# RESEARCH AND DEMONSTRATION
# HIGHLIGHTS 1988

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# SIDC
## INTRODUCTION

# 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.

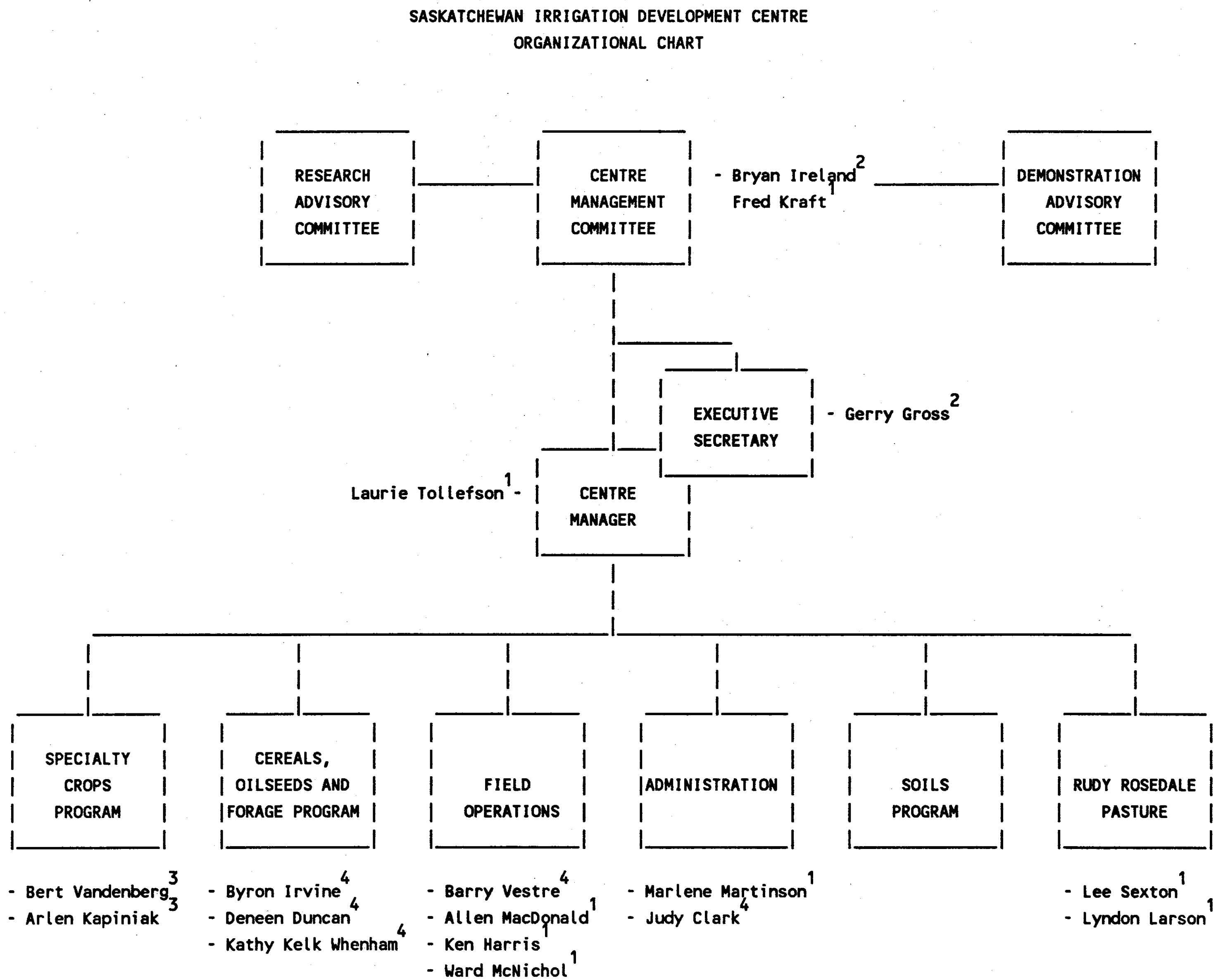
## THE ORGANIZATION:

The Centre consists of a landbase of eighty hectares. Research and demonstration projects are conducted both at the Centre and on farmer co-operative 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.

Figure 1: SIDC Organizational Chart:




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

2. The Research Advisory Committee in 1988 included farmer membership as well as membership from the University of Saskatchewan, federal and provincial governments and industry. This committee identified, reviewed and suggested proposals for irrigation 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 in 1988 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.

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

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.

## ACTIVITIES:

1988 was a busy year at the Centre. Some noteworthy accomplishments included:

1. The buried pressurized supply and irrigation system was modified to enable the system to operate automatically during the crop year.
2. A 15m x 36m steel storage quonset was erected.
3. A sample handling facility and drying room was constructed.
4. Additional office space was provided complete with a linking hallway.
5. Underground sprinklers were installed in the Centre grounds.
6. Initiation of the Specialty Crop Development and Demonstration program.
7. EM38 data recorded and salinity contour maps were generated.
8. Field 3 was converted from a flood irrigation area to a sprinkler irrigation area.
9. Removal of house B.
10. Centre road improvement and gravelling.

## CENTRE FUNDING

The core funding for the Saskatchewan Irrigation Development Centre is provided by Federal and Provincial A based funding. Additional funds are provided by the Federal-Provincial Irrigation Based Economic Development Agreement (IBED) and the provincially sponsored Agriculture Development Fund (ADF).

| Federal (Agriculture Canada) PFRA | | Provincial: Agri-Farm | Provincial: Spectrum Seeds | Provincial: Sask Water |
|---|---|---|---|---|
| Salaries | 171,200 | 211,370 | 71,820 | 80,800 |
| Operating | 120,000 | 18,020 | 21,100 | 38,700 |
| Capital: | | | | |
| Minor const. | 105,650 | | | |
| Equipment | 44,350 | 17,130 | 35,620 | |
| Travel | | 7,010 | 1,420 | |
| Total | 441,220 | 253,530 | 129,960 | 119,500 |
| | | | = 502,990 | |

Total expenditures for the year were 944,210

The Centre, in addition to funding "on-centre" activity, is responsible to manage all irrigation research, development and demonstration activities to support farmers in their effort to improve their competitive position. The financial support for this activity is now from the Canada-Saskatchewan Irrigation Based Economic Development (IBED) Agreement funded by Agriculture Canada and Saskatchewan Water Corporation. Original support for this activity was provided by funding from the Agriculture Development Fund.

To obtain IBED funding, the applicant must have an idea and plan for action which will aid the irrigation farmer. Application forms are obtained from the Centre, which are completed and returned to the Centre. Each application is reviewed and rated by a Research or Demonstration Advisory Committee. These committees advise the Centre Management Committee as to the proposal's merit. Once funding has been obtained, a contract is developed between the Centre and the applicant.

Dates for the submission of applications are January 1, April 1, July 1, and October 1. Applicants are notified of decisions within 90 days of the submission dates.

## SIDC Tours - 1988

Tours and extension are an important part of the Centre's activity.

Our summer field day was a particularly successful event with 120 people from the farming community in attendance.

32 tours were hosted by SIDC in 1988. The average size of group was 22 people. In total, there were over a thousand visitors to the Centre during the year.

# SIDC

## List of Projects

## ADF Research Projects:

| PROJECT NAME AND CO-OPERATOR | TERM | 1988 EXPENDITURES | TOTAL $ |
|---|---|---|---|
| Plant Disease of Irrigated Cereals<br>Principal: Duczek, Ag Canada | Four years | $27,950.00 | $111,300.00 |
| Management of Forage Production Under Irrigation<br>Principal: Goplen, Ag. Canada | Four years | $33,500.00 | $127,000.00 |
| Starch Potato Yields<br>Principal: Wahab, U of S | Four years | $8,277.00 | $66,100.00 |
| Irrigation Economics<br>Principal: S. Kulshreshtha, U of S | Four years | $24,600.00 | $88,300.00 |
| Irrigation of Dry Beans<br>Principal: A. Slinkard, U of S | Three years<br>Completed 1988 | $38,205.00 | $102,740.00 |
| Disease Screening<br>Principal: B. Harvey, U of S | Four years | $21,400.00 | $85,600.00 |
| Quality of Drainage Water<br>Principal: W. Nicholaichuk, et al<br>NHRI, SCC, Ag. Canada | Three years<br>Completed 1988 | $29,550.00 | $61,100.00 |
| Irrigating with Poor Quality Groundwater<br>Principal: Gillies, U of S | Three years<br>Completed 1988 | $15,900.00 | $47,700.00 |
| Semi-dwarf Barley<br>Principal: Rossnagel, U of S | Four years | $34,598.00 | $141,798.00 |
| TOTAL | | $233,980.00 | $831,638.00 |

## ADF Demonstration Projects:

| PROJECT NAME AND CO-OPERATOR | TERM | 1988 EXPENDITURES | TOTAL $ |
|---|---|---|---|
| Irrigated Canola Varieties Demonstration<br>Principal: Saskatchewan Canola Growers Assn. | Three years<br>Completed 1988 | $2,992.00 | $15,400.00 |
| Feed Value of Corn Silage by Harvest Maturity<br>Principal: SCC; Crowle, Ag Canada | Three years<br>Completed 1988 | 0.00 | $12,000.00 |
| TOTAL | | $2,992.00 | $27,400.00 |

IBED Research Projects:

| PROJECT NAME AND CO-OPERATOR | TERM | 1988 EXPENDITURES | TOTAL $ |
|---|---|---|---|
| Methods of Improving Alfalfa Establishment under Irrigated Conditions<br>Principal: B. Irvine, SIDC | Four years | $116.00 | $4,700.00 |
| Seed Production of Forage Legumes<br>Principal: B. Irvine, SIDC | Four years | $35.00 | $300.00 |
| Seed Production of Kentucky Bluegrass<br>Principal: B. Irvine, SIDC | Four years | $15.00 | $660.00 |
| Effects of Growth Regulators on Canola<br>Principal: B. Irvine, SIDC | Three years | $0.00 | $462.00 |
| Cultural Methods of Sclerotinia Control<br>Principal: B. Irvine, SIDC | Three years | $0.00 | $165.00 |
| Irrigation Scheduling Information<br>Principal: R. Lawford, NHRI | Two years | $4,500.00 | $30,000.00 |
| Corn Hybrid Testing<br>Principal: Sask Corn Committee | Three years | $0.00 | $17,135.00 |
| Determination of Soil Intake Rates under Centre Pivot Irrigation Systems<br>Principal: D. Norum, U of S | Two years | $0.00 | $52,600.00 |
| N Fertilization and Water Use Efficiency of Irrigated Crops<br>Principal: C. van Kessel, U of S | Three years | $35,946.00 | $134,000.00 |
| The Design and Field Testing of a Vertical Mulcher for Irrigated Soils<br>Principal: Paragon Consultants Ltd., T. Tollefson | Three years | $31,925.00 | $73,750.00 |
| Alfalfa Cultivar Evaluation on Flood Irrigated Clay Soils in South-west Saskatchewan<br>Principal: P. Jefferson | Four years | $0.00 | $210,000.00 |
| Irrigation Scheduling Tools for Farm Use<br>Principal: B. Irvine | Three years | $25,580.00 | $45,760.00 |
| Development of Added Value Alfalfa Varieties<br>Principal: | One year<br>Completed 1988 | $0.00 | $26,000.00 |
| Evaluation of Conventional Height Semi-Dwarf Cultivars for Irrigated Production in Saskatchewan<br>Principal: P. Hucl, Sask Wheat Pool | Three years | $3,000.00 | $14,033.00 |
| Sodicity Hazard of Sodium and Bicarbonate<br>Principal: F. Selles | | $0.00 | $349,200.00 |
| TOTAL | | $101,117.00 | $958,765.00 |

IBED Demonstration Projects:

| PROJECT NAME AND CO-OPERATOR | TERM | 1988 EXPENDITURES | TOTAL $ |
|---|---|---|---|
| Irrigated Canola Varieties Demonstration<br>Co-operator: M. Larson | Two years<br>Completed 1988 | $660.00 | $2,000.00 |
| Intensive Production of Irrigated Soft Wheat<br>Co-operative: H. Joel | Three years | $482.00 | $3,143.00 |
| Use of Moisturized Seed for Increased Crop Yields<br>Co-operative: R. Duncan | Three years | $652.00 | $3,100.00 |
| Fertigation Feasibility on Fine Sandy Loam<br>Co-operators: Roger and Richard Bond<br>Richard Bond | Three years | $2,524.00 | $10,914.00 |
| Yield Comparison of Wheat & Barley under Spring-flood Irrigation<br>Co-operator: Rick Tweet | Three years | $727.00 | $2,225.00 |
| Effect of Nozzle Type & Water Volume on Control of Quackgrass at Two Growth Stages<br>Co-operator: R. Derdall | Two years | $0.00 | $1,048.00 |
| Seed Rate Comparison of Irrigated Durum, Site #1<br>Co-operator: D. Ewen | Three years | $528.00 | $1,508.00 |
| Seed Rate Comparison of Irrigated Barley, Site #2<br>Co-operator: G. Follick; Year two: R. Duncan | Three years | $544.00 | $1,508.00 |
| Oilseed/Pulse Crop Sequence<br>Co-operator: R. Byron Irvine, SIDC | Three years | $491.00 | $2,592.00 |
| Double Cropping of Annual Forages vs. Alfalfa Forage<br>Co-operator: R. Byron Irvine, SIDC | Three years | $510.00 | $2,496.00 |
| Agronomics of Pinto Beans Using Conventional Farm Equipment<br>Co-operator: K. Carlson, Keg Farms Ltd. | Three years | $3,476.00 | $10,500.00 |
| Comparison of Leduc and Virden Barley for Silage Production Under Irrigation<br>Co-operator: R. Byron Irvine, SIDC | Two years<br>Completed 1988 | $400.00 | $1,800.00 |
| Irrigated Production of Texas Kochia on Saline Soil<br>Co-operator: R. Derdall | Two years | $1,343.00 | $4,000.00 |
| Irrigated Field Pea Early Seeding Demonstration<br>Co-operator: J. Konst | Three years | $4,708.00 | $14,982.00 |
| Ripping Solonetzic Soils<br>Co-operator: M. Grevers | Three years | $7,646.00 | $27,253.00 |
| Alfalfa Varieties on Border Dyke Irrigation - Yield and Stand Longevity<br>Co-operator: R. Anderson | Five years | $2,367.00 | $12,050.00 |
| Alfalfa Establishment and Fertility for Increased Yield<br>Co-operator: R. Harrigan | Five years | $1,980.00 | $49,883.00 |
| Maximum Economic Yield<br>Co-operator: Outlook Irrigation Production Club | Four years | $16,971.00 | $77,900.00 |
| Finishing & Marketing Options for Lambs Raised on Irrigated Pasture<br>Co-operator: Dale Kelman | One year<br>Completed 1988 | $3,500.00 | $5,000.00 |
| Creep Feeding Lambs Raised on Irrigated Pasture<br>Co-operator: R.D.H. Cohen | One year<br>Completed 1988 | $8,320.00 | $12,360.00 |

IBED Demonstration Projects (cont.)

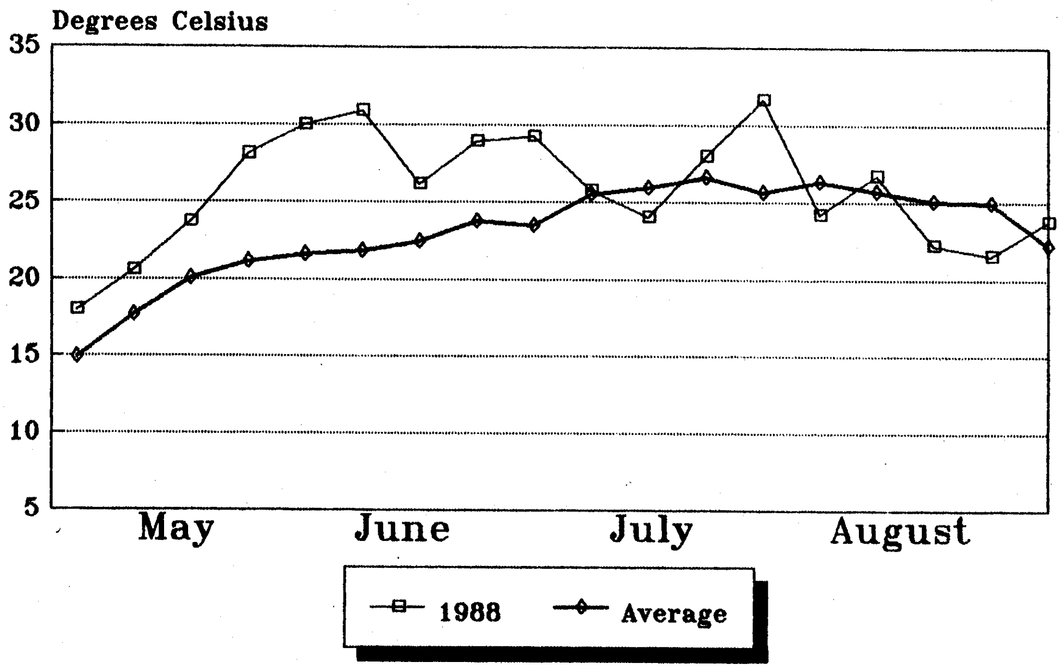
| PROJECT NAME AND CO-OPERATOR | TERM | 1988 EXPENDITURES | TOTAL $ |
|---|---|---|---|
| Drainage & Subsoiling to Improve the Yield of Alfalfa on Border Dyke Irrigation<br>Co-operator: D. Harrigan | Four years | $516.00 | $14,748.00 |
| Use of Spring Seeding Winter Annual Cereal Grains for Grazing I. Large Animal Trial<br>Co-operator: Vestre Farms | Two years | $3,235.00 | $8,720.00 |
| Use of Lentil as a Companion Crop in Establishing Irrigated Alfalfa for Seed Production<br>Co-operator: Keg Farms Ltd. | Three years (Year 1 cancelled) | $0.00 | $15,260.00 |
| Irrigated Fababean Agronomy Demonstration of Benefits of Early Seeding<br>Co-operator: M. Miller | Three years | $3,167.00 | $11,232.00 |
| Alternative Desiccation Products for Lentils<br>Co-operator: D. Duncan, SIDC<br>Site: B. Tullis | Two years | $44.00 | $2,770.00 |
| Intensive Management of Irrigated Soft Wheat, Site 2<br>Co-operator: D. Duncan, SIDC<br>Site: D. Dyck | Two years | $471.00 | $1,540.00 |
| Use of Moisturized Seed for Increased Crop Production, Site #2<br>Co-operator: D. Duncan, SIDC<br>Site: W. Jones | Two years | $626.00 | $1,725.00 |
| Canola Variety Demonstration, Site 1<br>Co-operator: D. Duncan, SIDC | Three years Begins 1989 | $0.00 | $6,175.00 |
| Canola Variety Demonstration, Site 2<br>Co-operator: D. Duncan, SIDC<br>Site: C. Bagshaw | Three years | $1,235.00 | $5,050.00 |
| Evaluation of a Reservoir Tillage System to Reduce Runoff at High Water Application Rates<br>Co-operator: D. Duncan, SIDC<br>Site: J. Eliason | One year Completed 1988 | $2,062.00 | $2,220.00 |
| Yield Response to Nitrogen Fertilizer under Backflood Irrigation<br>Co-operator: Paul Perrault | Three years | $24.00 | $3,000.00 |
| Irrigated Safflower Agronomy: Evaluation of Fungicides for Disease Control<br>Co-operator; Gerald Follick | Three years | $1,639.00 | $14,817.00 |
| Kochia Production Under Irrigation<br>Co-operator: R.S.Williamson | Three years | $148.00 | $6,180.00 |
| Using Chemical Desiccants to Speed Curing of Alfalfa Forage<br>Co-operator: L. Knapik | Two years | $0.00 | $3,212.00 |
| Irrigated Field Pea Agronomy<br>Co-operator: G. Follick | One year Completed 1988 | $3,198.00 | $3,738.00 |
| TOTAL | | $74,194.00 | $346,649.00 |

# SIDC

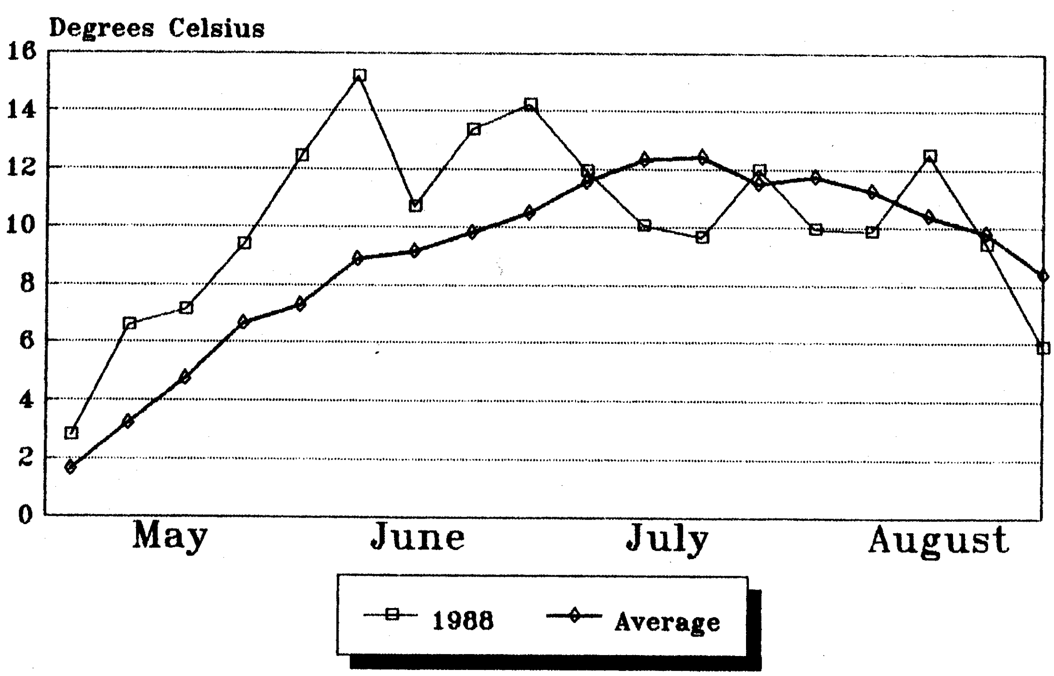
## Meteorological and Irrigation Data

Page

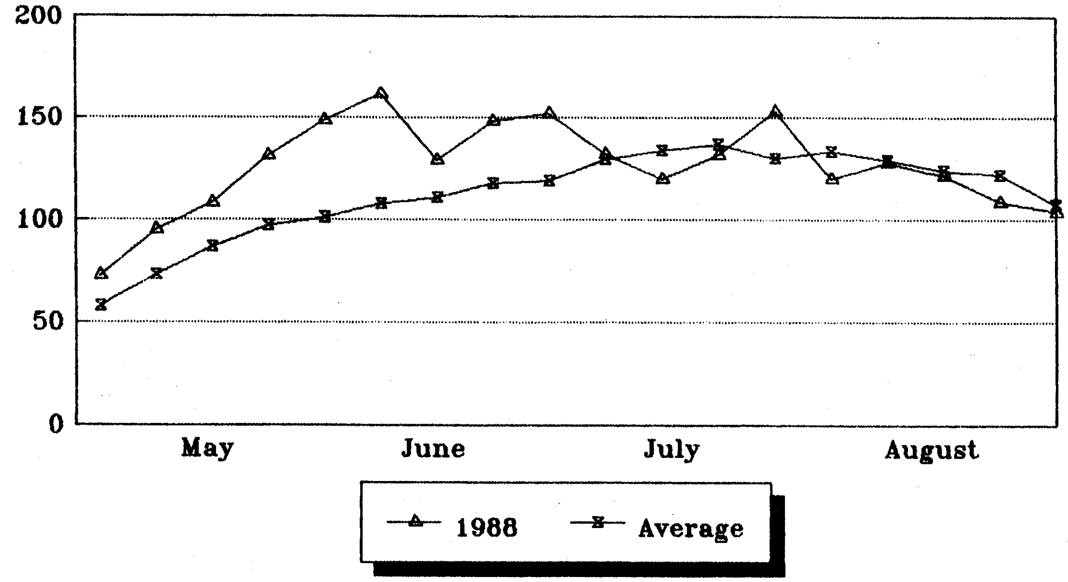
# Weekly Mean Maximum Temperature S.I.D.C.



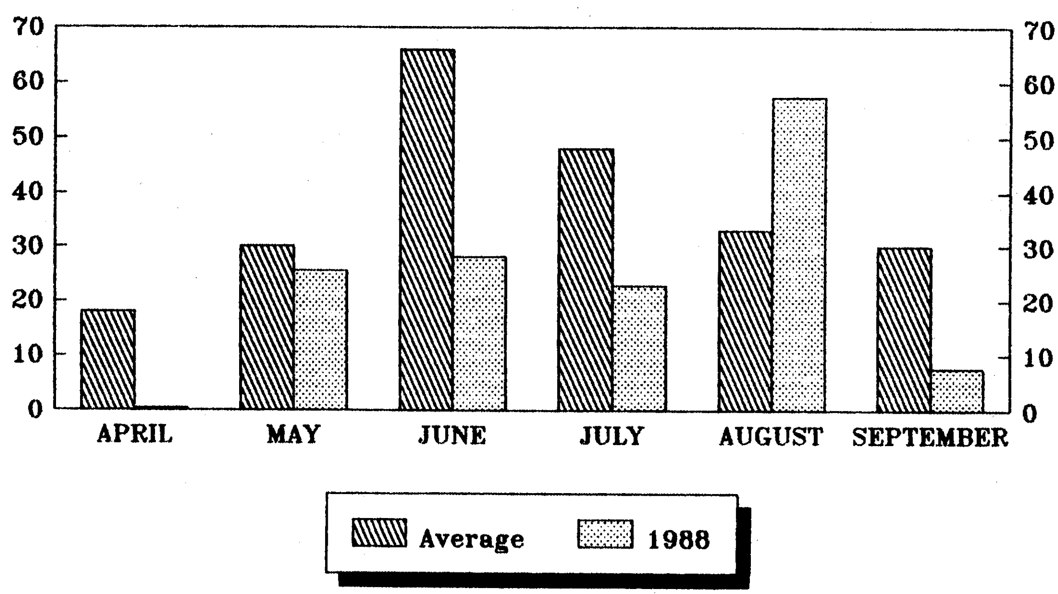

# Weekly Mean Minimum Temperature S.I.D.C.



# Growing Degree Days
## Weekly Accumulation
## S.I.D.C.

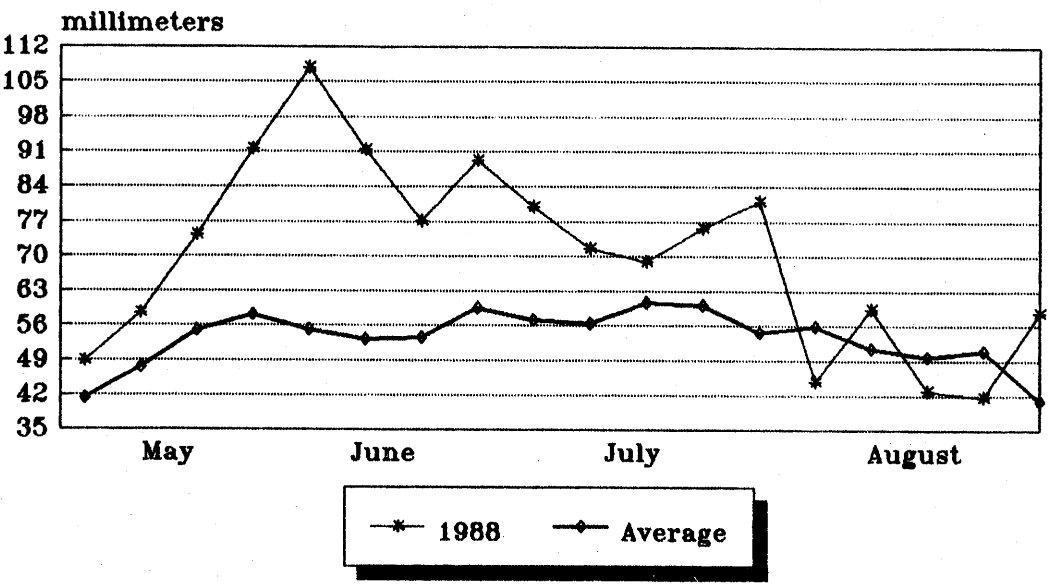



# Precipitation
## Monthly Accumulation
## S.I.D.C.




Outlook, Sask.

# Evaporation Pan Readings
## Weekly Accumulation
## S.I.D.C.



# 1988 Irrigation Data (mm)

| Crop | May | June | July | August | Sept. | Total through Growing Season | Fall Irrigation | Total Irrigation |
|---|---|---|---|---|---|---|---|---|
| Argyle Barley | 17.5 | 182.0 | 97.0 | 0.0 | 0.0 | 296.5 | 50.0 | 346.5 |
| ADF Variety Trial | 17.5 | 150.0 | 97.0 | 35.0 | 0.0 | 299.5 | 50.0 | 349.0 |
| Corn (Crowle) | 17.5 | 165.0 | 97.0 | 35.0 | 0.0 | 314.5 | 50.0 | 364.5 |
| Seed Potatoes | 17.5 | 18.0 | 97.0 | 35.0 | 0.0 | 319.5 | 50.0 | 369.5 |
| HY 320 | 0.0 | 92.0 | 53.0 | 0.0 | 0.0 | 145.0 | 0.0 | 145.0 |
| Leduc Barley (1) | | | July 25 (flooded) | | Sept. 6 (flooded) | | | |
| Owens & Fielder Soft Wheat | | June 8 (flooded) | July 25 (flooded) | | | | | |
| Alfalfa Establishment | 0.0 | 82.5 | 107.5 | 42.5 | 55.0 | 287.5 | 0.0 | 287.5 |
| Leduc Barley (2) | 0.0 | 82.5 | 107.5 | 42.5 | 0.0 | 232.5 | 55.0 | 287.5 |
| Leduc Barley (3) | 0.0 | 82.5 | 107.5 | 0.0 | 0.0 | 190.0 | 97.5 | 287.5 |
| Alfalfa | 27.5 | 235.0 | 112.5 | 47.5 | 60.0 | 482.5 | 0.0 | 482.5 |
| HRS Varieties | 0.0 | 118.0 | 70.0 | 0.0 | 0.0 | 188.0 | 55.0 | 243.0 |
| Cereal Diseases (Duczek) | 15.0 | 150.0 | 140.0 | 25.0 | 0.0 | 330.0 | 100.0 | 430.0 |
| Harrington Barley | 15.0 | 150.0 | 140.0 | 25.0 | 0.0 | 330.0 | 100.0 | 430.0 |
| Fielder Soft Wheat | 15.0 | 150.0 | 140.0 | 25.0 | 0.0 | 330.0 | 100.0 | 430.0 |
| Barley (Rossnagel) | 15.0 | 150.0 | 152.5 | 25.0 | 0.0 | 342.5 | 100.0 | 442.5 |
| Soft Wheat (Baker) | 15.0 | 177.0 | 152.5 | 50.0 | 0.0 | 394.5 | 100.0 | 494.5 |
| Canary Seed | 15.0 | 162.5 | 152.5 | 50.0 | 0.0 | 380.0 | 100.0 | 480.0 |
| Mid and Late Barley | 15.0 | 150.0 | 152.5 | 25.0 | 0.0 | 342.5 | 100.0 | 442.5 |
| Katepwa | 15.0 | 150.0 | 0.0 | 0.0 | 0.0 | 165.0 | 277.5 | 442.5 |
| Canola | 15.0 | 113.0 | 175.0 | 45.0 | 0.0 | 348.0 | 0.0 | 348.0 |
| Mustard | 15.0 | 113.0 | 175.0 | 45.0 | 0.0 | 348.0 | 0.0 | 348.0 |
| Sunflower | 15.0 | 113.0 | 200.0 | 20.0 | 0.0 | 348.0 | 0.0 | 348.0 |
| Canola (Teo) | 15.0 | 103.0 | 162.5 | 25.0 | 0.0 | 305.5 | 0.0 | 305.5 |
| Dry Bean - Full Irrigation | 15.0 | 98.0 | 155.0 | 25.0 | 0.0 | 293.0 | 0.0 | 293.0 |
| Dry Bean - Partial Irrigation | 15.0 | 45.5 | 45.0 | 0.0 | 0.0 | 105.5 | 0.0 | 105.5 |
| Peas | 15.0 | 98.0 | 155.0 | 25.0 | 0.0 | 293.0 | 0.0 | 293.0 |
| Durum Varieties | 42.0 | 140.0 | 152.5 | 0.0 | 0.0 | 334.5 | 100.0 | 434.5 |
| Malt Barley | 42.0 | 142.0 | 152.5 | 0.0 | 0.0 | 336.5 | 100.0 | 436.5 |
| Leduc Barley (4) | 42.0 | 142.0 | 152.5 | 0.0 | 0.0 | 336.5 | 100.0 | 436.5 |
| Heartland Barley | 0.0 | 107.0 | 71.2 | 0.0 | 0.0 | 178.2 | 475.0 | 653.2 |
| Owens Soft Wheat | 50.0 | 155.0 | 162.0 | 25.0 | 0.0 | 392.0 | 60.0 | 452.0 |
| Fababean | 50.0 | 155.0 | 162.0 | 25.0 | 0.0 | 392.0 | 60.0 | 452.0 |
| Double Cropping | 50.0 | 155.0 | 162.0 | 25.0 | 0.0 | 392.0 | 72.0 | 464.0 |
| Oilseed Pulse Crop - Year 2 | 0.0 | 155.0 | 162.0 | 25.0 | 0.0 | 342.0 | 60.0 | 402.0 |
| Oilseed Pulse Crop | 0.0 | 155.0 | 162.0 | 45.0 | 0.0 | 362.0 | 60.0 | 422.0 |
| Elrose Barley | 0.0 | 155.0 | 162.0 | 45.0 | 0.0 | 362.0 | 60.0 | 422.0 |

# CEREALS

Page

# Spring Grain Regional Adaptation Trials

Principal: F.A. Holm, Crop Development Centre
University of Saskatchewan
Saskatoon, Saskatchewan S7N 0W0

The Regional Spring Grain Variety Testing program is a co-operative venture of the University of Saskatchewan, Crop Development Centre, Saskatchewan Rural Development Extension Service and participating farmers. The Agriculture Development Fund provides funding for this program. The location at SIDC in Outlook is the only irrigated testing site in Saskatchewan.

Spring Grain Irrigated Variety Trials, Outlook, Saskatchewan, 1983-1988:

Table 1. Yield as % of Katepwa

| Wheat | 83 | 84 | 85 | Ave. |
|---|---|---|---|---|
| Katepwa | 100 | 100 | 100 | 100 |
| Columbus | 96 | 79 | 98 | 91 |
| Neepawa | 96 | 88 | 101 | 95 |
| Benito | -- | 85 | -- | 85 |
| Leader | 95 | 94 | -- | 95 |
| HY 320 | 116 | 113 | 131 | 120 |
| Fielder | 117 | 111 | 116 | -- |
| Dirkwin | 101 | -- | -- | 101 |
| Owens | -- | 123 | 114 | 119 |

Table 2. Yield % of Wascana

| Durum Wheat | 87 | 88 | Ave. |
|---|---|---|---|
| Wascana | 100 | 100 | 100 |
| Arcola | 125 | 129 | 127 |
| Kyle | 108 | 139 | 124 |
| Medora | 105 | 119 | 112 |
| Sceptre | 97 | 128 | 112 |
| Wakooma | 104 | 98 | 101 |

Table 3. Yield as % of Dufferin

| Flax | 83 | 84 | 85 | 86 | 87 | 88 | Ave. |
|---|---|---|---|---|---|---|---|
| Dufferin | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| McGregor | 103 | 132 | 122 | 125 | 128 | 98 | 118 |
| Noralta | 95 | 102 | 131 | 109 | 127 | 82 | 108 |
| Norlin | 107 | 102 | 135 | 116 | 131 | 86 | 113 |
| Linott | 96 | 110 | 126 | 115 | 94 | 94 | 106 |
| Culbert | 95 | -- | 126 | -- | -- | -- | 111 |
| Norman | 93 | 110 | 129 | 126 | 113 | 99 | 112 |
| Vimy | -- | -- | -- | 113 | 99 | 105 | 106 |
| STS | -- | -- | 135 | 106 | 102 | -- | 115 |
| Andro | -- | -- | -- | -- | -- | 81 | 81 |

Table 4. Yield of % of Westar

| Canola | 83 | 84 | 85 | 86 | 87 | 88 | Ave. |
|---|---|---|---|---|---|---|---|
| B. Napus | | | | | | | |
| Westar | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Andor | 93 | 109 | -- | 80 | -- | -- | 94 |
| Altex | 86 | -- | -- | -- | -- | -- | 86 |
| Regent | 85 | 88 | -- | 77 | 100 | 102 | 90 |
| Triton | -- | 65 | -- | 55 | -- | -- | 60 |
| Tribute | -- | -- | -- | 55 | 68 | -- | 60 |
| DN 188 | -- | -- | -- | -- | -- | 107 | 107 |
| DO 195 | -- | -- | -- | -- | -- | 84 | 84 |
| Alto | -- | -- | -- | -- | -- | 107 | 107 |
| Legend | -- | -- | -- | -- | -- | 103 | 103 |
| B. campestris | | | | | | | |
| Tobin | 89 | 106 | -- | 112 | 80 | 69 | 91.2 |
| Candle | 77 | 82 | -- | 82 | -- | -- | 81 |
| ACS C1 | -- | -- | -- | -- | -- | 75 | 75 |
| SV03334 | -- | -- | -- | -- | -- | 70 | 70 |
| SV8236579 | -- | -- | -- | -- | -- | 63 | 63 |

Table 5. Yield as % of Domo

| Mustard | 83 | 84 | 85 | 86 | 87 | Ave. |
|---|---|---|---|---|---|---|
| Oriental: | | | | | | |
| Domo | 100 | 100 | 100 | 100 | 100 | 100 |
| Cutlass | 103 | 106 | 110 | 96 | 113 | 106 |
| Donskaja | -- | -- | 111 | 79 | -- | 95 |
| Brown: | | | | | | |
| Blaze | 101 | 91 | -- | -- | -- | 96 |
| Scimitar | -- | -- | 68 | 84 | 88 | 80 |

Table 6. Yield as a % of Harrington

| 2-ROW BARLEY | | 6-ROW BARLEY | |
|---|---|---|---|
| Variety | 88 | Variety | 88 |
| Harrington | 100 | Argyle | 105 |
| Ellice | 96 | Heartland | 95 |
| TR 479 | 92 | Leduc | 111 |
| TR 490 | 97 | Virden | 119 |

Table 7. Yield as a % of HY320

| Variety | % of HY320 |
|---|---|
| HY100 | 83 |
| HY320 | 100 |
| HY593 | 76 |
| HY925 | 73 |
| HY355 | 117 |
| HY364 | 108 |
| HY368 | 109 |
| HY371 | 98 |
| HY372 | 102 |
| HY373 | 99 |
| HY374 | 114 |
| HY375 | 100 |
| HY376 | 117 |
| HY377 | 105 |
| HY378 | 109 |
| HY379 | 115 |
| HY380 | 127 |
| HY381 | 118 |
| HY382 | 100 |
| HY383 | 105 |
| HY607 | 102 |
| HY608 | 84 |
| HY609 | 105 |
| HY931 | 108 |
| HY933 | 102 |

## EVALUATION OF CONVENTIONAL HEIGHT AND SEMI-DWARF DURUM CULTIVARS FOR IRRIGATED PRODUCTION IN SASKATCHEWAN

Principal: Pierre Hucl
Saskatchewan Wheat Pool
#15 Innovation Blvd.
Saskatoon, Saskatchewan S7N 2X8
Funding: Irrigation Based Economic Development Agreement
Location: 1 km east of Outlook
Progress: First year of three
Objectives: To evaluate the potential of semi-dwarf versus conventional height amber durum wheat (*Triticum turgidum L. var. durum*) cultivars and lines under irrigation production conditions.

The 1988 irrigated durum test consisted of 13 durum cultivars or lines, four of which were U.S. semi-dwarf experimental lines. The cultivars Neepawa and Fielder were included as standard CWRS and CWSWS checks. These 15 lines were seeded in a randomized complete block with four replicates at a site approximately 1 km east of Outlook.

Although it is very difficult to make any conclusions based on only one station-year of data, the following statements can be made:

1. Medora was the best yielding registered cultivar under irrigated production at Outlook, Saskatchewan in 1988.
2. Semi-dwarf cultivars have the potential for high yield and good quality, with reduced straw height compared to conventional cultivars under irrigation.
3. Provided that the crop is provided adequate fertilizer Nitrogen, quality of durum produced under irrigation is comparable to that produced under dryland conditions.

## Estimating Potential Yields of Durum Wheat

| | |
|---|---|
| Principal: | Outlook Irrigation Production Club<br>R. Byron Irvine, Saskatchewan Irrigation Development Centre |
| Funding: | Irrigation Based Economic Development Agreement |
| Location: | Outlook area |
| Progress: | First year of four |
| Objective: | To determine the potential yields of durum wheat early in the season. |

It has been established that grain yields are strongly related to dry matter production and to harvest index. Forage researchers have used a weighted disc to rapidly estimate the dry matter yields of grasses. John Harrington, from the Outlook Cereal Production Club, took six samples 1 $m^2$ from each of three fields of durum wheat at Zadoks growth stages 31, 41, 51 and 91. These six samples were from areas which appeared to differ in growth and could represent 18 distinct "fields". Weighted disc measurements were taken at GS 31, 41 and 51 from the same area of the field. The disc used was 60 cm in diameter made from 9 mm thick plywood weighted to 2 kg. The disc has a hole in the center through which a pipe is inserted. The disc compresses the plant material and the height of the compressed plant is related to the dry matter production at this time.

The disc used requires refinement. The following linear regression models were obtained:

$$\text{Grain} = 113.7 + 2.525 \text{ (height of disc mm @ GS 51)} \quad R^2 = 0.633$$

$$\text{Grain} = -112.9 + 2.03 \text{ (height of disc mm @ GS 51)} + 867 \text{ (Harvest index)} \quad R^2 = 0.88$$

It is obvious that an $R^2$ of 0.633 does not, in itself, explain sufficient variation to be predictive nor does an estimate of harvest index. Since harvest index is not available at GS 51, kernels/spike could be determined at this time and this could be used in place of harvest index with some drop in accuracy. Although high temperatures after GS 51 could reduce grain filling period and, thus, kernel size, the method could have merit since nothing is currently available.

The results of this trial are sufficiently encouraging to warrant expansion of this work due to the great need for a simple estimate of potential yield on which to base fungicide application decisions.

## Soft White Spring Wheat Co-operative Trial

Principal: R.J. Baker, Crop Development Centre
University of Saskatchewan
Saskatoon, Saskatchewan S7N OWO

Thirty spring wheat cultivars, including four check cultivars, four fourth-year entries, two third-year entries, eight second-year entries and 12 first-year entries were evaluated in a four-replicate experiment at SIDC. The same test was also grown at Saskatoon, Lethbridge, Vauxhall and Bow Island. All entries except the check cultivars, WA 6920 (from USDA, Washington) and ID0266 (from USDA Idaho) are from the Agriculture Canada Research Station in Lethbridge. Average 1988 yields (kg/ha) at Outlook and over all five test sites are reported below.

Table 1. Average 1988 yields

| Entry | Year in test | Yield (kg/ha) | | Entry | Year in test | Yield (kg/ha) | |
|---|---|---|---|---|---|---|---|
| | | Outlook | Average | | | Outlook | Average |
| Fielder | check | 3340 | 5050 | 85-WI-0546 | 2 | 4350 | 5640 |
| Owens | check | 3560 | 5190 | 84-2094 | 2 | 4020 | 5200 |
| HY320 | check | 2890 | 4300 | HY355 | check | 3910 | 5370 |
| L2627-40 | 4 | 3360 | 5010 | 83111-130 | 1 | 3140 | 4640 |
| WA 6920 | 4 | 3235 | 4880 | 83104-42 | 1 | 3000 | 4640 |
| L2630-25 | 4 | 3770 | 5370 | 83117-189 | 1 | 4000 | 5610 |
| L2630-58 | 4 | 3520 | 5030 | 83111-103 | 1 | 2540 | 4470 |
| IDO 266 | 3 | 3860 | 4990 | 83351-794 | 1 | 3160 | 5030 |
| L2634-23 | 3 | 3480 | 4920 | 83351-830 | 1 | 3200 | 4950 |
| Bliss-411 | 2 | 3380 | 5260 | 83351-829 | 1 | 3200 | 5070 |
| Bliss-459 | 2 | 3820 | 5410 | 83351-796 | 1 | 3360 | 5150 |
| 85-WI-0263 | 2 | 3810 | 5640 | 83351-724 | 1 | 3200 | 4730 |
| 85-WI-0545 | 2 | 4070 | 5430 | 83351-795 | 1 | 3250 | 5080 |
| 85-WI-0912 | 2 | 3550 | 5260 | SWS-52-1 | 1 | 3970 | 5410 |
| 85-WI-1003 | 2 | 3780 | 5130 | SWS-52-2 | 1 | 3760 | 5210 |

## Irrigated Semi-dwarf Barley: Maximizing Barley Production Under High Input Conditions via Semi-dwarf Varieties in Saskatchewan

Principal: Brian Rossnagel, Crop Development Centre
University of Saskatchewan
Saskatoon, Saskatchewan S7N OWO
Funding: Agriculture Development Fund
Site: Outlook
Co-operator: Saskatchewan Irrigation Development Centre
Progress: Third year of four

As part of a larger project funded by the Saskatchewan Agriculture Development fund, several semi-dwarf evaluations were undertaken at SIDC in 1988. Four different trials were conducted .

The first trial was a varietal comparison trial including the standard height check cultivars Heartland and Leduc, the registered semi-dwarf cultivars, Duke, Samson and Winchester and ten CDC semi-dwarf breeding lines, two of which are hulless semi-dwarfs. Of note was the exceptionally good performance of lines SB86453 and SB84668 and the relatively poor performance of Winchester. This last was considered useful despite the general lack of lodging due to the extreme June heat.

The second test is a seeding rate trial comparing the three registered semi-dwarfs with the Heartland check at three different seeding rates. No seed rate by variety interaction was detected.

The third trial is a seeding depth study comparing the same four varieties as the second test at four seeding depths ranging from 3-9 cm (1-4 inches). Once again, no variety by treatment interaction was detected.

The final test is a trial which evaluated the check varieties Heartland, Duke, Samson, Winchester and BT492 (an advanced normal height hulless genotype) and compared these with five foreign introductions and thirty CDC semi-dwarf breeding lines, 11 of which again were hulless selections. Based on this and other data from a second location, the best of these lines will be advanced to further trials in 1989.

## Dwarf Oat Trial 1988 Demonstration

Principal: R. Byron Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Location: Saskatchewan Irrigation Development Centre
Objective: To test three new lines of Dwarf Oats and two standard varieties of oats under pivot irrigation.

Germination of all plots was uniform, with a good, healthy stand. There was no apparant disease occurring with any of the varieties and zero percent lodging was recorded. The Robert Oats had a late maturity date compared to the other varieties which all matured about the same time.

Plant heights taken on September 7, 1988 did not differ significantly. This result was unexpected and cannot be explained, since the three new lines of Oats tested contained dwarf genes (Table 1). All plots were combined on September 7, 1988 with final average grain yields not significantly different from each other.

Table 1. Dwarf Oat trial mean plant heights and mean grain yields, taken on September 7, 1988.

| Variety | Height | Mean grain yield |
|---|---|---|
| | (cm) | (kg/ha) |
| ROBERT | 109.0 | 4577.4 |
| CALIBRE | 108.8 | 4355.6 |
| *W86719 | 100.0 | 4800.9 |
| *W86012 | 103.0 | 4692.6 |
| *W86718 | 99.0 | 4405.4 |
| | PROB>F=0.5443 | PROB>F=0.5624 |

* contains the dwarf gene

The 1988 Dwarf Oat Trial showed no significant difference between varieties in either plant height or yield. The extreme heat which occurred in the growing season of 1988 is not considered normal for this area. Problems with lodging generally occur under irrigation with standard oat varieties.

## PLANT DISEASES OF IRRIGATED CEREALS

Principal: L.J. Duczek, Agriculture Canada Research Station
Saskatoon, Saskatchewan S7N 0X2
Funding: Agriculture Development Fund
Location: Main site at SIDC
Several commercial fields
Co-operators: SIDC
Progress: Third year of four
Objective: To evaluate the incidence, severity and control of cereal crop diseases under irrigated conditions.

A disease survey of irrigated spring wheat and spring barley fields indicated that foliar disease levels were low throughout the growing season in 1988. By the end of July, there was little disease in the upper leaves so there should not have been any significant yield loss due to foliar diseases. Foliar disease levels, common root rot and Septoria seed infestation were higher on wheat sown on cereal stubble than on wheat sown on oilseed or legume stubble. However, all levels of disease were low and insignificant in terms of damage to yield and quality.

In tests done at SIDC in Outlook, the use of registered seed treatments did not result in yield gains in either wheat or barley. Application of some foliar fungicides decreased foliar disease levels compared to an untreated check but disease levels were low and, as expected, no treatments significantly increased yield in either wheat or barley. At an irrigated site at Saskatoon, cultivars were assessed for foliar disease but levels of disease were too low to adequately assess resistance in wheat, barley and oats.

## DISEASE SCREENING

Principal: B.L. Harvey, Dept. of Crop Science & Plant Ecology
University of Saskatchewan, Saskatoon, Saskatchewan, S7N 0W0
Funding: Agriculture Development Fund
Site: University of Saskatchewan
Co-operators: Crop Development Staff
Progress: Third year of four
Objective:
a) to establish an intensive irrigation field disease screening system at the University of Saskatchewan;
b) to begin disease screening for resistance to various diseases including stem and leaf rust of wheat and barley, septoria in wheat and barley, net blotch and scald of barley, tan spot in wheat and aschochyta on pulses.

Despite the rather drastic weather conditions of 1988 at Saskatoon, our high frequency low volume irrigation system continued to work well when screening for net-blotch (Pyrenophora teres f. sp. maculata) in barley and Ascochyta leaf blotch in lentil. The extreme heat in early June did delay infection and led to a later than normal epidemic, however, effective screening was still possible. For the wheat projects aimed at screening for leaf spot (Septoria tritici repentis) infection was very restricted and only limited selection was feasible. Little success occurred in any of our 1989 stem rust screening nurseries in hard red spring or durum wheat and while a very late infection occurred in the barley rust nurseries after repeated inoculations, selection again was not as effective as normal. The very high temperatures and resultant low relative humidity over extended periods, even with irrigation, led to these unusually unsuccessful results. Of particular note was that at one point during the month of June with air temperatures in excess of $40^{0}C$, even with the irrigation system operating, the relative humidity in the nursery was less than 85%.

The following sub-projects were conducted in 1988:

1) Spot-form net-blotch screening in barley (B.G. Rossnagel & B.L. Harvey):

Several thousand barley genotypes were evaluated for tolerance to the "spot-form" of net blotch using the infected field debris/high frequency low volume irrigation inoculation system developed and refined under this project. Twenty-seven bales of diseased straw collected at Shellbrook in 1988 and 1987 were spread over the area. All straw, including the two year old material sporulated adequately. Spore formation and infection requires high relative humidity (>85%), and at times in June, even with the irrigation system operating, relative humidity was less than 85%, and infection was negatively affected. However, sufficient humidity was eventually achieved and while infection differences were not as dramatic as in 1987 or at Shellbrook in either 1987 or 1988, disease levels were adequate for selection and differentiation. While contaminants of bacterial streak, scald (trace only) and true-spot blotch (trace only) were present, it has been determined that these may be minimized by irrigating at temperatures that favour net-blotch development over other diseases and by avoiding inoculum contaminated with these pathogens. The following materials were evaluated:

a) Hill plots:

i) 1337 genotypes (replicated at Shellbrook natural nursery) including:
- 20 disease survey genotypes
- 169 co-op test genotypes
- 260 advanced U of S and Ag Canada, Winnipeg breeding lines
- 460 anther-culture derived genotypes from U of S feed barley project
- 219 breeding lines from Ag Canada programs at Winnipeg and Brandon
- 145 net-blotch differentials from Ag Canada pathology program at Winnipeg
- 35 introductions with net-blotch tolerance in Denmark
- 29 best genotypes from 1987.

ii) 912 genotypes from U of S feed and malting barley preliminary yield trial materials.

iii) 3368 $F_4$ and $F_5$ generation materials from 19 different hybrid combinations. The best 20-25% of these were selected with good disease scores.

Unfortunately, with hot, dry, windy weather, the irrigation sprinklers gave poor water distribution and the rust epidemics developed very slowly and erratically. It was decided that none of the nurseries would give reliable results and no data were recorded. All of the tests will be repeated in 1989.

## MAXIMUM ECONOMIC YIELD

Principal: Outlook Irrigation Production Club
Funding: Irrigation Based Economic Development Agreement
Progress: First year of four
Objectives:
a) to demonstrate the use and value of detailed production records;
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 crop diseases by monitoring disease development and sampling to determine disease identification.

Traditional cereals are a major crop in the irrigated regions of Saskatchewan. Producers have experience growing cereals and it is necessary to include them in the cropping rotation. The aim of the crop club is to investigate management methods which will increase the return to irrigated cereal cropping.

The ten members of the club met four times in the winter and spring of 1987. General concerns and plans for the growing season were discussed. A fieldman was hired in late April to assist the group. Two field tours, one local and one at Birch Hills, were attended by the club members.

Several investigations were carried out on the ten fields. These included the application of additional fertilizer, micronutrients plant growth, regulators and fungicides. Three fields received the fertilizer/growth regulator/fungicide intensive management package.

The fieldman monitored the fields weekly for moisture status, disease, insects and other production concerns. Plant and head counts were recorded as well as harvest data and yield component data. Soil and tissue tests were evaluated. On average, 20 calls per field were made.

Early season conditions were warmer and drier than normal. Many irrigation systems were unable to meet crop water demands, especially during the hot days of June. Crop emergence was 60% of seed sown on average, resulting in plant stands of less than the target of $350/m^2$. Subsequently, head counts were also less than intended.

Leaf disease incidence was minimal and resulted in small losses, if any. Fungicide control of disease, notably Septoria sp., rust and scald was very good. There were no yield increases noted from fungicide use in 1988. Barley Yellow Dwarf Virus was widespread, occurring in each of the ten fields. Overall losses to this disease were minimal with the exception of three fields where some yield loss may have occurred as a result of lower kernel weight.

The growth regulator performed well. It shortened durum wheat by 32% and greatly improved the standability of two-row barley. It did, however, cause a delay in tiller development and maturation in HY 355 C.P.S. wheat. There was no economic benefit to growth regulator use in 1988.

The use of additional fertilizer resulted in low incremental gains or in substantial losses, depending on the yield of the particular crop.

The average yield for the durum, prairie spring and soft wheats was 3850 kg/ha (53 bu/ac). Hard wheats averaged 1050 kg/ha (22.5 bu/ac). The greatest yield attained was 4870 kg/ha (72 bu/ac) for soft wheat.

A review of the first year of operation led to eight recommendations to improve the value of the field investigations and seven recommendations to improve the operation of a crop club in general.

**Table 1. Net returns to intensive cropping inputs, 1988**

| | | Yield increase (kg/ha) | Increased crop return ($/ha) | Increased cost ($/ha) | Net return ($/ha) | Net return ($/ac) |
|---|---|---|---|---|---|---|
| Extra fertilizer | - durum wheat | 380 | 65 | 43 | 22 | 9 |
| | - soft wheat | 40 | 5 | 55 | -50 | -20 |
| Growth regulator | - durum | 260 | 44 | 53 | -9 | -4 |
| Fungicide | - durum | -520 | -88 | 25 | -113 | -45 |
| MEY package | - durum | 210 | 36 | 78 | -42 | -17 |
| | - HY355 | -100 | -12 | 157 | -169 | -68 |

# Yield Comparison of Wheat and Barley under Backflood Irrigation

Principal: Deneen Duncan, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Cooperator: Rick Tweet
Location: Hanley (SE 29-29-4-3)
Progress: Second year of three
Crop: Katepwa wheat, Medora durum, Oslo Canada prairie spring, Heartland barley, Harrington barley
Objective: To compare the yields of several wheat and barley cultivars under backflood irrigation conditions.

The project was initiated in 1987 to compare the yield of hard red spring wheat, durum, Canada prairie spring wheat, malt barley, and feed barley under backflood irrigation conditions. All varieties used remained the same except for the substitution of Oslo for HY320 in 1988. The site was a 2-hectare area located south of Hanley on a clay loam soil. Only 1-3 cm of water was available for flood in the spring of 1988.

The Katepwa, Medora, Oslo, Harrington, and Heartland varieties were seeded May 19 in 18 cm row spacings at a depth of 4-5 cm using a hoedrill. The barley was seeded at 215 seeds/$m^2$ and the wheat at 160 seeds/$m^2$. Fertilizer application included 56 kg/ha of N broadcast prior to seeding and 22 kg/ha of seed-placed $P_2O_5$. Chemical weed control was not required due to a lack of weed pressure.

The varieties were combined in mid September and average yields from 1987 and 1988 are illustrated in figure 1. Limited spring water, low rainfall (under 50 mm), and high temperatures produced less than favorable results for the 1988 growing season. Based on two years results, Harrington was the stronger barley variety in terms of yield and height. Both varieties graded #1 CW and plant stress in 1988 caused the protein level of the Harrington barley to be over 14%. Yield differences were not apparent among the wheat varieties in 1988, however, in 1987 Katepwa was lower yielding than either the durum or the Canada prairie spring wheat. The protein content of the wheat ranged from 14.5 - 15.5% with grades of #2 CW or lower.

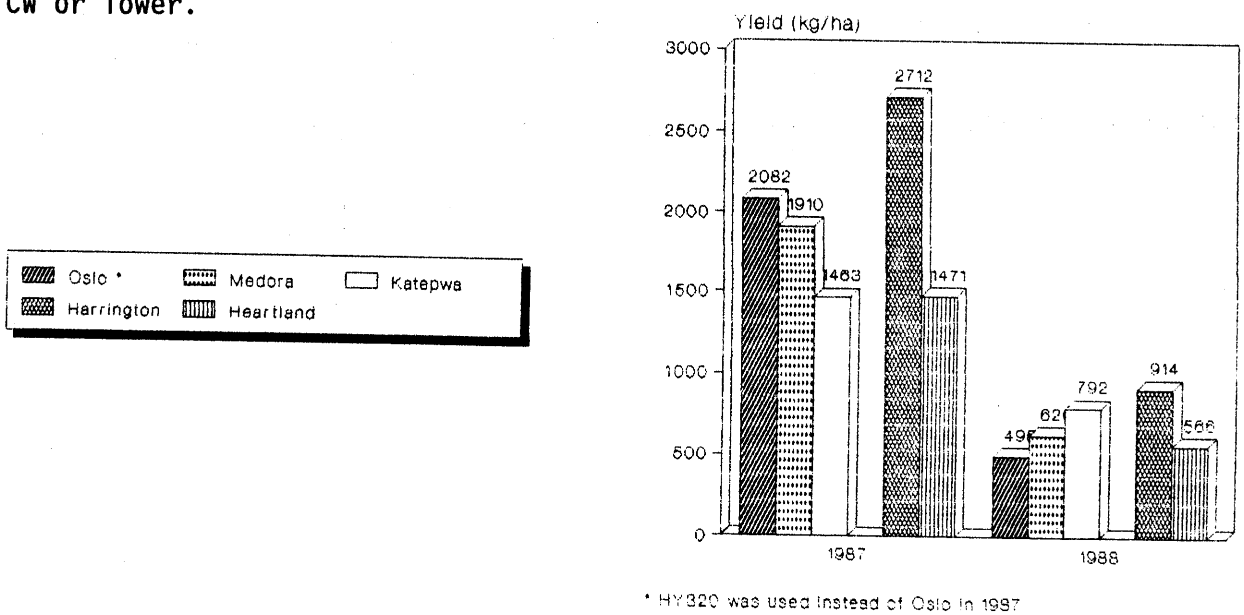



Figure 1: 1987 and 1988 yields of the barley and wheat varieties.

# OILSEEDS

# IRRIGATED CANOLA VARIETY DEMONSTRATION

Principal: Deneen Duncan, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Co-operators: Kelvin Bagshaw; Merle & Robert Larson
Location: Birsay; Outlook
Progress: Year one of three; Year three of three
Objective: To compare the irrigated yields and seed quality of several canola varieties.

This demonstration was developed to compare the irrigated yield and seed quality of Global, Pivot, Westar, Topaz, and Tobin canola. The project was initiated in 1986 at Outlook. A second project was initiated in 1988 in the Birsay area.

The canola varieties were seeded in mid May at a rate of 9 kg/ha, 1-2 cm deep using a hoedrill with 18 cm spacings. Fertilizer application between sites ranged from 112-145 kg/ha N and 50-78 kg/ha $P_2O_5$. Treflan or Edge was applied in the fall at recommended rates for weed control. Rovral Flo was applied at 30-40% bloom of the canola for control of sclerotinia. Irrigation ranged from 400-500 mm of water and estimated rainfall for the growing season was 110-140 mm.

The Tobin canola was swathed during the first week of August, Westar and Pivot canola in mid August, and Topaz and Global canola were swathed in the end of August. Hail and high winds affected the final yield data. The 1988 yield trend was similar to the trend between 1986 and 1987 (Figure 1). During the three years of the demonstration, Westar consistently produced higher numbers of green seeds per sample as well as higher levels of seed chlorophyll (Figure 2). Topaz and Global had lower levels of blackleg infection than the remaining varieties.

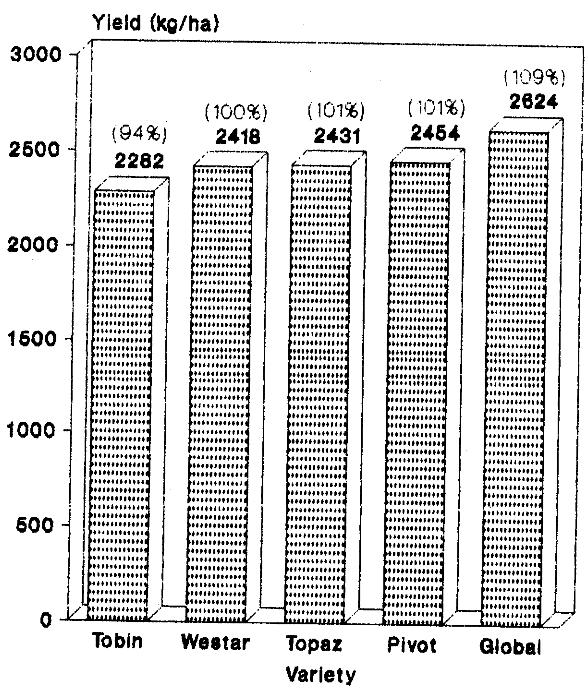



Figure 1

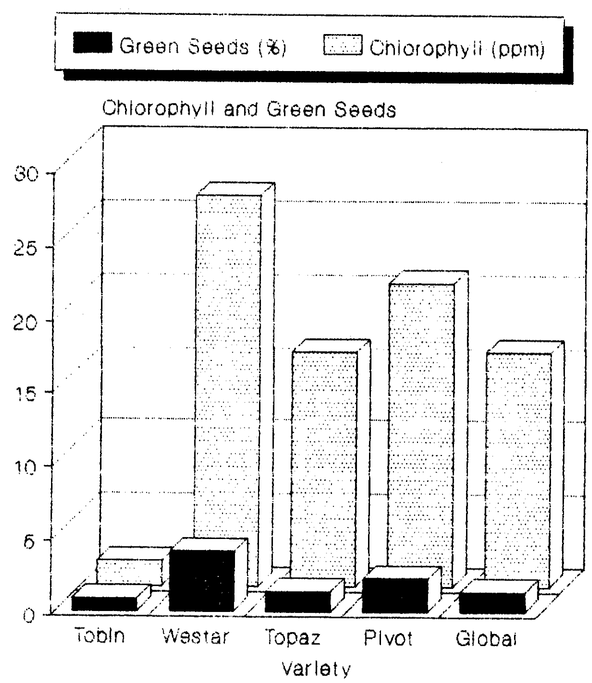



Figure 2

## 1988 Regional Canola Test

Principal: R. K. Downey, Agriculture Canada Research Station
Saskatoon, Saskatchewan
Co-operator: Saskatchewan Irrigation Development Centre

The test was seeded at 32 locations - 20 in Saskatchewan, two in Alberta, three in Eastern Canada, and seven in the Northern United States. Due to the widespread drought, complete tests were lost at Assiniboia, Elrose, Fox Valley, Riverhurst, Wakaw, Wynyard, Kernen, Nipawin, Girvin, Rainy River, Langdon and Fargo. In addition, the capestris portion of the test was lost at Kelvington.

Both species at Canora and Lethbridge had a C of V over 25% as well as the B. napus entries at Watrous and Brookston, and yield data was not used from these locations in calculating the overall average yields.

The design of the test was a randomized complete block with three or four replicated. Oil content was determined at the Saskatoon Research Station using a Newport Mark III A NMR spectrometer.

The test was co-ordinated by the Saskatoon Research Station. Only the Outlook results are reported here. For the complete results, call the principal researcher.

Table 1. Yield of seed (00's kg/ha) at Outlook sites.

| B. napus strain | Outlook Farmlab | Outlook Irrigated | Outlook Dryland |
|---|---|---|---|
| Westar | 29.8 | 40.4 | 33.1 |
| Regent | 30.4 | 40.8 | 33.2 |
| Tribute | 16.8 | 30.5 | 24.2 |
| DN-188 | 32.0 | 38.8 | 33.9 |
| DO-195 | 24.9 | 42.2 | 25.7 |
| 81-17016A (Alto) | 31.8 | 43.9 | 32.5 |
| Sv02402 (Legend) | 30.7 | 40.7 | 29.1 |
| Average | 28.0 | 39.6 | 30.3 |
| C of V % | 13.4 | 14.1 | 14.1 |
| L.S.D. 5% | 5.6 | N.S. | N.S. |

| B. campestris strain | Outlook Farmlab | Outlook Irrigated | Outlook Dryland |
|---|---|---|---|
| Tobin | 20.5 | 28.6 | 16.3 |
| ACS-C1 | 22.3 | 34.7 | 18.5 |
| Sv03334 (Horizon) | 20.7 | 32.0 | 21.8 |
| Sv8236579 (Colt) | 18.7 | 35.1 | 20.1 |
| Average | 20.6 | 32.6 | 19.2 |
| C of V% | 10.9 | 16.2 | 23.0 |
| L.S.D. 5% | N.S. | N.S. | N.S. |

Table 2. Oil content in percent of dry weight at Outlook sites.

| B. napus strain | Outlook Farmlab | Outlook Irrigated | Outlook Dryland |
|---|---|---|---|
| Westar | 42.2 | 44.9 | 43.7 |
| Regent | 41.5 | 44.2 | 43.4 |
| Tribute | 39.1 | 41.1 | 40.5 |
| DN-188 | 42.8 | 45.3 | 44.4 |
| DO-195 | 40.2 | 43.8 | 42.1 |
| 81-17016A (Alto) | 42.2 | 44.8 | 43.2 |
| Sv02402 (Legend) | 41.4 | 43.4 | 42.4 |
| Average | 41.4 | 43.9 | 42.8 |
| C of V % | 0.9 | 1.2 | 1.2 |
| L.S.D. 5% | 1.0 | 0.8 | 0.7 |

| B. campestris strain | Outlook Farmlab | Outlook Irrigated | Outlook Dryland |
|---|---|---|---|
| Tobin | 41.7 | 42.2 | 39.9 |
| ACS-C1 | 43.0 | 43.8 | 41.4 |
| Sv03334 (Horizon) | 41.9 | 43.0 | 41.4 |
| Sv8236579 (Colt) | 41.0 | 42.6 | 40.8 |
| Average | 41.9 | 42.9 | 40.8 |
| C of V% | 0.7 | 0.9 | 1.1 |
| L.S.D. 5% | 0.9 | 0.6 | 0.7 |

Table 3. Days from seeding to maturity at Outlook sites.

| B. napus strain | Outlook Dryland | Outlook Irrigated |
|---|---|---|
| Westar | 90 | 91 |
| Regent | 102 | 95 |
| Tribute | 97 | 92 |
| DN-188 | 102 | 96 |
| DO-195 | 98 | 92 |
| 81-17016A (Alto) | 92 | 90 |
| Sv02402 (Legend) | 98 | 93 |
| Average | 97 | 93 |
| **B. campestris strain** | | |
| Tobin | 79 | 80 |
| ACS-C1 | 80 | 84 |
| Sv03334 (Horizon) | 80 | 82 |
| Sv8236579 (Colt) | 79 | 83 |
| Average | 80 | 82 |

Table 4. Plant height in centimeters at Outlook sites.

| B. napus strain | Outlook Dryland | Outlook Irrigated |
|---|---|---|
| Westar | 86 | 98 |
| Regent | 105 | 99 |
| Tribute | 78 | 86 |
| DN-188 | 106 | 111 |
| DO-195 | 110 | 109 |
| 81-17016A (Alto) | 90 | 92 |
| Sv02402 (Legend) | 98 | 100 |
| Average | 96 | 99 |
| **B. campestris strain** | | |
| Tobin | 60 | 76 |
| ACS-C1 | 78 | 90 |
| Sv03334 (Horizon) | 74 | 89 |
| Sv8236579 (Colt) | 78 | 91 |
| Average | 73 | 87 |

## Canola/Rapeseed Co-operative Trials at Outlook

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

The test was grown at 34 locations in Western Canada. 17 in the mid-season zone, 9 in the long-season zone, 2 in the irrigation zone and 6 in the short season zone. Due to the widespread drought, the tests at Saskatoon, Vermillion, Westlock, Morden, Brandon, Delacour, Vegerville, Somme, Carrot River and Oak River were abandoned. Also lost was the Brassica napus portion of the test at Forestburg as well as the Brassica campestris portion of the test at Altona and Olds. The B. napus strains at Olds were badly frozen and yield of the B. campestris entries at Forestburg was very erratic; therefore, the data from these sites were not included in the report. In addition, the C of V for both species at Winnipeg, Watrous and Lethbridge Dryland as well as the B. napus strain at Altona was over 25%. The data from these sites were not included in averages. All locations either cut or straight combined strains according to maturity.

The Svalof B. napus strain Sv02402 was licensed and named Legend. The two Svalof campestris strains Sv03334 and Sv8236579 were also licensed and named Horizon and Colt.

The 13 B. campestris entries grown at all locations were arranged in a randonmized complete block with four replicates. The 20 earlier maturing B. napus entries grown in the short season zone were arranged in a 4 x 5 rectangular lattice with four replicates. All the other zones consisted of all 30 entries arranged in a 5 x 6 rectangular lattice with four replicates.

All seed quality analyses were done in duplicate. The fatty acid oil and glucosinolate analyses were conducted by the Saskatoon Research Station. Chlorophyll and protein content were analyzed by the Canada Grain Commission. Grain Research Laboratory at Winnipeg. The test was co-ordinated by the Saskatoon Research Station.

Only the Outlook results are reported here; for the complete results, call the principal researcher.

Entries in the 1988 Tests:

| N. napus | ORIGIN |
|---|---|
| Westar | Certified |
| Regent | Certified |
| Tribute | Breeder |
| DN-188 | Saskatoon Canola Strain |
| DO-195 | Saskatoon Canola Strain |
| ACS-N1 | Saskatoon Canola Strain |
| ACS-N3 | Saskatoon Canola Strain |
| ACS-N4 | Saskatoon Canola Strain Tr. Res. |
| AU012 | Allelix Canola Strain |
| AU154 | Allelix Canola Strain |
| S82-4362 | Winnipeg Hi. Er. Lo. Gl. Strain |
| S83-3242 | Winnipeg Canola Strain |
| Sv02404 | Svalof Canola Strain |
| C62287 | A.W.P. Canola Strain |
| WW1449 | Allelix Canola Strain |
| C56687 | A.W.P. Canola Strain |
| Au275 | Allelix Canola Strain |
| CS002 | Conti Seed Canola Strain |
| Sv02402 | Svalof Canola Strain |
| AU028 | Allelix Canola Strain |
| Sv8525952 | Svalof Canola Strain |
| Sv8525953 | Svalof Canola Strain Tr. Res. |

| B. napus | ORIGIN |
|---|---|
| Sv02403 | Svalof Canola Strain |
| AU001 | Allelix |
| AU008 | Allelix Canola Strain |
| AU028 | Allelix Canola Strain |
| LD9922 | Paladin Canola Strain |
| K7-1 | King Agro Canola Strain |
| Global | Breeder |

| B. campestris | |
|---|---|
| Tobin | Breeder |
| S84-43529 | Winnipeg Canola Strain |
| S84-4533 | Winnipeg Canola Strain |
| RR83-5370 | Winnipeg Canola Strain |
| ACS-C1 | Saskatoon Canola Strain |
| 83-51249N | U of A Canola Strain |
| 83-51243N | U of A Canola Strain |
| Sv03350 | Svalof Canola Strain |
| Sv03351 | Svalof Canola Strain |
| AU045 | Allelix Canola Strain |
| Sv03503 | Svalof Canola Strain Hi. palmitic |
| Sv0334 | Svalof Canola Strain |
| Sv8236579 | Svalof Canola Strain |

Table 1. Brassica napus Co-op Test, 1988, at Outlook, Saskatchewan

| Strain | Yield (kg/ha) | Oil Content % | Days from seeding to maturity | Plant height (cm) |
|---|---|---|---|---|
| Westar | 37.9 | 45.2 | 89 | 90 |
| Regent | 40.8 | 43.9 | 94 | 105 |
| Tribute | 36.2 | 41.0 | 92 | 96 |
| DN-188 | 36.3 | 45.2 | 92 | 106 |
| DO-195 | 38.1 | 42.5 | 91 | 102 |
| ACS-N1 | 41.5 | 45.0 | 94 | 104 |
| ACS-N3 | 41.3 | 44.3 | 93 | 108 |
| ACS-N4 | 41.1 | 43.9 | 94 | 109 |
| AU012 | 45.1 | 43.9 | 98 | 119 |
| AU0154 | 40.1 | 43.4 | 92 | 109 |
| S82-4362 | 36.0 | 44.4 | 98 | 102 |
| S83-3242 | 34.8 | 44.6 | 94 | 112 |
| Sv02404 | 38.8 | 43.7 | 92 | 106 |
| C62387 | 40.9 | 43.5 | 94 | 109 |
| WW1449 | 34.8 | 43.0 | 95 | 111 |
| C5687 | 37.2 | 42.8 | 91 | 98 |
| AU0275 | 36.5 | 43.2 | 93 | 104 |
| CS002 | 39.6 | 42.6 | 94 | 114 |
| Sv02402 | 39.6 | 43.4 | 95 | 106 |
| Au028 | 32.6 | 42.8 | 96 | 110 |
| Sv8525952 | 31.9 | 41.5 | 92 | 104 |
| Sv8525953 | 41.5 | 42.4 | 92 | 106 |
| Sv02403 | 37.8 | 44.6 | 92 | 105 |
| AU001 | 36.2 | 40.5 | 97 | 114 |
| AU008 | 34.5 | 41.1 | 89 | 94 |
| AU022 | 42.4 | 41.8 | 91 | 105 |
| LD9922 | 39.2 | 43.2 | 93 | 101 |
| M86-001 | 39.8 | 42.4 | 98 | 114 |
| K7-1 | 36.7 | 44.2 | 92 | 98 |
| Global | 40.6 | 43.9 | 93 | 104 |
| Average | 38.3 | 43.3 | 93 | 105 |
| C of V% | 16.8 | 1.9 | | |
| L.S.D. 5% | | 1.2 | | |

Table 2. Brassica campestris Co-op Test, 1988, at Outlook, Saskatchewan

| Strain | Yield (kg/ha) | Oil Content % | Days from seeding to maturity | Plant height (cm) |
|---|---|---|---|---|
| Tobin | 26.0 | 43.6 | 78 | 88 |
| S84-3529 | 29.9 | 45.4 | 81 | 90 |
| S83-4533 | 29.3 | 44.2 | 81 | 91 |
| RR83-5370 | 26.4 | 44.2 | 84 | 103 |
| ACS-C1 | 29.7 | 44.7 | 82 | 101 |
| 83-51249N | 26.7 | 45.0 | 80 | 94 |
| 83-51243N | 28.7 | 45.0 | 81 | 95 |
| Sv03350 | 29.9 | 44.1 | 83 | 110 |
| Sv03351 | 29.8 | 43.4 | 82 | 103 |
| AU045 | 30.8 | 42.8 | 84 | 102 |
| Sv03503 | 30.0 | 43.2 | 81 | 86 |
| Sv03334 | 27.3 | 44.2 | 82 | 102 |
| Sv8236579 | 33.4 | 44.6 | 82 | 99 |
| Average | 29.1 | 44.2 | 82 | 97 |
| C of V % | 18.8 | 1.4 | | |
| L.S.D. 5% | N.S. | 0.9 | | |

## MUSTARD CO-OPERATIVE TRIALS AT OUTLOOK

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

The test was grown at 18 locations, three in Alberta, five in Saskatchewan, four in Manitoba, and six in the Northern States. Due to the widespread drought in 1988, the tests at Delacour, Saskatoon, Morden, Oak River, Fargo and Langdon were lost. The Brassica juncea portion of the test at Lethbridge and Crookston has a C of V of 25% and were not included in the overall average. As a consequence of the drought, the oil content is lower than last year, while the allyl isothiocyanate content is similar to last year on an oil free meal basis, but slightly higher on a whole seed basis.

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

The test was co-ordinated by the Saskatoon Research Station. Only the Outlook results are reported here. For the complete results, call the principal researcher.

Entries in 1988 test:

| Brasica juncea | TYPE | Sinapsis alba | TYPE |
|---|---|---|---|
| Cutlass | Oriental | Gisilba | Yellow |
| Leth 22A | Oriental | Ochre | Yellow |
| Comm. Brown | Brown | Tilney | Yellow |
| CJ86 Z | Oriental | | |
| Zem 87-1 | Oriental | | |

Table 1. Mustard Co-operative Trials, 1988, at Outlook, Saskatchewan.

| Strain & species | Yield (kg/ha) | Oil Content % | Days from seeding to maturity | Plant height (cm) | Allyl Isothiocyanate content mg/gm | Hydroxybenzyl glucosinolate um/gm |
|---|---|---|---|---|---|---|
| B. Juncea | | | | | | |
| Cutlass | 3886 | 36.6 | 80 | 96 | 19.8 | |
| Leth. 22A | 2879 | 35.9 | 86 | 91 | 15.3 | |
| Blaze | 3812 | 34.7 | 85 | 95 | 14.9 | |
| Comm. Brown | 3785 | 35.7 | 86 | 92 | 15.1 | |
| CJ86Z | 3664 | 35.7 | 83 | 106 | 21.7 | |
| Zem 87-1 | 3648 | 36.4 | 80 | 102 | 19.9 | |
| Average | 3612 | 35.8 | 84 | 97 | 17.8 | |
| C of V % | 13.1 | 2.2 | | | | |
| L.S.D. 5% | 720 | 1.2 | | | | |
| S. alba | | | | | | |
| Gisilba | 2588 | 24.8 | 88 | 64 | | 195.6 |
| Ochre | 2607 | 26.8 | 88 | 74 | | 196.8 |
| Tilney | 2533 | 27.4 | 89 | 74 | | 190.4 |
| Average | 2576 | 26.3 | 88 | 70 | | 194.3 |
| C of V % | 7.2 | 4.5 | | | | |
| L.S.D. 5% | N.S. | N.S. | | | | |

## Flax Co-operative Test

Principal: A. Vandenberg
Funding & Site: Saskatchewan Irrigation Development Centre

Mean yield, plant height and days to maturity for Flax Co-operative Test, 1988, at Outlook, Saskatchewan.

| Cultivar or line | Yield (kg/ha) | Plant height (cm) | Days to maturity |
|---|---|---|---|
| FP870 | 2615 | 54 | 126 |
| FP855 | 2614 | 53 | 125 |
| McGregor | 2556 | 50 | 128 |
| FP876 | 2541 | 52 | 132 |
| FP891 | 2520 | 50 | 126 |
| FP866 | 2499 | 48 | 130 |
| Linott | 2475 | 45 | 127 |
| Dufferin | 2456 | 57 | 125 |
| Norman | 2454 | 49 | 129 |
| FP862 | 2401 | 50 | 128 |
| FP859 | 2372 | 44 | 125 |
| Vimy | 2355 | 49 | 126 |
| Norlin | 2344 | 52 | 126 |
| FP884 | 2336 | 49 | 130 |
| FP890 | 2334 | 47 | 127 |
| FP894 | 2273 | 54 | 128 |
| FP879 | 2273 | 54 | 128 |
| FP846 | 2155 | 52 | 128 |
| FP856 | 2123 | 45 | 129 |
| Noralta | 1965 | 54 | 126 |
| Mean | 2383 | | |
| Replication | 4 | | |
| CV % | 8 | | |
| LSD (0.05) | 270 | | |

| Water application (mm): | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 15 | 25 | 40 |
| June | 113 | 28 | 141 |
| July | 175 | 37 | 212 |
| Aug. | 45 | 53 | 98 |

Plot size: 1.2 m x 3.7 m
Planting date: May 13
Harvest: Combined on Oct 13

# THE EFFECT OF RESCHEDULING OF IRRIGATION DURING FLOWERING ON SCLEROTINIA STEM ROT AND YIELD OF CANOLA

Principal: Dr. K.B. Teo, Dept. of Biology
University of Saskatchewan
Saskatoon, Saskatchewan, S7N OWO
Site: Saskatchewan Irrigation Development Centre
Objectives: a) to determine if the absence of irrigation during flowering affect incidence of Sclerotinia stem rot disease, and
b) to observe whether irrigation would increase yield in the presence of high density of sclerotia of Sclerotinia sclerotiorum.

The test was carried out at the Saskatchewan Irrigation Development Centre, in Outlook, in 1987 and 1988. The treatments were to stop irrigation at the following stages of canola (Brassica napus, cv. Westar) plant growth:

1) rosette, 2) budding, 3) 10% flowering, and 4) irrigation throughout the season (no cessation).

Results in 1987 showed that cessation of irrigation at the end of the rosette stage significantly reduced disease incidence and also significantly reduced yield loss when compared with other irrigation treatments (Table 1). In 1988, there was no significant difference in disease incidence among all the treatments. There was no significant difference in yield between cessation at late rosette stage and cessation at budding stage (Table 1). Continued irrigation until flowering signficantly increased yield compared with cessation at either of the previous two stages (rosette and budding). Irrigation throughout the season further increased yield significantly. The results of the two years were compared. Disease incidence was significantly greater in 1987 than in 1988. There was no significant difference in yield between 1987 and 1988. Our data suggest that during high rainfall, further irrigation after late rosette stage increased disease incidence and reduced yield. During low rainfall, irrigation during flowering increased yield but did not increase disease incidence signficantly. Because the two experiments occurred in two different rainfall patterns, similar experiments are desirable to be carried out in future to validate these results.

Table 1. Disease incidence and yield of canola (Brassica napus) plants resulting from cessation of irrigation at various stages.

| | Cessation of irrigation at: | | | |
|---|---|---|---|---|
| | Rosette | Budding | 10% flowering | None |
| | percent | | | |
| 1987 D.I.* | 32.2a** | 51.6b | 49.6b | 52.1b |
| 1988 D.I. | 1.1a | 2.0a | 3.4a | 9.7a |
| | grams | | | |
| 1987 yield | 426b | 252a | 269a | 215a |
| 1988 yield | 190a | 209a | 319b | 362c |

* D.I. = disease incidence
** Suffixed by the same letter within the same row are not signficantly different at p = 0.05

## RELATIVE YIELDS OF OILSEEDS AND PULSE CROPS

Principal: R. Byron Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Location: Saskatchewan Irrigation Development Centre
Progress: Second year of four
Objective: To determine the yields of canola, flax, canola and peas, fababean, yellow mustard and peas and to provide a site for recropping studies designed to determine the effect of each of these crops on the yields of subsequent cereal crops.

Yields of flax were excellent despite the poor stands and problems encountered in setting up the plot combine (Table 1). The poor stands may have been due to the high rate of nitrogen which was sidebanded. Varying amounts of canola established in the pea and canola intercrop system but in many places there were too few canola plants to prevent lodging. Canola yields varied from 18% of the final yield to 40% of the total yield. A large number of years and sites of data will be required to determine the true yield potential of the various cropping systems, however, the initial two years look very positive for fababean, less so for pea and very poor for yellow mustard.

Table 1. Yield of oilseeds and pulse crops.
(yields vary widely between years)

| | | Grain yield | |
|---|---|---|---|
| Variety | crop | (kg/ha) | SE |
| Outlook | fababean | 4324 | 248 |
| Victoria | pea | 3085 | 110 |
| Global | canola | 2476 | 162 |
| Tilney | yellow mustard | 1878 | 17 |
| McGregor | flax | 2498 | 206 |
| | pea & canola | 3160* | 305 |

SE = standard error
* total yield 30% of which was canola

## Cereal Recropping on the 1987 Oilseed and Pulse Crop Stubble

Principal: R. Byron Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Location: Saskatchewan Irrigation Development Centre
Progress: First year of three
Objective: To determine the effect of previously grown pulse and oilseed crops on the yields of durum wheat, soft white spring wheat and two-row malting barley with differing levels of nitrogen fertilizer.

There was a significant effect of the crops grown in 1987 on the cereal crop yields in 1988 (Table 1). Yields were highest following peas and lowest in the plots which had grown mustard and fababean in 1987. A large portion of this difference may have been due to the volunteer crop which was not adequately controlled.

Table 1. Effect of previous crop on yields of Sceptre and Fielder

| | Grain yield (kg/ha) | | |
|---|---|---|---|
| Crop 1987 | Sceptre durum | Fielder soft white | Mean |
| Westar canola | 3921 | 3861 | 3891 |
| Tilney yellow mustard | 3812 | 3202 | 3507 |
| Century pea | 4405 | 4254 | 4330 |
| Semu pea | 4497 | 3708 | 4103 |
| Westar & Century | 4271 | 3267 | 4119 |
| Outlook Fababean | 4007 | 3539 | 3892 |
| Mean | 4153 | 3755 | 3954 |
| LSD | | | 271 |

The previous crop did not influence the time to mature with both Sceptre and Fielder maturing in about 95 days. This is much earlier than usual, reflecting the high temperatures encountered during the growing season. We were unable to detect differences in the number of heads produced on plots which had grown different crops the previous year. Sceptre produced significantly fewer heads than Fielder (380 vs. 475).

# FORAGES

Page

## Management of Forage Production under Irrigation

Principal: B.P. Goplen
Agriculture Canada Research Station
107 Science Crescent
Saskatoon, Saskatchewan S7N 0X2
Funding: Agriculture Development Fund
Co-investigators: B.D. Gossen, J. Soroka, R.P. Knowles
Location: Outlook and Miry Creek
Progress: Third year of four
Objectives:

a) to investigate the potential for alfalfa seed production under irrigation in the Outlook area;
b) to identify the fertilizer requirements for optimum alfalfa seed and forage production under irrigation in Saskatchewan;
c) to evaluate alfalfa cultivars for production potential under irrigation management;
d) to compare the production potential of several bluegrass lines selected at Saskatoon with other forage grasses under irrigation;
e) to examine the effect of cutting management on stand longevity, yield and disease incidence under irrigated conditions;
f) to monitor disease progress of alfalfa root and crown disease under irrigation conditions;
g) to compare selected alfalfa cultivars currently recommended in Saskatchewan for resistance to Coprinus psychromorbidus.
h) to survey irrigated alfalfa fields for the presence of Verticillium wilt.

In spite of, or perhaps as a result of the hot, dry weather this summer, alfalfa seed production under irrigated conditions at both Outlook and Saskatoon was excellent, with small plot yields of over 500 lbs/ac at both locations. Varietal differences in seed production were significant, but the effect of alfalfa stand density on seed production is still unclear. Fertilizer treatments did not affect seed production in the first year of a multi-year trial. Leafcutter bee production was 500% at Outlook. Bluegrass seed yields were also excellent in the first production year. A new trial to examine the suitability of forage grasses under irrigation was established at Outlook.

## Rudy Rosedale Community Pasture Irrigation Project

Rudy Rosedale Community Pasture Irrigated Alfalfa Project again provided large tonnages of high quality feed. It's value to PFRA was apparent in this year of severe drought.

Operation:

The southwest quarter had been broken in the fall of 1986. Oats were grown as greenfeed in 1987. Beaver Alfalfa (8 kg/ha) plus Calibre Oats (38 kg/ha) were planted in 1988. The southeast quarter was broken from alfalfa in 1987 and planted to Calibre Oats (76 kg/ha) in 1988. The northeast and northwest quarter were kept in alfalfa.

Warm growing conditions allowed three cuts of alfalfa to be taken. The yields were, however, reduced at 7.3 t/ha. These areas will be broken, planted to a cereal for one year then reestablished. The green oats were harvested at each kernel formation and yielded 7.5 t/ha. The forage quality and bale allocation are included in tables 1 and 2.

Table 1. Alfalfa and Oat Feed Quality

| | Moisture % | Protein % | Estimated Energy % TDN | Calcium % | Phos-phorus % | Nitrate % | pH |
|---|---|---|---|---|---|---|---|
| A88/5,030 SW Oats | 14.30 | 7.33 | 49 - 51 | 0.44 | 0.23 | trace | |
| | 100% Dry Matter | 8.56 | 57 - 59 | 0.51 | 0.27 | | |
| A88/5,031 NW 3rd Cut | 13.02 | 15.85 | 52 - 54 | 0.92 | 0.23 | trace | |
| | 100% Dry Matter | 18.22 | 60 - 62 | 1.06 | 0.27 | | |
| A88/5,032 NE 3rd Cut | 14.15 | 15.94 | 51 - 53 | 1.03 | 0.23 | trace | |
| | 100% Dry Matter | 18.57 | 60 - 62 | 1.20 | 0.27 | | |
| A88/5,033 SE Oats | 15.48 | 8.02 | 47 - 49 | 0.35 | 0.23 | trace | |
| | 100% Dry Matter | 9.49 | 56 - 58 | 0.41 | 0.27 | | |

Table 2. Bale Allocation

| Location | Green Feed (bales) | Hay (bales) |
|---|---|---|
| Oakdale | 60 | 60 |
| Fairview | 60 | |
| Monet | 180 | 150 |
| Antelope Park | | 90 |
| Kindersley-Elma | 120 | 60 |
| Newcombe | 150 | 120 |
| Eagle Lake | 60 | 90 |
| Montrose | 60 | |
| Mantario | 90 | 60 |
| Willner-Elbow | 180 | 120 |
| Wreford | 60 | 60 |
| McCraney | 90 | 120 |
| Prairie Rose | 150 | 30 |
| Wolverine | 60 | |
| Tecumseh | 60 | |
| Maple Creek Bull Stn. | 90 | 150 |
| Shamrock | 30 | 60 |
| Hillsburg | | 30 |
| Usborne | | 30 |
| Dundurn | | 30 |
| Excel | | 30 |
| Laurier | | 30 |
| Lomond #1 | | 30 |
| Bitter Lake | 13 | 2 |
| Big Stick | 13 | 2 |
| Reno | 27 | |
| Rudy Rosedale | 86 | 126 |
| Total: | 1639 | 1480 |

Improvements:

1. Installation of a self-cleaning algae screen contained in a concrete structure.
2. Turbine repair, modification and realignment.
3. Construction of earthern bridges through wet areas.

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

Principal: Deneen Duncan, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Cooperator: Roy Harrigan
Location: Maple Creek (S 1/2 19-11-26-3)
Progress: First year of four
Objective: To determine the best method of establishing alfalfa grown on the clay soils of the Maple Creek area.

Three establishment methods are compared: 1) seeding alfalfa with a nurse crop; 2) direct seeding of alfalfa into standing stubble; and 3) direct seeding alfalfa into winter wheat or fall rye (the winter crop will be chemically burnt off to create a mulch of plant material to shade the soil surface). A new site will be established each year for five years. Phosphate and potash will be applied annually to each site to create a high fertility strip to determine the effect of the fertilizer on stand longevity. The site established in 1988 was a 17 hectare field with conductivity levels of 1.8-3.8 mS/cm in the top 60 cm of the soil profile.

In 1988, only two establishment methods were used. The first method involved the seeding of alfalfa with a nurse crop (Johnston barley) into cultivated soil and the second method involved the seeding of the alfalfa and nurse crop into standing stubble. The alfalfa used was a mixture of Maxim, Splender, Beaver, and Rangelander. The crop was seeded in early May using a hoedrill with 18 cm spacings. A seeding rate of 11 kg/ha and 54 kg/ha was used for the alfalfa and barley, respectively. Prior to seeding, 112 kg/ha $P_2O_5$ was broadcast over the entire field. Spring soil tests showed nutrient levels of 46 kg/ha N, 18 kg/ha P and 392 kg/ha K. Roundup was applied to the direct seeded treatment for control of weeds.

Emergence was adequate in both cases, but stand declined during the season due to cracking of the soil, excessive heat, and excessive dry conditions. Water availability was limited in 1988 and only one flood of approximately 150 mm was applied to the alfalfa.

## ALFALFA VARIETIES ON BORDER DIKE IRRIGATION: YIELD AND STAND LONGEVITY

Principal: Deneen Duncan, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Co-operator: Ross Anderson
Location: Maple Creek (NW-8-11-26)
Progress: First year of five
Varieties: Heinrick, Roamer, Rangelander, Beaver, Anchor, Barrier, and Pioneer 5444
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.

Soil tests taken in the spring of 1988 indicated salinity levels of 1.3 - 4.9 mS/cm. Initial nutrient levels were 53 kg/ha $NO_3$, 74 kg/ha P, 504 kg/ha K, and 108+ kg/ha $SO_4$. Seven inoculated alfalfa varieties (Heinrick, Roamer, Rangelander, Beaver, Anchor, Barrier, and Pioneer 5444) were seeded April 28-29, 1988 at a rate of 11 kg/ha and a depth of 1-2 cm using a double disc drill with 15 cm spacings. Prior to seeding, 112 kg/ha of $P_2O_5$ was broadcast over the field. Water availability was limited in 1988 and only one flood of approximately 150 mm was allowed.

Establishment of the varieties was successful. The project is to continue for an additional four years to collect information on yield and stand longevity of the varieties. A $K_2O$ fertilizer strip will be added to determine the effect of this product on stand longevity.

## Corn Hybrid Testing

Principal: D. Belisle, Saskatchewan Corn Committee
Leigh Crowle, Agriculture Canada, Saskatoon, Saskatchewan

Funding: Irrigated Based Economic Development Agreement

Co-investigators: L. Townley-Smith, Agriculture Canada, Melfort, Saskatchewan
D. Derksen, Agriculture Canada, Indian Head, Saskatchewan

Progress: First year of three

Objectives:
a) to continue the provision of accurate unbiased information on corn hybrids and their suitability for Saskatchewan conditions;
b) to enhance technology transfer through the involvement of the Saskatchewan Cattlefeeders Association;
c) to aid in the development of an annual forage crop for Saskatchewan.

Table 1. SCC Silage Corn Commercial Trials, 1988, at Outlook, Saskatchewan

| Variety | Days 50% silk | Popn 000/ha | Moist % | Yield t/ha(dry) | Y/M index |
|---|---|---|---|---|---|
| DK-233 | 79.5 | 60.7 | 65.6 | 9.1 | 1.4 |
| DK-235 | 82.8 | 64.5 | 70.0 | 12.3 | 1.8 |
| K-730 | 82.3 | 60.7 | 70.6 | 10.3 | 1.5 |
| LX-149 | 79.8 | 62.4 | 64.9 | 9.1 | 1.4 |
| K-1108 | 81.5 | 58.6 | 60.9 | 10.6 | 1.7 |
| P-3995 | 78.8 | 64.5 | 57.9 | 8.7 | 1.5 |
| P-3994 | 77.0 | 64.5 | 64.0 | 10.4 | 1.6 |
| P-3979 | 83.8 | 65.0 | 71.3 | 13.0 | 1.8 |
| P-3969 | 82.8 | 66.1 | 64.8 | 12.4 | 1.9 |
| P-3953 | 81.8 | 64.5 | 70.0 | 14.1 | 2.0 |
| KWS Santos | 83.8 | 63.4 | 74.0 | 12.9 | 1.7 |
| KWS Rana | 80.3 | 65.0 | 48.5 | 9.1 | 2.0 |
| KWS Atlet | 81.3 | 66.1 | 68.4 | 11.9 | 1.7 |
| KWS Atout | 86.5 | 65.0 | 65.8 | 12.5 | 1.9 |
| KWS Bonny | 80.3 | 66.1 | 68.7 | 13.0 | 1.9 |
| KWS-798 | 89.0 | 66.1 | 71.9 | 12.1 | 1.7 |
| PIC-2477 | 78.5 | 64.5 | 64.7 | 11.6 | 1.8 |
| PIC-2435 | 82.5 | 64.0 | 64.5 | 9.4 | 1.5 |
| Mean | 81.8 | 64.0 | 65.9 | 11.3 | 1.7 |
| LSD (.05) | 3.4 | 4.3 | 4.8 | 1.7 | 0.4 |

Date seeded: May 6, 1988
Date harvested: September 12, 1988
Plot size: 6.1 m x 0.75 m

# SPECIALTY CROPS

# FEED VALUE OF CORN SILAGE RELATED TO HARVEST STAGE AND VARIETIES

| | |
|---|---|
| Principals: | Saskatchewan Corn Committee<br>W.L. Crowle, Agriculture Canada Research Station<br>Saskatoon, Saskatchewan |
| Co-investigators: | D. Christensen, Animal and Poultry Science<br>University of Saskatchewan, Saskatoon<br>W.J. King, Saskatchewan Water Corporation<br>Outlook, Saskatchewan<br>J. Korol, Agriculture Canada Research Station<br>Saskatoon, Saskatchewan |
| Funding: | Agriculture Development Fund<br>Saskatchewan Cattle Feeders' Association |
| Site: | Saskatchewan Irrigation Development Centre |
| Progress: | Final year |
| Objective: | a) to determine the effect on the feed value of corn silage on ten of the most recently recommended hybrids at three levels of maturity;<br>b) to conduct corn evaluation trials (grain and silage) as layed forth by the Saskatchewan Corn Committee. |

Stage of maturity at harvesting has a signficant effect on the nutritive value of whole plant corn for silage. Protein, calcium and phosphorus levels decline while fiber levels increase as the plant matures.

Variety did have a significant effect on crude protein and neutral-detergent fiber levels in 1988. There is a variety effect on dry matter yield.

Results from the three-year corn study indicate that the 75% moisture level at harvesting is optimum in terms of nutritive value and dry matter yield fo silage.

Table 5. Effect of season on the composition* and dry matter yield of corn harvested at three moisture levels.

| Target moisture level, % | Days to harvest | | | Actual Moisture, % | | | % CP in dry matter | | | Dry matter yield tonnes/hectares | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Eighty-five | 106 | 108 | 104 | 78.2 | 82.6 | 80.3 | 9.4 | 9.7 | 9.3 | 11.3 | 9.6 | 9.5 |
| Seventy-five | 131 | 123 | 118 | 74.7 | 79.6 | 72.9 | 8.5 | 8.7 | 8.1 | 14.4 | 12.5 | 10.7 |
| Sixty-five | 142 | 134 | 135 | 65.7 | 73.8 | 60.3 | 8.4 | 7.6 | 6.6 | 13.8 | 13.6 | 10.6 |

* Samples were analyzed by the Saskatchewan Feed Testing Laboratory, Saskatoon.
1 - 1986; 2 - 1987; 3 - 1988

# Specialty Crop Development Program

Principal: A. Vandenberg
Saskatchewan Irrigation Development Centre

## Dry Bean Research

### General

As part of an ongoing research project, four irrigated dry bean variety tests and five agronomic experiments were established. 1988 was an excellent year for irrigated dry bean production because the growing season was hotter and drier than normal. 1988 was the third year of agronomic investigations of seeding date, harvest date, seeding rate, row spacing and harvest method. Results from these studies will be incorporated into a production guide for irrigated dry bean. Results from the 1988 studies are reported here. Funding for the 1988 dry bean research program was shared between ADF and SIDC as part of the IBED agreement.

### Variety Evaluations

The U.S. Dry Bean Co-operative Nursery was grown as an adaptational trial for the third year (Table 1). Because the weather was unusually warm in 1988, all entries matured before the first fall frost. In most years, many lines of this trial mature too late in the south-central Saskatchewan environment. There were several pinto and pink lines with suitable maturity and yield equal to or greater than the checked cultivar Viva pink.

Three new dry bean nurseries were grown in 1988. The Prairie Bean Co-operative Test was established in 1988 at eight locations including SIDC. This test included check varieties and promising lines of dry bean in seven market classes grown in Western Canada (Table 2).

The Pinto Observational Test was grown for the first time in 1988 (Table 3). All lines matured in 1988, but long term yield performance will be evaluated by testing these lines for at least one more year.

The Coloured Bean Observational Test (Idaho based lines) was also grown for the first time in 1988 (Table 4). The earliest and highest yielding lines will be tested again in 1989. The most promising lines were in the large white (Great Northern) class, although no lines outperformed the check cultivar Viva.

### Seeding Date Study

This was the third year of the trial. Table 5 shows that in 1988, the same trend occurred as in the previous two years. Delaying seeding until after the first week of June resulted in yield decreases for the pinto and pink cultivars.

Differences in yield between the first and second seeding date were less than in the previous two years because 1988 was much warmer than usual, allowing the first two dates to mature before the first killing frost. Results from the preceding two seasons show a large decrease for seeding date delay into June. This points out that 1988 was an abnormally hot year favouring high yield and early maturity for irrigated dry bean.

Table 1 Yield, seed weight and days to flower and maturity for the U.S. Dry Bean Co-operative Nursery at Outlook, Saskatchewan, 1988

| Market class | Cultivar or line | Yield (kg/ha) | 1,000 seed weight (g) | Days to flower | Days to maturity |
|---|---|---|---|---|---|
| Small white or navy | 6137 | 1677 | 161 | 56 | 118 |
| | Aurora | 1532 | 130 | 60 | 120 |
| | Fleetwood | 1420 | 168 | 62 | 123 |
| | ISB82-258 | 1367 | 169 | 62 | 117 |
| | Mayflower | 1202 | 161 | 66 | 122 |
| | 6123 | 962 | 144 | 61 | 119 |
| Pinto | Olathe | 2098 | 299 | 59 | 114 |
| | ISB84-114 | 2087 | 366 | 54 | 111 |
| | P86299 | 2070 | 329 | 68 | 123 |
| | CO-33142 | 2060 | 419 | 60 | 119 |
| | D85212 | 1885 | 291 | 54 | 107 |
| | UI 114 | 1867 | 316 | 59 | 116 |
| | 8173-6E | 1856 | 311 | 53 | 106 |
| | D85234 | 1743 | 258 | 61 | 113 |
| | RS1101 | 1733 | 303 | 59 | 110 |
| | ISB82-354 | 1527 | 370 | 51 | 103 |
| Pink | Yolano | 2162 | 316 | 57 | 109 |
| | UNS-117 | 2029 | 297 | 58 | 110 |
| | Viva | 2015 | 227 | 54 | 108 |
| Great northern | 64043 | 1994 | 297 | 69 | 125 |
| | UI 59 | 1965 | 298 | 68 | 122 |
| | JM24 | 1789 | 293 | 65 | 122 |
| | GN-WM-85-55 | 1747 | 308 | 68 | 125 |
| | GN-WM-85-45 | 1577 | 389 | 56 | 119 |
| | GN-WM-85-43 | 1468 | 370 | 60 | 117 |
| Kidney* | Redkloud | | | 51 | |
| | Montcalm | | | 62 | |
| | K-59 | | | 65 | |
| | K-407 | | | 68 | |
| | Lassen | | | 52 | |
| | Lisa | | | 67 | |
| | ISB82-1024 | | | 61 | |
| Mean | | 1752 | | | |
| C.V. (%) | | 14 | | | |
| LSD (0.05) | | 354 | | | |

* Plots removed before harvest

Water application (mm):

| | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 0 | 25 | 25 |
| June | 90 | 28 | 118 |
| July | 75 | 37 | 112 |
| August | 0 | 53 | 53 |

Replications: 4

Plot size: 1.2 m x 3.7 m

Planting rate: 30 plants/$m^2$

Planting date: May 20 at off-station site

Harvest: Pulled, bagged and threshed at maturity

Table 2 Mean yield, seed weight, days to flowering and days to maturity for Prairie Bean Coop Test at Outlook, Saskatchewan, 1988

| Market class | Cultivar or line | Yield (kg/ha) | 1000 seed weight (g) | Days to 50% flower | Days to maturity |
|---|---|---|---|---|---|
| Black | MDA075067 | 3387 | 198 | 53 | 114 |
| | Loop | 3367 | 186 | 55 | 109 |
| Great northern | US-1140 | 4620 | 336 | 42 | 115 |
| | 83B342 | 4407 | 401 | 48 | 116 |
| | 83B352 | 4320 | 330 | 48 | 105 |
| Pink | ISB480 | 5197 | 318 | 46 | 100 |
| | 55001 | 5043 | 309 | 46 | 113 |
| | ISB473 | 5028 | 310 | 45 | 98 |
| | Othello | 4871 | 374 | 45 | 110 |
| | Harold | 4725 | 330 | 46 | 115 |
| | Viva | 4402 | 279 | 47 | 113 |
| Pinto | Nodak | 5006 | 335 | 46 | 105 |
| | Norwest590 | 4779 | 328 | 48 | 112 |
| | Topaz | 4513 | 373 | 47 | 105 |
| | Fiesta | 4456 | 426 | 47 | 108 |
| | UI 114 | 4350 | 381 | 54 | 116 |
| | UI 111 | 4231 | 384 | 52 | 113 |
| | Norwest410 | 4160 | 322 | 56 | 118 |
| Red kidney | Red Kloud | 3824 | 538 | 43 | 116 |
| | Montcalm | 2861 | 561 | 48 | -- |
| Red mexican | NW63 | 5086 | 345 | 45 | 116 |
| | Garnet | 4729 | 299 | 43 | 105 |
| | UI36 | 4504 | 356 | 44 | 114 |
| | D79144 | 4384 | 368 | 44 | 97 |
| | Rufus | 3513 | 306 | 62 | 119 |
| Small white or navy | Pulsar | 3956 | 176 | 44 | 100 |
| | K0107 | 3883 | 176 | 49 | 113 |
| | L-9336 | 3690 | 178 | 55 | 117 |
| | D80024 | 3611 | 196 | 48 | 104 |
| | ISB274 | 3411 | 177 | 47 | 117 |
| | L-9322 | 3381 | 199 | 51 | 115 |
| | Upland | 3344 | 194 | 45 | 104 |
| | L-9325 | 3320 | 188 | 50 | 115 |
| | L-9384 | 3317 | 198 | 50 | 116 |
| | HR14 | 3300 | 222 | 51 | 101 |
| | D84071 | 3194 | 183 | 44 | 117 |
| | L-9340 | 3128 | 207 | 55 | 115 |
| | B2W83-3 | 2998 | 201 | 44 | 105 |
| | ISB85-486 | 2953 | 179 | 43 | 110 |
| | ISB1 | 2940 | 205 | 47 | 104 |
| | OAC Seaforth | 2899 | 208 | 45 | 104 |
| | ISB82-258 | 2450 | 193 | 50 | 111 |
| Mean | | 3941 | | | |
| CV % | | 11 | | | |
| LSD (0.05) | | 583 | | | |

Note: Yield adjusted to 16% moisture

Water application (mm):

| | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 15 | 25 | 40 |
| June | 98 | 28 | 126 |
| July | 155 | 37 | 192 |
| Aug | 25 | 53 | 78 |

Replication: 4
Plot size: 1.2 m x 3.7 m
Planting rate: 30 plants/$m^2$
Planting date: May 20
Harvest: pulled, bagged and threshed at maturity

Table 3. Mean yield, seed weight, plant height, days to flower and days to maturity for Pinto Observational Test, at Outlook, Saskatchewan, 1988

| Cultivar or line | Yield (kg/ha) | 1000 seed weight (g) | Plant height (cm) | Days to maturity | Days to flowering |
|---|---|---|---|---|---|
| NW590 | 5110 | 335 | 27 | 116 | 52 |
| Topaz | 4961 | 404 | 30 | 115 | 52 |
| Olathe | 4879 | 381 | 29 | 116 | 51 |
| Fiesta | 4740 | 401 | 33 | 107 | 48 |
| 81125 | 4736 | 397 | 29 | 115 | 52 |
| Bill Z | 4620 | 344 | 27 | 110 | 50 |
| NW410 | 4462 | 364 | 26 | 118 | 54 |
| Pindak | 4413 | 316 | 29 | 109 | 53 |
| Othello | 4123 | 360 | 29 | 105 | 49 |
| UI 111 | 3968 | 348 | 34 | 104 | 49 |
| Nodak | 3777 | 331 | 24 | 103 | 48 |
| 6315 | 3462 | 376 | 32 | 103 | 48 |
| 5325 | 3370 | 366 | 29 | 103 | 49 |
| Ouray | 3225 | 432 | 31 | 120 | 54 |
| Mean | 4275 | | | | |
| CV % | 13 | | | | |
| LSD (0.05) | 772 | | | | |

Water application (mm):

| | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 15 | 25 | 40 |
| June | 98 | 28 | 126 |
| July | 155 | 37 | 192 |
| August | 25 | 53 | 78 |

Replication: 4
Plot size: 1.2 m x 3.7 m
Planting rate: 30 plants/$m^2$
Planting date: May 20 at SIDC
Harvest: Pulled, bagged and threshed at maturity

Table 4. Mean yield, seed weight and days to maturity for Colored Bean Observational Test at Outlook, Saskatchewan, 1988

| Market class | Cultivar or line | Yield (kg/ha) | 1000 seed weight (g) | Days to maturity |
|---|---|---|---|---|
| Black | UI 906 | 1448 | 161 | 111 |
| Large white | 54026 | 2569 | 333 | 110 |
| | 54038 | 2493 | 297 | 115 |
| | 85:598 | 2432 | 272 | 105 |
| | UI 59 | 2269 | 325 | 123 |
| | 5430 | 2155 | 335 | 119 |
| Pink | Viva | 3127 | 250 | 112 |
| | 55009 | 2423 | 294 | 107 |
| | 5524 | 2326 | 293 | 105 |
| | 5521 | 2326 | 293 | 105 |
| | 55038 | 1859 | 315 | 110 |
| Red | 5217 | 2731 | 293 | 105 |
| | 52024 | 2288 | 282 | 101 |
| | 52059 | 2106 | 262 | 101 |
| | 52009 | 1799 | 306 | 107 |
| Small white | 6138 | 2344 | 160 | 113 |
| | 6137 | 1805 | 179 | 119 |
| | Seaforth | 1376 | 196 | 122 |
| | Seaforth | 1246 | 192 | 111 |
| | 6123 | 1037 | 166 | 113 |
| | 6124 | 704 | 171 | 117 |
| Mean | | 2031 | | |
| CV% | | 18 | | |
| LSD (0.05) | | 504 | | |

Water application (mm):

| | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 0 | 25 | 25 |
| June | 90 | 28 | 118 |
| July | 75 | 37 | 112 |
| August | 0 | 53 | 53 |

Replication: 4
Plot size: 1.2 m x 4.26 m
Planting rate: 30 plants/$m^2$
Planting date: May 20 at off-station site
Harvest: Pulled,bagged and threshed at maturity

Table 5. Effect of seeding date on yield of three dry bean cultivars under irrigation at Outlook, Saskatchewan, 1988

| Cultivar | Market class | Seeding date May 20 | June 1 | June 9 |
|---|---|---|---|---|
| | | ------------kg/ha---------- | | |
| UI 111 | pinto | 2,692 | 3,174 | 2,283 |
| Viva | pink | 2,867 | 3,130 | 2,448 |
| Seaforth | navy | 1,250 | 1,209 | 1,182 |
| Mean | | 2,270 | 2,504 | 1,971 |
| CV% | | 20 | 25 | 17 |

Replication: 6 within each date
Plot size: 1.2 m X 3.7 m
Planting rate: 30 plants/$m^2$
Harvest: Bagged and combined at maturity

## Seeding Rate/Row Spacing Study

Viva pink, UI 111 pinto and Seaforth navy were seeded at 15, 30, 45 and 60 seeds/$m^2$ in 30 cm and 60 cm rows. In 1988, a response to increase seeding rate occurred for Seaforth but not for Viva or UI 111 (Table 6). Yield of Viva was significantly higher than Seaforth or UI 111 and was lower at the highest seeding rate. The growing season was hot and dry. Row spacing had no effect on yield in 1988.

Table 6. Effect of seeding rate on yield of three dry bean cultivars under irrigation at Outlook, Saskatchewan, 1988

| Market class | Cultivar | Seeding rate (seeds/$m^2$) 15 | 30 | 45 | 60 | Mean |
|---|---|---|---|---|---|---|
| | | -------------------kg/ha------------------- | | | | |
| Navy | Seaforth | 2,586 | 2,911 | 3,321 | 3,275 | 3,018 |
| Pink | Viva | 3,975 | 4,037 | 4,032 | 3,464 | 3,870 |
| Pinto | UI 111 | 3,285 | 3,052 | 3,008 | 3,128 | 3,124 |
| Mean | | 3,282 | 3,329 | 3,478 | 3,293 | |
| Pooled S.E. | | | | | | 237 |
| CV = 17 | | | | | | |

Water application (mm):

| | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 15 | 25 | 40 |
| June | 98 | 28 | 126 |
| July | 155 | 37 | 192 |
| August | 25 | 53 | 78 |

Replications: 6
Plot size: 2.4 m x 3.7 m
Planting rate: 30 plants/$m^2$
Planting date: May 20 at SIDC
Harvest: Bagged and threshed middle 1.2 m at maturity

These data will be combined with the previous two years results to assemble agronomic recommendations for irrigated dry bean production in south-central Saskatchewan.

## Harvest Date Study

In this experiment, three cultivars of dry bean were harvested at weekly intervals beginning at physiological maturity. There was no effect of delayed harvest date on yield indicating that no significant shattering losses occurred (Table 7). Viva and UI 111 were significantly higher yielding than Seaforth. These results are similar to those of 1986 and 1987. Unless Sclerotinia stem rot is a problem, shattering loss in the field after physiological maturity pose no threat for dry bean production provided that harvest occurs at the proper seed moisture content.

Table 7. Effect of harvest date on yield of three dry bean cultivars at Outlook, Saskatchewan, 1988

| Market class | Cultivar | Date* 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|---|
| | | kg/ha | | | | | |
| Navy | Seaforth | 2891 | 3040 | 2882 | 2487 | 2938 | 2862 |
| Pink | Viva | 4968 | 3880 | 5067 | 4399 | 4602 | 4620 |
| Pinto | UI 111 | 4736 | 4247 | 4449 | 5044 | 3564 | 4408 |
| Mean | | 4199 | 3732 | 4132 | 3976 | 3701 | |
| Pooled S.E. | | | | | | | 425 |
| CV = 15% | | | | | | | |

*Date 1 is physiological maturity; subsequent dates at weekly intervals.

Replication: 4
Plot size: 1.2 m X 3.7 m
Planting rate: 30 plants/$m^2$
Planting date: May 20
Harvest: Bagged and combined at maturity

## Harvest Method Study

Row spacing had no effect on yield in 1988 (Table 8). These results parallel those of the seeding rate/row spacing experiment. Harvest method had no effect on yield of Midnight or Seaforth. For Viva (pink) and UI 111 (pinto), which have a vinier growth habit, harvesting by pulling increased yield significantly compared to harvesting with a small plot combine at both 30 and 60 cm row spacing.

Table 8. Effect of harvest method and row spacing on yield of four dry bean cultivars at Outlook in 1988.

| | | | Row Spacing (cm) | | | | |
|---|---|---|---|---|---|---|---|
| | | | 30 | | 60 | | |
| Market class | Growth habit | Cultivar | Combine | Pull | Combine | Pull | Mean |
| | | | ---------------------kg/ha------------------- | | | | |
| Black | upright | Midnight | 3,461 | 3,953 | 3,156 | 3,537 | 3,526 |
| Navy | bush | Seaforth | 2,582 | 2,761 | 2,425 | 2,295 | 2,475 |
| Pink | semi-vine | Viva | 3,386 | 4,360 | 3,494 | 4,592 | 3,958 |
| Pinto | vine | UI 111 | 2,886 | 4,164 | 3,190 | 4,171 | 3,602 |
| Mean | | | 3,079 | 3,809 | 3,066 | 3,648 | |
| Pooled S.E. | | | | | | 331 | |
| CV = 16% | | | | | | | |

Water application (mm):

| | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 15 | 25 | 40 |
| June | 98 | 28 | 126 |
| July | 155 | 37 | 192 |
| August | 25 | 53 | 78 |

Replication: 6
Plot size: 2.4 m X 3.7
Planting rate: 30 plants/$m^2$
Planting date: May 20 at SIDC
Harvest: Bagged and threshed or direct combined middle 1.2 m at maturity

## Irrigation Scheduling Study

Results of a preliminary irrigation scheduling experiment showed significant differences among treatments (Table 9). Following a pre-seeding irrigation applied to all plots, an additional two irrigations doubled yield relative to the dryland treatment. A third irrigation significantly increased yield again. No difference in yield was observed between treatments with three and five irrigations or between those with five and six irrigations. This indicates a levelling off in yield response to water application between approximately 300 mm (14") and 500 (20") on a pre-irrigated light-textured soil. The dryland treatments had significantly smaller seed size, indicating drought stress during seed filling. The treatment with two irrigations had significantly larger seed size, indicating that yield was limited by reduced seed set. The 1988 results confirm that dry bean is a low water use crop relative to cereals and alfalfa. This experiment will be refined and repeated in 1989 to obtain further information on irrigation scheduling responses in dry bean.

Table 9. Mean yield and seed weight for UI 111 pinto bean at five levels of irrigation in 1988 at Outlook, Saskatchewan

| Treatment | Number of irrigations | Water application (mm) Rainfall | Irrigation | Total | Yield (kg/ha) | 1000 seed weight (g) | Mature seeds per square meter |
|---|---|---|---|---|---|---|---|
| 60% FC | 6 | 137 | 456 | 593 | 3841 a | 359 a | 1069 |
| 40% FCIR | 5 | 137 | 381 | 518 | 3726 ab | 361 a | 1032 |
| 40% FC | 3 | 137 | 228 | 365 | 3487 b | 359 a | 971 |
| Visible | 2 | 137 | 152 | 289 | 2933 c | 384 b | 763 |
| Dryland | 0 | 137 | 0 | 137 | 1533 d | 330 c | 464 |
| Mean | | | | | 3104 | 359 | |
| CV % | | | | | 9 | 4 | |
| LSD (0.05) | | | | | 337 | 16 | |

Field was irrigated to field capacity (FC) one week before seeding. Field capacity was estimated by averaging tensiometer readings from 30 cm and 60 cm depths for 2 replicates. For FCIR treatment, plots were irrigated at 40% FC until flowering, then irrigated when stress levels were indicated using a Scheduler Plant Stress Monitor (infrared). Visible treatments were irrigated when foliage appeared "blue" relative to irrigated treatments.

Treatments followed by the same letter indicate no significant difference based on protected LSD test at P = 0.05 level.

Replications: 6
Plot size: 2.4 m x 3.7 m
Planting date: May 20
Planting rate: 30 plants/$m^2$
Harvest: 1.2 m x 3.7 m sub-plot pulled and combined at maturity

## FABABEAN RESEARCH

### General

Fababean is a pulse crop that responds to irrigation. In 1988, a small research program was initiated with the objectives of evaluating better varieties and identifying agronomic practices that will help producers achieve more consistent yields.

### Variety Evaluations

The Western Canadian Fababean Co-operative Test was grown in 1988 (Table 1). Short season cultivars were the lowest yielding. A yield test including European determinate types was conducted. Results were inconclusive because of high variability, but in 1988, the determinate types as a group yielded less than the indeterminate varieties traditionally grown in Western Canada (Table 2).

### Date of Seeding Study

The 1988 results from the date of seeding study showed a significant yield increase due to early seeding (Table 3). However, seeding date was confounded with field location in this experiment. Although the trend was consistent with previous research, this experiment will have to be repeated to obtain a better estimate of the true effect of early seeding on yield of fababean. No signficant differences in yield among cultivars were observed.

## Seeding Rate and Row Spacing Study

Aladin and Outlook fababean were sown at 20, 30 and 40 seeds/$m^2$ at 20, 40 and 60 cm row spacings. No differences in yield were observed among any of the seeding rate/row spacing combinations (Table 4). Aladin outyielded Outlook by about 6% (significant at P = 0.05). This experiment will be repeated to accumulate data on year effects on irrigated fababean yield.

## Potassium Response Study

Potassium fertilizer was side-banded at seeding at rates of 50, 100 and 200 kg/ha in plots of Outlook fababean. No significant yield response to application ofthe chloride or sulfate form of potassium fertilizer was observed, although all treatments outyielded the control (Table 5). The original soil test showed a potassium level of 270 lbs/acre (Saskatchewan Soil Testing Laboratory, Saskatoon). All potassium treated plots had significantly increased plant height. Further research is required to quantify potential yield respones to potassium fertilizer for pulse crops on light-textured irrigated soils.

Table 1. Mean yield, days to flowering and plant height for Western Canadian Fababean Co-operative Yield Test at Outlook, Saskatchewan, 1988.

| Cultivar or line | Yield (kg/ha) | Days to flowering | Plant height (cm) |
|---|---|---|---|
| Encore | 5516 | 48 | 91 |
| 81RM3054 | 4849 | 45 | 83 |
| Pegasus | 4843 | 48 | 107 |
| Aladin | 4820 | 50 | 85 |
| 82RM2227 | 4793 | 47 | 92 |
| 82RM2218 | 4561 | 47 | 80 |
| Outlook | 4403 | 48 | 75 |
| Herz Freya | 4042 | 47 | 93 |
| Orion | 3312 | 39 | 59 |
| Avanti | 2271 | 42 | 71 |
| Mean | 4301 | | |
| CV % | 25 | | |

| Water application (mm): | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 50 | 25 | 75 |
| June | 155 | 28 | 183 |
| July | 162 | 37 | 199 |
| Aug | 25 | 53 | 78 |

Replication: 3
Plot size: 1.2 m x 3.7 m
Planting rate: 40 plants/$m^2$
Planting date: April 29
Harvest: swathed and combined

Table 2. Mean yield, plant height, height to first podded node, and number of days to flower for Fababean Determinate Test at Outlook, Saskatchewan, 1988

| Variety | Yield (kg/ha) | Plant height (cm) | Height to first podded node (cm) | Days to flower |
|---|---|---|---|---|
| Outlook | 3131 | 81.3 | 25.0 | 62 |
| Ticol | 3046 | 75.0 | 20.0 | 58 |
| Herz Freya | 3015 | 88.8 | 38.8 | 60 |
| Erfordia | 2905 | 70.0 | 22.5 | 63 |
| Tigo | 2755 | 77.5 | 31.3 | 59 |
| Fritel | 2356 | 88.8 | 32.5 | 61 |
| Boss | 2334 | 72.5 | 26.3 | 49 |
| Tinova | 2094 | 76.3 | 41.3 | 64 |
| Piccolo | 2035 | 83.8 | 23.8 | 58 |
| Pronto | 1580 | 85.0 | 32.5 | 55 |
| Mean | 2778 | | | |
| CV % | 24 | | | |
| LSD (0.05) | 869 | | | |

| Water application (mm): | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 50 | 25 | 75 |
| June | 155 | 28 | 183 |
| July | 162 | 37 | 199 |
| August | 25 | 53 | 78 |

Replication: 4
Plot size: 1.2 m x 3.7 m
Planting rate: 40 plants/$m^2$
Planting date: April 29
Harvest: Combined in early September

Table 3. Effect of seeding date on yield of three fababean cultivars at Outlook, Saskatchewan, 1988

| Cultivar | Seeding date: April 29 | May 11 | May 19 | Mean |
|---|---|---|---|---|
| Outlook | 5916 | 3781 | 3761 | 4486 |
| Aladin | 6320 | 3305 | 2783 | 4136 |
| Herz Freya | 5462 | 3316 | 3219 | 3999 |
| Mean | 5899 | 3467 | 3254 | |
| CV% | 19 | 19 | 23 | |
| Pooled S.E. | | | | 514 |

Replication: 6

| Water application (mm): | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 50 | 25 | 75 |
| June | 155 | 28 | 183 |
| July | 162 | 37 | 199 |
| Aug | 25 | 53 | 78 |

Plot size: 1.2 X 3.7 m
Harvest: swathed at 25% black pod, then combined

Table 4. Effect of seeding rate and row spacing on two fababean cultivars at Outlook, Saskatchewan, 1988

| Treatment | Cultivar | Yield(kg/ha) | | | Treatment mean |
|---|---|---|---|---|---|
| Seeding rate | | 20 seeds/$m^2$ | 30 seeds/$m^2$ | 40 seeds/$m^2$ | |
| | Aladin | 4419 | 4628 | 4393 | 4480 |
| | Outlook | 4216 | 4051 | 4435 | 4226 |
| | Mean | 4318 | 4340 | 4413 | |
| Row spacing | | 20 cm | 40 cm | 60 cm | |
| | Aladin | 4474 | 4570 | 4397 | 4480 |
| | Outlook | 4107 | 4442 | 4116 | 4226 |
| | Mean | 4301 | 4506 | 4257 | |
| CV = 16% | | | | | |

Replication: 6

Water application (mm):

| | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 50 | 25 | 75 |
| June | 155 | 28 | 183 |
| July | 162 | 37 | 199 |
| August | 25 | 53 | 78 |

Plot size = 2.4 X 3.7 m

Harvest = middle 1.2 m swathed and combined in September

Table 5. Effect of potassium fertilzer application on yield and height of Outlook fababean at Outlook, Saskatchewan, 1988

| Potassium source | Rate of $K_2O$ applied (kg/ha) | Yield (kg/ha) | Plant height (cm) |
|---|---|---|---|
| Control | 0 | 4651 | 91* |
| KCl | 50 | 5400 | 106 |
| KCl | 100 | 5007 | 100 |
| KCl | 200 | 5247 | 104 |
| $K_2SO_4$ | 50 | 5086 | 105 |
| $K_2SO_4$ | 100 | 5099 | 105 |
| $K_2SO_4$ | 200 | 4953 | 107 |
| Mean | | 5079 | 103 |
| CV = 8% | | | |

* Significant at P = 0.05

Water application (mm):

| | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 50 | 25 | 75 |
| June | 155 | 28 | 183 |
| July | 162 | 37 | 199 |
| August | 25 | 53 | 78 |

Replication: 4

Plot size: 4.8 m X 9.2 m

Harvest: 2.7 m X 9.2 m swathed and combined

## FIELD PEA

### General

Irrigated field pea research at SIDC began in 1988. Emphasis is placed on evaluating varieties suitable for irrigated production and investigating agronomic practices that will improve potential yield under irrigation. The results of trials reported here are considered preliminary because this was the first year of a five year program.

### Variety Testing

Three variety tests were grown in 1988 - the Special Purpose PeaCo-operative Test, the Field Pea Co-operative Test and a preliminary yield test grown in co-operation with the Crop Development Centre in Saskatoon. This was the first year of testing under irrigation in Saskatchewan, therefore, relative performance of varieties over a number of years and locations is not available. These tests will help develop a base for variety recommendation for irrigated pea production in south-central Saskatchewan.

Many of the lines tested in the Field Pea Co-operative Test (Table 1) are shorter and earlier than the standard Century and Trapper types. Several lines from the Agriculture Canada pea breeding program in Manitoba were highest yielding in 1988. In the Special Purpose Pea Co-operative Test (Table 2), Tara significantly outyielded many of the experimental lines. No significant yield differences were observed in the preliminary yield test (Table 3).

### Date of Seeding Study

Replicated plots of four cultivars were seeded on April 29, May 9 and May 27. Highly significant date effects were observed but due to interaction between location and seeding date, soil factors were considered to be the main influence on yield. Repetition of this experiment on more uniform soil will be attempted in 1989.

### Potassium Response Study

An experiment similar to that for the fababean potassium response study was conducted (Table 4). No statistically significant yield increases for Tara pea were observed when side-banded potassium was added to a sandy loam soil testing 270 lbs/acre $K_2O$ (Saskatchewan Soil Testing Laboratory, Saskatoon). However, the control plots had the lowest yield of all treatments. These results parallel to those of the fababean study of potassium response. Further research will be conducted.

Table 1. Mean yield, seed weight, vine length, days to flowering and days to maturity for Field Pea Co-operative Test at Outlook, Saskatchewan, 1988

| Cultivar or line | Yield (kg/ha) | 1000 seed weight (g) | Vine length (cm) | Days to 50% flower | Days to maturity |
|---|---|---|---|---|---|
| MP954 | 5588 | 293 | 96 | 44 | 92 |
| MP1005 | 5497 | 289 | 42 | 37 | 89 |
| MP990 | 5481 | 291 | 49 | 41 | 90 |
| Triumph | 5343 | 308 | 68 | 50 | 102 |
| CS-8 | 5167 | 203 | 102 | 49 | 97 |
| Fortune | 4896 | 197 | 68 | 47 | 99 |
| Express | 4881 | 228 | 47 | 47 | 91 |
| MP889 | 4850 | 256 | 100 | -- | 100 |
| BL-81 | 4846 | 331 | 49 | 44 | 92 |
| Danto | 4587 | 273 | 47 | 45 | 90 |
| Victoria | 4554 | 187 | 69 | 38 | 88 |
| Trapper | 4497 | 133 | 79 | 48 | 96 |
| SV84539 | 4455 | 202 | 53 | 43 | 90 |
| CL85 | 4419 | 273 | 53 | 45 | 90 |
| Titan | 4314 | 273 | 100 | 49 | 100 |
| Century | 4313 | 218 | 87 | 45 | 98 |
| Bohatyr | 4239 | 281 | 52 | 39 | 92 |
| Fjord | 4163 | 229 | 51 | 44 | 92 |
| Miranda | 4118 | 352 | 34 | 39 | 83 |
| MP993 | 3989 | 286 | 86 | 36 | 90 |
| Tipu | 3979 | 222 | 90 | 44 | 97 |
| SS-5 | 3913 | 191 | 49 | 39 | 88 |
| Kasino | 3783 | 289 | 41 | 38 | 84 |
| Princess | 3322 | 209 | 38 | 34 | 83 |
| Alcan | 2102 | 243 | 51 | 33 | 81 |
| Mean | 4448 | | | | |
| CV % | 20 | | | | |
| LSD (0.05) | 1250 | | | | |

Water application (mm):

| | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 15 | 25 | 40 |
| June | 98 | 28 | 126 |
| July | 155 | 37 | 192 |
| Aug | 25 | 53 | 78 |

Replication: 4
Plot size: 0.6 m x 3.7 m
Planting date: May 12
Harvest: Combined on August 24

Table 2. Mean yield, seed weight, days to flowering and vine length for Special Purpose Pea Co-operative Yield Test, 1988 at Outlook, Saskatchewan.

| Cultivar or line | Yield (kg/ha) | 1000 seed weight (g) | Days to flower | Vine length (cm) |
|---|---|---|---|---|
| Tara | 6250 | 213 | 48 | 84 |
| Victoria | 5738 | 144 | 41 | 76 |
| Bellevue | 5455 | 142 | 52 | 80 |
| Stehgolt | 5418 | 327 | 39 | 35 |
| Century | 5365 | 162 | 39 | 115 |
| SS-10 | 5280 | 258 | 42 | 39 |
| SS-7 | 5178 | 326 | 40 | 59 |
| Radley | 5145 | 187 | 40 | 49 |
| SS-5 | 5127 | 196 | 45 | 49 |
| Alaska 81 | 5117 | 235 | 36 | 91 |
| Semu SI | 5059 | 221 | 50 | 95 |
| Marrowfat | 4999 | 337 | 44 | 48 |
| Magnus | 4853 | 268 | 50 | 83 |
| Progreta | 4819 | 345 | 43 | 43 |
| Princess | 4707 | 213 | 36 | 37 |
| Consort | 4419 | 319 | 39 | 39 |
| SS-3 | 4376 | 263 | 39 | 46 |
| Tiara | 3942 | 173 | 29 | 36 |
| Whero | 3447 | 196 | 49 | 106 |
| Mean | 5070 | | | |
| CV % | 12 | | | |
| LSD (0.05) | 895 | | | |

Water application (mm):

| | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 15 | 25 | 40 |
| June | 98 | 28 | 126 |
| July | 155 | 37 | 192 |
| Aug | 25 | 53 | 78 |

Replication: 4
Plot size: 1.2 m x 3.7 m
Planting rate: intended 80 plants/$m^2$
Planting date: April 29
Harvest: Combined on August 24

Table 3. Yield, seed weight, vine length and days to flowering for field pea preliminary test at Outlook, Saskatchewan, 1988

| Line or cultivar | Yield (kg/ha) | 1000 seed weight | Vine length (cm) | Days to Days to flowering |
|---|---|---|---|---|
| Century | 5303 | 232 | 110 | 47 |
| Tara | 5124 | 215 | 78 | 47 |
| Express | 5104 | 255 | 41 | 42 |
| L4 | 4905 | 180 | 110 | 47 |
| L3 | 4851 | 309 | 51 | 37 |
| Victoria | 4714 | 197 | 65 | 41 |
| L1 | 4621 | 362 | 53 | 34 |
| L5 | 4526 | 312 | 47 | 37 |
| L2 | 4217 | 390 | 47 | 34 |
| Mean | 4818 | | | |
| CV% | 20 | | | |

| Water application (mm): | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 15 | 25 | 40 |
| June | 98 | 28 | 126 |
| July | 155 | 37 | 192 |
| August | 25 | 53 | 78 |

Replication: 4
Plot size: 1.2 m X 3.7 m
Planting date: April 29
Harvest: Combined on August 24

Table 4. Effect of potassium fertilizer addition on yield of Tara pea at Outlook, Saskatchewan, 1988

| Potassium source | Rate of $K_2O$ applied | Yield (kg/ha) |
|---|---|---|
| Control | 0 | 3200 |
| KCl | 50 | 3511 |
| KCl | 100 | 3781 |
| KCl | 200 | 3481 |
| $K_2SO_4$ | 50 | 3435 |
| $K_2SO_4$ | 100 | 3505 |
| $K_2SO_4$ | 200 | 3843 |
| Mean | | 3536 |
| CV% | | 20 |

| Water application (mm): | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 15 | 25 | 40 |
| June | 98 | 28 | 126 |
| July | 155 | 37 | 192 |
| Aug | 25 | 53 | 78 |

Replication: 4
Plot size: 4.8 m X 9.1 m
Planting rate: 80 plants/$m^2$
Planting date: May 4
Harvest: 2.6 m X 9.1 m swathed and combined at maturity

## LENTIL RESEARCH

### General

Two lentil experiments were conducted in 1988. The Lentil Co-operative Test was grown in co-operation with the Crop Development Centre at University of Saskatchewan. A date of seeding study was also located at SIDC as part of a project funded by the Saskatchewan Pulse Crop Development Board and the Agriculture Development Fund of Saskatchewan Agriculture. This is the first year of irrigated lentil research and results should not be considered conclusive.

### Variety Testing

Results of the Lentil Co-operative Test are shown in Table 1. The highest yielding entry was the red lentil (Red Eston) line registered in 1989 as the cultivar Rose. It is similar in yield and maturity to Eston. Both these varieties significantly outyielded Laird under irrigation.

### Date of Seeding Study

Results showed an interaction between seeding date and genotype (Table 2(a)). This is best illustrated by comparing yield of Laird and Eston across dates. Late May and June seeding dates reduced seed yield of Laird significantly in comparison to Eston. Total dry matter yields were relatively unaffected by seeding date (Table (b)). The harvest index data show that Eston is unaffected by seeding date while Laird harvest index approaches zero by mid-June seeding dates. Days to flower was relatively constant across dates for genotypes except for the two earliest flowering lines, PI 244046 and Eston, on the first date. Eston outyielded Laird for all but the first seeding date. These results represent one location of several in a larger study which was completed in 1988.

It can be concluded that the date of seeding window for Eston is much larger than for Laird. This could benefit irrigation farmers who may wish to seed a late irrigated crop of Eston or other varieties with a similar growth pattern.

Table 1. Mean yield, days to flowering, and seed weight for Lentil Co-operative Yield Test at Outlook, Saskatchewan, 1988

| Variety | Yield (kg/ha) | Days to flowering | 1000 seed weight (g) |
|---|---|---|---|
| Red Eston | 3156 | 37 | 53 |
| Lax-35 | 2952 | 40 | 47 |
| Eston | 2773 | 39 | 35 |
| 77-572 | 2771 | 41 | 50 |
| T-B403M | 2765 | 45 | 37 |
| T-B406M | 2568 | 40 | 44 |
| Lax-5 | 2562 | 41 | 54 |
| Emerald | 2253 | 42 | 58 |
| WA256112 | 1750 | 44 | 64 |
| Laird | 1738 | 50 | 61 |
| Mean | 2529 | | |
| CV % | 18 | | |
| LSD (0.05) | | | |

| Water application (mm): | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 15 | 25 | 40 |
| June | 46 | 28 | 74 |
| July | 45 | 37 | 82 |
| Aug. | 0 | 53 | 53 |

Replication: 4
Plot size: 1.2 m x 3.7 m
Planting date: May 12
Harvest: Under-cut, bagged, threshed at maturity in Aug.

Table 2 Seed yield, dry matter yield, days to flower and harvest index of five lentil genotypes seeded on five dates at Outlook, Saskatchewan, 1988

| | Line or cultivar | April 29 | May 9 | May 27 | June 3 | June 17 |
|---|---|---|---|---|---|---|
| | | Seed yield (kg/ha) | | | | |
| a) | PI244046 | 411 | 632 | 945 | 1144 | 1873 |
| | Eston | 1432 | 3193 | 3959 | 1712 | 2285 |
| | Laird | 2153 | 2592 | 1360 | 975 | 254 |
| | Indianhead | 3178 | 3048 | 1731 | 1568 | 1381 |
| | PI298121 | 2420 | 1658 | 924 | 347 | 108 |
| | Pooled SE | 302 | | | | |
| | CV% | 25 | | | | |
| b) | | Dry matter yield (kg/ha) | | | | |
| | PI244046 | 1838 | 3709 | 3403 | 3068 | 5745 |
| | Eston | 3721 | 7084 | 9216 | 4908 | 8337 |
| | Laird | 7413 | 8916 | 7322 | 6363 | 7084 |
| | Indianhead | 9574 | 9755 | 9670 | 7243 | 9194 |
| | PI298121 | 8848 | 11377 | 8082 | 6857 | 7373 |
| | Mean | 6278 | 8168 | 7539 | 5688 | 7547 |
| | Pooled SE | 824 | | | | |
| | CV% | 16 | | | | |
| c) | | Days to flower | | | | |
| | PI244046 | 36.0 | 29.0 | 24.7 | 22.7 | 24.5 |
| | Eston | 48.7 | 36.5 | 38.5 | 35.2 | 37.2 |
| | Laird | 53.5 | 57.7 | 53.5 | 50.2 | 56.0 |
| | Indianhead | 59.2 | 53.5 | 52.5 | 49.7 | 51.5 |
| | PI298121 | 69.7 | 61.2 | 61.7 | 61.0 | 65.5 |
| | Pooled SE | 2.3 | | | | |
| | CV% | 7 | | | | |
| d) | | Harvest index | | | | |
| | PI244046 | 0.17 | 0.16 | 0.28 | 0.34 | 0.32 |
| | Eston | 0.38 | 0.45 | 0.43 | 0.36 | 0.28 |
| | Laird | 0.29 | 0.30 | 0.19 | 0.14 | 0.04 |
| | Indianhead | 0.33 | 0.30 | 0.18 | 0.21 | 0.15 |
| | PI298121 | 0.27 | 0.15 | 0.11 | 0.05 | 0.01 |

Replication: 4 within dates
Plot size: 1.2 m x 3.7 m
Harvest: Undercut, bagged and threshed at maturity

## Grass Pea Research

General

Grass pea (Lathyrus sativus L.) is a potential new pulse crop for Western Canada being developed at Morden Research Station, Agriculture Canada. Research at SIDC was initiated in 1988 as part of a three-year project jointly funded by the Saskatchewan Pulse Crop development Board and Canada/Saskatchewan subsidiary Agreement on Agricultural Development (ERDA). The project is conducted jointly with Dr. A. Slinkard, Crop Devlopment Centre and Dr. C. Campbell at Morden.

Variety Evaluations

The Lathyrus Co-operative Test was established under irrigation. High mean yields were observed with significant differences among entries (Table 1). This test will be grown in future years to establish a baseline for expected yields under irrigated conditions.

Table 1. Mean yield, seed weight, days to flowering, and plant height for Lathyrus Cooperative Test at Outlook, Saskatchewan, 1988

| Line | Yield (kg/ha) | 1000 seed weight (g) | Days to flowering | Plant height (cm) |
|---|---|---|---|---|
| NC8A-61W | 6704 | 269 | 37 | 84 |
| NC8A-75/1C | 6372 | 243 | 38 | 86 |
| LS83387 | 6069 | 192 | 37 | 84 |
| NC8A-26/1 | 5976 | 246 | 37 | 84 |
| NC8A-60D | 5759 | 256 | 38 | 83 |
| NC8A-26/2 | 5505 | 232 | 37 | 79 |
| NC8A-74 | 5457 | 247 | 37 | 84 |
| NC8A-65/2C | 5229 | 250 | 35 | 73 |
| LS8246 | 4730 | 196 | 37 | 68 |
| LS8511 | 4664 | 171 | 38 | 70 |
| NC8A-30W | 4494 | 250 | 38 | 66 |
| LS8501 | 4345 | 205 | 39 | 71 |
| LS8541 | 4271 | 190 | 38 | 78 |
| LS8524 | 4113 | 177 | 38 | 74 |
| LS8515 | 4018 | 198 | 39 | 49 |
| LS8510 | 3400 | 179 | 38 | 63 |
| Mean | 5069 | | | |
| CV % | 20 | | | |
| LSD (0.05) | 1405 | | | |

| Water application (mm): | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 15 | 25 | 40 |
| June | 98 | 28 | 126 |
| July | 155 | 37 | 192 |
| August | 25 | 53 | 78 |

Replication: 4
Plot size: 0.6 m x 3.7 m
Planting date: May 9
Harvest: Combined on September 28

## Irrigation Study

Grass pea contains BOAA, a neurotoxin. Lines with reduced BOAA content were grown under three irrigation regimes to evaluate responses in yield, BOAA content and seed weight (Table 2). Significant differences were observed in yield due to irrigation treatment but not due to line. A significant decrease in BOAA content was observed due to irrigation treatment but not due to line. Irrigation had no effect on seed size while line 1-7F had significantly smaller seed size compared to lines A-44, A-64 and A-7. Therefore, the variation in BOAA due to irrigation was possibly caused by altered protein content or composition. This research will be continued to further investigate the nutritional quality of grass pea in response to irrigation.

Table 2. Effect of irrigation on seed yield and seed BOAA content of grass pea at Outlook, Saskatchewan, 1988

| | | Irrigation Treatment | | | |
|---|---|---|---|---|---|
| Measurement | Line | Dryland | Partial irrigation | Full irrigation | Mean |
| | | kg/ha | | | |
| Yield | | | | | |
| | A-14 | 947 | 4002 | 6765 | 3904 |
| | A-64 | 926 | 4309 | 6594 | 3843 |
| | A-7 | 1150 | 5297 | 7851 | 4766 |
| | A-74 | 1224 | 4849 | 7250 | 4455 |
| | A-84 | 1265 | 4180 | 6438 | 3961 |
| | Mean | 1102 | 4527 | 6979 | |
| | Pooled SE | | | | 589 |
| | CV = 19% | | | | |
| BOAA content | | % of seed dry weight | | | |
| | A-14 | 0.26 | 0.22 | 0.21 | 0.23 |
| | A-64 | 0.30 | 0.20 | 0.15 | 0.21 |
| | A-7 | 0.26 | 0.21 | 0.17 | 0.21 |
| | A-74 | 0.23 | 0.19 | 0.12 | 0.18 |
| | A-84 | 0.23 | 0.22 | 0.16 | 0.20 |
| | Mean | 0.26 | 0.21 | 0.16 | |
| | Pooled SE | | | | 0.03 |
| | CV = 21% | | | | |
| Seed weight | | g/1000 seed | | | |
| | A-14 | 236 | 234 | 227 | 232 |
| | A-64 | 230 | 232 | 232 | 233 |
| | A-7 | 224 | 233 | 224 | 227 |
| | A-74 | 196 | 204 | 191 | 197 |
| | A-84 | 207 | 225 | 205 | 212 |
| | Mean | 219 | 226 | 216 | |
| | Pooled SE | | | | 15 |
| | CV = 10% | | | | |

Replications: 4
Water application: Irrigation plus precipitation: dryland - 143 mm; partial irrigation - 249 mm; full irrigation - 436 mm
Seeding date: May 9
Harvest: Combined in late September after desiccation

# Safflower Research

## General

In 1988, two safflower experiments were conducted in co-operation with the safflower breeding program at Agriculture Canada at Lethbridge Research Station and the New Crops Program at Agriculture Canada at Morden.

## Variety Evaluation

Results of the Safflower Co-operative test are shown in Table 1. All varieties matured in 1988 because the weather was much warmer than normal. The test site had soil variability, making it difficult to separate mean yield of lines in the test. The nursery will be repeated to accumulate base information on expected yield and maturing for irrigated safflower.

Table 1. Mean yield, days to flowering, plant height, seed weight and test weight, for New Crop Co-op Safflower Test at Outlook, Saskatchewan, 1988

| Cultivar or line | Yield (kg/ha) | Days to 50% flower | Plant height (cm) | 1000 seed weight (g) | Test weight (kg/hl) |
|---|---|---|---|---|---|
| Lesaf 200 | 2313 | 68 | 38 | 40 | 50 |
| Lesaf 239 | 2240 | 67 | 36 | 40 | 49 |
| Girard | 2181 | 73 | 39 | 48 | 53 |
| S-541 | 2157 | 72 | 38 | 45 | 51 |
| Saffire-23 | 2107 | 66 | 32 | 41 | 50 |
| Saffire-6 | 2070 | 68 | 34 | 46 | 52 |
| Saffire-47 | 1966 | 68 | 34 | 41 | 50 |
| Lesaf 215 | 1952 | 68 | 33 | 41 | 48 |
| Saffire | 1949 | 66 | 34 | 42 | 52 |
| Lesaf 241 | 1818 | 67 | 32 | 41 | 53 |
| S-208 | 1718 | 71 | 36 | 43 | 47 |
| Lesaf 240 | 1716 | 70 | 35 | 40 | 52 |
| Lesaf 199 | 1699 | 68 | 31 | 42 | 50 |
| Saffire-15 | 1653 | 65 | 28 | 43 | 50 |
| Saffire-29 | 1465 | 69 | 38 | 39 | 50 |
| Saffire-26 | 1418 | 69 | 35 | 47 | 50 |
| Mean | 1894 | | | | |
| CV % | 21 | | | | |

Water application (mm):

| | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 15 | 25 | 40 |
| June | 46 | 28 | 74 |
| July | 45 | 37 | 82 |
| Aug | 0 | 53 | 53 |

Replication: 4
Plot size: 1.2 m x 3.7 m
Planting date: April 30
Harvest: Combined on September 19

### Seeding Rate/Irrigation Scheduling Study

Saffire safflower was sown in replicated blocks at 15, 22.5 and 30 kg/ha in three separate plot areas which received 143 (dryland), 249 (partial irrigation) and 436 (fall irrigation ) mm. Measurements of yield, oil content, height and seed weight were recorded. Plot location was confounded with irrigation treatment and soil quality. As a result, germination and growth were affected. Data were analyzed but are not presented because they are not meaningful.

## CANARYSEED RESEARCH

### General

This was the first year of canaryseed testing under irrigation. This work was done in co-operation with the Crop Development Centre in Saskatoon and the New Crops Program at Agriculture Canada in Morden.

### Variety Evaluation

There were six entries in the 1988 Annual Canaryseed Test. The two registered varieties had relatively earlier heading dates (Table 1) but were not significantly different in yield. Weed problems caused variability in yield. This test will be grown each year to help generate a data base for irrigated canaryseed production recommendations. An observational nursery was also established. Seed was increased for possible further testing.

Table 1. Mean yield, plant height, test weight and days to heading for the Annual Canaryseed Test at Outlook, Saskatchewan, 1988

| Cultivar or line | Yield (kg/ha) | Plant height (cm) | Test weight (kg/hl) | Days to heading |
|---|---|---|---|---|
| 153 | 2300 | 66 | 63 | 47 |
| Elias | 2193 | 63 | 64 | 41 |
| 170 | 2035 | 75 | 61 | 49 |
| 176 | 1894 | 59 | 59 | 42 |
| 163 | 1812 | 78 | 60 | 48 |
| Keet | 1758 | 60 | 60 | 42 |
| Mean | 1997 | | | |
| Replication | 4 | | | |
| CV % | 22 | | | |

Water application (mm):

| | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 42 | 25 | 67 |
| June | 142 | 28 | 170 |
| July | 153 | 37 | 190 |
| August | 0 | 53 | 53 |

Replication: 6
Plot size: 1.2 m x 3.7 m
Planting date: May 13
Harvest: Combined on Sept. 9

# Other Specialty Crops Research

## General

Several other specialty crops were grown strictly as observational rows or plots as a crude screening for possible adaptation. Except for the Fenugreek Co-operative Test, no yield data were recorded. Seed was harvested from lines of any crop that matured before the first killing frost. In most cases, very few lines were tested per crop.

## Fenugreek

Three lines were entered in the 1988 Fenugreek Co-operative Test. The line NC 109-1 yielded significantly more than the other two entries which were affected by root rot (Table 1).

Table 1. Mean yield and seed weight for for Fenugreek Co-operative Test, at Outlook, Saskatchewan, 1988

| Variety | Yield (kg/ha) | 1000 seed weight (g) |
|---|---|---|
| NC109-1 | 3349 | 25 |
| NC109-2 | 333 | 18 |
| NC109-3 | 495 | 19 |
| Mean | 1392 | |
| CV % | 19 | |

Water application (mm):

| | Irrigation | Rainfall | Total |
|---|---|---|---|
| May | 15 | 25 | 40 |
| June | 46 | 28 | 74 |
| July | 45 | 37 | 82 |
| August | 0 | 53 | 53 |

Replication: 4
Plot size: 1.2 m x 3.7 m
Planting date: May 9
Harvest: cut October 5; threshed October 11

## Other Pulse Crops

Samples of pulse crops listed in Table 2 were obtained from various sources and established as observational plots in 1988.

No mature seed was harvested from pigeon pea. If this crop failed to mature in 1988, the warmest summer on record, it has no potential in south-central Saskatchewan. The same scenario occurred for guar, which was also extremely susceptible to Sclerotinia stem rot.

Table 2. Pulse crops grown in observational rows at Outlook, Saskatchewan, 1988

| Crop | Genus and species |
|---|---|
| Pigeon pea | *Cajanus cajan* |
| White lupin | *Lupinus albus* |
| Yellow lupin | *Lupinus luteus* |
| Narrow-leafed lupin | *Lupinus angustifolius* |
| Chickpea (desi) | *Cicer arietinum* |
| Common vetch | *Vicia sativa* |
| Narbon vetch | *Vicia narbonensis* |
| Guar | *Cyamopsis tetragonoloba* |
| Mung bean | *Vigna radiator* |

All three lines of the three species of lupin were stunted, presumably because of poor adaptation to alkaline soil. Chickpea grew normally but was very slow to dry down under irrigated conditions. Common vetch produced large amounts of dry matter when grown in single rows. The Narbon vetch lines had poor germination. Seed was harvested from the mung bean entry but seed quality was substandard, indicating poor adaptation.

## SPICE CROPS

Observational rows of the spice crops listed in Table 3 were established in May, 1988. Most of these crops have small seeds and establishment was not successful for cumin, anise or caraway because temperatures were well above normal in May. Coriander, fennel and dill germinated but stands were very thin. Lines which matured will possibly be tested again if sufficient seed stocks are available.

Table 3. Spice crops seeded in observational rows at Outlook, Saskatchewan, 1988

| Crop | Genus and species |
|---|---|
| Anise | *Pimpinella anisum* |
| Caraway | *Carum carvi* |
| Coriander | *Coriandrum sativum* |
| Cumin | *Cyminum cuminum* |
| Dill | *Anethum graveolens* |
| Fennel | *Foeniculum vulgare* |

## Agronomics of Pinto Bean

Principal: Deneen Duncan, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Co-operator: Keg Farms Ltd.
Location: Outlook (SE 27-30-7-3)
Progress: Second year of three
Crop: Topaz and Fiesta pinto bean
Objective: To illustrate the successful production of irrigated pinto bean in south-central Saskatchewan using traditional equipment found on most irrigation farms.

The project was initiated in 1987 to demonstrate the successful production of irrigated pinto bean in south-central Saskatchewan using traditional equipment found on most irrigation farms. Results in the first year were inconclusive because the only seed available was a late maturing variety and the crop was destroyed by sclerotinia before the pods were able to be filled.

The site used in 1988 was a 14 hectare field located northeast of Outlook on a loam textured soil. Two registered varieties of pinto bean, Topaz and Fiesta, were seeded on May 24 at a rate of 84 kg/ha in 18, 35, and 53 cm row spacings to a depth of 4 cm using a hoedrill. Phosphorus was seed-placed at a rate of 40 kg/ha of $P_2O_5$.

Broadleaf weeds were controlled by Basagran (1.75 L/ha) and grassy weeds were controlled by Poast (1.6 L/ha). Benlate, a fungicide used for the control of sclerotinia, was applied at 1.75 L/ha during the early bloom stage. The use of a fungicide is essential to the successful production of dry bean and a dual application may be required in some years.

Approximately 225 mm of irrigation water and 137 mm of rain was received by the crop during the growing season. The beans were harvested in mid September using a 25′ flex header with air reel. Yield loss from the flex header/air reel system averaged 4-5% with no differences between varieties or among row spacings. Average yields did not differ between varieties (Fig. 1). Both varieties exhibited higher sclerotinia infections as row spacing decreased with Fiesta showing the highest susceptibility. The demonstration results showed an average infection of 34% in Fiesta compared to 10% in Topaz. Under irrigated production conditions in Saskatchewan, decreased row spacing has not shown any yield advantage for pinto bean.

Wider row spacings will enhance sunlight penetration and air reducing the risk of sclerotinia infection which is promoted by moist canopy conditions. If targeted spray techniques are used, wider row spacings may allow a more efficient fungicide application.

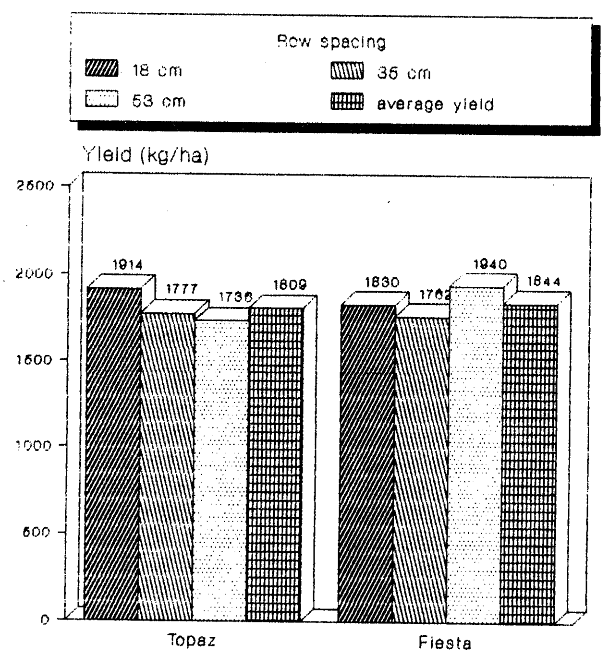



Figure 1.

## IRRIGATED FIELD PEA AGRONOMY: EARLY SEEDING DEMONSTRATION

Principal: A. Kapiniak, B. Vandenberg - SIDC
Funding: Irrigation Based Economic Development Agreement
Co-operator: John Konst
Location: Outlook (SE-10-30-8-3)
Progress: First year of three
Objectives: To demonstrate the yield benefits of early seeding of field pea.

Early seeding of field pea is a recommended practice for field pea prodution throughout western Canada. Results from 1988 showed no significant differences among April 16, April 29, and May 13 seeding dates (Table 1). Yield for all dates of seeding was increased when pre-plant incorporated herbicide was used. However, yield levels for all treatments were low.

Table 1: Effect of seeding date and soil-incorporated herbicide on yield of irrigated field pea in 1988 at Outlook.

| Seeding date | Average yield (kg/ha) | Yield: With ethalfluralin (kg/ha) | Yield: No ethalfluralin (kg/ha) |
|---|---|---|---|
| April 16 | 2158 | 2387 | 1930 |
| April 29 | 2431 | 2697 | 2165 |
| May 13 | 2101 | 2280 | 1923 |
| Mean | 2230 | 2455 * | 2006 |
| CV | 16% | | |

* Significant at P=0.05 level.

## IRRIGATED FIELD PEA AGRONOMY: EVALUATION OF POTASSIUM RESPONSE IN PEA SEED PRODUCTION

Principal: A. Kapiniak, B. Vandenberg - SIDC
Funding: Irrigation Based Economic Development Agreement
Co-operator: Gerald Follick
Location: Outlook (SE-1-29-8-3)
Progress: One year only
Objectives:
a) to evaluate the potassium fertilizer response for field pea in in a soil showing deficiency for pulse;
b) to evaluate the potential for pea seed production in south-central Saskatchewan.

Field pea is a relatively high user of potassium. To obtain top quality seed and high yield, some soils may require additional potassium. Based on the standard soil test, some sandy loam soils in SSRID #1 are showing a potassium deficiency for pulse production. In this demonstration, potassium fertilizer (KCl) was applied at rates of 0, 56, and 112 kg/ha (0, 50, 100 lb/ac) to an irrigated field pea crop grown on a field showing potassium deficiency for pulse crop. The soil test recommended 17 kg/ha (15 lb/ac) $K_2O$ for fababean production.

The response of field pea under irrigation to added KCl is shown in Table 1. Yield increased 31% by respectfully adding 56 and 112 kg/ha (50 and 100 lb/ac) KCl.

Table 1: Yield response of irrigated semi-leafless field pea to potassium fertilizer at Outlook in 1988.

| KCl added | | Yield | |
|---|---|---|---|
| (kg/ha) | (lb/ac) | (kg/ha) | (bu/ac) |
| 0 | 0 | 1462 a | 23 a |
| 56 | 50 | 2087 b | 31 b |
| 112 | 100 | 2113 b | 32 b |

a, b, Yields followed by same letter are not significantly different at the the P=0.05 level.

## Irrigated Safflower Agronomy: Evaluation of Fungicides for Disease Control

Principal: A. Kapiniak, B. Vandenberg - SIDC
Funding: Irrigation Based Economic Development Agreement
Co-operator: Gerald Follick
Location: Outlook (SE-1-29-8-3)
Progress: First year of three
Objectives:
a) to evaluate the potential for irrigated safflower production in south-central Saskatchewan;
b) to evaluate the use of fungicide for control of Sclerotinia and Alternaria.

Safflower is adapted to warm and dry environments but is grown under irrigation in many areas. The crop is susceptible to Sclerotinia head rot and Alternaria leaf spot and head rot. These diseases are favoured in moist environments. Benomyl (Benlate) and Iprodione (Rovral) were applied at full and half the recommended dry bean rate at the early bloom stage to an irrigated field of Saffire safflower. No significant differences due to fungicide treatments were observed. Average yield was 1154 kg/ha (Table 1). Yield was highly variable throughout the field due to weed competition, irregular water distribution and sub-optimal irrigation water application. Saffire matured in 1988 but more research will be necessary to determine irrigation strategy and long term potential yield levels under irrigation in south-central Saskatchewan.

Table 1: Effect of fungicide application on yield of irrigated safflower at Outlook, in 1988.

| Treatment and rate | Yield (kg/ha) |
|---|---|
| Benomyl at 2.25 kg/ha | 1384 |
| Benomly at 1.12 kg/ha | 1187 |
| Iprodione at 3.0 L/ha | 978 |
| Iprodione at 1.5 L/ha | 1002 |
| Control | 1220 |
| Mean | 1154 |
| CV% = 34 | |

## IRRIGATED FABABEAN AGRONOMY: DEMONSTRATION OF BENEFITS OF EARLY SEEDING

Principal: A. Kapiniak, B. Vandenberg - SIDC
Funding: Irrigation Based Economic Development Agreement
Co-operator: Michael Millar
Location: Birsay (NE-5-24-7-3)
Progress: First year of three
Objectives: The objective of the project is to demonstrate to producers the importance of early seeding for irrigated fababean production.

Inconsistent yield is a major problem for fababean producers. Research across Western Canada shows that early seeding increases yield potential. The effect of seeding date on fababean yield was demonstrated in 1988. Yield from plots seeded April 20 was 3.5% greater than from plots seeded on May 2, and 10% greater than those seeded on May 14 (Table 1).

Table 1: Effect of seeding date on yield of Outlook fababean under irrigation in 1988 at Birsay.

| Date of seeding | Yield (kg/ha) |
|---|---|
| April 20 | 3638 |
| May 2 | 3517 |
| May 14 | 3302 |
| CV | 8.2% |

# Sunflower Co-operative Trial

Principal: Agriculture Canada Research Station
Saskatoon, Saskatchewan
Co-operator: Saskatchewan Irrigation Development Centre

All tests were conducted by the Saskatchewan Sunflower Committee with funds provided by testing fees paid by companies submitting entries. The test was grown at six locations in Saskatchewan.

Each test was arranged in a randomized complete block design with four replicates. Oilseed types were grown at a population of 45,000 plants/hectare. Confection types were grown at a population of 35,000 plants/hectare. Protection from bird damage was provided for all sites. Oil content and confection seed sizing was carried out at the Saskatchewan Research Station.

The test was co-ordinated by the Saskatoon Research Station.

Table 1.

| Variety | 1986 Yield | 1987 Yield | 1988 Yield |
|---|---|---|---|
| OILSEED: | | | |
| 894 | 100 | 100 | 100 |
| DO-855 | -- | -- | 110 |
| DO-164 | 101 | 129 | 122 |
| DO-643-11E | -- | -- | 112 |
| SIG 402 | -- | -- | 79 |
| S 1296 | -- | -- | 110 |
| IS 52017 | -- | -- | 92 |
| IS 7000 | 106 | 102 | 109 |
| IS 7101 | 101 | 93 | 96 |
| IS 7111 | 106 | 98 | 104 |
| MRS 37 | -- | -- | 87 |
| MRS 40 | -- | -- | 74 |
| SUN M20 | 105 | 113 | 98 |
| SUN S600 | -- | -- | 113 |
| 743 | -- | -- | 98 |
| 747 | -- | -- | 98 |
| 751 | -- | -- | 77 |
| CONFECTION: | | | |
| D-131 | 107 | 148 | 92 |
| RH-2141 | -- | -- | 105 |
| Sundak | 68 | 103 | -- |

Table 2. Seed size (% over screen) of Confectionery

| Hybrid or Variety | Location | 20 | 18 | Through |
|---|---|---|---|---|
| D-131 | Carievale | 53.4 | 28.0 | 18.7 |
| | Outlook | 48.3 | 29.9 | 21.8 |
| | Watrous | 1.4 | 15.6 | 83.0 |
| | Moose Jaw | 11.9 | 36.6 | 51.5 |
| | Saskatoon | 16.4 | 33.5 | 50.1 |
| | Regina | 5.9 | 34.0 | 60.2 |
| | Average | 22.9 | 29.6 | 47.6 |
| RH-2141 | Carievale | 45.4 | 35.9 | 18.6 |
| | Outlook | 43.8 | 38.1 | 18.1 |
| | Watrous | 0.9 | 20.8 | 78.4 |
| | Moose Jaw | 6.1 | 39.0 | 55.0 |
| | Saskatoon | 12.3 | 45.8 | 41.9 |
| | Regina | 8.0 | 39.4 | 52.6 |
| | Average | 19.4 | 36.5 | 44.1 |

Table 3.

| | Yield of Seed (kg/ha) | % Oil (0 moisture basis) | 1000 seed weight (gms) | Days to first bloom | Days to maturity | Height (cm) | Stem strength (1 = good, 7 = poor) |
|---|---|---|---|---|---|---|---|
| OILSEED: | | | | | | | |
| 894 | 2645 | 43.6 | 45.7 | 80 | 121 | 141 | 3 |
| DO-855 | 2908 | 45.2 | 54.5 | 76 | 125 | 161 | 4 |
| DO-164 | 3234 | 43.6 | 55.4 | 77 | 122 | 161 | 3 |
| DO-643-11E | 2959 | 44.2 | 51.5 | 74 | 123 | 131 | 4 |
| SIG 402 | 2085 | 39.7 | 45.4 | 67 | 114 | 91 | 3 |
| S 1296 | 2918 | 45.6 | 47.7 | 73 | 120 | 128 | 3 |
| IS 52017 | 2421 | 42.8 | 56.4 | 76 | 123 | 150 | 4 |
| IS 7000 | 2882 | 46.5 | 58.2 | 74 | 122 | 136 | 4 |
| IS 7101 | 2530 | 45.0 | 48.2 | 77 | 121 | 146 | 3 |
| IS 7111 | 2746 | 46.1 | 52.2 | 76 | 122 | 146 | 4 |
| MRS 37 | 2312 | 45.0 | 62.7 | 73 | 121 | 176 | 3 |
| MRS 40 | 1960 | 44.0 | 41.2 | 73 | 118 | 149 | 3 |
| SUN M20 | 2602 | 47.7 | 57.5 | 73 | 120 | 163 | 2 |
| SUN S600 | 2994 | 45.2 | 50.2 | 74 | 123 | 137 | 3 |
| 743 | 2601 | 45.8 | 53.9 | 72 | 117 | 138 | 4 |
| 747 | 2604 | 46.6 | 56.2 | 73 | 119 | 139 | 3 |
| 751 | 2044 | 44.6 | 45.6 | 75 | 118 | 155 | 3 |
| Average | 2614 | 44.8 | 51.9 | 74 | 121 | 144 | 3 |
| C of V % | 13.9 | 2.8 | 6.5 | 1.9 | 1.2 | 2.2 | 15.1 |
| L.S.D. (5%) | 517.9 | 1.8 | 4.8 | 2.0 | 2.1 | 4.6 | 0.7 |
| CONFECTIONERY | | | | | | | |
| D-131 | 2443 | | | 78 | 126 | 138 | 4 |
| RH-2141 | 2766 | | | 77 | 125 | 161 | 4 |
| Average | 2605 | | | 77 | 125 | 150 | 4 |
| C of V % | 5.1 | | | 0.7 | 1.3 | 2.2 | |
| L.S.D. (5%) | 296.8 | | | 1.3 | 3.7 | 7.5 | |

## IRRIGATED DRY BEAN EVALUATION

Principals: A. Vandenberg, Saskatchewan Irrigation Development Centre
A.E. Slinkard, Crop Development Centre, U of S

Funding: Agriculture Development Fund

Site: Saskatchewan Irrigation Development Centre

Progress: Final year

Objectives:

a) to determine the potential of dry beans (P. vulgaris L.) as an alternative short season irrigated crop, with emphasis on the evaluation of adaptable bean market types;

b) to search for higher yielding, early maturing cultivars;

c) to generate information on crop management practices to optimize yield and quality including practices such as seeding date, seeding rates and row widths, delayed harvesting and harvest methodology (direct combining vs. pulling).

The project goal was to generate agronomic information for irrigated production recommendations for dry bean, a new specialty crop for south-central Saskatchewan.

Adapted dry bean varieties are available, especially in the pinto market class. Pinto bean should be seeded in the fourth week of May at 30 seeds per square meter in 18-21" rows. Sclerotinia stem rot is the major production problem. The crop can be left standing and direct combined at 16-18% seed moisture. A production guide is being prepared for irrigation farmers in the Lake Diefenbaker region.

## EVALUATION OF SEED POTATOES AT NORTHERN LATITUDES

Principals: J. Wahab, C. Stushnoff, D. Waterer,
Dept. of Horticulture Science
R. J. Baker, Crop Development Centre
University of Saskatchewan, Saskatoon, Sask. S7N OWO
Co-operators: University of Saskatchewan
Saskatchewan Irrigation Development Centre
Progress: Third year of four
Objectives:
a) to determine which cultivar(s) will regularly yield the maximum quantity of starch per unit area under irrigated production in Saskatchewan;
b) to determine and demonstrate agronomic and irrigation management techniques required for maximum production of potato starch per unit area.

This research project is being conducted by the Department of Horticulture Science to compare the productive capacity of potato seed-tubers produced in Saskatchewan versus tubers produced in the U.S.A. Two popular cultivars, Norland and Russet Burbank are used in the study. During 1987, Elite III seed-tubers were multiplied at Becker (Minnesota), La Ronge (Potato Lake Project), Prince Albert (John's Nursery), and Outlook (SIDC). The harvested seed-tubers were stored under standard conditions in Saskatoon and utilized for yield trials at Becker (irrigated), Kamsack (dryland), Outlook (irrigated), Prince Albert (dryland) and Saskatoon (irrigated) during 1988. The experiments were laid out as randomized complete block design with six replications. Planting was done according to commercial recommendations. Yields with seeds from various locations were compared at 90 ("Early'"harvest) and 120 ("Final" harvest) days from planting. Tubers were graded with the marketable category containing tubers of diameter 45 - 90 mm. The data reported are from the Outlook site only.

At the "Early" harvest cv., Norland produced significantly higher marketable tuber yields than cv. Russet Burbank (Table 1).

At the "Early" harvest, Norland potatoes had significantly larger tubers and more tubers per plant than Russet Burbank. No significant differences were observed between the number of tubers per plant or weight of individual tubers between the seed sources during the "Early" harvest for either cultivars. Specific gravities for Norland was higher than for Russet Burbank during the "Early" harvest which is an indication of early maturity of cv. Norland. The specific gravity of both cultivars produced from the Becker seed source was significantly higher than the Saskatchewan sources. This may be an expression of advanced physiological age of tubers produced from Becker seeds as a result of the comparatively warmer growing conditions at Becker.

At the "Final" harvest, Norland again outyielded Russet Burbank (Table 2).

Saskatchewan grown seed tubers frequently outyielded seed from the Becker source at the "Final" harvest. The yield increases of the Saskatchewan seed sources during the "Final" harvest was mainly due to more tubers per plant and slightly larger tubers. The plants produced from Saskatchewan seed tubers retained active green foliage for a longer period than the plants from Becker seeds (data not presented). This could have possibly contributed to the increase in yields of Saskatchewan tubers during the "Final" harvest.

Table 1. Yield and yield components of marketable tubers of potato cvs. Norland and Russet Burbank grown from Becker (U.S.A.), La Ronge Outlook and Prince Albert seed sources during "Early" harvest (Location - Outlook).

| Source | Mark yield t/ha | No. tubers per plant | Av. tuber wt. (g) | Specif grav. |
|---|---|---|---|---|
| | | cv. Norland | | |
| Becker | 39.98 | 6.17 | 177.2 | 1.0752 |
| Outlook | 35.32 | 5.13 | 190.3 | 1.0735 |
| Prince Albert | 38.43 | 5.44 | 192.2 | 1.0735 |
| La Ronge | 39.05 | 6.07 | 174.5 | 1.0723 |
| | | cv. Russet Burbank | | |
| Becker | 19.13 | 3.07 | 159.3 | 1.0747 |
| Outlook | 19.21 | 3.50 | 148.7 | 1.0671 |
| Prince Albert | 17.73 | 2.15 | 154.1 | 1.0672 |
| La Ronge | 18.93 | 3.02 | 169.2 | 1.0675 |
| LSD (5.0%) | 8.16 | 1.14 | 31.5 | 0.0034 |
| CV (%) | 24.66 | 21.82 | 15.7 | 0.27 |

Table 2. Yield and yield components of marketable tubers of potato cvs. Norland and Russet Burbank grown from Becker (U.S.A.), La Ronge Outlook and Prince Albert seed sources during "Final" harvest (Location - Outlook).

| Source | Mark yield t/ha | No. tubers per plant | Av. tuber wt. (g) | Specif grav. |
|---|---|---|---|---|
| | | cv. Norland | | |
| Becker | 40.71 | 5.46 | 203.1 | 1.0763 |
| Outlook | 36.81 | 4.35 | 227.1 | 1.0727 |
| Prince Alberta | 45.22 | 5.50 | 222.3 | 4.0749 |
| La Ronge | 43.83 | 5.67 | 208.5 | 1.0748 |
| | | cv. Russet Burbank | | |
| Becker | 30.49 | 4.02 | 212.6 | 1.0872 |
| Outlook | 38.25 | 4.64 | 224.7 | 1.0880 |
| Prince Alberta | 32.87 | 4.35 | 204.3 | 1.0882 |
| La Ronge | 40.79 | 4.85 | 227.4 | 1.0897 |
| LSD (5.0%) | 7.55 | 0.96 | 31.4 | 0.0044 |
| CV (%) | 16.69 | 16.82 | 12.3 | 0.34 |

# SOILS/FERTILIZER/WATER

## DETERMINATION OF SOIL INTAKE RATES UNDER CENTER PIVOT IRRIGATION

Principal: Donald I. Norum
Dept. of Agriculutral Engineering
University of Saskatchewan
Saskatoon, Saskatchewan S7N OWO
Funding: Irrigation Based Economic Development Agreement
Progress: First year of two
Objectives:

a) to determine improved design and operating criteria for center pivot sprinkler systems taking into consideration the types of nozzles used, the application rate and the soil and crop canopy conditions;
b) to determine actual infiltration rate curves for various soils that are bieng sprinkler irrigated.

Field tests have been conducted to determine the time at which ponding starts to occur, for different application rates and different soils, for center pivot irrigation systems. The tests show that for a loam soil at the SIDC, an application rate of less than 12 mm/hr is necessary if more than 17 mm of water is to be applied. If a greater rate is used, either ponding and surface flow will occur or less than 17 mm will have to be applied (Figure 1). For a sandy loam soil near Saskatoon, an application of more than 11 mm would result in surface ponding if an application rate of more than 15 mm/hr was used. This 11 mm figure was independent of any application rate greater than 15 mm/hr. (Figure 2).

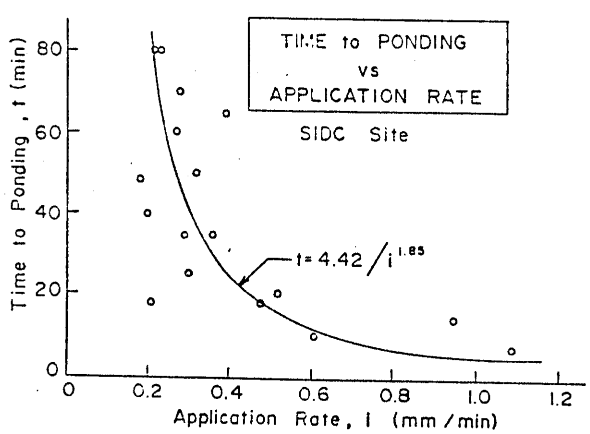



Figure 1. Time to ponding versus application rate at the SIDC Site, loam soil with medium growth alfalfa.

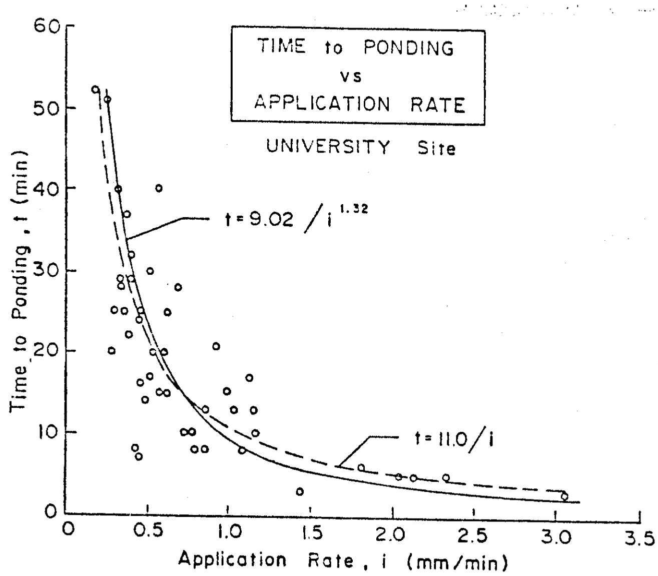



Figure 2. Time to ponding versus application rate at the UNIVERSITY Site, sandy loam soil with grass forage.

## Environmental Impacts of Using Poor Quality Groundwater for Irrigation

Principal: J.A. Gillies
Department of Agricultural Engineering
University of Saskatchewan
Saskatoon, Saskatchewan S7N 0W0
Funding: Agriculture Development Fund
Co-operators: R. Regehr, Donavon; C. Borsheim/Bruce Hill, Watrous
Progress: Third year of three
Objectives:
a) to assess changes in the salinity of soils irrigated with groundwater
b) to determine if changes in the quality of water in contiguous surface aquifers can be related to the leaching of salts from the irrigated fields,
c) to assess the impact on the source aquifer when groundwater is used as a source of supply for irrigation

Development of the groundwater resource, as a source of supply for irrigation, may provide many farm operators the opportunity to enhance the productive capabilities of their farms. In the United States, groundwater is used extensively as a source of supply for irrigation. However, in Saskatchewan, the quality of groundwater generally is not considered suitable for irrigation.

Saskatchewan farm operators have shown increased interest in using groundwater as a source for irrigation. Generally, the only aquifers capable of supplying a long-term irrigation demand are the buried preglacial and glacial valley systems. The quality of water from such aquifers is not considered suitable for irrigation unless the soils to be irrigated have good internal drainage, and the leaching requirement can be satisfied. In Saskatchewan, there are approximately 70,000 hectares of land that could be developed for irrigation using groundwater as a source of supply.

To supply the demand for a one-quarter center pivot irrigation system, pumping rates in the order of 45 L/s are required. Since pumping for irrigation is seasonal, the effect of such "slug" withdrawals on the ability of the aquifer to recover is not known.

Shallow aquifers near fields irrigated with poor quality groundwater may be reliable sources of domestic supply for many farmsteads. Superimposing additional recharge on these aquifers from percolating irrigation water (leachate) may result in elevated water tables and reduced water quality.

To investigate some of the agronomic and environmental impacts of using groundwater as a source of supply for irrigation, the Department of Agricultural Engineering, University of Saskatchewan, is monitoring two projects using groundwater as a source of supply for irrigation. One project is located near Donavon, Saskatchewan (13-32-9, W3), where water for irrigation is being pumped from the Tyner Valley Aquifer.

To date, results indicate that:

(a) The level of near surface salinity has increased.
(b) No significant leaching of the "additional salts" out of the soil profile has occurred.
(c) The groundwater in shallow surface aquifers near the irrigated fields has not shown a significant change in quality.
(d) At the Donavon site, there has been some lowering of the piezometric surface in the source aquifer due to pumping.

There are no specific recommendations at this time.

## HERBICIDE, NUTRIENTS AND WATER DRAINAGE FROM AN IRRIGATED FIELD

| | |
|---|---|
| Principal: | W. Nicholaichuk<br>National Hydrology Research Institute<br>Saskatoon, Saskatchewan |
| Funding: | Agriculture Development Fund |
| Site: | Pederson Farm, Outlook |
| Co-investigators: | R. Grover, Agriculture Canada Research Station<br>J. Whiting, Saskatchewan Research Council |
| Co-operators: | Roger Pederson, Outlook<br>Saskatchewan Irrigation Development Centre |
| Progress: | Final year |
| Objectives: | |

To determine:

a) the amount of surface and subsurface drainage water following each rainfall and irrigation event;
b) the quality of surface and subsurface drainage water with respect to nutrients and herbicides;
c) irrigation efficiency with respect to application of irrigation water, nutrients and herbicides;
d) the impact of irrigation drainage on downstream flows and water quality;
e) opportunity for the reuse of irrigation drainage water;
f) the effect of application technique (e.g. pre- or post-) and/or crop situation by selecting a different monitoring site each year.

Based on a three-year study (1986, 1987 and 1988), irrigating a soft white spring wheat (Triticum aestivum) by the corrugation method, has resulted in 14.3%, 10.6% and 23.1%, respectively, of the applied irrigation water being returned as surface drainage water.

In 1986, 1987 and 1988, 0.1% (0.12 kg/ha), 0.1% (0.15 kg/ha ) and 0.5% (0.43 kg/ha), respectively, of the applied nitrogen was lost to surface drainage water. Similarly for phosphorus, 0.1% (0.07 kg/ha) was found in 1986 and 0.2% (0.06 kg/ha) was found in 1987. No phosphorus was applied in 1988.

With respect to the loss of applied herbicides, in 1986, the maximum concentrations observed were 4.3 ppb Dicamba and 10.7 ppb MCPA, compared to 4.7 ppb Dicamba, 12.9 ppb MCPA and 17.4 ppb Diclofop in 1987. In 1988, 3.5 ppb of

2,4-D, 63.8 ppb of Diclofop and 20.4 ppb of Bromoxynil was observed. In 1986, these losses of drain water represent 0.1% (0.13 g/ha) Dicamba and 0.1% (0.44 g/ha) of MCPA of the amount applied. Compared to 1987, 0.2% (0.18 g/ha) of Dicamba, 0.1% (0.56 g/ha) of MCPA and 0.2% (1.37 g/ha) of Diclofop was lost. In 1988, 0.1% (0.32 g/ha) of 2,4-D, 0.7% (5.85 g/ha) of Diclofop and 0.7% (0.27 g/ha) of Bromoxynil was observed.

## Development of a Computerized Soil Moisture Model for Irrigation Scheduling

Principal: R. Lawford
Hydrometeorological Research Division, AES
11 Innovation Blvd.
Saskatchewan, Saskatchewan S7N 3H5
Funding: Irrigation Based Economic Development Agreement
Location: Outlook and Birsay
Progress: First year of two
Objective:

To develop an irrigation scheduling information system to make efficient use of water for irrigation purposes in west central Saskatchewan by providing:

a) the Saskatchewan Water Corporation with a highly visible advisory service for farmers and by allowing them to incorporate the latest technology into their monitoring of the requirements for irrigation;

b) farmers with information on when to water their crops to optimize use of water;

c) farmers with guidance on when not to irrigate their crops to reduce leaching of the soil and pumping costs.

Initially, a literature search was conducted for various authors and papers written, with regards to soil moisture modeling and their associated crop production models. Before any particular soil moisture models were chosen, a background search was carried out to determine the proven and tested methods for determining which factors have the greatest effect on actual water movement in and out of the soil profile (i.e. soil properties and environmental factors affecting evapotranspiration). These references will also be used at a later date when trouble shooting the various soil models.

The initial search for soil moisture budgets and crop growth models has produced the following results:

a) Versatile Soil Moisture Budget (VSMB):

Dyer, J.A. and A.R. Mack (1984). The versatile soil moisture budget-version three, Tech. Bull. 1984 - 1E, Research Branch, Agriculture Canada, Ottawa, 24 pp + apps.

b) Irrigate:

Agriculture Canada, Research Section
Land Resource Research Center
Ottawa, Ontario

c) Lethbridge Research Station Irrigation Management Model (LRSIMM):

Agriculture Canada, Research Branch
Soil Science Section, Research Station
Lethbridge, Alberta

d) Soil-Plant-Air-Water Model (SPAW):

K.E. Saxton, P.F. Brooks and R.Richmond
USDA -SEA AR in cooperation with
Washington State University, Pullman, Washington

e) CERES Model:

J.T. Ritchie and S. Otter
USDA Grassland
Soil and Water Research Laboratory
Temple, Texas

Preparation of data gathered from the two research sites at Outlook and Birsay, during the growing season of 1988:

This data has to be dumped from the data loggers by a micro computer to storage discs and hard copies produced by an application program called "Split". This program allows the data to be output in a format which will allow the data to be readily input to the chosen soil moisture and crop production models. At this stage, the weather data from the Birsay site is currently being worked on.

## N-FERTILIZATION AND WATER USE EFFICIENCY OF IRRIGATED CROPS

Principal: C. van Kessel, Department of Soil Science
University of Saskatchewan
Saskatoon, Saskatchewan, S7N OWO
Funding: Irrigation Based Economic Development Agreement
Co-investigator: N.J. Livingston
Location: Saskatchewan Irrigation Development Centre
Progress: First year of three
Objectives:

a) to maximize N-fertilizer use efficiency of irrigated crops and investigate the optimum time for N applications;
b) to determine fertilizer use efficiency of urea and urea-ammonium nitrate (UAN) and measure the extent of N-losses through leaching;
c) to determine water use efficiency and relate to N uptake and plant growth of various crops.

Crops selected in 1988 were canola (Westar and Tobin) and fababean (Outlook).

N application of 150 kg N/ha increased grain yield of canola-Tobin and canola-Westar to 2901 and 2811 kg/ha, respectively (Table 1). Corrected for a 14.5% moisture content, this corresponds to 60 bushels/acre. Yield was independent of the form of N applied and no significant differences with regard to time of N application were observed. The second application of N occurred 55 days after seeding and it may be that at this stage in the growing season, most of the N accumulation had already occurred, especially in a year like 1988 which was characterized by high temperatures in June.

Fababean did not respond at all to N applications and an average grain yield of 3900 kg/ha was observed (Table 1). Fababean was very well nodulated and it appears that a large portion of the accumulated N was derived from $N_2$-fixation.

Table 1. Total yield of canola and fababean

| Treatment N applied (kg/ha) | Crop | Total yield (kg/ha) | Grain yield (kg/ha) | Total N (kg/ha) |
|---|---|---|---|---|
| 0 | Westar | 6652 | 1832 | 70.2 |
| 75 + 75 urea | Westar | 8718 | 2747 | 123.0 |
| 75 + 75 UAN | Westar | 9397 | 2901 | 132.7 |
| 150 urea | Westar | 9127 | 2763 | 158.5 |
| 150 UAN | Westar | 9698 | 2854 | 129.3 |
| 0 | Tobin | 4735 | 1497 | 61.9 |
| 150 UAN | Tobin | 7105 | 2811 | 111.8 |
| 0 | Fababean | 8659 | 4017 | 234.5 |
| 25 + 25 urea | Fababean | 8111 | 3824 | 236.3 |
| 25 + 25 UAN | Fababean | 7931 | 3862 | 235.8 |
| 50 urea | Fababean | 8525 | 3898 | 246.6 |
| 50 UAN | Fababean | 8029 | 3535 | 215.7 |

## FERTIGATION ON SANDY SOILS

Principal: Deneen Duncan, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Co-operators: Roger & Richard Bond
Location: Donavon (NW 27-32-6-3)
Progress: Second year of three
Crop: Katepwa wheat
Objective: To evaluate the efficiency of fertigation as a method of applying nitrogen to crops.

When initiated in 1987, the three application methods compared were: (1) 100% soil applied nitrogen; (2) 50% soil applied and 50% fertigation; and (3) 100% fertigation, all applied to Samson barley. Year two (1988) compared 100% soil applied nitrogen to 100% fertigation on Katepwa spring wheat. The demonstration was located east of Donavon on a 25-hectare field with loamy sand textured soil.

The Katepwa wheat was seeded May 14, 1988 at a rate of 100 kg/ha and a depth of 7-10 cm using a double disc press drill with 15 cm spacings. A total of 160 kg/ha of $P_2O_5$ was applied to the soil, 112 kg/ha was deep-banded in the fall of 1987 and the remaining 48 kg/ha was seed-placed. Half of the plots received 112 kg/ha of N broadcast after seeding and half of the plots received 112 kg/ha of N via fertigation split into two application dates (June 15 and July 10). A centre pivot was used to apply approximately 250 mm of water to the crop. Estimated rainfall for the growing season was 25 mm. Data collection is presented in Table 1.

Data on plant density, dry matter production at anthesis and maturity, tiller numbers, and plant height was collected before harvest. The treatments were distinguishable in 1987 by a difference in color in the early stages of growth. This visual difference was not noted in 1988.

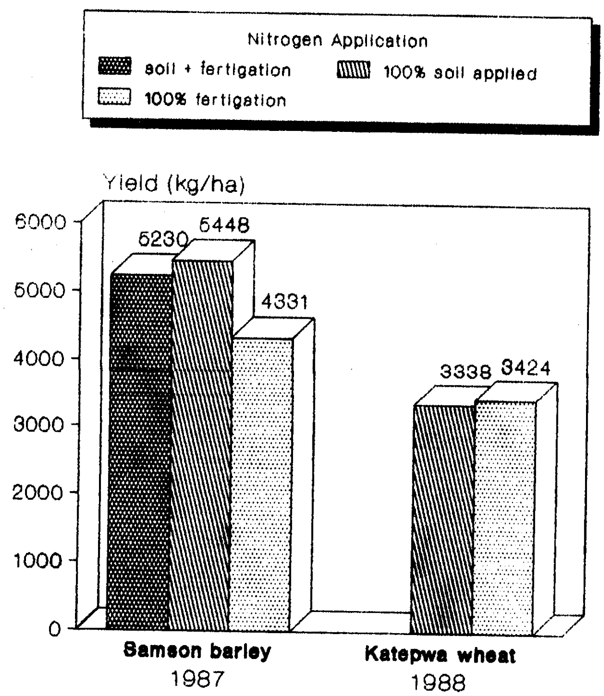
Table 1: Plant density, dry matter weight, number of tillers, and plant height of Katepwa spring wheat.

| Treatment | Density (plants/m$^2$) | Height (cm) | Yield (kg/ha) | Seed weight (g/100) | Kernels per head | Protein (%) | Grade (range) |
|---|---|---|---|---|---|---|---|
| Soil applied | 181.2 | 83.2 | 3338 | 37.6 | 17.2 | 15.2 | 3-feed |
| Fertigation | 179.7 | 81.5 | 3424 | 38.9 | 15.6 | 14.8 | 3-feed |
| Prob>F | 0.86 | 0.72 | 0.83 | 0.70 | -- | 0.18 | -- |

No real differences in plant density, dry matter weight, tiller production, or plant height occurred between the two methods of nitrogen application. The same trends were present in the first year of the demonstration.

In each plot, prior to tillering, the main stems of several plants were tagged to produce information on harvest index, seed weight, kernels per head, and protein content of the main stems versus tillers. The wheat was swathed August 25 and combined August 31.

The only differences occurring related to treatment was in seed weight of the main stems. However, this difference was not evident in the mean. The mean seed weight was measured from the yield samples taken at harvest. In 1987, the 100% fertigation method resulted in reduced barley yield. This difference did not occur with the wheat in 1988 probably due to higher initial soil nitrate levels.




## Conclusions:

Based on two years of results, it would appear that fertigation is a viable alternative for applying nitrogen providing initial soil nitrate levels are adequate for plant growth. If fertigation is desired, a combination of soil applied nitrogen (seed-placed) and fertigation would help ensure sufficient nutrient levels at all times during growth.

## Ripping of Irrigated Solonetzic Soil to Increase Water Penetration and Crop Yield

Principal: Mike Grevers
Saskatchewan Institute of Pedology
University of Saskatchewan
Saskatoon, Saskatchewan S7N 0W0
Funding: Irrigation Based Economic Development Agreement
Co-operators: Jerry Eliason, Dale Eliason, Randy & Rollie Riopka
Location: Outlook
Progress: First year of three
Objectives:

a) to increase the depth of moisture penetration in solonetzic soil;
b) to demonstrate the suitability of these solonetzic soils for irrigation when properly managed.

The deep ripping operations had been conducted in the belief that the three soils were "relic" solonetzic soils. Relic solonetzic soils or "solods" are often characterized as having a hardpan layer (Bnt horizon), which has remained from previous high sodium salt levels. The Bnt horizon results from high sodium levels in the soil which cause dispersion of clay particles, which are then washed (leached) from the surface horizon to a lower soil horizon, creating a dense and compact layer. When the levels of sodium in the soil decrease (washed down the soil profile with rainfall), the Bnt horizon is expected to eventually disintegrate with time. Deep ripping of such soils is therefore expected to speed up this process. Chemical analysis of the three soils carried out in the winter of 1987-1988 revealed that the soils should be classified as solonetzic (Jerry Eliason), saline non-solonetzic (Riopka), and non-saline non-solonetzic (Dale Eliason).

<u>Summary of the Results and the Prognosis for 1989</u>:

The three sites that were deep ripped include a solonetzic soil, a non-solonetzic saline soil, and a non-solonetzic non-saline soil. In general, deep ripping achieved considerable soil loosening, which at one site resulted in improved soil water infiltration. Soil water-recharge over the winter period (88/89), should give further indications of the above, providing adequate snowfall and/or rainfall takes place during this period. Crop production was improved at one site, while at the other two sites, poor weed control prevented the crop from fully exploring the "altered" soil structure from deep ripping. It has been suggested (Dale Eliason) that only in the second year following deep ripping, are improvements in crop production noticeable.

## DRAINAGE INVESTIGATION AT SIDC

Principal: L. Tollefson, Saskatchewan Irrigation Development Centre
B. Harron, PFRA, Regina

Salinity monitoring and reclamation activity were conducted at the drainage site.

The area was planted to Heartland barley (100 kg/ha) using a press drill on April 28, 1988. Fertilizer recommendations were based on soil test recommendations. Weed control was adequate. Irrigation water was applied during the growing season using a linear system (178 mm). The area was harvested September 8, 1988. The average yield was 3225 kg/ha. After harvest was completed, a leaching irrigation was applied. An additional 475 mm of irrigation water was applied after harvest and prior to freeze-up.

Monitoring:

The area was monitored during 1988. Effluent flows ranged from no flow in early spring to levels of 320 l/m during the leaching irrigation. Effluent chemistry (Table 1) illustrates effluent quality changes during leaching.

Table 1. Water Quality and Outflow

| Date | TDS | pH | Cond. ms/cm | $Na^+$ | $Ca^{++}$ | $Mg^{++}$ | $K^+$ | $Cl^-$ | $SO_4^-$ | $HCO_3^-$ | SAR | Outflow l/min |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (ug/ml) | | | | | | | | |
| May 18 | 736 | 8.0 | 1.2 | 23 | 74 | 87 | 17 | 21 | 137 | 525 | 0.4 | 4.6 |
| August 26 | 1498 | 7.3 | 2.3 | 77 | 161 | 228 | 44 | 13 | 892 | 805 | 0.9 | 190 |
| September 13 | 4844 | 8.0 | 7.5 | 597 | 449 | 1020 | 40 | 77 | 5204 | 798 | 3.5 | 320 |
| November 4 | 2279 | 7.8 | 3.6 | 106 | 388 | 360 | 30 | 44 | 1858 | 711 | 0.9 | |

Soil salinity analysis was conducted at surveyed sites in 1986 and again in 1988. A significant average decline in EC occurred (5.9 ms/cm) in the top 0-60 cm depth. Horizontal EM 38 readings showed the same reduction trend in the 0-60 cm depth. Deeper readings using the EM 38 in the vertical mode, however, did not display this trend. Figure 1 displays these changes.

It appears that the salt has been leached past the 0-60 cm depth. This has facilitated reasonable crop growth.

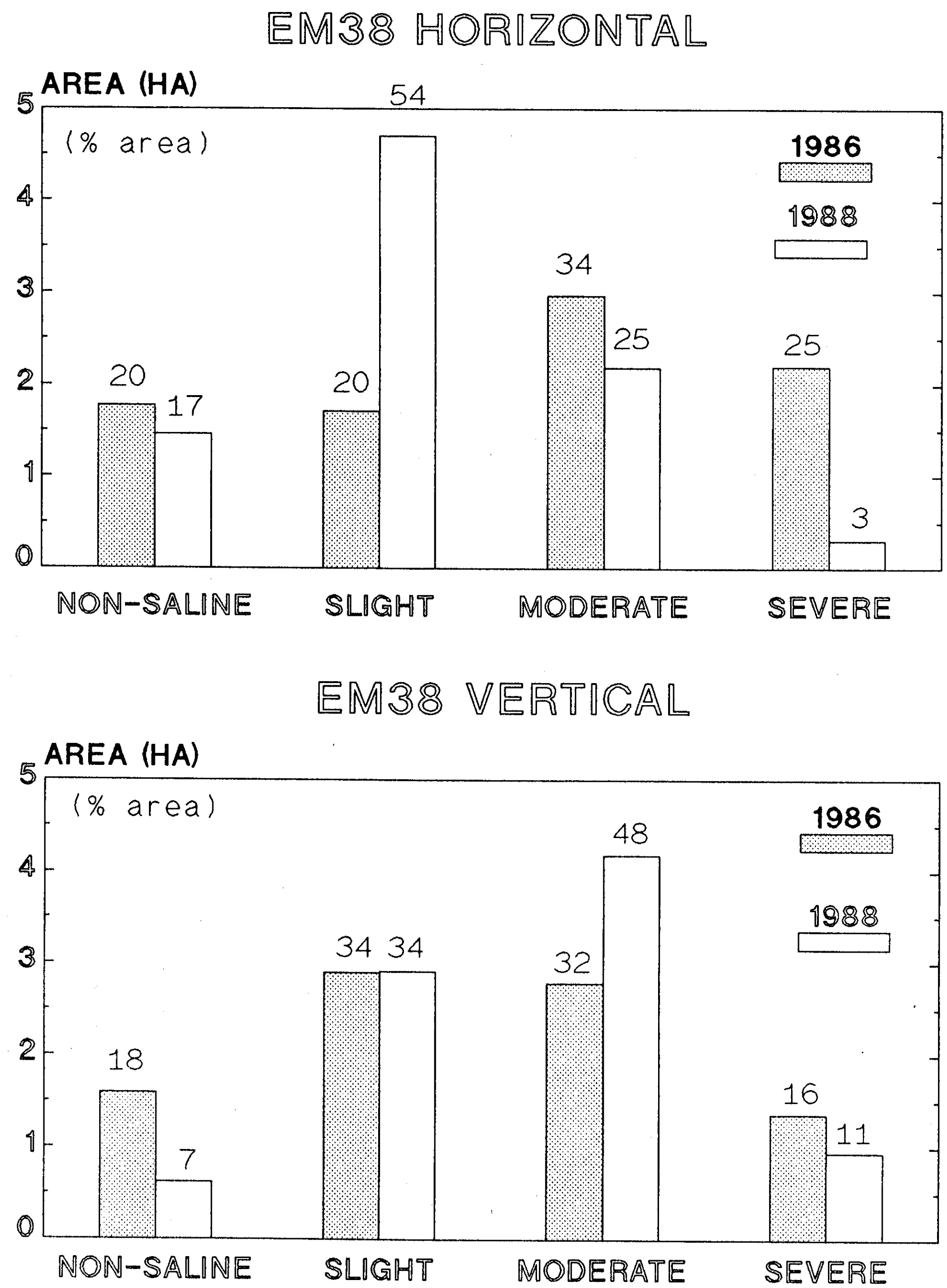



Figure 1: Area Analysis Salinity

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

Principal: Deneen Duncan, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Cooperator: Doug Harrigan
Location: Maple Creek (SW-17-11-26-3)
Progress: First year of four
Objective: To demonstrate methods of improving the productivity of flood irrigated fields affected by salinity, low hydraulic conductivity, low infiltration rate, and poor drainage.

A 10 hectare field was divided into four treatments: 1) check; 2) mole drain only; 3) mole drain plus paraplow; and 4) paraplow only. The soil was clay textured with conductivity levels of 3.5 - 5.3 mS/cm in the top 60 cm of the soil profile.

The mole drain and paraplow treatments were completed on April 13-14, 1988. In mid November of 1988, a trench leading to the drainage ditch was dug perpendicular to the mole drains and filled with gravel. Water reaching the moles will drain into the trench and water samples may be collected from the point where the trench meets the drainage ditch.

Johnston barley was seeded as a companion crop with Maxim alfalfa. The barley was seeded at a rate of 80 kg/ha and the alfalfa at a rate of 10 kg/ha using a hoedrill with 18 cm spacings. Spring soil tests showed nutrient levels of 49 kg/ha $NO_3$, 17 kg/ha P, and 392 kg/ha K. No additional fertilizer was applied to the soil.

Water availability was limited in 1988 and only one flood of 150 mm was applied to the crop. Hence, any form of drainage was not necessary in the initial year of the demonstration. The alfalfa did not get established in 1988 and the cooperator intends to seed the field to kochia in 1989. The barley produced approximately 930 kg/ha of hay.

## Irrigation Scheduling Tools for Farm Use

Principal: R. Byron Irvine, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Location: Saskatchewan Irrigation Development Centre
Progress: First year of three
Objective: To evaluate soil-based, water-based and plant-based systems of irrigation scheduling with the goal of identifying a system or combination of systems which would be simple to use and relatively inexpensive.

The irrigation scheduling tools being evaluated for farm use fall in the following categories:

1) Soil Moisture Measurement:

| | |
|---|---|
| Hand feel | Hydrovisorr |
| Gravimetrics | Hydromanager |
| Neutron Probe | Aquamiser |
| Tensiometer | Aqwa II heat dissipation sensor |

2) Weather-based estimates of crop water use:

Several "cheque book" style models based on a combination of temperature, solar radiation, stored soil moisture, wind, precipitation and irrigation measurements are being evaluated for farm use with an IBM PC.

3) Plant-based methods of scheduling:

Infrared thermometry
Crop Water Stress Index

Due to delays in ordering equipment, testing did not begin until early June. High temperatures resulted in a poor stand of canola and strong winds in September blew away the swath before yields could be obtained. There was no evaluation made on the Lethbridge version of the Jensen-Haise equations for canola since they were not received until mid-December. The unit which measures soil moisture by heat dissipation was received after the growing season and is currently been evaluated indoors.

Preliminary conclusions are that the Hydrovisor (glass bead tensiometer) works fairly well but would be best used for solid set systems where the demand for water could be met in a very short period of time. The Aquamiser unit may have potential but it seems to need calibration for each soil, reducing its value. The Hydromanager did not appear to be sufficiently sensitive to changes in soil moisture at low moisture tensions to be useful for irrigation scheduling in our soils. The Agwatronics (heat dissipation unit) has not been evaluated as it was received late. However, we are extremely confident that this unit works well based on work done by the civil engineering department at the University of Saskatchewan, Saskatoon. The infrared temperature gun could not be used before the development of a full canopy and required nearly full sunlight to work well.

This year illustrated the fact that the evaporative demand is the major factor influencing water availability to the plant. The CWSI was higher on a hot windy day than it was the day after, which had a much lower evaporative demand. This indicates the need for daily measurement of CWSI. When center pivot irrigation is available, it would be desirable to maintain water at a higher level of availability when potential evapotranspiration is predicted to be high.

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

Principal: Terry S. Tollefson
Paragon Consultants Ltd.
Mossbank, Saskatchewan SOH 3GO
Funding: Irrigation Based Economic Development Agreement
Progress: First year of three
Objective:

a) To design, construct and test a field scale soil vertical mulcher;
b) To measure the improvement in soil water infiltration and storage as a result of vertical mulching prior to irrigation;
c) To measure the duration of vertical mulch treatment effect;
d) To measure crop yields on mulched vs. conventionally irrigated fields to further substantiate benefits.

A soil vertical mulcher was constructed in 1988, through the modification of a John Deere forage harvester and a Lloyd's subsoiler. The forage harvester picks up windrowed straw, chops and blows it into a soil opening created by the subsoiler. The current machine configuration produces two slots on 8' centers and is capable of operating to depths of 30 to 36" if sufficient straw is present to fill the slots and sufficient drawbar horsepower is present to operate the subsoiler at that depth.

Large scale demonstration and smaller scale research plots were established in October, 1988, using the mulcher. Preliminary results show that this machine conveniently removes excess surface trash while, at the same time, dramatically improves soil water infiltration rates. Initial measurements show a 6 times increase in infiltration rate of slot mulched versus no-till, and 1.25 to 2 times increase of slot mulched as compared to subsoiled (Table 1 and 2).

Table 1. Infiltration rates measured for Site 1.

| Treatments | Infiltration rates (cm H20/min) |
|---|---|
| Slot mulch 16" | 15.60 |
| Subsoil 16" | 5.58 |
| Control | 14.80 |
| Slot mulch 16" reflooded* | 7.69 |
| Control* | 1.36 |

Table 2. Water infiltration measurements of Site 2.

| Treatments | Infiltration rates (cm H20/min) |
|---|---|
| Slot mulch 16" | 2.44 |
| Slot mulch 10" | 1.10 |
| Subsoil 16" | 2.20 |
| Subsoil 10" | 0.66 |
| Control | 0.38 |

*The exceptionally high infiltration rate of the control treatment of Site 1 was due to the extreme cracking of the heavy clays because of drought. The slot mulched and control treatments were therefore reflooded one hour later with another 4" of water to assess how swelling and crack closure due to the initial addition of water would affect subsequent infiltration rates. The reflooded control treatment showed a dramatic 10.8 times decrease in infiltration, however the slot mulch experienced only a 2 times decrease. This is an indication of the ability of the straw filled channels to maintain high infiltration rates.

## Evaluation of a Reservoir Tillage System

Principal: Deneen Duncan, Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Co-operator: Jerry Eliason
Location: Outlook (SE-11-30-6-3)
Progress: One year only
Crop: Sceptre durum
Objective: To make a simple evaluation of the effectiveness of a soil pitting machine on a clay soil known to have low infiltration rates and high application levels of irrigation water.

Reservoir tillage is a system which places small pockets in the soil surface to be used as a trap for excess surface water, thus reducing soil erosion and increasing water use efficiency. The intent of this project was to make a simple evaluation of the effectiveness of a soil pitting machine on a clay soil known to have low infiltration rates and high application levels of irrigation water. The site was located northeast of Outlook on a clay to clay loam soil with solonetzic properties. The reservoir tillage implement used had five shank openers followed by five paddle wheels spaced 90 cm apart. The paddles made indentations in the soil 10-15 cm deep. Power requirements are in the range of 25-30 hp per shank. The machine should cause minimal soil disruption and it is recommended that it be used within three days after seeding.

All fertilizer was deep-banded prior to seeding at levels of 78 kg/ha N, 56 kg/ha $P_2O_5$, and 34 kg/ha $K_2O$. Spring soil tests showed nutrient levels of 96 kg/ha $NO_3$, 34 kg/ha P, and 762 kg/ha K. Sceptre durum was seeded May 11, 1988 at 170 kg/ha, 5 cm deep using a hoedrill with 18 cm spacings. Weeds were controlled by Target at 1.25 L/ha. A centre pivot applied approximately 450 mm of water and estimated rainfall was 75 mm for the growing season.

The reservoir tillage implement was used May 12 on a 4 hectare area. Lumps were brought to the surface by the shanks. This excessive disturbance was probably caused by the compact columnar structures present in solonetzic soils. Regardless of this seedbed disturbance, yield was not largely affected. Yields were 4487 kg/ha and 4768 kg/ha for the reservoir tilled and untreated area respectively. The indentations caused by the paddle wheels became less evident through the growing season and were almost negligible by harvest. The time required for the pits to level out is dependent on the amount of natural precipitation and irrigation applied. Subsequent operations, especially weed control, were affected by the indentations. Reduced speeds were necessary and considerable bouncing of the boom occurred which may decrease the efficiency of chemical applications.

The practicality of a reservoir tillage system would be increased if combined with row cropping or used in situations where steep slopes have caused soil erosion problems due to water runoff. Aerial application of weed control chemicals and fungicides should be considered.

# LIVESTOCK

# FINISHING AND MARKETING OPTIONS FOR LAMBS RAISED ON IRRIGATED PASTURE

Principal: Saskatchewan Irrigation Development Centre
Funding: Irrigation Based Economic Development Agreement
Cooperator: Dale Kelman
Riverside Sheep Co-operative Ltd.
Progress: One year only
Objectives: To demonstrate the most efficient method of finishing and marketing 75 lb. lambs that have been raised on irrigated pasture. The information generated will allow Saskatchewan Sheep Producers to effectively evaluate the use of irrigated pasture in their total feeding management and marketing program.

Number of lambs palced in feedlot: 300 head
Reason for shortfall in numbers:

a) Extreme heat conditions slowed the growth of lambs on pasture, resulting in lambs that were not ready to go into feedlot until late August and early September.
b) The price of finished lamb fell drastically during this period. Prices were not expected to rise until mid-November or later.
c) Price of prepared rations rose by 12%.
Price of hay rose by 21%.
Price of lamb fell by 29 1/2%.
d) Due to the above mentioned conditions, the majority of producers involved in the project decided, after much discussion, to forego further participation. Most producers felt that by not finishing lambs at this time and feeding home-grown rations, their costs would be less.

Sales: 60 head

All sales were to private individuals, with the exception of 15. These went to the local butcher.

Cost to consumer: $1.00 per pound, live weight, plus processing.
$2.25 per pound, dressed*

*when the national average price for finished lamb was $.59 - $.62 per pound, live weight.

As mentioned previously, low market prices were the reason why larger quantities of lamb were not offered for sale.

Disadvantages:

1) Low lamb numbers mean high labour costs. It costs the same amount to look after 300 lambs as it does to look after 2,000.
Labour for this project was $1,500.00:
$1,500/2,000 = $.75/head
$1,500/300 = $5.00/head

Based on $10.00/hour and travel for the time involved.

2) Rental of equipment and feedlot with small numbers again means high costs:
   rental of equipment $1,500/300 = $5.00/head
   rental of feedlot $1,000/300 = $3.33/head

   Based on 2,000 head, costs are:
   rental of equipment = $.75/head
   rental of feedlot = $.50/head

3) By committing large numbers to the feedlot, producers would have no choice but to finish lambs as quickly as possible and accept the average price, which under normal conditions would be acceptable. However, conditions, as noted, were not normal.

<u>Advantages</u>:

1) By taking lambs straight off pasture to an adjacent feedlot, we found:

   a) low stress on lambs;
   b) no weight loss;
   c) lambs readily accepted the changeover to dry rations from milk and grass;
   d) lambs were all in the same weight range and body condition;
   e) all lambs could go on the same rations, making labour less intensive;
   f) apart from a small percentage, weight gains were the same on a per head basis.

2) High quality product and easy accessability enabled us to sell lamb to the general public at a price 65% higher than the national average at that time.

3) Interest was shown by large quantity buyers until the price fell.

4) On large numbers, the cost of labour, equipment and feedlot rental would have been minimal.

<u>Budget Outline</u>:

a) Cost per pound gained on 300 head:

| | |
|---|---|
| Prepared ration | $1,500.00 |
| Hay | 870.00 |
| Equipment rental | 1,500.00 |
| Feedlot rental | 1,000.00 |
| Labour | 1,500.00 |
| Trucking | 350.00 |
| Total | $6,720.00 |

$6,720.00/300 head = $22.40/head

| | |
|---|---|
| Average weight of lambs in | 75 lbs. |
| Average weight of lambs out | 112 lbs. |
| Average gain | 37 lbs. |
| Cost/lb. gained | 60.5 cents |

b) Cost/lb. gained on 2,000 head, based on above figures:

| | |
|---|---|
| Prepared ration | $10,000.00 |
| Hay | 5,800.00 |
| Equipment rent | 1,500.00 |
| Feedlot rent | 1,000.00 |
| Labour | 1,500.00 |
| Trucking | 2,333.33 |
| Total | $22,133.33 |

2,133.33/2,000 = $11.06/head

With the same gain (37 lbs./head)
Cost/lb. gained would be $.30/lb.

Summary:

On low numbers, such as were in this project, unless all lambs can be sold farmgate (directly to the consumer), the costs involved in a feedlot would be prohibitive to most producers {see budget outline a)}.

However, on large numbers, the figures show a definite advantage to having a feedlot {see budget outline b)}.

It must be remembered that there is no provision here for capital outlay. Also, no death loss and no fluctuation in labour costs for higher numbers. Also, not included are marketing costs and cost of final destination trucking.

It is unfortunate that this project was not fully completed, although sufficient data was gathered to show basic costs and feasability of such an operation.

Conclusions:

Advantages gained by taking lambs off pasture to an adjacent feedlot:

1) Low stress on lambs;
2) No weight loss;
3) Changeover from grass to dry rations readily accepted; and
4) Easy accessability to the general public allows for higher farmgate sales.

Disadvantages:

1) Unless lamb numbers are 1,000 head or more, the costs involved with setting up a finishing operation make the operation of a feedlot uneconomical.

## Creep Feeding Lambs on Irrigated Pasture

Principal: R.D.H. Cohen
Dept. of Animal & Poultry Science
University of Saskatchewan
Saskatoon, Saskatchewan S7N 0W0
Funding: Irrigation Based Economic Development Agreement
Co-operator: Riverside Sheep Co-op
Outlook, Saskatchewan
Progress: One year only
Objective: To demonstrate the management necessary to raise 120-pound finished lambs in irrigated pasture.

This project was designed to demonstrate to Saskatchewan sheep producers the value of providing supplemental creep feed to lambs grazed on irrigated pasture. The project was run in conjunction with the Riverside Sheep Co-op, a producer group involved with the irrigated pasture at Outlook, Saskatchewan.

One hundred and twenty-five ewes and one hundred and ninety-six lambs were provided for the project by co-operating producers. Two dietary regimes were utilized. These included creep feeding, plus grazing with ewes and pasture grazing with ewes. The demonstration commenced on May 20, 1988, and ran through to August 24, 1988. Non-creep lambs were pastured with ewes twice daily from 0600 hours to 0900 hours, and from 1700 hours to 2000 hours. Creep fed lambs and ewes were pastured from 0930 hours to 1650 hours.

Throughout the feeding period, creep fed lambs consistently outgained non-creep lambs. For the 97-day feeding period, daily gains from the creep and non-creep lambs were 0.36 and 0.17 pounds (Figure 3). Cost of creep supplementation averaged $0.10 per head per day. At a current market price of $0.75 per pound live weight, the return to creep feeding averaged $4.00 per head. At $0.90 per pound, a return of $6.70 would be realized.

It is evident from this demonstration project that lambs grazed on irrigated pasture benefit from a supplemental energy source. Economic analysis indicates that the return to creep feeding is influenced by input costs and the market price for lamb.

It should be noted, however, that due to the nature of this demonstration, it is not possible to statistically analyze the data. Thus, it is not possible to state with a given level of confidence that these results are repeatable.

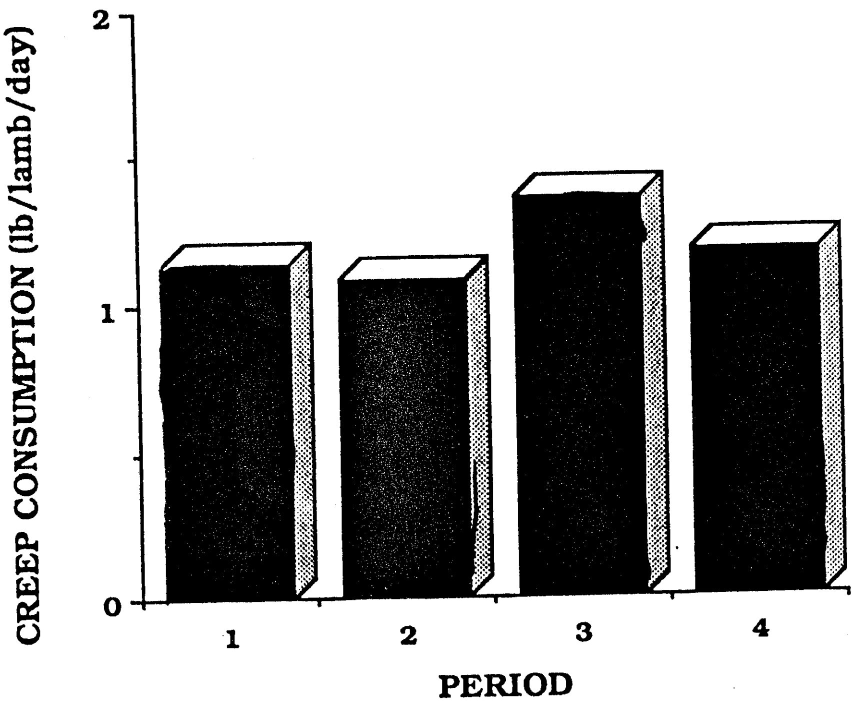



Fig 1. Creep consumption by lambs for each period.
(Period 1: May 20-Jun 15; 2: Jun 15-Jul 25; 3: Jul 25-Aug 24; 4: May 20-Aug 24)

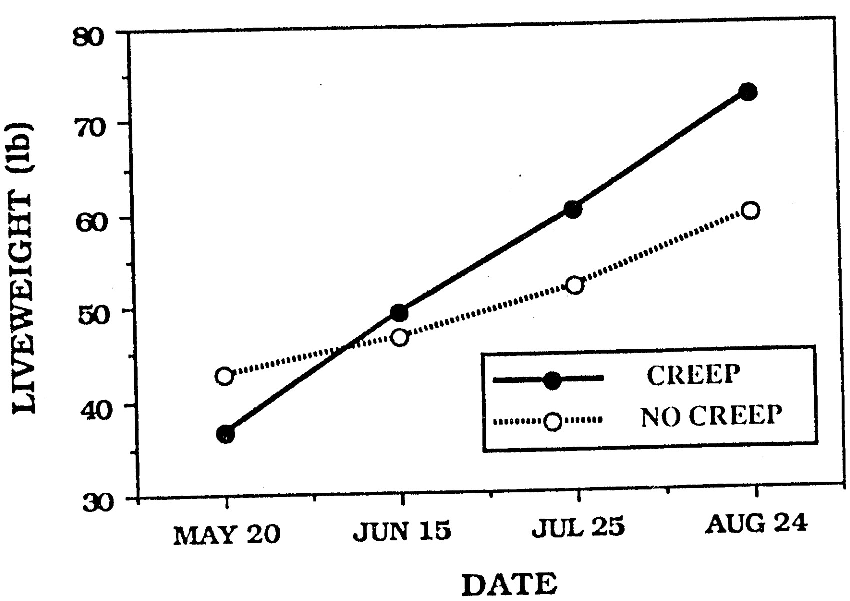



Fig 2. The effect of creep feed on the liveweight of lambs on irrigated pasture.

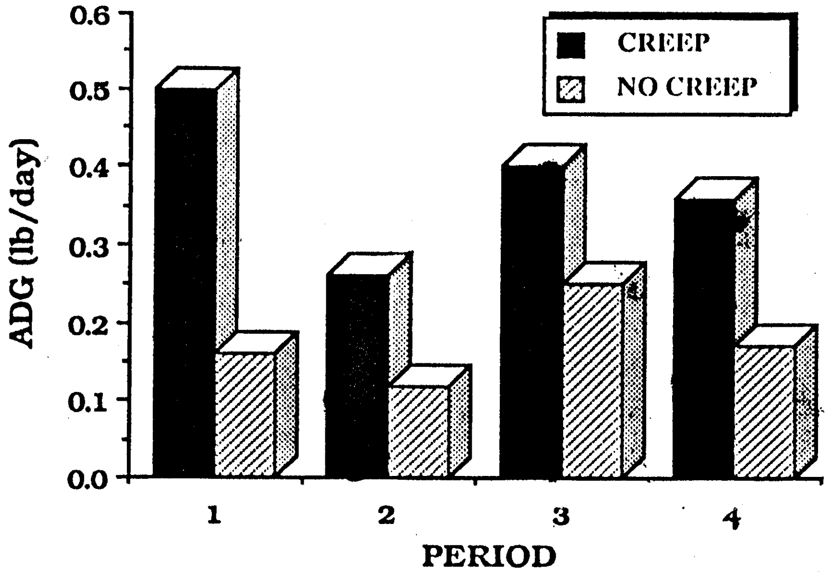



Fig 3. The effect of creep feed on the average daily gain of lambs on irrigated pasture.

(Period 1: May 20-Jun 15; 2: Jun 15-Jul 25; 3: Jul 25- Aug 24; 4: May 20-Aug 24)

# ECONOMICS

## ECONOMICS OF IRRIGATION IN SASKATCHEWAN

Principal: Professor S.N. Kulshreshtha
Department of Agricultural Economics
University of Saskatchewan
Saskatoon, Saskatchewan S7N 0W0
Funding: Agriculture Development Agreement
Co-operators: Nineteen irrigation farmers
Location: Various locations
Progress: Third year of four
Objectives:
a) to develop a simulation model for on-farm decision making with respect to irrigation under Saskatchewan conditions;
b) to generate a data base for formulation of public policies on irrigation development;
c) to gather production data through a three-year series of farm workshops using the Schoney Top Management Model;
d) to develop an irrigation investment analysis program for use by extension staff and farmers.

The second in a series of three sets of workshops was held to estimate the average costs and returns, on a per acre basis, for irrigated crops in Saskatchewan. Nineteen farmers participated in the study, and they were able to produce a detailed business plan for their operation for the coming five years.

The participants profile is summarized in Table 1.

Table 1. Profile of workshop participants, 1987 and 1988.

| | Age | Education | Farm size | Percentage of land under irrigation | Assets | Debts | Equity | D/A* |
|---|---|---|---|---|---|---|---|---|
| | Years | Years of schooling | Acres | % | $ | $ | $ | |
| 1988 Average | 34.8 | 13.2 | 1,839 | 23.0 | 791,468 | 291,396 | 500,072 | 0.37 |
| 1988 Range: | | | | | | | | |
| High | 54 | 16 | 3,621 | 71.0 | 1,885,720 | 803,043 | 1,082,677 | 0.75 |
| Low | 21 | 8 | 581 | 0.0 | 372,003 | 32,345 | 121,162 | 0.06 |
| 1987** Average | 36.6 | 12.5 | 1,800 | 28.8 | 609,739 | 232,261 | 377,478 | 0.38 |
| 1987** Range: | | | | | | | | |
| High | 53 | 15 | 3,760 | 100.0 | 1,644,595 | 745,784 | 943,823 | 1.02 |
| Low | 22 | 8 | 400 | 1.6 | 160,642 | 30,542 | 5,456 | 0.07 |

* Debt-Asset Ratio
** Profile of 1987 workshop participants

The farm data is processed using the Top Management Model developed at the University of Saskatchewan.

## Results:

The results of the 1988 workshops are published by the University of Saskatchewan. Economics of Irrigation in Saskatchewan: Results of the 1988 Farm Workshop. R.G. Roy, W.J. Brown, S.N. Kulshreshtha, Department of Agricultural Economics. Research Report: 88-02.

Some highlights are presented here. Estimated returns and costs for a selection of the crops are given in Table 2 and Table 3.

Table 2. Estimated returns and costs for hard wheat, 1988

| Crop and Type of Irrigation | Average Value ($/Acre) Pivot Irrigation | Average Value ($/Acre) Dryland Stubble |
|---|---|---|
| Number of farms reporting | 6 | 8 |
| a) Total Return | | |
| Yield (bushels) | 57.60 | 22.30 |
| Price | 2.73 | 2.87 |
| Other Returns, e.g. SCGP | 18.08 | 10.28 |
| Gross Returns | 175.33 | 74.28 |
| b) Variable Costs | | |
| Direct | | |
| Seed | 6.68 | 4.90 |
| Fertilizer - N | 19.17 | 6.76 |
| - $P_2O_5$ | 11.27 | 5.94 |
| - Other, e.g. Blend | 5.09 | 0.00 |
| Chemicals - Broadleaf | 3.18 | 2.40 |
| - Grassy | 7.28 | 3.85 |
| - Broadleaf and Grassy | 3.81 | 2.76 |
| Crop and Hail Insurance | 6.24 | 3.13 |
| Irrigation Machinery and Equipment - Fuel | 13.49 | -- |
| - Repair | 4.63 | -- |
| Other Machinery and Equipment - Fuel | 9.17 | 4.31 |
| - Repair | 6.94 | 3.62 |
| Custom Work Hired | 1.30 | 0.14 |
| Water tax | 6.05 | --- |
| Other, e.g. Machine Lease | 0.91 | 0.41 |
| Total Direct Costs | 105.21 | 38.22 |
| Returns above Direct Costs | 70.12 | 36.06 |
| Operating Capital Charges | 6.39 | 2.29 |
| Operator Labor | 18.10 | 6.27 |
| Total Variable Costs | 129.70 | 46.78 |
| Returns above Variable Costs | 45.63 | 27.50 |
| c) Fixed Costs | | |
| Equipment and Buildings CRC | 107.53 | 22.10 |
| Land | 26.94 | 21.05 |
| Management | 33.21 | 7.09 |
| Indirect Overhead | 38.53 | 8.96 |
| Total Fixed Costs | 206.21 | 59.20 |
| Returns above Variable and Fixed Costs | -160.58 | -31.70 |

Table 3. Estimated returns and costs for alfalfa, 1988

| Crop and Type of Irrigation | Average Value ($/Acre) Pivot Irrigation | Dryland |
|---|---|---|
| Number of farms reporting | 7 | 5 |
| a) Total Return | | |
| Yield (ton) | 4.30 | 0.90 |
| Price | 70.39 | 57.16 |
| Gross Returns | 302.68 | 51.44 |
| b) Variable Costs | | |
| Direct | | |
| Fertilizer - N | 0.00 | 0.00 |
| - $P_2O_5$ | 18.66 | 0.00 |
| - Other, e.g. Blend | 3.79 | 0.00 |
| Chemicals - Broadleaf | 0.00 | 0.00 |
| - Grassy | 0.00 | 0.00 |
| - Broadleaf and Grassy | 0.00 | 0.00 |
| Crop and Hail Insurance | 3.02 | 0.00 |
| Irrigation Machinery and Equipment - Fuel | 29.69 | --- |
| - Repair | 6.61 | --- |
| Other Machinery and Equipment - Fuel | 13.37 | 2.88 |
| - Repair | 4.80 | 0.74 |
| Custom Work Hired | 10.55 | 0.00 |
| Water Tax | 0.66 | --- |
| Other, e.g. Machine Lease | 0.43 | 1.33 |
| Total Direct Costs | 91.58 | 4.95 |
| Returns above Direct Costs | 211.10 | 46.49 |
| Operating Capital Charges | 5.59 | 0.30 |
| Operator Labor | 18.44 | 2.71 |
| Total Variable Costs | 115.61 | 7.96 |
| Returns above Variable Costs | 187.07 | 43.48 |
| c) Fixed Costs | | |
| Equipment and Buildings CRC | 63.45 | 7.70 |
| Land | 28.54 | 11.03 |
| Management | 14.88 | 1.43 |
| Indirect Overhead | 18.50 | 1.90 |
| Total Fixed Costs | 125.37 | 22.06 |
| Returns above Variable and Fixed Costs | 61.70 | 21.42 |

## Cost Comparison on a Per Acre and Per Bushel Basis, 1987 and 1988

The data presented in Tables 2 and 3 demonstrate that the variable and fixed costs of crops grown under irrigation as opposed to dryland increase dramatically on a per acre basis but are reasonably close on a bushel basis. An example of this is illustrated in Table 4. All categories of variable costs contribute equally to the increase under irrigation. Machinery and equipment CRC contribute the most to the increased fixed costs per acre under irrigation. Machinery and equipment investment for hard wheat on an acre basis averaged: $88.77 on stubble, $346.82 for pivot irrigation, and $267.27 for all types of irrigation (including irrigation equipment).

## Comparison of Returns above Costs on a Per Acre and Per Bushel Basis, 1987 and 1988

Data presented in Table 4 illustrate the returns above variable and total costs on a per acre and per bushel basis. It shows the effects of the low prices projected by the study participants. Returns above variable costs per acre for hard wheat are greater under irrigation than on dryland stubble but returns above total costs are much lower. This shows that, with the prices projected by the participants, dryland cropping of hard wheat is currently more favorable on a per acre basis than under irrigation. With current projected yields and total costs, a break-even analysis shows that prices of $6.50 per bushel for hard wheat under pivot irrigation and $6.15 per bushel under all types of irrigation are needed in order to have returns above total costs per acre comparable with that of hard wheat on stubble. Any price increase above these would make the growing of irrigation hard wheat superior to that of dryland stubble.

Table 4. Cost and returns above cost comparison of crop enterprises, 1987 and 1988

| | | Variable costs | | Total costs | | Returns above variable costs | | Returns above total costs | |
|---|---|---|---|---|---|---|---|---|---|
| | | $/ac | $/bu | $/ac | $/bu | $/ac | $/bu | $/ac | $/bu |
| Hard Wheat on Fallow[1] | 1987 | 37.47 | 1.57 | 90.24 | 3.79 | 36.55 | 1.54 | -16.22 | -0.68 |
| | 1988 | 38.80 | 1.44 | 104.21 | 3.87 | 46.15 | 1.72 | -19.26 | -0.72 |
| Hard Wheat on Fallow[2] | 1987 | 45.28 | 1.90 | 117.12 | 4.92 | 28.74 | 1.21 | -43.10 | -1.81 |
| | 1988 | 46.90 | 1.74 | 134.46 | 5.00 | 39.93 | 1.48 | -47.63 | -1.77 |
| Hard Wheat on Stubble | 1987 | 51.44 | 2.60 | 110.01 | 5.56 | 10.93 | 0.55 | -47.64 | -2.41 |
| | 1988 | 46.78 | 2.10 | 105.98 | 4.75 | 27.50 | 1.23 | -31.70 | -1.42 |
| Fallow | 1987 | 7.81 | -- | 26.88 | -- | -7.81 | -- | -26.88 | -- |
| | 1988 | 8.10 | -- | 30.25 | -- | -6.22 | -- | -28.37 | -- |
| Hard Wheat - Pivot Irrigation | 1987[4] | 138.89 | 2.50 | 333.60 | 6.01 | 29.28 | 0.53 | -165.43 | -2.98 |
| | 1988 | 129.70 | 2.25 | 335.91 | 5.83 | 45.63 | 0.79 | -160.58 | -2.79 |
| Hard Wheat - All Types of Irrigation | 1987[4] | 124.81 | 2.22 | 285.81 | 5.09 | 45.17 | 0.81 | -115.83 | -2.06 |
| | 1988 | 118.65 | 2.32 | 283.72 | 5.54 | 35.85 | 0.70 | -129.22 | -2.52 |
| Soft Wheat - All Types of Irrigation | 1987[4] | 119.24 | 1.69 | 253.29 | 3.60 | 61.69 | 0.88 | -72.36 | -1.03 |
| | 1988 | 129.90 | 1.87 | 284.66 | 4.11 | 31.87 | 0.46 | -122.89 | -1.77 |
| Canola - All Types of Irrigation | 1987 | 133.57 | 3.08 | 292.73 | 6.76 | 81.63 | 1.89 | -77.53 | -1.79 |
| | 1988 | 134.42 | 2.98 | 292.06 | 6.48 | 122.87 | 2.50 | -44.77 | -0.99 |
| Flax - All Types of Irrigation | 1987 | 142.55 | 3.83 | 328.77 | 8.84 | 13.69 | 0.37 | -172.53 | -4.64 |
| | 1988 | 122.12 | 3.35 | 283.77 | 7.77 | 61.79 | 1.69 | -99.86 | -2.74 |
| Alfalfa - Pivot Irrigation | 1987 | 106.55 | 23.89[3] | 260.12 | 58.32[3] | 209.31 | 46.93[3] | 55.74 | 12.50[3] |
| | 1988 | 115.61 | 26.89[3] | 240.98 | 56.04[3] | 187.07 | 43.50[3] | 61.70 | 14.35[3] |
| Alfalfa- All Types of Irrigation | 1987[4] | 84.36 | 22.03[3] | 197.30 | 51.51[3] | 194.62 | 50.81[3] | 81.68 | 21.33[3] |
| | 1988 | 109.61 | 26.73[3] | 238.59 | 58.19[3] | 182.27 | 44.46[3] | 53.29 | 13.00[3] |

1 Excluding fallow costs
2 Including fallow costs
3 Alfalfa costs are in $/ton
4 Errors were found in three of the participant farms and were adjusted accordingly