cm row spacing. A factorial arrangement of the pinto bean cultivars, starter nitrogen rates and inoculant treatments in a randomized complete block design with four replicates was used. Normal fertilizer, weed control and irrigation practices for irrigated dry bean production were followed. Each treatment consisted of two passes with the drill and measured 2.4 m x 8 m.

Soil analysis of samples collected in the spring prior to plot establishment indicated soil available NO_3-N (0-24") = 36 lbs/ac and P (0-12") = 20 lbs/ac. Current soil test recommendations indicated the requirement of 95-105 lbs N/ac and 30-35 lbs P_2O_5/ac for irrigated non-inoculated dry bean.

Plant height at the pod fill growth stage was significantly effected by cultivar, nitrogen rate and inoculant treatment (Table 36). Othello produced higher plants than CDC Pintium, plant height increased as the nitrogen rate increased and plants were higher where inoculant was applied.

Biomass was significantly affected by cultivar with Othello producing more biomass at the pod fill growth stage than CDC Pintium (Table 37). There was also a trend of increasing bean dry weight biomass yield as the nitrogen application rate increased; however, the effects were not statistically significant.

Dry bean yield showed a significant response to cultivar, nitrogen application rate and inoculant (Table 38). CDC Pintium produced a higher yield than Othello. Othello is a longer season variety and did fully mature in the cool growing season conditions resulting in low yield whereas CDC Pintium is a shorter season variety which did not mature in the shorter, cooler growing season conditions experienced in 2004. CDC Pintium yield increased with each increment in nitrogen fertilizer application with the highest rate producing a significantly higher yield than the 25 and 50 kg N/ha rates which, in turn, produced a higher yield than the control treatment. There was no affect of nitrogen application on Othello yield. CDC Pintium yield was also higher where inoculant was applied. Othello showed no effect of inoculant application.

Seed weight was greater for CDC Pintium compared to Othello (Table 39). As well, seed weight was greater where inoculant was applied. Dry bean seed weight showed a trend of increasing with nitrogen application rate but the increases were not significant. The number of pods per plant (Table 40) and seeds per plant (Table 41) was slightly higher for Othello than CDC Pintium. There was no effect of nitrogen rate or inoculant on the number of pods or seeds produced.

Table 36. Effect of starter nitrogen rate and inoculant treatment on the plant height (cm) of irrigated Othello and CDC Pintium pinto bean.

N Rate (kg/ha)	Othello			CDC Pintium			Overall Mean
	Control	Inoculant	Mean	Control	Inoculant	Mean	
0	42	45	44	37	41	39	41
25	42	43	43	39	39	39	41
50	44	45	45	40	41	40	42
75	46	45	45	41	41	41	43
Mean	44	45		39	41		
Overall Mean	44			40			
CV (%)	4.6						
ANOVA	LSD (0.05)						
Cultivar ©)	1						
N Rate (N)	1						
Inoculant (I)	2						
C x N	NS[1]						
C x I	NS						
N x I	NS						
C x N x I	NS						

[1] not significant

Table 37. Effect of starter nitrogen rate and inoculant treatment on the pod fill growth stage dry matter yield (kg/ha) of irrigated Othello and CDC Pintium pinto bean.							
N Rate (kg/ha)	Othello			CDC Pintium			Overall Mean
	Control	Inoculant	Mean	Control	Inoculant	Mean	
0	4231	5019	4325	3919	4288	4103	4214
25	4500	5475	4988	4481	4094	4288	4638
50	4844	5200	5022	3969	4331	4150	4586
75	5219	5350	5284	3963	5163	4563	4924
Mean	4699	5261		4083	4469		
Overall Mean	4980			4276			
CV (%)	15.4						
ANOVA	LSD (0.05)						
Cultivar ©)	358						
N Rate (N)	NS[1]						
Inoculant (I)	NS						
C x N	NS						
C x I	NS						
N x I	NS						
C x N x I	NS						

[1] not significant

Table 38. Effect of starter nitrogen rate and inoculant treatment on the seed yield (kg/ha) of irrigated Othello and CDC Pintium pinto bean.							
N Rate (kg/ha)	Othello			CDC Pintium			Overall Mean
	Control	Inoculant	Mean	Control	Inoculant	Mean	
0	1892	1947	1919	1574	2063	1783	1864
25	1974	1958	1966	1927	2220	2073	2020
50	1975	1852	1913	2213	2286	2250	2081
75	2049	1789	1919	2385	2760	2572	2245
Mean	1973	1887		2025	2332		
Overall Mean	1929			2182			
CV (%)	10						
ANOVA	LSD (0.05)						
Cultivar ©)	103						
N Rate (N)	146						
Inoculant (I)	103						
C x N	207						
C x I	146						
N x I	NS[1]						
C x N x I	NS						

[1] not significant

Table 39. Effect of starter nitrogen rate and inoculant treatment on the seed weight (mg) of irrigated Othello and CDC Pintium pinto bean.							
N Rate (kg/ha)	Othello			CDC Pintium			Overall Mean
	Control	Inoculant	Mean	Control	Inoculant	Mean	
0	282	284	283	327	341	334	309
25	279	284	281	341	335	338	310
50	275	285	280	334	331	332	306
75	278	284	281	335	347	314	298
Mean	279	284		334	339		
Overall Mean	281			336			
CV (%)	2.4						
ANOVA	LSD (0.05)						
Cultivar ©)	4						
N Rate (N)	NS[1]						
Inoculant (I)	4						
C x N	NS						
C x I	NS						
N x I	NS						
C x N x I	11						

[1] not significant

Table 40. Effect of starter nitrogen rate and inoculant treatment on the number of pods per plant of irrigated Othello and CDC Pintium pinto bean.

N Rate (kg/ha)	Othello			CDC Pintium			Overall Mean
	Control	Inoculant	Mean	Control	Inoculant	Mean	
0	12	13	13	12	10	11	12
25	15	14	14	11	10	10	12
50	14	14	14	13	13	13	14
75	14	12	13	12	14	13	13
Mean							
Overall Mean	13			12			
CV (%)							

ANOVA	LSD (0.05)
Cultivar ©)	1
N Rate (N)	NS[1]
Inoculant (I)	NS
C x N	NS
C x I	NS
N x I	NS
C x N x I	NS

[1] not significant

Table 41. Effect of starter nitrogen rate and inoculant treatment on the number of seeds per plant of irrigated Othello and CDC Pintium pinto bean.

N Rate (kg/ha)	Othello			CDC Pintium			Overall Mean
	Control	Inoculant	Mean	Control	Inoculant	Mean	
0	53	56	54	44	36	40	47
25	55	56	56	40	36	38	47
50	58	52	55	47	47	47	51
75	51	49	50	48	49	49	50
Mean	54	53		45	42		
Overall Mean	54			43			
CV (%)	20.8						

ANOVA	LSD (0.05)
Cultivar ©)	5
N Rate (N)	NS[1]
Inoculant (I)	NS
C x N	NS
C x I	NS
N x I	NS
C x N x I	NS

[1] not significant

Response of Contrasting Growth Habit Pinto Bean Cultivars to Late Nitrogen Application Under Irrigated Conditions

Third year. The objective is to determine the effect of late nitrogen application on the yield and seed quality of contrasting growth habit pinto bean cultivars under irrigated conditions.

Dry bean is generally considered a poor nitrogen fixing species and, as such, requires the application of some additional nitrogen fertilizer in order to produce optimum yield. Applying all the nitrogen prior to plant emergence may result in excessive vegetative growth resulting in a reduction in seed yield and a greater chance of the development of diseases such as white mold (sclerotinia). Bean plants may also benefit from increased levels of available soil nitrogen during pod fill if the ability of the plants to acquire nitrogen from symbiotic N_2 fixation or soil uptake is impaired by root disease or nodule senescence. By delaying the application of the additional nitrogen later in the growth stage, a greater proportion of the nitrogen may be utilized in seed production, producing more and/or larger seeds rather than vegetative growth.

A dry bean late nitrogen fertilizer response trial was established in the spring of 2004 at CSIDC. Treatments included nitrogen applications at seeding, early flower, mid-late flower and early pod fill of 50 kg N/ha applied as granular ammonium nitrate (34-0-0) plus a control. The granular ammonium nitrate was side-band applied for the seeding nitrogen treatment while the late nitrogen applications were broadcast applied just prior to an irrigation application that allowed movement of the nitrogen into the soil. Two pinto bean cultivars of contrasting growth habit (Othello - type III indeterminate sprawling vine and CDC Pintium - type I upright determinate) were seeded at a target plant population of 30 seeds/m^2 using a 40 cm row spacing. A factorial arrangement of the nitrogen fertilizer application times and dry bean cultivars in a randomized complete block design with four replicates was used. Normal fertilizer, weed control and irrigation practices for irrigated dry bean production were followed. Each treatment consisted of two passes with the drill and measured 2.4 m x 8 m.

Plant height was affected by cultivar and the time of nitrogen application (Table 42). Othello produced taller plants than CDC Pintium. Applying nitrogen at seeding increased plant height compared to the control treatment and applying nitrogen at the mid-late flower and early pod fill growth stages.

Dry bean yield and seed weight showed no significant response to the nitrogen applications (Table 42). Nitrogen applied at seeding as well as the late nitrogen applications did not increase yield or seed weight above that of the control treatment. Overall yield was low probably due to the cool growing season conditions experienced in 2004. Othello, a late season variety, did not fully mature resulting in low yields while CDC Pintium, a short season variety, reached maturity. As a result, both yield and seed weight were greater for CDC Pintium compared to Othello.

Table 42. Effect of time of nitrogen application on the plant height, seed yield and seed weight of irrigated Othello and CDC Pintium pinto bean.									
Time of Nitrogen Application	Plant Height (cm)			Seed Yield (kg/ha)			Seed weight (mg)		
	Othello	CDC Pintium	Mean	Othello	CDC Pintium	Mean	Othello	CDC Pintium	Mean
Control	40	37	39	1912	1846	1879	282	342	312
Seeding	43	39	41	1934	2131	2033	274	345	310
Early Flower	42	38	40	1800	2140	1970	283	329	306
Mid-Late Flower	41	36	39	2040	2108	2074	284	342	313
Early Pod Fill	41	37	39	2011	2062	2037	286	342	314
Mean	41	38		1939	2057		282	340	
CV (%)	4.7			10.4			2.3		
ANOVA	LSD (0.05)			LSD (0.10)			LSD (0.05)		
Cultivar ©)	1			111			5		
Time (T)	2			NS			NS		
C x T	NS[1]			NS			10		

[1] not significant

Determining the Yield Potential of Dry Pea

Ongoing project. Funded by Agriculture and Agri-Food Canada to determine under conditions where disease is controlled by limiting canopy wetness without soil moisture stress.

Principal: R.B. Irvine, Brandon Research Centre, Brandon, Manitoba

Dry pea yield potential will be determined under conditions where disease is controlled by limiting canopy wetness without soil moisture stress. Thus the direct impact of temperature on crop yields can be determined. This will enable producers to limit fungicide applications to times where there is sufficient disease and yield potential to warrant application of fungicide.

Experimental Design

The following treatments were applied to plots of SW Parade dry pea planted at 100 seeds m^2. Treatments were arranged in a split plot design with early and late May seeding dates as the main plots.

1. Irrigation plus multiple fungicide applications, these applications began at the start of flowering and were weekly until the end of flowering using Headline foliar fungicide at 0.16 L/ac.
2. Irrigation only
3. No irrigation or fungicide

Results and Discussion

Plants stands were similar at both seeding dates and as expected did not differ due to irrigation treatments which were applied later in the season (Table 43). While not significant, there was a trend towards the later seeded crop having a slightly lower biomass at the time of flowering. The number of nodes at the time of flowering was significantly greater at the later seeding depth. The value of fungicide was limited in terms of yield at both seeding dates. Stem disease levels were reduced by fungicide application but were lower at the later seeding date indicating that conditions were less favourable for disease development.

There was a significant interaction between soil moisture and fungicide treatments between seeding dates. The lowest yield was the fully irrigated treatment at the late seeding date. The same treatment at the early seeding date was the highest yielding being almost 60% higher. A high portion of the yield differences were due to differences in seed size and were not predictable by biomass at flowering, number of nodes or any combination of these. Early seeding continues to be an important contributor to high pea yields when diseases are not important or are controlled.

Table 43. Impact of seeding date and moisture plus fungicides on pea yield at Outlook in 2004

Treatment[1]	Seed Date	Plants /m2	Biomass @ onset flower (kg/ha)	# nodes @ flower	Biomass @ end flower (kg/ha)	Leaf disease rating (Xue)[2]	Stem disease rating (Wang)[2]	Seeds /plant	Seed weight (mg)	Seed yield (kg/ha)
Irr + Fung	early	71.7	3009	11.8	13846	4.6	4.0	6971	229	293
Irrg	early	69.4	2992	11.6	13013	5.8	5.0	7628	214	241
Dry	early	73.1	2689	11.9	10800	4.8	3.1	4596	186	258
Irr + Fung	late	67.5	2445	12.8	12729	3.8	2.4	4751	183	235
Irr	late	74.6	2436	13.0	11459	4.3	3.5	4364	161	271
Dry	late	72.3	2635	13.2	10289	4.0	3.2	5328	214	179
Seed date		0.98	0.12	0.03	0.07	0.06	0.04	0.01	0.00	0.23
Irr + Fung		0.58	0.95	0.58	0.01	0.01	0.01	0.07	0.06	0.12
Irr x date		0.33	0.43	0.75	0.79	0.36	0.03	0.00	0.00	0.06

[1] Irr = irrigated; Fung = fungicide; Dry = not irrigated

[2] Disease rating scales

Variety Development

Evaluation of Durum Breeding Lines for Irrigation

Ongoing Program. Funded by Agriculture and Agri-Food Canada to identify superior durum wheat lines for production under irrigation in Saskatchewan. The trials are conducted at Swift Current and Outlook, Saskatchewan.

Plant Breeder: J.M. Clarke, Semiarid Prairie Agricultural Research Centre, Swift Current

The Durum Central 'A' test was planted under irrigation at Outlook in 2004, in addition to an irrigated site at Lethbridge, Alberta, and non-irrigated tests at Brandon, Indian Head, Regina and Swift Current. This test consisted of short and semidwarf durum lines with potential adaptation to irrigated and high rainfall environments. There were a total of 114 experimental lines and six check cultivars, replicated twice to make a total of 240 plots. Fifty-five lines were selected from this test, and will be further evaluated for suitability to enter the 2005 Durum 'B' Test, the final test prior to the Durum Cooperative Test.

In addition, our irrigated testing at Outlook included three trials of F_4 and F_5 breeding lines, consisting of a total of 964 lines. These experimental lines come from crosses with semidwarf parents, and have potential for improvement of yield, straw strength, disease resistance, and protein content compared to AC Navigator and Commander, the only registered semidwarf varieties. The best lines from these trials will be grown under irrigation in 2005. Testing of this material under irrigation permits selection for straw strength and leaf diseases, and increases the chance of identification of good semidwarf varieties.

Disease resistance and straw strength continue to be the major impediments to high yields in semidwarf durum wheat. We can select for leaf spots and kernel diseases such as red smudge and blackpoint in our Saskatchewan and Alberta test sites, and we select for Fusarium Head Blight resistance in nurseries in Manitoba.

Pea Cultivar Preliminary Yield Trials

Ongoing project. Funded by the Saskatchewan Agriculture Development Fund, the Saskatchewan Pulse Growers, the Agri-Food Innovation Fund, and the Crop Development Centre, University of Saskatchewan to develop high yielding, early, disease resistant green, yellow and specialty pea varieties for Saskatchewan.

Plant Breeders: A. Vandenberg, T. Warkentin, S. Baniza and K. Bett,
Crop Development Centre, University of Saskatchewan, Saskatoon

Field pea advanced breeding trials conducted at Outlook under irrigated conditions identified several high-yielding yellow, green and specialty field pea lines with improved lodging resistance and resistance to powdery mildew. Two elite and 13 advanced level two-replicate trials of 24 to 36 entries of mostly green and yellow types were grown. An additional 12-entry two-replicate trial of specialty pea types was also grown. Most lines were resistant to powdery mildew. Green-seeded lines were evaluated for tolerance to bleaching. Lines with the highest yield, best lodging tolerance, best disease tolerance ratings and above average quality profile will be advanced to registration recommendation trials for the 2005 season.

Dry Bean Cultivar Preliminary Yield Trials

Ongoing project. Funded by the Saskatchewan Agriculture Development Fund, the Saskatchewan Pulse Growers, the Agri-Food Innovation Fund, and the Crop Development Centre, University of Saskatchewan, to develop high yielding, adapted dry bean varieties for Saskatchewan.

Plant Breeders: A. Vandenberg, T. Warkentin, S. Baniza and K. Bett,
Crop Development Centre, University of Saskatchewan, Saskatoon

Dry bean trials were conducted at Outlook under irrigated conditions to identify early-maturing, high yielding breeding lines in the pinto, black, navy, great northern, red, pink and specialty market classes for the narrow row production system. Seven 36-entry two-replicate and one 18-entry two-replicate elite trials were grown along with ten 36-entry two-replicate and one 18-entry two replicate advanced trials. On August 20-21, damage from frost caused unacceptably high variability for yield evaluation, maturity and seed quality.

Sugar Beet Trial

Researcher: Dr. Thomas S. C. Li, Agriculture and Agri-Food Canada, Summerland, BC

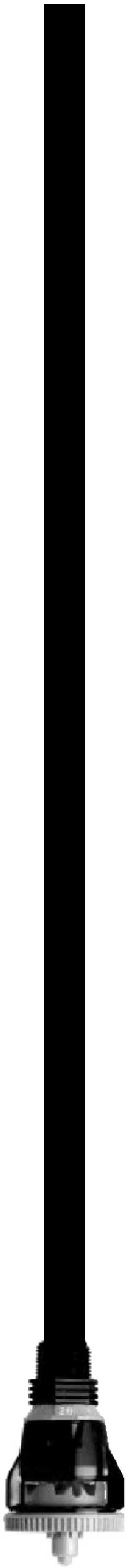
Leaders in utilizing ethanol as a fuel are Brazil, United States, and European countries. Advantages of ethanol as a fuel are high in octane number, there is no need for lead in the fuel, and it doesn't contain sulfur. With the growing environmental concerns in Canada, ethanol and other alternative fuels are receiving increased consideration and biomass ethanol derived from agricultural residues has gathered great interest. There are various possibilities which agriculture offers as a contribution to resolving the energy crisis by producing material as a source of biofuel production. With respect to the need to find new ways of using surplus agricultural crops outside the food industry, utilization of sugar beet for liquid fuel production is a valuable alternative.

Objectives and approaches

1. Select a new crop suitable and more efficient for ethanol production to replace currently used crop material.
2. Variety trials in at least two regions in Canada to select varieties with high sugar content and yield.
3. Develop a sustainable production system for this chosen crop.
4. Determine ethanol production rates of selected varieties.
5. Invite industry to a joint research with AAFC for this new approach.

Work in progress

Thirty five varieties of sugar beet were collected in the spring of 2004. Variety trials were conducted in Manitoba, Saskatchewan, and British Columbia in May-June, and harvested in Sept-Oct. Yield, individual root size, sugar and ethanol contents will be determined.



Horticultural Crops Program

Dr. Jazeem Wahab, Acting Manager
Canada-Saskatchewan Irrigation Diversification Centre
Outlook, Saskatchewan

Greg Larson, Acting Special Crops Agronomist
Canada-Saskatchewan Irrigation Diversification Centre
Outlook, Saskatchewan

Potato Research and Development Program

Medicinal Herb Research Program

Potato Research and Development Program

Introduction

Saskatchewan has become one of the leading seed potato producers and exporters in North America. This is mainly due to the phenomenon of 'Northern Vigour™' and disease-free status of seed tubers produced in this province. Saskatchewan is recognized as one of the few remaining areas in North America that can consistently produce high quality early generation seed potatoes. The major target markets include the USA, Mexico, and several Canadian provinces. Quality characteristics of a superior seed stock include greater physiological vigour, freedom from tuber-borne diseases, and uniform tuber size of the seed lot as demanded by the target market. Appropriate production and storage management practices are necessary to produce disease-free, physiologically vigorous seed-tubers of specific size grades to suit market needs. Commercial potato growers demand specific size grades. As such, the seed crop should be raised appropriately, top-killed and harvested at a suitable time to produce high quality seed-tubers of the required size grade as demanded by the buyers. Further, storage management practices should be managed in a manner that they will not negatively impact the advantages derived from 'Northern Vigour'.

The processing potato industry is also expanding in Western Canada. Multi-year research conducted at the University of Saskatchewan and the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC) have shown that high quality processing potato can be grown in Saskatchewan. The irrigated area of southern Saskatchewan is ideally suited to the production of high quality processing potatoes.

The Canada-Saskatchewan Irrigation Diversification Centre (CSIDC) has expanded its potato research and development program to support the needs of this expanding industry. The main objective includes:

- identify superior cultivars for the 'seed', 'processing', and 'table' markets,
- develop cost-effective agronomic practices to suit the relatively short and cool growing seasons of Saskatchewan,
- develop economically viable and sustainable potato-based crop rotations, and
- identify physiological parameters responsible for superior vigour of seed lots and develop production and storage management practices to maintain productive superiority of seed-tubers.

These projects are conducted jointly with industry partners, the Saskatchewan Seed Potato Growers Association and Lethbridge Research Centre, Agriculture and Agri-Food Canada.

Partial funding for these projects was provided by the Canada-Saskatchewan Agri-Food Innovation Fund, and Agriculture and Agri-Food Canada Matching Investment Initiative.

Field Trials:

The studies were conducted in the field plots of the CSIDC during a cool, wet growing season. The 2004 growing season received 270.4 mm of precipitation and only 140 mm of irrigation was provided to maintain favourable soil moisture.

Test plots were established May 17 through May 28, 2004. The crop was raised using standard management practices with treatments applied appropriately as required by the different tests. The common production practices included (i) Eptam 8E as pre-plant herbicide, (ii) 90 cm row spacing, (iii) 200 kg N/ha (half at planting and half at hilling), 60 kg P_2O_5/ha, 50 kg K_2O/ha, (iv) insect control using Cygon, and (iv) disease control using Bravo 500, Dithane, and Acrobat MZ. The test plots were top-killed at different dates depending on the test. Top-kill was performed by flailing and/or by Reglone application.

Flailing: Flailing followed by one application of Reglone (1.73 L Reglone/ha in 455 L water), *Chemical desiccation:* Split application of Reglone (first application at 2.2 L Reglone/ha in 455 L water and second application with 1.24 L Reglone/ha in 455 L water approximately seven days later).

Tubers were harvested after proper skin set. The harvested potatoes were graded based on tuber diameter according to Canadian Seed Standards. Seed grades were categorized in the following manner based on tuber diameter:

Oblong tubers:
- Grade B: 30 mm - 45 mm
- Grade A: 45 mm - 70 mm

Round tubers:
- Grade B: 30 mm - 50 mm
- Grade A: 50 mm - 80 mm

Yield estimates were also recorded for tubers larger than the maximum size set by Canadian seed standards. In the following discussion, ‘Seed Grade’ indicates the sum total of both Grade A and B tubers for the round and oblong tubers. The ‘consumption’ category included tubers larger than 45 mm diameter. Tuber specific gravity and culinary characteristics (boiled, baked, chip, and french fry) were determined using recommended Prairie Regional Variety Testing protocols. Fry colour categories were based on USDA classification.

Cultivar Evaluation

Advanced Adaptation Trial - I

The performance of forty-four potato clones were evaluated in comparison with nine commercial cultivars (Russet Burbank, Shepody, Amisk, Norland, Sangre, Atlantic, Snowden, Russet Norkotah, NorValley) under irrigated condition. Test plots contained 12 hills and were replicated two times. Superior clones will be advanced for further evaluation.

Advanced Adaptation Trial - II

The performance of thirty-five potato clones were evaluated in comparison with nine commercial cultivars (Russet Burbank, Shepody, Norland, Sangre, Atlantic, Snowden, Ranger Russet, Russet Norkotah, NorValley) under irrigated condition. Test plots contained 12 hills and were replicated four times. Superior clones will be advanced for further evaluation.

Prairie Early Replicated Trial

The Prairie Early Replicated trial was conducted at CSIDC under irrigation. This test evaluated fifteen advanced generation clones (2 Fresh market; 3 Chipping; 2 Fresh market/chipping dual purpose; 3 French fry) in comparison with industry standards Norland, Atlantic, AC Ptarmigan, NorValley, and Russet Norkotah. Field plots were flailed at 87 and 101 days after planting and harvested the following day. The yield performance and culinary characteristics were determined for the harvested tubers. This information will be used to support registration of new cultivars.

Prairie Main Replicated Trial

The Prairie Main Replicated trial was conducted at CSIDC under irrigation. Thirty-two clones (2 Fresh market; 16 French fry; 6 Chipping) and eight standards (Russet Burbank, Shepody, Snowden, Atlantic, Norland, Russet Norkotah, Sangre, Ranger Russet) were evaluated. The crop was flailed and desiccated 113 days after planting and harvested two weeks later. The yield performance and culinary characteristics were determined for the harvested tubers. This information will be used to support registration of new cultivars.

National Potato Variety Trial 2004

Promising table, french fry, and chipping clones from Western and Eastern Canada were grown in single-row plots under standard management practices suited for irrigation. This demonstration included seven new french fry clones, ten chipping clones, and four fresh market clones. The standard cultivars included Russet Burbank, Shepody, and Amisk for french fry; Atlantic and Snowden for chipping; and Russet Norkotah, Norland, and Sangre for table market classes. The demonstration crop was harvested and displayed to the participants during the during the Potato Field Day on August 12th. The crop was flailed and desiccated 113 days after planting and harvested two weeks later. The yield performance and culinary characteristics were determined for the harvested tubers. This information will be used to support registration of new cultivars.

Genetically Modified Potato

Verticillium wilt or ‘Early dying’ in potato is becoming a major problem for potato producers in Western Canada. Research is being conducted at the AAFC Lethbridge Research Centre to develop potato cultivars resistant to several pests and diseases including Verticillium wilt. The current project is designed to introduce Verticillium resistance to commercial potato cultivars.

The Ve gene from tomato has been introduced to Amisk (Ranger Russet), Atlantic, Red Norland, Russet Burbank, Russet Norkotah, Sangre, Shepody, Snowden, Viking, and Yukon Gold. This strategy is similar to that used for late blight resistance that provided 100% late blight control. Results will support the efforts of potato improvement targeted for different markets.

Commercial Scale Evaluation of Advanced Clones (MII Project)

Five advanced clones from LRC were evaluated at CSIDC for storage and culinary practices. This seed will be utilized for field-scale multiplication in a commercial field. The project partner (Dutch Potato Farms) conducted most of the production operations under the supervision of CSIDC staff.

Determination of critical irrigation stages to optimize 'seed' grade tubers for contrasting cultivars

Potato responds well to irrigation. Both excess and deficit moisture situations can adversely affect potato yield and quality. Moisture stress can reduce tuber yield and quality characteristics. On the other hand, excess moisture can negatively impact tuber specific gravity and fry colour of processing potato. Timing of irrigation is essential to maximize yields of high quality uniform grade tubers. Moisture stress, depending on the crop growth stage, can reduce tuber yields and/or affect processing quality. For example, transient moisture stress during stolon formation or tuber initiation can reduce tuber set, while moisture stress at tuber bulking stage can reduce tuber size. It should be possible to maximize yields of smaller sized 'seed' grade tubers or larger 'consumption' grade tubers through careful water management. It is likely that the optimum moisture requirement may be different for 'seed' and 'consumption' grade market classes depending on cultivars and plant population.

This study was designed to determine the critical stages of the potato crop at which soil moisture should be maintained at optimum level (approximately 60% Field capacity) to maximize yields of high quality 'seed' and 'consumption' potatoes. The following commercially important potato cultivars were included in this study:

Norland:	Early, table
Russet Burbank :	Very-late, french fry
Russet Norkotah:	Mid-season, table
Ranger Russet:	Very-late, french fry
Shepody:	Mid-season, french fry
Atlantic:	Mid-season, chipping
Alpha:	Very-late, table

Sufficient soil moisture was maintained at three specific crop growth stages using supplemental irrigation. The crop growth stages, irrigation treatments, rainfall, and irrigation are presented in Table 44. The growth stages I & II (planting to stolon formation), growth stage III (stolon formation to tuber initiation/flowering), and growth stage IV (flowering to senescence) were identified based on their distinct physiological phases in the crop growth cycle. In the following discussion, growth stage-I & II will be called 'early', growth stage III as 'mid', and growth stage-IV as 'late'. Field trials were planted on May 21, desiccated on September 8 and 15, and harvested on September 23rd and 24th.

Results

The irrigation periods for the various water management treatments are presented in Table 44. The entire growing season received 269 mm rain. Growth stage-1 (May 21-July 19) received 132 mm, growth stage-II (July 20-August 3) 15.2 mm, and growth stage-III (August 4-September 8) 121.8 mm. The full irrigation treatment (III) received a total of 409 mm of water that included 269 mm rain and 140 mm irrigation.

Table 44. Rainfall, irrigation timing and irrigation amounts for the water management treatments in 2004

Crop growth stages	Irrigation treatment								
	IDD	IID	III	DII	DDI	DDD	IDI	DID	Rainfall at growth stage (mm)
Planting to stolon formation (May 21-Jul 19)	Irrig	Irrig	Irrig	Dry	Dry	Dry	Irrig	Dry	132
Stolon formation to tuber development (Jul 20-Aug 3)	Dry	Irrig	Irrig	Irrig	Dry	Dry	Dry	Irrig	15.2
Tuber development to senescence (Aug 4-Sep 8)	Dry	Dry	Irrig	Irrig	Irrig	Dry	Irrig	Dry	121.8
In-season irrigation (mm)	65	115	140	75	25	0	90	50	
In-season rainfall (mm)	269	269	269	269	269	269	269	269	
In-season moisture (mm)	334	384	409	344	294	269	359	319	

D and I indicate dryland and irrigation respectively.
Maintain soil moisture at >65% FC at the prescribed growth stages for the various treatments.

Seed Grade Yield:
Unlike previous years, the full irrigation treatment (III) did not produce the highest yields (Table 45). Dryland (DDD) produced the lowest yields with the IID and DII treatments producing the greatest yields.

For yield ranking, the Dark Red Norland ranked highest in most treatments. Russet Norkotah and Ranger Russet were also high yielding cultivars. However, only treatments IDD, DDD and DID showed significant yield differences between varieties. Alpha tended to rank lowest for 'seed' grade yield.

Consumption Grade Yield:

As with 'seed' yield, full irrigation (III) did not produce the highest 'consumption' grade yield (Table 46). The same two treatments, IID and DII, produced the highest yields with dryland (DDD) producing the lowest yields.

Unlike the 'seed' grade yields, all treatments in the 'consumption' grade study produced significant yield differences between cultivars. Alpha was consistently the lowest yielding cultivar. Dark Red Norland ranked highest for yield in over half the treatments with Shepody also yielding well.

Table 45. 2004 irrigation scheduling effects on 'seed' grade tuber yields for commercial potato cultivars.

Treatment	Irrigation treatment							
	I-D-D	I-I-D	I-I-I	D-I-I	D-D-I	D-D-D	I-D-I	D-I-D
	---------------------------------Tuber yield (t/ha)-------------------------------							
Alpha	30.0	30.2	31.6	33.9	31.2	27.3	32.5	29.2
Atlantic	30.8	34.5	33.1	35.0	31.5	28.7	33.7	33.4
Dark Red Norland	48.2	43.6	42.8	40.4	43.4	42.6	34.6	48.6
Russet Burbank	33.5	32.2	32.9	32.5	32.8	31.4	32.0	27.7
Russet Norkotah	35.4	39.4	39.1	39.8	41.0	38.3	34.6	35.4
Ranger Russet	37.2	42.2	31.5	37.0	36.8	36.1	37.1	36.9
Shepody	36.4	33.8	39.6	37.1	34.3	31.0	34.6	33.5
Analyses of Variance								
Source: Cultivar	***(7.1)	ns	ns	ns	ns	***(6.5)	ns	***(4.2)
C.V. (%)	13.3	23.1	16.4	10.1	16.5	12.8	19.9	8.2

*** and ns indicate significance at P<0.001 level of probability and not significant respectively.
Values within parentheses are LSD estimates at 5.0% level of significance.

Table 46. 2004 irrigation scheduling effects on 'consumption' grade tuber yields for commercial potato cultivars								
Treatment	Irrigation treatment							
	I-D-D	I-I-D	I-I-I	D-I-I	D-D-I	D-D-D	I-D-I	D-I-D
	----------------------------------Tuber yield (t/ha)--------------------------------							
Alpha	18.3	18.4	16.2	19.3	17.1	13.9	19.4	15.4
Atlantic	36.6	43.7	38.6	38.4	39.2	32.8	37.6	38.6
Dark Red Norland	48.2	45.3	41.2	41.1	41.4	42.5	32.7	48.0
Russet Burbank	37.6	36.7	34.8	34.3	33.1	35.0	36.4	29.3
Russet Norkotah	31.1	34.8	33.7	34.6	36.5	35.1	31.8	32.5
Ranger Russet	40.8	47.7	35.3	37.2	37.8	38.0	38.3	41.2
Shepody	47.2	44.0	39.4	44.2	41.9	38.9	41.2	41.7
Analyses of Variance								
Source: Cultivar	***(6.6)	***(12.1)	***(9.0)	***(6.6)	***(9.2)	***(6.1)	***(8.6)	***(5.3)
C.V. (%)	12.0	21.0	17.8	12.5	17.5	12.1	17.0	10.1
*** indicates significance at P<0.001 level of probability. Values within parentheses are LSD estimates at 5.0% level of significance.								

Effects of top-kill methods and harvest stages on yield and tuber size distribution for dryland and irrigated potato

Commercial potato growers demand specific size grades. As such, the seed crop should be raised appropriately, top-killed and harvested at a suitable time to produce high quality seed-tubers of the required size grade as demanded by the buyers. Further, storage practices should be managed in a manner that they will not negatively impact the advantages derived from ‘Northern Vigour’.

This study evaluated six commercial potato cultivars (Dark Red Norland, Russet Burbank, Russet Norkotah, Ranger Russet, Shepody, Atlantic) two top-kill methods (Flail, apply Reglone, and harvest 2 WAD; two Reglone applications 7 days apart), and three top-kill stages (90, 97 and 104 days after planting). This study was conducted both under irrigation and dryland conditions.

Results

Irrigated potatoes produced higher 'seed' and 'consumption' grade tuber yields at all three top-kill dates (Tables 47 and 48). Potatoes top-killed by flailing or by chemical desiccation produced similar 'seed' and 'consumption' grade yields across all top-kill dates under both growing conditions (Tables 47 and 48).

Table 47. 2004 effects of top-kill method and top-kill timing on 'seed' grade yield for commercial potato cultivars grown under dryland and irrigation

Treatment	Dryland crop - Top-kill date			Irrigated crop - Top-kill date		
	90 DAP	97 DAP	104 DAP	90 DAP	97 DAP	104 DAP
	---Tuber yield (t/ha)---					
Top-kill:						
Reglone 2X	20.7	24.8	32.5	28.0	33.9	35.4
Flail + Reglone	20.7	29.5	33.0	28.4	35.0	35.6
Cultivar:						
Atlantic	18.9	25.4	31.1	30.1	34.8	33.4
Russet Burbank	19.5	26.5	33.0	24.6	34.1	30.9
Russet Norkotah	22.9	28.0	33.6	28.7	35.5	39.2
Dark Red Norland	29.8	34.7	38.6	37.9	42.4	44.4
Ranger Russet	15.7	23.3	29.8	25.1	27.1	32.5
Shepody	17.5	25.1	30.2	22.9	32.6	32.8
Analyses of Variance						
Source						
Desiccation	ns	ns	ns	ns	ns	ns
Cultivar	***(2.9)	***(4.1)	***(4.3)	***(3.5)	***(5.8)	***(4.5)
Cultivar x Desiccation	ns	ns	ns	ns	ns	ns
C.V. (%)	13.7	15.0	12.8	12.2	16.5	12.4

*** and ns indicate significance at P<0.001 level of probability and not significant respectively. Values within parentheses are LSD estimates at 5.0% level of significance.

‘Seed’ and ‘consumption’ grade tuber yields increased with delaying of desiccation dates. Yield rankings were somewhat similar across the various desiccation dates under irrigated and dryland production. Dark Red Norland produced the highest ‘seed’ grade yields and Ranger Russet produced the lowest ‘seed’ grade yields during all top-kill dates under both growing conditions (Table 47). Dark Red Norland also produced the highest ‘consumption’ grade yields for most treatments. Russet Burbank, however, produced the lowest ‘consumption’ grade yields for 90 DAP and 104 DAP for both growing conditions, while Ranger Russet ranked lowest for yield for 97 DAP under dryland and irrigation (Table 48).

Table 48. 2004 effects of top-kill method and top-kill timing on ‘consumption’ grade yield for commercial potato cultivars grown under dryland and irrigation

Treatment	Dryland crop -Top-kill date			Irrigated crop - Top-kill date		
	90 DAP	97 DAP	104 DAP	90 DAP	97 DAP	104 DAP
	--------------------------Tuber yield (t/ha)------------------------------					
Top-kill:						
Reglone 2X	14.3	21.8	34.5	21.9	32.7	40.5
Flail + Reglone	15.2	26.1	34.2	22.0	32.5	40.5
Cultivar:						
Atlantic	15.5	27.0	40.1	24.7	38.2	43.2
Russet Burbank	9.1	19.3	28.5	14.1	26.8	30.5
Russet Norkotah	16.4	24.3	34.8	22.5	32.1	44.1
Dark Red Norland	24.0	32.7	39.6	30.4	40.7	48.4
Ranger Russet	9.8	18.4	28.7	20.1	25.0	35.6
Shepody	14.0	22.1	34.6	19.9	32.7	41.3
Analyses of Variance						
Source						
Desiccation	ns	ns	ns	ns	ns	ns
Cultivar	***(3.5)	***(4.5)	***(4.9)	***(3.5)	***(5.9)	***(4.5)
Cultivar x Desiccation	ns	ns	ns	ns	ns	ns
C.V. (%)	23.2	18.5	13.9	15.5	17.7	10.9

, * and ns indicate significance at P<0.01 and 0.001 levels of probability and not significant respectively. Values within parentheses are LSD estimates at 5.0% level of significance.

Effects of top-kill methods, top-kill dates, and growing condition of the seed crop, and seed-tuber grade on productivity of the progeny

Productivity of seed potato is a function of physiological vigour of the tuber and the presence/absence of tuber-borne diseases. Physiological vigour in turn is a combination of the inherent productivity of the seed-tuber and the influence of external conditions under which the seed crop is grown (environment and agronomic practices) and stored. Physiologically younger seed-tubers are considered to be more productive than physiologically old seed-tubers.

In this study, productivity of Dark Red Norland, Russet Burbank, Russet Norkotah, Ranger Russet, Shepody, and Atlantic seed potatoes raised under a variety of production conditions were evaluated under irrigation. The following treatments were examined in this study:

Top-kill method: Flailing + Reglone, chemical desiccation (two applications of Reglone)
Top-kill date: 90, 104 days after planting
Growing condition: Irrigation, dryland
Seed grade: Canada Grade A, Canada grade B

Results

Tables 49 and 50 summarize the effects of the agronomic practices during the seed production season and seed-tuber grade on 'seed' and 'consumption' grade tuber yields respectively of the progeny. Different cultivars responded differently to the effects of seed production agronomy on 'seed' and 'consumption' grade yields.

Following is a summary of the results:

- Seed crops top-killed by flailing or chemical desiccation produced similar 'seed' and 'consumption' grade yields.
- Seed crops produced under dryland or irrigated growing conditions produced similar 'seed' and 'consumption' grade yields.
- Seed crops produced under different top-kill dates produced similar 'seed' and 'consumption' grade yields.
- Grade A seed tubers of the Dark Red Norland cultivar produced significantly higher 'seed' and 'consumption' grade yields. Grade A seed Russet Burbank tubers also produced significantly higher 'consumption' grade yield relative to Grade B seed.

Table 49. 2004 effects top-kill method and timing, growing condition, and seed-tuber grade on 'seed' grade yield of commercial potato cultivars

Treatment	Russet Burbank	Dark Red Norland	Shepody	Russet Norkotah	Ranger Russet	Atlantic
Top-kill method:	---------------------------------- Tuber yield (t/ha) ---------------------------					
Flail	32.5	46.7	41.8	44.7	36.6	37.8
Reglone	32.9	47.0	42.9	44.2	35.6	37.9
Top-kill date:						
104 DAP	33.3	46.8	42.9	44.6	36.8	38.2
90 DAP	32.1	46.9	41.7	44.2	35.3	37.4
Growing condition:						
Dryland	32.3	47.0	42.8	43.5	36.0	38.6
Irrigation	33.3	46.7	41.8	45.4	36.2	37.0
Seed grade:						
Grade A	31.8	50.2	43.3	45.7	36.0	38.8
Grade B	33.5	43.5	41.3	43.2	36.1	36.9
Analyses of variance						
Source:						
Top-kill method (M)	ns	ns	ns	ns	ns	ns
Top-kill date (D)	ns	ns	ns	ns	ns	ns
Growing condition (G)	ns	ns	ns	ns	ns	ns
Seed grade (S)	ns	***(2.6)	ns	ns	ns	ns
M x D	ns	ns	ns	ns	*(2.7)	ns
M x G	ns	ns	ns	ns	ns	ns
M x S	ns	ns	ns	ns	ns	ns
D x G	ns	ns	ns	ns	ns	ns
D x S	ns	*(3.7)	ns	ns	ns	***(2.7)
G x S	ns	ns	ns	ns	ns	*(2.7)
M x D x G	ns	ns	ns	ns	ns	**(3.9)
M x D x S	ns	ns	ns	ns	ns	ns
M x G x S	ns	ns	ns	ns	ns	*(3.9)
D x G x S	ns	ns	ns	ns	ns	ns
M x D x G x S	ns	ns	ns	ns	ns	ns
C.V (%)	12.2	11.0	11.9	11.8	10.5	10.2

*, **, *** indicate significance at P<0.05, 0.01, 0.001 levels of probability and not significant respectively.

Values within parentheses are LSD estimates at 5.0% level of significance.

Table 50. 2004 effects top-kill method and timing, growing condition, and seed-tuber grade on 'consumption' grade yield of commercial potato cultivars

Treatment	Russet Burbank	Dark Red Norland	Shepody	Russet Norkotah	Ranger Russet	Atlantic
Top-kill method:	------------------------------------- Tuber yield (t/ha) ---------------------------					
Flail	28.2	47.0	41.1	43.1	33.9	41.6
Reglone	28.4	47.4	41.3	43.1	33.4	40.7
Top-kill date:						
104 DAP	28.6	46.3	41.7	42.8	34.5	41.4
190 DAP	28.0	48.1	40.8	43.4	32.8	40.8
Growing condition:						
Dryland	28.2	46.9	41.6	42.2	33.5	41.2
Irrigation	28.5	47.5	40.8	43.9	33.8	41.1
Seed grade:						
Grade A	26.6	49.0	41.3	42.8	32.7	41.9
Grade B	30.0	45.4	41.1	43.4	34.6	40.4
Analyses of variance						
Source:						
Top-kill method (M)	ns	ns	ns	ns	ns	ns
Top-kill date (D)	ns	ns	ns	ns	ns	ns
Growing condition (G)	ns	ns	ns	ns	ns	ns
Seed grade (S)	**(2.2)	*(2.7)	ns	ns	ns	ns
M x D	ns	ns	ns	ns	*(2.9)	ns
M x G	ns	ns	ns	ns	ns	ns
M x S	ns	ns	ns	ns	ns	ns
D x G	ns	ns	ns	ns	ns	ns
D x S	ns	*(3.9)	ns	ns	ns	***(2.7)
G x S	ns	ns	ns	ns	*(2.9)	ns
M x D x G	ns	ns	ns	ns	ns	***(3.8)
M x D x S	ns	ns	ns	ns	ns	ns
M x G x S	ns	ns	ns	ns	ns	ns
D x G x S	ns	ns	ns	ns	ns	ns
M x D x G x S	ns	ns	ns	ns	ns	ns
C.V (%)	15.6	11.5	12.2	12.7	12.2	9.2

*, **, *** indicate significance at P<0.05, 0.01,0.001 levels of probability and not significant respectively.
.
Values within parentheses are LSD estimates at 5.0% level of significance.

Nitrogen and Phosphorus Rate and Placement Study

Co-investigator: Terry Hogg

Potato is a high nutrient requiring crop. Nitrogen and phosphorus are the two most limiting nutrients for potato production. Careful management of these elements is essential to produce superior yields of high quality tubers and optimize returns. Nitrogen management is particularly important for processing potato under the relatively cool and short growing season in Saskatchewan. Nitrogen shortage can reduce vigour and predispose the crop to diseases while excess nitrogen can delay maturity and adversely affect yield and quality. Efficient nutrient uptake by crops depends on the proximity of fertilizer to the root zone. This is particularly important for crops that have limited root growth such as potato.

This study compared the effects of broadcasting, side-banding different rates of nitrogen and phosphorus fertilizers for potato cultivars Atlantic, Dark Red Norland, Russet Burbank, Russet Norkotah, Ranger Russet, and Shepody. For the broadcast treatment, the fertilizer was spread evenly in the furrow prior to planting. For side-banding, the fertilizer was placed 5cm away and 2.5 cm above the seed piece. Studies were conducted both under dryland and under irrigation.

Nitrogen

Pre-plant application of nitrogen (46-0-0) at rates of 50, 75, and 100 kg N/ha, that was sideband and broadcast applied, was examined in this study. A pre-plant application of 120 kg P_2O_5/ha and 150 kg K_2O/ha, and a top-dressing of 100 kg N/ha was given uniformly across all treatments. Spring soil analysis at the test site indicated soil nutrient levels at 31 kg N/ha, 14 kg P_2O_5/ha, and 357 kg K_2O/ha at 0 to 30 cm depth.

The effects of nitrogen rates and placement on ‘seed’ and ‘consumption’ grade yields for the various cultivars are summarized in Table 51.

Side-band and broadcast application of nitrogen produced similar ‘seed’ and ‘consumption’ grade yields (Table 51).

The nitrogen rates ranging from 50 to 100 kg N/ha applied at planting produced similar ‘seed’ and ‘consumption’ grade yields (Table 51).

Yield rankings varied for ‘seed’ grade versus ‘consumption’ grade for the various cultivars. Russet Burbank produced the highest ‘seed’ grade yield and Shepody produced the highest ‘consumption’ grade yield. Conversely, Shepody produced the lowest ‘seed’ grade yield and Dark Red Norland produced the lowest ‘consumption’ grade yield.

Phosphorus

Pre-plant application of phosphorus (12-51-0) at the rates of 40, 80, and 120 kg P_2O_5/ha, sideband and broadcast applied, was examined in this study. A pre-plant application of 100 kg N/ha and 150 kg K_2O/ha was given uniformly across all treatments. One hundred kg/ha of nitrogen was top-dressed at second hilling. Spring soil analysis at the test site indicated soil nutrient levels at 31 kg N/ha, 14 kg P_2O_5/ha, and 357 kg K_2O/ha at 0 cm to 30 cm depth.

The effects of phosphorus rates and placement on ‘seed’ and ‘consumption’ grade yields for the various cultivars are summarized in Table 52. Phosphorus rates and placement methods produced similar ‘seed’ and ‘consumption’ grade yield (Table 52). As with the nitrogen study, Shepody produced the highest ‘consumption’ grade yield, but Russet Norkotah produced the lowest ‘consumption’ grade yield in the phosphorus study. For ‘seed’ grade yield in the phosphorus study, Dark Red Norland was highest with Atlantic lowest.

Table 51. 2004 nitrogen placement and rate effects on 'seed' and 'consumption' grade tuber yields for commercial potato cultivars

Treatment	'Seed' grade yield (t/ha)	'Consumption' grade yield (t/ha)
Nitrogen placement:	---------------------------- Tuber yield (t/ha) ----------------------	
Broadcast	47	45.8
Side-band	47.4	46.2
Nitrogen rate at planting:		
50 kg N/ha	47	47.2
75 kg N/ha	47.2	45.6
100 kg N/ha	47.4	45.2
Cultivar:		
Atlantic	48.6	48.6
Dark Red Norland	47.9	43
Ranger Russet	46.4	48
Russet Burbank	48.9	43
Russet Norkotah	46	43.5
Shepody	45.5	50
Analyses of Variance		
Source:		
Nitrogen application (A)	ns	ns
Nitrogen rate ®)	ns	ns
Cultivar ©)	***(2.2)	***(2.3)
A x R	ns	ns
A x C	ns	ns
R x C	ns	ns
A x R x C	ns	ns
C.V. (%)	8.2	8.8

*** and ns indicate significance at P< 0.001 level of probability and not significant respectively. Values within parentheses are LSD estimates at 5.0% level of significance.

Table 52. 2004 phosphorus placement and rate effects on 'seed' and 'consumption' grade tuber yields for commercial potato cultivars		
Treatment	'Seed' grade yield (t/ha)	'Consumption' grade yield (t/ha)
Phosphorus placement:	------------------------------ Tuber yield (t/ha) ------------------------	
Broadcast	41.5	42.4
Side-band	42.6	44.4
Phosphorus rate at planting:		
40 kg P_2O_5/ha	40.7	41.6
80 kg P_2O_5/ha	41.7	44.2
120 kg P_2O_5/ha	43.8	44.5
Cultivar:		
Atlantic	38.8	42.9
Dark Red Norland	44.8	42.8
Ranger Russet	42.4	45.5
Russet Burbank	44.1	41.3
Russet Norkotah	42.8	40.8
Shepody	39.6	47.2
Analyses of Variance		
Source:		
Phosphorus application (A)	ns	ns
Phosphorus rate ®)	ns	ns
Cultivar ©)	***(2.8)	***(2.7)
A x R	ns	ns
A x C	ns	ns
R x C	ns	ns
A x R x C	ns	ns
C.V. (%)	11.5	10.6

*** and ns indicate significance at P<0.001 level of probability and not significant respectively. Values within parentheses are LSD estimates at 5.0% level of significance.

Medicinal Herb Research Program

Increasing health care costs, and individuals taking more responsibility for their own health, has lead consumers to seek alternate approaches to treat and prevent diseases. Consequently, natural products (nutraceuticals, functional foods, and dermaceuticals) represent one of the most rapidly expanding industries in the developed countries. To meet the demand of this growing industry, the medicinal and aromatic plant production and processing sectors are growing fast in Saskatchewan. Effective agronomic practices are essential to consistently produce superior yields of high quality herbs. Agronomic research for commercially important herbs were carried out at the Canada-Saskatchewan Irrigation Diversification Centre in Outlook.

The Canada-Saskatchewan Irrigation Diversification Centre conducted extensive research to develop cost-effective agronomic practices for commercial scale production of promising medicinal herbs. The focus of CSIDC's herb research includes:

- Evaluation of the adaptability of promising medicinal and culinary herbs for Saskatchewan conditions.
- Development of management practices for mechanized commercial production.
- Development of labour saving agronomic practices.
- Comparison of dryland and irrigated production in relation to yield and quality.
- Assessment of the feasibility of direct seeding and transplanting under dryland and irrigated conditions.
- Determination of stage and method of harvesting practices (primary processing) to increase recovery and to maintain quality.

Research conducted for feverfew, St. John's Wort, and milk thistle during the summer of 2004 are described in this report. Considerable variability, particularly with St. John's Wort, was observed in the field trial. This is likely due to the variation in plant stand, for example through winter kill with St. John's Wort.

Feverfew

Effects of plant population and cutting stage on productivity and quality of transplanted feverfew

Different herb buyers prefer feverfew harvested at different growth stages such as prior to flowering, during early flowering, or at full bloom. This study examined the interactive effects of plant spacing and harvest stage on herbage yield for transplanted 'Wild' feverfew grown under dryland and irrigated conditions.

Treatments included two within-row spacings (15, 30 cm), three harvest stages (pre-flower, 10%-flower, 100%-flower), and two growing conditions (dryland, irrigation). The rows were spaced 60 cm apart. Feverfew transplants were raised in the greenhouse and field planted on April 19, 2004. The pre-flower, 10%-flower, and 100%-flower harvest were taken on July 27, August 13, and August 27, respectively. The soil moisture status for the irrigated crop was maintained above approximately 50% Field Capacity through supplemental irrigation using overhead sprinklers.

Results

Irrigated feverfew on average produced 28% higher dry herb yield than the dryland crop (Table 53). Under irrigation closer (15 cm) spacing produced significantly higher dry herb yields than wider (30 cm) spacing. However under dryland, both plant spacings produced similar yields.

Delaying harvest from pre-flowering to 100% flowering resulted in higher herb yields under both irrigated and dryland production (Table 53).

Table 53. Plant spacing effects on fresh and dry herbage yields for 'Wild' feverfew grown under dryland and irrigation

Treatment	Dry herb yield (t/ha)	
	Irrigated crop	Dryland crop
Plant spacing:		
15 cm	1.61	1.17
30 cm	1.31	1.11
Harvest stage:		
Pre-flower	0.59	0.32
10%-flower	1.48	1.12
100%-flower	2.31	1.99
Analyses of variance		
Source:		
Spacing	**(0.67)	ns
Harvest stage	***(0.82)	***(0.85)
Spacing x Harvest stage	ns	ns
C.V.(%)	49.5	69.5

, *, and ns indicate significance at P<0.01, <0.001 levels of probability and not significant respectively.
Values within parentheses indicate significance at 5.0% level of probability.

St. John's Wort

Effect of plant spacing on dry herb yields for St. John's wort biotypes grown under irrigation

Five St. John's Wort biotypes (Standard, New Stem, Elixir, Topas, Helos) were evaluated at two within-row spacings (15, 30 cm) under irrigated production. Between-row spacing was maintained at 60 cm for all treatments. This test was established in 2002.

Results

Elixir and Topas were the superior yielding biotypes (Table 54). Helos suffered total winter kill. Newstem and Standard produced significantly lower yields than Elixir or Topas. The higher yield responses for 'Elixir' and 'Topas' appears to be a function of less winter-kill in these cultivars.

Plant spacing had no effect on dry herb yields when grown under irrigation (Table 54).

Table 54. Plant spacing effects on winter-kill incidence and herbage yield for St. John's Word grown under dryland and irrigation

Treatment	Dry herb yield (t/ha)
Cultivar:	
Elixir	1.02
Helos	0
New Stem	0.28
Standard	0.35
Topas	1.06
Plant spacing:	
15 cm	0.41
30 cm	0.67
Analyses of variance	
Source:	
Cultivar	*(0.89)
Spacing	ns
Cultivar x Spacing	ns
C.V.(%)	665

* and ns indicate significance at P<0.05 level of probability and not significant respectively.
Values within parenthesis indicate significance at 5.0% level of probability.

Effects of straw mulch and nitrogen application on dry herb yield for St. John's Wort biotypes grown under irrigation and dryland

The effects of mulching (straw mulch and no mulch) and three nitrogen rates (0, 100, 200 kg N/ha) on dry herb yields were evaluated for five St. John's Wort biotypes (Standard, New Stem, Elixir, Topas, Helos) under irrigated and dryland production. This crop was established in 2003.

Results

Dry herb yields for the various biotypes and their interaction with mulching when grown under irrigation and dryland are summarized in Tables 55 and 56 respectively.

Under irrigation, mulching had no effect on herb yield for Standard, New Stem, Topas and Helos. For Elixir, mulching produced significantly higher yield than no mulch. (Table 55). Under dryland, all biotypes grown without mulch produced significantly lower yields than the mulched crop (Table 56). The positive yield responses with straw mulch for the various cultivars was due to less winter kill under straw mulch compared to no mulch. It was observed that the dryland crop suffered more winter kill than the irrigated crop.

Nitrogen application reduced herb yield under both irrigated and dryland production (Tables 55 and 56). No nitrogen fertilizer treatment produced the highest yields and the higher application rate (200 kg N/ha) produced the lowest yield and the yield responses varied with the different cultivars and growing condition.

Table 55. Effects of mulching and nitrogen application on herbage yield for St. John's Wort biotypes grown under irrigation					
Treatment	Dry herb yield (t/ha)				
	Standard	New Stem	Elixir	Topas	Helos
Mulching:					
No mulch	0.48	0.33	1.39	1.87	0.93
Straw mulch	0.47	0.63	2.47	1.11	1.2
Nitrogen rate (kg N/ha)					
0	1.05	0.94	2.65	1.95	1.79
100	0.26	0.32	1.92	0.96	1.03
200	0.12	0.18	1.21	0.53	0.37
Analyses of variance					
Source:					
Mulch	ns	ns	**(0.33)	ns	ns
Nitrogen	**(0.25)	**(0.30)	*(0.49)	**(0.32)	***(0.24)
Mulch x Nitrogen	ns	ns	ns	ns	ns
C.V. (%)	213	247	101	112	90

*, **, ***, and ns indicate significance at P<0.05, <0.01, <0.001 levels of probability and not significant respectively. Values within parentheses indicate significance at 5.0% level of probability.

Table 56. Effects of mulching and nitrogen application on herbage yield for St. John's Wort biotypes grown under dryland

Treatment	Dry herb yield (t/ha)				
	Standard	New Stem	Elixir	Topas	Helos
Mulching:					
No mulch	0.03	0.2	0.4	0.08	0.02
Straw mulch	0.32	0.96	0.97	0.62	0.26
Nitrogen rate (kg N/ha)					
0	0.21	0.7	1.07	0.47	0.23
100	0.23	0.73	0.78	0.3	0.1
200	0.08	0.31	0.21	0.28	0.09
Analyses of variance					
Source:					
Mulch	*(0.29)	***(0.25)	**(0.56)	***(0.50)	*(0.32)
Nitrogen	ns	*(0.37)	**(0.84)	ns	ns
Mulch x Nitrogen	ns	ns	ns	ns	ns
C.V. (%)	1012	255	490	851	1336

*, **, ***, and ns indicate significance at P<0.05, <0.01, <0.001 levels of probability and not significant respectively. Values within parentheses indicate significance at 5.0% level of probability.

Effect of straw mulch, harvest height and harvest frequency on dry herb yield for St. John's Wort biotypes grown under irrigation and dryland

St. John's Wort is a perennial. Flowering tops are harvested for commercial use as the flowers and leaves are found to contain higher levels of hypericin. Plant growth characteristics and harvest height can affect yield and quality. Plant growth and flowering habit can be a function of many factors including genotype, population density, winter kill, and growing conditions. This study examines the effects of mulching, harvest height, and harvest frequency on dry herb yield for St. John's Wort biotypes grown under irrigation and dryland.

In this study, St. John's wort biotypes Topas, Helos, Elixir, New Stem and Standard were examined under irrigated and dryland production. Treatments included two cutting heights (top-1/3, top-2/3), two cutting frequencies (One cut, two cuts), and two mulching treatments (no mulch, straw mulch). Test plots were established in 2002 under irrigation and dryland.

Results

The effects of cutting height (top-1/3 or top-2/3), cutting frequency (one or two cuts per year), and mulching (straw mulch or no mulch) on dry herb yields are summarized below:

Irrigated Crop:
Cutting height, cutting frequency, and mulching had no effect on dry herb yield for Topas, Elixir, and Helos (Table 57).

With Standard, the unmulched crop out yielded the mulched crop. The reason for this response is not clear. For New Stem, the cutting height x mulching interaction indicates that for the unmulched crop, harvesting the top-1/3 produced higher herb yield than harvesting the top-2/3. The trend was reversed for the mulched crop. Further investigation is needed to confirm these responses.

Dryland Crop:
The effects of cutting height, cutting frequency and mulching on dry herb yield for the dryland crop is summarized in Table 58.

Topas: Mulched crop produced higher herb yield than the unmulched crop. Cutting height and cutting frequency had no effect on herb yield.

Helos: Mulched crop, top-2/3 cutting height, and single cut per year produced higher yields that unmulched crop, top-1/3 cutting height, and two cuts per year.

Elixir: Top-2/3 cutting height, and single cut per year produced higher herb yields than top-1/3 cutting height and two-cut harvest. Mulching had no effect on herb yield.

New Stem: Top-2/3 cutting height, and single cut per year produced higher herb yields than top-1/3 cutting height and two-cut harvest. Mulching had no effect on herb yield.

Standard: Mulching, top-2/3 cutting height, and single cut per year produced higher herb yields than the unmulched crop, top-1/3 cutting height and two-cut harvest. The differences did not reach significant proportion for cutting height and cutting frequency effects.

Table 57. Effects of cutting height, cutting frequency and mulching on herbage yield for St. John's Wort biotypes grown under irrigation (2002 planting)					
Treatment	Dry herb yield (t/ha)				
	Topas	Helos	Elixir	New Stem	Standard
Cutting height					
Top-1/3	0.22	0.84	1.6	1.7	2.03
Top-2/3	0.47	0.7	1.69	1.91	1.98
Cutting frequency					
1-cut/year	0.45	0.92	1.95	1.9	2.35
2-cuts/year	0.24	0.62	1.33	1.71	1.66
Mulching:					
No mulch	0.21	0.71	1.95	2.02	2.53
Straw mulch	0.49	0.83	1.34	1.59	1.48
Analyses of variance					
Source:					
Cutting height (H)	ns	ns	ns	ns	ns
Cutting frequency (F)	ns	ns	ns	ns	ns
Mulching (M)	ns	ns	ns	ns	**(0.61)
H x F	ns	ns	ns	ns	ns
H x M	ns	ns	ns	** (0.56)	ns
F x M	ns	ns	ns	ns	ns
H x F x M	ns	ns	ns	ns	ns
C.V. (%)	516	380	313	248	243

**, and ns indicate significance at P<0.01, level of probability and not significant respectively. Values within parentheses indicate significance at 5.0% level of probability.

Table 58. Effects of cutting height, cutting frequency and mulching on herbage yield for St. John's Wort biotypes grown under dryland (2002 planting)					
Treatment	Dry herb yield (t/ha)				
	Topas	Helos	Elixir	New Stem	Standard
Cutting height					
Top-1/3	0.28	0.38	0.92	1.25	1.78
Top-2/3	0.32	0.74	1.38	2.06	2.32
Cutting frequency					
1-cut/year	0.43	0.93	1.54	2.41	2.92
2-cuts/year	0.18	0.19	0.76	0.9	1.18
Mulching:					
No mulch	0.11	0.2	1.14	1.45	1.46
Straw mulch	0.5	0.92	1.17	1.86	2.64
Analyses of variance					
Source:					
Cutting height (H)	ns	*(0.28)	*(0.30)	***(0.33)	ns
Cutting frequency (F)	ns	***(0.28)	***(0.30)	***(0.33)	ns
Mulching (M)	*(0.25)	***(0.28)	ns	ns	***(0.59)
H x F	ns	ns	*(0.30)	ns	**(0.59)
H x M	ns	*(0.28)	ns	ns	ns
F x M	ns	*(0.28)	*(0.30)	ns	ns
H x F x M	ns	ns	ns	ns	*(0.59)
C.V. (%)	656	399	209	162	226

*, **, ***, and ns indicate significance at P<0.05, <0.01, <0.001 levels of probability and not significant respectively. Values within parentheses indicate significance at 5.0% level of probability.

Milk Thistle

Saskatchewan's relatively short growing season and the uneven maturity of milk thistle poses major challenges for production and once-over machine harvesting. The crop has to be desiccated to facilitate mechanical harvest. Reglone can be used successfully to desiccate milk thistle. However, the demand for organic milk thistle necessitates organic desiccants for top-kill milk thistle. The present study is designed to develop cost-effective agronomic practices for large scale mechanized production of milk thistle under Saskatchewan growing conditions. The objectives include:

i. Seeding rate and row spacing effects on yield and quality.
ii. Seeding date effects on growth characteristics and productivity.
iii. Nitrogen and phosphorus effects on productivity.
iv. Effectiveness of vinegar as a desiccant for machine harvest compared to reglone.

The following studies were conducted to address these objectives.

Nitrogen and phosphorus effects on yield and quality for non-organically desiccated milk thistle using Reglone at two different bloom stages under dryland conditions

Three nitrogen rates (0, 50, 100 kg N/ha) three phosphorus rates (0, 60, 120 kg P_2O_5/ha) were examined in this study. Fertilizer mixture applied (seed placed) at seeding. The crop was desiccated with Reglone (2.7l/ha @ 1000 l water/ha) and machine harvested. Yield responses were observed at two desiccation periods, i.e.

Early': When approximately 50-60 % of the flower heads are mature.
'Late': Approximately one week after first desiccation.

Reglone was an effective top-kill agent as sufficient dry-down occurred with only one application of Reglone. With Reglone application, it was possible to combine the crop 3-4 days after spraying. By contrast, vinegar was not an effective means of top-kill. Even after two application, the dry-down was insufficient for proper machine harvesting.

Results

Seed yields for the various nitrogen and phosphorus treatments at the two harvest dates are summarized in Table 59. Seed yields for 0 and 50 kg N/ha was approximately 800 kg/ha for 'early' desiccation and 1100 kg/ha for 'late' desiccation. Application of 100 kg seed-placed N/ha caused significant decrease in plant stand that resulted in substantially lower seed yields compared to the lower nitrogen rates. Phosphorus application rates had no effect on seed yield at both desiccation periods.

On average, 'early' desiccation produced 625 kg/ha milk thistle seed. Delaying desiccation by 6 days resulted in a 65% higher yield relative to 'early' desiccation.

Seeding rate and row spacing effects on yield for milk thistle desiccated with vinegar

Treatments included six seeding rates (25, 50, 75,100, 125, 150 seeds / m^2) and two row spacings (20, 60 cm). The crop was desiccated using vinegar (14% acetic acid) at 1000 l/ha.

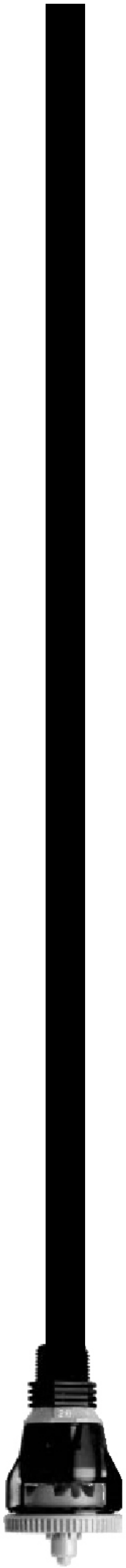
Results

Seed yields for the various seeding rate and row spacing effects for milk thistle when harvested after desiccation with vinegar (14% acetic acid) is summarized in Table 60. Seed yields ranged between 500 and 800 kg/ha. Seeding rate or row spacing had no effect on seed yield.

Table 59. Nitrogen and phosphorus rate effects on milk thistle seed yield when desiccated with Reglone at two different times		
Treatment	Seed yield (kg/ha)	
	'Early desiccation'	'Late' desiccation
Nitrogen (kg N/ha)		
0	808	1121
50	782	1291
100	287	683
Phosphorus (kg P_2O_5/ha)		
0	655	996
60	573	998
120	649	1102
Analyses of Variance		
Source:		
Nitrogen (N)	***(166)	***(230)
Phosphorus (P)	ns	ns
N x P	ns	ns
C.V. (%)	32.1	26.9

*** and ns indicate significance P<0.001 level of probability and not significant respectively. Values within parentheses are LSD estimates at 5.0% level of probability.

Table 60. Seeding rate and row spacing effects on seed yield for milk thistle desiccated with vinegar.			
Seeding rate	Seed yield (kg/ha)		Mean
	20 cm row spacing	60 cm row spacing	
25 seeds/m^2	661	570	615
50 seeds/m^2	636	763	699
75 seeds/m^2	797	697	747
100 seeds/m^2	691	673	682
125 seeds/m^2	671	534	602
150 seeds/m^2	685	736	710
Mean	690	992	
Analysis of variance			
Source:			
Seeding rate ®)		ns	
Row spacing (S)		ns	
R x S		ns	
C.V. (%)		22.3	
ns indicates non-significant treatment effects.			



Horticultural Crops Demonstration Program

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Improved Vegetable Production and Storage Techniques

Improved Vegetable Production and Storage Techniques

Season Extension (High Tunnel) Demonstration

Final year of three. Funded by the Agri-Food Innovation Fund (AFIF) and Agriculture and Agri-Food Canada, PFRA to demonstrate the effect of green pepper plant population and cantaloupe plant population and planting material (direct seed vs. transplants) on yield and economic return.

Warm season high value crops such as cantaloupe and peppers are difficult to produce under Saskatchewan climatic conditions without using some form of season extension. In 2004, the Canada-Saskatchewan Irrigation Diversification Centre completed demonstrations aimed at maximizing production and economic return for cantaloupe and pepper utilizing a method of season extension commonly referred to as a "high tunnel." High tunnels are essentially plastic-covered greenhouses constructed in the field with no artificial heating or ventilation (Figure 1). Ventilation is achieved by rolling up the sides of the high tunnel.

High tunnels significantly alter the growing conditions of crops. There are more Growing Degree Days in the high tunnel as compared to growing conditions outside the tunnels (Figure 2). In order to maximize production with these favorable growing conditions, agronomic practices such as plant population, fertility management, planting date(s), and planting method need to be refined.

Study Description

The green pepper plant population demonstration was grown in high tunnel #3 and #2 in 2003 and 2004, respectively. Due to an early killing frost, the results from 2002 will not be presented. Fertilizer applications in the tunnels were based on soil test recommendations. Four lengths of infra-red transmissible (IRT) plastic mulch was evenly spaced across the 6m wide tunnel with an irrigation drip tape underneath.

Whopper Improved green pepper was seeded in the greenhouse in mid-April in 72 square seedling flats. These were transplanted in mid to late May in the high tunnel at in-row spacings of 15cm, 30cm, and 60cm on a double row configuration for each mulch strip. Floating row covers were placed over the peppers to provide extra frost protection. Irrigation was provided using trickle tape.

The cantaloupe plant population and direct seeding vs. transplant demonstration were grown in high tunnel #2 in 2003 and #3 in 2004. Fertilizer applications in the tunnels were based on soil test recommendations. Four lengths of IRT mulch were evenly spaced across the 6m wide tunnel along with drip tape under the mulch. Transplanting and the first direct seeding were conducted in early May. Floating row covers were placed over the plants to provide extra frost protection. Direct seeding continued for the next four consecutive weeks. Cantaloupe transplants and seeds were planted at 30cm and 60cm in-row spacings utilizing a double row configuration on each mulch strip. Irrigation was applied using drip tape. Honey bees were placed inside the tunnel for pollination. Melons were harvested at full slip.

Figure 1. High-tunnel (4.3 m x 29 m) at CSIDC.

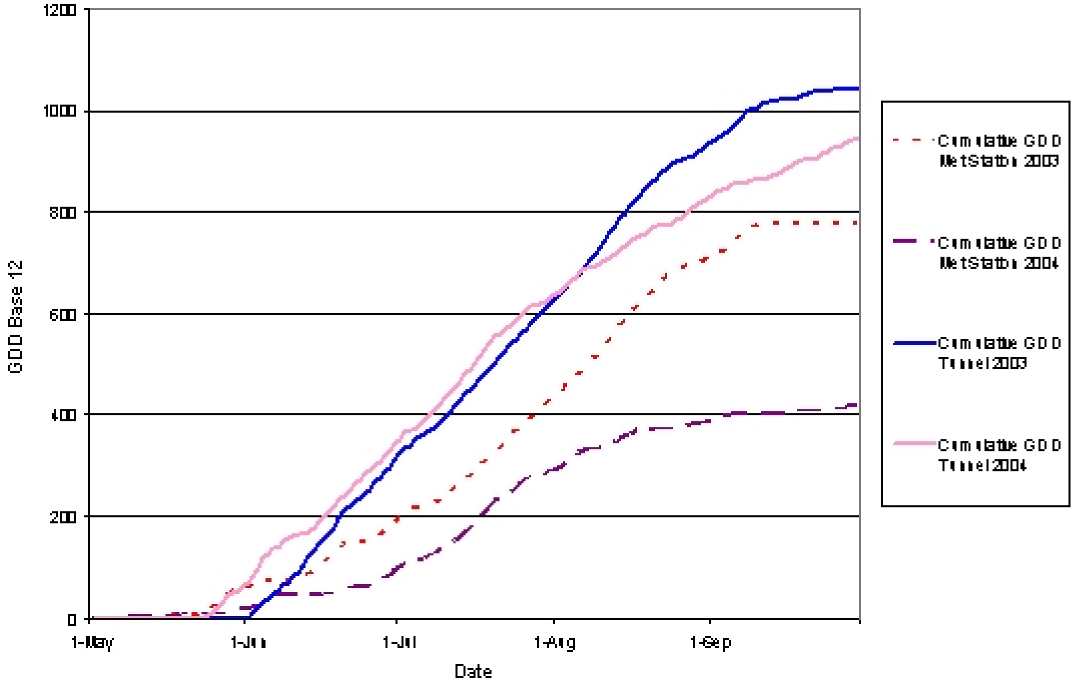


Figure 2. Growing Degree Days (Base 12) outside and inside the high-tunnel at CSIDC in 2003 and 2004.

Results

Yield and quality of the pepper crop in both 2003 and 2004 was excellent. There were significant yield differences among the 15 cm, 30 cm, and 60 cm plant spacings. There was no significant yield difference between years (Table 61). There was, however, a significant difference in the percentage of red peppers. In 2003, 80% of the pepper crop matured to red, while in 2004 only 40% matured to red. The warmer than normal summer in 2003 and the cooler than normal summer in 2004 affected the maturation of the crop. This is significant because the price of red market peppers tends to be much higher than that of green market peppers resulting in a higher gross return (Table 62) and higher net economic returns (Table 63). With a standard 29m x 6m high tunnel and planting eight rows on a 15cm spacing, net returns ranged from $1600/tunnel to $2600/tunnel depending on weather conditions.

The cantaloupe plant population and transplant vs. direct seeding demonstration benefitted greatly from the warm summer in 2003. The early transplants and direct seeding produced higher yields and higher gross returns than the late seeded crop (Table 64). The later seeded crops produced excess of vegetative growth with little fruit development. The cantaloupe crop did not produce well in 2004. Despite being inside the high tunnel, the fruit did not mature resulting in no harvestable yield.

Conclusion

Pepper yields inside high tunnels increase with closer in-row spacings with no significant difference in quality. Net economic returns, despite utilizing season extension technology such as high tunnels, can still be affected by climatic conditions. A warmer than normal year will result in a high percentage of the pepper crop maturing to red, thus increasing economic returns. A cooler than normal year will result in less mature fruit, and lower economic returns.

Cantaloupe yields inside high tunnels were quite variable. In this demonstration, early direct-seeding at 30cm spacing under “normal” climatic conditions resulted in the highest yields. Transplanting did not have the desired result of earlier maturity as compared to the direct seeding. This was mainly due to “transplant shock” of the plants. Within a two to three week period, the direct seeded plants were at the same stage of growth as the transplants. This suggests that the added expense of producing transplants is not cost effective. Sequential planting did not have the desired effect. By increasing and spreading out planting dates, we hoped to lengthen the marketing period. This did not occur. The later planting dates resulted in reduced fruit set and subsequently less mature fruit.

The economics of producing cantaloupes in a high tunnel is questionable. In this demonstration, using wholesale prices, the highest gross economic yield was $8.00/m². This was from the early direct-seeded, 30cm plant spacing treatment. With the above yield and price, the net economic return on a standard 6m x 29m tunnel is -$63.00 (Table 65). In order to make production of cantaloupe inside high tunnels economical, both yield and price must be substantially higher. In this demonstration, the melons were sold into the wholesale market and the price received was two to three times less than that received by direct selling. The method of marketing is a major factor in successful economic production of cantaloupe under high tunnels. Maximizing total yield of melons is also a challenge. Excellent plant growth did not result in excellent fruit production. Factors such as soil fertility, temperature control, and cultivars under high tunnel production need to be addressed.

Table 61. 2004 pepper yield inside the High Tunnel, Outlook.												
Plant Spacing	Yield by market class, kg/m double row										% Red market	
	Red market		Green market		Red chopper		Green chopper		Total yield			
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
15 cm	11.4	6.3	2	6.2	0.9	0.9	0.1	0.9	14.4	14.3	79	44
30 cm	9.3	4.8	1.1	5.5	0.9	1.2	0.4	1.2	11.7	12.7	80	38
60 cm	6.6	3.7	0.4	5.4	0.6	0.7	0.2	0.7	7.8	10.5	85	35

Table 62. 2004 gross return for High Tunnel pepper production, Outlook.										
Plant Spacing	Gross return by market class, $/m double row									
	Red market		Green market		Red chopper		Green chopper		Total gross return[1]	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
15 cm	36.3	20	3.9	11.4	1	1.1	0.11	1.1	41.3	31.6
30 cm	29.6	15.3	2.1	11.1	1.1	1.5	0.5	1.5	33.3	28.3
60 cm	21	11.8	0.8	9.9	0.7	0.9	0.2	0.9	22.7	23.4

[1]Market prices: Red market = $3.18/kg; Green market = $1.84/kg; Choppers = $1.22/kg

Table 63. Net returns for pepper production in the High Tunnel, Outlook.		
	High	Low
Revenue	$ 4,500.00	$ 3,500.00
Expenses		
High tunnel - 20 yr. amortization	$ 350.00	$ 350.00
Fertilizer/pesticide	$ 50.00	$ 50.00
Seed/transplants	$ 100.00	$ 100.00
Tillage	$ 50.00	$ 50.00
Labour - soil preparation	$ 100.00	$ 100.00
- seeding/planting	$ 300.00	$ 300.00
- weeding	$ 100.00	$ 100.00
- harvest/packing	$ 300.00	$ 300.00
Marketing	$ 400.00	$ 400.00
Packing material	$ 100.00	$ 100.00
Total Expense	$ 1,875.00	$ 1,875.00
Net Return	$ 2,625.00	$ 1,625.00

Table 64. 2004 Harvested cantaloupe yields in the High Tunnel, Outlook.							
Planting method	Date	Spacing	Total count	Total weight (kg)	Mean weight (kg/fruit)	Total yield (kg/m²)	Gross return[1] ($/m²)
Transplant	May 7	30 cm	66	81	1.23	5.78	6.35
		60 cm	56	67	1.2	4.81	5.3
Direct seed	May 7	30 cm	72	102	1.41	7.26	8
		60 cm	56	81	1.44	5.78	6.35
Direct seed	May 14	30 cm	54	66	1.22	4.71	5.18
		60 cm	24	32	1.32	2.26	2.5
Direct seed	May 22	30 cm	36	44	1.21	3.12	3.4
		60 cm	12	15	1.29	1.11	1.22
Direct seed	May 29	30 cm	18	25	1.37	1.76	1.93
		60 cm	6	11	1.84	0.79	0.87

[1]Market price = $1.10/kg

Table 65. Net returns for cantaloupe production in the High Tunnel, Outlook.	
Revenue	$ 1,392.00
Expenses	
High tunnel - 20 yr. amortization	$ 350.00
Fertilizer/pesticide	$ 50.00
Mulch and drip tape	$ 25.00
Seed/transplants	$ 10.00
Tillage	$ 50.00
Labour - soil preparation	$ 100.00
- seeding/planting	$ 20.00
- weeding	$ 50.00
- harvest/packing	$ 300.00
Marketing	$ 400.00
Packing material	$ 100.00
Total Expense	$ 1,455.00
Net Return	$ (63.00)

Pumpkin Irrigation Scheduling Demonstration

Third year of a four year project. Funded by the Agri-Food Innovation Fund and Agriculture and Agri-Food Canada, PFRA to demonstrate irrigation scheduling and to estimate water use and water use efficiency of pumpkin grown using trickle irrigation and IRT plastic mulch under Saskatchewan growing conditions.

Principal: T.J. Hogg, CSIDC, Outlook, Saskatchewan
Co-investigators: J. Wahab, D. David, B. Vestre, L. Tollefson, CSIDC, Outlook, Saskatchewan

A pumpkin irrigation scheduling trial was established in the spring of 2004 at CSIDC. The soil at the site is classified as Bradwell loam to silty loam. The site received a broadcast application of nitrogen applied as 46-0-0 at a rate of 45 kg N/ha, phosphorus applied as 12-51-0 at a rate of 60 kg P_2O_5/ha and potassium applied as 0-0-60 at a rate of 100 kg K_2O/ha. The fertilizer was incorporated to a depth of 8 cm.

Infrared Transmissible (IRT) plastic mulch and T-Tape (TSX 506-08-670) trickle irrigation tape (20 cm emitter spacing) were applied in a single operation in strips 135 m in length and on three m centers using a commercial mulch/trickle tape applicator. To make most efficient use of the mulch, pumpkin was seeded in a double row configuration along the outer edges with the drip tape running between the two rows and below the plastic mulch. Pumpkin (cv Spirit) was hand seeded (two seeds/hill) through the plastic mulch at a 0.9 m in-row spacing and 0.6 m between row spacing on each mulch strip. Areas with poor plant emergence were re-planted using pumpkin transplants in order to maintain a uniform plant stand.

Soil moisture monitoring was conducted with a neutron moisture meter at four locations (subsamples) in each pumpkin water treatment strip (Figure 3). Aluminum neutron access tubes were installed to a depth of 120 cm and readings conducted at 15 cm intervals except for the 0-15 cm interval. The moisture content of the 0-15 cm interval was measured by the time domain reflectometry technique using a TDR 300 soil moisture meter. Soil moisture was measured at the time of installation, just after seeding, at varying intervals throughout the growing season and at harvest.

Total water use for any given time period was calculated by adding rainfall for the time period, irrigation for the time period and the difference between the soil profile (0-120 cm) water content at the beginning and the end of the time period (profile moisture change). Total water use over the growing season (seeding to harvest) was calculated by summing the water use for each individual time period.

At harvest, yield estimates were obtained by weighing each individual pumpkin from an area 10 m x 2 rows centered on each neutron access tube.

Analysis of variance with subsamples was used to determine the significance of differences among the water treatments for profile moisture change, total water use, yield, pumpkin number and mean pumpkin weight.

Results

The average overall water application rate was 1.236 l/hr/emitter when operating at a system pressure of approximately 8 psi. This flow rate was used to calculate the quantity of water applied at each irrigation time.

Field capacity (100% available water (A.W.)) for the 0-30 cm depth ranged from 0.2032 to 0.3026 g/g with a mean value of 0.2522 g/g, while permanent wilting point (0% A.W.) for the 0-30 cm depth ranged from 0.0829 to 0.1274 g/g with a mean value of 0.0995 g/g. Using these values, the estimated water potential for Water Treatment 1 (85% A.W.) and Water Treatment 2 (70% A.W.) were determined to be 57 and 83 cb, respectively. In order to maintain soil available water above these levels, irrigation was initiated to maintain the soil water potential as indicated by the tensiometers at the 30 cm depth in the range of or below 30-40 cb for Water Treatment 1 (85% A.W.) and in the range of or below 50-60 cb for Water Treatment 2 (70% A.W.).

Tensiometer readings for the two water application treatments indicated that the soil moisture tension was maintained below the targeted levels throughout the growing season (Figures 4a and 4b). Deep tensiometer readings also indicated that the soil moisture tension was maintained within the targeted levels lower in the rooting zone and that the proper quantity of irrigation water was applied (data not shown).

The timing and quantity of irrigation water applied to the pumpkin varied for the two water treatments. Water Treatment 1 received a total of 88 mm irrigation water while Water Treatment 2 received 26 mm of irrigation water. In addition, all plots received 274 mm of precipitation from plant emergence to harvest. Limited irrigation water was required to maintain the soil water tension within the targeted levels due to the higher than normal precipitation and below normal temperatures during the growing season. This resulted in conditions of lower than normal potential evapotranspiration (data not shown).

Total water use at the various time intervals throughout the growing season indicated that in most cases water use was of the order Water Treatment 1 > Water Treatment 2 > Dryland Treatment. Cumulative water use throughout the growing season followed the same trend (Figure 5). Water Treatment 1 used significantly more water than Water Treatment 2 and the Dryland Treatment. There was no significant difference in water use between Water Treatment 2 and the Dryland Treatment (Table 66). Overall water use was lower in 2004 than in the previous two years due to the cooler than normal growing conditions that resulted in poor pumpkin growth.

Pumpkin yield was low and showed no relationship to the quantity of water applied (Table 66). Yields were 8.55 kg/m double row, 8.96 kg/m double row and 8.27 kg/m double row for Water Treatment 1, Water Treatment 2 and the Dryland Treatment respectively.

There were no significant yield differences due to the water treatments. The number of pumpkins produced per unit area, the mean pumpkin weight and the fruit size distribution also showed no significant differences among the water treatments. A greater percentage of pumpkins were in the < 5 kg weight class than the 5-10 kg weight class. Less than 1% of the pumpkins produced were in the > 10 kg weight class. The lack of yield response to the addition of irrigation water was probably due to the cool growing conditions. As well, the cool wet growing conditions prevented the pumpkins that were produced from maturing properly, resulting in green pumpkins. Conditions were ideal for the onset of disease and fruit rot (Figure 6).

Pumpkin yield showed no response to water use. As a result, water use efficiency (kg pumpkin produced/mm water use) showed little response to the different water application treatments (Figure 7).

It is clear from these results that adequate heat is required for optimum pumpkin production. Without adequate heat there will be no response to irrigation water applications.

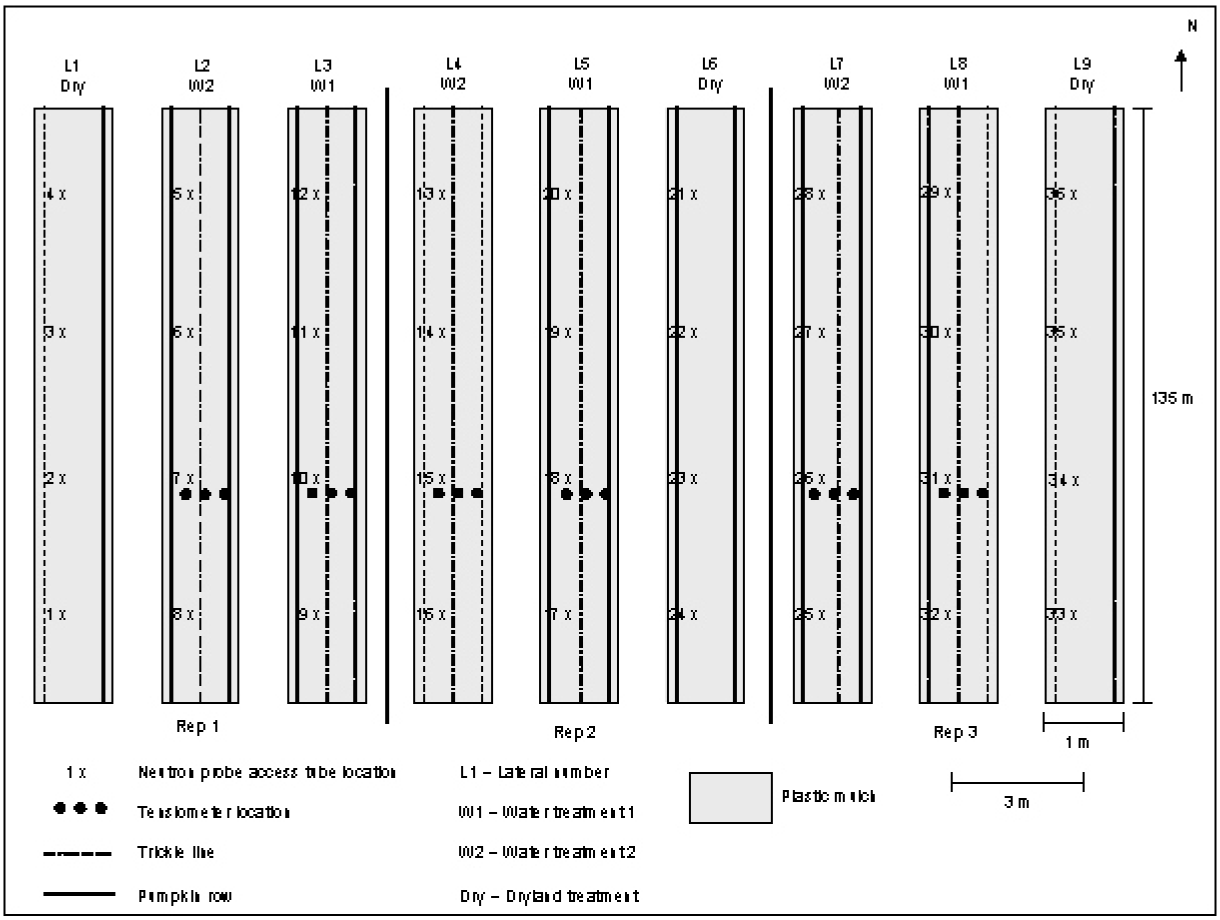


Figure 3. Pumpkin irrigation scheduling trial field layout.

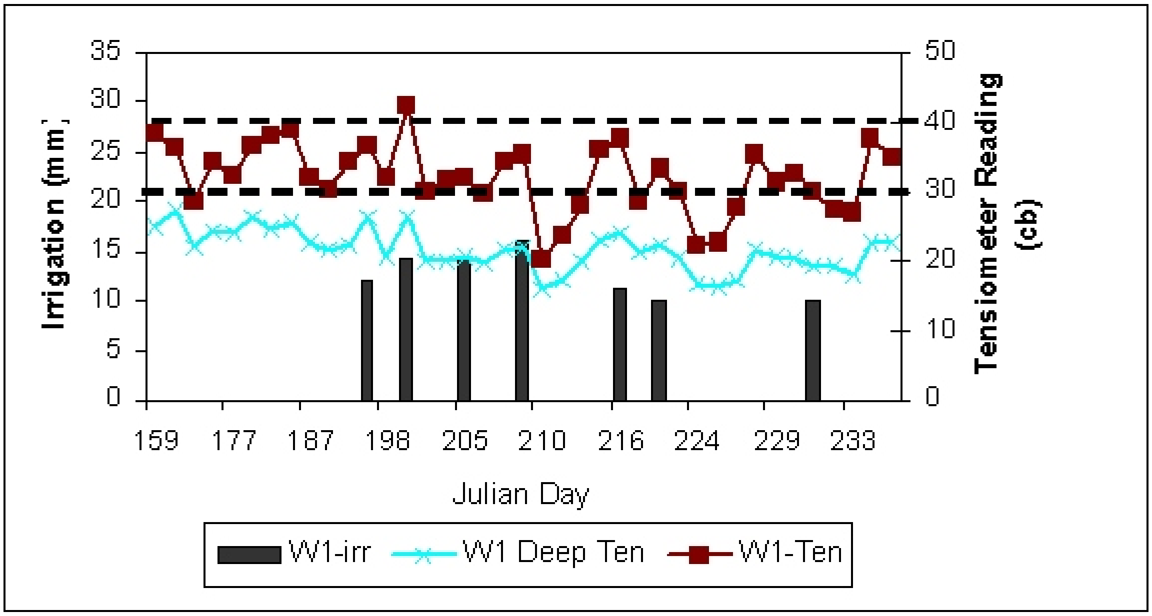


Figure 4a. Water Treatment 1 (W1) tensiometer readings and irrigation applications for the pumpkin trickle irrigation scheduling trial.

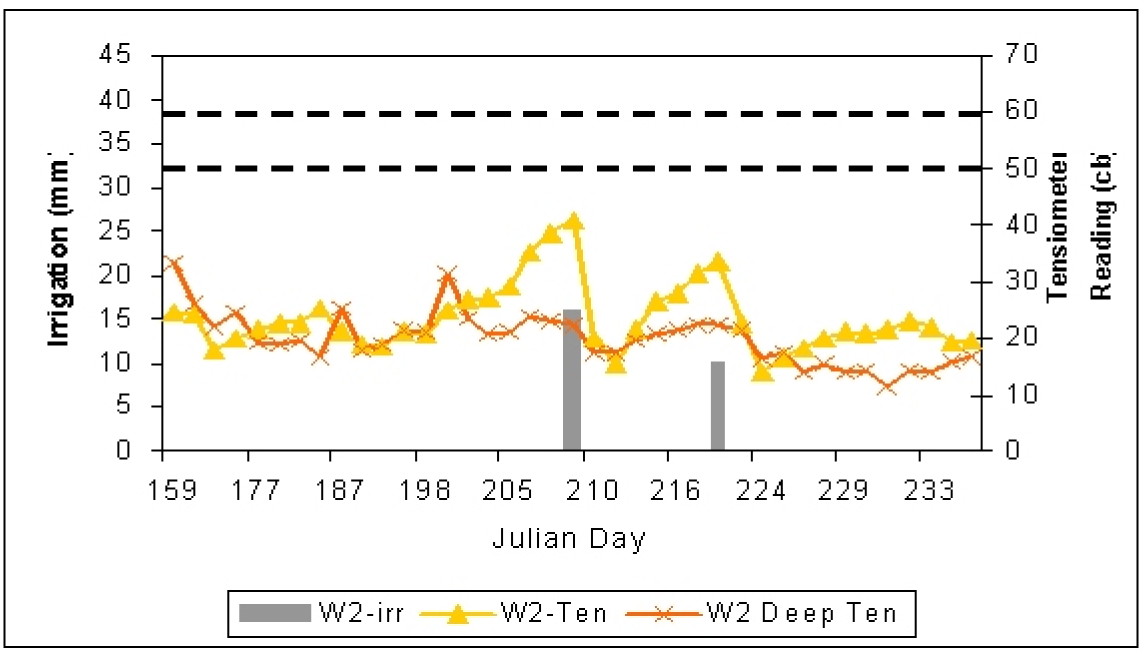


Figure 4b. Water Treatment 2 (W2) tensiometer readings and irrigation applications for the pumpkin trickle irrigation scheduling trial.

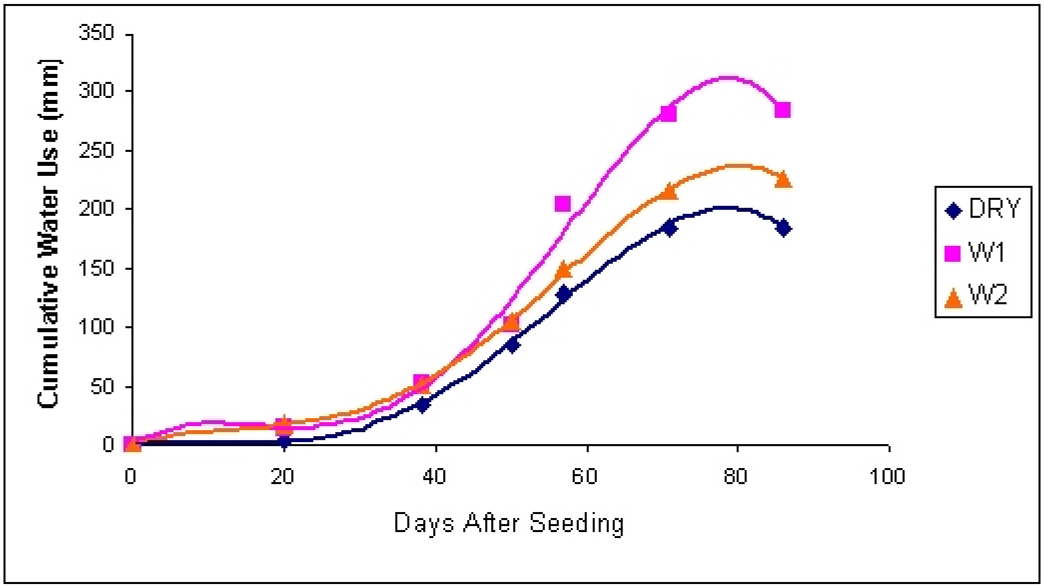


Figure 5. Water treatment effect on seasonal cumulative water use for trickle irrigated pumpkin (cv. Spirit).

Table 66. Effect of water treatment on yield, number of pumpkins, mean weight and total water use for trickle irrigated pumpkin (cv. Spirit).

Water Treatment	Yield (kg/m double row)	Pumpkin Quantity (#/m double row)	Mean Pumpkin Weight (kg)	Total Water Use (mm)
W1	8.55	1.97	4.38	285
W2	8.96	1.95	4.6	211
Dry	8.27	1.84	4.49	185
LSD (0.05)	NS[1]	NS	NS	69
CV (%)	24.5	17.4	26.2	30.3

[1] not significant

Figure 6.Weather conditions favored Sclerotinia disease development.

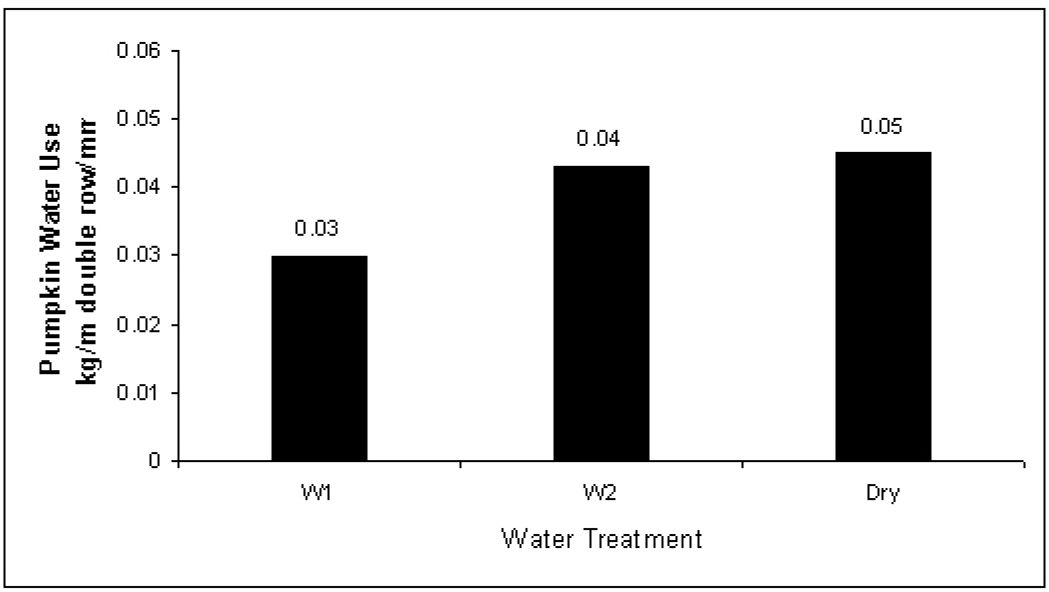


Figure 7. Water treatment effect on water use efficiency of trickle irrigated pumpkin.

Cabbage / Celery Storage Demonstration

Final year of a three year project. Funded by the Agri-Food Innovation Fund and Agriculture and Agri-Food Canada, PFRA to demonstrate storage techniques for cabbage and other selected vegetables that allows extension of the marketing period.

Co-investigators: T. Hogg, and J. Wahab, CSIDC, Outlook, Saskatchewan

In 2005, CSIDC completed a cabbage storage demonstration and an observational celery storage demonstration. Three cultivars of cabbage (Cecile, Bravo, Lennox) grown in CSIDC fields were stored in three separate storages: a filacel cooler (FC), an evaporative cooler (EC) with a humidifier, and an insulated storage with no artificial cooling (NAC) or humidification. All storages are located in the Vegetable Storage and Handling Facility at CSIDC.

The varieties of cabbage used in this study were recommended by producers and industry. The cabbage was grown to maturity and harvested. Yields were recorded, and sub-samples of each variety were placed in the coolers. Cabbage samples were removed from the storages after 60, 120, and 180 days.

The celery storage demonstration was observational only. A small area of celery was produced with the majority sold at harvest. A portion of the crop was placed in the filacel cooler and monitored to determine storability. The celery remained in a marketable condition for approximately three to four weeks after harvest, which greatly extended the marketing period.

As with many other vegetables, the province imports over 90% of its cabbage requirement. Saskatchewan producers can and do produce high yields of quality fresh market and storage cabbage. One key factor limiting expansion is the lack of proper storage. Many of the current producer's storages are basic cold cellar facilities that cannot keep the cabbages in a marketable condition past early December. The demand for fresh market and processing cabbage continues throughout the winter with increased prices over those in the fall. To capture a portion of this market, producers need to be able to store their cabbage longer into the winter while considering the additional costs associated with this storage.

Study Description

The cabbages for the storage trials were produced in Field 1 in 2002 and 2003, and in Field 2 in 2004. Fertilizer was applied according to soil test recommendations. Treflan was applied at recommended rates and incorporated for weed control.

Lennox, Cecile, and Bravo cultivars were seeded in the greenhouse in late April in 162 seedling trays. The cabbages were transplanted in the field mid-May with a water wheel transplanter. Row spacing was 60cm and plant spacing was 45cm. A two metre driveway was left every 12 rows of cabbage to accommodate spraying operations. Lorsban was applied to control root maggots. Alternate applications of Ripcord, Decis, and Sevin were applied to control flea beetles. Irrigation was provided with a low pressure centre pivot. Soil moisture was monitored with tensiometers.

Harvest of the cabbage occurred as each variety matured. Cecile and Bravo varieties were typically one month earlier than Lennox. Harvested yields were recorded for each variety. Size and weights of 12 randomly selected cabbage heads of each variety were collected and disease conditions noted. An additional 36 heads of each variety were sized and weighed and placed in (i) a filacel cooler/storage, (ii) a more typical evaporative cooler with a humidifier, and (iii) a basic cold storage with no artificial cooling or humidification. A filacel cooler is a special cooling and humidification unit designed to maintain temperatures at or near 0° C and humidity at or near 100% without freezing. These conditions are required for many of the storage type vegetables. An evaporative cooler can maintain temperatures near 3° C (the unit will freeze up at lower temperatures) but also dehumidifies the air. A humidifier was placed in this cooler to counteract the dehumidification of the cooling unit.

After 60, 120, and 180 days, 12 cabbages of each variety were removed from the coolers. Discolored and diseased outer leaves were removed as required and the cabbage was weighed to determine storage losses and the net marketable weight.

Temperature and relative humidity (RH) data from the filacel and evaporative cooler was collected using "Hobo" temperature and RH data loggers. The filacel averaged 1.2˚C and 98.5% R.H. The evaporative cooler averaged 3.6 ˚C and 95% R.H. The storage with no artificial cooling was maintained at 5˚C. There was no humidity sensor in this storage.

Celery was produced on Field 1 in 2002 and 2003, and on Field 2 in 2004. The fields were fertilized according to soil test recommendations. The cultivar Utah 52-70 was seeded in the greenhouse in late March and transplanted in the field in late May. A water wheel transplanter was used to transplant the celery. Weed control consisted of hand roguing and roto-tilling. Soil moisture was maintained above 50% field capacity with a low pressure centre pivot and monitored with tensiometers. Harvest was completed in late September and a small sample placed in the filacel cooler and visually monitored for five to six weeks for marketability.

Results

Harvested yields of cabbage were high for each of the three years. The average yields were 79 t/ha, 78 t/ha, and 71 t/ha for Lennox, Bravo, and Cecile respectively (Table 67).

Table 67. Harvested yield of Cabbage, Outlook, Sask.

Variety	Harvested yield (t/ha)			Mean
	2002	2003	2004	
Lennox	62	98	78	79
Bravo	66	88	81	78
Cecile	55	73	85	71

Storage losses varied between varieties, type of cooler, and year (Table 68). Lennox, which is more suited to storage, stored very well in both the FC and EC coolers and reasonably well in the NAC cooler in all three years. Bravo and Cecile were more unpredictable as they stored well in 2002 but not in 2003 and 2004. This is due in part to the growing conditions in 2003 and 2004. In 2003, growing conditions were excellent resulting in the Bravo and Cecile maturing in mid-August. The cabbages were put into storage much earlier than normal when outside temperatures were warm resulting in significant storage losses. After 120 days, there was

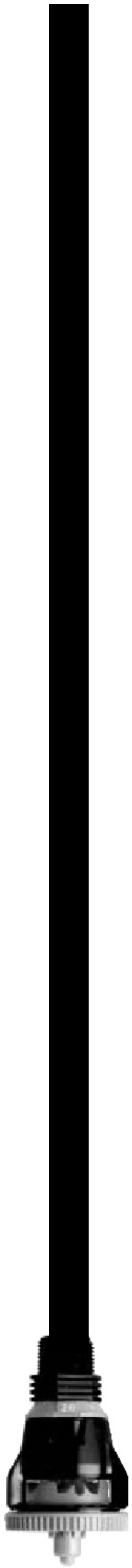
100% storage loss of Bravo and Cecile in all cooler types. In 2004, growing and harvest conditions were wet resulting in disease development in the field. Disease was carried into storage resulting in 100% loss after 120 days.

Overall results show that Lennox will store better than Cecile or Bravo in each of the three cooler types. The filacel or evaporative coolers will have similar storage losses throughout the storage period. Cecile and Bravo cabbage stored with no artificial cooling or humidification will deteriorate very quickly, especially if the harvest is early or harvest conditions are not favorable for proper storage. Since the Cecile and Bravo varieties did not store well in each of the coolers, Lennox will be used to determine the economic viability of storing cabbage for the final report.

The celery stored very well in the filacel cooler for two to three weeks. After three weeks some deterioration occurred with the crop being virtually unmarketable by the sixth week. The economic viability of storing celery will be included in the final report.

Table 68. Percentage storage losses of cabbage varieties after three storage periods by storage type (2002-2004, Outlook, Sask.)

	Filacel cooler			Evaporative cooler			No artificial cooling		
Variety	60 days	120 days	180 days	60 days	120 days	180 days	60 days	120 days	180 days
2002 Storage loss (%)									
Lennox	13	15	16	15	23	19	19	25	29
Bravo	17	25	23	19	26	27	26	35	100
Cecile	17	21	21	20	31	29	33	39	100
2003 Storage loss (%)									
Lennox	13	21	22	14	34	34	32	36	39
Bravo	20	100	100	9	100	100	100	100	100
Cecile	17	100	100	21	100	100	100	100	100
2004 Storage loss (%)									
Lennox	13	20	100	13	35	100	17	31	100
Bravo	11	19	100	11	24	100	100	100	100
Cecile	14	20	100	10	24	100	25	100	100



Field Demonstration Program

ICDC Agrologists

Swift Current, Saskatchewan

Outlook, Saskatchewan

Irrigation Crop Diversification Corporation

Objects and Purposes of ICDC – The Irrigation Act, 1996

The objects and purposes of ICDC are the following:

- to research and demonstrate to producers and irrigation districts profitable agronomic practices for irrigated crops;
- to develop or assist in developing varieties of crops suitable for irrigated conditions;
- 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;
- to co-operate with SIPA (Saskatchewan Irrigation Projects Association) and the minister in promoting and developing sustainable irrigation in Saskatchewan.

Optimizing Livestock Feeding Systems

Silage Corn

In 2004, ICDC added a further 34 irrigated corn fields to its already large agronomic database. 2004 was the “one year in ten” as opposed to the “nine out of ten” described in the Corn Heat Unit map that ICDC Agrologists compiled and is published on Saskatchewan Agriculture and Food’s website www.agr.gov.sk.ca under /Crops/Irrigation. Corn variety testing (both grain and silage) continued in its second year under The Alberta Corn Committee at CSIDC, Outlook. After topping all sites in 2003, Outlook was in the middle of the pack in 2004. Check www.albertacorn.com for the results. A Minor Use Registration Initiative – Liberty 200SN for corn was hosted at CSIDC under the coordination of SAF. ICDC is also distributing Corn Production in Manitoba, revised by The Manitoba Corn Growers Association.

Sweet Corn

ICDC contributed to the update of SAF’s ‘Sweet Corn in Saskatchewan’ and assisted in establishing variety trials at CSIDC.

Osler Dairy Forage Centre

Two ICDC intensively managed irrigated forage trials were established in 2003 at Osler in the heart of Saskatchewan's dairy country. The purpose of these trials is to highlight the potential production and variety responses of irrigated forages under intensive management.

Swift Current Alfalfa Demonstration

Irrigation is intensifying forage production for the beef industry in south west Saskatchewan. The ICDC demonstration, located just outside Swift Current, shows the production capacity of two-cut irrigated alfalfa destined for the beef market.

SeCan Cereal Forage Demonstration

The goal of this demonstration is maximizing cereal silage production under irrigation. SeCan and ICDC cooperated on two sites: Osler and Maple Creek. ICDC was able to show 400% increases in water use efficiency by converting land from flood to sprinkler irrigation at Maple Creek. This demonstration takes intensification under sprinkler irrigation to the next level.

Forage Digestibility

ICDC analysed 31 irrigated forage samples for 48 hour in-vivo digestibility. Samples included ryegrass, timothy and cereal silage. This is an example of ICDC taking the irrigated crop product into the "processor", the animal.

Can Irrigation Support a 10,000 Head Feedlot in Saskatchewan?

ICDC collaborated with the University of Saskatchewan, Animal Sciences Dept and with SAF specialists to compile the data to answer this question in published form.

Using Irrigation to Feed a Large Dairy

ICDC compiled and published the data relating irrigated forage yields and quality to the specialized requirements of dairy cattle.

Increasing Crop Profits

Timothy Hay

ICDC is following the lead of the processed timothy industry to assist it with its research and demonstration priorities. Field trials include a phosphorus rate trial and a harvest timing trial. ICDC is also an industry partner in a Matching Investments Initiative irrigated timothy project with AAFC.

Bean Disease Research for Bean Seed Production

ICDC is following up on its irrigated dry bean seed initiative by collaborating in a national research effort to test the effectiveness of bacterial blight resistance under artificially produced disease pressure.

Dry Bean Production Options

As a result of producer interviews, 'Dry Bean Production Options' was published and distributed to all irrigators by ICDC.

Fusarium and Leaf Disease Survey

ICDC participated in these SAF's provincial surveys to add irrigated sites and data.

Potato Variety Research

ICDC contributed in-kind support to a Matching Investments Initiative for potato variety research coordinated from AAFC Lethbridge and including a site at CSIDC.

Expanding Production Capacity – Water for Food Sufficiency

ICDC staff attended "Confronting Water Scarcity" a conference put on by Alberta Agriculture and Rural Development and Alberta Environment in Lethbridge. Saskatchewan is fortunate to have an abundance of good quality water and this conference underlined what a privilege that is in today's world. ICDC's water use efficiency demonstrations such as Treasure Valley Market Garden and the Gold and Backman projects in water-short south west Saskatchewan were affirmed by presenters at this international event. Saskatchewan has the increasing opportunity to export "virtual water" in value-added crop products such as fruit, vegetables and forage.

Irrigation Management

With the assistance of Alberta Agriculture and Rural Development, SAF and ICDC have been able to set up Outlook meteorological data on Alberta's Irrigation Management Climate Information Network (IMCIN). The meteorological data is used in the Alberta Irrigation Management Model (AIMM) to provide a web-based irrigation scheduling service to irrigators to optimize water use efficiency. A training event was held at CSIDC for agri-business field staff and for irrigators. The website is www.imcin.net .

ICDC's Irrigation Education Initiative adds CCA Accredited Irrigation Events

The ICDC Board has been an advocate for improved irrigation education opportunities in Saskatchewan. The Irrigator, July 2002, documented the existing options for irrigation education and training:

School system ➜	Project WET, Ag In The Classroom's Water for Life
SIAST Moose Jaw ➜	Irrigation course
Green Certificate Farm Training Program ➜	Irrigated Crop Production Technician
ICDC & The Irrigation Centre ➜	Extension - field days, website, newsletters, etc.
University of Saskatchewan ➜	Work Experience (co-op students)

ICDC has been active in the development of "Ag In The Classroom" irrigation material. ICDC is also working through CSIDC to promote The Green Certificate Program. ICDC Director John Könst is on the SIAST Program Advisory Committee. Work by ICDC on irrigation curriculum at the U of S continues. ICDC has mentored eight co-op students over five years from the College of Agriculture working on irrigation research and demonstration projects for the past five years.

ICDC has been involved in hosting SAF's Dutch consultant in Outlook. Hopes are for an expanded exchange program between students from Holland & Canada. In 2004, ICDC added support for the Certified Crop Advisor Program (CCA). CCA has over 14,000 certified advisors in the USA and Canada. To become a CCA, one must pass two exams, national and local. Once certified, a CCA must complete 40 hours of Continuing Education Units (CEUs) every two years in order to remain certified. Irrigation fits the soil and water management area of CCA competency. ICDC offered a total of 28 CEUs in 2004: eight for soil and water management, three for integrated pest management, 17 for crop management.

Crop Development Opportunities

Strawberry Crowns

Strawberry Crown production was demonstrated under irrigation at CSIDC in 2004 in cooperation with ICDC, Agri-ARM and The University of Saskatchewan. Saskatchewan-grown strawberry crowns are of higher quality than Californian-grown crowns because of Northern Vigor®. Saskatchewan-grown crowns command a premium price. Market access and cultivar work need to continue to commercialize this irrigation opportunity.

Irrigated Crop Survey

ICDC agrologists carried out a field by field irrigated crop survey of the 75,000 irrigated acres in the major irrigation districts around Lake Diefenbaker. The survey showed that Saskatchewan's irrigators have intensified their crop rotations just as Alberta's have.

Table 69. Crop mix in irrigation districts around Lake Diefenbaker vs Alberta.

CROP	SASKATCHEWAN	ALBERTA
Vegetables	7%	*6%
Pulses	7%	4%
Oilseeds	22%	8%
Cereals	27%	30%
Forages	36%	48%
Miscellaneous	1%	4%

*includes sugar beets

The big difference between our two provinces is that Alberta has developed the "critical mass" (1.3 million irrigated acres) to support the value-added food processing sector. This supports the position of the ICDC Board since its inception: that Saskatchewan should develop its irrigation infrastructure (eg. ICDC's submission to Sask Water in April 2000).

ICDC Technology Transfer

List of Events

Jan 13 & 14	Western Canada Crop Production Week, Saskatoon, lectures and display
Jan 14	DeKalb Winter grazing field day, Bradwell, guest speaker
Jan 29	SPARC Regional Forage & Beef Update Seminar, Swift Current, display
Feb 5, 6 & 7	Canadian Hay Assoc. 2004 National Conference, display
Feb 6	CSIDC/ICDC program meeting, Outlook, agronomy partner
Feb 19	Soils and Crops Workshop, Saskatoon, paper presentation
Feb 24	Managing Your Costs seminar, Outlook, guest speaker.
Feb 25	Regional Rural Opportunities Conference, Swift Current, display
Mar 12	Alberta Corn Committee, Lethbridge, guest speaker
Mar 16	Crop and Beef Enterprise, Swift Current, seminar
Mar 16	Crop and Beef Enterprise, Riverhurst, seminar
Mar 22	Crop Production, Economics & Development, Warman, seminar
Mar 22	Timothy Production, Outlook, seminar
Mar 23	Making Irrigation Pay, Outlook, seminar
Mar 24	Making Irrigation Pay, Lucky Lake, seminar
Mar 26	Sask. Seed Potato Grower Assoc. seminar, guest speaker
Mar 31	Water the Economic Driver, Swift Current, display
Apr 29	Timothy Producer Workshop, Lethbridge, display
Jun 10	Irrigation Scheduling Workshop, Outlook, CCA approved
Jun 25	Sask Vegetable Grower's Assoc. Field Day, Outlook, program
Jun 26	Sask Fruit Growers Association Summer Tour, Outlook, program
Jul 8	Annual CSIDC Field Day and Trade Show, Outlook, CCA approved
Jul 13	Irrigated Market Garden and Fruit Crop Field Day, Cadillac, CCA approved
Jul 14 & 15	Confronting Water Scarcity, Lethbridge, display
Jul 19	Dairy Quality Silage and Forage Tour, Osler, CCA approved
Jul 22	PMRA Minor Use Tour, Outlook, guest speaker
Jul 26	SPARC Irrigated Forage and Grazing Tour, Swift Current, CCA approved
Jul 26	Irrigated Crop Performance Field Day, Maple Creek, CCA approved
Aug 5	Bean & Soybean Field Day, Outlook, CCA approved
Aug 12	Sask Seed Potato Grower's Assoc. Day, Outlook, program
Aug 28	Animal Science 301 Animal Production Tour, Osler, Guest speaker
Sep 14	Corn Performance, Nutrition, & Sweet Corn Field Day, Outlook, CCA approved
Nov 4	Drought Proofing the Economy, Regina, display
Nov 5	College of Agriculture Career Fair, Saskatoon, display
Nov 16	Timothy Production Seminar, Outlook, demo results
Dec 3	Prairie Seed Grazing Corn Field day, Harris, guest speaker
Dec 6 & 7	SIPA – ICDC AGM and Tradeshow, Swift Current, program

www.irrigationsaskatchewan.com

This farmer-friendly gateway to irrigation information and contacts on the prairies and around the world is being developed and upgraded by both SIPA and ICDC. In 2004, the site had over 50,000 hits from over 900 unique visitors. The average number of pages per visit were 4.1 up from 2.6 in 2003. The site has 615 unique links. This site is seen as vital to ICDC's role of disseminating timely irrigation information.

9th Annual SIPA ICDC Irrigation Conference 2004

Following 2003's Annual Conference in Outlook with its strong development message, the 9th Annual SIPA / ICDC Irrigation Conference in Swift Current featured a speech by Deputy Premier, the Hon. Clay Serby. The Deputy Premier announced that an irrigation strategy was under preparation which includes consultations with the federal government, SIPA and the private sector. Dr Graham Parsons, President of the Organization for Western Economic Cooperation and Vice President of Clifton and Associates, developed a Fifty Year Water Plan for Saskatchewan which includes major implications for irrigation. This plan was presented at the Conference. The International Joint Commission held public consultations in 2004 in response to Montana's claim that it should be entitled to a larger share of the St. Mary and Milk rivers than currently provided under the 1921 Order. His topic was explained to conference delegates from both the Alberta and Saskatchewan perspectives. An explanation of the Canada Saskatchewan Water Supply Expansion Program was provided to delegates with particular reference to irrigation. Alberta's Water for Life strategy was presented by the Executive Director of the Alberta Irrigation Projects Association.

Water: Droughtproofing the Economy Conference

ICDC was a partner in Saskatchewan Agrivision Corporation's conference, Water: Droughtproofing the Economy, held in Regina on November 4. ICDC and SIPA were both represented on the conference steering committee and participated in a series of workshops held around the province.

This was the follow-up to the conference, Water: Economic Driver of the Future, held in March 2003 in which ICDC also partnered. The follow-up was a presentation of "The Fifty Year Plan for Water in Saskatchewan" by Dr Graham Parsons and Wayne Clifton. This plan was developed with CARDS funding. Summaries of the full document are available on www.droughtproofing.com .

Acknowledgments and Sponsors

Co-operating Producers

- B.J. Boot
- P, R & J Enns
- Dale Ewen
- Cypress Hutterite Colony
- Peter J. Fehr
- Gerald and Terry Follick
- Henry Friesen
- Keg Farms
- Gordon and Rodney Kent
- John Könst
- Roger Pederson
- Greg Sommerfeld
- Jeff Weibe
- Wheaton Bee Farm
- Kate Whenham

Partners and Collaborators

- Agri-Arm
- Agriculture and Agri-Food Canada (Dr. Bruce Coulman and Myriam Fernandez)
- Canada-Saskatchewan Irrigation Diversification Centre
- Canadian Hay Association
- College of Agriculture, U of S (Department of Animal and Poultry Science, Dr. Karen Tanino, Dr. Brian Rossnagel)
- Saskatchewan Agriculture and Food (Penny Pearse, Bill Kowalenko, Marsha Cannon, Karen Bolton)
- Saskatchewan Prairie Arid Research Centre
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- Brett Young Seeds
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For more information on any of these projects and for a copy of the *2004 ICDC Demonstration Program Final Report,* call ICDC at (306) 867-5500, Outlook or (306) 867-5403, Swift Current. Results can also be found on www.irrigationsaskatchewan.com .