

Irrigation in Western Canada: Improving Water Productivity through Research and Technology

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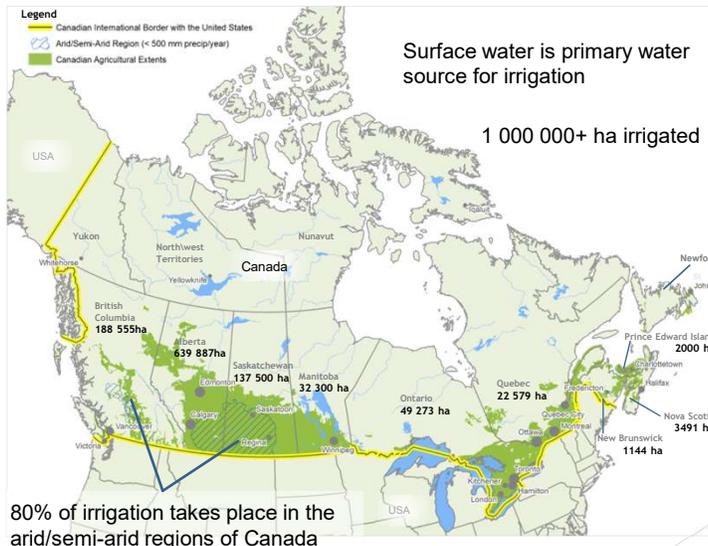
Agriculture and Irrigation in Canada



Legend
 Canadian International Border with the United States
 Arid/Semi-Arid Region (< 500 mm precip/year)
 Canadian Agricultural Extents

Surface water is primary water source for irrigation

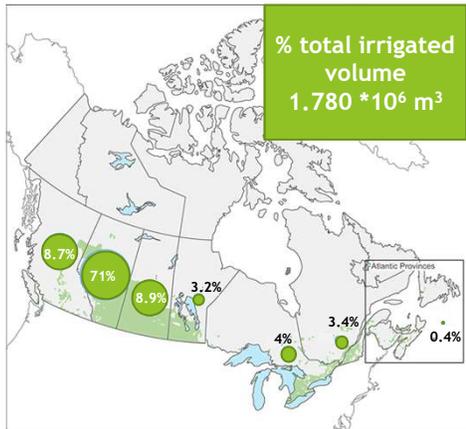
1 000 000+ ha irrigated



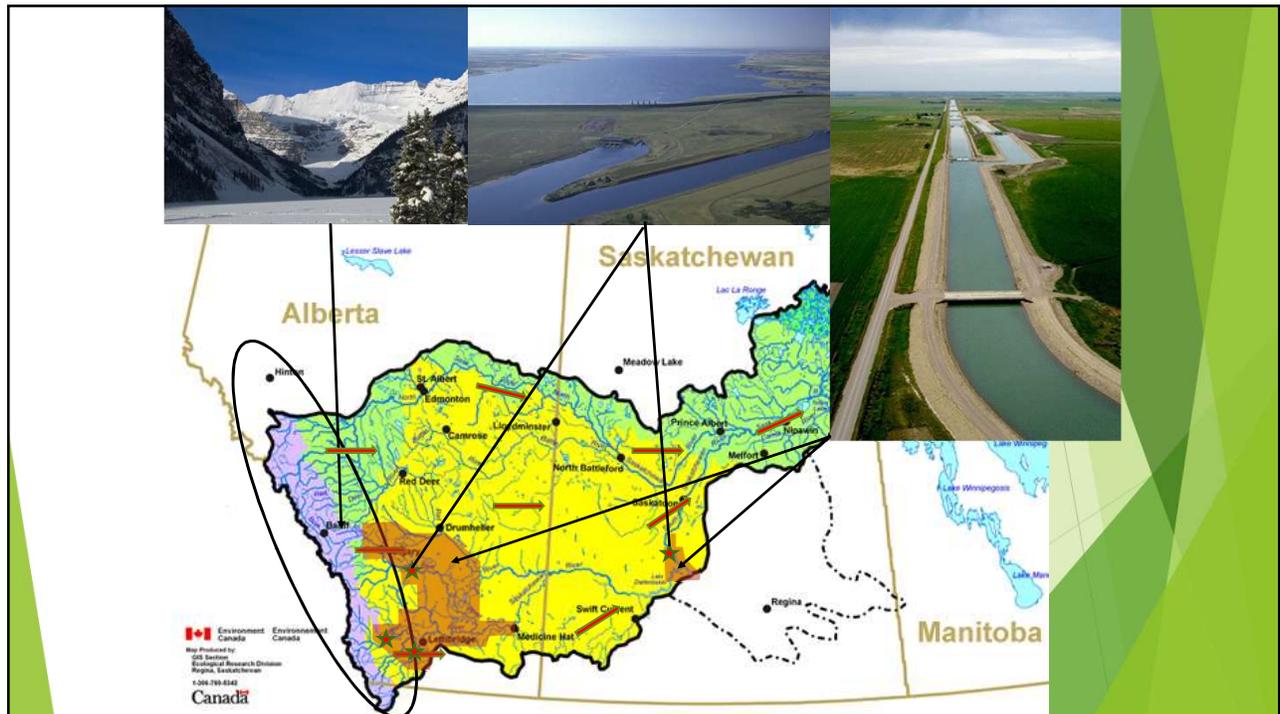
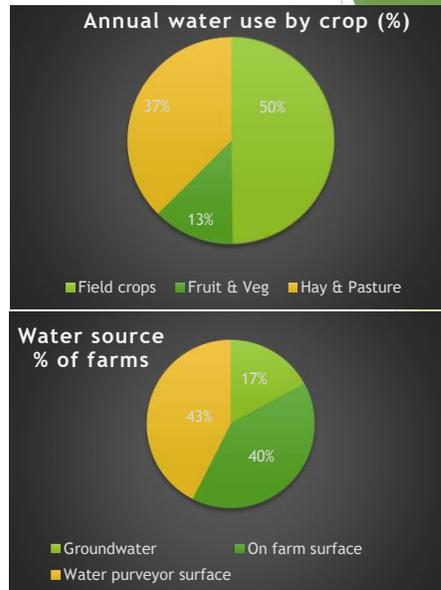
Province	Estimated Irrigated Area (ha)
British Columbia	188,555
Alberta	639,887
Saskatchewan	137,500
Manitoba	32,300
Ontario	49,273
Quebec	22,579
New Brunswick	1,144
Nova Scotia	3,491
Prince Edward Island	2,000
Newfoundland	188
Total	1,076,917

80% of irrigation takes place in the arid/semi-arid regions of Canada

Water use in Canada by province, crop and source

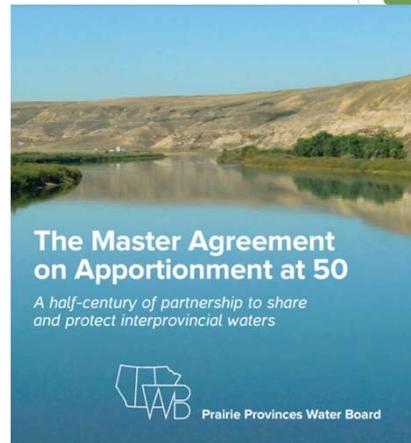


Statistics Canada. 2021. Table 38-10-0239-01 Irrigation volume by province and drainage region (x 1,000)



Irrigation in Saskatchewan

- ▶ Water is Provincial responsibility - licensing and regulation.
- ▶ Flow allocation agreements exist between Alberta, Saskatchewan and Manitoba. Govern quantity and quality.
- ▶ Provincial government issues 'water rights' licenses.
- ▶ Different between each province.



Irrigation in Saskatchewan

- ▶ Irrigation Development in Saskatchewan requires two stages of approval:
 - 1) Irrigation Certification
 - Required by all projects over 10 acre feet
 - Administered by Saskatchewan Ministry of Agriculture
 - 2) Water License
 - District Irrigator - agreement with district
 - Non-district Irrigator - agreement with Province (Water Security Agency)

Irrigation Certification

- ▶ Administered by the Saskatchewan Ministry of Agriculture,
- ▶ Ensures projects meet soil and water standards for irrigation,
- ▶ Producers pay upfront irrigation development fee (~\$2,300 per ¼ section field),
- ▶ Fees cover costs of soil and water source testing and administration,
- ▶ If land and water source are deemed of sufficient quality then the irrigation certificate is issued.



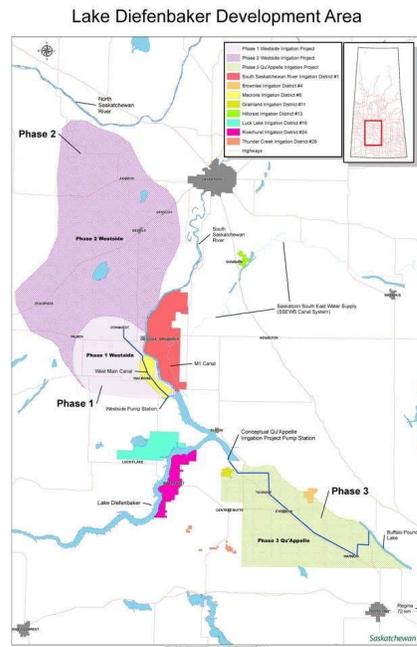
Water Rights License

- ▶ With IRRIGATION CERTIFICATE client can enter into one of two agreements:
 - i. Water Rights License - Non-District Irrigators
 - License is approved by Water Security Agency
 - Annual fee dependent on withdrawal volume
 - Fee ranges from \$100 - \$1000 / annually.
 - ii. Water Service Agreement - District Irrigators
 - District has license with Province
 - Users pay fee to district to cover cost associated with supply (operation and maintenance of headworks, administration and licensing fees).

Irrigation Districts

Irrigation Districts - a group of irrigators that operate and maintain irrigation infrastructure with limited self-governing powers granted by the province.

Non-District - individual irrigators that do not require district infrastructure to supply project. Generally located near public water body/source (lake, stream, groundwater).



Governments Role

Historically

- Built storage (dams) and delivery (canals) infrastructure
- Owned and operated off-farm infrastructure

Today

- Finance water delivery infrastructure (Infrastructure Bank)
- Operate main water supply canals and storage, secondary infrastructure transferred to farm groups (Districts)
- Research funding and support environmentally sustainable irrigation equipment and practices (Canadian Ag Partnership)



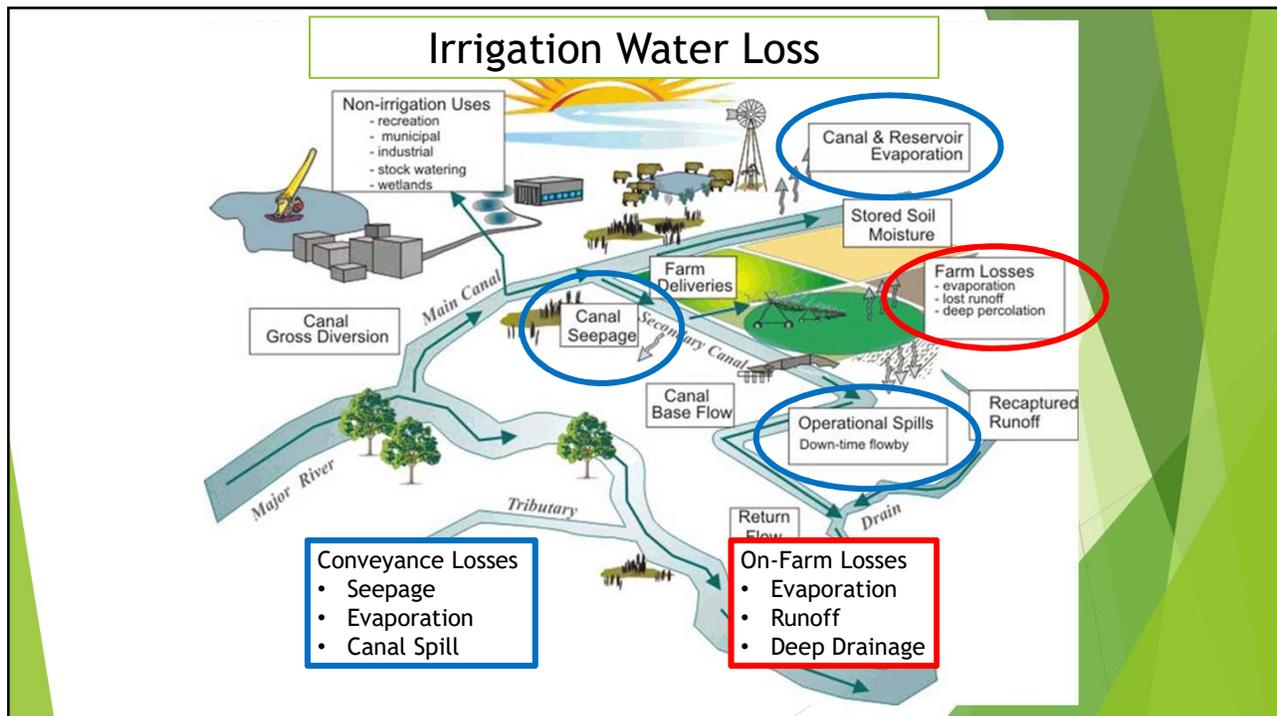
Government Shift Development → Sustainability

- Irrigation expansion occurring in some areas (Saskatchewan 2020-2030)
- Water allocation in some basins at capacity (Southern Alberta)
- Best use of water resources
 - maximize water productivity
- **Water Productivity** : marketable yield per unit of water input.

How Do we Accomplish:

- Genetics - Breeding
- System efficiency - conveyance and application
- Management efficiency - scheduling

“More Crop Per Drop”



Conveyance Efficiency

Conveyance Efficiency

- Main Supply Canals → Lined Canal (2 - 3% Water Savings)
- Secondary Canals → Pipeline
 - Reduce Seepage, Evaporation, Maintain Capacity



Main Canal



Secondary Canal

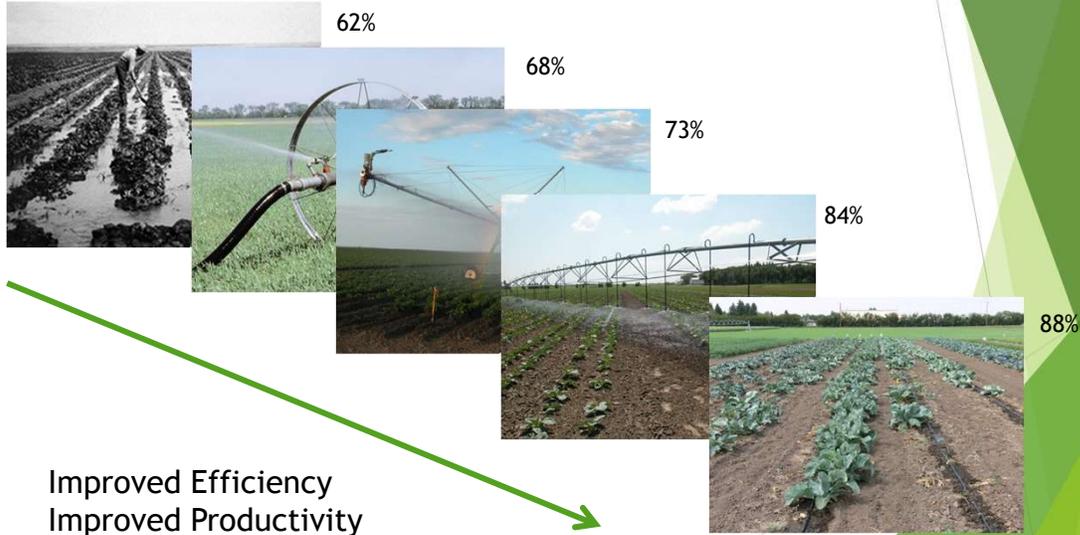


Conveyance Efficiency

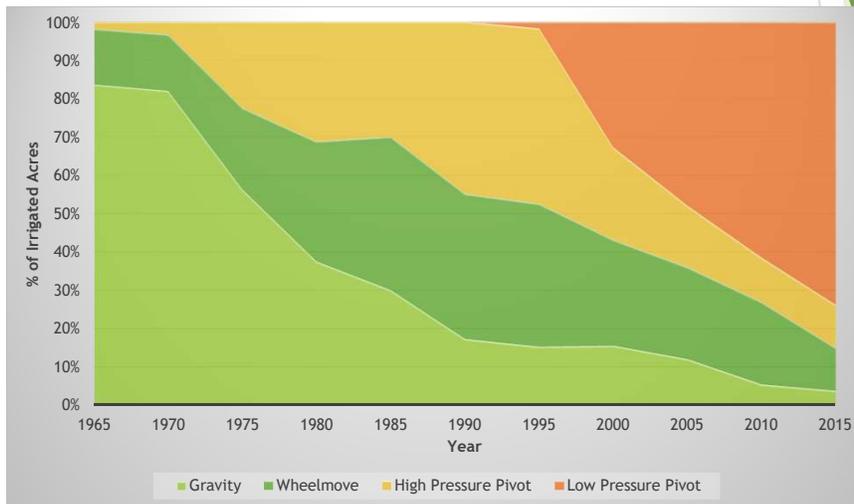
- Canal return flow accounts for 11% of water diverted
- SCADA - Supervisory Control and Data Acquisition
 - On demand systems reduces flow losses through diversions



Irrigation System Application Efficiency



Irrigation System Conversion

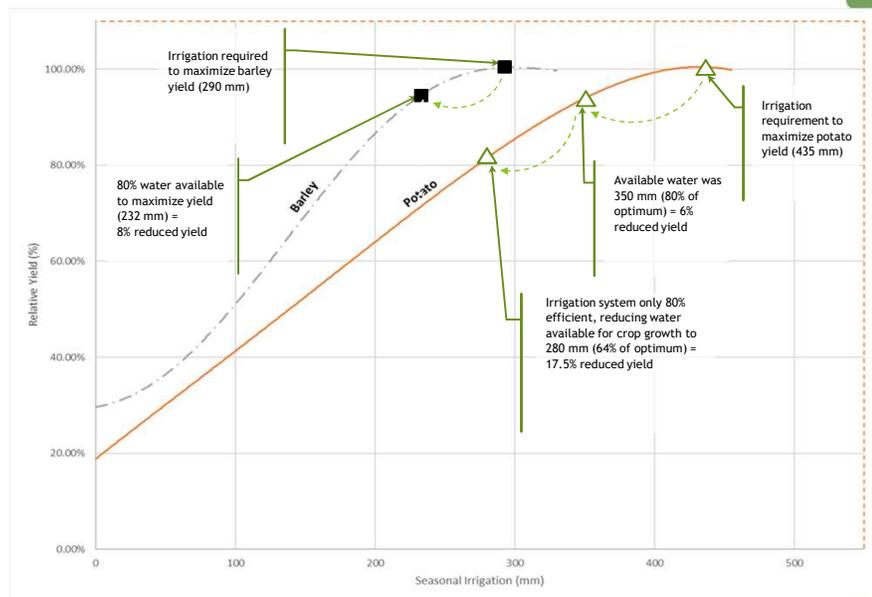
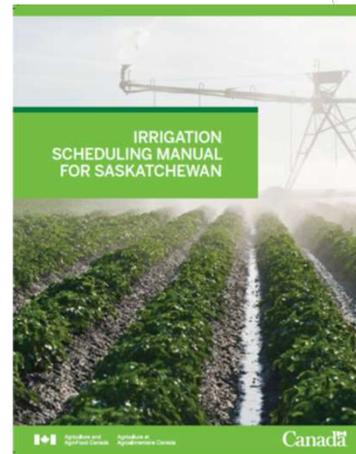


Source: Government of Alberta 2016

Management: Irrigation Scheduling

Irrigation scheduling - management of the **timing** and **application** depth of irrigation events.

- improves crop yield and quality;
- decreasing nutrient loss;
- improves water use efficiency;



Modelled Water-Yield curves for irrigated barley and potato (Model output based on 2018 weather data from Outlook, Saskatchewan. Analysis completed using FAO AquaCrop 6.1).

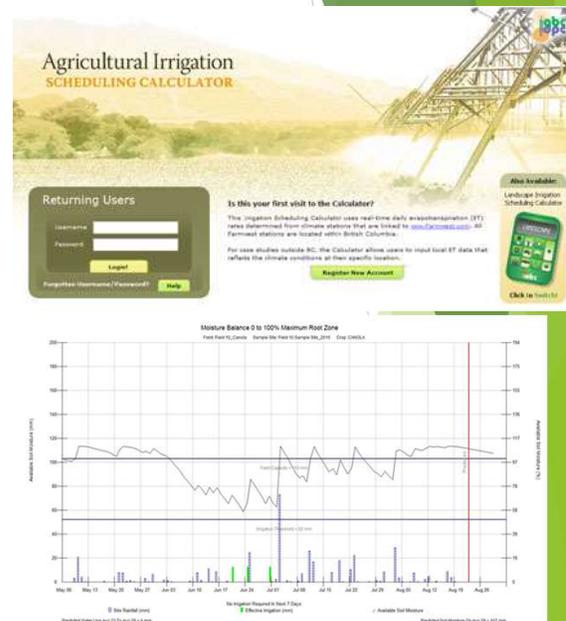
Scheduling Techniques: Soil Based

- Direct measurement of soil moisture status
- Maintain adequate crop available moisture
- Types:
 - Hand Feel,
 - Tensiometer
 - Time-Domain Reflectometry (TDR)
 - Capacitance Probes



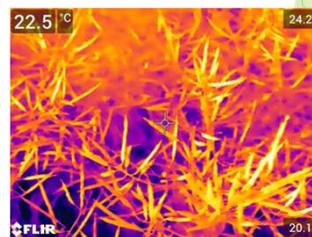
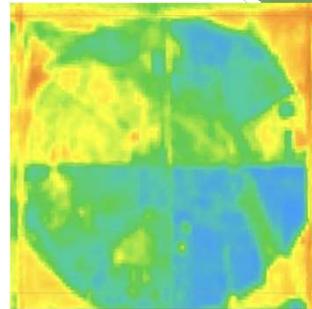
Scheduling Techniques: Climate Models

- Climate based irrigation scheduling calculators
- Use climate data to model crop water use
- Water balance
(Water Out = Water In)



Scheduling Techniques: Plant Based

- Measurement of crop canopy as indication of water stress,
- Useful in irrigation trigger but not irrigation amount,
- Types:
 - Normalized Difference Vegetative Index,
 - Thermal

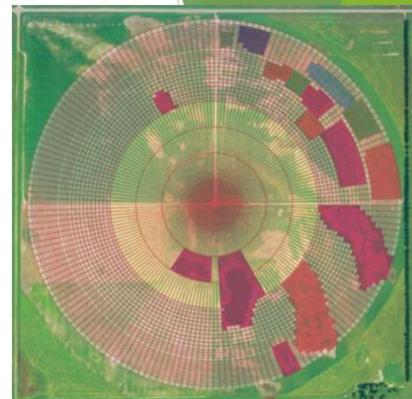


TAKE HOME

Use an irrigation scheduling method that you are comfortable with and fits your operation

Area of Research: Variable Rate Irrigation

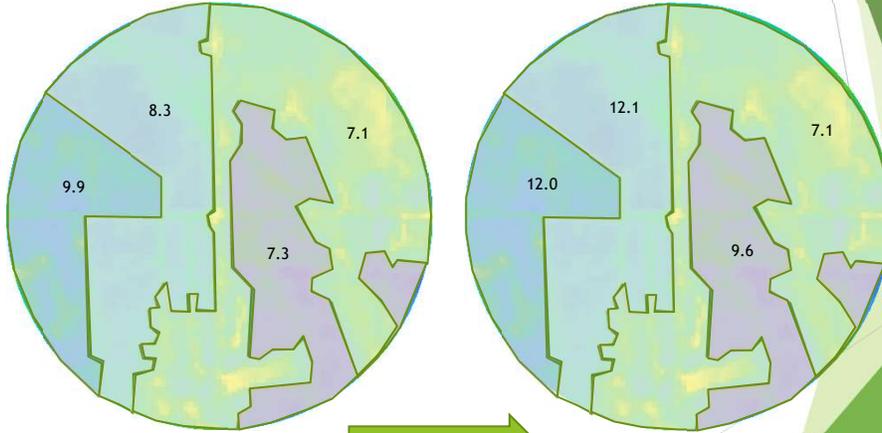
- Precision Ag applied to irrigation
- Irrigation rates are adjusted by ‘pulsing’ flow to each sprinkler using a electric/pneumatic water valve.
- Rates are adjusted to meet crop water demand.



Area of Research: Variable Rate Irrigation (VRI)

Uniform Rate Irrigation
Total Applied = 175 mm

Variable Rate Irrigation
Total Applied = 125 - 200 mm



15% Increase in Water Use Efficiency

For Purposes of Illustration Only

Agriculture and Agri-Food Canada Research Centres



 Agriculture and Agri-Food Canada Agriculture et Agroalimentaire Canada

CSIDC

- The Canada-Saskatchewan Irrigation Diversification Centre (CSIDC)
- Federal/provincial/industry/university partnership dedicated to sustainable irrigated production practice
- Conducts, funds and facilitates irrigated research, demonstration, technology transfer and education in support of this goal



Canada

SIPA

UNIVERSITY OF SASKATCHEWAN

CSIDC

Saskatchewan

CSIDC: Extension

Research → Development → Knowledge Transfer

- CSIDC plays role on all phases of the RDT continuum.
- Knowledge Transfer occurs in collaboration with industry and provincial government partners. Through:
 - Training sessions,
 - Field Days,
 - Demonstration,
 - Knowledge products



Questions

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Thank-you