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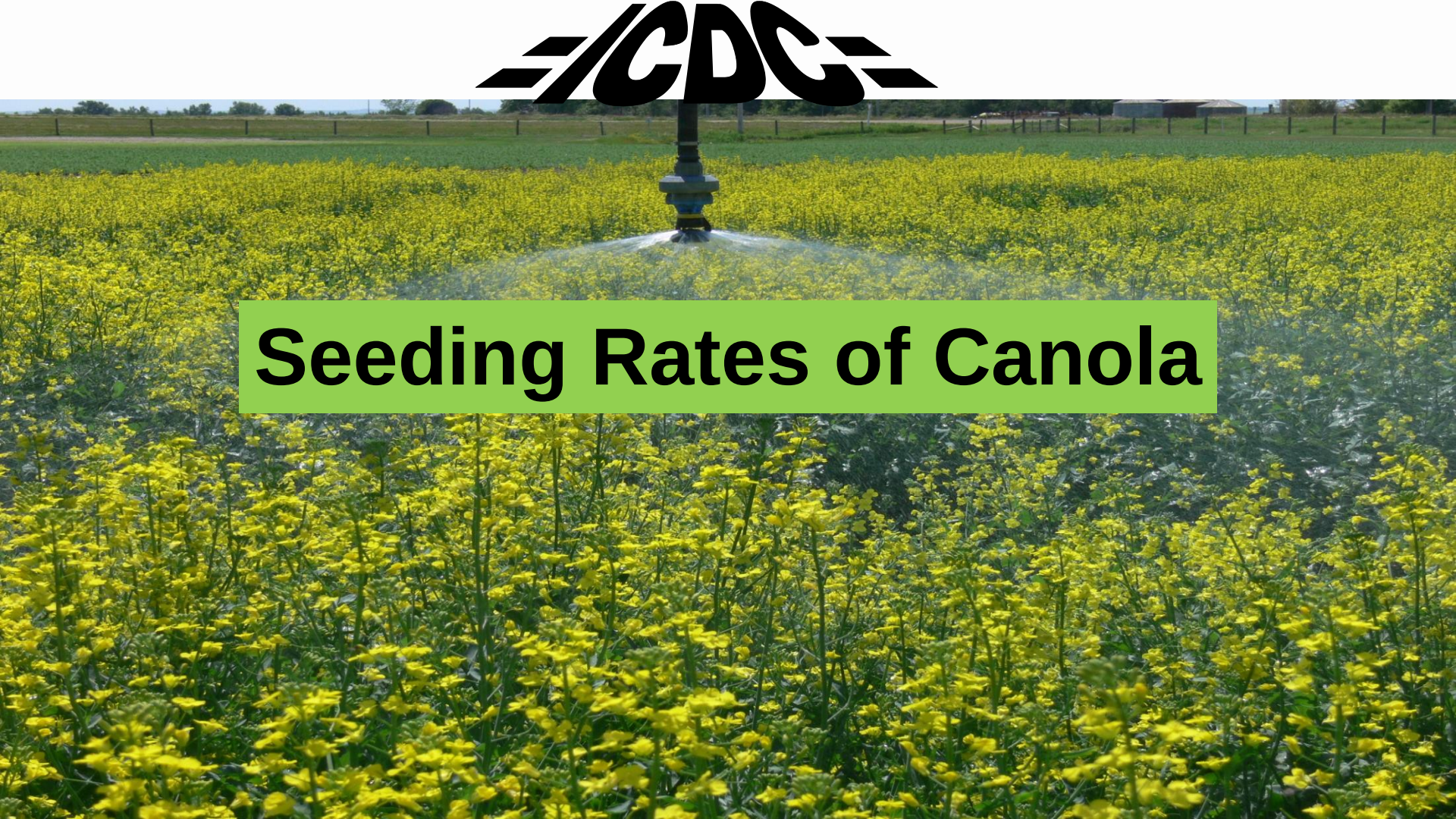
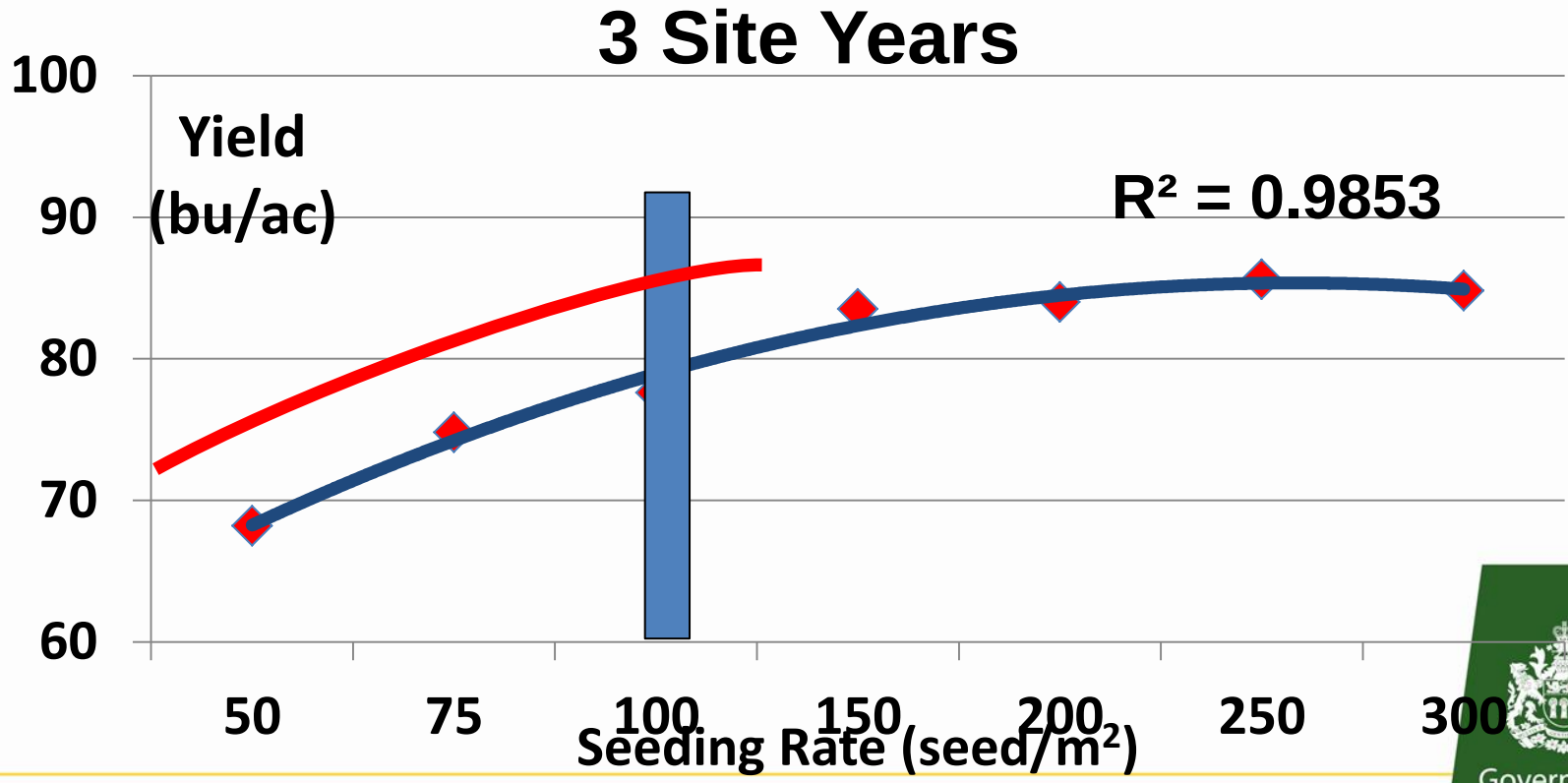

Seeding Rates of Canola

Varieties 45H21 & 5440 (live seeds planted)

Seeding Rate (seeds/m^2)	Canola (lbs./acre)
50	2.5
75	3.7
100	5.0
150	7.5
200	10.0
250	12.5
300	15.0

Seeding Rate vs Yield - Canola



Rate (lbs/ac)	2.5	3.7	5.0	7.5	10	12.5	15.0

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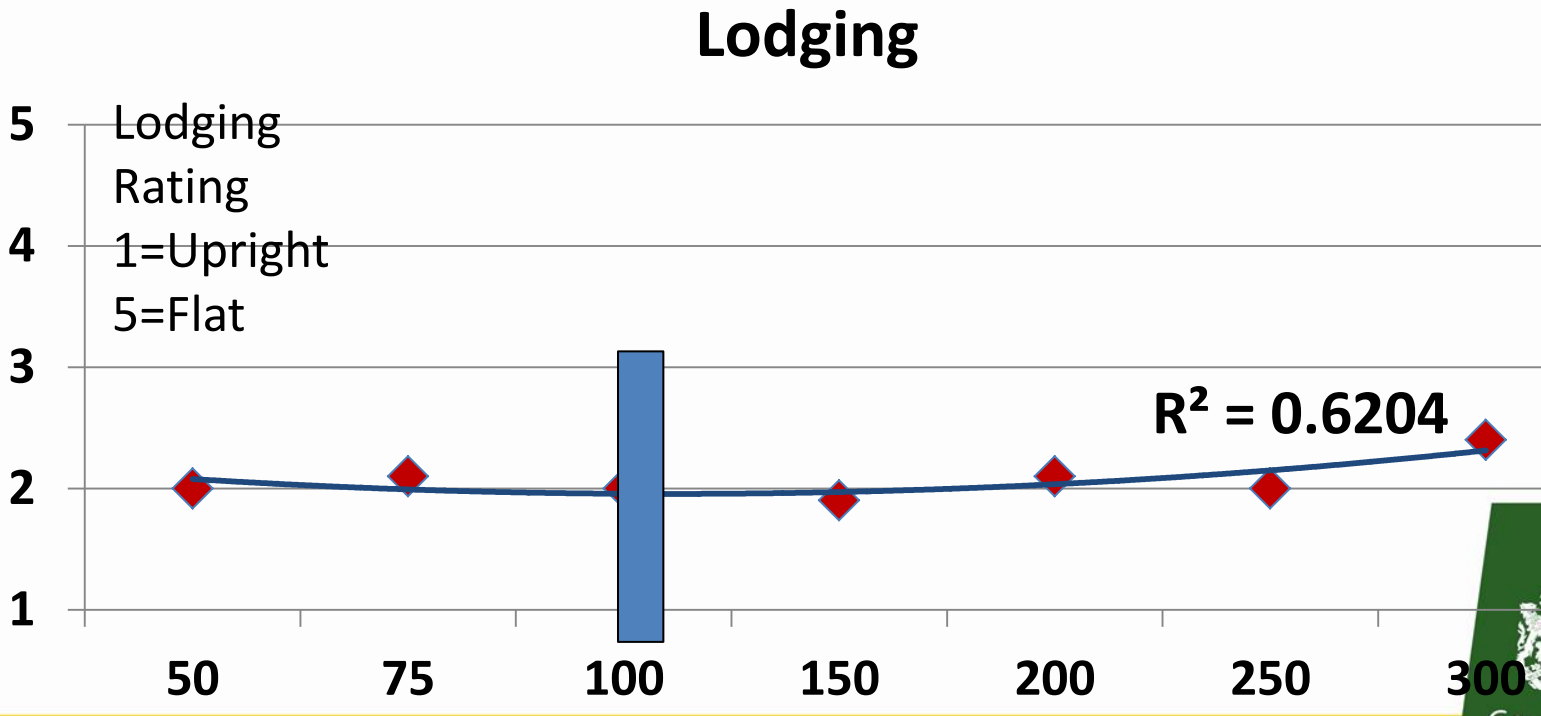
Seeding Rate vs Lodging-Canola



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Seeding Rate Summary

- ***Canola***
  - Present recommended target rate of 110 viable seeds/m^2 is at the minimum target range, yields continue to increase to 200 seeds/m^2.
  - Increasing seeding rates do not appreciably increase lodging.

High Yielding Canola

Role of Soil Fertility Under Irrigation

High Yielding Canola

- Plan to seed early but manage considering soil temperature
- Slow down during seeding to achieve uniform shallow seeding depth
- Early weed removal – keep canola clean up to four leaf stage
- Grow varieties of differing maturities to spread out swathing and avoid cutting too early to be able to get the job done.

Our Canola World is Changing

- Hybrids
- High seed cost
- New approach to seeding philosophy
- Opportunity cost and value of time in spring
- High moisture years – high target yields

High Yielding Canola

- Nov 2013
  - Stats Can – Sask production rose 37.5% to 8.9MMT

  (av. yield rose nearly 50% to 37.6 bu/ac from 25 bu/ac in 2012)
- Jan 2014
  - Canola Council targets av. production of 52 bu/ac in 2025
- What fertilizer requirements are needed to reach these targets?

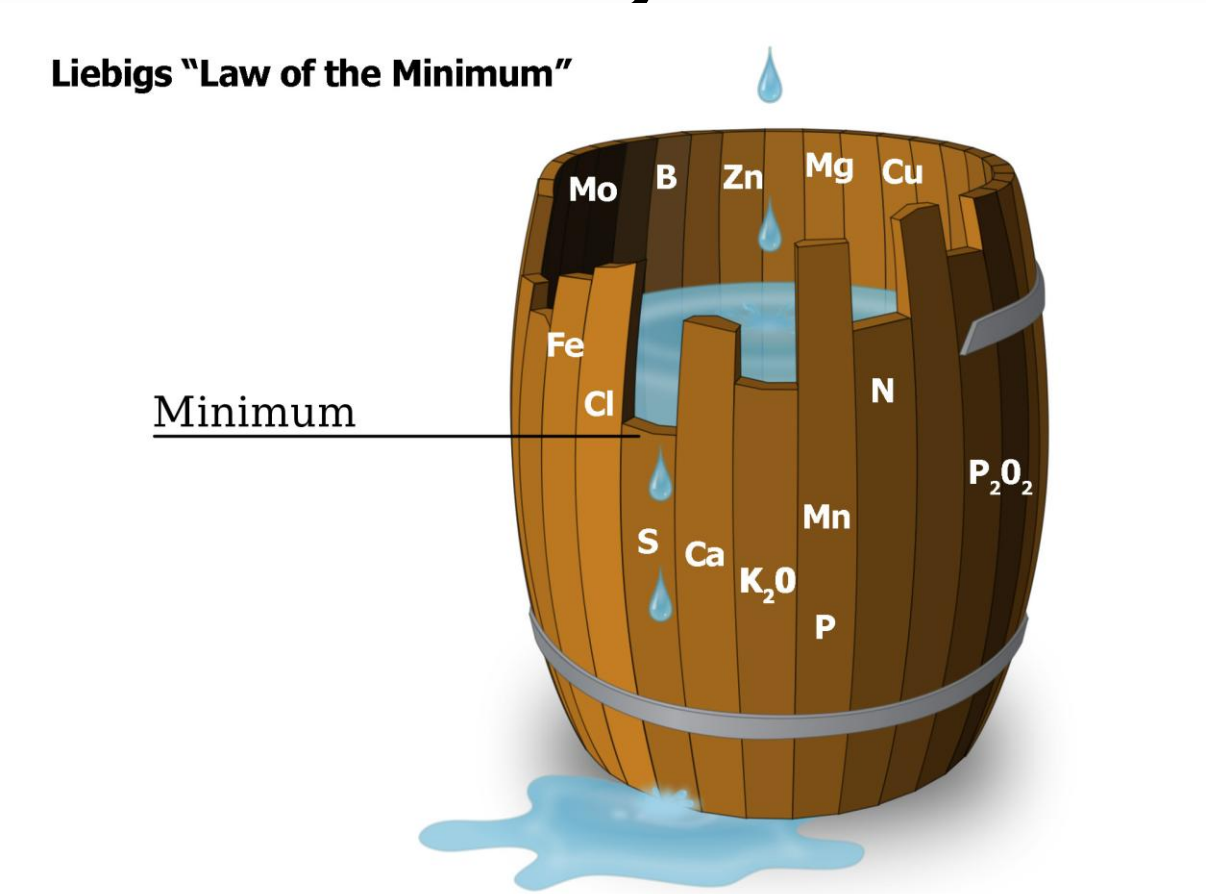
High Yielding Canola

- Neil Harker – 3 year study at Lacombe 2008-2010
  - Seeding rates – 75 seeds/m^2 & 150 seeds/m^2
    - Increase of 1.3-2.9 bu/ac
    - CCC suggests between 40 and 200 seeds/m^2
  - N rates – 100% & 150 % of soil test recommendation
    - Increase of 2.1 bu/ac in 2008 and 4.5 in 2010.
  - Polymer coated N in 50% blend
    - Increase of 1.8 bu/ac in 2010 but no response in 2008

High Yielding Canola

- Balanced fertility
- If planting delayed, match fertilizer rates to appropriate yield target.

Balanced fertility



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Canola Council Survey 2009

500 grower survey responses were ranked by sorting their canola yields.
Average fertilizer practices determined

Rate of Fertilizer	Low Yields	Mid Yields	High Yields
N (lb N/ac)	63	73	80
P_2O_5 (lb P_2O_5/ac)	22	24	25
S (lb S/ac)	11	14	17

Nutrient removal by irrigated crops

Crop	Crop Part	Nitrogen (N)	Phosphate (P_2O_5)	Potassium (K_2O)	Sulphur (S)
					lb/acre
Spring wheat 100 bu/ac	Seed	145	55	35	10
	Straw	55	15	120	14
	Total	200	70	155	24
Barley 140 bu/ac	Seed	145	50	45	12
	Straw	65	15	135	14
	Total	210	65	180	26
Canola 70 bu/ac	Seed	160	60	30	20
	Straw	65	20	120	15
	Total	225	80	150	35
Flax 55 bu/ac	Seed	150	45	35	13
	Straw	45	10	100	17
	Total	195	55	135	30

Source: Fertilizer Requirements of Irrigated Grain and Oilseed Crops (Alberta Agriculture, 2013)

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ECONOMICS

CROP: CANOLA

ITEM	#	UNIT	$/ac	My Farm $/ac
Seed			$56.25	
Seed treatment			$0.00	
Soil test			$0.65	
Fertilizer: N	160	lb	$91.53	
P_2O_5	40	lb	$18.89	
K_2O	15	lb	$4.94	
Herbicide			$8.50	
Insecticide *			$6.15	
Fungicide			$22.00	
Equipment fuel			$19.62	
Equipment repair			$6.22	
Custom work			$14.00	
Irrigation power	13	inches	$22.10	
Irrigation repair			$11.28	
Irrigation service/water charge			$34.63	
Crop insurance ǂ	47	bu/ac	$10.84	
Hail insurance			$13.65	
Hired labour	0	hr/ac	$0.00	
Other			$0.00	
Farm overhead			$9.20	
Operating int	4.2	%	$7.36	
Total Cash Costs			**$357.82**	
Farm Equipment & Buildings			$55.61	
Irrigation System			$28.03	
Specialized Equipment			$0.17	

AGRONOMICS

Variety Selection:

Select a canola variety that is resistant to blackleg and resistant to lodging. Refer to the publication "Crop Varieties for Irrigation" for production data specific to irrigation in Saskatchewan.

Seeding:

Plant population	110.0	plants/sq m.
TKW Hybrid Canola	5.0	grams
Seeding Rate	5.0	lb/ac

Seed before May 15th.

Fertilization:

Apply 145-160 lb/ac N, 30-40 lb/ac P_2O_5 and 10-15 lb/ac K_2O. A soil test is recommended for fertilizer application based on soil nutrient levels and crop needs. Sulphate fertilization may be required if fall or spring soil conditions are conducive to leaching.

Crop Water Use and Irrigation:

The active root zone of canola is 1.0 metre. Maintain the soil water content at or above 50% field capacity.† The average total seasonal crop water requirement is 480 mm (19 inches). Critical irrigation period extends from the late vegetative stage through flowering to initial seed ripening.

Daily crop water use:

Vegetative: 1.5-3.0 mm/day

30 day average peak use: 6.0-6.5 mm/day

Flowering: 7.5 mm/day maximum

Harvest:

High Yielding Canola – Nutrient Uptake

- Canola needs 3.2 lb N / bu of seed yield
- Canola needs 1.5 lb P_20_5 / bu of seed yield
- Canola needs 2.3 lb K_20 / bu of seed yield
- Canola needs 0.55 lb S / bu of seed yield
- Target yield of 70 bu/ac needs
  224 lb N, 105 lb P_20_5, 161 lb K_20, 39 lb S
- Target yield of 100 bu/ac needs
  320 lb N, 150 lb P_20_5, 230 lb K_20, 55 lb S

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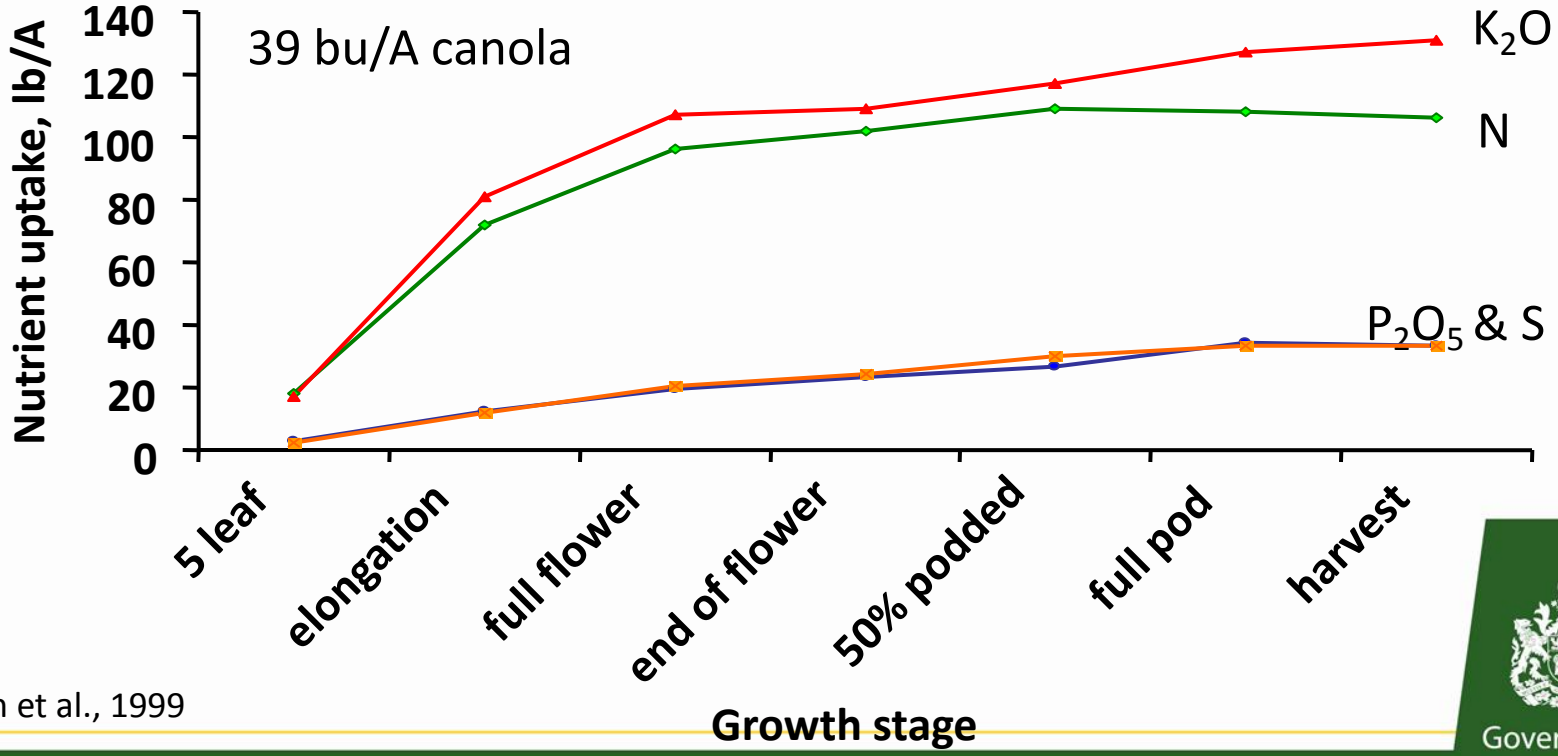
Fertilizer not the only source

- Mineralization from OM
  - 10 -15 lb N/ percent organic matter
- N release from previous legume crop residues
    - Fababean – 60 lb N
    - Alfalfa – 100 + lb N/ac
    - Pea - 20-50 N/ac
    - Lentil – 10-20 N/ac
- Residual N in soil – 20-50 lb N/ac
- Lightning – 1-5 lb N/ac

How Much N, P, K, and S Does Canola Take Up



Johnston et al., 1999

High Yielding Canola – Nutrient Uptake

- What are the risks?
  - Too much fertilizer in the band – seedling injury
    - roots unable to access fertilizer nutrients
  - Delayed maturity – early frost
  - Unbalanced fertility – induced deficiency
    e.g. N/S
  - Unpredicted limiting growth factor
  - Increased risk of disease and insects
  - Lodging

Potential solutions ?
Time and method of N application

- Side band, mid-row band, fall band, liquid sources, fertigation, topdress, foliar application
- Different proportions of N mid row banded at seeding with rest applied as surface dribble band of 28-0-0

IHARF - Greenseeker technology

- Conducted 9 trials with Greenseeker
  - 7 of 9 years – spring full N = split application
  - Very little grained in most years

Another study

- Pat Flaten of SaskCanola reported study
  - Applied different proportions of N with mid-row bander at seeding with rest in crop as surface dribble band of UAN
  - At least 50% of N needed at seeding
  - Yields never higher with split application

Risks

- Multiple passes – fuel, traffic, labour
- Surface application – volatilization loss?
- In crop soil application damage to crop?
- Missed window of application
- Rate chosen to split

Controlled Release Fertilizer

- ESN, Super U, SCU
  - Single application with N released over the growing season
  - Needs moisture to release N over season

Other CR Approaches

- Nitrification Inhibitors
  - Nitrapyrin, dicyandiamide (DCD), and ammonium thiosulfate (ATS).
- Urease Inhibitors
  - Agrotain

P Placement Affects Crop Response

Spring broadcast,
40 lb P_2O_5/A

Seed-placed,
20 lb P_2O_5/A

Source: Agrium, Ray Dowbenko

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Phosphate Seed-row Tolerance of Crops

- Wheat >Canary > Pinto Bean> Chickpea>

  40 lb P_2O_5/ac 30 lb P_2O_5/ac

Canola>Mustard, Flax>Alfalfa>Field pea

20 lb P_2O_5/ac 15 lb P_2O_5/ac

Source : Qian, Schoenau, King, and Fatteicher, 2012

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Canola yield response to key practices

Table 2. Canola yield responses to key crop management practices in western Canada

Crop management practices	No. samples	Seed yield (kg ha^{-1})	Std Err
(F) Application of K			
With K	14	2502	156
With no K	47	2006	85

Source: Liu et al., 2014. Evaluation of on-farm crop management Decisions on canola production. CJPS 94:131-139

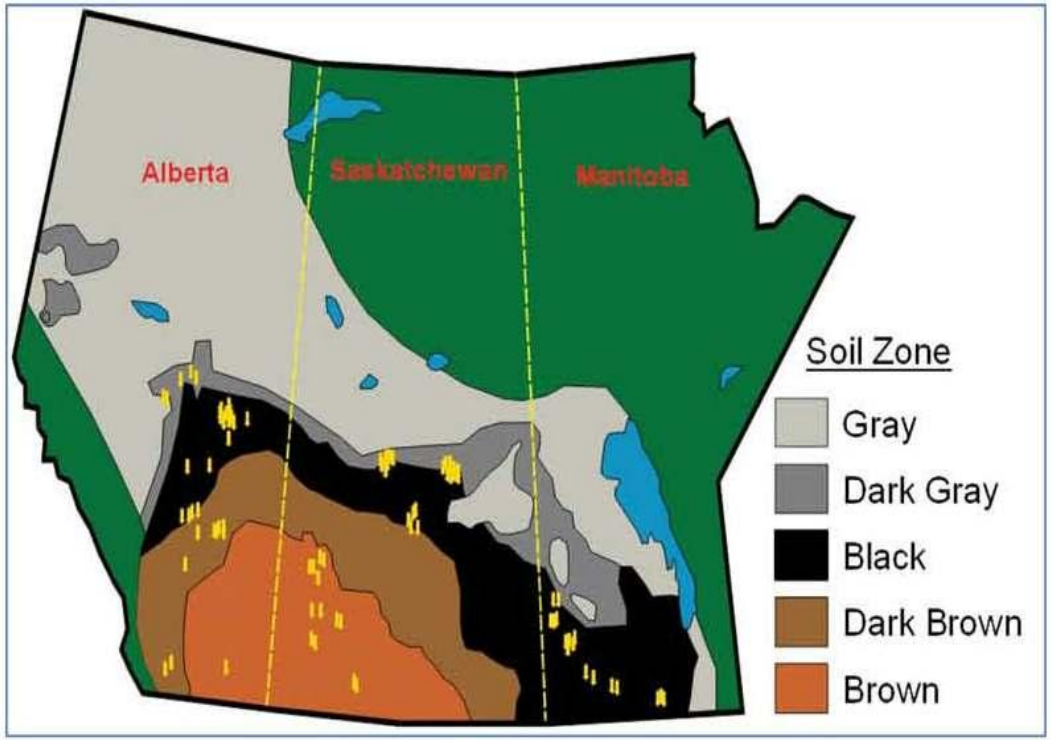

Fig. 1. Distribution of canola fields (yellow arrows) involved in the study conducted in the three prairie provinces of western Canada

K recommendations for SK

Soil Test (0-6”)	Cereals and Oilseeds	Barley and Pulses	Grass and Hay	Alfalfa and Clover
(ln. K/ac.)		lb/ac. of K20 to apply		
0-60	120-140	140-160	120-140	140-160
61-90	90-110	110-130	90-110	110-130
91-120	80-90	90-110	80-90	90-110
121-150	5-60	80-90	60-70	80-90
151-180	15-25	50-60	50-60	60-70
181-210	10-20	10-20	30-40	50-60
211-350	0 or 15	0 or 15	0-30	40-50

http://www.agriculture.gov.sk.ca/Crops/ Soil, Fertility and Nutrients/ Potassium fertilization in crop production

Other questions for K fertility

- Has field been affected by severe wind erosion?
- Is field light textured?
- Is growth stunted with smaller leaves and thinner stems
- Leaf edges brown and leaves drop off early
- Consider evaluation by plant root simulator (PRS probe)

Sulphur fertility

- Irrigated soils
  - 4-5 lb S/ac-inch of irrigation water
  - Subsoil S often has adequate supply if well distributed
  - Irrigated fields receive 6-12 inches of irrigation water
  - Canola needs 35-40 lb S/ac
  - Only risk under irrigation is uniform rainfall in May and June as in 2010.
  - Insurance of 5-10 lb sulphate-S/ac in broadcast blend
  - Topdress of 10 lb S/ac needed if no irrigation in June

Conclusion

- Canola has high nutrient requirements
- Current varieties have excellent genetic yield potential
- Need to explore innovative ideas to provide these nutrients in environmentally safe manner with agronomic effectiveness

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