Research and Demonstration Highlights 1991

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SIDC
Introduction

Introduction

Manager's Report

On behalf of the Centre Management Committee, it is my pleasure to present the Annual Progress Report for the Saskatchewan Irrigation Development Centre. This report summarizes the work conducted, funded or facilitated by the Centre in 1991. I trust you will find this report informative and useful.

Record low grain prices have placed interest in diversification and cropping alternatives at an all time high. This was readily apparent by the response to our booth at the Crop Production Show and the inquiries for information on potential alternative crops. The success of the Centre is dependent upon its ability to increase the number of viable cropping options available to irrigation farmers along with its ability to increase irrigated crop productivity on a sustainable basis. These efforts contribute to the ultimate goal of increased farm profitability.

Environmental issues have more recently gained prominence. SIDC has been involved through activity under the Environmental Sustainability Initiative (ESI). Our intent is to meet environmental goals in ways that promote economic prosperity.

Research and demonstration results are now beginning to accumulate. A concerted effort will be made to ensure this information is made available to the irrigation farmer.

Year's Highlights

Many highlights occurred at the Centre in 1991. The following are a few of the more noteworthy.

1. A major role of the Saskatchewan Irrigation Development Centre has been to fund irrigated research and demonstration activity. This has been done primarily using funding from the Canada/Saskatchewan Irrigation Based Economic Development Agreement. To date, 89 research applications have been received for funding and 33 have been approved. In addition, 143 demonstration applications have been received with 89 being approved. Additional project detail is provided in this report.

2. Thirty tours were hosted by SIDC in 1991. The average size of each group was 15. In total over 1,500 guests visited the Centre. Particular highlights included our annual field day, a summer evening tour and our annual winter report session.

3. Lectures, papers and/or poster sessions were presented at: Soils and Crops Workshop, Pulse Crop Growers Association Meeting, Waterscapes, Turf Grass Growers Association, SIDC Report Day and the Expert Committee on Grain Production. In addition an SIDC booth was staffed at the Crop Production Show and the Waterscapes Conference.

4. Created and staffed market analyst position (H. Clark). This position was created to examine market trends, price expectations and opportunities for irrigated crop production and to assist in targetting research efforts toward a market driven approach.

Canada-Saskatchewan Irrigation Development Centre

The Saskatchewan Irrigation Development Centre (SIDC) originated as the Prairie Farm Rehabilitation Administration Farm (PFRA), at Outlook, Saskatchewan. The PFRA Predevelopment Farm was established at Outlook in 1949, prior to the development of Gardiner Dam. The farm was designed as a centre to demonstrate irrigation methods to aid farmers in their transition to irrigated agriculture. Upon completion of the Gardiner Dam and the formation of Lake Diefenbaker, the farm became known as the Demonstration Farm and served a useful role in demonstrating irrigation technology.

However, irrigated research and demonstration programs by Agriculture Canada, PFRA, the University of Saskatchewan and by Saskatchewan Agriculture were limited and programs addressed specific organizational or scientific objectives on an independent basis. The need existed for a co-ordinated, co-operative program. A joint federal-provincial agency called the Saskatchewan Irrigation Development Centre was formed in 1986, at Outlook, Saskatchewan to help better address these needs.

Objectives of the Centre:

1. To direct the focus of research and demonstration activities to meet the needs of irrigation farmers in Saskatchewan.

2. To develop, refine and test modern irrigation technology, cropping systems and soil conservation measures by conducting activities at the Development Centre and off-station sites in close co-operation with research organizations.

3. To demonstrate irrigation technology, cropping systems and soil conservation measures under irrigation at off-station sites throughout Saskatchewan.

4. To promote advanced irrigation technology, cropping systems, and soil conservation measures under irrigation in co-operation with extension agencies.

5. To provide suitable land, facilities and technical support to research agencies to conduct research into irrigation technology, cropping systems and soil conservation measures under irrigation.

The Organization:

The Centre consists of 80 hectares of federal land at Outlook, 65 hectares (leased with Saskatchewan Irrigation Based Economic Development (SIBED) funding) north of Outlook and 260 hectares at Rudy Rosedale Community Pasture. Research and demonstrations are conducted both at the Centre and on selected satellite sites.

The organizational structure at the Centre is shown in Figure 1.

1. The Centre Management Committee is the main governing body of the Centre. It consists of a federal and provincial representative, one from Agriculture Canada, PFRA, and one from Saskatchewan Water Corporation. This group co-ordinates and implements the general program and objectives of the Saskatchewan Irrigation Development Centre.

2. The Research Advisory Committee includes representatives from the University of Saskatchewan, Agriculture Canada, the provincial government and industry. This committee identified, reviewed and suggested proposals for irrigation research work to be conducted,

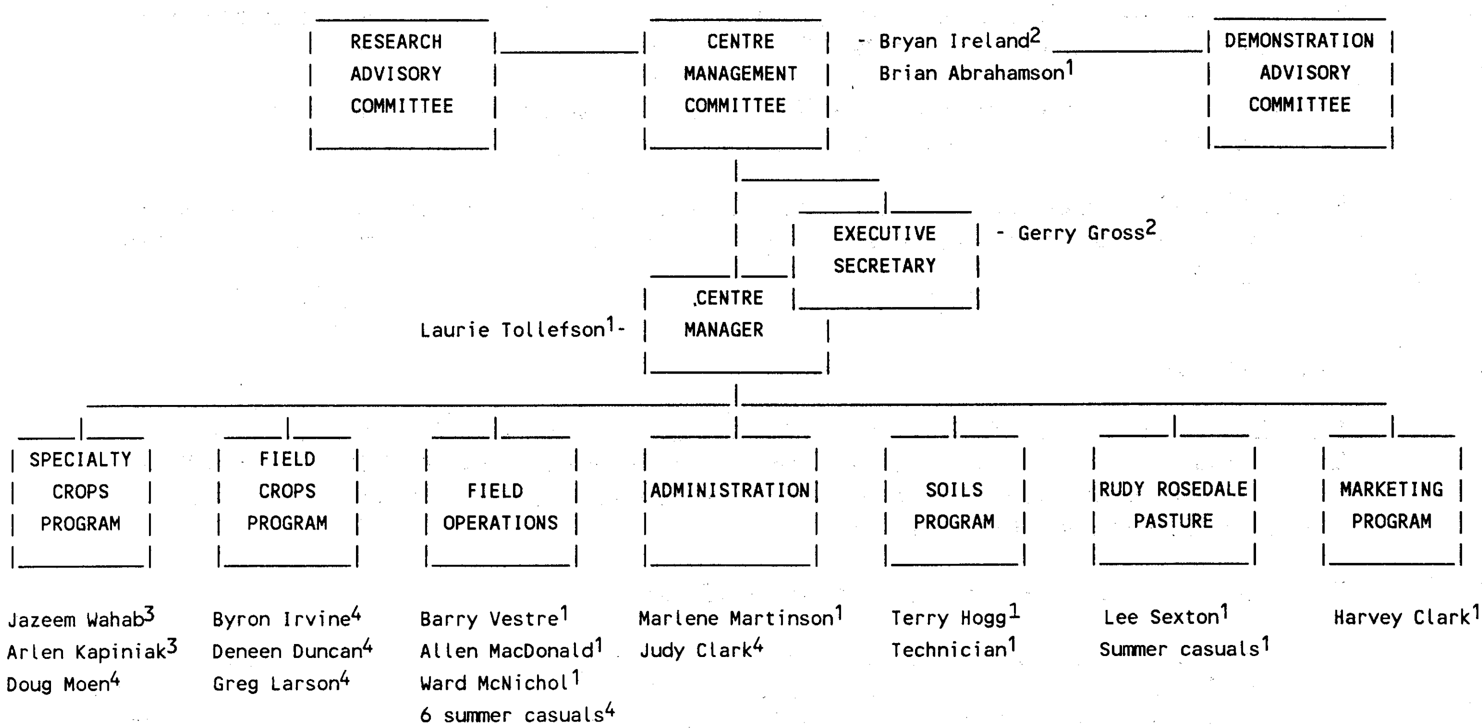
prioritized and recommended proposals to the Centre Management Committee, and advised the Centre Management Committee on all matters related to irrigation research and extension. They also reviewed and assessed research work at the request of the Centre Management Committee.

3. The Demonstration Advisory Committee, comprised of mainly irrigation farmers, reviewed and suggested proposals for the type of irrigation demonstration work to be conducted. It also recommended and prioritized proposals to the Centre Management Committee and advised the Centre Management Committee on all matters related to irrigation demonstration and extension. This committee also reviewed irrigation research proposals.

4. The Centre Manager is staffed by Agriculture Canada, PFRA, and is responsible to manage staff, programs, contracts and budgets assigned to the SIDC.

5. The Executive Secretary position is staffed by the Saskatchewan Water Corporation. The duties of this position include preparation and supervision of off-centre contracts, preparation of centre agreements, implementation of an SIDC extension program.

Figure 1. Organizational Chart



1. PFRA 2. SASKATCHEWAN WATER CORPORATION 3. SPECTRUM SPECIALTY SEEDS INC. (SIBED CONTRACT) 4. AGRI-FARM CONSULTANTS LTD. (SIBED CONTRACT)

Centre Funding:

The base funding for the Saskatchewan Irrigation Development Centre is provided by PFRA and Saskatchewan Water Corporation. Additional funds were provided by the Canada/Saskatchewan Irrigation Based Economic Development Agreement (SIBED) and the Environmental Sustainability Initiative (ESI).

	(Ag Canada) PFRA	1991 SIBED	ESI	SASK WATER
Salaries	314,570	345,610		42,888
Operating	130,000	78,100		1,083
Capital	55,700	---		
Research		577,427		
Demonstration		232,404		
Other Projects			38,900	
Total	500,270	1,233,541	38,900	43,971

Total expenditures for the year were $1,816,682.00

In addition to funding "on-centre activity" SIDC is responsible for managing all irrigation research, development and demonstration activity in Saskatchewan. The financial support for this expanded activity is through the SIBED agreement. This agreement identified 7.0 million for irrigated research and demonstration. A total of 33 irrigated research and 89 demonstration projects have been funded. These are included in the SIDC list of projects.

SIDC
List of Projects

Irrigation Based Economic Development Fund (IBED):

IBED Research Projects:

PROJECT NAME AND CO-OPERATOR	TERM	1991 EXPENDITURES	TOTAL $
Soil Salinity Investigation at the SSRID #1 Principal: L. Henry, U of S	One year Completed 1987	$0.00	$100,000.00
Methods of Improving Alfalfa Establishment under Irrigated Conditions Principal: B. Irvine, SIDC	Four years Completed 1990	$0.00	$182.00
Seed Production of Kentucky Bluegrass Principal: B. Irvine, SIDC	Four years Completed 1990	$0.00	$176.00
Irrigation Scheduling Information Principal: R. Lawford, NHRI	Two years Completed 1990	$0.00	$29,718.00
Determination of Soil Intake Rates under Centre Pivot Irrigation Systems Principal: D. Norum, U of S	Two years Completed 1990	$0.00	$35,282.00
N Fertilization and Water Use Efficiency of Irrigated Crops Principal: C. van Kessel, U of S	Three years Completed 1990	$5,401.00	$134,500.00
The Design and Field Testing of a Vertical Mulcher for Irrigated Conditions Principal: Paragon Consultants Ltd., T. Tollefson	Four years	$4,000.00	$73,750.00
Alfalfa Cultivar Evaluation on Flood Irrigated Clay Soils in South West Saskatchewan Principal: P. Jefferson, Ag Canada, Swift Current	Four years	$55,400.00	$210,000.00
Irrigation Scheduling Tools for Farm Use Principal: B. Irvine, SIDC	Three years Completed 1990	$0.00	$30,755.00
Evaluation of Conventional Height Semi-Dwarf Cultivars for Irrigated Production in Saskatchewan Principal: P. Hucl, Sask Wheat Pool	Three years Completed 1990	$2,037.00	$14,033.00
Sodicity Hazard of Sodium and Bicarbonate Principal: F. Selles; Contractor: Normac AES Ltd.	Four years Completed 1991	$73,361.00	$349,200.00
Denitrification in Irrigation Cropping Systems and its Significance for Crop Production Principal: C. van Kessel, U of S	Two years Completed 1990	$2,698.00	$43,000.00
Influence of Seed Piece Spacing, Fertility and Irrigation on Yields of Whole Seed Potatoes in Saskatchewan Principal: D. Waterer, U of S	Two years Completed 1990	$0.00	$55,950.00
Diseases of Irrigated Wheat to Evaluate Fungicide Sprays for Foliar Disease Control Principal: L. Duczek, Ag Canada, Saskatoon	Three years	$12,060.00	$41,700.00

IBED Research Projects (cont.):

PROJECT NAME AND CO-OPERATOR	TERM	1991 EXPENDITURES	TOTAL $
Management of Alfalfa for Seed Production under Irrigation Principal: B. Goplen, Ag Canada, Saskatoon	Three years	$13,048.00	$38,440.00
Irrigated Production of Hybrid Canola Seed Principal: D. Hutcheson, Ag Canada, Saskatoon	Three years	$34,665.00	$91,161.00
Herbicide, Pesticide and Nutrient Loss Using Low Pressure (High Volume) Irrigation Systems Principal: W. Nicholaichuk, NHRI	Three years	$32,000.00	$98,200.00
Grass Species for Irrigated Pastures Principal: B. Goplen, Ag Canada, Saskatoon	Three years	$51,700.00	$170,007.00
Management of Forage Production under Irrigation Principal: B. Goplen, Ag Canada, Saskatoon	Three years	$54,143.00	$192,400.00
Barley Silage as a Source of Available Energy and Nonstructural Carbohydrate for Lactating Dairy Cows Principal: D.A. Christensen, U of S	Two years Completed 1991	$45,725.00	$60,100.00
Evaluation of High-yielding, Disease-resistant Durum Wheat Breeding Lines for Irrigated Production Principal: J.M. Clarke, Swift Current Research Station	Three years	$57,400.00	$168,300.00
Nutrient Requirements of Irrigated Crops Principal: L. Henry, U of S	Three years	$43,443.00	$233,950.00
Barley Development and Evaluation for Irrigation in Saskatchewan Principal: B. Rossnagel, U of S	Three years	$65,397.00	$191,376.00
Screening for Phytopath Resistance in Cereal and Pulse Crops for Saskatchewan Principal: B. Rossnagel, U of S	Three years	$18,319.00	$74,990.00
Establishment and Seed Production of Turf and Forage Grasses under Irrigation Principal: Newfield Seeds Limited	Three years	$6,910.00	$27,200.00

IBED Demonstration Projects:

PROJECT NAME AND CO-OPERATOR	TERM	1991 EXPENDITURES	TOTAL $
Irrigated Canola Varieties Demonstration Co-operator: M. Larson	Two years Completed 1988	$0.00	$1,684.00
Irrigated Production of Texas Kochia Co-operator: R. Derdall	One year Completed 1987	$0.00	$1,558.00
Fertigation Feasibility on Fine Sandy Loam Co-operators: R. & R. Bond	Three years Completed 1989	$0.00	$7,695.00
Oilseed/Pulse Crop Sequence Co-operator: B. Irvine, SIDC	Three years Completed 1989	$0.00	$1,181.00
Agronomics of Pinto Beans Using Conventional Farm Equipment Co-operator: K. Carlson, Keg Farms Ltd.	Three years Completed 1988	$0.00	$7,000.00
Comparison of Leduc and Virden Barley for Silage Production under Irrigation Co-operator: B. Irvine, SIDC	Two years Completed 1988	$0.00	$575.00
Infrared Crop Photography of Irrigated Production Co-operator: J. Linsley, SWC	One year Completed 1987	$0.00	$5,968.00
Irrigated Production of Texas Kochia on Saline Soil Co-operator: R. Derdall	Two years Completed 1989	$0.00	$3,091.00
Irrigated Field Pea Early Seeding Demonstration Co-operator: J. Konst	Three years Completed 1990	$3,422.00	$11,909.00
Ripping Solonetzic Soils Co-operator: M. Grevers	Three years Completed 1990	$2,360.00	$27,253.00
Alfalfa Varieties on Border Dyke Irrigation - Yield and Stand Longevity Contractor: Normac AES Ltd.	Five years	$2,650.00	$12,050.00
Alfalfa Establishment and Fertility for Increased Yield Contractor: Normac AES Ltd.	Five years	$14,900.00	$55,088.00
Maximum Economic Yield Co-operator: Outlook Irrigation Production Club	Four years Completed 1991	$16,104.00	$62,189.00
Finishing & Marketing Options for Lambs Raised on Irrigated Pasture Co-operator: D. Kelman	One year Completed 1988	$0.00	$3,500.00

IBED Demonstration Projects (cont.)

PROJECT NAME AND CO-OPERATOR	TERM	1991 EXPENDITURES	TOTAL $
Creep Feeding Lambs Raised on Irrigated Pasture Co-operator: R.D.H. Cohen	One year Completed 1988	$0.00	$12,360.00
Drainage & Subsoiling to Improve the Yield of Alfalfa on Border Dyke Irrigation Contractor: Normac AES Ltd.	Four years Completed 1991	$10,348.00	$14,748.00
Use of Spring Seeding Winter Annual Cereal Grains for Grazing (Large Animal Trial) Co-operator: Vestre Farms	Two years Completed 1989	$0.00	$5,425.00
Irrigated Fababean Agronomy Demonstration of Benefits of Early Seeding Co-operator: M. Miller	Three years Completed 1990	$2,360.34	$8,716.00
Canola Variety Demonstration, Site 2 Co-operator: D. Duncan, SIDC Site: C. Bagshaw	Two years Completed 1989	$0.00	$2,638.00
Evaluation of a Reservoir Tillage System to Reduce Runoff at High Water Application Rates Co-operator: D. Duncan, SIDC Site: J. Eliason	One year Completed 1988	$0.00	$2,086.00
Using Chemical Desiccants to Speed Curing of Alfalfa Forage Co-operator: L. Knapik	Two years Completed 1990	$0.00	$1,672.00
Irrigated Field Pea Agronomy Co-operator: G. Follick	One year Completed 1988	$0.00	$3,198.00
Irrigated Alfalfa Seed Production Co-operator: M. Millar	Three years Completed 1991	$5,000.00	$15,500.00
Semi-dwarf vs. Traditional Barley Varieties Grown under Irrigation Co-operator: J. Senger	One year Completed 1989	$0.00	$1,945.00
Irrigated Pinto Bean Agronomy: Evaluation of Disease Control Technology Co-operator: J. Eliason	One year Completed 1989	$0.00	$2,975.00
Increasing Returns from Irrigated Grass Pastures Grazed by Sheep Co-operator: Riverside Sheep Co.	One year Completed 1989	$0.00	$1,808.00
Irrigated Pinto Bean Agronomy: Evaluation of Disease Control Technology Co-operator: Derdall Irrigation	Three years Completed 1991	$4,201.00	$12,060.00

IBED Demonstration Projects (cont.)

PROJECT NAME AND CO-OPERATOR	TERM	1991 EXPENDITURES	TOTAL $
Irrigated Safflower Agronomy; Evaluation of Nitrogen Response in Safflower Productivity Co-operator: J. Massey	Three years Completed 1991	$1,543.00	$6,001.00
Irrigated Great Northern Bean/Pinto Bean - Evaluation of Disease Control Technology Co-operator: J. Konst	Three years Completed 1991	$838.00	$5,190.00
Irrigated Pinto Bean Agronomy: Evaluation of Disease Control Technology Co-operator: Lakeview Ranch	Three years Completed 1991	$4,774.00	$15,508.00
Irrigated Pinto Bean Agronomy: Evaluation of Disease Control Technology Co-operator: K. Carlson	Three years Completed 1991	$4,734.00	$14,333.00
Skid Boom Sprayer Evaluation for Sclerotinia Control in Irrigated Pinto Bean Co-operator: J. Konst	One year Completed 1989	$0.00	$4,421.00
Timothy Production under Irrigation Co-operator: P. & S. Verwimp	Three years Completed 1990	$2,632.00	$9,456.00
Irrigated Field Pea Agronomy: Early Seeding Date Co-operator: G. Ostie	Two years Completed 1990	$0.00	$5,026.00
Demonstration of Alfalfa Seed Production Under Irrigation Co-operator: M. & R. Larson	Three years Completed 1991	$5,000.00	$15,500.00
Timothy Production under Irrigation Co-operator: K. Bagshaw	Three years Completed 1991	$3,050.00	$9,080.00
Irrigated Field Pea Agronomy: Early Seeding Demo Co-operator: M. Purcell	Two years Completed 1990	$0.00	$4,183.00
Canola Productivity Centre Pilot Project Co-operator: Canola Council of Canada & Sask Canola Growers Association	One year Completed 1990	$324.00	$10,726.00
Grasses for Irrigated Pastures Co-operator: N. MacLeod	Three years	$1,025.00	$7,200.00
Hay Certification and Forage Market Access Project Co-operator: V. Racz, U of S	Three years	$35,347.00	$147,500.00

IBED Demonstration Projects (cont.)

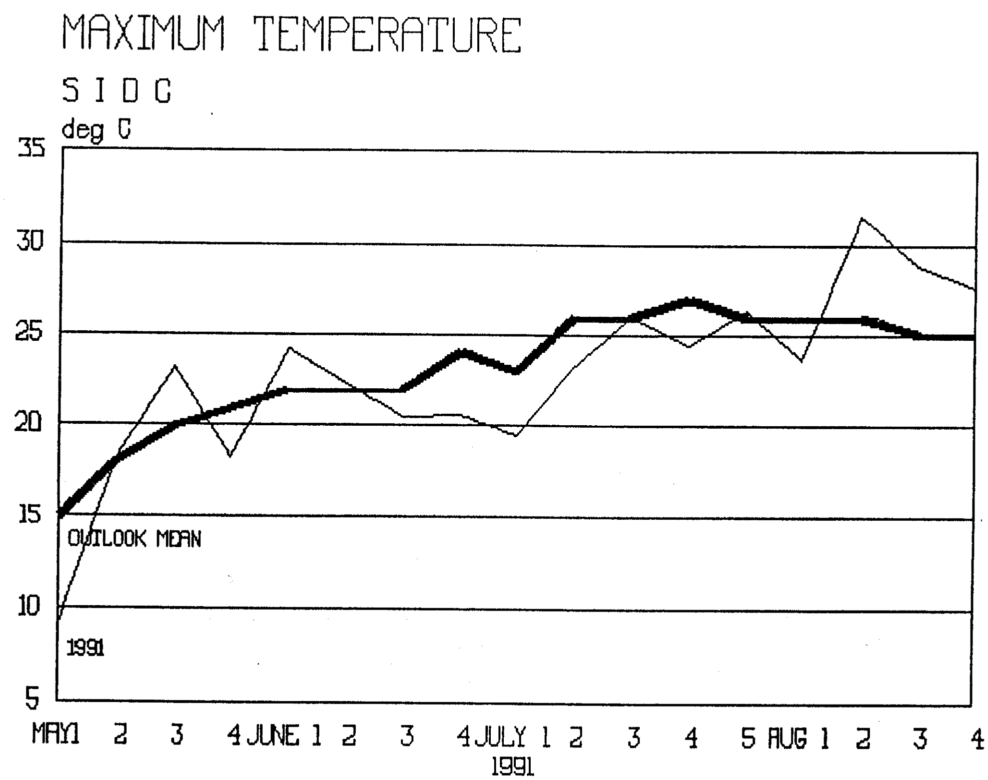
PROJECT NAME AND CO-OPERATOR	TERM	1991 EXPENDITURES	TOTAL $
Grasses vs. Alfalfa Production and Nutritional Value on Border Dyke Irrigation in SW Saskatchewan Contractor: Normac AES Ltd.	Three years	$5,300.00	$17,750.00
Irrigated Pinto Bean Agronomy: Evaluation of Airseeders for Pinto Bean Production Co-operator: B. Whenham	One year Completed 1990	$0.00	$3,500.00
Irrigated Pinto Bean Agronomy: Evaluation of Airseeders for Pinto Bean Production Co-operator: W. Jones	One year Completed 1990	$0.00	$2,728.00
Irrigated Pinto Bean Agronomy: Evaluation of Nitrogen Response in Pinto Bean Production Co-operator: J. Massey	Two years Completed 1990	$2,984.00	$5,661.00
Irrigated Pinto Bean Agronomy: Evaluation of Airseeders for Pinto Bean Production Co-operator: B. Tullis	One year Completed 1990	$0.00	$3,156.00
Irrigated Pinto Bean Agronomy: Harvestability Evaluation Co-operator: B. Davison	One year Completed 1990	$0.00	$3,103.00
Testing Grain Crop Varieties under Irrigation Co-operator: B. Harvey	Three years	$63,658.00	$179,050.00
Adaptation and Recommendation Testing of Forage Crop Varieties in Saskatchewan Co-operator: Sask Forage Council/Newfield Seeds	Three years	$0.00	$57,500.00
Irrigated Pinto Bean Agronomy: Evaluation of Disease Control Technology Co-operator: M. Larson	Two years Completed 1991	$3,500.00	$7,000.00
Demonstration of Techniques for the Seed Production of Meadow Bromegrass Co-operator: R., M. & R. Larson	Three years	$3,500.00	$10,500.00
Fertilizing Grass Alfalfa Mixtures Co-operator: E. William	Two years	$1,015.00	$2,260.00
Response of Established Irrigated Alfalfa to Potassium Fertilization Co-operator: J. Torrie	Two years	$857.00	$2,090.00
Irrigated Pinto Bean Agronomy: Evaluation of Disease Control Technology Co-operator: B. Davison	One year Completed 1991	$3,467.00	$3,467.00

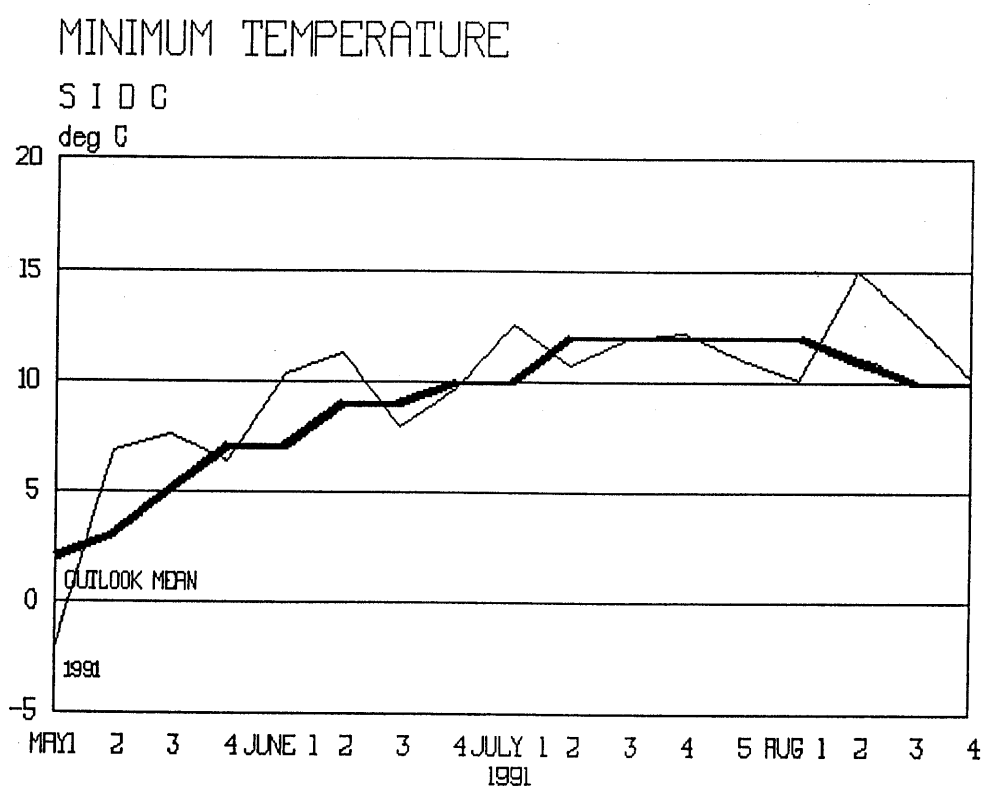
IBED Demonstration Projects (cont.)

PROJECT NAME AND CO-OPERATOR	TERM	1991 EXPENDITURES	TOTAL $
Irrigated Pinto Bean Agronomy: Evaluation of Nitrogen Response in Pinto Bean Production Co-operator: B. Sawatzky	One year Completed 1991	$2,916.00	$2,916.00
Irrigated Pinto Bean Agronomy: Evaluation of Harvesting Technologies Co-operator: M. Larson	One year Completed 1991	$3,314.00	$3,314.00
Irrigated Pinto Bean Agronomy: Evaluation of Nitrogen Response in Pinto Bean Production Co-operator: B. Ringdal	One year Completed 1991	$3,500.00	$3,500.00
Response of Established Irrigated Alfalfa to Potassium Fertilization Co-operator: B. & B. Spigott	Two years	$831.00	$2,090.00
Minimizing Bean Harvesting Losses: Field Demonstration and Tests Co-operator: L. Hill, PAMI	One year Completed 1991	$20,785.00	$20,785.00
Seed Yields of Forage, Turf and Amenity Grass Species and Varieties under Irrigated Conditions Co-operator: Saskatchewan Forage Council	Two years	$1,850.00	$25,000.00
Irrigated Fababean Agronomy: Row Spacing and Mechanical Weed Control Evaluation Co-operator: J. Gray	One year Completed 1991	$1,750.00	$1,750.00
Response of Established Irrigated Alfalfa to Potassium Fertilization Co-operator: L. Knapik	Two years	$624.00	$2,090.00

SIDC
Meteorological and Irrigation Data

Meteorological Data (Growing Season)





PRECIPITATION

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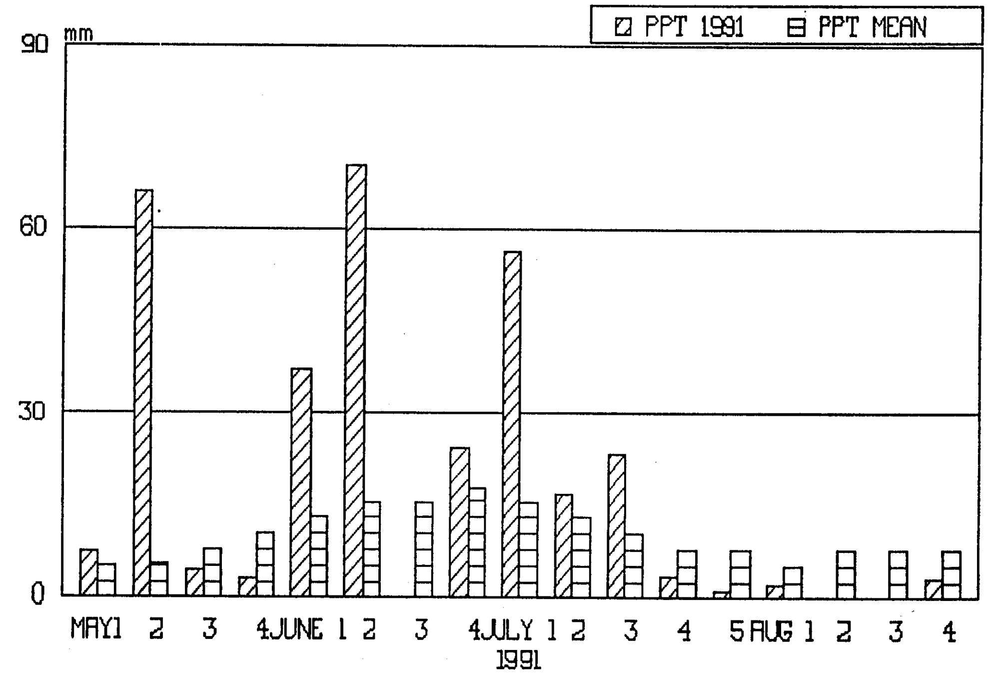

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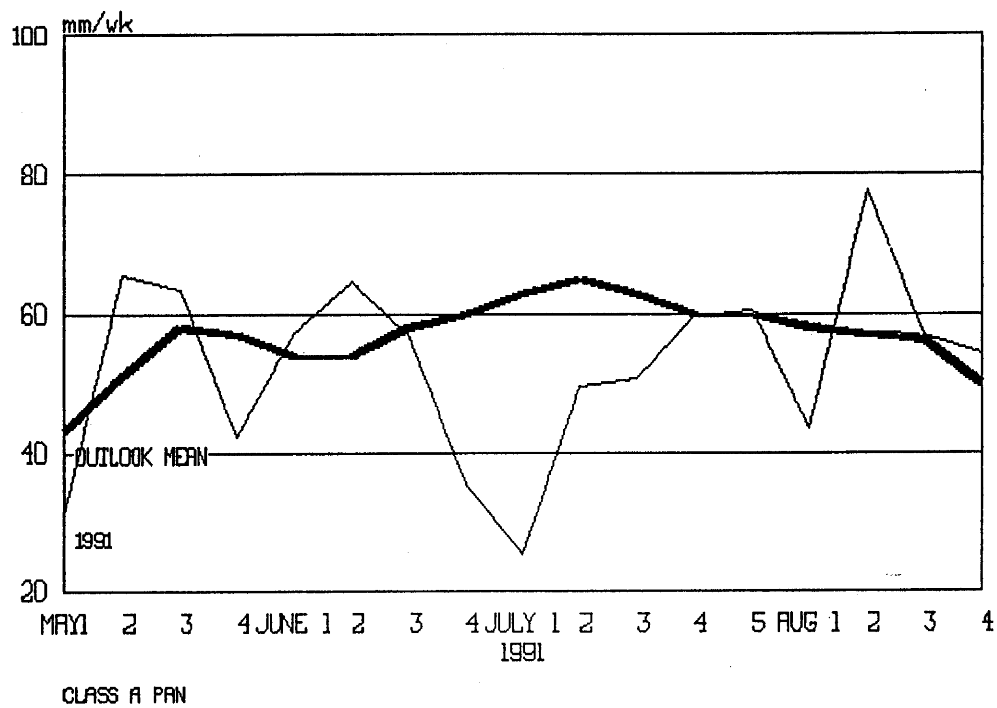


1991 Irrigation Data (mm) (application records at SIDC for various plots)

CROP	PLOT	MAY	JUNE	JULY	AUGUST	SEPTEMBER	Total through Growing Season	Fall Irrigation	Total Irrigation
Winter Wheat	1	25	22.0	0.0	0.0	0.0	47.0	21.0	68.0
Sunola	1	0.0	21.0	42.0	85.0	0.0	148.0	21.0	169.0
Sunflowers	1	0.0	22.0	42.0	85.0	0.0	149.0	21.0	170.0
Corn	1	0.0	22.0	42.0	85.0	0.0	149.0	21.0	170.0
Barley(Duke)	1	0.0	22.0	43.0	0.0	0.0	65.0	85.0	150.0
Alfalfa	2B	0.0	0.0	One Flood	One Flood	0.0	150.0	50.0	200.0
Wheat(Laura)	2A	0.0	0.0	60.0	0.0	0.0	60.0	70.0	130.0
Triticale	3	0.0	0.0	40.0	0.0	0.0	40.0	70.0	110.0
Alfalfa	4	25	0.0	33.0	92.0	0.0	150.0	50.0	200.0
Barley(Duke)	5	15	20.0	43.0	0.0	0.0	78.0	50.0	128.0
Alfalfa(Esso)	7	0.0	0.0	0.0	54.0	0.0	54.0	75.0	129.0
Double Cropping	7	0.0	0.0	0.0	54.0	0.0	54.0	75.0	129.0
Wheat(Laura)	7	0.0	0.0	0.0	0.0	0.0	0.0	75.0	75.0
Grass Seed	8	0.0	22.0	27.0	45.0	0.0	94.0	0.0	94.0
Durum	8	0.0	20.0	67.0	22.0	0.0	109.0	72.0	181.0
Soft Wheat(Co-op)	8	0.0	16.0	67.0	22.0	0.0	105.0	72.0	177.0
Soft Wheat (Fielder)	8	0.0	20.0	67.0	22.0	0.0	109.0	72.0	181.0
Cereal Diseases	9	0.0	16.0	51.0	17.0	0.0	84.0	72.0	156.0
Semi-Dwarf Barley	9	0.0	31.0	57.0	19.0	0.0	107.0	72.0	179.0
Soft Wheat (Fielder)	9	0.0	42.0	61.0	33.0	0.0	136.0	72.0	208.0
Soft Wheat (Fielder)	10	0.0	42.0	59.0	42.0	0.0	143.0	72.0	215.0
Barley (Duke)	11	0.0	60.0	33.0	0.0	0.0	93.0	297.0	390.0
Nutrient Req'ts	11	0.0	0.0	33.0	26.0	0.0	59.0	0.0	59.0
Late Seeding	11	0.0	0.0	33.0	26.0	0.0	59.0	0.0	59.0
Durum (Sceptre)	12	0.0	0.0	54.0	0.0	0.0	54.0	71.0	125.0
Malt Collaborative	12	0.0	0.0	38.0	0.0	0.0	38.0	29.0	67.0
Pulse block	12	0.0	0.0	37.0	0.0	0.0	37.0	51.0	88.0
Alfalfa/Grass	12	0.0	0.0	54.0	75.0	0.0	129.0	71.0	200.0
Demo Site	NE	0.0	0.0	56.0	19.0	0.0	75.0	85.0	160.0
Demo Site	NW	0.0	22.0	38.0	42.0	0.0	102.0	85.0	187.0
Demo Site	SE	0.0	0.0	66.0	46.0	0.0	112.0	40.0	152.0
Demo Site	SW	0.0	0.0	63.0	42.0	0.0	105.0	40.0	145.0

Cereals

Testing Grain Crop Varieties under Irrigation

Principal: B.L. Harvey, Department of Crop Science
University of Saskatchewan, Saskatoon, Saskatchewan
Funding: Irrigation Based Economic Development Agreement
Progress: Second year of three
Objective: To evaluate current and potential grain crop varieties for irrigated production. Data obtained from replicated yield trials over a number of seasons and locations will provide information to producers to allow them to make informed choices of varieties under irrigation.

In 1991, selected varieties of each of the major grain crops and specialty crops grown in Saskatchewan were evaluated in replicated yield trials at three irrigated locations: Aberdeen, Birsay, and Broderick. Due to a perennial weed problem, the fourth irrigated location at Outlook was abandoned after seeding. In total, sixty-seven varieties and advanced lines were seeded at each site. Seeding and establishment of plots were completed by May 27. Unfortunately, the cereals sustained chemical damage at Aberdeen and Broderick so that data obtained in 1991 was short of our target. In 1992, we plan to use post-emergent weed control only to remedy this situation in the cereals.

Despite difficulties, unbiased data was collected on the performance of a range of crop varieties under irrigation in 1991. In order to provide a reliable data base, yield data needs to be collected on an annual basis. Without the information provided by this project, it would be difficult to serve the agricultural community in making informed choices of crop varieties suited to their needs under irrigated production.

Table 1. SIDC Hard Red Spring Wheat Test 1990-91. Yield as a % of Katepwa.

SPRING	ABERDEEN		BIRSAY			IRRIG.	# OF
WHEAT	90	Ave.	90	91	Ave.	MEAN	LOCATION-YEARS
Katepwa	100	100	100	100	100	100	3
Roblin	79	79	88	108	98	92	3
Laura	90	90	88	94	91	91	3
Pasqua				100	100	100	1
CDC Makwa	92	92	117	98	107	102	3
CDC Teal	92	92	84	108	96	95	3
Kenyon				98	98	98	1
Conway				100	100	100	1
AC Minto				97	97	97	1
BW 140				96	96	96	1
BW 148				96	96	96	1
BW 150				98	98	98	1
BW 630				102	102	102	1
BW 632				100	100	100	1
BW 636				101	101	101	1

Table 2. SIDC Durum Wheat Test, 1990-1991. Yield as a % of Kyle.

DURUM	ABERDEEN 90	ABERDEEN Ave.	BIRSAY 90	BIRSAY 91*	BIRSAY Av.	BRODERICK 90*	BRODERICK Av.	OUTLOOK 90	OUTLOOK Av.	IRRIG. MEAN	# OF LOCATION-YEARS
Kyle	100	100	100	100	100	100		100	100	100	3
Medora	118	118	103	157	103	87		94	94	105	3
Sceptre	130	130	110	160	110	100		101	101	114	3
Arcola	128	128	114	165	114	101				121	2
Plenty	136	126	112	146	112	87		107	107	115	3
DT 618				156							

*Data not included in long-term mean.

Table 3. SIDC Canada Prairie Spring Wheat and Soft White Wheat Test, 1990-1991. Yield as a % of Katepwa.

CPS & SOFT WHITE WHEAT	ABERDEEN 90	ABERDEEN Av.	BIRSAY 90	BIRSAY 91	BIRSAY Av.	IRRIG. MEAN	# OF LOCATION-YEARS
Katepwa	100	100	100	100	100	100	3
Biggar	116	116	104	108	106	109	3
AC Taber				120	120	120	1
Genesis	110	110	119		119	115	2
Oslo	104	104	102		102	103	2
Fielder				98	98	98	1
SWS-52				110	110	110	1
SWS-87				97	97	97	1

Table 4. SIDC 2-row Barley Test, 1991. Yield as a % of Harrington.

2-ROW BARLEY	ABERDEEN 90	ABERDEEN Av.	BIRSAY 90	BIRSAY 91*	BIRSAY Av.	BRODERICK 90*	BRODERICK Av.	IRRIG. MEAN	# OF LOCATION-YEARS
Harrington	100	100	100	100	100	100		100	2
Ellice	109	109	106		106	86		108	2
AC Oxbow	113	113	108	123	108	98		110	2
Manley	115	115	116	132	116	88		115	2
Bridge	123	123	115	117	115	113		119	2
Deuce	114	114	114		114	132		114	2
TR 188				119					
TR 941				122					

*Data not included in long-term mean.

Table 5. SIDC 6-row Barley Test, 1991. Yield as a % of Harrington.

	ABERDEEN		BIRSAY			BRODERICK		IRRIG.	# OF
6-ROW BARLEY	90	Av.	90	91*	Av.	90*	Av.	MEAN	LOCATION-YEARS
Harrington	100	100	100	100	100	100		100	2
Duke	108	108	120	136	120	105		114	2
Samson	109	109	117	131	117	99		113	2
Heartland	104	104	116	127	116	116		110	2
Brier	113	113	122		122	106		118	2
Argyle	96	96	85	120	85	68		90	2
Tankard	115	115	104	145	104	94		110	2
Virden				130					
Winchester				136					
BT 926				126					

*Data not included in long-term mean.

Table 6. SIDC Oat Test, 1990-1991. Yield as a % of Calibre.

6-ROW	ABERDEEN			BIRSAY			BRODERICK			IRRIG.	# OF LOCATION-
BARLEY	90	91	Av.	90	91*	Av.	90*	91	Av.	MEAN	YEARS
Calibre	100	100	100	100	100	100	100	100	100	100	5
Derby	96	94	95	99	102	101	87	86	86	95	5
Waldern	110	121	116	111	145	128	90	93	93	116	5
Jasper	101		101	95		95	115			98	5
Robert	96		96	104		104	95			100	5
OT 257	109	108	109	106	77	90	90	96	96	99	5

*Data not included in long-term mean.

Table 7. SIDC Flax Test, 1990-1991. Yield as a % of Norlin.

	ABERDEEN			BIRSAY		OUTLOOK		IRRIG.	# OF
FLAX	90	91	Av.	90	Av.	90	Av.	MEAN	LOCATION-YEARS
Norlin	100	100	100	100	100	100	100	100	4
McGregor	96	84	88	101	101	104	104	95	4
Somme	106	80	91	93	96	98	98	93	4
Flanders	106	95	99	80	80	109	109	97	4
Andro	92		92	88	88	98	98	93	3

Table 8. Location Summary for SIDC Canola Test, 1991 (Aberdeen). Yield kg/ha.

Variety	MEAN	% of Westar
Westar	1401	100
AC Excel	1592	114
Pivot	1592	114
Topas	2045	146
Global	2446	175
LSD 5%	344	
Standard Error	106	
CV%	10.1	

Table 9. SIDC Field Pea Test, 1990-1991. Yield as a % of Express.

	ABERDEEN			BIRSAY			BRODERICK		IRRIG.	# OF
Field Pea	90	91	Av.	90	91	Av.	91	Av.	MEAN	LOCATION-YEARS
Express	100	100	100	100	100	100	100	100	100	5
Titan	68	79	74	38	96	67	94	94	75	5
Radley	78	96	85	51	52	52	57	57	66	5
Bellevue	53	59	56	58	76	67	107	107	71	5
Tara		78	78		74	74	109	109	87	3
Century		66	66		92	92	74	74	78	3

Table 10. SIDC Fababean Test, 1990-1991. Yield as a % of Outlook.

	ABERDEEN		BIRSAY			BRODERICK		IRRIG.	# OF
Fababean	90	Av.	90	91	Av.	91	Av.	MEAN	LOCATION-YEARS
Outlook	100	100	100	100	100	100	100	100	4
Aladin	92	92	99	94	97	106	106	98	4
Pegasus	102	102	97	128	112	111	111	110	4
Encore			89		89			89	1

Soft White Spring Wheat Co-operative Trial

Principal: R.J. Baker, Dept. of Crop Science & Plant Ecology
University of Saskatchewan
Saskatoon, Saskatchewan

Twenty-five soft white spring wheat cultivars, including one from the University of Saskatchewan, were evaluated in a four-replicate test at the Saskatchewan Irrigation Development Centre at Outlook. This test formed part of the official testing program of Soft White Spring wheats in Western Canada. The test was also grown under irrigation at Saskatoon and at four locations in Alberta.

A further 25 advanced lines from the University of Saskatchewan Soft White Spring wheat breeding program were also tested in a four-replicate test at SIDC. This test was also grown under dryland and irrigation at Saskatoon. Results from this test will be used to identify improved lines for further testing in the Co-operative Trial.

Barley Development and Evaluation for Irrigation in Saskatchewan

Principal: B. G. Rossnagel, Crop Development Centre
University of Saskatchewan, Saskatoon, Saskatchewan
Funding: Irrigation Based Economic Development Agreement
Co-investigator: B.L. Harvey, Dept. of Crop Science and Plant Ecology
Co-operators: Saskatchewan Irrigation Development Centre
L. Hamoline, Aberdeen, Saskatchewan
Progress: Second year of three
Locations: Saskatoon, Aberdeen and Outlook
Objective: To continue efforts to develop superior six-row and two-row feed and malting barley cultivars for irrigated conditions in Saskatchewan and to evaluate currently available barley varieties under irrigation.

During the second year of this project, 475 advanced Crop Development Centre barley breeding lines and selections, as well as introductions from the United States, Scandanavia and Europe, were evaluated under irrigation at one to three locations. Test locations included Saskatoon, Aberdeen and Outlook. Materials under test included both two-row and six-row feed and malting types, with varying maturities, disease resistance attributes and market end-use quality features.

Superior straw strength achieved via the introgression of semi-dwarf genes is a major criterion in selection of materials for testing and their retention for further evaluation. In addition to evaluation for yield potential, straw strength and maturity, genotypes are tested for superiority in physical and chemical grain quality traits including plumpness, test weight, kernel weight, protein, viscosity and beta-glucan (hulless types) and alpha-amylase and saccharifying activity (malting types) and for resistance to various diseases, in particular net blotch and scald.

Based on 1991 data, several lines appear to have promising combinations of straw strength, yield potential and maturity. These will be tested again in 1992/93. Of most interest was the performance of several two-row genotypes which yielded at levels similar to that of the check cultivar Harrington but did not lodge and in some cases were several days earlier to maturity and have superior disease resistance.

In addition to these breeding and development activities, the project evaluated all currently registered barley varieties suggested for production in Saskatchewan at the three irrigated sites. The results were provided to the barley coordinator of the Saskatchewan Advisory Council on Crops, Grain

Crops Sub-committee. That information is then added to the data base of information regarding barley variety performance under irrigation in Saskatchewan, which is, in turn, utilized to develop the Barley Irrigation Section within the annual "Varieties of Grain Crops for Saskatchewan" publication.

This project will assist in the development of more consistently productive and marketable barley varieties for production under irrigation. The eventual results of these efforts will provide more variety choices to irrigation area producers including two-row and six-row, hulled and hulless, feed, malting and specialty food market types.

Screening for Phytopath Resistance in Cereal and Pulse Crops in Saskatchewan

Principal:	B. G. Rossnagel, Crop Development Centre University of Saskatchewan, Saskatoon, Saskatchewan
Funding:	Irrigation Based Economic Development Agreement
Co-investigator:	A.E. Slinkard, P.J. Hucl and D.B. Fowler, Crop Development Centre B.L. Harvey, R.J. Baker, G.R. Hughes and D.R. Knott, Dept. of Crop Science and Plant Ecology
Progress:	Second year of three
Location:	Saskatoon
Objective:	To operate intensive irrigated disease resistance selection nurseries at the Crop Development Centre, Saskatoon, screening for genetic disease resistance in barley, wheat and lentil varieties for Saskatchewan.

The Crop Development Centre irrigated disease resistance selection nurseries completed another successful year of operation. Intensive screening and selection for genetic disease resistance to seven different diseases in wheat (five classes), barley (six classes) and lentil was carried out. The use of irrigation is imperative to the success of establishing and maintaining disease infection in the breeding nurseries at Saskatoon. Once this is achieved, using a computer controlled high frequency low intensity irrigation system, the normally disease-free environment at Saskatoon becomes an ideal site at which to screen en-mass in the field for resistance to the diseases in question.

Some 40,000 early generation individuals and 9,983 advanced two-row and six-row, feed and malting, hulled and hulless barley lines were tested/screened for improved tolerance to the spot-form of net blotch (*Phrenophora teres* f. sp. *maculata*) and to stem rust (*Puccinia graminus* f.sp. *tritici*). More than 13,000 individual Hard Red, Soft White and Canada Prairie Spring and Durum wheat genotypes were evaluated for resistance to stem and leaf rust (*P. graminus* and *P. recondita*) as were 1750 Winter Wheat breeding lines. Over 680 wheat lines were tested for better tolerance to various races of *Septoria sp.* and some 2600 wheat genotypes were scored for resistance to Black Point, Bunt and Loose Smut. Finally, in excess of 500 lentil selections were evaluated for tolerance to Ascochyta leaf blight.

Based on the results of these screening trials, susceptible genotypes are discarded and tolerant/resistant lines are advanced to the next stage of the breeding and selection process, where they will normally be retested for disease reaction to verify previous tests. Verification normally requires three years of data.

The overall value of this critical activity is in the assistance it provides in the overall selection of improved cereal and pulse crop cultivars for Saskatchewan producers. Disease resistance selection activities are especially critical to irrigators since crop disease losses are consistently more important under high moisture conditions.

Diseases of Irrigated Wheat to Evaluate Fungicide Sprays for Foliar Disease Control

Principal:	L.J. Duczek, Agriculture Canada Research Station Saskatoon, Saskatchewan
Funding:	Irrigation Based Economic Development Agreement
Co-investigators:	L. Tollefson, H. Harding
Location:	Saskatchewan Irrigation Development Centre
Progress:	Second year of three
Objective:	To evaluate the efficacy of registered fungicides and to evaluate the effect of timing on application of fungicides.

Foliar disease levels in Katepwa and Fielder wheat were significantly reduced in small plot field trials at Outlook in 1991 by applications of Tilt, Dithane and Polyram fungicides. Symptoms on penultimate leaves were reduced from 9% to as low as 2%. One application spray of Tilt was just as effective as two applications. Yield was significantly increased by all the fungicide applications with an average increase of 9% over the unsprayed plots. In a study on timing of application, disease levels were reduced by a single application of Tilt between booting to the emergence of inflorescence growth stages. Yield increases were in the order of 12% at these growth stages. Septoria leaf spot caused about 90% of the leaf spots with *Septoria nodorum* being the dominant pathogen while *S. avenae* f.sp. *triticea* being less common. Tan spot caused by *Pyrenophora tritici-repentis* caused about 10% of the foliar diseases.

Evaluation of High-Yielding, Disease Resistant Durum Wheat Breeding Lines for Irrigated Production in Saskatchewan

Principal:	J.M. Clarke
Funding:	Irrigation Based Economic Development Agreement
Co-investigators:	M. Fernadez, B. Irvine, G. McLeod, R. DePauw, R. Knox
Location:	Swift Current and Outlook
Progress:	Year two of three
Objective:	To determine agronomic and disease resistance and the agronomic traits required for successful production of durum wheat under irrigation in Saskatchewan.

Three field experiments were conducted in 1991. Two yield trials (one of 155 entries and two replications, and one of 80 entries and one replication) with F_6 and F_8 breeding lines, advanced lines, and registered durum and common wheat check cultivars, were grown under irrigation at Swift Current, and under irrigation at Outlook. A fungicide time of application experiment was conducted under irrigation at Outlook. Overall condition of the experiments was good. Dryland yields were generally much higher than in the 1990 trials, while lodging and incidence of seed-borne diseases such as blackpoint were lower. Incidence of leaf diseases, mainly tan spot, was higher in 1991 than in 1990, and provided a good opportunity for selection of resistant lines. Approximately 60 breeding lines that performed well at all three locations have been selected and are being increased in California during the winter for further testing in 1992.

Crop height was greatest at Outlook (Table 1), as in 1990. Despite the tall plants, there was poor lodging differential. Yields under irrigation of some of the conventional height cultivars, such as Arcola and DT367, was higher in 1991 than in 1990, probably partly as a consequence of less lodging in 1991. The durums performed relatively better than the common wheats in all environments in 1991. Westbred 881, widely grown under irrigation in the southwestern U.S., again performed poorly under irrigation compared to the best local cultivars and breeding lines. Susceptibility to leaf diseases was perhaps a contributing factor. Several of the short-strawed conventional-height advanced breeding lines, such as 8667-*D037A and 8667-*216C, showed good yield potential and adequate protein content.

Fungicide treatment increased yield of the 13 lines in the fungicide experiment (data not shown). A repeat of this experiment in 1992 will provide an indication of the average yield loss caused by leaf diseases such as tan spot.

Table 1. Crop height, relative maturity, lodging, grain yield, and grain protein of registered durum cultivars, advanced lines and introductions, and bread wheat checks grown under irrigation at Swift Current (SC) and at Outlook (Ou) in 1991.

Cultivar[2]	Height SC	Height Ou	Maturity SC	Lodging[3]	Yield (kg/ha)[1] SC		Yield (kg/ha)[1] Ou		Protein SC	Protein Ou
	--cm--				--% of Kyle--				-%-	
Kyle	97	133	3.0	3	6007	(6160)	6544	(7210)	12.73	14.30
Arcola	103	124	3.0	3	107	(101)	118	(103)	13.25	15.83
Medora	98	126	2.5	2	100	(100)	99	(99)	13.85	15.28
Plenty	106	134	3.0	1	100	(108)	98	(111)	12.93	14.59
Sceptre	89	119	2.5	2	98	(98)	119	(110)	13.47	14.61
Wakooma	104	128	3.5	4	99	(103)	82	(104)	14.23	14.71
DT 618	109	131	3.0	2	106		121		12.95	15.72
DT 367	96	123	3.5	3	109	(114)	114	(108)	11.55	13.39
DT 369	85	106	3.5	3	99	(115)	107	(115)	13.61	13.96
8663-BP2B	85	107	3.5	1	112		122		12.09	14.99
8667-*D037A	90	120	2.0	1	105		112		14.55	15.06
8667-*D216C	90	117	2.5	1	106		117		13.46	16.23
8678-*I023C	94	109	4.0	3	93	(123)	86	(99)	12.55	14.27
8678-*I048A	82	104	3.0	2	105	(120)	107	(116)	12.01	13.85
8678-AR1A	86	110	4.0	3	101		97		13.41	14.54
Westbred 881	80	104	2.5	2	94	(88)	87	(100)	14.22	14.56
Biggar	85	93	5.0	3	96	(110)	74	(105)	11.70	11.05
Genesis	105	116	5.0	3	102	(125)	77	(81)	11.40	12.01
Katepwa	101	117	3.0	3	75	(91)	85	(81)	14.24	15.92
Laura	92	117	3.0	2	79	(89)	79	(88)	15.21	15.64
Fielder	89	112	4.5	3	81	(109)	88	(93)	10.19	10.69

1 Yield - 1990 yields in brackets.
2 Semidwarf lines: DT369, 8663-BP2B, 8678-*I023C, 8678-*I048A, 8678-AR1A, Westbred 881, Bigger, Fielder
3 Lodging: 1 = upright 9 = flat

Maximum Economic Yield

Principal: Outlook Irrigation Production Club
Funding: Irrigation Based Economic Development Agreement
Progress: Final year
Objectives:

a) to demonstrate the use and value of detailed field monitoring of irrigated crops;
b) to compare High Input Crop Management techniques to standard agronomic practices in an attempt to reach maximum economic yields;
c) to monitor crop growth and development to better understand crop growth stages and to improve the timing of application of agronomic inputs;
d) to improve the participants' knowledge of the effects of disease, lodging, irrigation scheduling, and agronomic practices on crop returns under irrigation.

A written report representing the data collected from the nine cereal fields in the fourth and final year of the project was presented to the nine club members in January, 1992.

Field trials in 1991 included six fertilizer trials, two growth regulator trials, three fungicide trials and one tiller study. Tensiometers were installed in all fields and moisture status, growth stage, disease incidence, lodging pressure, and field conditions were monitored and recorded weekly. Harvest data was collected using weigh wagons, square meter samples or weighed truck loads.

The fertilizer trial received an additional 50 kg N/ha, 22 kg P_2O_5/ha and 56 kg K_2O/ha beyond the soil lab high recommendations. The extra fertilizer did not result in significant yield increases in 1991 nor in any other year of the project.

The application of a growth regulator was highly effective in preventing lodging in one trial where the field was moderately lodged. There was a net increase of 739 kg/ha. There was no difference in measured yield in the other trial where there was no lodging pressure.

The application of a fungicide was very economical in one of the three fungicide trials. This was a field of Biggar wheat that was severely infested with leaf diseases late in the growing season (August 1). The fungicide trial averaged 5309 kg/ha compared to a field average of 4032 kg/ha. There was a 269 kg/ha decrease in one fungicide trial on Durum wheat and no difference in the other fungicide trial of Laura wheat. The Durum field had low to moderate levels of disease but was badly affected by common root rot and the Laura field had only a trace of leaf diseases.

The field person and the project supervisor are currently summarizing the data collected and published in the four yearly written reports. The summary will highlight the management techniques, crop varieties and inputs that led to higher and conversely, lower yields over the four years of the project. This written report will be available March 15, 1992.

Irrigated Soft Wheat Production Package

Principal:	D. Duncan, Saskatchewan Irrigation Development Centre
Funding:	Irrigation Based Economic Development Agreement
Co-operators:	SIDC, Wayne Jones
Location:	Outlook (NW 26-29-8-W3), Birsay (SE 4-27-7-W3)
Progress:	Year three of four
Objective:	To develop a production package for irrigated soft wheat that will consistently produce economically high yields with acceptable seed quality.

Results from the first two years of the package indicated the levels of nitrogen in excess of 112 kg/ha were not necessary to produce high yields. In fact, at Outlook in 1990, nitrogen levels greater than 112 kg/ha significantly reduced yield due to an increase in lodging rate and severity of the soft wheat accompanied by a reduction in seed weight. Hence, in order to comply with the objectives of the soft wheat production package, the nitrogen rate variable was removed from the project and replaced with an equal number of seeding rate treatments (250, 350, and 450 seeds/m^2). The intent of the change was to focus on a production system that would reduce the lodging potential of irrigated soft wheat. The row spacing (8 and 16 cm) and fungicide application (zero and recommended rate) treatments remained the same as in previous years of the project.

Lodging was not prevalent at either location in 1991. Thus, there are no conclusions that can be drawn about the effect of seeding rate and/or row spacing on this variable. However, it is worth noting that reducing the seed rate of soft wheat to 250 seeds/m^2 did not have a negative impact on yield even under lodge-free conditions.

In all three years of the soft wheat production package there has been a positive yield response of Fielder to fungicide application. Disease infections were severe in 1991. On average, the plots not treated with a fungicide had 67-73% of the flag leaf area infected with disease. Leaf rust made up approximately 43-46% of the untreated flag leaf area. Tan spot and septoria accounted for the remainder of the infected area with traces of spot blotch also being present. As a contrast, on average only 10-18% of the flag leaf area was infected with disease on the plots treated with the fungicide Tilt. Leaf rust represented approximately 4-8% of the treated flag leaf area. Yield was increased by 572 kg/ha with a single application of Tilt at Outlook and 914 kg/ha with a dual application of Tilt at Birsay (Table 1). The yield increase was related to an increase in seed weight resulting from the fungicide application(s). The seed weight of the soft wheat kernels increased by 2.4 and 5.3 g/1000 seeds at Outlook and Birsay, respectively.

Table 1. Effect of fungicide on yield, seed weight, kernel numbers, and seed protein of Fielder soft white spring wheat grown at Outlook and Birsay in 1991.

Fungicide	OUTLOOK				BIRSAY			
	Yield (kg/ha)	Seed Weight (g/1000)	Kernels (#/head)	Protein (%)	Yield (kg/ha)	Seed Weight (g/1000)	Kernels (#/head)	Protein (%)
Tilt	3253	30.5	39	12.0	3738	32.0	43	11.5
No Tilt	2681	28.1	34	12.3	2824	26.7	38	11.5

Irrigated Durum Production Package

Principal: D. Duncan, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Co-operators: SIDC, Wayne Jones
Location: Outlook (NW 26-29-8-W3), Birsay (SE 4-27-7-W3)
Progress: Year three of four
Objective: To develop a production package for irrigated durum that will consistently produce economically high yields with acceptable seed quality.

The irrigated durum production package was designed to demonstrate the effect of various combinations of nitrogen rate, seeding rate, and row spacing on the yield of Sceptre durum. Three seeding rates of 215, 320, and 430 seeds/m^2 and four row spacing including solid seeded, 8 cm, 16 cm, and 20 cm were tested under two nitrogen application rates of 112 kg/ha and 150 kg/ha. A single treatment combination consisting of solid seeded rows and 320 seeds/m^2 was tested under an additional two nitrogen rates of 45 kg/ha and 80 kg/ha. The purpose was to ensure that adequate ranges of nitrogen were being used in the production package demonstration.

For the third consecutive year, nitrogen rates in excess of 112 kg/ha did not affect yield (Table 1). In fact, at the Outlook site, yield was significantly reduced by applying the highest level of nitrogen to the durum plots. As the nitrogen rate increased, the rate and severity of lodging also increased. As the level of lodging increased, the seed weight of the durum decreased and the number of kernels produced per head declined. Consequently yield was reduced. Even in a situation where lodging was minimal (Birsay site, 1991), nitrogen applications exceeding 112 kg/ha did not have an effect on yield.

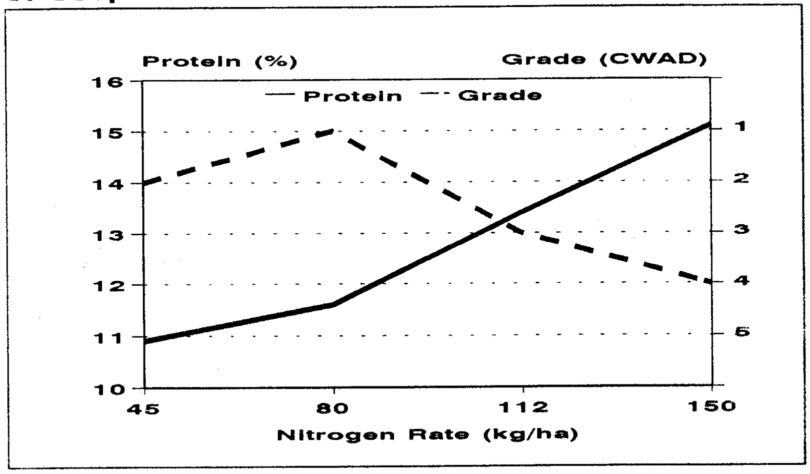
Table 1. Effect of nitrogen rate on lodging, yield, and seed weight of Sceptre durum solid seeded at a rate of 320 seeds/m^2 (Outlook, 1991).

Nitrogen Rate (kg/ha)	Lodging Rate† (%)	Lodging Severity‡ (1-9)	Yield (kg/ha)	Seed Weight (g/1000)
45	0	-	4027	40.0
80	2	2	4076	38.9
112	64	6	3416	36.1
150	79	8	2851	32.4

†Lodging rate refers to the percentage of plot area exhibiting lodging.
‡Lodging severity is the degree of lodging where 1 = least severe and 9 = most severe.
NOTE: Initial soil nitrate-nitrogen levels were 78 kg/ha.

As nitrogen rate increased the protein content of the Sceptre durum increased resulting in a difference of 4.2% between the high and low nitrogen rates. However, nitrogen rates in excess of 80 kg/ha substantially reduced the grade of the durum (Figure 1). In economic terms, the drop in grade would reduce the producer's gross return by a minimum of $7/tonne (based on the 1991-92 initial grain prices) in conjunction with higher fertilizer costs ranging from $17 to $37/tonne for the additional nitrogen.

Figure 1: Effect of nitrogen on protein and grade of Sceptre durum solid seeded at 320 seeds/m².



Over the last two years of the production package, high seeding rates have consistently reduced irrigated durum yield because the increase in seeding rate contributed to an increased lodging rate. It appears that seeding rates greater than 215 seeds/m^2 (91-101 kg/ha) are not necessary for irrigated durum production. The effect of row spacing on durum yield or the interaction between row spacing and seeding rate is currently not conclusive.

Relative Yields of Cereal Cultivars

Principal: B. Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Progress: Year three of an ongoing project
Objectives: To determine the yields of all major classes of cereal grains when grown under the same "non-yield limiting" conditions.

The plots at all sites were seeded at 300 seed/m^2 in rows 20 cm apart. The entire plot was harvested and subsamples taken to determine moisture and dockage. All tests were irrigated using center pivot or linear move irrigation systems. Soil moisture was monitored using tensiometers so that soil moisture did not drop below 50% of the field capacity of the soil. Seeding dates and nutrient levels are shown in Table 1.

Table 1. Seeding dates and nutrient levels for cereal variety test 1991.

		Soil test nutrient (kg/ha)				Fertilizer (kg/ha)	
Test	Seeding date	N	P	K	S	N	P_2O_5
E1989	May 12, 1989	40	22	320	105+	122	44
L1989	May 28, 1989	40	22	320	105+	122	44
E1990	May 4, 1990	45	22	300	80	132	55
L1990	May 28, 1990	45	22	300	80	132	55
B1990	May 23, 1990	20	27	717	102+	122	55
L1991	May 26, 1991	49	26	407	106+	100	55
B1991	May 28, 1991	25	22	506	102+	122	55

E1989=Early 1989 Outlook, L1989=Late 1989 Outlook,
E1990=Early 1990 Outlook, L1990=Late 1990 Outlook,
B1990=Birsay
L1991=Late Outlook 1991 B1991=Birsay 1991

Grain yields are reported at 14% moisture. Grade, protein and seed size were determined on a cleaned composite sample. Yields of all grains are expressed as (%HRS). The HRS check yield is the mean yield of the cultivars Katepwa and Roblin.

In 1991, barley yields were much lower relative to wheat than they have been in previous years. Over the three test years (seven site years), the most commonly grown barley cultivar, Harrington, has yielded about the same as the mean of the hard red spring wheat checks (Table 2). The semi-dwarf barley cultivar Duke outyielded Harrington by 25% presumably due to superior lodging tolerance.

Roblin performed very well at the Outlook site in 1991 but over the test period was similar to other cultivars (Table 2). The hard red spring wheat cultivar, Laura, continues to yield poorly under center pivot irrigation due mainly to lodging. Under conditions where lodging is minimal this variety has the potential to outyield other hard red spring cultivars.

Table 2. Yield of cereal varieties of sites and years.

Cultivar	E1989 %HRS	L1989 %HRS	E1990 %HRS	L1990 %HRS	B1990 %HRS	L1991 %HRS	B1991 %HRS	Mean %HRS
DUKE	110	139	138	130	140	104	112	125
HARRINGTON	88	113	113	93	102	91	91	99
MANLEY	91	114	123	101	104	94	98	104
TR930	108	113	132	108	117	94	111	112
GENESIS	99	100	105	100	108	71	92	96
BIGGAR	122	113	121	111	126	91	102	112
AC TABER						99	118	109
ARCOLA	103	103	99	92	94	84	105	97
DT369			111	104	114			110
PLENTY						93	103	98
MEDORA	102	96	102	88	99	100	129	102
SCEPTRE	114	101	111	96	103	108	125	108
BW606			106	94	96	95	102	99
KATEPWA	100	98	104	104	99	88	100	99
LAURA	95	82	85	72	76	83	94	84
ROBLIN	100	102	96	96	101	112	100	101
FIELDER	115	112	113	102	113	91	90	92
SWS-52			90	93	98	82	96	92
BARLEY	5403	5176	6489	4935	5287	3575	4213	5011
CPS	6011	4578	5709	4817	5332	3195	3985	4804
DURUM	5800	4349	5371	4344	4681	3583	4739	4695
HRS	5351	4071	4938	4177	4250	3503	4045	4334
SWS	6234	4868	5115	4475	4822	3252	3800	4652
CV	7.2	9.6	7.8	10.9	9.4	10.5	6.7	
LSD	582	566	610	702	648	164	404	

Biggar (HY368) produced greater yields than Genesis (HY355) in all tests presumably due to its superior lodging resistance (Table 2). The cultivar AC Taber (HY380) was tested for the first time in 1991 and was superior to Biggar (HY368).

The soft white spring wheat SWS-52 did not yield well in 1991 or in 1990 despite improved resistance to lodging (Table 2). This cultivar is late and cannot be recommended for our growing area (Table 2).

The durum wheat, Plenty, did not yield well in 1991. It will be included in the 1992 test to develop a more complete information package (Table 2). During the test period, Sceptre has been the highest yielding and least lodging prone of registered durum cultivars. Breeding efforts to produce a semi-dwarf durum with good disease resistance and grain quality are being supported by the IBED agreement.

The protein contents of barley and soft wheat were too high in 1991 due in part to lower yields. There are not clear trends for grade and protein as related to variety but where differences occurred in durum, Sceptre had slightly lower protein levels (Table 3).

Table 3. Grade and protein of cereal cultivars 1991.

Cultivar	E1990		L1990		B1990†		L1991		B1991†	
	Grade	Prot	Grade	Prot	Grade	Prot	Grade	Prot	Grade	Prot
DUKE	1	13.4	1	14.2	1	14.3	1	15.7	1	14.4
HARRINGTON	1	14.3	1	14.3	1	13.0	1	16.3	1	15.2
MANLEY	1	14.4	1	14.9	1	13.6	1	17.0	1	14.8
TR930	1	13.4	1	12.1	1	13.9	1	15.4	1	14.1
GENESIS	1	12.2	F	12.4	--	--	2	13.9	1	12.8
BIGGAR	1	11.9	2	11.4	1	11.1	2	12.8	2	13.2
AC TABER							F	13.1	1	12.5
ARCOLA	3	13.9	4	13.8	1	13.5	2	15.7	1	14.9
DT369	3	13.4	3	12.5	5	11.5				
MEDORA	2	13.6	3	12.6	2	12.9	4	15.3	2	14.4
PLENTY							3	15.0	2	14.8
SCEPTRE	2	13.4	3	13.8	1	11.1	3	14.6	2	13.9
BW606	2	14.5	3	14.9	2	12.9	3	15.6	F	15.4
KATEPWA	2	14.6	F	14.2	2	12.3	2	15.6	2	15.4
LAURA	2	14.4	F	14.6	3	14.2	2	15.7	1	14.8
ROBLIN	2	14.6	2	14.9	2	14.2	2	15.8	--	15.7
FIELDER	1	11.3	F	11.8	2	9.8	2	12.3	2	12.0
SWS-52	2	11.3	F	10.5	1	11.1	F	13.0	1	13.1

†Barley on 0% moisture basis. F = Feed

Cereal Recropping on Oilseed and Pulse Crop Stubble

Principal: B. Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Progress: Final year
Objective: To determine the yields of durum, soft wheat and malt barley grown on areas which had previously grown canola, pea, fababean, flax, peaola, N fertilized peaola and Canada Prairie Spring wheat.

Soil moisture was monitored and irrigation applied with a center pivot system to ensure available soil moisture was not depleted to less than 50% of field capacity.

Sceptre and Fielder wheat and Harrington barley were planted at right angles to the previous crop in a split block design. The seeding rate was 110 kg/ha for the wheats and 90 kg/ha for barley in 1988 and 300 seeds/m^2 for all crops in subsequent years. Details of plot size, seeding date and weed control are given in Table 1. In all years, grain samples were taken from the center of the plot and the outside portion of the plot was discarded to reduce edge effects.

Table 1. Seeding date, weed control products and plot size.

Year	Seeding date	Weed control: Product	rate L/ha	Area m^2: Planted	Harvested
1988	May 6	Hoegrass II	3.5	8.9	4.2
		2,4-D	1.25		
1989	May 4	Buctril M	1.0	8.3	4.4
		Estaprop	1.75		
1990	May 5	Hoegrass II	3.5	11.4	3.1
1991	May 10	Stampede CM	1.6	11.4	5.5

Fertilizer levels added are given below:

Year	Ammonium nitrate kg/ha of N				Monoammonium phosphate kg/ha N	kg/ha P_2O_5
1988	40	70	110	140	8	35
1989		60	100	140	11	50
1990	0	40	80	120	12	57
1991	0	40	80	120	12	57

Nitrogen levels (kg/ha to 60 cm) are given in Fig. 1. Sodium bicarbonate extractable phosphorous levels from 1988 thru 1991 were 16, 12, 30, and 26 kg/ha, respectively.

Maturity ratings were taken in 1988 and 1989 but were discontinued since there were no biologically significant differences. Although lodging ratings were taken every year, lodging was not a serious problem in this test and rates were erratic.

Yield estimates in 1988 were quite variable due mainly to a soil texture gradient within the field. This resulted in two replicates having a mean yield of 3289 kg/ha with the other two replicates having a yield of 5002 kg/ha.

Absolute yield levels varied greatly between seasons with maximum yields in 1989 and minimum yield levels in 1991. The nitrogen rate x previous crop interaction was significant only in Sceptre in 1991 (Table 2). There was very little response to added nitrogen in any season despite relatively low initial nitrate levels (Fig 2-5). The only situation where there was a significant effect of nitrogen rate was with Sceptre in 1990. Likewise, there was no consistent effect of the previous crop on yield. There was a significant reduction in the yield of Sceptre grown on wheat stubble only in 1990. The lack of response may have been due to high levels of nitrogen applied the previous year and not detected by the nitrate test.

Fig 1 Effect of previous crop on soil nitrate levels as estimated by chemical analysis

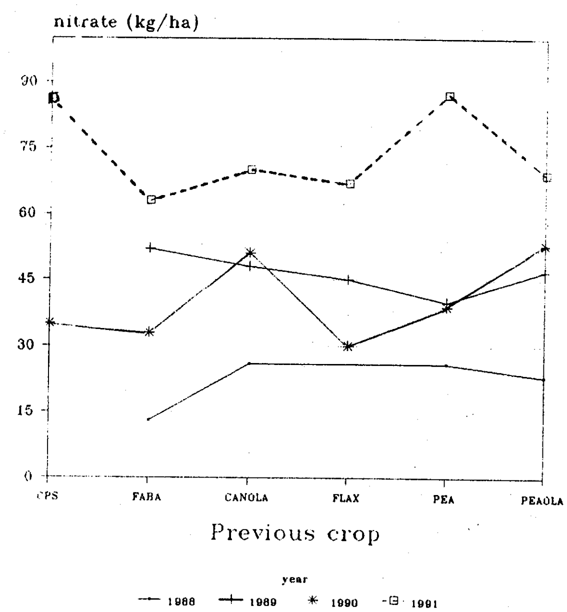


Table 2. Mean squares for yields of Fielder soft wheat, Sceptre durum wheat and Harrington barley 1988 to 1991 grown on stubble of different previous crops at varying nitrogen levels.

MS(1000's)	Fielder				Sceptre				Harrington		
	1988	1989	1990	1991	1988	1989	1990	1991	1989	1990	1991
Precrop	1169*	206	1679*	811	992	828	2717*	377	474	625	143
Rep	998	1103	1307	961	1185	2941	472	1713	1139	3512	262
P*R(error a)	184	398	352	447	698	492	227	226	539	341	66
Nitrogen	1597	1079	433	933	4011	1393	1267*	1068	51	337	576*
N*R(error b)	9749	802	421	541	11759	1963	238	583	896	570	139
N*P	634	88	436	239	259	264	265	262*	350	170	81
error c	390	224	341	229	469	234	238	84	311	233	99

*Significant at 5%

This study indicates that there are no differences between well fertilized oilseed crops and pulse crops in their effects on subsequent cereal grain yields. Since there is only two seasons of data for cereals on cereals the effect of crop rotation (cereal-non cereal) cannot be adequately determined.

There was no detectable effect of previous crop or nitrogen rate on the grade of wheat produced (Table 3). However, this was on a composite sample and therefore not replicated. Grain protein increased with an increase in nitrogen rate with the largest increase coming from the first increment of nitrogen. Grain protein was lowest on wheat stubble with very little difference from production on the stubble of other crops.

Table 3. Effect of previous crop and nitrogen level on grade and protein content of Fielder and Sceptre.

		Fielder				Sceptre			
Previous	Nitrogen	Grade		Protein %		Grade		Protein %	
Crop	kg/ha	1990	1991	1990	1991	1990	1991	1990	1991
Wheat	0	1	2	9.4	9.7	3	2	9.6	11.8
	40	1	2	10.3	10.0	3	2	9.6	11.5
	80	1	3	10.3	11.5	1	2	11.0	13.2
	120	1	2	10.4	11.7	2	2	11.7	14.4
Flax	0	1	2	9.7	10.1	3	3	9.7	12.9
	40	2	2	10.1	10.2	-	2	11.8	12.4
	80	2	2	10.6	9.8	2	2	12.2	12.6
	120	2	2	11.1	11.9	1	2	12.6	14.3
Canola	0	1	2	9.5	10.3	2	2	10.1	12.3
	40	2	2	10.6	10.9	2	2	11.8	12.4
	80	2	2	11.0	11.2	2	2	12.2	13.4
	120	1	2	11.5	11.4	2	2	12.8	14.5
Fababean	0	1	2	9.7	10.4	3	2	9.8	11.7
	40	1	3	10.9	10.6	2	2	12.2	12.5
	80	1	2	11.3	11.1	2	2	12.5	13.2
	120	1	1	10.7	11.8	2	2	13.7	14.2

Fig 2. Effect of nitrogen rate and previous crop on yield of Sceptre 1988

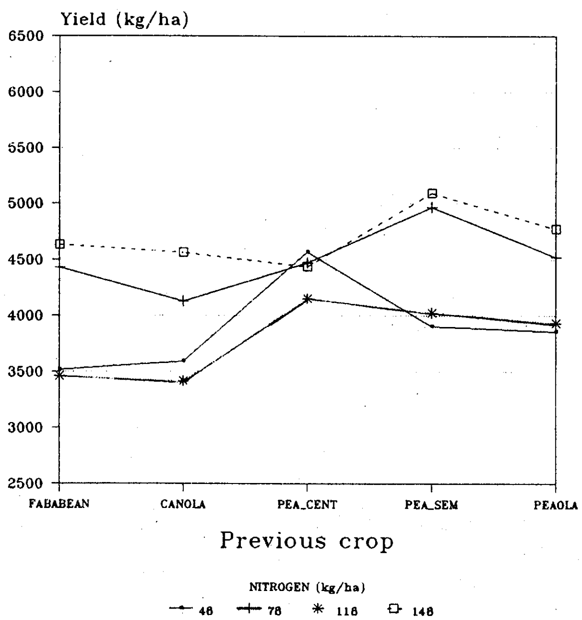


Fig 3. Effect of nitrogen rate and previous crop on yield of Sceptre 1989

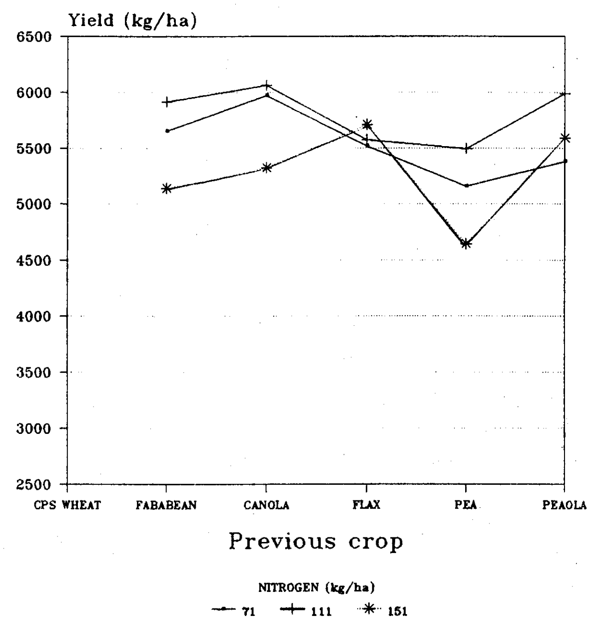


Fig 4. Effect of nitrogen rate and previous crop on yield of Sceptre 1990

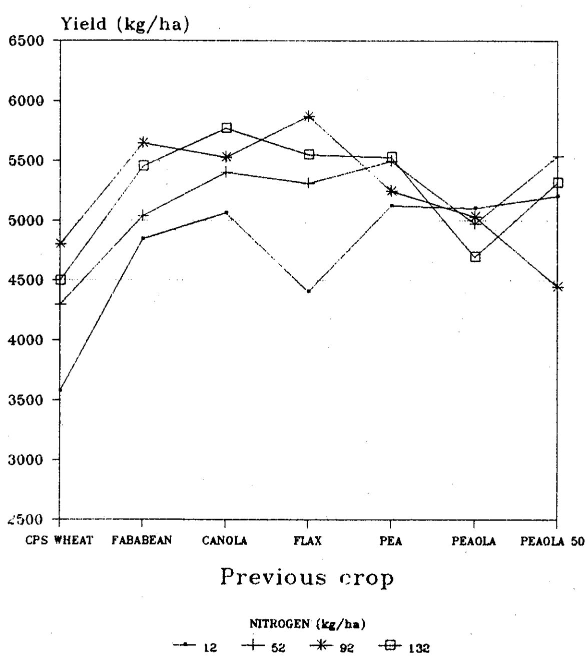
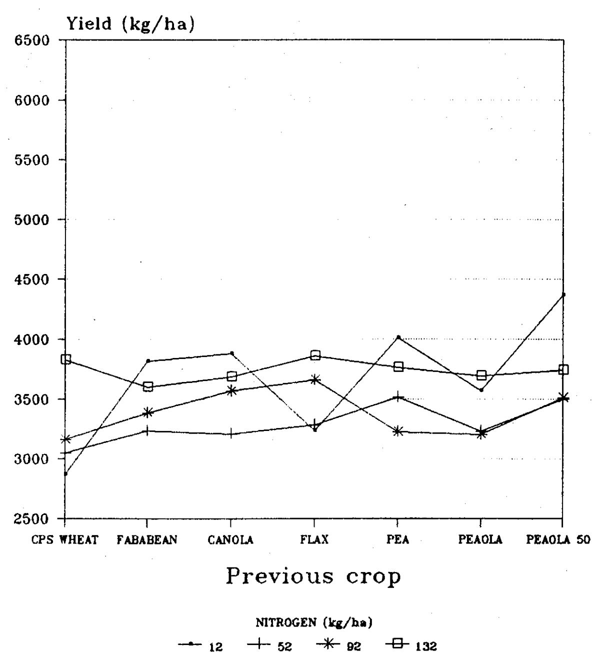


Fig 5. Effect of nitrogen rate and previous crop on yield of Sceptre 1991



Effect of Tillage and Residue Management of Flax, Durum Wheat and Canola on the Subsequent Yields of Wheat and Barley

Principal: B. Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Progress: Year two of three
Objecive: To determine the effect of plowing, discing and spiking combined with removal or retention of crop residues on the yields of subsequently grown wheat and barley crops.

Irrigation using a center pivot irrigation system maintained the top 60 cm of the soil profile at or above 50% of field capacity at all times.

CPS wheat was seeded at 275 seeds/m^2 at right angles to the previously grown durum wheat, canola and flax plots. Phosphorous was sidebanded at 55 kg/ha of P_2O_5. Nitrogen was applied to all plots at 144 kg/ha in 1990 while in 1991 main plots of Biggar wheat were given 45 or 90 kg/ha broadcast at seeding or sidebanded. Other agronomic information is given below:

Soil test (kg/ha)	1990	1991
N	28	50
P	15	24
K	396	290
S	75	106+
Seeding date	May 4	May 10
Herbicide (L/ha):	Hoegrass II(3.5) Estaprop (1.7)	Stampede CM(1.5)
Plot area (m^2)		
Planted	47.2	22.8
Harvested	18.0	18.8

Analysis of variance was performed separately. Nitrogen rate and comparisons between treatments were made using linear contrasts where feasible. Contrasts are not orthogonal but do represent the necessary treatment comparisons.

Single degree of freedom comparisons indicated that removal or retention of durum crop residue did not affect grain yields of wheat (Table 1 and 2). Likewise plowing did not affect yields relative to spiking or discing. There was a small but statistically significant increase in wheat yields on flax and canola residue relative to durum residue in 1990 (Fig 1). In 1991, Biggar wheat on durum stubble yielded about 20% less than on canola or flax stubble at 90 kg/ha nitrogen levels (Fig 2 and 3).

There was a significant interaction between nitrogen application rate and method of applying nitrogen on durum stubble in 1991 (analysis not shown). When 90 kg/ha of nitrogen was applied to wheat grown on durum wheat stubble broadcasting and banding gave similar results. When 45 kg/ha of nitrogen was applied as a band, yields were similar to application of 90 kg/ha either broadcasted or banded. Broadcasting 45 kg/ha of nitrogen resulted in yields which were 14% lower than banding this amount of nitrogen. This may be due to short term immobilization as this reduction was not evident when these treatments were applied on canola residue which has a high nitrogen content. There was very little effect of tillage treatment, previous crop or residue removal on protein or grade.

Table 1. ANOVA for yields and plant numbers in 1990.

		Yield		Plants	
Source	df	MS	Pr>F	MS	Pr>F
Rep	3	516537		2629	
Treatment	12	232691	.018	468	.013
durum vs flax,canola	1	97831	.314	1900	.002
durum plow vs spike disc	1	530363	.023	231	.262
durum remove vs retain	1	123553	.259	135	.389
Error	36	93805		178	

Table 2. ANOVA for Biggar CPS wheat grain yields 1991.

		45 broadcast		45 band		90 broadcast		90 band	
Source	df	MS	Pr>F	MS	Pr>F	MS	Pr>F	MS	Pr>F
Rep	2	827022		1028090		2406850		3631987	
Treatment	12	2362785	.0033	972759	.008	510357	.023	833448	.008
durum vs flax,canola	1	13850881	.0001	8107411	.0001	4467442	.0001	7458547	.0001
durum plow vs spike disc	1	245822	.543	114034	.55	17145	.77		
durum remove vs retain	1	214457	.569	1460	.95	101847	.478		
Error	24	643960		310588		194781		261484	

Figure 1. Effect of nitrogen, tillage, residue and previous crop on Biggar wheat yields 1990 Outlook.

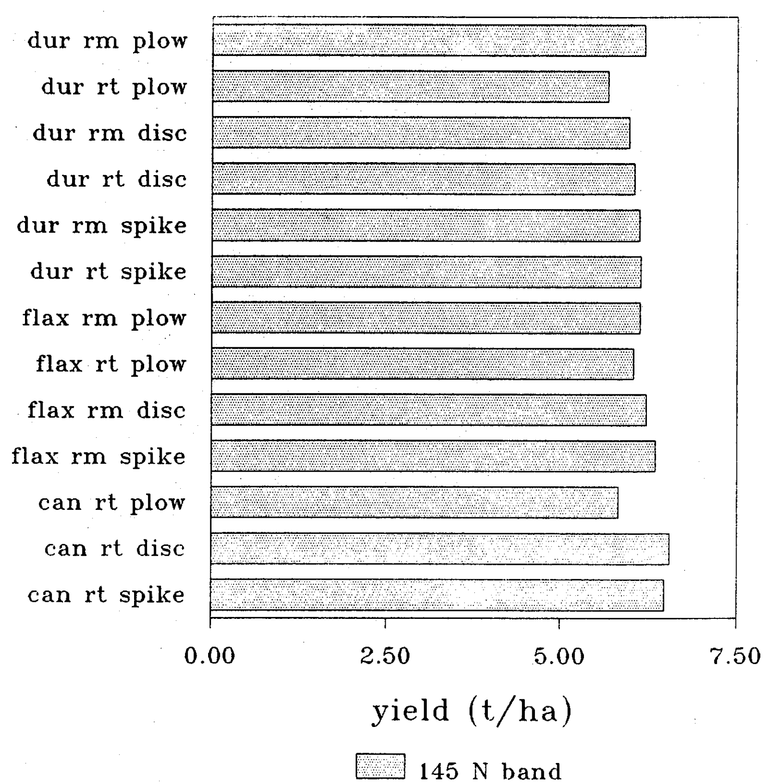


Figure 2. Effect of nitrogen, tillage, residue and previous crop on Biggar wheat yields - 1991 Outlook (45 kg/ha)

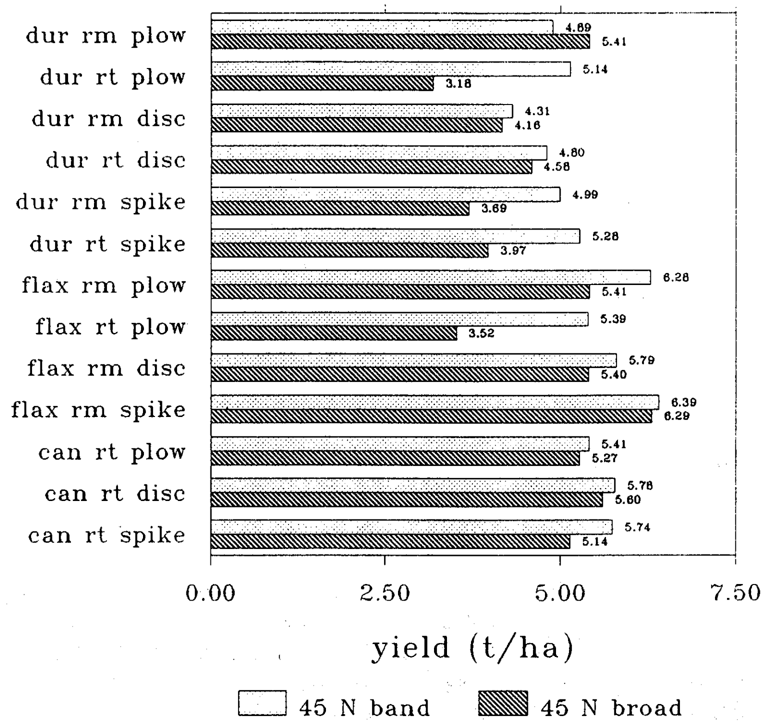
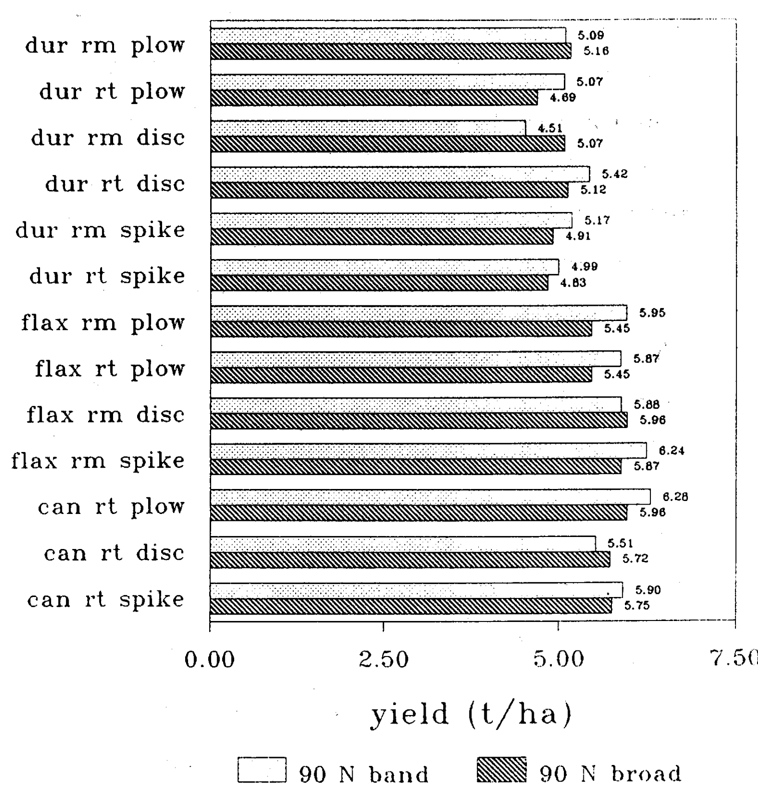


Figure 3. Effect of nitrogen, tillage, residue and previous crop on Biggar wheat yields - 1991 Outlook (90 kg/ha)



Irrigation Scheduling of Sprinkler Irrigated Cereal and Oilseed Crops

Principal: T. Hogg, Saskatchewan Irrigation Development Centre
Location: Saskatchewan Irrigation Development Centre (SW 15-29-8-W3)
Progress: Year one of an ongoing project
Objectives: To determine the effect of delaying the initiation of irrigation on the yield of sprinkler irrigated cereal and oilseed crops.

In 1991, an irrigation scheduling experiment was established to determine the effect of delaying initiation of irrigation on the yield of sprinkler irrigated cereal and oilseed crops. The crops selected were Biggar CPS wheat, Sceptre durum wheat, Topaz canola and McGregor flax. Growth stages selected for irrigation initiation were tillering (Zadoks 21), stem elongation (Zadoks 32) and initial flowering (Zadoks 60).

Above normal precipitation in June delayed the initiation of irrigation until early flowering. Consequently, one treatment was designated as a dryland control and the other two treatments received full irrigation.

Results indicated only a significant increase in grain yield for the irrigated canola over that of the dryland treatment (Table 1). No other significant responses were shown.

This experiment will be continued in subsequent years. Results over several seasons will provide irrigation growers with the appropriate timing of irrigation initiation to obtain maximum economic production of sprinkler irrigated cereal and oilseed crops.

Table 1. Grain yield for the cereal and oilseed crops irrigation scheduling experiment.

	Grain Yield (kg/ha)							
Water Treatment	Biggar CPS Wheat (14.5%)†	CV (%)	Sceptre Durum Wheat (14.5%)	CV (%)	Topaz Canola (10.0%)	CV (%)	McGregor Flax (10.5%)	CV (%)
1	5436	11	5036	10	1534	29	2025	20
2	5181	9	5307	18	1477	25	1875	20
3 (Dry)	5017	21	4724	22	884	28	1732	26
L.S.D. (0.05)	NS‡		NS		255		NS	

†Grain moisture content.
‡Not significant at P = 0.05.

Oilseeds

Irrigated Canola Production Package

Principal:	D. Duncan, Saskatchewan Irrigation Development Centre
Funding:	Irrigation Based Economic Development Agreement
Co-operator:	SIDC, Lorne Jackson
Location:	Outlook (NW-26-29-8-W3), Riverhurst (SE-4-27-7-W3)
Progress:	Year three of four
Objective:	To develop a production package for irrigated canola that will consistently produce economically high yields with acceptable seed quality.

Based on results from previous years, the canola production package demonstration was altered to meet requirements. The first change was the elimination of a fungicide treatment due to the lack of a yield response to either a partial or full rate fungicide application for control of sclerotinia. The second change was related to the lodging problem associated with canola production. Prior information gathered from the demonstration project had indicated a trend towards reduced disease infection and higher yields in situations where lodging was minimized. Hence, three seeding rates were introduced into the canola production package to be combined with the existing row spacing treatments to determine and demonstrate a seeding methodology that would reduce the lodging potential. The final change made to the program was to use the variety Topas. Under irrigated conditions, Global and Topas have appeared to be equivalent in terms of yield and seed quality, but Topas has exhibited greater straw strength. Thus, the revised canola production package compared five row spacing (solid seeded, broadcast and incorporated, 8 cm, 16 cm, and 20 cm) of Topas canola at three different seeding rates (80, 150, and 220 viable seeds/m^2). Solid seeding was achieved by attaching a deflector plate to the underside of the cultivator shovels from an air drill. The broadcast and incorporated treatment was designed to imitate seeding canola with a Valmar applicator mounted on a cultivator. An Amazone narrow row spacing drill with hoe type openers was used to generate the 8 and 16 cm spacing and an air drill, also with hoe type openers, was used to generate the 20 cm spacing.

The results produced from the first year of the altered production package were positive. In general, seeding methods that produced a more uniform spatial distribution of seed resulted in a larger population of canola plants per unit area (Figure 1). The degree and severity of lodging was closely associated with plant density (Figure 2). The more dense the plant population, the greater the lodging severity. As well, sclerotinia disease infection became more prevalent as lodging increased. Although lodging was not severe in 1991, the trends indicated are nevertheless important. It appears that a combination of high seeding rates with a narrow row spacing is not a desired method of seeding canola under irrigated conditions.

The effect of seeding rate and row spacing on yield and seed quality was not significant with one exception. The 20 cm row spacing produced plant populations that were 50-71% lower than the remaining treatments and had a significantly lower yield. The 1991 data clearly shows that even under situations of minimal lodging and disease, seeding canola at rates as low as 80 seeds/m^2 did not affect yield.

Once again, the quality of canola seed produced from the 1991 irrigated plots was much higher than either the district 6 or provincial averages (Table 1). These results are encouraging to the irrigation producer especially if the canola buyer is willing to pay a premium for oil production.

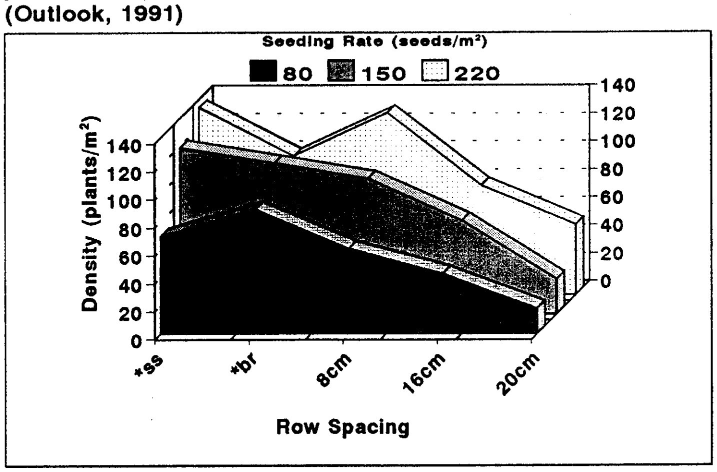
Unfortunately, 1992 will see the removal of Topas as a registered canola variety in Canada. Global will return as part of the canola production package for the final year of the demonstration.

Table 1. Comparison of the oil and protein content of the irrigated canola seed produced at the SIDC demonstration land base versus the local crop district area and provincial averages for 1991.

Location	Meal Protein (%)	Oil (%)
SIDC Demonstration Land Base	44.1	44.0
[1]Crop District #6	39.8	41.6
[1]All of Saskatchewan	38.7	41.7

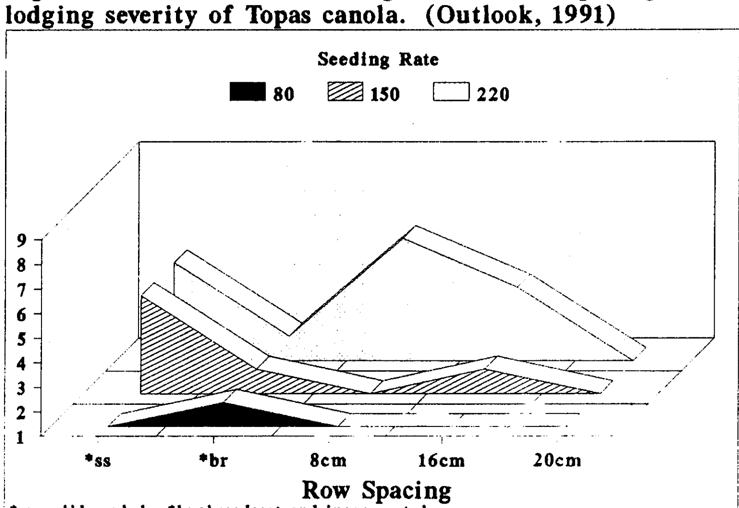
[1]Source: Quality of Western Canadian Canola, 1991. (Grain Research Laboratory, Canadian Grain Commission, Winnipeg)

Figure 1: Interaction of seeding rate and row spacing on the plant density of Topas canola. (Outlook, 1991)



*ss = solid seeded *br = broadcast and incorporated

Figure 2: Interaction of seeding rate and row spacing on the lodging severity of Topas canola. (Outlook, 1991)



*ss=solid seeded *br=broadcast and incorporated

Irrigated Production of Hybrid Canola Seed

Principal:	D.S. Hutcheson, Agriculture Canada Research Station Saskatoon, Saskatchewan
Funding:	Irrigation Based Economic Development Agreement
Progress:	Second year of four
Objective:	To examine both traditional and unconventional hybrid seed production techniques to foster the development of a Saskatchewan based hybrid canola seed production industry.

A three year study of the quantity and quality of hybrid *B. napus* seed production under irrigation has recently been completed. As indicated in Figures 1 and 2, the yield of hybrid seed produced by the novel technique is much higher than that resulting from conventional production under similar conditions. In 1991, a pilot-scale seed production experiment provided yields of hybrid seed in excess of 2700 kg/ha, compared to the 600 to 700 kg/ha obtained by conventional means. The percent hybridity of this seed met the standard for seed of this type (min. 75% hybridity), which would allow it to be labelled and sold as hybrid (Figure 3).

The performance of hybrid *B. napus* produced using this new seed production technique was compared to that of conventional hybrids and OP cultivars in six replicated yield trials grown in 1990 and 1991. Overall, the hybrids produced by the new technique equaled the yield of the conventionally produced pure hybrid and significantly exceeded the yield of all OP cultivars (Figure 4). A *B. napus* hybrid produced using this technique was also entered into official pre-registration trials in 1991.

It appears that new seed production techniques tested under this project are practical and will offer an economical "low tech" alternative to currently available *B. napus* hybrids. If adopted, this technique should allow a very significant reduction in the cost of hybrid seed production and thus the cost of hybrid *B. napus* seed to the commercial producer.

Figure 1:

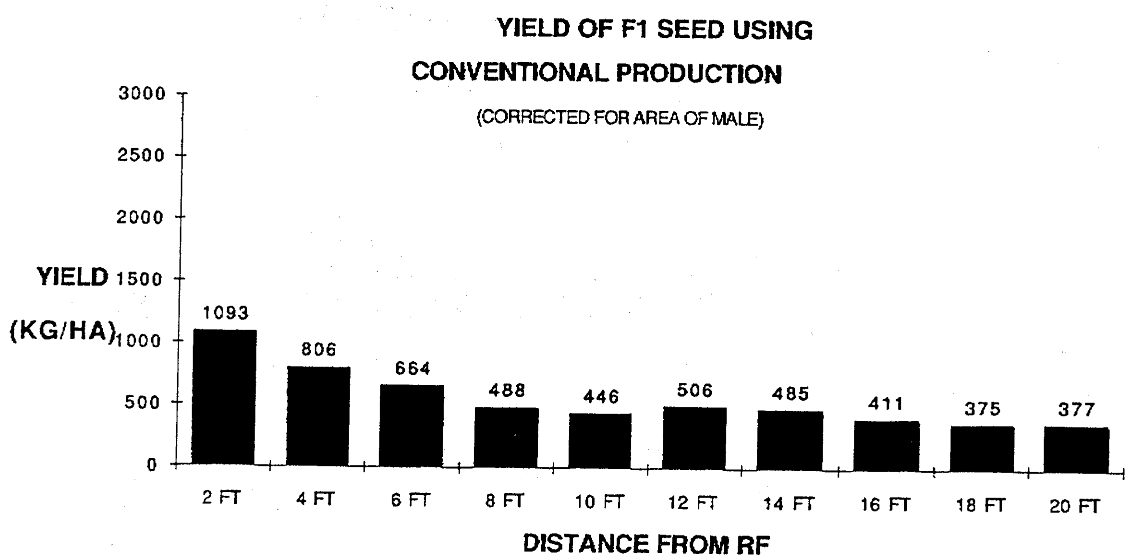


Figure 2:

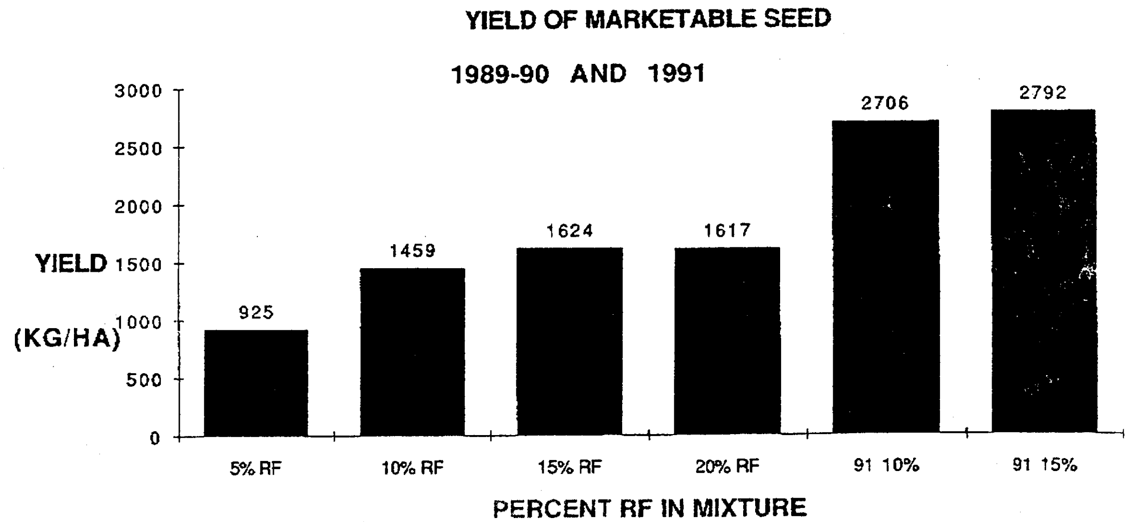


Figure 3:

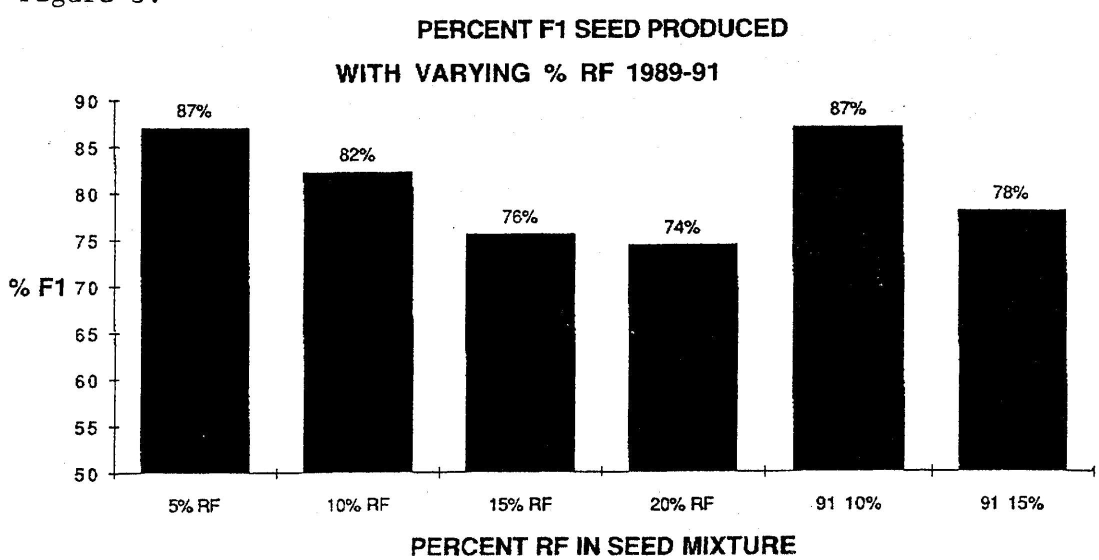
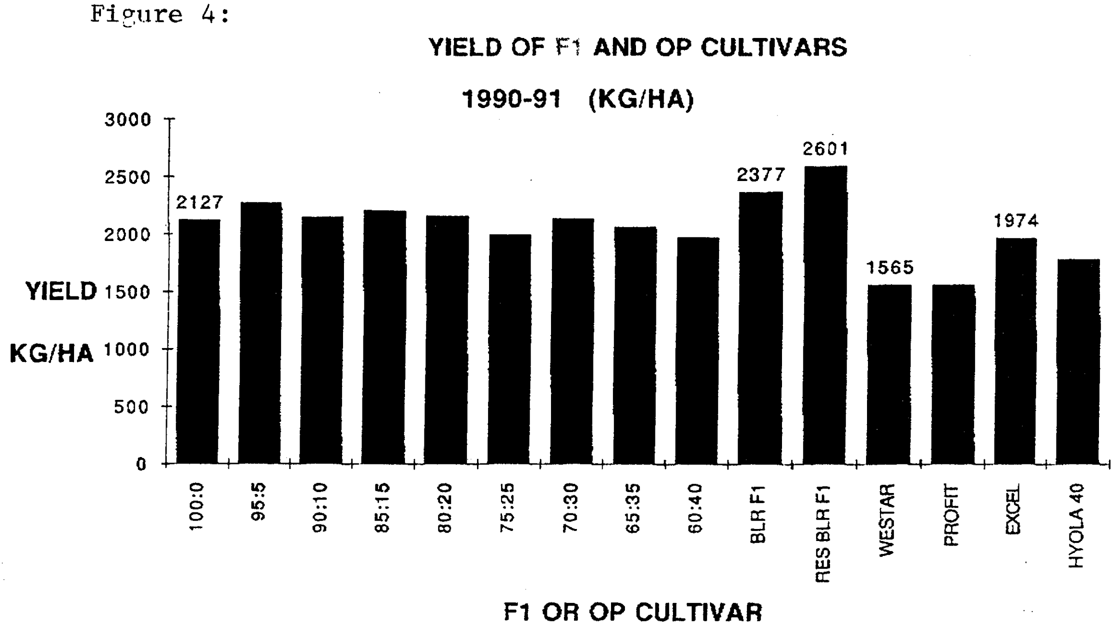


Figure 4:



1991 Regional Canola Test

Principal: R.K. Downey, Agriculture Canada Research Station
Saskatoon, Saskatchewan

Co-operator: Saskatchewan Irrigation Development Centre

The test was seeded at 27 locations, 14 in Saskatchewan, two in Alberta and 11 in the Northern States.

The *B. napus* strains CS005 and K4-87 were named HYOLA 401 and HC-120. The *B. campestris* strains DL6272, S83-5009W, and 84-56552N were named GOLDRUSH, REWARD and ELDORADO. Only the Outlook results are reported here.

	Yield of seed (00's kg/ha)	Oil content in percent of dry weight	Resistance to lodging (1-Good, 5-Poor)	Days from seeding to maturity
B. napus strains:				
Westar	14.9	40.1	4.2	83
Profit	18.7	41.4	3.8	85
Excel	18.6	42.0	3.0	84
Tristar	11.4	38.6	4.5	84
Stallion	21.3	38.9	2.0	88
Bounty	22.7	39.6	2.2	84
Hyola 401	29.1	42.1	1.0	84
HC-120	15.5	41.1	4.0	84
Hero	17.5	42.3	2.2	83
Legend	20.9	41.8	2.0	84
Delta	26.6	42.4	1.5	84
Vanguard	20.8	41.8	2.0	86
Celebra	24.3	42.3	1.2	88
Average	20.2	41.1		
CV	13.6	1.1		
L.S.D. 5%	4.0	1.0	2.6	85
B. campestris strains:				
Tobin	17.9	41.3	1.8	79
Parkland	19.4	43.4	1.8	80
Eclipse	16.7	42.2	2.2	80
Goldrush	16.5	41.9	1.8	80
Reward	20.0	43.0	2.2	80
Eldorado	17.6	42.9	2.0	80
Horizon	19.2	43.2	1.8	80
Average	18.2	42.6		
CV	11.0	1.4		
L.S.D. 5%	N.S.	1.5	1.9	80

Canola/Rapeseed Co-operative Trials at Outlook

Principal: R.K. Downey
Agriculture Canada Research Station
Saskatoon, Saskatchewan

The test was grown at 27 locations in western Canada, 11 in the mid-season zone, seven in the short season zone, seven in the long season zone and two in the irrigation zone.

Garst Seeds *B. napus* hybrid CS005 was registered as HYOLA 401 and the King Agro hybrid K4-87 as HC-120. University of Manitoba high erucic *B. napus* line S84-2208 was registered as MERCURY. Three *B. capestris* strains were licensed, Allelix DL6272, GOLDRUSH; University of Manitoba S83-5009W, REWARD; and University of Alberta strain 84-56552N as ELDORADO.

All 42 entries were seeded at all locations. The 36 *B. napus* entries were arranged in a 6 X 6 partially balanced lattice replicated four times at all locations except Winnipeg which had six replicates. These were analyzed as lattices and adjusted yield data is recorded for all locations except Beaverlodge, Lethbridge and Carman where the transgenic line AU239 was removed prior to flowering. At these locations, the test was analyzed as a randomized complete block. The six *B. campestris* entries were arranged and analyzed as a complete randomized block.

All seed quality analyses were done in duplicate. The fatty acid, oil, glucosinolate and protein analyses were conducted at the Saskatoon Research Station. Chlorophyll content was determined at the Canadian Grain Commission, Grain Research Laboratory at Winnipeg.

The test was coordinated by the Saskatoon Research Station. Only the irrigated results are in Tables 1, 2, 3, 4, 5 and 6.

Mustard Co-operative Trials at Outlook

Principal: R.K. Downey,
Agriculture Canada Research Station
Saskatoon, Saskatchewan

The test was grown at 11 locations. These locations were as far as possible situated in the mustard growing areas of western Canada. There were five tests in Saskatchewan, four in Alberta and two in Manitoba.

Oil content was determined at Saskatoon using a Newport Mark III.A NMR spectrometer. Glucosinolate analyses were done by gas chromatography of the Trimethylsilyl glucosinolates using benzyl glucosinolate as an internal standard. All quality analyses were done in duplicate for each strain.

The test was co-ordinated by the Saskatoon Research Station. The Outlook results are reported in Table 7.

Table 1. ***Brassica napus*** and ***B. Campestris*** 1991 - Co-op A test yield of seed (00's kg/ha) irrigation zone.

Strains	Outlook	Lethbridge	Average	% Average of Westar, Legend, Delta; Average (30.5)	Rank
B. napus					
Westar	16.8	38.8	27.8	91.1	33
A0352	36.7	38.7	37.7	123.6	2
K-213	28.6	41.5	35.0	114.8	7
AK88141	23.1	38.3	30.7	100.7	27
K-262	20.3	42.6	31.4	103.0	21
AK88140	21.3	39.8	30.6	100.3	28
A0375	28.0	39.3	33.6	110.2	11
AK88142	20.2	37.8	29.0	95.1	30
Profit	21.4	41.3	31.4	103.0	21
SV02406	31.5	37.3	34.4	112.8	9
SV02411	31.4	42.3	36.8	120.7	3
K255-88	22.2	44.3	33.2	108.9	16
CS017	28.2	34.3	31.2	102.3	23
Legend	24.1	34.9	29.5	96.7	29
AU233	28.7	41.5	35.1	115.1	5
Pal 21-88	28.2	33.8	31.0	101.6	25
AU238	25.2	44.2	34.7	113.8	8
SV02412	25.9	39.1	32.5	106.6	19
Delta	25.3	43.0	34.2	112.1	10
LA1304	22.8	38.8	30.8	101.0	26
GSN024	33.2	33.7	33.4	109.6	14
AU239	26.1	----	----	-----	---
GSN029	31.9	34.7	33.3	109.2	15
SV02413	27.0	39.2	33.1	108.5	17
ACS-H1	30.1	47.2	38.6	126.6	1
Pal 10-88	32.3	40.4	36.4	119.3	4
AG010	20.0	34.9	27.4	89.8	34
ACS-N8	21.2	43.0	32.1	105.2	20
K10-87	25.2	41.9	33.6	110.2	11
A0327	28.7	38.4	33.6	110.2	11
S85-1426	23.3	33.2	28.2	92.5	32
Stellar	17.0	27.0	22.0	72.1	35
ACS-N10	19.1	38.2	28.6	93.8	31
A0337	26.9	43.3	35.1	115.1	5
K-166	17.5	44.9	31.2	102.3	23
AK87752	24.3	41.7	33.0	108.2	18
Average	25.4	39.2	32.3		
CV%	19.0	10.7			
LSD 5%	6.8	5.7			
B. campestris					
Tobin	15.1	21.2	18.2	100.0	4
Parkland	15.7	21.8	18.8	103.3	3
CB8719	16.0	22.2	19.1	104.9	2
AK88998	11.2	22.7	16.9	92.8	6
SV03350	14.8	21.0	17.9	98.4	5
B00226	21.5	23.7	22.6	124.2	1
Average	15.7	22.1	18.9		
CV%	18.7	8.9			
LSD 5%	4.4	N.S.			

Table 2. ***Brassica napus*** and ***B. campestris*** Test 1991 - Co-op A test oil content in percent of dry weight irrigation zone.

Strains	Outlook	Lethbridge	Average	Rank
B. napus				
Westar	38.8	46.4	42.6	29
A0352	41.4	44.4	42.9	23
K-213	41.6	44.7	43.2	18
AK88141	40.7	47.4	44.0	4
K-262	40.9	45.6	43.2	18
AK88140	40.1	45.2	42.6	29
A0375	40.7	45.2	42.9	23
AK88142	40.9	46.0	43.4	14
Profit	40.5	47.3	43.9	5
SV02406	42.4	46.9	44.6	2
SV02411	41.6	45.5	43.6	8
K255-88	40.9	46.2	43.6	8
CS017	40.6	43.4	42.0	32
Legend	40.0	44.0	42.0	32
AU233	41.2	45.6	43.4	14
Pal 21-88	43.5	46.4	44.9	1
AU238	42.9	46.0	44.4	3
SV02412	41.8	44.3	43.0	21
Delta	40.6	45.4	43.0	21
LA1304	41.6	45.3	43.4	14
GSN024	41.2	43.8	42.5	31
AU239	40.8	---	---	--
GSN029	41.8	45.4	43.6	8
SV02413	41.6	44.4	43.0	21
ACS-H1	41.8	45.3	43.6	8
Pal 10-88	41.2	44.4	42.8	27
AG010	41.4	46.0	43.7	7
ACS-N8	40.8	46.4	43.6	8
K10-87	41.9	45.4	43.6	8
A0327	42.6	44.1	43.4	14
S85-1426	41.3	45.2	43.2	18
Stellar	39.6	43.2	41.4	35
ACS-N10	41.7	45.8	43.8	6
A0337	41.1	44.7	42.9	26
K-166	39.2	44.4	41.8	34
AK87752	40.4	45.0	42.7	28
Average	41.1	45.3	43.2	
CV%	1.9	1.3		
LSD 5%	1.8	1.2		
B. campestris				
Tobin	42.2	40.8	41.5	5
Parkland	43.0	42.8	42.9	1
CB8719	43.0	42.8	42.0	1
AK88998	41.8	40.6	41.2	6
SV03350	43.2	41.6	42.4	3
B00226	43.8	41.1	42.4	3
Average	42.8	41.6		
CV%	1.1	0.7		
LSD 5%	1.2	0.7		

Table 3. ***Brassica napus*** and ***B. campestris*** Test 1991 - Co-op A test protein content of seed meal - irrigation.

Strains	Outlook	Lethbridge	Average	Rank
B. napus				
Westar	44.4	41.6	43.0	20
A0352	41.5	41.3	41.4	32
K-213	43.9	42.0	42.9	23
AK88141	43.4	42.7	43.0	20
K-262	43.5	42.1	43.3	19
AK88140	44.7	44.3	44.5	5
A0375	44.6	42.6	43.6	13
AK88142	42.9	41.4	42.2	29
Profit	45.1	44.0	44.6	2
SV02406	44.9	43.8	44.4	8
SV02411	45.6	43.6	44.6	2
K255-88	43.8	42.0	42.9	23
CS017	43.7	43.2	43.4	17
Legend	45.3	42.6	44.0	11
AU233	44.6	43.4	44.0	11
Pal 21-88	41.2	40.0	40.6	33
AU238	44.0	43.2	43.6	13
SV02412	45.2	43.9	44.6	2
Delta	43.4	41.1	42.2	29
LA1304	41.4	39.2	40.3	34
GSN024	43.6	42.4	43.0	20
AU239	45.2	---	---	--
GSN029	41.8	38.8	40.3	34
SV02413	45.0	44.0	44.5	5
ACS-H1	45.2	43.5	44.4	8
Pal 10-88	45.2	43.8	44.5	5
AG010	45.9	44.1	45.0	1
ACS-N8	44.1	42.8	43.4	17
K10-87	42.7	42.6	42.6	27
A0327	44.0	43.0	43.5	15
S85-1426	43.2	42.6	42.9	23
Stellar	45.1	43.8	44.4	8
ACS-N10	44.0	43.0	43.5	15
A0337	43.8	41.4	42.6	27
K-166	43.6	42.2	42.9	23
AK87752	41.6	41.4	41.5	31
Average	43.9	42.5	43.2	
CV%	2.2	2.0		
LSD 5%	2.0	1.7		
B. campestris				
Tobin	40.8	40.3	40.6	5
Parkland	40.6	41.5	41.0	3
CB8719	42.4	42.4	42.4	1
AK88998	40.2	41.2	40.7	4
SV03350	41.5	41.2	41.4	2
B00226	40.8	39.8	40.3	6
Average	41.0	41.1	41.0	
CV%	1.4	1.9		
LSD 5%	1.5	2.0		

Table 4. Irrigated ***Brassica napus*** and ***B. campestris*** 1991 - Co-op A test days from seeding to maturity.

Strains	Outlook	Lethbridge
B. napus		
Westar	88	95
A0352	91	100
K-213	91	98
AK88141	89	95
K-262	90	96
AK88140	90	96
A0375	91	97
AK88142	88	97
Profit	90	98
SV02406	92	99
SV02411	91	98
K255-88	90	96
CS017	91	98
Legend	91	98
AU233	91	98
Pal 21-88	91	101
AU238	88	99
SV02412	92	100
Delta	91	98
LA1304	90	99
GSN024	94	103
AU239	94	---
GSN029	90	95
SV02413	91	99
ACS-H1	94	100
Pal 10-88	90	99
AG010	91	97
ACS-NB	89	96
K10-87	91	100
A0327	90	100
S85-1426	91	98
Stellar	94	101
ACS-N10	92	99
A0337	91	100
K-166	88	99
AK87752	89	98
Average	91	98
B. campestris		
Tobin	84	87
Parkland	85	89
CB8719	85	88
AK88998	85	88
SV03350	85	90
B00226	87	92
Average	85	89

Table 5. Irrigated ***Brassica napus*** and ***B. campestris*** 1991 - Co-op A test resistance to lodging (1 Good-5 Poor).

Strains	Outlook	Lethbridge
B. napus		
Westar	4.8	1.2
A0352	1.2	1.8
K-213	2.0	1.5
AK88141	4.0	1.2
K-262	4.5	1.8
AK88140	3.8	1.5
A0375	2.0	1.5
AK88142	4.5	1.5
Profit	4.0	2.2
SV02406	1.0	1.0
SV02411	1.2	1.5
K255-88	3.2	1.8
CS017	2.0	1.8
Legend	2.2	2.0
AU233	1.8	1.8
Pal 21-88	1.2	1.2
AU238	1.5	1.2
SV02412	1.5	2.2
Delta	2.2	1.5
LA1304	1.2	2.0
GSN024	1.8	1.8
AU239	2.2	---
GSN029	1.8	2.0
SV02413	1.8	1.5
ACS-H1	1.0	1.5
Pal 10-88	2.2	1.5
AG010	2.2	1.2
ACS-NB	2.8	1.2
K10-87	1.8	1.5
A0327	1.0	2.2
S85-1426	3.0	2.2
Stellar	2.5	2.2
ACS-N10	2.0	1.5
A0337	1.0	1.8
K-166	3.8	2.2
AK87752	2.0	1.5
Average	2.3	1.7
B. campestris		
Tobin	2.2	3.0
Parkland	2.5	2.5
CB8719	2.2	2.8
AK88998	2.2	3.0
SV03350	2.8	2.8
B00226	1.8	2.2
Average	2.3	2.7

Table 6. Irrigated ***Brassica napus*** and ***B. campestris*** 1991 - Co-op A test Chlorophyll content (P.P.M.).

Strains	Irrigation Zone A	Irrigation Zone B
B. napus		
Westar	10.7	10.0
A0352	7.1	8.2
K-213	9.6	9.5
AK88141	8.6	8.0
K-262	10.3	10.5
AK88140	13.1	13.0
A0375	10.9	10.5
AK88142	13.8	13.5
Profit	7.4	7.8
SV02406	5.7	6.5
SV02411	4.1	4.2
K255-88	12.5	12.2
CS017	8.0	6.3
Legend	10.5	9.2
AU233	8.2	8.3
Pal 21-88	7.6	6.6
AU238	6.0	7.3
SV02412	5.3	6.6
Delta	3.7	4.0
LA1304	9.4	8.4
GSN024	6.9	7.3
AU239	6.8	8.3
GSN029	5.2	6.8
SV02413	9.4	8.6
ACS-H1	10.6	9.4
Pal 10-88	15.9	15.0
AG010	8.7	8.6
ACS-NB	11.1	11.0
K10-87	12.3	12.5
A0327	11.2	11.0
S85-1426	11.7	11.9
Stellar	18.1	18.3
ACS-N10	7.6	7.4
A0337	7.3	7.8
K-166	12.2	13.3
AK87752	10.5	9.6
B. campestris		
Tobin	1.0	1.8
Parkland	2.5	1.5
CB8719	.0	.0
AK88998	0.7	.0
SV03350	3.8	2.0
B00226	3.6	2.1

Table 7. Mustard Co-operative Trial, 1991, Outlook, Saskatchewan.

Strain & Species	Yield (kg/ha)	Oil Content %	Days from seeding to maturity	Resistance to Lodging 1-Good;5-Poor	Allyl Isothiocyanate content (mg/gm)	Hydroxybenzyl glucosinolate (micromole/gm)
B. juncea						
Cutlass	3159	38.6	91	2.0	17.9	
Leth. 22A	2547	38.5	93	2.8	14.2	
Blaze	3368	35.3	95	2.0	14.3	
Comm. Brown	2409	35.4	94	2.2	12.9	
Forge	3784	37.2	91	1.0	18.7	
CBWR	2510	33.9	94	2.8	16.5	
J89-102	3715	38.0	91	1.2	19.9	
J89-144	2957	40.2	90	1.5	16.0	
Average	3056	37.2	92	1.9	16.3	
CV%	9.5	1.9				
L.S.D. 5%	427	1.6				
S. alba						
Gisilba	2223	26.9	93	2.2		198.8
Ochre	2178	27.6	93	3.0		205.0
Tilney	2556	27.4	91	1.5		188.0
CW/89/TY	2384	27.8	93	1.5		191.6
SA-1	2485	28.1	92	2.2		185.3
SA-2	2823	27.6	91	2.0		188.6
SA-3	2532	28.5	91	2.0		179.8
CW/91/CN	2681	27.6	91	1.2		183.6
Average	2483	27.7	92	2.0		190.1
CV%	11.0	2.4				
L.S.D. 5%	402	N.S.				

Previous Research and Demonstration Highlights presented the data in a similar table to allow comparisons to be made.

Pea/Canola and Mustard Intercropping

Principal: B. Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Progress: Year two of three
Objective: To determine the yield and economic performance of intercropping oilseeds with peas under irrigated conditions.

In 1990, Victoria pea was seeded at a 5 cm depth prior to the oilseeds which were planted 1.5 cm deep in a second seeding operation. Victoria pea was planted at 50 seeds/m^2 when planted with canola and 100 seeds/m^2 when seeded alone. Canola and mustard were at 224 seeds/m^2 when planted alone and 112 seeds/m^2 when planted with pea. The test was planted May 29 in a randomized complete block with six replicates. Cutlass oriental mustard *Brassica juncea*, Delta and Global *B. napus* and Parkland *B. campestris* canola were seeded to obtain a range of oilseed maturities. Standard errors were calculated for each component of the intercropping system.

Nutrient levels (kg/ha) are given below:

Crop	Soil test N	P	K	S	Fertilizer N	P_2O_5
Pea and mixtures	34	26	440	90	35	50
Canola and mustard	34	26	440	90	120	50

The pea/oilseed intercropping test was altered in 1991 to include Radley and Express pea as well as a sunola cultivar. Radley is an early, short semileafless pea. Express is a short early pea with good yield potential. The canola cultivars Delta and Parkland were removed and McGregor flax was added to ensure that all oilseed types were represented in the test. Global canola, Cutlass mustard and sunola were planted with each of the pea cultivars and by themselves as were the pea cultivars. Seeding rates (seeds/m^2) were: canola and mustard 224, flax 500, sunola 20, and pea 80. When a mixture was planted the oilseed and pea were planted in alternate rows at 50% of their normal seeding rate and only the oilseed received extra nitrogen. Therefore although the same setting on the fertilizer box was used for pure canola as canola in mixture, the mixture received only 50% as much nitrogen on a total plot basis. All fertilizer was sidebanded. Nutrient levels (kg/ha) are given below:

Crop	Soil test N	P	K	S	Fertilizer N	P_2O_5
Canola,mustard sunola, flax	65	22	360	106+	100	55
Pea alone	65	22	360	106+	12	55
Mixtures	65	22	360	106+	56	55

Pea yields and seed weights were analyzed as a split plot with pea cultivar as main plots and oilseed as the subplots. Standard errors were calculated for all crops and no attempt was made to compare pea yields with canola yields by analysis of variance.

In 1990, Global and Cutlass yielded 15% and 17% of their pure stand yields when grown in mixture with Victoria pea (Table 1) while in 1991 their yields were 23% and 27% of pure stand yields (Fig 1). This contrasts with Global and Cutlass grown with the other two pea cultivars where yields ranged from 44-56% of pure stand yields. This interaction was highly significant and indicates the competitive ability of the taller cultivar Victoria (Table 2).

The yields of canola and mustard in pure stands were 20-30% greater in 1990 than in 1991 while pea yields were similar in both seasons (Table 1 and Fig 1).

All pea cultivars had larger seeds when grown with Cutlass than with Global or when the pea cultivars were grown in pure stands (Fig 2). An increase in the seed weight of the pea cultivars appeared to be a major factor in Express and Victoria peas yielding higher when grown with Cutlass than when grown with Global (Fig 2). Although Radley pea also had larger seeds when grown with Cutlass, yields of this cultivar were much lower in mixtures relative to pure stands. If a premium was being paid for large seeded peas (such as with the marrowfat class) growing pea with a lodging resistant oilseed would be a viable option.

The sunola/pea combination does not appear to have any merit. There were too few plants to support the pea plants and it was almost impossible to remove split peas from the sunola. In addition, leaving peas until the sunola was ready to direct cut resulted in some shattering and an increase in the number of splits.

Table 1. Yields of pea/canola or pea/mustard mixtures.

Treatment	Pea kg/ha	Canola kg/ha
Cutlass	0	2279
Cutlass&Victoria	3289 (116)[1]	353 (15)
Global	0	2233
Global&Victoria	2681 (95)	396 (17)
Delta	0	1881
Delta&Victoria	3483 (123)	310 (16)
Parkland	0	1808
Parkland&Victoria	2965 (105)	187 (10)
Victoria	2827 (100)	0
CV	16.6	25.3
LSD	638	365

(_____)[1] % of pure stand yields

Table 2. ANOVA for yield and seed weight of pea cultivars 1991.

		Grain yield		1000 seed weight	
Source	df	MS	Pr>F	MS	Pr>F
Rep	5	144291		168	
Pea	2	2047839	.0007	20900	.0001
P*R (Error a)	10	122894		137	
Oilseed	3	8493018	.0001	2934	.0001
O*P	6	333239	.0512	173	.0081
Error b	44	144942		52	

Fig 1 Seed yield of intercropped pea and oilseed 1991

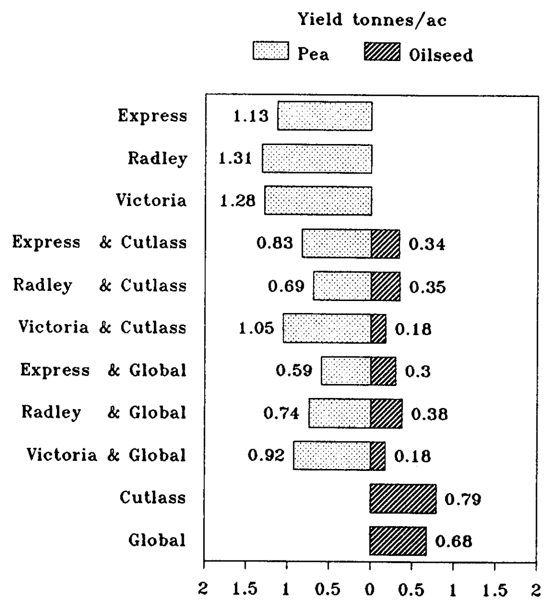
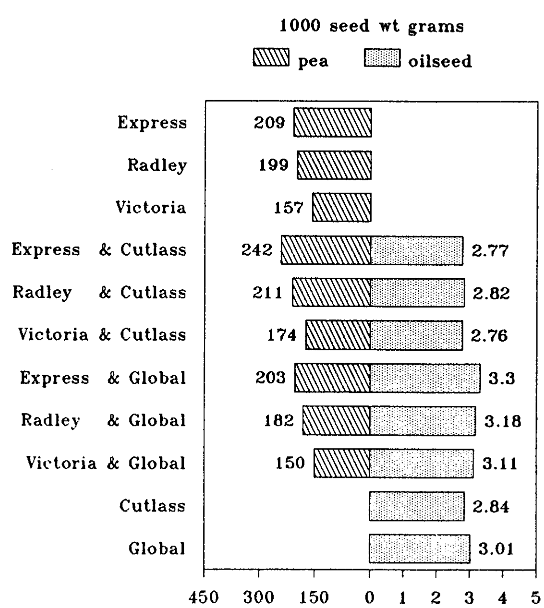


Fig 2 Seed weight of intercropped pea and oilseed 1991 Outlook



Effect of Seeding Rate and Seeding Method on Flax Yields

Principal: B. Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Progress: Year two of three
Objective: To determine the effect of seeding method and seeding rate on the yield of flax.

McGregor flax was planted in a 6 replicate randomized complete block with plots 13 m long and 2.25 m wide. Nutrient levels (kg/ha) and seeding dates are given below:

Year	Seeding Date	Soil test N	Soil test P	Soil test K	Soil test S	Fertilizer N	Fertilizer P_2O_5
1990	May 10	45	22	450	89	140	60
1991	May 8	77	21	352	105+	130	50

In 1991, yields were much lower than in 1990. There was a significant negative effect of seeding rate on seed yields in both seasons (Table 1). Highest seed yields were obtained with 30 kg/ha seeding rate regardless of the seeding equipment. There was no difference between hoedrill and broadcast seeding in 1991. In 1990, with the exception of the highest seeding rate, seeding with the hoedrill produced greater yields than broadcast seeding. Planting flax in rows 8 cm apart did not increase seed yields relative to rows 16 cm apart. Flax closes its canopy slowly and is known as a poor competitor with weeds, but in the absence of weed pressure there does not seem to be any need for narrow row spacings to obtain high yields.

Plant numbers increased as the seeding rate increased with both broadcast and hoedrill planting. In both seasons more plants were established using the hoedrill than broadcast and incorporating (Table 1). A plant population of 300 plants/m^2 was superior to plant populations greater than this.

Table 1. Yield and agronomic traits of flax seeded at different rates with different seeding methods in 1990 and 1991.

Seeding method	Seeding Rate kg/ha	Plants/m^2 90	Plants/m^2 91	Height cm 90	Height cm 91	Yield (kg/ha) 90	Yield (kg/ha) 91	Lodge 91
Amazone 8cm	50	580	601	68	81	2695	1431	4.7
Amazone 16cm	50	425	532	69	80	2804	1492	5.5
Broadcast	30	302	228	71	78	2664	1605	5.0
Broadcast	50	457	380	69	78	2340	1584	5.3
Broadcast	70	554	509	69	80	2194	1407	4.2
Hoedrill 20cm	30	467	377	61	80	2889	1584	5.7
Hoedrill 20cm	50	525	524	62	79	2606	1427	6.2
Hoedrill 20cm	70	675	736	61	78	2138	1319	4.8
CV		21	9	4	3	11	15	
LSD		126	51	3.2	3.2	336	224	

Flax Co-operative Test 1991

Principal: B. Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Progress: Year five of ongoing
Objective: To determine the yield and agronomic characteristics of potential new flax cultivars.

The 1991 yield data for the flax co-op is not reported due to the extremely high coefficient of variation.

Table 1. Seed yields of cultivars over time.

Variety	Seed yield (kg/ha) 1988	1989	1990	Lodging 1991†
Andro	2155	1928	2223	---
Flanders	2392	2022	2125	6.0
McGregor	2556	1933	1694	6.0
Norlin	2344	1936	2396	6.8
Somme	---	2378	1604	6.5
Vimy	2355	2011	980	7.3
FP862	---	2309	2082	6.0
FP900	---	1936	2185	4.5
FP907	---	1767	2009	4.5

†Rating (1=erect; 9=flat)

Although Vimy is a very popular and high yielding dryland variety, it lodges badly under irrigated conditions. McGregor usually resists lodging to a greater extent than other varieties and yields well. The new varieties FP 862 and FP 900 appear to have potential.

Flax Seeding Date

Principal: B. Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Progress: Year one of ongoing
Objective: To determine the effect of seeding date on the performance of five cultivars of flax reported to differ in response to seeding date.

A five-replicate split plot design was planted with early, normal and late seeding dates being the main plots. In 1991, the early, normal and late dates were May 7, May 17 and May 27, respectively. The subplots contained 11 rows on a 20 cm spacing with the rows being 6.1 m long. The cultivars Flanders, FP862, McGregor, Norlin and Somme were planted at 500 seeds/m^2 on each date.

Since this is the first year of the study, extreme caution must be exercised in the use of this data.

There was a significant reduction in flax yields at the late seeding date but no difference between yields at the early and normal seeding dates. There was no interaction between seeding date and cultivar in 1991 (Table 1). The cultivar, Somme, yielded significantly less than the other cultivars (Table 2) likely due to its greater lodging (6.5 relative to McGregor at 3.4).

The early seeding date lodged less than the other seeding dates in 1991 (Table 1). While McGregor continues to yield well and had the least lodging of any of the cultivars tested, there is a need to develop a shorter, less lodging prone cultivar.

There was a significant interaction between seeding date and cultivar for plant height (Table 1). While there was an overall trend for late plantings to be taller, the cultivar, Somme, experienced a 16 cm increase in height from early to late seeding, McGregor and FP862 were only five cm taller and Norlin and Flanders had an intermediate response (Table 2).

Table 1. ANOVA for yield and agronomic characteristics of flax cultivars seeded at different dates.

		Lodging		Grain yield		Flower		Height	
Source	df	MS	Pr>F	MS	Pr>F	MS	Pr>F	MS	Pr>F
Rep	4	19.9		82342		2.2		52	
Seeddate	2	37.9	.01	613522	.05	190.0	.0001	412	.001
SD*R (error a)	10	4.2	..	137607		2.2		24	
Cultivar	4	19.7	.001	226692	.0002	45.5	.0001	37	.029
SD*C	8	4.1	.06	82342	.502	5.2	.0001	42	.004
Error	44	2.1		31820		0.4		13	

Table 2. Yield and agronomic traits of flax seeded at differing times in 1991.

Cultivar	Seeding date	Days to mature	Lodging 1-9	Grain (kg/ha)	Days to flower	Height (cm)
Flanders	May 6	100	4.0	1535	60.8	74.0
Flanders	May 17	98	6.5	1622	59.0	79.4
Flanders	May 27	--	5.2	1338	57.0	83.0
Mean		*99*	*5.2*	*1489*	*58.9*	*78.8*
FP862	May 6	99	3.8	1650	59.4	75.8
FP862	May 17	95	5.6	1618	57.0	78.0
FP862	May 27	--	4.4	1444	52.0	80.2
Mean		*97*	*4.6*	*1571*	*56.17*	*8.0*
McGregor	May 6	102	2.6	1635	60.8	79.8
McGregor	May 17	100	5.4	1418	59.0	81.2
McGregor	May 27	--	2.2	1228	57.0	84.0
Mean		*101*	*3.4*	*1443*	*58.9*	*81.7*
Norlin	May 6	101	3.5	1649	58.8	72.6
Norlin	May 17	95	6.2	1593	57.0	80.4
Norlin	May 27	--	6.8	1204	52.0	80.4
Mean		*98*	*5.5*	*1482*	*55.9*	*77.8*
Somme	May 6	98	5.0	1374	57.0	73.8
Somme	May 17	93	6.9	1271	57.0	76.4
Somme	May 27	--	7.6	1068	52.0	89.0
Mean		*96*	*6.5*	*1250*	*55.3*	*79.7*
	May 6	100	3.8	1569	59.4	75.2
	May 17	96	6.1	1503	57.8	79.1
	May 27	--	5.2	1265	54.0	83.3
CV		1.6	28	12	1.1	4.5

Assessment of Genetic Resistance and Biological Control of Sclerotinia in Canola

Principal: D. McKenzie and P.R. Verma
Progress: First year of ongoing
Objective: To determine the resistance of various genotypes of canola to sclerotinia infection and to evaluate bacterial isolates as foliar sprays to control Sclerotinia infection.

Tests to assess the resistance to lines in the Co-op test and lines which had previously shown resistance to sclerotinia were planted in tests at Saskatoon and Outlook. No infection occurred at Outlook, but at Saskatoon the lines Golden and SRNBO-1365 showed significant resistance to infection. The effectiveness of the bacterial isolates could not be assessed since there was no infection at Outlook.

Sulfur Response of Irrigated Canola on Soil with Potentially Low Surface Soil Sulfur Content

Principal: T. Hogg and B. Irvine, Saskatchewan Irrigation Development Centre
Location: Saskatchewan Irrigation Development Centre
Progress: One year only
Objectives: To determine the response of irrigated canola to sulfur fertilization under conditions of potentially low surface soil sulfur content.

High precipitation levels in the spring of 1991 lead to conditions of potentially low available sulfur in the surface soil layer during the early growth stage of canola. A demonstration plot was established to determine if canola would respond to sulfur fertilization under these conditions.

Canola in the rosette growth stage was fertilized with one rate of sulfur (24 kg S/ha) applied as ammonium sulfate (21-0-0-34) and one rate of nitrogen (27 kg N/ha) applied as ammonium nitrate (34-0-0). The nitrogen was applied to give the equivalent quantity of nitrogen applied with the sulfur application.

The soil available sulfur level prior to plot establishment was sufficient (Table 1). The high precipitation in early spring had not leached the sulfur from the surface layer to any great extent.

There was no response of the canola to either the sulfur or nitrogen fertilizer applications (Table 2). Soil available sulfur was maintained at a sufficient level for canola production at this site.

Table 1. Spring 1991 soil analyses for the sulfur fertilization canola demonstration plot.

Depth (cm)	NO_3-N	SO_4-S
	------kg/ha------	
0-7.5	19	13
7.5-15	29	27+
15-22.5	47	27+
22.5-30	50	27+
30-60	87	112+

Table 2. Grain yield for the sulfur fertilization canola demonstration plot.

Treatment (kg/ha)	Mean Grain Yield @ 10% Moisture (kg/ha)	CV (%)
0	1601	9.6
27 S	1638	6.5
27 N	1698	5.7
L.S.D. (0.05)	NS†	

†Not significant at P = 0.05.

Effect of Row Spacing and Seeding Rate on Canola Yields and Sclerotinia Infection

Principal: B. Irvine, Saskatchewan Irrigation Development Centre
Progress: First year of ongoing
Objective: To determine the effect of row spacing and seeding rate on the yields of *Brassica napus* and *B. campestris.*

Two preliminary experiments were run to evaluate row spacings and seeding rates on yield and sclerotinia control. In the first experiment *B. campestris* (cv Parkland) was planted in a 4 replicate split plot design. Main plots were: untreated (UTC) and treated with Benalate (Benomyl 50% WP) at 1.5 kg/ha at approximately 35% bloom. All subplots had a seeding rate of 3 kg/ha with row spacings of 8, 16, 32, 48 and 64 cm.

In a second experiment *B. napus* (cv Global) was planted May 10 in a six replicate randomized complete block design. The row spacings and seeding rates used are listed below:

Row spacing cm	Seeding rate (kg/ha)		
8	3	6	9
16	3	6	9
32	3		
48	3		
16&48†	3		
64	2		

†(two rows 16 cm apart were planted with a 48 cm space between pairs of rows)

Just prior to maturity, excess rows were removed so that a known number of rows were harvested. The number of rows harvested ranged from 3 with the 64 cm spacing to 24 for the 8 cm spacing, this produced a harvested width of 1.92 m for all plots

The results reported are preliminary and due to the overall low yields may not represent long term trends.

The application of Benlate did not increase yields of *B. campestris* (Table 1). This was not surprising since no lodging occurred in this test and hot dry conditions occurred after flowering. Yields from the wide spaced rows did not differ from the narrow row spacings.

In the *B. napus* trial, plant numbers increased as the seeding rate was increased. Yield reductions due to wide row spacings could not be detected but the 64 cm spacing with the 2 kg seeding rate had the lowest yield (Table 2). Lower yields at low seeding rates was unexpected but may have been due to slow development and some flea beetle damage during early development. Higher seeding rates have been observed to cause more lodging and in the absence of lodging have little effect on yields.

Table 1. Yields of Parkland canola at various row spacings.

Row spacing (cm)	Seed yields (kg/ha) Benlate	UTC	Benlate/UTC
8	1131	1100	103
16	1115	1201	93
32	1101	1239	89
48	1150	1230	93
64	1188	1120	106
CV	5.5		
LSD	93		

Table 2. Yield and agronomic traits of Global canola grown with various row spacing and seeding rate combinations.

Row spacing (cm)	Seeding rate (kg/ha)	Plants /m^2	Days to mature	Sclerotinia infection %	Yield (kg/ha)
8	3	63	109	1.5	1470
8	6	114	106	2.5	1843
8	9	151	106	3.7	1873
16	3	77	108	5.0	1713
16	6	130	106	4.2	1947
16	9	188	105	3.0	2034
32	3	86	108	2.7	1621
48	3	88	107	3.8	1550
16&48	3	93	108	2.2	1408
64	2	64	108	2.0	1145
CV		17.9	1.5	63	16
LSD		21.9	1.9	2.2	309

Forages

Management of Forage Production under Irrigation

Principal:	B.P. Goplen Agriculture Canada Research Station, Saskatoon, Saskatchewan
Funding:	Irrigation Based Economic Development Agreement
Co-investigators:	B.D. Gossen, J.J. Soroka, S.B.M. Wright, H. Ukrainetz
Location:	Saskatchewan Irrigation Development Centre
Progress:	Second year of three
Objectives:	

a) to examine the effect of row spacing, seeding rate, fertilizer and cutting management on forage and seed yields of irrigated alfalfa;
b) to assess alfalfa lines and varieties for forage and seed production under irrigated conditions;
c) to assess forage grass species and grass/alfalfa mixtures for forage production under irrigation;
d) to determine the importance of insect and disease pests to alfalfa seed production.

A. **Seed production trials**

1987 Uniform Alfalfa Variety Test (seed) - Above-average rainfall in the spring and early summer in 1991 delayed flowering in the alfalfa seed trials and no irrigation was required. Conditions in late July and early August were favourable for pollination and alfalfa seed set was good, but harvest was not completed before an early snowfall halted progress. Leafcutting bee increase ranged from 2.2 to 3.5 times the number of bees set out. Seed yields for 1988-90 are given in Table 1.

Kentucky Bluegrass Seed Production - In a seed trial established in 1987, no significant differences in seed yield were observed in 1992 among cultivars, or between plots which were burnt after harvest the previous year versus those which had been clipped. The effect of timing of post-harvest fertilizer (100 kg/ha of N) application on seed production was examined in a grower's field in 1991-92. The results were highly variable, but October application produced the highest number of tillers. The only treatment that produced fewer tillers than the CHECK was fertilizer applied in spring.

B. **Forage trials**

1990 Uniform Alfalfa Registration and Adaptation Tests - Plots were rated for survival and spring vigor in May and two forage harvests were taken during the summer of 1991. Samples were taken from each plot in each cut for analysis of forage quality parameters of protein and fiber using Near-Infra-Red Spectrophotometry (NIRS). There were no significant differences among cultivars in protein or fiber components.

Effect of Soil Fertility on Forage Production of Alfalfa - In 1991, two forage harvests were taken at each of the two sites seeded in 1990. Production was excellent, but fertilizer treatments (N,P,K,S) did not increase dry matter yields. The fertilizer treatments will be applied again among species in 1992 before initial irrigation.

Grass Species - There were significant differences in forage production among species in 1991. Yield summaries are presented in Table 2.

Timothy Cultivar Trial - The trial was established in 1990 and two harvests were taken in 1991. There were no significant differences in yield in 1991. Yields in the first cut were very low, due to a heavy infestation of weeds in the establishment year. These results emphasize the need for early weed control in timothy forage production.

Bromegrass/alfalfa Mixture Trials - Harvests were taken in 1991, but the data analysis is not complete.

B. Pest monitoring

Insect Pests - Insects in the alfalfa plots at the SIDC site were sampled throughout the summer. In mid-June, economic thresholds for alfalfa plant bugs and lygus bugs were surpassed and all the seed plots were sprayed with dimethoate on June 20. Control of plant bugs was excellent and their populations were below the economic thresholds for the rest of the summer.

A survey for alfalfa seed chalcid was conducted in the autumn of 1990 and 1991. The larvae of alfalfa seed chalcids develop in and destroy alfalfa seed. This survey showed that the chalcid is not a major problem under irrigation in the Outlook area, but that it is important in dryland alfalfa seed production (Table 3).

Plant diseases - Cool, wet conditions early in the season resulted in epidemic development of several foliar diseases. Common leaf spot was the most common pathogen, but black stem and downy mildew were also prevalent. Foliar disease severity was generally higher in cultivars bred in Western Canada, e.g. Beaver, than lines developed in eastern North America, where substantial outbreaks of foliar diseases occur frequent survey of 61 irrigated and dryland fields was made in September of 1990 to look for Alfalfa Mosaic Virus. This virus is seed-borne, and infected plants are stunted and susceptible to winter injury. In the Melfort and Saskatoon regions, the virus was detected in only 2 of 30 fields, while 19 of 31 fields near Outlook and North Battleford were infected. Virus incidence was substantially higher in irrigated compared to dryland sites at Outlook, but this differences was not observed at the other locations. Samples collected in 1991 are being analyzed this winter.

Verticillium wilt was found in over half of the irrigated alfalfa fields examined at Miry Creek in southwestern Saskatchewan in 1991, and was also identified in several fields in the Riverhurst area.

Table 1. Seed yield (kg/ha) of alfalfa lines under irrigation at Outlook.

Cultivar/Strain	1988	1989	1990	Mean	% of Beaver
NAPB 32	910	650	447	669	(125)
OAC Minto	978	533	425	645	(120)
AP 40	962	615	355	644	(120)
Primal	804	622	389	605	(113)
Victoria	821	675	316	604	(112)
Glory	810	565	436	604	(112)
Anchor	760	654	365	593	(110)
Arrow	715	595	438	583	(109)
Riel	747	570	429	582	(108)
Apica	834	476	432	581	(108)
NAPB 31	747	571	381	566	(105)
NK 83632	679	579	397	552	(103)
Rambler	913	499	226	546	(102)
WL 222	857	516	251	541	(101)
Beaver	801	526	285	537	(100)
Barrier	695	488	404	529	(99)
Alouette	709	512	358	526	(98)
WL 316	621	591	355	522	(97)
A 872	691	546	311	516	(96)
VW-34-2	673	440	366	493	(92)
Vernal	664	499	294	486	(90)
Maxim	625	472	335	477	(89)
Spredor II	766	379	282	476	(89)
Oneida VR	644	507	242	494	(86)
80-16P	622	422	268	437	(81)
BLM-1019	793	295	203	430	(80)
Site1	494	350	335	393	(73)
Mean	753	524	345	541	
F Value	2.03	1.49	2.93		
CV (%)	21%	32%	24%		
LSD	225	212	117		

Table 2. Irrigated Grass Species Test, Outlook. Seeded 1988.

Species & Strain	1991	Mean 1989-91	(% of Carlton)
Crested wheatgrass - Kirk	7.8	10.0	(107)
Smooth Bromegrass - Carlton	6.9	9.3	(100)
- S-7133K	5.6	8.7	(93)
Meadow bromegrass - Fleet	6.8	9.0	(96)
Hard Fescue - Common	6.6	5.5	(59)
Tall Fescue - Mustang	5.7	6.8	(73)
- Courtney	4.7	7.6	(82)
Timothy - Champ	5.6	5.1	(55)
- Climax	5.2	4.7	(51)
Creeping Red Fescue - Boreal	5.5	4.3	(46)
Slender wheatgrass - Revenue	5.4	7.6	(82)
Steep Fescue - S-1765	5.1	3.4	(37)
Orchardgrass - Kay	4.5	4.4	(48)
- S-9071	4.4	3.9	(42)
- Chinook	3.9	4.1	(44)
Meadow Fescue - Beaumont	3.8	5.6	(61)
Mean	5.5	6.3	
F Value	4.9	17.2†	
CV (%)	21.0	19.0	
Waller MSD	1.4	1.3	

†Means are significantly different at P = 001

Table 3. Average number of intact and alfalfa seed chalcid-damaged seeds and % seed infested in 250 pods of alfalfa, 1990-91.

	1990			1991		
Location	Intact Seed	Damaged Seed	% Damaged	Intact Seed	Damaged Seed	% Damaged
SIDC	721	24	3.2	800	16	2.0
Outlook	587	22	3.6	764	2	0.3
Birsay	627	5	0.8	827	25	2.9
Irrigated†	638	21	3.2	773	20	2.5
Irr. & Dryland	690	30	4.2	792	25	3.0

†Number of irrigated fields in both 1990 and 1991=4, number of irrigated and dryland fields in 1990=32, in 1991=27.

Management of Alfalfa for Seed Production under Irrigation

Principal: B.P. Goplen
Agriculture Canada Research Station
Saskatoon, Saskatchewan
Funding: Irrigation Based Economic Development Agreement
Co-investigators: B.D. Gossen, J.J. Soroka, S.B.M. Wright
Location: Larson Farm, Saskatchewan Irrigation Development Centre
Progress: Third year of four
Objectives:

a) to examine the response of new alfalfa lines for their potential in the irrigated areas of Saskatchewan;
b) to examine the effects of plant stand density on seed production in medium to large-scale plots;
c) to investigate the response of meadow bromegrass seed yields to row width.

A. **Alfalfa seed production trials** - Above average rainfall in June and early July resulted in excessive vegetative growth and delayed flowering and leafcutting bee activity. However, seed harvest was stopped by an early snowfall and the harvest will be completed in the spring. Leafcutting bee reproduction was good. High levels of parasitise of the bee larvae have been noted in previous years, so we implemented a stringent parasite cleanup program in our research material using dichlorvos during incubation. This treatment was successful and parasitism in larval cells provided in 1991 was low.

Stand density study - In this trial, the alfalfa stand in a grower's field was thinned in the spring of 1990 using four treatments: 1) cultivation at right angles to the alfalfa rows using a cultivator with every second sweep removed, 2) cultivation at right angles and one diagonal, 3) cultivation at right angles and two diagonals, and 4) the check treatments. Stand differences were not as great as desired, and the treatments were re-applied in early spring of 1991. Cultivation significantly reduced plant and shoot number and plant height in spring (Table 1). Sections of each plot were hand harvested and threshed in October. Significantly more seed was produced in the two-cultivation treatment than in the no- or one-cultivation treatments. However, harvesting of the whole plots was not completed before snowfall.

B. **Meadow bromegrass seed production** - This study was established in 1989 to examine the effect of row spacings (1, 2 and 4 feet) on meadow bromegrass seed yield. There were no significant differences in seed yield in 1991 (mean 270 kg/ha), but mean yields for 1990 and 1992 (360, 330 and 280 kg/ha at 1, 2 and 4 feet, respectively) differed among treatments because of the effect of row spacing on yield in 1990. Seed yields in 1991 were lower than anticipated, probably because the irrigation scheduling on the whole plot area was based on optimum timing for alfalfa, not bromegrass, seed production.

Table 1. Effect of stand thinning on stand characteristics in spring and seed yield of hand-harvested Beaver alfalfa in 1991.

No. of Cultivations	No. of Crowns	No. of Shoots	Height (cm)	Seed Weight (g/2 m row)	Yield† (kg/ha)
None	8.0a‡	199.7 a	40.9 a	53.78 b	271.6
One	6.7ab	149.3 b	34.2 b	53.29 b	269.1
Two	5.0b	101.9 c	31.5 b	72.59 a	366.6
Three	5.4b	82.2 c	30.2 b	63.09 ab	318.6
Pooled SE	1.1	24.1	3.1	8.6	

† Extrapolated from yields from 2m samples.
‡ Means followed by the same letter within a column are not significantly (P=0.01) different based on Duncan's Multiple Range Test.

Irrigated Alfalfa Seed Production

Principal: R. Byron Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Progess: Final year
Objective: To demonstrate the successful production of alfalfa seed and to determine if broadcast or row seeding is the best method of establishing the correct plant population for alfalfa seed production.

Algonquin alfalfa was planted May 29, 1989, at 2 kg/ha in 18 cm rows or broadcast. Six strips, approximately 27 m wide and 396 m long, were planted with each seeding method. Flax was seeded at 22 kg/ha at right angles to the direction in which the alfalfa was planted. Prior to planting 185 kg/ha of P_2O_5 was applied to the entire area and no phosphorous was applied thereafter.

Weed control in 1989 was preplant trifluralin and post emergence bromoxynil. In the spring of 1990, the stand was thinned using a heavy duty cultivator with 16 inch sweeps with every other sweep removed. This left the field rough but by harvest, the field was fairly smooth. Bromoxynil was applied to control annual weeds in the spring of 1990, but this did not control the volunteer flax. In 1991, the area was sprayed with bromoxynil to control broadleaf weeds. Wild oats were controlled using Poast.

In 1991, insects were sprayed with Cygon on June 24 and Decis on July 2. In 1990, approximately

52,000 leafcutter bees/ha, and in 1991, approximately 76,600/ha were placed in the field on July 3. There were 13 shelters in 1990 and 15 in 1991, which resulted in one shelter for each one hectare. Bee numbers increased about 1.45 times in 1990 and 1.8 times in 1991.

The crop was desiccated using Reglone in both seasons. Yields were above average in 1990 (478 kg/ha) and below average (337 kg/ha) in 1991. There were no detectable yield differences due to planting method with press drill planting yielding 476 kg/ha (SE 37) and broadcast planting yielding 478 kg/ha (SE 56). Because of this, yield estimates were not taken in 1991 as the major effect would have occurred in 1990. In addition, cleavers were a major problem and no products are registered for control of this weed. There was considerable variability in seed yield due to distance from the shelter with higher yields closer to the shelter.

Demonstration of Alfalfa Seed Production under Irrigation

Principal: R. Byron Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Progess: Final year
Objective: To demonstrate yields attainable with best management of stand density, pest and pollinator management and irrigation management.

Initial soil tests indicated 20 kg/ha of P and 468 kg/ha of K. Prior to planting, an additional 112 kg/ha of P_2O_5 was soil incorporated. Trifluralin was applied to control weeds. Flax was planted at 22 kg/ha prior to planting of Beaver alfalfa at 1.3 kg/ha at a 30 degree angle to the flax. Despite a planting date of June 5 for flax and June 10 for alfalfa, the alfalfa was about 20" tall and in bloom prior to flax harvest.

Vegetative growth was excessive in 1990 and 1991 due to excess water. In the spring of 1991, the stand was thinned by cultivation to remove about 50% of the plants. Weed control was obtained by cultivation on May 30 and June 14 in 1990. Cultivation was used to incorporate Edge on June 10 in 1991. Reglone was used to desiccate the crop in both seasons.

Decis was applied to control insects in both seasons. Bees were placed in the field on July 4 each season. Each shelter served about two hectares. In 1990, 52,000 bees/ha were placed in the field and in that season, bee numbers doubled so that approximately 99,000 bees/ha were placed in the field in 1991. Bee numbers doubled in 1991 but since the price of alfalfa seed is low, acreage is being reduced. Also, prices for bees are currently very low.

In 1990, yields were only 336 kg/ha, due in part to excessive foliage and some moisture stress during seed filling. Yields were not determined in 1991 as snow arrived prior to the initiation of harvest.

Improving Alfalfa Establishment under Irrigated Conditions

Principal: R. Byron Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Progess: Year three of four
Objective: To develop information on companion crops which will enable producers to successfully establish alfalfa under center pivot irrigation while obtaining maximum returns from the land base during establishment.

PART I: Yields of Companion Crops

The test consisted of an oilseed/pulse block and a cereals block each with five replicates. Beaver alfalfa was solid seeded at 9 kg/ha at right angles to the direction in which the companion crops had previously been planted. Seeding information is given in Table 1. Nutrient levels (kg/ha) and seeding dates over the three seasons were:

Year	Seeding Date	Soil test N	Soil test P	Soil test K	Soil test S	Fertilizer N	Fertilizer P_2O_5	Fertilizer K_2O	Fertilizer S
1989	May 15	29	22	286	105+	120	40		
1990	May 9	23	18	180	105+	110	75	330	
1991	June 3	49	28	280	105+	110	110		

Table 1. Seeding information for companion crop test.

Crop type	Variety	Seeding rate (kg/ha)	Row spacing (cm)
Durum	Sceptre	60	20
Durum	Sceptre	60	40
CPS	Biggar	60	20
CPS	Biggar	60	40
Fababean	Outlook	90	40
Canola	Parkland	4	20
Lentil	Indian Head	30	20
Flax	McGregor	45	20

In 1991 canola and flax yields were low despite good stands. Fababean yields were poor due to a general poor vigor. Yields of cereal grains were 75% lower than in 1989 despite good initial rainfall and moderate irrigation (Table 2).

Table 2. Yield of crops in 1989, 1990, and 1991 (kg/ha).

Crop	Cultivar	spacing cm	1989 Yield	1989 SE	1990 Yield	1990 SE	1991 Yield	1991 SE
Durum	Sceptre	20	4195	359	3287	462	855	79
Durum	Sceptre	40	--	--	3293	277	976	122
CPS	Biggar	20	4233	306	2499	208	1091	273
CPS	Biggar	40	--	--	2993	355	1222	159
Fababean	Outlook	40	513	186	--	--	368	64
Canola	Parkland	20	452	28	1461	363	577	89
Lentil	Eston	20	115	31	826	220	--	--
Lentil†	Indian Head	20	--	--	--	--	3893	606
Flax	McGregor	20	782	104	1964	197	169	69
Alfalfa†	Beaver	solid	8354	469	--	--	3686	377

†forage yields; others are grain

Eston lentil can not be used as a companion crop since it does not compete well with alfalfa and produced seed yields of less than 200 kg/ha. Given the type of management and seeding date in 1991, there was no advantage to seeding Indian Head lentil with alfalfa over clear seeding of alfalfa. This may not be the case for earlier seeding dates.

Over the test period, fababean has not been a good companion crop. More evaluation is needed. Blister beetle damage has at times occurred.

PART II: Yield of Alfalfa in the Year Following Establishment

This test was established in 1989 and 1990 with the various companion crops as outlined in Part I. In 1990, two harvests of alfalfa were taken from four replicates of the test seeded in 1989 while in 1991 one harvest was taken from the test established in 1990. A second harvest could not be taken in 1991 as swathed hay remained on the plots creating uneven regrowth. Since the test was set up as two randomized complete block test separate ANOVA's were run for the cereals and oilseed/pulse blocks.

Growing a cereal companion crop in the establishment year did not reduce first year alfalfa yields in 1990 but yields were reduced from 9-27% in 1991 (Table 3). Oilseed and pulse crops grown in the establishment year did not affect subsequent alfalfa yields in either season (Table 4).

Competition for light in the establishment year may not be a major yield limiting factor in subsequent crops providing moisture is adequate.

Table 3. Alfalfa yields in the year after establishment with various cereal grain companion crops.

		Yield (kg/ha of dry matter)			
		Spacing	1990	1990	1991
Crop	Cultivar	cm	cut1	cut2	cut1
Durum	Sceptre	20	4768	6675	3400
Durum	Sceptre	40			3487
CPS	Biggar	20	5307	6004	2944
CPS	Biggar	40			3708
Barley	Winchester	20	4768	6675	
Soft wheat	Fielder	20	4423	6042	
Alfalfa	Beaver	solid	5280	6971	4091
CV			14.6	11.3	10.2
LSD			1024	1186	466
Pr > F			0.32	0.52	0.01

Table 4. Alfalfa yields in the year after establishment with various oilseed and pulse companion crops.

		Yield (kg/ha of dry matter)			
		Spacing	1990	1990	1991
Crop	Cultivar	cm	cut1	cut2	cut1
Fababean	Outlook	40	6337	5546	4697
Canola	Parkland	20	5568	5872	5092
Lentil	Eston	20	6625	5578	4929
Lentil†	Indian Head	20			
Flax	McGregor	20	6121	6247	4504
Alfalfa†	Beaver	solid	5458	5883	4816
CV			14.6	11.3	11.5
LSD			1353	1009	739
Pr > F			0.32	0.58	0.53

†forage yields; others are grain

Effect of Potassium Fertilization on Alfalfa Yield and Winter Survival

Principal: B. Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Progess: Year two of four
Objective: To evaluate the effect of potassium rate and source on alfalfa yields and winter survival.

This test was established as a split plot design with four replicates. Main plots were the alfalfa cultivars Anchor and Beaver which had been planted in 1988 and sub plots were the various nutrient levels. Soil test nutrient levels for 1990 and 1991 are given below:

Year	N	P	K	S
1990	20	26	270	108+
1991	22	44	---	108+

Phosphorous was broadcast over the entire area at 50 kg/ha P_2O_5 in the fall prior to both harvest seasons.

Potassium was applied at 0, 60, 120 and 180 kg/ha using potassium chloride as the source of K and at 120 kg/ha using potassium carbonate. Calcium chloride was also applied, to equal 120 kg/ha KCl, and evaluate if there was a chloride effect. Product was hand broadcast on plots 7.3 m x 3 m prior to the initiation of spring growth.

There were no significant yield differences due to cultivar, fertilizer treatment or their interaction in either 1990 or 1991 (Table 1). The coefficient of variability was quite high for the 1990 first cut yields. Forage yields were high and there was no trend towards improved yields at higher K fertility rates (Table 2). Soil test recommendations indicated that this site had sufficient potassium for optimum yields and this data supports that view. The effects of K fertilization on winter survival were not evident.

Table 1. ANOVA for alfalfa forage given differing nutrient level.

		Cut 1 1990		Cut 2 1990		Total 1990	
Source	df	MS	Pr >F	MS	Pr >F	MS	Pr >F
Cultivar	1	383154	.36	591484	.58	1926763	.46
Rep	3	1651094		184637		2123189	
C*R (Error a)	3	326242		1516502		2727037	
Product	5	1458976	.43	904202	.20	3144597	.20
P*C	5	815510	.73	575678	.44	771909	.85
Error b	29	1440891		577209		3144597	

		Cut 1 1991	
Source	df	MS	Pr >F
Cultivar	1	972450	.29
Rep	3	5332848	
C*R (Error a)	3	690757	
Product	5	415867	.72
P*C	5	27053	.99
Error b	29	722482	

Table 2. Effect of Potassium fertilization on alfalfa forage yields.

			Dry matter kg/ha					
			Anchor			Beaver		
Product	Nutrient	Level kg/ha	1990 cut1	1990 cut2	1991 cut1	1990 cut1	1990 cut2	1991 cut1
KCl	K	0	6720	5946	5523	7084	5365	5734
KCl	K	60	6756	5685	4928	6986	6090	5426
KCl	K	120	8299	6547	6168	7544	6000	5442
KCl	K	180	7254	5437	6246	6517	5499	5366
K_2CO_3	K	120	6522	6302	6187	7102	5453	5715
$CaCl_2$	Cl	120	7278	6244	5903	6376	6537	5796

Alfalfa Establishment and Fertility for Increased Yield and Stand Longevity on Border Dyke Irrigation

Principal: D. Cameron, Normac AES Ltd.
Swift Current, Saskatchewan
Funding: Irrigation Based Economic Development Agreement
Co-operator: R. Harrigan
Location: Maple Creek, Saskatchewan
Progress: Fourth year of five
Objective: To determine the best method of establishing alfalfa on the irrigated alluvial clay soils of the Maple Creek area.

In the early spring of 1991, an examination of the 1990 alfalfa establishment plot areas {manure, gypsum, weed control experiment(s)} indicated that the alfalfa catch from the previous year's seeding was fairly thin on both the Doug Harrigan and Lambert/Drever plots. It was decided that these plot areas would be lightly disked to kill the emerging weeds, while at the same time, minimizing damage to the established alfalfa. The plot areas were broadcast seeded and harrowed and with the excellent spring moisture (May, June and July precipitation of 214 mm), the alfalfa catch was very good. Seedling alfalfa plant counts made in June 1991 on the Doug Harrigan plot ranged from a low of 76/m^2 on the 1990 alfalfa-sweet clover plot to a high of 685/m^2 on an adjacent border dyke. However, weed seedling counts were also fairly high on these same plot areas ranging from a low of 61/m^2 to a high of 495/m^2. Lower weed counts were obtained on the weed control treatment plots where Treflan had been applied in 1990 and these counts ranged from 0 to 88 seedlings/m^2 while alfalfa seeding counts ranged from 106 to 504/m^2 on the same plot areas. The results also showed that there was a general tendency for the manure treatment to have higher alfalfa seeding emergence compared to some of the other treatments, but no statistical analysis was conducted to verify these results.

In the Lambert/Drever plot, the highest alfalfa seed count (688 plants/m^2) was obtained from the high gypsum-weed control plot followed closely by 680 seedlings/m^2 for the manure-weed control treatment. Weed seedling counts decreased from 316/m^2 to 114/m^2 to 30/m^2, respectively, for the same treatments. In the adjacent control plots, the weed counts ranged from 604 to 940 plants/m^2 and the alfalfa seedling counts ranged from 0 to 36 plants/m^2.

Adjusted fresh-weight alfalfa yields in the Ken Hope plot showed the manure-gypsum treatment to be superior with a yield of 1700 g/m^2 compared to the gypsum alone and control plots which had average fresh-weight yields near 1060 g/m^2.

The results from all the 1990 establishment plots indicated that the combination of weed control with gypsum and manure gave the highest plant counts and yields. Gypsum alone, without the addition of manure, did not appear to provide the same benefit. Hot dry weather in late July and throughout August and September appeared to set back many of the small seedlings. These plot areas will be re-assessed in 1992.

The Roy Harrigan plot which was originally established in 1989 when the project emphasis was on alfalfa establishment through zero-till and cover crops was also sampled in 1991. A comparison was made between the alfalfa first-cut yields on the check treatment (conventional tillage and seeding) and the zero-till direct seeding. Average yields of 4.67 tonnes/ha (dry weight basis) were achieved on the conventional tillage which compared favorable to a zero-till yield of 4.88 tonnes/ha.

Alfalfa Varieties on Border Dyke Irrigation: Yield and Stand Longevity

Principal:	D. Cameron, Normac AES Ltd. Swift Current, Saskatchewan
Funding:	Irrigation Based Economic Development Agreement
Co-operator:	R. Anderson, PFRA
Location:	Maple Creek (NW 8-11-26-W3)
Progress:	Fourth year of five
Objective:	To determine the alfalfa variety best suited to the heavy textured soils of the Maple Creek area. The most suitable variety would be one which is high yielding and has good stand longevity.

In 1988, seven varieties of alfalfa including Heinrichs, Beaver, Anchor, Barrier, Roamer, Pioneer and Rangelander were seeded in three replicate blocks on Ross Anderson's border dyke plot in the Maple Creek Irrigation Project. In the four years that this project has progressed, there have been a number of extremes in weather conditions. In 1988, a relatively good seed catch was obtained primarily due to fall rains which promoted growth. In 1989, only a partial irrigation was allowed and this occurred just prior to the second-cut. In 1990, there was sufficient spring moisture for one cut but no irrigation took place. In 1991, the spring conditions were excessively wet and a high yielding late first-cut was obtained but there was insufficient regrowth and moisture for a second-cut. First-cut yields in 1991 ranged from 2.64 tonnes/ha for Rangelander to 4.00 tonnes/ha for Heinrichs, Beaver and Roamer. An analysis of variance of the yield results showed no signficant differences between varieties. Over the three years of yield data collected, Roamer has the highest average yield with 3.32 tonnes/ha followed by Heinrichs at 3.16 tonnes/ha with the lowest yield going to Pioneer at 2.63 tonnes/ha. The long-term average yield for all of the varieties through the three years was 3.02 tonnes/ha.

Grass Versus Alfalfa Production under Border Dyke Irrigation

Principal: D. Cameron, Normac AES Ltd.
Swift Current, Saskatchewan
Funding: Irrigation Based Economic Development Agreement
Co-operator: D. Harrigan, A. Lambert and K. Hope
Location: Maple Creek
Progress: Second year of three
Objective: To compare the yield and nutritional value of various grass varieties to alfalfa on fine textured salt-affected border dyke irrigated soils in southwestern Saskatchewan.

Three grass-legume variety experimental plots were established in the Maple Creek irrigation flats. Larger scale replicated plots for comparison of crested wheatgrass, intermediate wheatgrass and brome were established at the Doug Harrigan site in 1991 while smaller nonreplicated plot areas were established in 1990 at the Lambert/Drever and Ken Hope sites. Comparisons included alfalfa, sweet clover, sanfoin, bromegrass, meadow bromegrass, crested wheatgrass, western wheatgrass, northern wheatgrass, creeping foxtail, Russian wild ryegrass, intermediate wheatgrass, slender wheatgrass and meadow foxtail. Spring moisture conditions were excellent with 214 mm of rainfall recorded for May, June and July. Grass seedling counts at the newly established Doug Harrigan plots averaged 110 seedlings/m^2. The grass seedlings were greatly outnumbered by the weed seedlings which averaged 910 seedlings/m^2 with an additional 225 mature weeds/m^2, demonstrating the fierce weed competition for the grass seedlings in these plots.

In order to compare the 1991 grass yields on the Lambert/Drever and Ken Hope plots, the yield weights had to be adjusted to discount the excessive weed growth. This was done by calculating an adjusted yield which took into account the plant weight and limited the percentage weeds to 20%. Grass-legume yields at the Lambert/Drever plot were very poor with the best fresh-weight yield obtained by sweet clover at 2410 kg/ha. Alfalfa, intermediate wheatgrass and crested wheatgrass had yields near 500 kg/ha. At the Ken Hope plot, the average adjusted grass-legume fresh-weight yields were better. Sweet clover had the highest yield near 2400 kg/ha followed by intermediate wheatgrass, sanfoin, bromegrass and crested wheatgrass - all with yields near 1900 kg/ha (fresh-weight). Russian wild ryegrass, northern wheatgrass and brome-alfalfa mix had yields near 1400 kg/ha. In both plots, creeping foxtail, slender wheatgrass and meadow foxtail performed very poorly.

Alfalfa Cultivar Evaluation on Flood Irrigated Clay Soils in South Western Saskatchewan

Principal: P.G. Jefferson, Agriculture Canada Research Station
Swift Current, Saskatchewan
Funding: Irrigation Based Economic Development Agreement
Co-investigator: R.J. Rempel
Co-operators: R. Oldhaver and D. Bradley, Miry Creek; B. Birkson and L. Dilworth, Rush Lake; V. and A. Perrault, Ponteix
Progress: Third year of four
Objectives:

a) to evaluate yield performance and forage quality of 11 alfalfa cultivars on heavy clay soils over a range of environmental conditions during a four year period;
b) to determine the relative compatibility of alfalfa cultivars when grown with an associated grass (intermediate wheatgrass and smooth bromegrass) as compared to a monoculture stand.

Current alfalfa cultivar recommendations for southwestern (SW) Saskatchewan were based on alfalfa grown in monoculture stands on well drained, sprinkler irrigated soil. However, these ideal conditions are not prevalent throughout SW Saskatchewan resulting in questions regarding the validity of current recommendations for the entire SW region.

The 1991 year was unusual in terms of growing season weather which hampered data collections. Heavy rains in May and June drowned out Rush Lake and any chance of obtaining yield data and influenced the irrigation schedule at Ponteix. In spite of less irrigation than normal at Miry Creek, an outbreak of verticillium wilt occurred. Presently, Barrier is the only verticillium wilt resistant alfalfa in the test. However, forage yields for Barrier are significantly less than other alfalfa cultivars at all locations. Also one site was abandoned at Miry Creek due to unsuccessful establishment. Cultivar ranking is highly variable between locations and between sites within a location. The faster recovering alfalfa varieties, Algonquin, Anchor and Apica, all yielded well but not consistently among locations. The one pattern being established is the higher grass proportion of the BG alfalfa mixture plots over the IWG mixture plots. The IWG consistently yields higher than the BG. Evidently the less competitive IWG is more compatible with alfalfa than bromegrass. Presently, data collected indicates that cultivar ranking is influenced by environment to some degree but further testing and data collection will have to be done in order to dispute current alfalfa cultivar recommendations for SW Saskatchewan.

Double Cropping

Principal:	B. Irvine, Saskatchewan Irrigation Development Centre
Funding:	Irrigation Based Economic Development Agreement
Progess:	Year two of four
Objective:	To increase returns to irrigated land and increase the flexibility of the crop rotation by growing two crops on the same land base each season.

Planting and nutrient information are provided in Tables 1 and 2. Sweetclover (cv. Norgold) was underseeded to wheat in June of 1990. After harvesting the sweetclover in June of 1991, it was found that many of the plots had severe infestations of quackgrass and this test was abandoned. Phosphorous was seed placed at 40 kg/ha of P_2O_5 with the rye and sidebanded at 50 kg/ha when the second crop was planted. In 1990 and 1991, both canola and lentil were broadcast into the standing rye crop but the stands were poor and valid data could not be obtained.

In 1990, the rye was harvested June 15 while in 1991 harvest was delayed until June 24.

Table 1. Seeding and nutrient levels for rye seeding

Crop	Seeding date	Seed rate (kg/ha)	Nutrient levels (kg/ha) Soil Test N	P	K	S	Fertilizer N	P_2O_5
Rye 1989!	Sept 12	120	75	16	275	105+	80~	40
Rye 1990!	Sept 13	120	81	48	560	108+	80~	40

!harvested subsequent season

Table 2. Seeding and fertilization of second crops.

Crop†	Nitrogen (kg/ha) 1990	1991	Seeding rate seeds/m^2
Indian Head lentil			100
Eston lentil			100
Parkland canola	100	100	225
Harrington barley	100	100	300
Common buckwheat		100	30

†Canola and barley were straight cut while buckwheat and lentil were swathed.

Yields of rye forage were lower in 1991 than in previous seasons (Table 3). The yields of sweetclover were approximately the same as rye and since sweetclover can fix its own nitrogen this would be the preferred crop. Sweetclover is difficult to make into good hay due to its coarse stems. Further effort to develop a low coumarin dwarf sweetclover may be warranted. The purpose of double cropping would be to meet the demand for hay in years of low rainfall. Sweetclover seed is low cost and thus sweetclover could be seeded with the previous season's canola crop and a hay cut taken only if prices are high. If hay prices are likely to be depressed due to abundant soil moisture in dryland hay fields the sweetclover would be sprayed about the third week of May and a grain crop planted. Otherwise, the sweetclover hay crop would be followed by a lentil or barley forage crop.

Table 3. Rye and Sweetclover dry matter yield and quality.

Crop	DM Yield Kg/ha	SE	%Protein	TDN%
Rye 1988	5667	262	6.1	51
Rye 1990	6658	605	5.7	51
Rye 1991	4607	304		
Sweetclover 1991	4808	87		

Indian head lentils produced slightly over 2.5 t/ha forage with a protein content of 15.5 % and a TDN of 62% in 1990 and approximately 2.0 t/ha in 1991 (Table 4). Barley forage yields were extremely poor in 1990, and since this appeared to be due to the phytotoxic effects of the rye crop, it was not included in the 1991 test. Higher yields might be expected if barley were planted into sweetclover stubble since yields of 12000 kg/ha dry matter have been obtained when barley is seeded at this time of year.

Eston lentil produced less than 1000 kg/ha in both seasons (Table 4). This is similar to dryland yields and, unless these yields are increased, would not be an economically viable option.

Buckwheat yields were very poor despite what appeared to be excellent stands (Table 4).

Canola yields with this type of management system will likely be 30-40% lower than full season canola. It will still be subject to sclerotinia damage and the problems this causes in the rotation.

Therefore, the economics of double cropping are questionable unless forage crops are valuable in the season in question or rotation benefits are considered. The yields obtained from seeding on rye stubble were similar to those obtained when canola was seeded at this time on wheat stubble from the previous season.

Table 4. Yields of crops grown after a rye forage crop (kg/ha).

Crop	Seeding	1990 Yield (kg/ha)	1990 SE	1991 Yield (kg/ha)	1991 SE
Grain (kg/ha)					
Eston lentil	broadcast	574	408	--	--
Eston lentil	drilled	654	231	849	92
Parkland canola	broadcast	840	---	--	--
Parkland canola	drilled	1425	40	1191	17
Buckwheat		---	--	411	35
Forage (kg/ha)					
Indian Head lentil	drilled	5055	1153	4443	243

Establishment and Seed Production of Turf and Forage Grasses

Principal: Newfield Seeds Limited, Nipawin, Saskatchewan
Funding: Irrigation Based Economic Development Agreement
Progress: Second year of three
Objectives: Difficulty in establishing grasses can limit the expansion of this crop type, particularly since no crop is obtained in the first season and weed control can be difficult. This project seeks to determine the effect of time of seeding and the use of a companion crop on the establishment and yield of turf and forage grasses.

In 1991, a six replicate test was planted as a split plot with main plot being early spring seeding, late spring seeding without a companion crop, late spring seeding with Biggar wheat as a companion crop and mid-July seeding. Weed control during the establishment year consisted of MCPA to control broadleafed weeds and mowing of plots where there was no companion crop. It was found that delaying seeding until mid-July virtually eliminated competition from green foxtail. The use of the wheat companion crop resulted in very poor establishment of all grasses with the fescues and turf grasses not establishing at all.

There was a fair amount of variability in seed yields with the seed yields of Dormie and Enjoy being very low at all seeding times (Table 1). Indeed the yields of all species were lower than desired with Paddock Meadow brome giving the best yields. Mid summer seeding appears to be satisfactory for most species but growing an annual forage crop prior to this may be necessary to obtain revenue. Further work on zero tillage or less competitive companion crops may be required to restrict soil crusting and provide revenue.

Table 1. Effect of seeding date on seed yield for six tested varieties.

Varieties	Early spring	Late spring	Mid-summer
Climate	362.4 a†	229.0 b	284.9 b
Jaguar	539.4 a	366.5 b	282.2 b
Paddock	484.0 b	365.7 c	581.0 a
Boreal	357.7 a	132.1 c	242.5 b
Dormie	43.2	33.8	62.4
Enjoy	56.6	39.3	65.4

† means values with the same letter are not different (P>0.05)

Feeding Value of Barley Silage Grown Under Irrigation Fed to Lactating Dairy Cows: Variety and Stage of Maturity

Principal: D.A. Christensen, University of Saskatchewan, Saskatoon, Saskatchewan
Funding: Irrigation Based Economic Development Agreement
Co-operator: B. Rossnagel, Crop Development Centre
Progress: Final year
Objective: To determine the nutritive characteristics of varieties of barley grown for silage on irrigation for use with high performance ruminants.

Barley is used extensively for dairy cattle in Saskatchewan both for the feeding value of its grain as well as the silage made from the whole plant. Irrigation is often used to increase the efficiency of production. Traditional varieties of barley often created harvesting problems with lodging of the plants when grown under conditions of high moisture and high fertilization. Advances in crop breeding have resulted in newer varieties that are more resistant to lodging under irrigation conditions and which are also improved in yield.

Duke, Virden and Heartland are such varieties of barley. Harrington is an established variety that also does well on dryland. While the increased yield of these new varieties has been obtained under irrigation as well as dryland conditions, the feeding value of these varieties as silage has not been investigated.

To determine the feeding value of silages from these varieties for dairy cattle, two feeding trials were conducted with the University of Saskatchewan dairy herd. Cows were fed the silage varieties along with a concentrate of rolled barley and supplement pellets balanced to make all silage rations equivalent in crude protein, calcium, phosphorus and other nutrients. Milk yield, milk composition, dry matter intake and some blood metabolites were measured and recorded.

In addition to testing barley varieties, one of the feeding trials was also structured so as to determine the effect the stage of maturity of the barley at time of cutting had on feeding value. Silages were cut at approximately 65 days maturity (early) or 72 days maturity (late). Milk production, milk composition, dry matter intake and blood metabolites were also measured.

Over both trials, average milk yields were 26.5, 28.2, 27.3, 27.8 kg/day for Harrington, Duke, Heartland and Virden varieties, respectively. Milk fat percentage and milk protein percentage was 3.70, 3.57, 3.75, 3.83 and 3.30, 3.32, 3.32, 3.28 for Harrington, Duke, Heartland and Virden varieties respectively. Both milk fat and protein percentages were above the proven acid averages.

Variety of barley was not as important in determining feed value as was stage of maturity at time of cutting. Although the Duke variety supported higher milk yield (28.2 kg) than Harrington variety (26.5 kg) in Trial 1 there was more effect on milk yield, milk composition and dry matter intake when stage of cut was compared in Trial 2. In Trial 2, cows fed silages cut late (72 days maturity) yielded more milk (28.7 vs. 26.4 kg), more kilograms of milk protein (.95 vs. .85) and ate more dry matter (20.2 vs. 18.3 kg) than cows fed the early cut (65 days maturity) silage.

The conclusion drawn from the feeding trials was that variety of barley is less important in determining the feeding value of barley silage than the stage of maturity at the time of cut.

Table 1. Effect of variety of barley silage on milk yield and composition: Trial 1.

	Harrington	SEM	Duke	SEM
Milk yield, kg/day	26.5b	1.70	28.2a	1.58
Persistency of yield, %	101.4	4.45	100.5	3.54
Milkfat, % (1)	3.7	0.14	3.57	0.13
3.5% FCM yield, kg/day	27.2	1.68	28.6	1.94
Persistency of 3.5% FCM yield %	99.3	4.17	99.9	3.00
Silage DM intake, kg/day	13.1	0.58	13.7	0.76
Conc DM intake, kg/day	8.7	0.40	9.1	0.62
Total DM intake, kg/day	21.8	0.98	22.9	1.39

ab Means within a row with different letters are significantly different ($P<0.05$).
Harvested 64 days after seeding.

Table 2. Composition of silages (% dry matter) Trial 1.

	Harrington	Duke
Dry matter	31.80	35.70
Crude protein	13.10	12.40
Calcium	0.50	0.53
Phosphorus	0.39	0.40
ADF	35.10	29.20
NDF	60.00	56.60

Table 3. Effect of silage variety and stage of maturity on milk yield and composition: Trial 2

Variety	Heartland		Virden	
Stage of cut*	Early	Late	Early	Late
Milk yield, kg/day	26.1b	28.4a	26.6b	28.9a
Persistency of yield, %	84.4b	98.7a	87.3b	99.6a
Milkfat, % (1)	3.94a	3.55b	3.90a	3.76a
3.5% FCM yield, kg/day	27.7b	28.5b	28.1b	30.0a
Conc, DM intake, kg/day	6.4b	7.5a	6.8b	7.6a
Silage DM intake, kg/day	10.6ab	10.2ab	9.7b	11.1a
Total DM intake, kg/day	17.0b	17.7ab	16.4b	18.7a
Silage DM, % of total intake	62.2a	57.8b	58.7b	59.2b
DM intake/100 kg 3.5% FCM, kg	67.4ab	69.7a	66.0b	69.1ab

abc Means within the same row with different letters differ significantly (P<0.05)

* Early = none to early milky dough stage; ~65 days after seeding. Late = mid to stiff dough stage;~ 72 days after seeding.

Table 4. Composition of Silages (% dry matter) Trial 2.

Variety	Heartland		Virden		Average	
Stage of cut	Early	Late	Early	Late	Early	Late
Dry Matter	34.5	35.6	33.0	34.1	33.7	34.8
Crude Protein	12.9	11.0	12.2	10.6	12.6	10.8
Calcium	0.5	0.28	0.36	0.32	0.41	0.35
Phosphorus	0.4	0.27	0.40	0.36	0.41	0.37
ADF	33.5	30.3	36.6	31.2	35.1	30.8
NDF	60.0	58.7	63.0	60.0	61.5	59.4

Adaptation and Recommendation Testing of Forage Crop Varieties in Saskatchewan

Principal: Saskatchewan Forage Council
Funding: Irrigation Based Economic Development Agreement (20%); Agriculture Development Fund (80%)
Co-investigators: B. Goplen, S.B.M. Wright, P. Jefferson, B. Gossen, R. Horton
Co-operators : R. Scowen (White Fox); G. Harbin (Lashburn)
Progress: Second year of three
Objectives:

a) to update and expand information available on recommended and registered forage variety performance across Saskatchewan;
b) to provide extension value to Forage Associations and other agencies by locating several research sites across the province;
c) to provide a larger data base for making variety recommendations to Saskatchewan forage producers.

To date, sites have been established at Loon Lake, White Fox, Melfort, Saskatoon, Outlook, Indian Head, Swift Current on irrigation and Swift Current on dryland. In 1992, the remainder of the sites will be estabished at Lashburn, Yorkton, Eastend and Estevan.

Second year yield and quality data was obtained from 1990 seeded alfalfa plots at Saskatoon, Outlook (irrigation) and Swift Current (dryland and irrigation). Second year irrigated alfalfa yields at Swift Current indicated that Trumpetor had the greatest first cut and total yield. Maxim had the greatest second cut yield. At Outlook, Rambler had the greatest first cut yield, Excaliber had the greatest second cut yield and total yield. It should be noted that, in the above variety observations, greatest yields or quality may be co-dominant with other varieties.

Hay Certification and Forage Market Access Project

Principal: Saskatchewan Forage Council
Funding: Irrigation Based Economic Development Agreement
Agriculture Development Fund
Co-investigators: Saskatchewan Feed Testing Laboratory, University of Saskatchewan
Progress: Second year of three
Objectives:

a) to implement an objective method of classifying hay for sale, facilitating the transfer of hay from seller to buyer;
b) to foster greater awareness of the production and worth of quality hay as reflected by the demands of the marketplace;
c) to investigate and establish techniques to facilitate the marketing of forage products.

The Hay Certification and Forage Market Access Project, initiated in May 1990, covers a three-year term. In the first year of the project, a coordinator was hired to implement the project and to develop a program to meet the objectives. A hay certification procedure and certificate was developed, describing the visual attributes and nutrient content of the forage. The certificate describes the hay to the buyer and can be used by the producer for promotion. Each spring, inspectors are trained. These inspectors, from various areas of the province, are available to certify hay for producers, on a fee-for-service basis. Support, in the form of advertising and promotion of inspector services, has been provided. Approximately 95 lots of hay were certified in the first year of the project.

The certified hays have been listed in the Feed Grain and Forage Listing Service of Saskatchewan Agriculture and Food.

A major portion of the project involved promotion of production and marketing on the basis of quality. Brochures and news releases have been prepared for livestock producer newsletters, radio, television and press, as well as utilizing Saskatchewan Rural Service Centers for information distribution. Promotion activities have included a forage day at Outlook the first year, attendance at producer meetings, and participation in fairs and major shows, such as Agribition.

Extensive rains in June of the second year of the project increased awareness of quality factors, especially mold in hay. Television interviews as a result of the rains produced greater awareness of the project itself and of the advantages of an objective description of hay.

In the second year of the project, inspector performance was reviewed. This allowed for 13 inspectors to be trained for a total of 19 inspectors available throughout the province. Inspectors were then able to travel shorter distances reducing the cost to the producer and increasing the number of lots certified. In total, 184 lots were inspected from 85 producers.

A major portion of the project in the second year involved promotion of both the project itself and of production and marketing of hay on the basis of quality.

Grass Species of Irrigated Pastures

Principal:	S. Wright Agriculture Canada Research Station, Saskatoon, Saskatchewan
Funding:	Irrigation Based Economic Development Agreement
Co-investigators:	B. Goplen, Agriculture Canada; R. Cohen and M. Howard, University of Saskatchewan
Co-operator:	N. McLeod
Location:	Outlook
Progress:	Second year of three
Objectives:	To provide information to producers on the suitability of seven grass species for irrigated pasture use.

Winter survival of all eight species was acceptable, with all grasses showing normal spring establishment. Fill in seeding was carried out in the spring on areas where establishment was not acceptable. There were no observable differences in the survival of the different species with all species showing some winterkill probably as a result of late season over-grazing by sandhill cranes and accidental grazing by sheep.

Summer grazing of the eight grass species was initiated May 30, and terminated September 13 despite some aftermath on the pastures. The early termination was carried out to maximize the potential overwintering of the more winter injury susceptible species. The experimental animals came off the pasture in excellent condition after 113 days of grazing. Four complete rotations of the six pastures were carried out with rest periods ranging from 17 to 27 days.

Pasture samples were obtained from eight exclosures in each grazed paddock. Clipping was carried out both inside and outside the exclosures to allow the estimation of the forage utilized. Sixteen tillers per species in each grazed paddock were marked and evaluated for the rate of elongation after grazing. The initial sample collection was carried out on June 4, and a total of 368 samples were collected. Pasture samples will be evaluated for the rate of digestion, crude protein, and the fiber constituents over the winter period. Pasture preference observations were initiated June 27, and a total of 55 observations were conducted throughout the grazing period.

Preliminary analysis of the animal preference data indicates the superior palatability of timothy throughout the grazing period. Slender wheatgrass was generally the lowest in palatability with a marked decline in grazing activity as this species matured. Intermediate wheatgrass was generally preferred over meadow and smooth bromegrass although the decline in preference was more marked than that of the two bromegrasses. These results are preliminary and data collection will continue over the next grazing season.

Hybrid Grain Corn Production

Principal:	B. Irvine Saskatchewan Irrigation Development Centre
Co-operator:	Lorne Jackson
Location:	Riverhurst
Progress:	Second year of ongoing
Objectives:	To evaluate the performance of grain corn hybrids.

Grain corn was planted May 7, 1990 and May 15, 1991. Weed control was fair in both seasons. While these trials are replicated there are a large number of potentially suitable hybrids which were not tested. Irrigation was excellent as was the nitrogen level in 1991. Yields and weights are given in Table 1. The yield levels for corn are not significantly higher than would be excepted for Canada Prairie Spring wheat however the site on which this test is located is quite sandy which may limit yields.

Table 1. Grain yield and weight.

	Yield kg/ha		kgs/m^2	
Cultivar	1990	1991	1990	1991
Pioneer 3995	4649	4843	772	772
Pioneer 3969	5744	5640	746	785
Pioneer 3979	4103	5260	682	772
HL3282	4096	3771	721	759
Pick 2435	5234	3957	759	785
Pick 2488	5636	4745	759	772
Pick 2477		4025		798
Pick 2404		4520		772
DK233	4060		772	
DK235	4024		746	
LG3	4340		798	
SE	459	371	23	23

Timothy Production under Irrigation

Principal:	B. Irvine, Saskatchewan Irrigation Development Centre
Funding:	Irrigation Based Economic Development Agreement
Progess:	Final year
Co-operator:	Kelvin Bagshaw
Location:	Birsay, Saskatchewan
Objective:	To determine the yields of timothy under irrigated conditions.

Clair timothy was planted in the spring of 1989 by broadcasting 10.6 kg/ha of seed and harrow packing twice. Prior to planting, the area received 153 kg/ha of phosphorus (P_2O_5) and 112 kg/ha of nitrogen. There was strong competition from wild oats and green foxtail and the stand obtained was only fair on the north half of the pivot and poor on the south half.

In 1990, the field was divided in half with one half receiving 112 kg/ha of N in the spring and the other half receiving 56 kg/ha in May and 50 kg/ha after the first cut. Initial nitrogen levels in 1990 were less than 11 kg/ha. In 1991, the field received 112 kg/ha of nitrogen on May 26 and an additional 112 kg/ha after first cut.

In 1990, rain delayed the first cut until July 7, while in 1991, rain delayed the first cut until July 27. First cut yields were 8.5 t/ha in 1990 and 6.7 t/ha in 1991. The poor stand on part of the field and low yields resulting from no second cut resulted in the demonstrator applying Roundup to the stand in the fall of 1991.

Given the significant cost of nitrogen and the fact that yields have not exceeded those of alfalfa, the price of timothy would have to be at least $10 per tonne greater than alfalfa to cover the nitrogen cost. At this time, the yields, relative to alfalfa, have not been compared but unless significant market opportunities develop, the risk of growing this crop is relatively high.

This field also had some quackgrass in it which made it impossible to compress for shipping to Japan. The Japanese are concerned that they may import the Hessian fly and do not allow importation of product with debris from wheat or wheat grasses unless it has been treated to kill this organism.

Effect of Nitrogen Timing on Timothy Yields

Principal:	B. Irvine, Saskatchewan Irrigation Development Centre
Funding:	Irrigation Based Economic Development Agreement
Progess:	Final year
Co-operator:	Paul and Silke Verwimp
Location:	Outlook, Saskatchewan
Objective:	To determine the potential yields of timothy under irrigation as influenced by timing of nitrogen application.

The timothy variety, Clair, was established in 1989 by broadcasting at 10 kg/ha on June 1 and harrowing. Phosphorous (P_2O_5) was applied at 140 kg/ha in 1989 and incorporated prior to planting. Green foxtail was a serious weed, which could not be controlled in 1989, and caused some competition. Once the green foxtail was headed out, it was cut for forage, but this forage had low value. Part of the success in establishing this stand was that heavy rains had created a very firm seedbed. Another site where the soil was dry before packing did not emerge despite application of water after planting. It would be desirable to have a relatively weed free field so that quackgrass plants could be easily spotted and removed using a wiping type of applicator and Roundup.

Soil test nitrogen levels in the spring of 1990 were less than 11 kg/ha. Nitrogen was applied at 157 and 90 kg/ha on June 2 using urea. Due to center pivot problems, both water and nitrogen were limited for the first cut in 1990. The custom applicator missed some areas in each pass which made nitrogen shortage very visible. The first cut was taken on June 20 and yielded 6.7 t/ha with no differences in yield between the strips. After the first cut, an additional 67 kg/ha of nitrogen was applied to the strips which had received only 90 kg/ha in the spring. The second cut was taken in late August and yielded 5.4 t/ha.

In 1991, nitrogen was applied to the entire field at 112 kg/ha on May 6. The first cut was taken on June 14 and had a yield of 6.3 t/ha. The quality of this material was very good; protein 17.66%, ADF 36.9, TDN 59, Ca 0.71% and P 0.21%. Nitrogen was applied at 67 kg/ha after the first cut and a yield of 5.4 t/ha was obtained from a late August cutting. Very little regrowth occurred in the fall.

Yields have been as good or better than alfalfa but nitrogen costs are $75-$100/ha and, thus, timothy hay must be sold at $8 to $10 per tonne more than alfalfa to be of similar value to the grower. Equal quality and higher yields can be obtained from bromegrass and intermediate wheatgrass, and unless strong Japanese markets can be developed, growing timothy in Saskatchewan may not be viable since the shipping distance to racehorse markets in the United States is great.

Rudy Rosedale Community Pasture Irrigation Project

The Rudy Rosedale Irrigation Alfalfa Project was set up to provide alfalfa hay to PFRA pastures and to demonstrate irrigated alfalfa production. Like many producers, the quantity and quality of hay were reduced from previous years, mainly due to the wet conditions during the first cut. There were again a few agronomic demonstrations conducted at Rudy and they are reported elsewhere in this report.

Operation

Three quarters were in straight alfalfa this year with one quarter (NW) in oats and alfalfa. The oats were drilled in on May 31 at 24 kg/ha and the alfalfa was seeded immediately after with a Valmar applicator at 13 kg/ha. Fertilizer was applied on all quarters according to soil test recommendations. With the cool, moist conditions, establishment of the alfalfa was very good.

Tables 1 and 2 indicate the quantity and quality of hay and Table 3 indicates the allocation of bales to the pastures.

Table 1. Forage yields at Rudy Rosedale Community Pasture.

	Alfalfa Hay (t/ha)					Greenfeed Oats (t/ha)	
Year	1st cut	2nd cut	3rd cut	Total	No. of bales	1st cut	No. of bales
1984	4.03	4.26		8.3	3400		
1985	4.30	4.70		9.0	3559		
1986	4.48	3.44		7.9	3215		
1987	4.70	2.47		7.2	2568	9.25	1050
1988	3.70	2.10	1.0	6.8	1480	7.50	1639
1989	4.60	3.50	1.8	9.9	2280	6.70	1482
1990	5.07	4.23	0	9.3	2209	7.76	1803
1991	3.33	3.91	0	7.2	2308	2.96	290

Table 2. Forage quantity and quality at Rudy Rosedale Community Pasture in 1991.

Location	Quantity (no.)	Protein (%)	TDN (%)	Nitrates (%)	Ave. weight (kg)
SW 1st cut	324	16.30	50-52	0	497
SE 1st cut	368	18.56	52-54	Trace	435
NE 1st cut	364	16.47	50-52	Trace	499
NW oats	290	14.78	58-60	Trace	560
SW 2nd cut	366	17.63	60-62	Trace	560
SE 2nd cut	387	17.42	58-60	Trace	553
NE 2nd cut	310	22.24	59-61	Trace	557
NW 2nd cut	189	23.59	69-70	Trace	603
<u>Square Bales</u>					
NE 1st cut	1440	16.47	50-52	Trace	31
SE 2nd cut	1560	17.42	58-60	Trace	34

Table 3. 1991 bale allocation

	Alfalfa	Oat
Mount Hope-Prairie Rose	120	60
Rudy-Rosedale	227	36
Ituna Bon Accord	180	--
Garry	270	30
Antelope Park	120	30
Maple Creek Bull Station	159	28
Kindersley - Elma	60	--
Fairview	30	--
Eagle Lake	60	--
Monet	30	--
Newcombe	120	60
Battle River - Cut Knife	150	--
Paynton	180	--
Auvergne - Wise Creek	30	--
Beaver Valley	30	--
Nashlyn	--	30
Webb	30	--
Oakdale	164	16
Bitter Lake	30	--
Shamrock	90	--
Govenlock	60	--
Hazel Dell	90	--
Dundurn	60	--
Total	2,290	290

Response of Established Irrigated Alfalfa to Nitrogen Fertilization

Principal: T. Hogg, Saskatchewan Irrigation Development Centre
Location: Rudy Rosedale Community Pasture (SW 01-31-07-W3)
Progress: Final year
Objectives: To determine the response of established irrigated alfalfa to nitrogen fertilization.

A demonstration project was established at the Rudy Rosedale Irrigated Alfalfa Project on the SW01-31-07-W3 to determine the response of established irrigated alfalfa to nitrogen fertilization. Nitrogen treatments consisted of two rates (25 and 50 kg N/ha) applied at two times (spring and 1st cut) as a surface broadcast application of ammonium nitrate (34-0-0).

Alfalfa yield (Table 1) and quality (Table 2) were not significantly affected by the rate or time of nitrogen fertilization. The nitrogen requirements of this stand of alfalfa appear to be met through nitrogen fixation. Similar results were observed in 1990.

Table 1. The first cut, second cut and total yearly dry matter yields for the alfalfa nitrogen demonstration plot.

Treatment (kg N/ha)	Dry Matter Yield (kg/ha) Cut 1 (June 17)	CV (%)	Cut 2 (Aug. 20)	CV (%)	Total	CV (%)
0	3160	10.7	3362	10.9	6522	9.2
25 Spring	3750	8.1	3502	12.4	7255	9.2
50 Spring	3659	7.1	3160	11.7	6819	8.6
25 1st Cut	3667	2.3	3318	13.4	6985	6.9
50 1st Cut	3374	10.3	3383	19.3	6758	13.7
L.S.D. (0.05)	NS†		NS		NS	

†Not significant at P = 0.05.

Table 2. Plant analyses of the first cut for the alfalfa nitrogen demonstration plot.

Treatment (kg N/ha)	N	P	K	S	Ca	Mg	Cu	Fe	Mn	Zn	B
	%						ug/g				
0	3.52	0.30	2.39	0.30	1.65	0.37	4	109	41	19	36
25 Spring	3.46	0.32	2.09	0.32	1.80	0.38	4	141	47	18	33
50 Spring	3.47	0.31	2.28	0.32	1.74	0.36	5	126	42	21	37
25 1st Cut	3.39	0.31	2.08	0.31	1.79	0.39	5	104	41	18	38
50 1st Cut	3.41	0.30	2.26	0.29	1.64	0.36	4	106	41	19	33

Irrigated Grass-Alfalfa Mixtures for Forage Production

Principal: T. Hogg, Saskatchewan Irrigation Development Centre
Location: Rudy Rosedale Community Pasture (NE 01-31-07-W3)
Progress: Second year of four
Objectives: To determine the yield and quality of irrigated grass-alfalfa mixtures.

A demonstration project was established at the Rudy Rosedale Irrigated Alfalfa Project to determine the yield and quality of irrigated grass-alfalfa mixtures. In 1990, seven grass varieties were seeded in mixture with Beaver alfalfa. The first yields were collected in 1991. Results indicated that bromegrass, intermediate wheatgrass, slender wheatgrass and meadow bromegrass in mixture with alfalfa produced significantly higher yields than pure alfalfa (Table 1). Quality of the pure alfalfa was superior to the grass-alfalfa mixtures, however, the quality for the grass-alfalfa mixtures was adequate for beef cattle (Table 2).

Yields of this plot will be monitored in subsequent years to determine the longterm viability of the grass-alfalfa mixtures for irrigated forage production.

Table 1. The first cut, second cut and total yearly dry matter yields for the grass-alfalfa demonstration plot.

Treatment	Dry Matter Yield (kg/ha)					
	Cut 1 (June 17)	CV (%)	Cut 2 (Aug. 20)	CV (%)	Total	CV (%)
Alfalfa	3443	10.8	2603	14.7	6046	4.1
Slender wheatgrass-alfalfa	4577	12.2	2882	17.8	7459	13.1
Intermediate wheatgrass-alfalfa	5388	5.8	2550	8.1	7939	1.4
Meadow bromegrass-alfalfa	4842	6.2	2879	5.8	7721	4.3
Bromegrass-alfalfa	5791	8.0	2808	26.2	8599	13.7
Timothy-alfalfa	3975	6.0	2690	14.7	6665	6.8
Creeping foxtail-alfalfa	3624	18.2	2833	14.3	6457	14.9
Reed canarygrass-alfalfa	3666	11.4	3036	12.1	6703	8.2
L.S.D. (0.05)	665		NS†		1039	

†Not significant at P = 0.05.

Table 2. Forage analysis for the grass-alfalfa demonstration plot.

Cut #	Treatment	Protein	T.D.N.	Ca	P	NO_3	A.D. Fibre
		%					
1	Alfalfa	20.66	62-64	1.70	0.31	trace	32.58
	Slender wheatgrass-alfalfa	17.88	59-61	0.90	0.30	trace	35.92
	Intermediate wheatgrass-alfalfa	15.71	57-59	0.52	0.32	trace	39.77
	Meadow bromegrass-alfalfa	14.56	56-58	0.70	0.27	0.34	40.08
	Bromegrass-alfalfa	13.29	53-56	0.51	0.27	0.31	43.03
	Timothy-alfalfa	16.32	58-60	0.84	0.31	trace	36.82
	Creeping foxtail-alfalfa	19.63	----	1.58	0.33	----	----
	Reed canarygrass-alfalfa	20.88	61-63	1.52	0.33	0.29	33.41
2	Alfalfa	24.52	62-64	1.59	0.33	trace	33.19
	Slender wheatgrass-alfalfa	17.86	57-59	0.87	0.27	trace	40.04
	Intermediate wheatgrass-alfalfa	23.14	63-66	1.12	0.37	trace	31.78
	Meadow bromegrass-alfalfa	16.90	56-58	0.71	0.29	trace	40.83
	Bromegrass-alfalfa	18.21	58-60	0.68	0.33	trace	37.49
	Timothy-alfalfa	18.69	59-61	0.83	0.33	trace	36.40
	Creeping foxtail-alfalfa	19.83	58-60	1.09	0.34	0.64	36.76
	Reed canarygrass-alfalfa	18.23	57-59	0.77	0.29	trace	39.09

Response of Irrigated Alfalfa to Soil Incorporated Micronutrient Fertilization Applications

Principal: T. Hogg, Saskatchewan Irrigation Development Centre
Location: Rudy Rosedale Community Pasture (NW 01-31-07-W3)
Progress: Year one of ongoing
Objectives: To determine the response of irrigated alfalfa to soil incorporated micronutrient fertilizer applications.

A demonstration plot was established at the Rudy Rosedale Irrigated Alfalfa Project on the NW01-31-07-W3 to determine the response of irrigated alfalfa to soil incorporated micronutrients. Soil analyses indicated a marginal level of copper on an area where alfalfa was to be established in 1991 (Table 1). Two rates of copper and zinc (10 and 20 kg/ha) were surface broadcast and soil incorporated prior to seeding. Beaver alfalfa was seeded with an oat companion crop. The companion crop was cut for greenfeed at the heading growth stage and the alfalfa regrowth was cut in mid-September after the first killing frost.

There was no significant yield increase for either the greenfeed oats or the alfalfa regrowth (Table 2). Plant analyses of the alfalfa regrowth indicated no dramatic changes in nutrient content for the micronutrient treatments (Table 3).

Soil samples collected in the fall indicated that the level of soil available copper and zinc had been increased by the respective micronutrient fertilizer applications.

Response of irrigated alfalfa to the soil incorporated micronutrient applications will be monitored in subsequent years.

Table 1. Spring soil analyses for the alfalfa micronutrient demonstration plot.

Rep	Depth (cm)	pH	1:1 E.C. (dS/m)	NO_3-N	P	K	SO_4-S	Cu	Fe	Zn	Mn	B
				kg/ha								
1 + 2	0-15	6.8	0.4	62	49	296	27	0.9	53.0	3.4	43.7	0.8
	15-30	6.9	0.4	83			30					
	30-60	7.2	0.3	93			38					
3 + 4	0-15	6.6	0.4	53	49	291	29	0.8	54.0	3.9	38.1	1.0
	15-30	6.9	0.3	54			31					
	30-60	7.6	0.4	81			35					

Table 2. The dry matter yield of oats greenfeed and alfalfa for the alfalfa micronutrient demonstration plot.

Treatment (kg/ha)	Dry Matter Yield (kg/ha) Oats Greenfeed (July 24)	CV (%)	Alfalfa (Sept. 19)	CV (%)
0	5257	18.6	1842	24.4
10 Cu	5484	2.8	1971	17.0
20 Cu	4891	12.3	1866	16.6
10 Zn	4583	34.7	1724	33.2
20 Zn	4582	13.8	1827	21.7
L.S.D. (0.05)	NS†		NS	

†Not significant at P = 0.05.

Table 3. Plant analyses for the alfalfa micronutrient demonstration plot located on the NW 01-31-07-W3.

Treatment (kg/ha)	N	P	K	S	Ca	Mg	Cu	Fe	Mn	Zn	B
	%						ug/g				
0	3.59	0.24	2.05	0.32	1.68	0.38	5	156	55	21	42
10 Cu	3.50	0.23	2.01	0.31	1.59	0.37	5	150	53	20	39
20 Cu	3.60	0.22	1.84	0.31	1.63	0.38	5	213	56	21	39
10 Zn	3.70	0.23	1.90	0.33	1.76	0.40	5	209	62	23	43
20 Zn	3.70	0.23	2.10	0.32	1.61	0.37	5	147	55	23	41

Response of Established Irrigated Alfalfa to Micronutrient Fertilization Applications

Principal: T. Hogg, Saskatchewan Irrigation Development Centre
Location: Rudy Rosedale Community Pasture (SW 01-31-07-W3)
Progress: Final year
Objectives: To determine the effect of micronutrient fertilization on established irrigated alfalfa.

In 1990, a demonstration project was established at the Rudy Rosedale Irrigated Alfalfa Project on the SW01-31-07-W3 to determine the response of established irrigated alfalfa to copper and zinc fertilization. Soil available copper and zinc were low. Results indicated that there was no yield response to the surface broadcast micronutrients in the year of application.

In 1991, response to the residual copper and zinc applications was monitored. There was no significant yield increase (Table 1). Plant analyses for the first cut indicated no dramatic changes in nutrient content for the micronutrient fertilizer treatments (Table 2). Copper and zinc do not appear to be limiting alfalfa production at this site.

Table 1. The first cut, second cut and total yearly dry matter yields for the alfalfa micronutrient demonstration plot.

Treatment (kg/ha)	Dry Matter Yield (kg/ha)					
	Cut 1 (June 17)	CV (%)	Cut 2 (Aug. 20)	CV (%)	Total	CV (%)
0	3313	4.8	3525	5.7	6838	3.8
11 Cu	3127	15.7	3401	16.6	6528	15.1
22 Cu	3848	26.5	3386	7.7	7235	17.1
15 Zn	3447	18.3	3479	15.4	6926	15.1
30 Zn	3282	10.5	3510	2.8	6793	5.4
L.S.D. (0.05)	NS†		NS		NS	

†Not significant at P = 0.05.

Table 2. Plant analyses of the first cut for the alfalfa micronutrient demonstration plot located on the SW 01-31-07-W3.

Treatment (kg/ha)	N	P	K	S	Ca	Mg	Cu	Fe	Mn	Zn	B
	%						ug/g				
0	3.32	0.28	2.57	0.26	1.49	0.34	5	112	38	18	35
11 Cu	3.56	0.30	2.73	0.29	1.59	0.36	6	86	34	20	39
22 Cu	3.49	0.28	2.72	0.28	1.44	0.32	8	110	36	21	36
15 Zn	3.52	0.28	2.64	0.30	1.58	0.34	5	104	37	21	38
30 Zn	3.46	0.29	2.70	0.29	1.51	0.35	4	102	39	21	36

Potassium Requirements of Irrigated Alfalfa

Principal: T. Hogg, Saskatchewan Irrigation Development Centre
Location: L. Knapik (NE 01-29-08-W3); Spigott Brothers (NE 29-28-8-W3); J. Torrie (NE 11-22-7-W3); Rudy Rosedale (NE 1-31-7-W3)
Progress: Year one of two for the first three sites and year two of ongoing for the fourth site
Objectives: To determine the response of irrigated alfalfa to potassium fertlization.

A demonstration project was established to determine the effect of potassium fertilization on irrigated alfalfa. Four sites with differing soils were selected (Table 1). Plots were established on three established irrigated alfalfa fields in the spring of 1991 (sites 1-3). Potassium treatments included rates of 0, 50, 100 and 150 kg K_2O/ha surface broadcast as potassium chloride (0-0-60) and potassium sulfate (0-0-50).

A fourth plot was established in 1990 on a field being established in alfalfa (site 4). Treatments included both annual (50 and 100 kg K_2O/ha) and large once only (100, 200 and 400 kg K_2O/ha) potassium fertilizer applications that were surface broadcast and soil incorporated prior to seeding. In 1991, fertilizer was applied to the annual treatments.

Table 1. Irrigated alfalfa potassium fertilization demonstration site characteristics.

Site #	Legal Description	Soil Association	Surface Texture
1	NE 01-29-08 W3	Asquith	FSL
2	NE 29-28-08 W3	Asquith	SL
3	NE 11-22-07 W3	Fox Valley -Haverhill	L
4	NE 01-31-07 W3	Dune Sand	LS-S

Initial soil analyses indicated a range in soil available potassium levels, however, all were considered sufficient according to current soil test benchmarks (Table 2).

Table 2. Initial soil analyses for the irrigated alfalfa potassium fertilization demonstration sites.

Site #	Depth (cm)	pH	1:1 E.C. (dS/m)	NO_3-N	P	K	SO_4-S
				--------	kg/ha	--------	
1	0-15	7.6	0.4	30	18	427	26
	15-30	7.7	0.4	18			20
	30-60	7.9	0.5	15			53
2	0-15	7.7	0.3	20	32	638	21
	15-30	7.8	0.4	17			24
	30-60	7.9	0.9	15			110
3	0-15	7.3	0.4	7	25	690	28
	15-30	7.7	0.8	6			59
	30-60	8.0	2.3	22			113
4	0-15	6.7	0.3	16	26	241	15
	15-30	7.1	0.2	16			24
	30-60	7.2	0.2	28			34

The yield of irrigated alfalfa was not significantly increased by the rate or source of potassium fertilizer (Table 3 and 4). Plant analyses indicated that the potassium content was increased by the potassium applications for site 4 (Table 5). The other sites showed no such trend.

Fall soil analyses indicated an increase in soil available potassium where potassium fertilizer had been applied.

Response of the irrigated alfalfa to the potassium fertilizer applications will be monitored in 1992.

Table 3. The yield of irrigated alfalfa for the potassium fertilization demonstration for Sites 1 - 3.

TREATMENT	DRY MATTER YIELD (kg/ha)											
	1st Cut						2nd Cut					
(kg K_2O/ha)	Site 1	CV (%)	Site 2	CV (%)	Site 3	CV (%)	Site 1	CV (%)	Site 2	CV (%)	Site 3	CV (%)
0	3952	7.4	4283	6.7	4355	9.4	988	21.3	2668	25.7	2169	31.7
50 KCl	3983	4.6	4320	7.6	4463	4.7	916	3.9	2469	29.9	2173	20.4
50 K_2SO_4	4173	5.0	4176	8.0	4435	6.6	876	9.8	2379	38.0	2425	30.3
100 KCl	3977	3.5	4240	5.7	4236	8.5	874	6.2	2666	41.0	2428	30.5
100 K_2SO_4	4233	2.8	4106	2.9	4510	4.5	1011	16.9	2497	32.3	2320	29.7
150 KCl	4268	9.9	4121	6.4	4501	11.4	851	5.8	2605	35.3	2321	18.3
150 K_2SO_4	4194	3.9	3986	7.4	4367	9.8	816	6.6	2476	35.1	2353	32.0
L.S.D.(0.05)	NS†		NS		NS		NS		NS		NS	

†Not significant at P = 0.05

Table 4. The yield of irrigated alfalfa for the potassium fertilizer demonstration for Site 4.

Treatment (kg K_2O/ha)	Total Potassium Added (kg K_2O/ha)	Dry Matter Yield (kg/ha) 1st Cut	CV %	2nd Cut	CV %
0	0	2475	12.3	2036	10.4
50 Annual	100	2911	10.7	1743	12.5
100 Annual	200	2953	9.3	2049	12.9
100 Once	100	2756	10.0	1914	9.1
200 Once	200	2695	11.1	2064	9.4
400 Once	400	2939	10.0	2276	19.4
L.S.D. (0.05)		NS†		NS	

†Not significant at P = 0.05

Table 5. Plant analyses of the first cut for the irrigated alfalfa potassium fertilization demonstration.

Treatment ($kg K_2O/ha$)	N	P	K	S	Ca	Mg	Cu	Fe	Mn	Zn	B
	%						ug/g				
Site 1											
0	3.67	0.32	2.27	0.28	1.79	0.49	6	93	44	21	34
50 KCl	3.75	0.32	2.30	0.28	1.84	0.49	5	97	45	19	33
50 K_2SO_4	3.61	0.32	2.28	0.27	1.77	0.48	5	92	41	19	32
100 KCl	3.64	0.31	2.28	0.27	1.81	0.50	5	78	45	24	33
100 K_2SO_4	3.49	0.31	2.33	0.28	1.78	0.50	5	82	47	28	32
150 KCl	3.54	0.32	2.40	0.28	1.80	0.49	5	78	40	23	32
150 K_2SO_4	3.72	0.32	2.36	0.30	1.74	0.47	5	76	42	23	33
Site 2											
0	3.38	0.31	3.11	0.27	1.62	0.36	7	94	31	19	33
50 KCl	3.26	0.31	3.15	0.27	1.52	0.35	7	81	31	21	32
50 K_2SO_4	3.55	0.32	3.20	0.29	1.58	0.36	7	84	30	21	34
100 KCl	3.67	0.32	3.18	0.29	1.64	0.37	7	78	32	20	34
100 K_2SO_4	3.42	0.32	3.03	0.29	1.61	0.36	8	88	32	20	34
150 KCl	3.47	0.34	3.46	0.32	1.72	0.38	8	99	35	32	37
150 K_2SO_4	3.44	0.32	3.18	0.29	1.58	0.37	7	112	31	20	34
Site 3											
0	4.16	0.41	2.31	0.32	1.84	0.36	8	127	47	32	44
50 KCl	4.23	0.42	2.61	0.33	1.89	0.37	8	136	50	31	45
50 K_2SO_4	4.33	0.42	2.57	0.33	1.82	0.37	8	131	50	36	45
100 KCl	4.28	0.44	2.35	0.33	1.83	0.37	7	177	52	39	43
100 K_2SO_4	4.20	0.42	2.36	0.34	1.80	0.36	8	138	47	40	41
150 KCl	4.24	0.41	2.32	0.32	1.80	0.36	7	136	47	37	42
150 K_2SO_4	4.32	0.43	2.34	0.35	1.82	0.36	8	132	49	35	44
Site 4											
0	3.73	0.34	1.60	0.30	1.85	0.38	5	100	48	27	34
50 Annual	3.68	0.33	1.78	0.28	1.83	0.35	4	100	46	27	33
100 Annual	3.62	0.35	1.83	0.30	1.82	0.33	4	100	48	26	34
100 Once	3.69	0.34	2.04	0.30	1.91	0.36	4	107	51	28	37
200 Once	3.70	0.35	1.93	0.30	1.75	0.34	4	104	49	32	36
400 Once	3.67	0.33	2.08	0.28	1.63	0.30	5	95	47	27	36

Specialty Crops

Specialty Crop Development Program

Specialty Crops Demonstration Program

Other Specialty Crops Projects

Specialty Crop Development Program

Principal: J. Wahab
Saskatchewan Irrigation Development Centre

Introduction

The Specialty Crops Development Program at the Saskatchewan Irrigation Development Centre was designed (i) to develop and improve agronomic practices for irrigated production of special crops with emphasis on dry bean, field pea, and fababean, and (ii) to evaluate new crops with market potential and generate appropriate agronomic practices for these crops. The focus of agronomic research during the summer of 1991 was on cultivar evaluation, irrigation scheduling, seeding rate x row spacing, and harvesting techniques for several specialty crops adapted for irrigated production in South Central Saskatchewan.

Irrigation Scheduling Studies

Irrigation scheduling studies were established under the linear irrigation system which is capable of controlled water application. Dry bean (cv. Othello), field pea, fababean, safflower (cv. Saffire), grass pea (Lathyrus), lupin (cv. Ultra), fenugreek (NC-109-1), and coriander (cv. Autumn) were subjected to moisture response studies. In the field pea test, the irrigation treatments were compared against four cultivars with contrasting leaf types and growth habits: Radley (medium height) and Tipu (tall) semi-leafless; Express (medium height) and Century (tall) regular leaf. The lathyrus study included three irrigation regimes and four lathyrus lines (X860125, L887117, LS87087, LS740026) with Century and Tara field pea as checks. In the fababean trial, six lines (Outlook, Chinese broad bean, 86LYL04, 86LYL08, 86SLT03, and 86LH08) were tested. For safflower, three seeding rates (15, 22.5, and 30 kg/ha) were tested under three irrigation levels. The remaining tests were exposed to four moisture regimes. The total precipitation and the amount of water applied from seeding to harvest for the different crops are summarized in Table 1.

Table 1. Irrigation application and the total rainfall from seeding to harvest of the different crops in the irrigation scheduling study.

	Irrigation (mm)				In season
Crop	Dry-land	Partial -1	Partial -2	Full irr.	Rain-fall (mm)
Fababean	0	25	76	140	311
Dry bean	0	25	51	102	236
Field pea	0	25	51	140	308
Coriander	0	25	51	127	248
Fenugreek	0	25	51	140	243
Lupin	0	25	51	140	306
Safflower†	0	-	51	140	254
Lathyrus†	0	-	51	140	245

†Safflower and Lathyrus were subjected to only three moisture levels.

Marketable yield and average seed weight of the different crops in response to moisture levels are described in Table 2. Pinto bean, fababean, lupin and coriander responded positively to all levels of supplemental water application. Highest lupin and fababean yields were observed at the maximum irrigation levels (approximately 450 mm total moisture).

Irrigation reduced yields in safflower and fenugreek. The lack of response to irrigation on safflower and coriander may indicate that the crop moisture requirements were adequately supplied by rainfall. There was no visual evidence of increased disease incidence for irrigated treatments.

Agronomic Investigations

Dry Bean Research

During the 1991 summer season, emphasis in dry bean research was focused on evaluating new cultivars, hastening crop maturity (to avoid fall frost damage), and on minimizing harvest loss through direct harvesting.

Cultivar Evaluation

The Prairie Dry Bean Wide Row Co-operative Test was conducted at SIDC for the fifth year. Forty entries in the different market classes of dry bean were included in the study. The pink bean RNK 312 produced the highest yield (Table 3). Flint and ISB 82772 were the highest yielders in the pinto and kidney market classes respectively. The number of pods held 5 cm above the ground level was visually assessed, and ranged from 17% to 38% among the different pinto bean entries. Arapaho bean had the lowest percentage of pods closest to the ground in 1991.

The Prairie Dry Bean Narrow Row Co-op Test was grown at SIDC for the second year. This test is designed to identify cultivars adapted for narrow low/high density planting (solid seeding) with minimal disease spread and suited for direct harvesting. The test included black, kidney, navy, and pinto market classes. Seed yields in this test were relatively higher than those in the Wide Row Co-op (Table 4). The feasibility of growing pinto bean cultivars with suitable architecture for direct harvesting at higher plant populations should be further researched when such cultivars become available.

The US Dry Bean Nursery was grown at SIDC for the sixth year in succession. Thirty-eight entries of different market classes were tested. The kidney bean Redkloud was the overall highest yielder (Table 5). Several entries in this nursery were too late maturing for Saskatchewan conditions.

Bean cultivars Viva (pink), UI59 (great northern), Midnight (black), and Montcalm (kidney) were tested in the Bean Modelling Nursery. Viva produced the highest yield (Table 6). The other cultivars produced similar yield.

Seed Priming Study

Vegetable seed research has shown that cyclical wetting and drying of seed enhanced germination and increased yield. Based on these findings, Othello seeds were subjected to 1, 2, and 3 cycles of alternate wetting (4 hrs) and drying (20 hrs). The treated seeds were compared with an untreated control. The dried seeds were sown in plots using the Fabro plot seeder with a target seeding rate of 30 seeds/m^2. No visible damage was caused to the primed seeds during the seeding operation. A progressive increase in yield was obtained with each increase in the number of wetting/drying cycles (Table 7). The three-cycle treatment recorded the highest plant stand compared to the other treatments which may have contributed to increased yield for the three-cycle treatment. This study will be repeated in 1992 to further investigate the effect of seed priming on dry bean growth and development.

Table 2. Yield and average seed weight of dry bean, field peas, fababean, safflower, lathyrus, fenugreek, lupin, and coriander in response to different levels of water application.

Irrig. level	Dry bean	Field pea	Faba-bean	Saff-lower	Lath-yrus	Fenu-greek	Lupin	Cori-ander
				Yield (kg/ha)				
Dry	3003	3696	3277	4509	3836	2228	4053	1954
P-1	3547	4138	3683	-	-	1916	4749	2314
P-2	3464	3889	4004	4251	4059	1602	4413	2062
Full	3443	3765	4110	3972	4292	1767	4839	2132
Sig.	0.05	NS	<0.01	<0.01	NS	<0.01	<0.01	0.05
LSD(5%)	499	-	869	417	-	218	334	327
CV (%)	14.5	14.4	6.4	6.7	20.1	11.1	7.1	10.5
				1000 Seed weight (g)				
Dry	357	209	310	37.3	183	5.58	301	168
P-1	389	206	315	-	-	5.44	302	162
P-2	379	208	330	37.1	193	5.13	290	168
Full	402	200	321	37.8	193	5.13	290	168
Sig.	<0.01	0.01	NS	NS	<0.01	<0.01	NS	NS
LSD(5%)	18	11	-	-	11	0.33	-	-
CV (%)	4.5	3.8	28.6	3.6	4.4	6.0	4.6	5.9

Pea - irrigation main effect (averaged over cultivars).
Fababean - irrigation main effect (averaged over cultivars).
Safflower - irrigation main effect (averaged over seeding rates).

Test	Plot size (m)	Seeding	Harvesting
Fababean	2.4 x 3.6	May 06	Aug. 21-30
Dry bean	1.2 x 3.6	May 30	Sept. 6
Coriander	1.2 x 3.6	May 23	Sept. 25
Field pea	1.2 x 3.6	May 08	Aug. 20
Fenugreek	1.2 x 3.6	May 28	Sept 13
Lupin	1.2 x 3.6	May 10	Sept 16
Safflower	1.2 x 3.6	May 17	Sept 19
Lathyrus	1.2 x 3.6	May 18	Sept 3-10

Table 3. Growth and yield characteristics of different market classes of dry bean: WIDE ROW CO-OP TEST.

Market class /entry	Days to flower	Plant ht.(cm)	Yield kg/ha	Seed wt.(mg)	Seed quality†	Pods held <5cm
Kidney						
Redkloud	44	47	3149	519	6.6	23
ISB 82772	44	36	3271	666	6.8	21
ISB 82865	43	46	2763	572	8.0	27
Red Mexican						
NW 63	46	64	3455	366	6.6	34
Pinto						
ISB 82354	46	65	2993	387	7.8	33
Flint	50	74	3645	384	7.9	23
RNK-232	49	43	3171	362	7.9	26
ISB 8414	49	75	3244	398	7.4	38
Othello	49	61	2976	393	8.9	25
Agassiz	47	41	3395	416	9.0	21
6315	49	41	2937	418	8.6	26
NW 410	50	72	3305	336	7.1	30
Arapaho	51	70	2627	373	7.3	17
Bill-Z	48	71	3533	357	6.3	23
Pink						
RNK 312	48	59	4096	364	6.9	18
Viva	48	53	3568	288	7.0	18
UI 537	47	64	3348	348	6.3	25
Black						
88147	50	32	2282	196	8.5	14
88190	50	36	2808	183	8.3	12
88225	46	31	1893	226	8.8	16
88133	53	43	2725	198	8.1	8
UI 906	53	46	3129	164	8.0	12
88184	44	39	2352	192	8.0	18
88140	53	38	2875	197	8.3	23
Loop	56	50	3103	188	8.5	12
HR 21-893	53	51	3962	185	8.8	16
88186	51	37	2326	155	8.1	13
Great Northern						
Beryl	50	55	3404	299	7.9	26
US 1140	47	71	3401	350	7.8	44
Navy						
6137	49	56	3108	180	6.1	11
HR 16-818	53	47	2660	201	7.8	12
LS 91-1	49	38	2680	212	8.3	12
Seaforth	49	40	2390	221	8.1	12
ISB 486	47	37	2569	184	6.8	12
ISB 565	46	37	2398	212	5.4	11
RNK 103	47	59	2543	190	6.5	17
ISB 65912	48	33	2493	207	6.5	9
Schooner	51	62	2300	176	5.1	17
UI 158	52	61	2830	185	5.5	21
Significance	-	-	<0.01	<0.01	<0.01	-
LSD (5.0%)	-	-	562	24	1.2	-
C.V. (%)	-	-	13.5	5.4	11.5	-

† Seed quality rating, 1 to 10 - poor to excellent.
Plot size - 1.2 x 3.6 m
Seeding date - May 27, 1991
Harvesting date - Sept. 5-13, 1991
Rainfall - 236mm
Irrigation - 76 mm

Table 4. Yield components, seed quality, and lodging percentage in different market classes of beans: NARROW ROW CO-OP TEST.

Market class / Entry	Lodging (%)	Pods held <5cm(%)	Yield (kg/ha)	Seed weight (mg)	Seed quality†
Kidney					
ISB 82865	00	10	3135	606	7.6
Navy					
K0107	35	25	3872	176	6.9
LRS 91-1	8	28	2991	211	8.3
L 9322	0	5	2801	207	5.6
Seaforth	13	17	2870	209	8.1
HR 55	35	14	2783	196	8.0
Black					
UI 906	0	8	3302	164	7.5
Pinto					
Agassiz	8	13	3924	410	7.9
Topaz	15	23	3945	396	7.9
Significance	-	-	<0.01	<0.01	<0.01
LSD (5.0%)	-	-	423	17	1.2
C.V. (%)	-	-	8.8	4.1	11.2

† - Seed quality rating 1=poor, 10=excellent.
Plot size - 1.2 x 3.6 m
Seeding date - May 27, 1991
Harvesting date -Sept. 6, 1991
Rainfall - 236 mm
Irrigation - 76 mm

Table 5. Yield components in different market classes of dry bean: US DRY BEAN CO-OP TRIAL.

Market class	Days to flowering	Yield (kg/ha)	Seed weight (mg)	Seed quality†
Kidney				
K-59-7	50	3085	545	7
CDRK 82	50	3025	586	9
CELRK	49	3295	686	8
Redkloud	46	3599	573	7
Montcalm	49	3092	570	9
SVM 29-21	45	2898	541	7
SVM 31-19	48	2410	614	8
SVM 37-16	47	2636	627	7
SVM 40-23	45	2281	646	7
Red Mexican				
NW 63	48	3642	372	8
5229	49	3345	353	7
Pinto				
Olathe	52	3355	344	8
UI 114	53	3396	373	8
UI 537	49	3159	395	7
Arapaho	53	3204	396	7
6315	51	2868	429	8
Pink				
Viva	49	3358	307	8
Black				
UI 906	49	3336	175	7
Panther	53	2680	293	9
HR 21-893	53	3922	204	9
Midnight	56	3048	195	8
Great Northern				
UI 59	50	3758	343	7
CO 1760	51	2831	273	5
Beryl	52	3796	315	8
Starlight	51	2789	425	8
54028	52	2856	355	6
Navy				
Gryphon	54	2770	189	7
Sprint	52	2407	253	9
Cygnus	50	3423	212	8
Centralia	51	2621	235	8
HR 17-827	53	2893	179	7
HR 18-657	54	3184	175	7
ISB 486	49	2485	187	5
ISB 565	50	2544	215	6
ISB 672	48	2338	205	6
ISB 782	48	2449	198	7
Auroa	51	2583	147	6
Fleetwood	46	3250	190	7
Significance	-	<0.01	<0.01	-
LSD (5.0%)	-	559	25	-
C.V. (%)	-	13.2	5.0	-

† - Seed quality rating 1=poor, 10=excellent.
Plot size - 1.2 x 3.6 m
Seeding date - May 27, 1991
Harvesting date - Sept. 16, 1991
Rainfall - 236 mm
Irrigation - 76 mm

Table 6. Plant height and yield characteristics in different market classes of dry bean: BEAN MODELLING NURSERY.

Market class	Cultivar	Plant height mature (cm)	Yield kg/ha	Seed weight(mg)
Pink	Viva	58	4000	287
G. Northern	UI 59	95	2950	291
Black	Midnight	59	2666	194
Navy	Aurora	72	2963	138
Kidney	Montcalm	45	2998	559
Significance		<0.01	<0.01	<0.01
LSD (5.0%)		5	381	24
Coefficient of variation (%)		4.9	8.3	5.5

Plot size - 2.4 x 3.6 m
Seeding date -May 27, 1991
Harvesting date -Sept. 6, 1991
Rainfall - 236 mm
Irrigation - 76 mm

Table 7. Effect of seed priming on plant stand, plant height and seed yield in Othello dry bean.

Cycles moistening and drying	Stand (plants /m^2)	Pl. height 30 days from planting (cm)	Pl. height 60 days from planting (cm)	Yield (kg/ha)
0	24.4	38.4	44.4	3151
1	22.8	40.1	43.9	3261
2	25.2	40.4	45.1	3602
3	31.4	39.8	45.0	3801
Significance	0.05	NS	NS	0.05
LSD (5.0%)	5.7	-	-	396
C.V. (%)	13.6	5.5	3.6	7.2

Plot size - 1.2 x 3.6 m
Seeding date - May 27, 1991
Harvesting date - Sept. 6, 1991
Rainfall - 236 mm
Irrigation - 76 mm

Seeding Rate x Row Spacing Study

The objective of this experiment was to determine the optimum plant stand and row spacing for irrigated pinto bean (Othello) production. Higher seeding rate significantly increased plant stand and crop yield (Table 8).

The absence of white mold incidence during the 1991 growing season was a contributing factor to the positive yield response to increased seeding date. The optimum row spacing for irrigated Othello in 1991 was 40 cm.

Seeding Depth Study

Othello pinto bean was seeded at 2.5, 5.0 and 7.5 cm depths. Seeding depth did not affect yield in 1991 (Table 9). This contrasts with the 1990 observation that seeding at a depth of 2.5 cm produced the highest plant stand compared to deeper seeding.

Seeding Bean Into Standing Wheat Stubble

Two off-station trials, one under irrigation and one under dryland conditions, were established to study the effect of seeding dry bean into standing wheat stubble. The hypotheses was that the wheat stubble would (i) hold the bean plants erect to facilitate direct harvesting to help reduce harvest loss, and (ii) promote moisture conservation. The irrigated trial was abandoned due to salinity damage. The results of the dryland test are summarized in Tables 10 and 11. Pinto bean seeded into standing stubble produced significantly higher yields compared to seeding into a tilled seed bed. Othello bean outyielded Topaz by 47% under the dryland condition (Table 10). There was a significant interaction between cultivar and seeding method and the yield response of Othello was greater than Topaz when seeded into standing stubble (Table 10). The plants grew more vigorously when seeded into stubble compared to seeding into a conventionally tilled seed bed (Table 11).

Desiccation Study

This test was designed to compare the possible effects of desiccant for direct harvesting. There was no significant effect of either desiccants or stage of dessication on dry-down of Othello bean (Table 12) due to the exceptionally warm weather conditions of late August and early September.

Dry-down Study

Dry bean must be harvested at the appropriate stage of maturity to minimize harvest losses. Generally, the crop should be harvested at 16-20% seed moisture. Harvesting earlier can affect quality while delayed harvesting may result in excessive loss due to shattering. The present study was laid out to monitor the rate of dry-down for irrigated dry beans. Beryl (great northern), Othello (pinto), and Viva (pink) were used in this investigation. The objective of the study was to record visual indicators of pod dry-down in an attempt to relate these to the optimum seed moisture level for harvesting. Samples were taken beginning August 19. The progression of dry-down and moisture loss for all three cultivars were recorded (Figure 1-3). The dry-down process was extremely rapid due to high temperatures during the pod ripening period. During the period between August 19 and September 3 an average daily seed moisture loss of 2.6%, 3.6%, and 4.2% were recorded for Viva, Beryl, and Othello respectively. Highest moisture depletion rate was observed during the final stages: viz. 13%, 18%, and 21% moisture loss for Viva, Beryl, and Othello, respectively, between August 29 and September 3. The high temperatures also accelerated crop maturity. In 1991 the 20% seed moisture level corresponded approximately to 98% dry and buckskin pods for all three dry bean cultivars. This study will be repeated to quantify the relationship between pod maturity and seed moisture content under different climatic conditions.

Table 8. Plant stand, plant height, and seed yield of Othello dry bean as influenced by seeding rate and row spacing.

Seed rate seeds/m^2	Plant stand per m^2	Plant height (cm)	Yield (kg/ha)
15	21	71	3127
30	36	71	3788
45	47	76	4274
Significance	<0.01	NS	<0.01
LSD (5.0%)	7.5	-	465
Row spacing (cm)			
20	30	72	3406
40	35	72	4237
60	40	74	3545
Significance	0.05	NS	<0.01
LSD (5.0%)	7.5	-	465
C.V. (%)	25.7	8.9	14.8

Plot size - 1.2 x 3.6 m
Seeding date - May 27, 1991
Harvesting date - Sept. 9, 1991
Rainfall - 236 mm
Irrigation - 76 mm

Table 9. Plant attributes and yield of Othello pinto bean when seeded at different depths.

Seed depth	Plant stand /m row	Plant ht (cm)	Pods held below 5 cm(%)	Yield (kg/ha)
2.5 cm	20.5	66	34	3420
5.0 cm	19.6	65	36	3681
7.5 cm	16.9	67	32	3621
10.0 cm	16.8	68	28	3324
Significance	0.05	NS	NS	NS
LSD (5.0%)	2.6	-	-	-
C.V. (%)	11.7	8.8	32.7	15.2

Plot size - 1.2 x 3.6 m
Seeding date - May 27, 1991
Harvesting date - Sept. 5, 1991
Rainfall - 236 mm
Irrigation - 76 mm

Table 10. Yield (kg/ha) of Othello and Topaz pinto bean when seeded into standing stubble.

Seeding method	Othello	Topaz	Mean*
No stubble	1963	1402	1683 a
Stubble	2298	1506	1902 b
Mean*	2131 b	1454 a	

Stubble x cultivar interaction significant at 1.0% level.
* Values followed by different letters in the stubble and cultivar main effects are significantly different at P <0.05 level.
Plot size - 1.2 x 6.0 m
Seeding date - May 24, 1991
Harvesting date - Aug. 28, 1991
Rainfall - 279 mm

Table 11. Plant height and average seed weight of pinto bean in response to seeding into standing wheat stubble under dryland conditions.

Treatment	Plant* height (cm)	Seed* weight (mg)
Seeding method		
No stubble	35 a	259 a
Stubble	38 b	258 a
Seeding rate seeds/m^2		
30	39 b	258 a
40	36 a	259 a
40	35 a	260 a
Cultivar		
Othello	39 b	248 a
Topaz	35 a	269 b
C.V. (%)	8.9	5.5

* Values followed by a different letter(s) in the main effects of the different parameters (columns) are significantly different at P <0.05 level.
Plot size - 1.2 x 6.0 m
Seeding date - May 24, 1991
Harvesting date - Aug. 28, 1991
Rainfall - 279 mm

Table 12. Mean effect of desiccants and the stage of application on yield of Othello pinto bean.

Desiccant	Yield (kg/ha)
Roundup	3401
Reglone	3432
Cerone	3425
Control	3502
Significance	NS
Stage of desiccation (% striped + buckskin + dry pods)	
75 % (August 21)	3447
95 % (August 24)	3384
100 % (August 31)	3372
Significance	NS
C.V. (%)	6.7

Plot size - 2.4 x 3.6 m
Seeding date - May 27, 1991
Harvesting date - Sept. 9, 1991
Rainfall - 236 mm
Irrigation - 76 mm

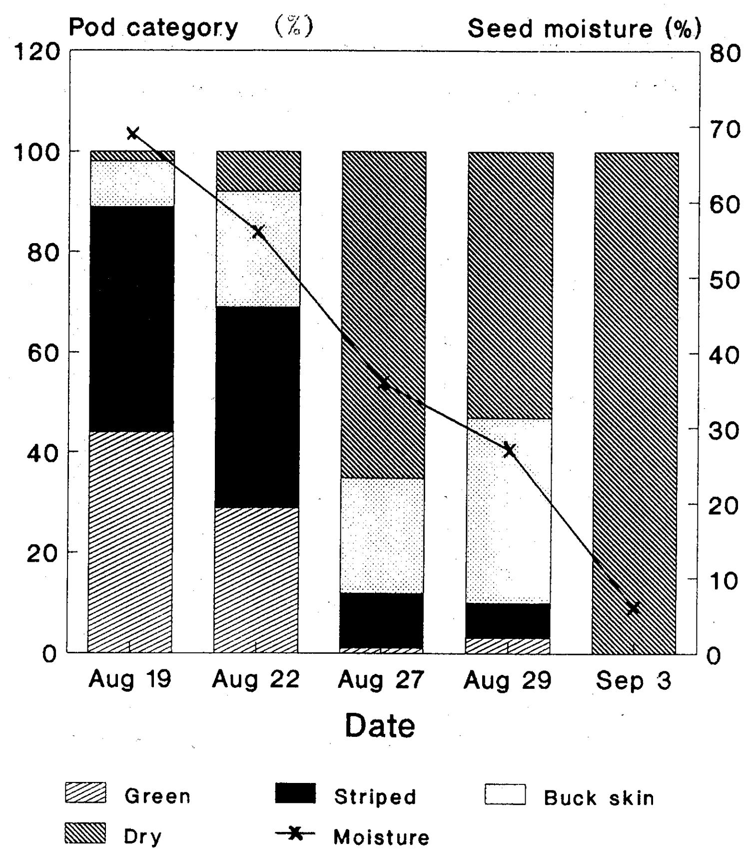


Figure 1. Pod maturity stages and the progression of pod moisture loss in Othello (pinto).

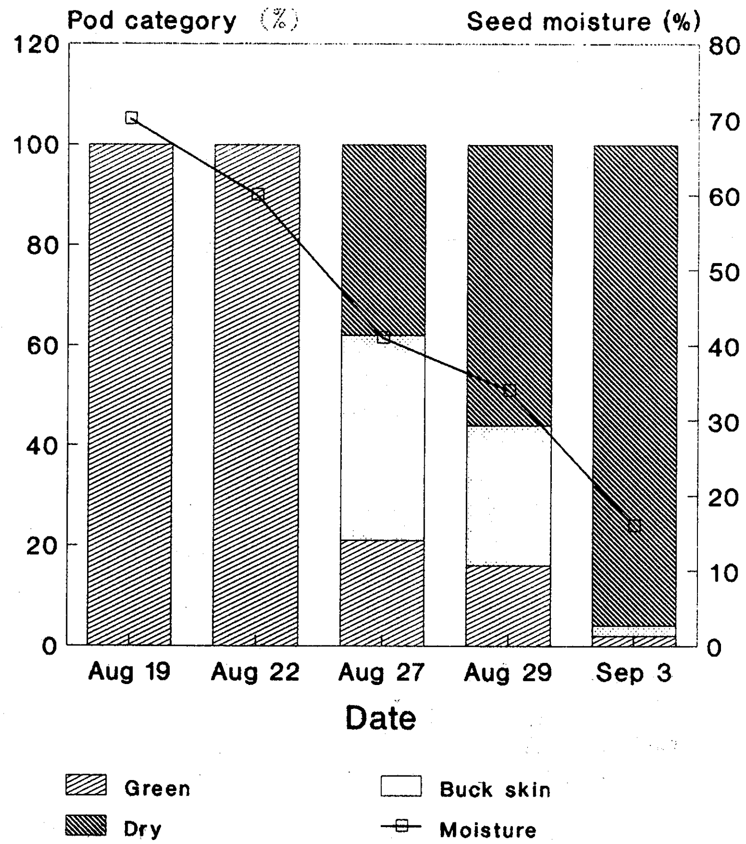


Figure 2. Pod maturity stages and the progression of pod moisture loss in Beryl (great northern) bean.

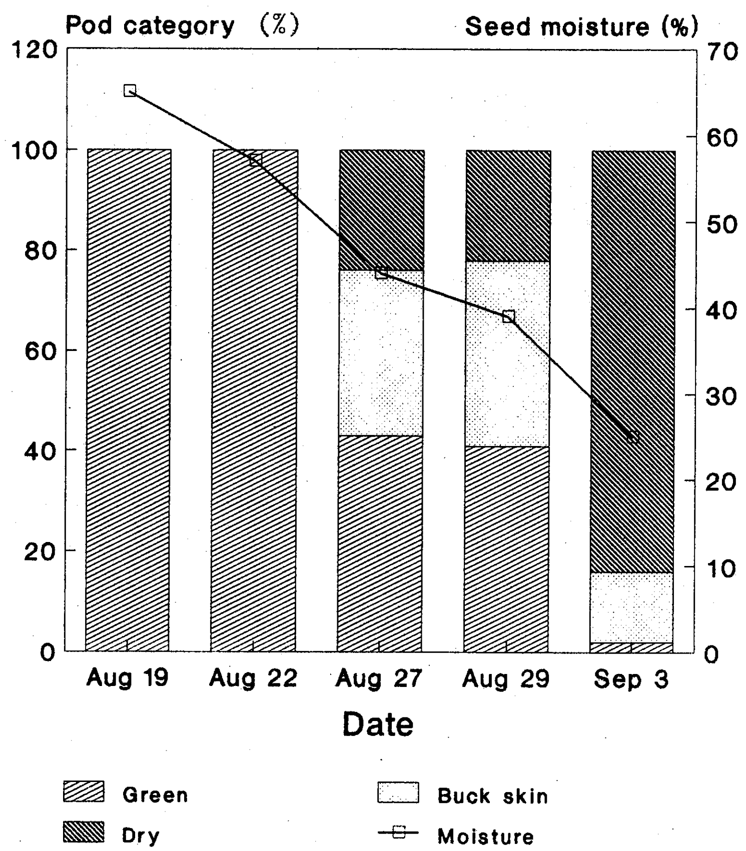


Figure 3. Pod maturity stages and the progression of pod moisture loss in Viva (pink) bean.

Field Pea

Cultivar Evaluation

The Special Purpose Pea Co-op Test was established at the SIDC demonstration site. Thirty entries of field pea in several size and market classes including short and tall plant types and standard and semi-leafless leaf characteristics were evaluated. Due to favourable moisture and environmental conditions, relatively high yields were recorded (Table 13). Several entries exceeded the 4000 kg/ha yield level.

The Field Pea Co-op Test was abandoned as the experiment was severely damaged by flooding soon after seeding.

Stand Establishment Studies

Germination failure and poor plant stand is a commonly reported problem with extra-large seeded pea cultivars. Two tests were carried out at the SIDC demonstration site to identify possible causes such as cool soil temperature at seeding, seeding too deep, and soil borne pathogens associated with germination failure. Results of the experiments are summarized in Tables 14, 15, and 16. Very high pea yields were obtained due to favourable environmental conditions.

Late seeded pea produced significantly higher yields than early seeded treatment in this experiment (Table 14). Other studies have shown greater benefits from early seeding in most years. It is suspected that high rainfall in June resulting in prolonged soil saturation and possible effects of leaf diseases may have reduced the yield of the early seeded crop.

The yield depression due to early seeding was particularly significant in the small seeded Radley compared to large seeded Progretta. Visual indications showed a higher proportion of unmarketable seed through dockage in the early seeded crop again suggesting problems arising from excess moisture. Early seeding, however, produced larger seeds and the size difference between the early and late seeding was highest in the larger seeded Progretta. Neither cultivar nor time of seeding affected the plant stand.

Seeding depth did not affect plant stand or seed yield (Table 15). In this experiment Radley pea significantly outyielded Express and Progretta. In most of the field trials over the past several years Express outyielded Radley. This is further indication that the possible differences were due to leaf disease build up in Express under unusually high rainfall conditions.

Fungicidal seed treatment had a variable effect with respect to plant stand (Table 16). In one experiment Apron produced significantly higher plant stand than Captan and Crown. However, the untreated control, Captan, and Crown produced similar plant stands. In both experiments, none of the seed treatments were effective in increasing seed yield compared to the check treatment (Table 16).

Fababean

Excellent moisture and good growing conditions favoured high yields in fababean.

Cultivar Evaluation

Ten fababean entries were tested in a replicated experiment. There were no significant yield differences among the entries although Aladin outyielded the rest (Table 17). Several entries had significantly larger seeds compared to the check cultivars.

Table 13. Plant height and yield components of special purpose pea: PRAIRIE SPECIAL PURPOSE PEA CO-OP.

Entry	Plant height (cm)	Yield (kg/ha)	Seed weight (mg)
Express	83	4445	274
Tara	145	3123	208
Titan	161	2951	280
Bellevue	136	3097	204
Radley	85	3753	215
BL616-87	92	3532	265
BL617-ALEX	91	4425	313
BL618-FLUO	78	4339	369
RNK431	99	3643	252
RNK442	80	4175	238
HJA53666	92	3856	289
HJA53750	93	4320	262
AG89-1	103	3614	455
AG90-7	74	2917	329
AG89-12	88	3647	378
AG89-14	83	3342	250
AG89-88	110	3805	383
AG90-3	95	4253	272
AG90-19	64	3727	328
Orb	76	3828	247
Baroness	103	4299	341
863	91	3429	414
Anno	79	4295	261
Montana	76	4037	303
Impala	98	4093	293
HR 2/1/3	87	3866	301
Vert	89	4027	314
Erbi	91	4088	299
NGA643	91	3859	308
CPS5	96	4026	336
Significance	<0.01	<0.01	<0.01
LSD (5.0%)	11	796	31
C.V. (%)	7.9	14.8	7.4

Plot size - 2.1 x 3.4 m
Seeding date - May 11, 1991
Harvesting date - Aug. 19, 1991
Rainfall - 308 mm
Irrigation - 27 mm

Table 14. Yield components of Express, Progretta, and Radley pea during early and late seeding.

Seeding date	Progretta	Express	Radley
		Yield (kg/ha)	
May 7	4973	4575	4662
May 21	6089	5489	6509
Significance		<0.01	
LSD (5.0%)		648	
C.V. (%)		12.2	
		Seed weight (mg)	
May 7	365	228	201
May 21	326	213	192
Significance		<0.01	
LSD (5.0%)		19	
C.V. (%)		7.5	
		Stand (plants/m^2)	
May 7	74	74	72
May 21	72	80	74
Significance		NS	
LSD (5.0%)		-	
C.V. (%)		18.6	

Plot size - 1.2 x 3.6 m
Seeding date - May 7, May 21, 1991
Harvesting date - Aug. 20, Aug 26, 1991
Rainfall - 308 mm
Irrigation - 105 mm

Table 15. Plant stand and seed yield of three field pea cultivars when seeded at different depths.

Treatment (main effects)	Stand (plants/m^2)	Yield (kg/ha)
Seeding depth (cm)		
2.5	83	6867
5.0	82	6507
7.5	77	6532
Significance	NS	NS
Cultivar		
Progretta	78	6496
Express	80	6247
Radley	83	7163
Significance	0.05	<0.01
LSD (5.0%)	4	287
C.V. (%)	12.3	12.1

Plot size - 1.2 x 3.6 m
Seeding date - May 25, 1991
Harvesting date - Sept. 4. 1991
Rainfall - 308 mm
Irrigation - 105 mm

Table 16. Plant stand and yield response of field pea to fungicidal seed treatment.

Fungicide main effect	Stand(plant/m^2) Exp-I	Stand(plant/m^2) Exp-II	Yield (kg/ha) Exp-I	Yield (kg/ha) Exp-II
Apron	81	83	5328	6611
Crown	73	80	5409	6635
Captan	71	82	5550	6630
ICIA0523	-	79	-	6584
Control	72	78	5244	6717
Significance	0.01	NS	NS	NS
LSD (5.0%)	6	-		
C.V. (%)	18.6	12.3	12.2	12.1

Plot size - 1.2 x 3.6 m
Seeding date - As in Tables 14 and 15
Harvesting date - As in Tables 14 and 15
Rainfall - 308 mm
Irrigation - 105 mm

Table 17. Growth characteristics and yield components of fababean: CO-OP TEST.

Entry	Days to flowering	Plant height (cm)	Yield (kg/ha)	Seed weight (mg)
Aladin	49	146	6109	452
Herz Freya	50	143	5133	439
Orion	45	123	5028	423
Outlook	49	131	5388	381
Pegasus	49	136	5461	410
SNSS-1	52	143	5205	347
86LH08	47	130	5588	637
86LH10	45	133	4962	568
86LYL01	43	134	5706	618
86LYL07	44	130	5637	601
Significance	<0.01	0.01	NS	<0.01
LSD (5.0%)	1	5	-	5
C.V. (%)	0.9	4.9	8.7	4.9

Plot size - 1.2 x 3.6 m
Seeding date - May 7, 1991
Harvesting date - Sept 9, 1991
Rainfall - 308 mm
Irrigation - 27 mm

Lentil

Cultivar Evaluation

Several lentil entries were grown under irrigation with Eston and Laird as checks. Eston outyielded all other entries (Table 18). Laird, as in other years, performed poorly under irrigation and showed greatly reduced seed weight from the expected 70 g per 1000 seeds. Severe incidence of Anthracnose infection resulted in high variability in plot yields.

Seeding Rate x Row Spacing Study

Eston lentil was grown under irrigation in factorial combination of two row spacings (10 and 20 cm) and four seeding rates (100, 125, 150, 175, and 200 plants/m^2). The observed stands were slightly higher than the intended plant stand as the additional 10% of seeds allowed to compensate for germination losses also germinated due to favourable weather conditions.

Increasing seeding rate had a positive effect on seed yield up to 75% above the recommended rate of 100 plants/m^2 (Table 19). No significant yield differences were observed between the two row spacings. However, narrow row-spacing favoured disease spread.

Safflower

Cultivar Evaluation

Sixteen safflower entries were tested under irrigation. Several entries outyielded the check cultivar, Saffire (Table 20). Two entries were slightly earlier maturing than Saffire.

Seeding Rate x Row Spacing Study

Safflower was seeded in a factorial combination of six seeding rates and two row spacings and the crop was grown under dryland conditions. Increased seeding rates resulted in higher yields but decreased the number of capitula per plant (Table 21). The 20 and 40 cm row spacings produced similar yields and growth attributes.

Other Specialty Crops

Canary Seed

Cultivar Evaluation

Six entries of canary seeds were tested under irrigation. All entries tested produced similar seed yields (Table 22). Entry NC 123-9 flowered approximately four days later than the earliest entry, NC 123-3.

Proso Millet

Cultivar Evaluation

Nine proso millet entries were tested under irrigation. Seed yields were variable. Entries NC 22-50 and NC 22-14 produced the highest and the lowest yields, respectively (Table 23). Flowering dates ranged from 52 to 61 days from seeding.

Table 18. Plant stand, yield components, and disease rating of lentil entries: CO-OP TEST.

Entry	Stand plants/m^2	Yield (kg/ha)	1000 seed weight (g)	Disease rating†
Eston	125	2743	32	3.3
Laird	121	1290	59	3.6
La x 179310-8	140	2270	43	2.9
89-LPR-122	140	2059	28	2.9
179310 x La-25	144	2177	37	3.5
La x 17931-4	143	2177	40	3.9
179310 x La-7	148	1481	46	3.6
VLT-15	122	947	44	3.6
PR86-78	126	1867	54	3.8
ZT-4	113	1602	36	3.7
Significance	-	<0.01	<0.01	-
LSD (5.0%)	-	330	4	-
C.V. (%)		12.0	5.9	-

†Disease rating: 1-no disease, 5-total infection
Plot size - 1.2 x 3.6 m
Seeding date - May 16, 1991
Harvesting date - August 30, 1991
Rainfall - 308 mm
Irrigation - 50 mm

Table 19. Effect of seeding rate and row spacing on plant stand, disease incidence, and seed yield of irrigated Eston lentil.

Seed rate (seeds m^2)	Stand plants/m^2	Yield (kg/ha)	Disease rating†
100	114	3553	38
125	167	3762	35
150	166	4020	36
175	183	4462	25
200	207	4187	32
Significance	<0.01	0.01	NS
LSD (5.0%)	30	570	-
Row spacing (cm)			
10	164	4129	39
20	171	3830	28
Significance	NS	NS	0.01
LSD (5.0%)	-	-	8
C.V. (%)	21.9	17.4	47.8

† Disease rating (% plot infection)
Plot size - 1.2 x 3.6 m
Seeding date - May 17, 1991
Harvesting date - Sept. 13, 1991
Rainfall - 308 mm
Irrigation - 27 mm

Table 20. Growth characteristics and yield components of safflower entries grown under irrigation.

Entry	Plant height (cm)	Days to flower	Days to mature	Yield (kg/ha)	Seed weight (mg)
S-208	94	85	115	3413	38
Saffire	84	79	113	3371	35
S-541	94	85	116	3647	36
Lesaf 271	75	79	113	2639	40
Lesaf 258	83	80	113	4109	33
Lesaf 273	80	79	112	3391	34
Lesaf 410	89	84	116	3692	38
Lesaf 295	89	81	114	3528	28
Lesaf 412	84	85	115	3387	41
Saff 23-66	81	79	113	2823	35
Saff 29-90	79	79	112	2878	31
Saff 29-119	84	81	113	2752	30
Saff 29-37	79	80	113	2752	31
L241E-238	83	81	114	3725	37
L741L-138	85	82	114	4019	36
L241EL	85	82	115	3968	38
Significance	<0.01	<0.01	<0.01	<0.01	<0.01
LSD (5.0%)	6	1	1	405	2
C.V. (%)	4.6	0.5	0.7	8.5	4.3

Plot size - 1.2 x 3.6 m
Seeding date - May 17, 1991
Harvesting date - Sept 26, 1991
Rainfall - 308 mm
Irrigation - 50 mm

Table 21. Mean effect of seeding rate and row spacing on yield components of safflower (cv. Saffire) grown under dryland conditions.

Seed rate (kg/ha)	Mature plant height (cm)	Capitulum per plant	Yield (kg/ha)	1000 seed weight (g)
7.5	74.3	16	2216	37
15.0	79.0	12	2736	37
22.5	76.5	11	3061	37
30.0	78.5	8	3396	37
37.5	78.4	8	3353	37
45.0	77.5	7	2898	35
Significance	0.01	<0.01	0.02	<0.01
LSD (5.0%)	2.8	3	529	1.1
Row spacing (cm)				
20	76.6	10	2991	36.7
40	78.1	11	2896	36.6
Significance	NS	NS	NS	NS
C.V. (%)	4.3	21.9	3.7	38.6

Seeding rate x row spacing interactions were not significant.
Plot size - 1.2 x 3.6 m
Seeding date - May 16, 1991
Harvesting date - Sept. 19, 1991
Rainfall - 308 mm

Table 22. Growth and yield characteristics of canary seed entries: CO-OP TEST.

Entry	Days to 50% flowering	Plant height (cm)	Yield (kg/ha)
NC 123-2	54	118	1184
NC 123-3	52	109	1117
NC 123-5	54	116	1203
NC 123-8	55	118	1007
NC 123-9	56	122	924
NC 123-10	54	109	1033
Significance	<0.01	NS	NS
LSD (5.0%)	0.7	-	-
C.V. (%)	0.9	6.0	13.8

Plot size - 1.2 x 3.6 m
Seeding date - May 29, 1991
Harvesting date - Sept. 25, 1991
Rainfall - 308 mm
Irrigation - 50 mm

Table 23. Seed yield and days to flowering in Proso millet entries: CO-OP TEST.

Entry	Days to 50% flowering	Yield (kg/ha)
NC 22-3	52	4441
NC 22-14	58	2590
NC 22-42	55	2804
NC 22-43	54	3658
NC 22-44/1	56	3846
NC 22-47	55	4371
NC 22-50	56	4780
NC 22-51	55	3100
NC 22-52	62	2604
Significance	<0.01	<0.01
LSD (5.0%)	1.06	1031
C.V. (%)	1.3	19.7

Plot size - 1.2 x 3.6 m
Seeding date - May 29, 1991
Harvesting date - Sept. 13, 1991
Rainfall - 308 mm
Irrigation - 50 mm

Fenugreek

Cultivar Evaluation

Three fenugreek entries were tested under irrigation. Entries differed significantly in yield. As in other years, NC 109-1 had the highest yield (Table 24). NC 109-1 also produced the largest seed compared to the other entries tested.

Soybean Observational Trial

Eight soybean entries were tested in an observational trial under two levels of irrigation. The yield response of the entries were variable (Table 25). Increased water application resulted in a slight yield advantage. Some of the promising entries will be tested again in 1992.

Table 24. Plant height and yield components of fenugreek entries.

Entry	Plant height (cm)	Yield (kg/ha)	1000 seed weight (g)
NC 109-1	49.5	1009	19.4
NC 109-2	49.0	624	16.1
NC 109-3	55.5	774	15.1
Significance	NS	<0.01	<0.01
LSD (5.0%)	6.8	129	0.7
C.V (%)	7.7	9.3	2.3

Plot size - 1.2 x 3.6 m
Seeding date - May 16, 1991
Harvesting date - Aug. 30, 1991
Rainfall - 308 mm
Irrigation - 75 mm

Table 25. Yield response of soybean under two irrigation levels: OBSERVATIONAL TRIAL.

	Yield (kg/ha)	
Entry	25 mm Irrig.	75 mm Irrig.
Maple Ridge	1794	1971
Maple Presto	1525	1902
Baron	2016	2050
KG 20	2814	2579
X 2713-C-19-2	1781	2355
X 2713-C-19-8	2332	2139
X 2713-C-44-1	2043	2346
X 1995-B-19-4-3	2054	2180
Mean	2045	2178

Plot size - 1.2 x 3.6 m
Seeding date - May 17, 1991
Harvesting date - Sept. 9, 1991
Rainfall - 254 mm

Irrigated Pinto Bean Agronomy: Evaluation of Nitrogen Response in Pinto Bean Production.

Supervisors: A. Kapiniak, J. Wahab
Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Co-operators: J. Massey, C. Millar, B. Ringdal, B. Sawatzky
Locations: Riverhurst, Birsay, Hawarden, Riverhurst
Progress: Final
Objectives:

1) to evaluate the response of irrigated pinto bean to nitrogen fertilizer under south-central Saskatchewan conditions.
2) to demonstrate irrigated pinto bean production in the Lake Diefenbaker area.

Pinto bean is a legume crop capable of fixing nitrogen (N) from the atmosphere. However, the crop is repeatedly a poor fixer of nitrogen. Therefore, much of the nitrogen needed to produce a crop of pinto bean must come from soil organic matter or added commercial fertilizers. Many of the irrigated fields in south-central Saskatchewan are loamy sand soils which are low in organic matter and nitrogen. Consequently, commercial fertilizers are needed to produce an economic yield. Excess nitrogen fertilizer tends to extend the growing period of the dry bean crop. Extending days to maturity beyond 110 days in South-Central Saskatchewan increases the risk of frost damage to pinto bean. To evaluate the response of irrigated pinto bean to applied nitrogen fertilizer, a two year on-farm demonstration was conducted in the Outlook--Birsay--Riverhurst area.

The average potential yield (net yield plus harvest losses) and net yield of irrigated pinto bean in response to rate of applied nitrogen is shown in Table 1. Statistically, the difference among yields is not significant. The low yields are due to harvesting difficulties, inexperienced growers, and/or unco-operative weather. In addition to improved yields, harvest efficiency also improved from increased rates of applied N fertilizer.

Table 1. Average yield, harvest efficiency, and economic benefit in response to nitrogen fertilizer on irrigated pinto bean in 1990 and 1991.

Applied N fertilizer (kg/ha)	Average yield Potential (kg/ha)	Average yield Net (kg/ha)	Harvest efficiency (%)		Economic benefit* ($/ha)
28	1584	829	52		--
56	1642	867	53		11.80
112	1721	1097	58		7.32
				Total	19.12

* (Yield increase x 44¢) - (increase in applied N x 49¢)

Assuming a current nitrogen cost of 49¢/kg and a gross return of 44¢/kg of pinto bean (for producers enrolled in the National Tripartite Price Stabilization Program), addition of 56 and 112 kg N/ha appear economical.

The full benefit of applying 56 and 112 kg N/ha may not have been achieved due to leaching of the nitrogen in 1991 (above average rainfall early in the growing season) and other factors that reduced overall yield potential. Future demonstrations will evaluate the effects of nitrogen fertilizer application timing (pre-seeding, vegetative stage, and split applications) on yield of irrigated pinto bean.

Irrigated Pinto Bean Agronomy: Evaluation of Disease Control Technology

Supervisors: A. Kapiniak, B. Vandenberg
Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Co-operators: K. Carlson, B. Davison, R. Derdall, J. Eliason, D. Kelk, J. Konst, M. Larson, D. Walberg
Location: North-northeast of Outlook and Dunblane
Progress: Final
Objectives:
1) to determine what level of yield losses is attributable to Sclerotinia (white mold) for irrigated dry bean production in Saskatchewan;
2) to evaluate the effectiveness of fungicidal control of Sclerotinia by comparing conventional spraying with airblast spraying;
3) to demonstrate production of a new irrigated specialty crop.

White mold, caused by *Sclerotinia sclerotiorum*, can devastate an irrigated dry bean (*Phaseolus vulgaris* L.) crop. The fungal infection begins on the petals when the weather is cool and damp, or the microclimate within the crop canopy remains humid. Sclerotinia infection can be reduced by an application of fungicide on the bean petals before the infection begins. Because leaves shield the flowers on dry bean plants, conventional field sprayers may not be the most effective method of applying fungicide. A three year program involving a network of co-operating irrigation farmers was set up to demonstrate and compare the skid-boom and airblast sprayers to conventional sprayers for effectiveness of fungicide application. Effectiveness was measured by the number of Sclerotinia infected plants and yield of irrigated dry bean. Yield is reported as potential yield (net yield plus harvest losses) so that differences of equipment, operators, and weather during harvest, do not confound the results.

Combined data from all sites involved in the network, show that Sclerotinia infection rates differed significantly among years (Figure 1). The high Sclerotinia infection rate in 1990 was due to the lower temperatures during the flowering period. Mean maximum temperatures for the last two weeks of July were 30, 24, and 26 ^{o}C in 1989, 1990, and 1991, respectively. Despite Sclerotinia (white mold) infection on approximately 20% of the plants in 1990, the yield of irrigated dry bean was significantly higher than in 1991 when only 6% of the plants were infected with white mold. This indicates that factors other than Sclerotinia influenced yield potential, such as irrigation scheduling.

Yield from control strips were not significantly lower than from strips sprayed with Benlate by a skid-boom or by a conventional sprayer (Figure 2). Strips of irrigated dry bean that received Benlate, had lower incidence of Sclerotinia than the control strips (Figure 3). This shows that timely applications of fungicide can reduce Sclerotinia infection rates in irrigated dry bean. Differences in yield and incidence of Sclerotinia were significant among years at these sites.

At sites where the airblast sprayer was evaluated, yield among sprayer treatments did not differ significantly (Figure 4). There were significant yield differences among years. The number of Sclerotinia infected plants did not significantly differ from the control strips at these sites (Figure 5). Both yield and Sclerotinia incidence were lower in 1991 compared to 1990, indicating that insufficient irrigation water was applied at these sites. Seed size is an indicator of the amount of water applied (Table 1).

Benlate application can reduce Sclerotinia infection, but there was no advantage to using a skid-boom or airblast sprayer compared to a conventional sprayer. Differences in Sclerotinia infection rates among years were highly significant. This indicates that the weather pattern during the flowering period, has a great effect on Sclerotinia incidence, but reducing irrigation to help control Sclerotinia reduces the yield potential of dry bean. The decision to apply fungicide for Sclerotinia control in irrigated dry bean should be made primarily on the basis of field history and on the probability of a cool, moist period when the bean plants are flowering.

Table 1: Effect of rainfall and irrigation on seed size and potential yield of pinto bean at sites demonstrating the airblast sprayer for fungicide application in 1991.

Site	Rainfall		Irrigation		Seed size	Potential Yield	
Number	(cm)	(in)	(cm)	(in)	(mg)	(kg/ha)	(lb/ac)
1	15.2	6.0	26.7	10.5	408	1873	1672
2	23.9	9.4	5.1	2.0	327	1612	1439
3	23.6	9.3	6.4	2.5	323	1603	1431

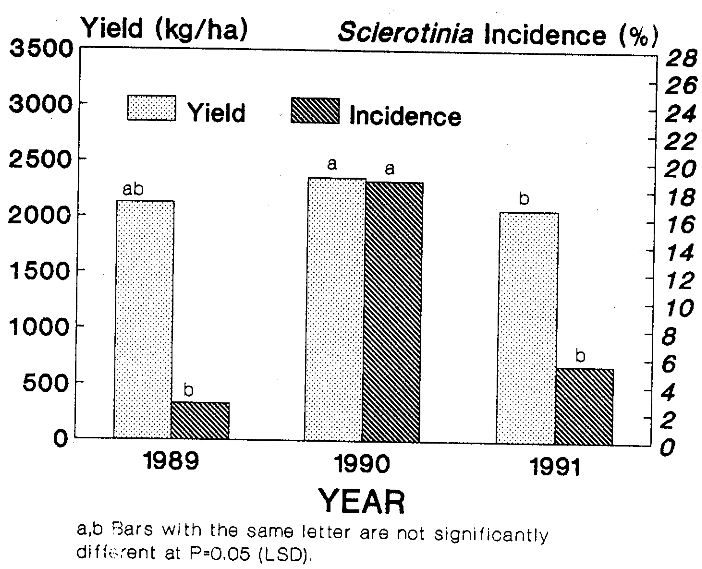


Fig. 1. Average Yield and Sclerotinia Incidence of Irrigated Dry Bean 1989-1991.

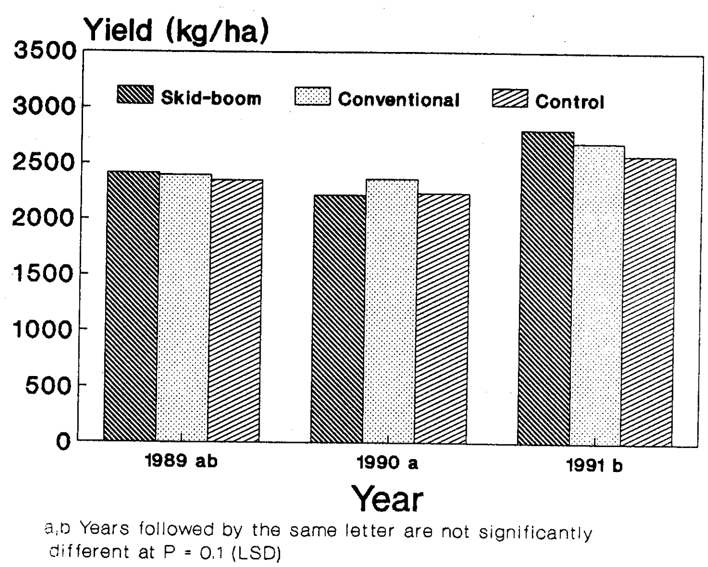


Fig. 2. Average Potential Yield of Irrigated Dry Bean at Skid-boom Sites 1989-1991.

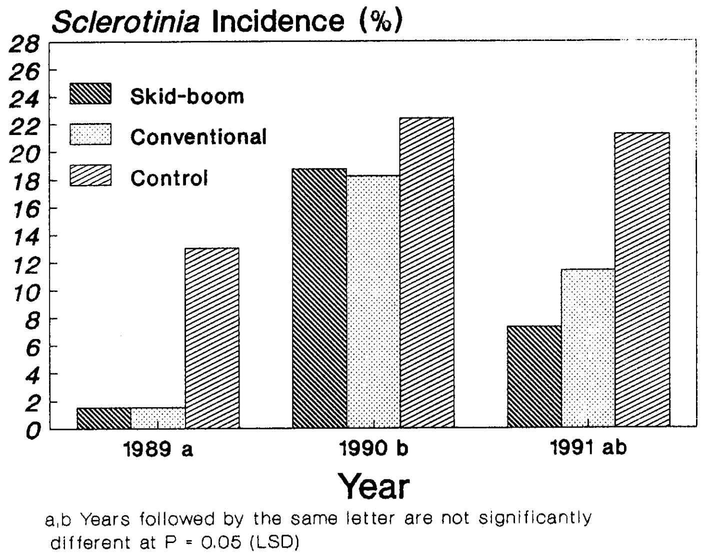


Fig. 3. Average Sclerotinia Incidence in Irrigated Dry Beans at Skid-boom Sites.

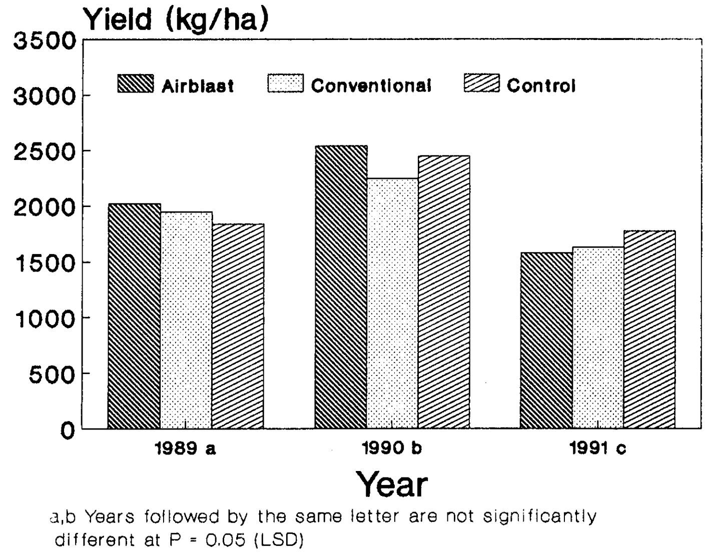


Fig. 4. Average Potential Yield of Irrigated Dry Bean at Airblast Sites 1989-1991.

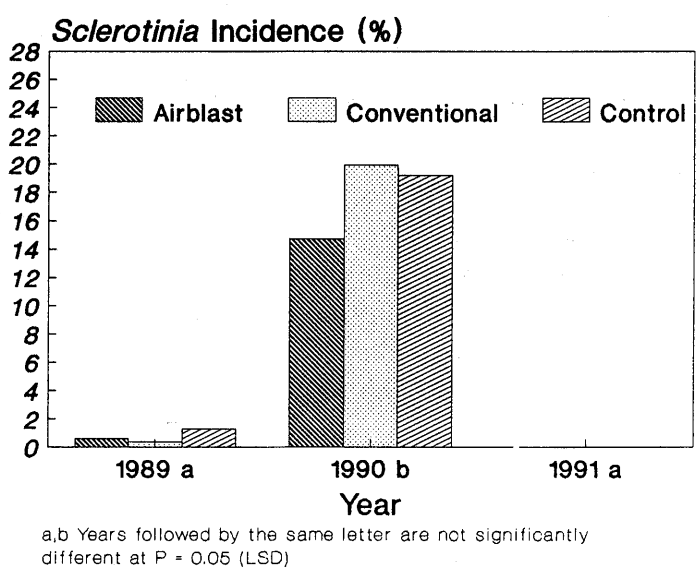


Fig. 5. Average Sclerotinia Incidence in Irrigated Dry Bean at Airblast Sites 1989-1991.

Irrigated Safflower Agronomy: Evaluation of Nitrogen Response in Safflower Production

Supervisors: A. Kapiniak, A. Vandenberg
Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Co-operator: J. Massey
Location: Riverhurst (NE-28-23-6-W3)
Progress: Final
Objectives:

1) to evaluate the potential for irrigated safflower production in south-central Saskatchewan;
2) to evaluate the response of irrigated safflower to nitrogen fertilizer.

Safflower is deep-rooted, drought tolerant and well-adapted to light soils. It is grown in the warm longer season areas of southern Alberta and southern Saskatchewan. The irrigated regions of south-central Saskatchewan may be suitable for Saffire, an early maturing variety that is used for birdseed. In traditional growing areas, safflower shows a yield response to nitrogen fertilizer application under irrigated conditions. Application of nitrogen under irrigated conditions in south-central Saskatchewan may delay maturity so that fall frost causes crop damage.

A three year (1989-1991) demonstration project was conducted at Riverhurst, Saskatchewan, to evaluate the effect of nitrogen fertilizer on irrigated safflower. In 1989, safflower growth was inhibited by an overabundance of kochia weeds which responded to the additional fertilizer. Data collected in 1989 were not used in the statistical analysis of this project. The two year average net yield, was not significantly different among fertilizer rates (Table 1). No maturity difference due to fertilizer treatment was observed due to hot dry weather in late August and early September of both years. The mean seed weight is 4% lower than the mean seed weight of Saffire produced in small plots under irrigation at SIDC during 1990 and 1991. This indicates that safflower plants in the demonstrations did not receive enough water to reach potential yields. According to published recommendations, the potential yield range for irrigated Saffire in southern Alberta is 2750 to 4400 kg/ha. Further demonstrations, with improved irrigation scheduling, are needed to better determine the high limit for yield potential for irrigated safflower production in south-central Saskatchewan.

Table 1: Effect of nitrogen application on yield, seed weight and economic benefit of irrigated Saffire safflower at Riverhurst, 1990 and 1991.

Nitrogen application (kg/ha)	Nitrogen application (lb/ac)	Average net yield† (kg/ha)	Average net yield† (lb/ac)	Seed weight (mg)	Economic‡ Benefit ($/ha)
28	25	1333	1190	32.5	--
56	50	1452	1296	33.7	12.46
112	100	1539	1374	33.4	<8.30>
Mean		1441	1287	33.2	
CV (%)		31		1	
LSD (0.05)‡		NS		S	

† Yield adjusted to 9.5% moisture content. Dockage removed.
‡ NS = nonsignificant; S = significant.
a (Yield increase x $.22/kg) - (increase in applied N x $.49/kg)

Irrigated Fababean Agronomy: Row Spacing and Harrowing for Weed Control

Supervisors: A. Kapiniak, J. Wahab
Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Co-operator: J. Gray
Location: Eyebrow (NW-5-21-29-W2)
Progress: Final
Objectives:

1) to evaluate the benefits of seeding fababean in wide row spacings.
2) to evaluate the effectiveness of a post-emergent harrowing for weed control.

Results from research conducted at SIDC show that yields of irrigated fababean are not significantly different when the rate of seeding is reduced (up to 50%), or by changing the row spacing from 20 cm to 30 cm or 40 cm. By opening up the crop canopy with wider row spacing, the environment becomes less favourable for potential disease development. These practices, which show promise in small research plots, were demonstrated on a commercial scale in 1991. The results are shown in Table 1. The variation in plant density was related to seeder calibration difficulties. Strips of fababean seeded at 53 cm row spacings had a plant density approximately 35% lower than the current recommendations, yet produced the highest yield and largest seeds in 1991. Large seeds are desirable in the market place. Plant density had an important influence on seed size. These results are from one year and are not conclusive for determining the optimum row spacing for irrigated fababean production.

Rainy weather prevented a timely post-emergent harrowing for weed control. Therefore, no data were collected to determine the effect of a post-emergent harrowing operation on the fababean crop yield, stand and weed population.

Table 1: Effect of row spacing and plant density on yield and seed size of Outlook fababean under irrigation in 1991 at Eyebrow, Saskatchewan.

Row spacing		Plant density no. plants/		Net yield†		Seed size
(cm)	(in)	(m^2)	(ft^2)	(kg/ha)	(lb/ac)	(mg)
15	6	47	4 a	2676	2389 ab	451 a
30	12	33	3 b	1942	1734 a	456 a
53	21	26	2 c	3076	2746 b	472 b
C.V.(%)		18		18		1

† Net yield adjusted to 16% moisture. Dockage removed.
a-c Means within columns followed by the same letter are not significantly different at P = 0.05 (LSD test).

Minimizing Bean Harvesting Losses: Field Demonstration and Tests

Principal:	L. Hill, Prairie Agriculture Machinery Institute (PAMI) Humboldt, Saskatchewan
Funding:	Irrigation Based Economic Development Agreement
Co-operators:	Merle Larson, Outlook, Saskatchewan Arlen Kapiniak, Saskatchewan Irrigation Development Centre, Outlook
Progress:	One year only
Objective:	To provide farmers with an assessment of conventional agriculture equipment in the harvesting of pinto beans.

Three commercial air reels were alternately installed on a John Deere 224 flexible cutterbar header. Each reel system was assessed in pinto beans for ease of installation, cutterbar losses and crop feeding. Dutch vine lifters were also assessed with each air reel.

Losses measured while harvesting beans with the Crary Air Reel and Crary Finger Air Reel were excessively high. The losses ranged from 24 to 42% of the total crop yield. Losses of this magnitude are considered unacceptable when compared to losses of less than 5% when harvesting cereal crops. Any difference measured with changes in ground speed, harvesting direction, reel types or when using lifters were insignificant considering the high overall loss level.

The Keho Vortex Reel was unable to supply a suitable air blast which resulted in cutterbar plugging. The air blast was very turbulent and diffused and was not sufficient to clear cut material off the cutterbar. Material would buildup on the cutterbar and uncut bean plants were pushed ahead of the cutterbar.

Reducing harvesting losses to a reasonable level would make growing pinto beans more economically viable. The value of the loss is high enough to justify expenditure on specific harvesting equipment that would reduce loss. It is recommended that future research be done to investigate methods that would reduce harvesting losses with pinto beans.

Zinc Fertilization of Irrigated Dry Bean

Principal:	T. Hogg, L.Tollefson, A. Vandenberg and A. Kapiniak Saskatchewan Irrigation Development Centre
Location:	B. Davison farm (SW 3-30-8-W3)
Progress:	One year only
Objective:	To determine the effect of zinc fertilization on irrigated drybean maturity and yield.

Irrigated dry bean production in Saskatchewan requires timely seeding to ensure the crops reaches maturity. Bean growers in Southern Alberta routinely apply zinc, claiming earlier flowering and reduced time to maturity.

In 1991, a demonstration plot was established to determine the effect of zinc fertilization on irrigated dry bean production in Saskatchewan. Zinc treatments included soil incorporated zinc sulfate (10 kg Zn/ha), foliar zinc (0.5 kg Zn/ha) applied at the trifoliate leaf stage and soil incorporated plus foliar zinc.

Initiation of pod formation was taken as an indication of maturity. There was no significant difference in pod numbers for the zinc treatments at three sampling dates during the growing season (Table 1). At the last sampling date, there was no significant effect of zinc fertilization on pod size

(Table 2). In addition, there was no significant effect of the zinc fertilization treatments on grain yield, total aboveground dry matter yield or seed size (Table 3).

The results from this site indicate that there was no significant effect of zinc fertilization on irrigated dry bean maturity or yield.

Table 1. Pod counts for the irrigated dry bean zinc fertilization demonstration.

Zinc Application Treatment	July 26 Pods/plant	CV (%)	August 7 Pods/plant	CV (%)	August 15 Pods/plant	CV (%)
Control	10	20	17	4	17	23
Soil	8	19	16	7	17	16
Soil + Foliar	8	31	15	13	16	21
Foliar	9	12	16	14	19	14
L.S.D. (0.05)	NS†		NS		NS	

†Not significant at P = 0.05.

Table 2. Pod length for the irrigated dry bean zinc fertilization demonstration.

Zinc Application Treatment	% Pods < 50 mm	CV (%)	50-80 mm	CV (%)	> 80 mm	CV (%)
Control	11	75	16	25	74	8
Soil	10	63	13	16	77	10
Soil + Foliar	14	68	16	29	71	10
Foliar	13	78	11	35	76	14
L.S.D. (0.05)	NS†		NS		NS	

†Not significant at P = 0.05.

Table 3. Grain yield, total yield and seed size for the irrigated dry bean zinc fertilization demonstration.

Zinc Application Treatment	Yield (kg/ha) Grain @ 16.0% moisture	CV (%)	Total Dry Matter	CV (%)	1000 Seed Weight (g)	CV (%)
Control	1992	11	3000	10	358	2
Soil	2048	7	3064	6	363	3
Soil + Foliar	1938	14	2897	15	365	1
Foliar	1946	3	2928	3	363	1
L.S.D. (0.05)	NS†		NS		NS	

†Not significant at P = 0.05.

Soil Moisture Monitoring of Sprinkler Irrigated Fababean and Dry Bean

Principal:	T. Hogg, A. Vandenberg, J. Wahab and D. Moen
Location:	Saskatchewan Irrigation Development Centre
Progress:	Year two of three
Objectives:	To determine the soil moisture change, total water use and water uptake from different soil depths for sprinkler irrigated fababean and dry bean.

Soil moisture change, total water use and water uptake from different soil depths were monitored in an irrigation response experiment established by the Specialty Crops Program at SIDC in 1990 and 1991. Moisture gradients ranging from dry to full irrigation were established under a linear sprinkler irrigation system. Soil moisture monitoring was conducted at approximately two week intervals throughout the growing season with a neutron moisture meter.

The water use of sprinkler irrigated fababean and dry bean increased with increasing water application (Table 1). Total water use was greater in 1991 than in 1990. Fababean had a greater water use than dry bean.

Water uptake decreased with increasing depth in the soil (Table 2). The majority of the water uptake occurred in the top 60 cm of the soil profile, with the greatest uptake occurring in the 0-30 cm depth. In 1990, increasing irrigation applications resulted in increasing water uptake from the 0-30 cm depth and decreasing water uptake from the 30-60 cm depth. Similar trends were not observed in 1991. Excess precipitation in June of 1991 possibly caused leaching losses below the zone of measurement resulting in an over estimation of water uptake from lower depths.

Table 1. Seasonal summary moisture budget for the sprinkler irrigated fababean and dry bean irrigation response experiment conducted in 1990 and 1991.

Year	Crop	Water Treatment	Rainfall	Irrigation	Growing Season Soil Moisture Change	Total Water Use
			---mm---			
1990	Fababean	Dry	231	0	60	291
		P1	231	28	74	333
		P2	231	78	61	370
		P3	231	123	49	403
		Full	231	167	34	432
		L.S.D. (0.05)			NS†	29
1991	Fababean	Dry	297	0	137	434
		P1	297	25	140	462
		P2	299	76	141	516
		P3	299	102	122	523
		Full	299	140	99	538
		L.S.D.(0.05)			19	21
1990	Dry Bean	Dry	155	0	73	228
		P1	155	22	64	241
		P2	155	61	50	266
		P3	155	108	38	301
		Full	155	160	24	339
		L.S.D. (0.05)			11	11
1991	Dry Bean	Dry	242	0	74	316
		P1	242	25	61	328
		P2	242	51	63	356
		P3	242	76	64	382
		Full	242	102	54	398
		L.S.D.(0.05)			11	11

†Not significant at P=0.05

Table 2. Water uptake from different depths for the sprinkler irrigated fababean and dry bean irrigation response experiments conducted in 1990 and 1991.

Year	Crop	Water Treatment	% Water Uptake 0 - 30 cm	30 - 60 cm	60 - 120 cm
1990	Fababean	Dry	55	30	15
		P1	62	26	12
		P2	67	21	12
		P3	78	16	6
		Full	80	14	6
1991	Fababean	Dry	40	31	29
		P1	38	33	29
		P2	37	34	29
		P3	36	35	29
		Full	37	39	24
1990	Dry Bean	Dry	52	31	17
		P1	58	28	14
		P2	67	23	10
		P3	77	17	6
		Full	78	16	6
1991	Dry Bean	Dry	55	24	21
		P1	51	25	24
		P2	52	24	24
		P3	50	23	27
		Full	45	19	36

Vegetable Cultivar Testing Program

Principal:	D.R. Waterer, Department of Horticulture Science University of Saskatchewan, Saskatoon, Saskatchewan
Funding:	Agriculture Development Fund
Location:	Petrofka, Saskatoon and Saskatchewan Irrigation Development Centre, Outlook
Progress:	1991 trials completed
Objective:	Vegetable cultivar trials were conducted by the Department of Horticulture Science to supply information regarding cultivar performance under local growing conditions. The cultivars tested are ones which performed well in previous trials, ones recommended by other provinces, and ones recommended by seed companies as suitable to our area. The results compiled in this bulletin are meant to aid commercial and hobby growers in selecting improved vegetable cultivars. Each year, several crops are tested.

The 1991 trials were supported by the Agriculture Development Fund of Saskatchewan Agriculture and Food.

The spring of 1991 was cool and wet resulting in poor conditions for seeding and stand establishment. The summer was closer to normal, while the first killing frost was earlier than normal.

All crops were planted in twin rows. Rows were from 6 - 10 m in length and data was collected from the centre of each plot. A Plant Jr. seeder was used for all direct seeded crops (cabbage, lettuce, corn, onion, and carrots). Melons and zucchini were hand seeded following mulching (1 mil black plastic). Broccoli and cauliflower were grown from transplants.

Crop production and pest control measures all followed recommended practices. Soil fertility was adjusted according to recommendations outlined in the Horticulture Science Publication "Vegetable Crop Fertility Schedules". Overhead or drip irrigation was used to maintain adequate soil moisture levels throughout the growing season. Yields were excellent at the Outlook and Saskatoon sites, while yields at Petrofka were reduced by hail and insect damage.

Broccoli

Emerald City and Everest consistently produced good yields and high quality heads. Mariner performed well for the second year in a row. Other good cultivars were Arcadia, Emperor and Zxp. 6453. Many of the other cultivars showed uneven maturity and/or undesirable growth habits.

Cauliflower

Serrano produced good quality heads and excellent yields. Problems with other cultivars included uneven maturity and excessive lateness.

Cabbage

Of the early types tested, Princess performed best. For main crop cabbage Bravo appeared best, while Multikeeper was consistently the highest yielding storage cabbage.

Carrots

Caro-best (Imperator) produced the best combined yields and root characteristics of cultivars tested. Neither of the Nantes types tested performed well, while Napoli produced the best yields and quality for the Danvers type.

Romaine (Cos) Lettuce

Green Tower and Romulus yielded well and produced high quality, uniform heads.

Onions

Marketable yields at the Petrofka site were reduced due to hail. Ratings were based mainly on yields of medium bulbs and scale adherence. Yula performed best with high yields and good scale adherence. Benchmark, Flame and Sweet Sandwich showed good yield potential and scale adherence.

Sweet Corn

Of the normal sugar types (Su) Norgold was the highest yielding, while Seneca Horizon was earliest. Of the sugar enhanced varieties (Se), Peaches'n Cream Early produced the highest yields. Crisp'n Sweet 711 hyb yielded best of the supersweet (Sh2) varieties, while Northern Supersweet performed well in terms of combined yield and earliness.

Muskmelons

Marketable yields at the Petrofka site were reduced due to hail and rot. Burpies hyb performed well at both sites. PSX 88122 performed well at both sites but had a slightly musky flavor. Earligold hyb did not yield well this year due to problems with establishment, but it was excellent in terms of fruit quality. Alaska yielded well but had a poor taste while Pulsar hyb showed good yield potential and fruit quality.

Zucchini

All cultivars tested performed well. Super Select and PSX 8587 produced the highest yields of marketable fruit. Elite yielded well but had problems with end flaring. Embassy tended to break when picked.

A complete summary of trial results are available by writing Doug Waterer, Horticulture Science Department, University of Saskatchewan, Saskatoon, SK S7N 0W0.

Soils/Fertilizer/Water

Herbicide, Nutrients and Water Drainage from an Irrigated Field

Principal:	W. Nicholaichuk National Hydrology Research Institute Saskatoon, Saskatchewan
Funding:	Irrigation Based Economic Development Agreement
Site:	Saskatchewan Irrigation Development Centre
Co-investigators:	K. Best, A. Cessna, J. Elliott
Progress:	Final year
Objectives:	a) to estimate the potential for contamination of the water supply by herbicides and nitrates under low pressure (high volume) irrigation; b) to monitor the leaching of agrochemicals in soil, the unsaturated zone and drainage water; c) to use computer modelling techniques to identify irrigation management practices which minimize the risk of water supply contamination.

The study was conducted on Field 11 at SIDC. The field is irrigated by linear sprinkler and is tile drained. In 1991, the barley yield was 4570 kg/ha (109 bu/ac). Ammonium nitrate was broadcast at 100 kg N/ha and ammonium phosphate was placed with the seed at 30 kg P_2O_5/ha. Hoe Grass II (diclofop-methyl and bromoxynil) and a 2,4-D/Banvel tank mix were applied at the recommended rates. Water samples were collected from the soil, at depths of 30, 60, 90, 150 and 180 cm using suction lysimeters and from the tile drain. All samples were analyzed for herbicide residues and nutrients.

Only trace amounts of bromoxynil and dicamba were found in the water samples. 2,4-D was consistently found at the 30 and 60 cm sampling depths after the first irrigation (June 24) but only a few of the deeper lysimeters contained significant concentrations. The greatest concentration detected was 0.243 ppb (ae). The breakdown of 2,4-D was rapid and by August 2 only trace amounts were found. Diclofop was frequently detected with concentrations in excess of 0.3 ppb (ae) at all sampling depths and in the tile drain throughout the growing season. All herbicide concentrations were well below toxic levels but the mobility and persistence of diclofop residues indicate that it may be a potential contaminant.

Nitrate was found in the drainage water in quantities well in excess of drinking water quality guidelines but phosphorus levels were within the guidelines. Nitrate leaching is clearly a problem under irrigation. Computer modelling research has been initiated to optimize fertilizer and irrigation management practices and minimize leaching losses.

Drainage and Subsoiling to Improve the Yield of Alfalfa on Border Dyke Irrigation

Principal:	D. Cameron, Normac AES Ltd. Swift Current, Saskatchewan
Funding:	Irrigation Based Economic Development Agreement
Co-operator:	D. Harrigan and others
Location:	Maple Creek (SW 17-11-26 W3)
Progress:	Final year
Objective:	To demonstrate methods of improving the productivity of flood irrigated fields affected by salinity, low hydraulic conductivity, low infiltration rate and poor drainage.

The drought and lack of irrigation throughout 1988 to 1990 have severely hampered the collection of research data on the drainage and subsoiling projects. In 1988, the Doug Harrigan plot was selected for part of the initial subsoiling/paraplowing and mole drain experiments initiated by SIDC. However, no reasonable alfalfa establishment was achieved throughout 1988 and 1989 due to the dry conditions and lack of irrigation water. In the fall of 1989, the mole drain tile outlet was lost when the drainage ditch was reconstructed. Cultivation and tillage of this plot area in the fall of 1988 and through 1989 and 1990 likely covered up any of the effects of subsoiling and paraplowing. In 1990 and 1991, much of the plot area was used for grass variety and alfalfa establishment plots. Rainfall was excellent in early 1991 with 214 mm falling in May, June and July.

In the spring of 1991, a PFRA chain trencher was utilized to install drainage tile to a depth of approximately 1.2 m on the Doug Harrigan border dyke 3 and subsurface irrigation tile to a depth of approximately 0.8 m on border dyke 5. In both cases, the installation procedure went very smoothly and once the tiles were installed and backfilled, the area was then levelled and seeded to grass (as part of the grass variety experiment). These plots were irrigated for the first time in many years on May 23-25, 1991.

The subsoiling experiments advanced very well in 1991. We obtained a single Noble Blade unit and removed the blade from the shank. The leading edge of the shank was sharpened and a cap was placed on the toe of the shank to prevent wear. This became our knife-shin Noble Blade subsoiler and it was tested out on an old stand of brome-alfalfa in Roy Harrigan's west plot area. Although the results did not show an improvement in yield (primarily because of inherent differences between adjacent plots), they did show that the plot took on almost twice as much water from the open channels left by the subsoiler than the adjacent plot did. The surface disturbance appeared minimal. It would be beneficial to pursue the subsoiling study with emphasis on timing of the subsoiling with respect to moisture, plant growth and time of irrigation.

In 1991, a demonstration aeration unit was also tried on border dyke 8 of Doug Harrigan's alfalfa plots. The blades on the aeration rotovator penetrated to about 20 cm into the soil with minimal plant disturbance. However, comparative yields taken in June 1991 did not show any significant difference between the border dyke that was aerated and the adjacent border dykes.

The Design and Field Testing of a Vertical Mulcher for Irrigated Soils

Principal: T.S. Tollefson
Paragon Consultants Ltd.
Mossbank, Saskatchewan
Funding: Irrigation Based Economic Development Agreement
Progress: Third year of four
Objectives:

a) to design, construct and test a field scale soil vertical mulcher;
b) to measure the improvement of soil water infiltration and fall to spring moisture storage efficiency as a result of vertical mulching in conjunction with fall irrigation;
c) to measure the effect of vertical mulching on subsequent crop yield to further substantiate the benefits of the vertical mulch treatment.
d) to monitor the duration of the vertical mulch effect.

Major emphasis during year one and two of this project was focused on the design and construction of a vertical (slot) mulcher prototype. The prototype has now under gone two seasons of testing. The present design parameters, while requiring further refinement, clearly demonstrate that they are the basis for the construction of a reliable field scale vertical mulcher.

Project emphasis in year three has now switched to measuring the agronomic benefits associated with the practice of vertical mulching. Therefore, two large scale demonstration plots were established in the fall of 1990. One site located at the Saskatchewan Irrigation Development Centre, Outlook, the second site on the farm of Mr. Bill Ringdal of Hawarden, Sask. Three treatments, vertical mulch, subsoil and control, replicated a minimum of three times, were applied to each site. Neutron access tubes were installed in the fall of 1990 after the plots were established. Subsequently, each site received a minimum of 54 mm irrigation prior to Oct. 1. Moisture measurements were made four times during the period Oct. 1/90 to Oct. 1/91. The plots were subject to the same cropping and irrigation schedule as the rest of the field. Crop yields were estimated.

Soil moisture values fluctuated widely over the measurement period, however, treatment effects were apparent. At the relatively coarse textured SIDC site, both the vertical mulch and the subsoil treatments decreased the amount of soil water storage as compared to the control, spring 1991 excepted. At the Ringdal site where soil water infilitration rates are reduced due to a heavier texture and the presence of significant sodium, the vertical mulch treatment enhanced soil water infiltration and storage as compared to the control at every measurement interval. The subsoil treatment also increased soil water storage over control but only at the spring 1991 measurement period. At all other measurement periods, the subsoil treatment did not differ significantly from the control. This increased soil moisture storage of the vertical mulch treatment was located at 30-90 cm. Surface moisture values (0-30) were not greatly affected by any treatment. At the Ringdal site, soil water storage in the vertical mulch treatment was (106-120%) average 114% of the control value, whereas the subsoil treatment was (93-114%) average 100% of the control value. On the SIDC site, vertical mulch and subsoil treatments were (92-111%) average 99% and (90-102%) average 94%, respectively, of the control value. No yield differences were observed on any treatments. This was primarily due to the abnormal amount of rainfall which occurred during the 1991 growing season (eg. 417 mm at the Ringdal site). These unusually wet growing conditions erased any possible yield differences which may have accrued due to the extra stored moisture of the vertical mulch treatment.

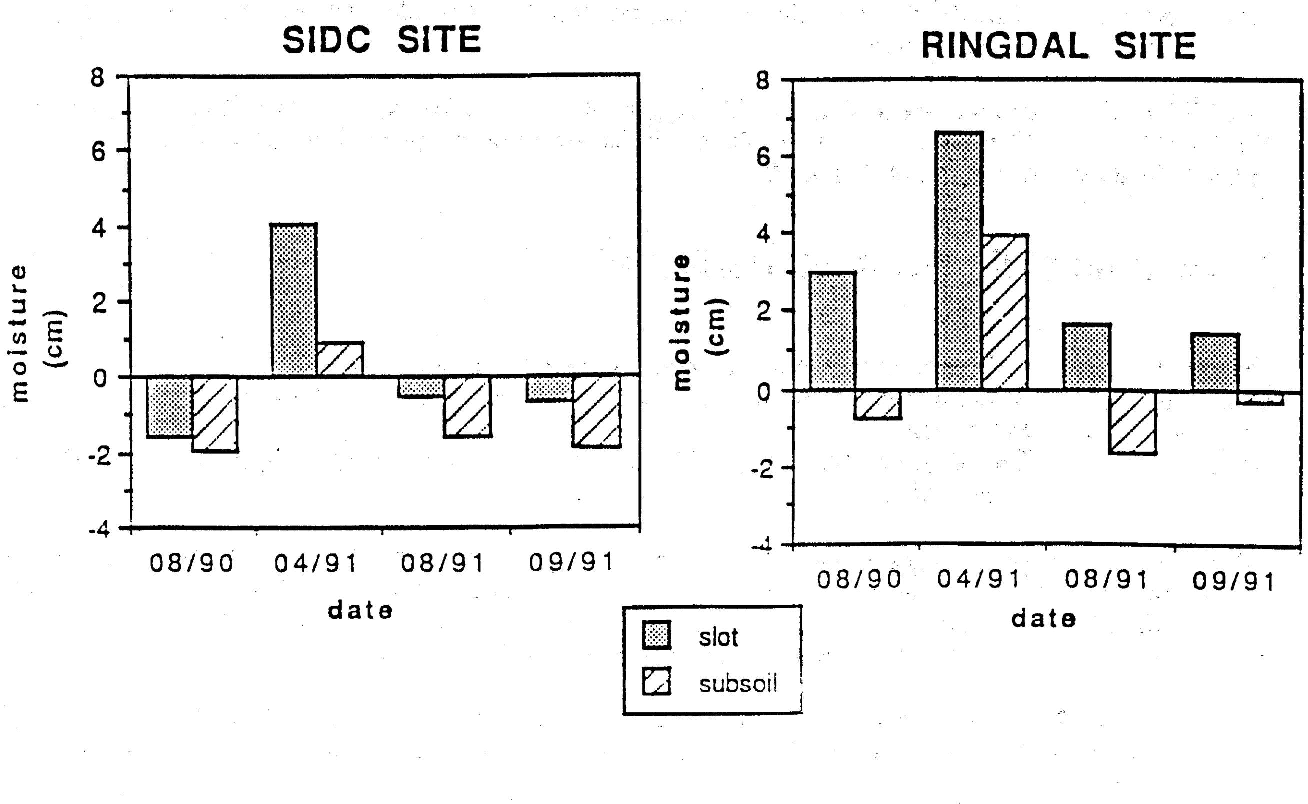


Figure 1. The effect of subsoiling and vertical mulching on the amount of stored moisture contained in the top 90 cm of soil profile as compared to the control treatment.

Nutrient Requirements of Irrigated Crops

Principal: J. L. Henry, Department of Soil Science
University of Saskatchewan, Saskatoon, Saskatchewan
Funding: Irrigation Based Economic Development Agreement
Progress: Second year of three
Objectives:
a) to re-evaluate response to phosphorus under irrigation;
b) to evaluate the revised nitrogen soil test benchmarks;
c) to evaluate split applications of nitrogen;
d) to attain plot yields exceeding 6720 kg/ha for CPS wheats.

To meet these objectives, a phosphorus experiment was designed with seed placed rates of phosphate from 11 to 90 kg/ha on Biggar and Katepwa wheat. The experiment was conducted on a previously non-irrigated parcel of land in an Elstow silty clay loam soil with a very low phosphorus test. The yield response of Katepwa wheat to phosphorus at this site was 1008 kg/ha and for Biggar wheat the phosphorus response was 403 kg/ha. At a second site, irrigated since 1949, on a Bradwell very fine sandy loam soil with slightly higher phosphorus test, no response to phosphorus fertilizer was obtained.

To address the remaining objectives, a nitrogen experiment was designed for Biggar wheat with nitrogen rates ranging from 0 to 224 kg N/ha. At each rate, the nitrogen was applied either as a single preplant band operation or a split application involving seed placed plus post-seeding applications. This experiment was conducted on two irrigated fields, one with a very high (143 kg/ha to 60 cm) nitrogen soil test and one with a medium (67 kg/ha to 60 cm) nitrogen soil test.

On the medium testing field, response to nitrogen was obtained that was in line with nitrogen recommendations provided in the past and in line with the current nitrogen recommendations provided for "average irrigation". On the high testing field, no grain yield response to nitrogen was obtained. The information obtained this year did not support the recommendations we are now making for nitrogen for "optimum irrigation".

In addition, the maximum yield obtained for Biggar wheat was 5376 kg/ha. The reason for failing to reach the objective of 6720 kg/ha was attributed to disease pressure, particularly root rot, which resulted in a significant proportion of unfilled heads.

Evaluation of the Product SPER SAL

Principal: T. Hogg, Saskatchewan Irrigation Development Centre
Location: Saskatchewan Irrigation Development Centre (SW 15-29-8-W3)
Progress: Final year
Objectives: To evaluate the product SPER SAL as a soil amendment to reclaim irrigated saline soils.

SPER SAL is a liquid comprised of 50% hydrolized polymaleic anhydride, a synthetic low molecular weight anionic polyelectrolyte. It is promoted as a soil amendment for reclaiming saline irrigated soil. This product is not registered for sale as a soil amendment in Canada and as such no information is available under Western Canadian conditions confirming its use in reclaiming irrigated saline soils.

In 1990, SPER SAL was tested at SIDC on a moderately saline soil. Results indicated that SPER SAL had no positive effect on the germination or yield of canola or flax. It was suggested that further testing was required.

In 1991, SPER SAL was again tested at SIDC. A moderately saline soil was selected and canola and flax were used as the test crops. Results indicated that SPER SAL had no positive effect on the germination or yield of either crop (Table 1).

SPER SAL does not appear to be effective in reclaiming irrigated saline soil conditions as they occur at SIDC.

Table 1. The effect of SPER SAL on the germination and yield of irrigated canola and flax.

Crop	Plant Counts ($plants/m^2$)			Grain Yield (kg/ha)		
	Untreated	Treated	t	Untreated	Treated	t
Canola	154	137	0.98 NS†	2677	2085	1.45 NS
Flax	413	431	0.98 NS	2249	2343	1.28 NS

†Not significant at P = 0.05.

Esso Chemical Canada 1991 Field Trials

Principal: Esso Ag. Biologicals, Dr. Russell K. Hynes
Location: Saskatchewan Irrigation Development Centre
Progress: Second year of three
Objective: To test naturally occurring soil microorganisms known as plant growth promoting rhizobacteria (PGPR) on alfalfa with Rhizobium inoculant Nitragin Gold. The purpose of this experiment is to screen strains for promotion of nodulation, increased dry matter yield and total nitrogen of alfalfa dry matter.

The design of the experiments was a six-replicate RCBD with statistical analysis using the LSD test at the 90 and 95% level of confidence.

Strain Screens:

The cultivar of alfalfa used in this experiment was Beaver. Four strains co-inoculated with Rhizobium, Rhizobium alone and untreated made up the treatments. All microorganisms were formulated in Nitragin Gold kindly provided by Dr. R.S. Smith, Lipha-Tech. Milwaukee.

Nodule Promotion:

Nodulation activity on alfalfa was compared.

Observations made on this experiment:

1. Two emergence counts from 1 m^2 within each plot was done to obtain an estimate of stand.
2. Nodule rating of the root system.
3. Two cuts were taken and the dry matter yield was obtained.
4. Total Nitrogen was analysed in the alfalfa.

Sodicity Hazard of Sodium and Bicarbonate Containing Waters on the Long Term Productivity of Irrigated Soils

Principal: F. Selles, Agriculture Canada, Swift Current
Funding: Irrigation Based Economic Development Agreement
Contractor: D. Cameron, Normac AES Ltd., Swift Current
Progress: Final year
Objectives:

a) to identify and evaluate the carbonate-related factors and processes affecting the chemical properties of selected irrigated soils in Saskatchewan, which have shown strong tendencies towards sodification;
b) to determine the rates of physicochemical deterioration of these soils in order to obtain sufficient information so as to improve the accuracy and precision of general irrigation water quality criteria; and
c) to predict the severity of salinization and sodification of these soils when irrigated with poor quality water and to determine their reclamation possibilities and their rates of amelioration.

Monitoring of the field reclamation plots at the two sites near Cadillac which had been damaged by irrigation with sodic waters continued in 1991. In addition, a new set of plots was established on the less sodic of the two sites to further evaluate the effectiveness of calcium-supplying amendments, namely gypsum and calcium chloride. Both amendments, but especially calcium chloride, improved crop performance on the new plots in 1991. The yield of durum on the check, gypsum- and calcium chloride-treated plots averaged 2082, 2509, and 3202 kg/ha, respectively. The large response to the amendments seems to be partly related to the fact that 1991 was a particularly wet year. Even so, it is evident that limited dissolution of gypsum occurred. Overall, our results for 1991 are consistent with the view that the rate of reclamation is strongly dependent on the amount of water which is available to dissolve the chemical amendment and leach the displaced sodium from the root zone. The possibility of enhancing water for reclamation from snow-fencing was evaluated at a second site. More than twice the quantity of snowcover was retained on the fenced plots compared to quantities observed on plots not fenced.

Laboratory studies to determine the causes of sodium-induced structural deterioration in Saskatchewan soils continued in 1991. The following conclusions may be drawn from this work:

1. the dispersion and swelling of soil clays both contribute to structural deterioration;

2. swelling is most important at high sodicity levels where it occurs even in concentrated electrolyte solutions;

3. clay dispersion is more sensitive to electrolyte concentration than is swelling, moderate electrolyte concentrations effectively prevents dispersion at sodium adsorption ratios up to 40;

4. the outcome of laboratory dispersion tests is strongly dependent on experimental variables (e.g., mechanical effects and particle concentration) so that caution is needed in extrapolating the results to field conditions.

At this point, a good understanding of sodium stability characteristics of Saskatchewan soils and the contributing mechanisms has been achieved. The challenge in the remaining months of this project is to integrate our information on the various soils, water, management, and environmental factors to produce a set of guideline proposals which will minimize the risk of sodicity problems in future irrigation developments in the province.

Moisture Monitoring of a Sprinkler Irrigated Field After Deep Ripping

Principal: T. Hogg and B. Vestre, Saskatchewan Irrigation Development Centre
Location: Saskatchewan Irrigation Development Centre (SW 15-29-8-W3)
Progress: One year only
Objective: To determine the effect of deep ripping on the soil moisture content and total water use for a sprinkler irrigated field.

Poor water infiltration on sprinkler irrigated fields can lead to runoff and waterponding. Water infiltration can be improved by deep ripping.

A demonstration project was initiated in the fall of 1990 to determine the effect of deep ripping on soil moisture for a sprinkler irrigated field at SIDC. Four strips were deep ripped to a depth of 50 cm. Each deep ripped strip was separated by a non-ripped check strip.

In the spring of 1991, Duke barley was seeded on the entire field. Neutron access tubes were installed to a depth of 120 cm at two locations within each deep ripped and check strip. Soil moisture was monitored with a neutron moisture meter throughout the growing season.

Total soil water content was significantly greater for the check strips at the last two sampling dates (Table 1). On the otherhand, total seasonal water use was greater for the deep ripped strips compared to the check strips (Table 2). Deep ripping would appear to have enhanced water uptake by the barley. However, there was no beneficial effect of the deep ripping on the irrigated barley grain yield at this site (Table 3).

Table 1. Comparison of total soil water content at specific sampling dates for the deep ripping demonstration on Field 5 at SIDC.

Sampling Date	Total Soil Water to a depth of 120 cm (mm) Deep Rip	Control	t
May 29	357	366	1.17 NS†
June 21	372	379	1.08 NS
July 5	390	397	1.24 NS
July 17	367	373	1.28 NS
July 31	328	345	2.15‡
August 12	320	344	2.54‡

†Not significant at P = 0.05.
‡Significant at P = 0.05.

Table 2. Seasonal water use for the deep ripping demonstration on Field 5 at SIDC.

Treatment	Precipitation	Irrigation	Soil Moisture Content Seasonal Change	Total Water Use
	----------	---------- mm	----------	----------
Deep Rip	247	63	37	347
Control	247	63	21	331
t value				2.22†

†Significant at P = 0.05.

Table 3. Yield of irrigated barley for the deep ripping demonstration on Field 5 at SIDC.

Treatment	Grain Yield @ 15% Moisture (kg/ha)	CV (%)	SE
Deep Rip	5055	11.0	276
Control	4920	17.0	416
t	0.95 NS†		

†Not significant at P = 0.05.

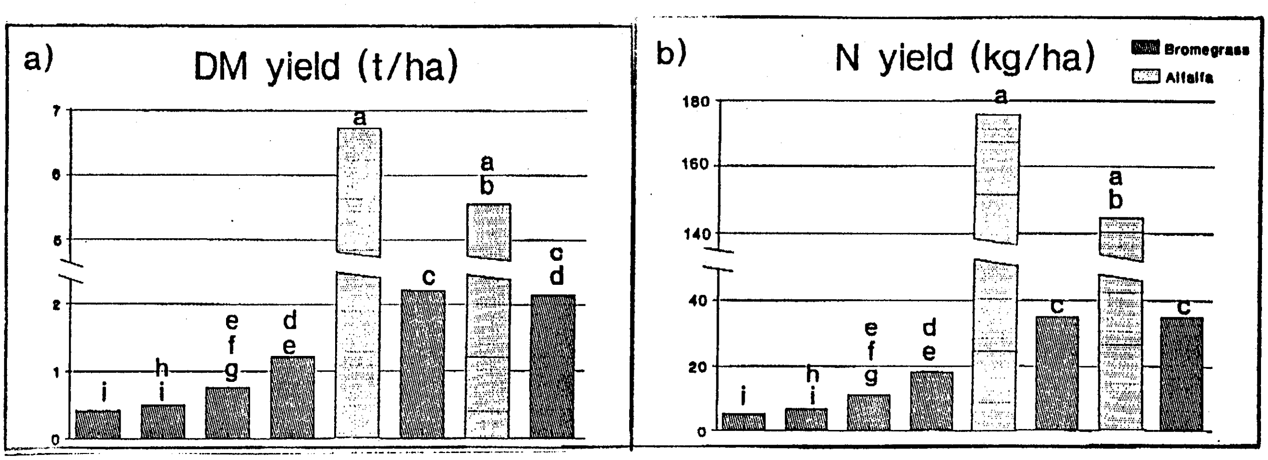
Mechanisms of Interspecific Nitrogen Transfer

Principal:	G.O. Tomm, EMBRAPA, Passo Fundo, RS, Brazil, Ph.D, Student at the Department of Crop Science and Plant Ecology, University of Saskatchewan
Co-investigators:	Dr. C. van Kessel and Dr. A.E. Slinkard, University of Saskatchewan

Progress:	Second year of three
Objectives:	Increase knowledge on N transfer to improve the basis for management decisions to increase productivity of legume-grass associations and reduce the dependency on N fertilizers.

Non-N_2-fixing crops intercropped with legumes may benefit through transfer of symbiotically fixed N from the legume crop. This effect of intercropped alfalfa (*Medicago sativa* L.) on meadow bromegrass (*Bromus riparius* Rhem.) forage and N yield by a combination of N transfer mechanisms occurring under field conditions was evaluated as a part of a broader study. Swards of single bromegrass and alfalfa intercropped with bromegrass were seeded in rows 17.8 cm apart in May 1990 at the SIDC. In the following year individual rows of plants, adjacent to each other, on both sides of the edge between the different swards were harvested separately for dry matter (DM) and N yield. Results of bromegrass were related to distance from the nearest row of alfalfa (Figure 1). Forage yield gradually increased from 427 to 1230 kg/ha and N yield increased from 53 to 184 kg/ha as the distance between the bromegrass row and the alfalfa row decreased from 71.1 cm to 17.8 cm. Yield of bromegrass located up to 35.6 cm from alfalfa was significantly increased, indicating transfer of N from alfalfa to bromegrass in agronomically relevant amounts.

Figure 1. Forage DM and N of alfalfa and bromegrass grown at a distance of 17.8, 35.6, 53.4 or 71.2 cm from alfalfa plants.



Means followed by a common letter do not differ (P<0.05) by Fisher's protected LSD test.

Environmental Sustainability Initiative

Canada-Saskatchewan Agreement on Environmental Sustainability (ESI)

The ESI Agreement was designed to facilitate the adoption of effective resource management and environmentally sustainable practices to ensure the long-term sustainability and competitiveness of the agri-food sector.

The Agreement is managed by the federal and provincial officers responsible for the Canada-Saskatchewan Agreement on Soil Conservation. It is administered for the federal government by Agriculture Canada's Prairie Farm Rehabilitation Administration (PFRA), and for the Province by Saskatchewan Agriculture and Food.

The following projects were actively conducted at SIDC and funded through this program.

Evaluation of a Mechanical Procedure for the Management of Crop Resources from Irrigated Production - Flail Shredder

Principal:	District #16 ADD Board
Funding:	Environmental Sustainability Initiative Program
Progress:	One year only
Location:	Outlook
Objectives:	To devise an environmentally and economically sustainable method of handling irrigated crop residues.

A flail shredder is a PTO-driven mower with flail knives spinning vertically around a drum. It is these flail knives which cut stubble (straw) into easily incorporated pieces. One or two passes with a field cultivator are usually enough to prepare a seedbed. The flail shredder was originally designed to shred corn stover, but also works well on cereal stubble. The main difference between a flail shredder and a rotary mower is in residue distribution patterns. By distributing the residue evenly across the soil surface a flail shredder can cope with heavier growth than a rotary mower.

Shredding or mowing is a conservation practice that reduces tillage and pulverization, protects soil structure, and builds organic content. Leaving residue shredded on the surface instead of burying it with tillage or removing it by baling or burning has real conservation value. Shredding residue is a good intermediate step between conventional horsepower tillage and zero tillage.

A flail shredder was purchased at a cost of $15,500. The machine was made available to individual irrigation producers for evaluation. Each cooperator treated 20 - 30 ha with the flail shredder and prepared the rest of the field for planting using traditional methodology. The minimum number of tillage operations required to facilitate easy passage of the seed drill will be evaluated in spring 1992. Records will be kept on equipment used, the number of operations and timing of the operations. SIDC staff and individual irrigation producers evaluated and conducted field trials in specific areas on specific crops in the fall of 1991. Videotaping and a demonstration day of the flail shredder were conducted in the fall of 1991 at SIDC. The early arrival of winter resulted in complete shutdown until spring 1992. The number of preseeding tillage operations, straw distribution, economics, soil moisture retention, and energy costs will be evaluated. SIDC staff will monitor several fields to determine the effect of shredding on the breakdown of crop residue.

SIDC staff surveyed ten co-operators and the following advantages and disadvantages were identified.

Advantages of Flail Shredder:

1) Soil conservation - through reduced tillage;
2) Energy reduction - through reduced tillage;
3) Soil enhancement - incorporate residues rather than burn;
4) Improved air quality - reduced burning;
5) Economic diversification - reduces impediments to growing irrigated crops that have residue problems;
6) Weed seeds remain on surface after shredding;
7) Low input sustainable agriculture.

Disadvantages of Flail Shredder:

1) Direct seeding after use may be limited by cool soils;
2) Purchase price versus benefits (cost per acre);
3) Parts availability (American company);
4) Trouble with hydraulics (end digging into ground);
5) Plugs if straw is wet in heavy stubble areas;
6) Hitch should be longer to allow for easier turning and stop PTO hammering;
7) Jacks are light duty for this heavy duty unit;
8) Chemical incorporation (chemigation?).

The shredder would have to replace one tillage operation and save at least one tillage operation to be a viable option. This project will evaluate these options in spring 1992.

Herbicide and Nutrient Leaching from an Irrigated Field

Principal:	W. Nicholaichuk National Hydrology Research Institute Saskatoon, Saskatchewan.
Funding:	Environmental Sustainability Initiative Program
Site:	Saskatchewan Irrigation Development Centre
Co-Investigators:	K. Best, A. Cessna, J. Elliott
Progress:	One year only
Objective:	To maximize the collection of water samples from suction lysimeters and the tile drain in a herbicide and nutrient leaching experiment.

The study was conducted on Field 11 at SIDC. The field is irrigated by linear sprinkler and is tile drained. Water samples for herbicide and nutrient analysis were collected during the fall leaching period. Suction lysimeters were used to collect water samples from depths of 30, 60, 90, 150 and 185 cm. Water flowing from the tile drain was also collected. An automated sample collection system was used to maintain a constant suction on 8 of the 64 lysimeters installed in the field.

Samples were collected from the tile drain every day from September 12 to October 18. A total of 376 water samples were collected from the lysimeters on seven sampling days: September 12, 15, 18, 23, 27, 30 and October 3. Samples were only collected from 65% of the lysimeters on the first sampling day but thereafter there was an 87% success rate.

Preliminary results indicate that residues from the herbicide "Lontrel" had penetrated to 90 cm by October 3rd. Although residues were not found in the deeper lysimeters, some residues were found in the tile drains suggesting that there were some preferential flowpaths in the soil.

Evaluation of Bezzerides Mechanical Weeding System in Row Crop Production

Principal:	Broderick Garden Centre
Funding:	Environmental Sustainability Initiative Program
Progress:	One year only
Objective:	To evaluate the Bezzerides mechanical weeding system for use in vegetable production in Saskatchewan.

The Bezzerides cultivation system uses a tined ground driven wheel to loosen the soil and a flat spring steel blade to remove weeds in the crop row. This machine was tested in the fall of 1991. A video of the machine in action is available for viewing. The machine is not effective on large weeds particularly those which produce vines like wild buckwheat. It would appear that this cultivation tool would be most effective when the crop plant is large relative to the weed and the seed bed is level. Although not all weeds are removed in the row, the amount of hand weeding required would be very significantly reduced.