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Sustainable Cropping System Platforms for Biodiesel Feedstock Quantity and Quality (SBQQ)

4F CROPS
March 24, 2009
Madrid

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Canada

Higher Canola Production

- It is estimated that there will be a demand for 15 million tonnes of Canadian canola by 2015 – 2.5 million tonnes for biodiesel feedstock
- In 2008, Canada grew 10.9 million tonnes of canola on 6.4 million hectares – a new record!
- As canola growers shorten rotations and reduce crop diversity to grow more canola, disease, weed, and insect outbreak risks will increase and threaten canola biodiesel feedstock quantity and quality.

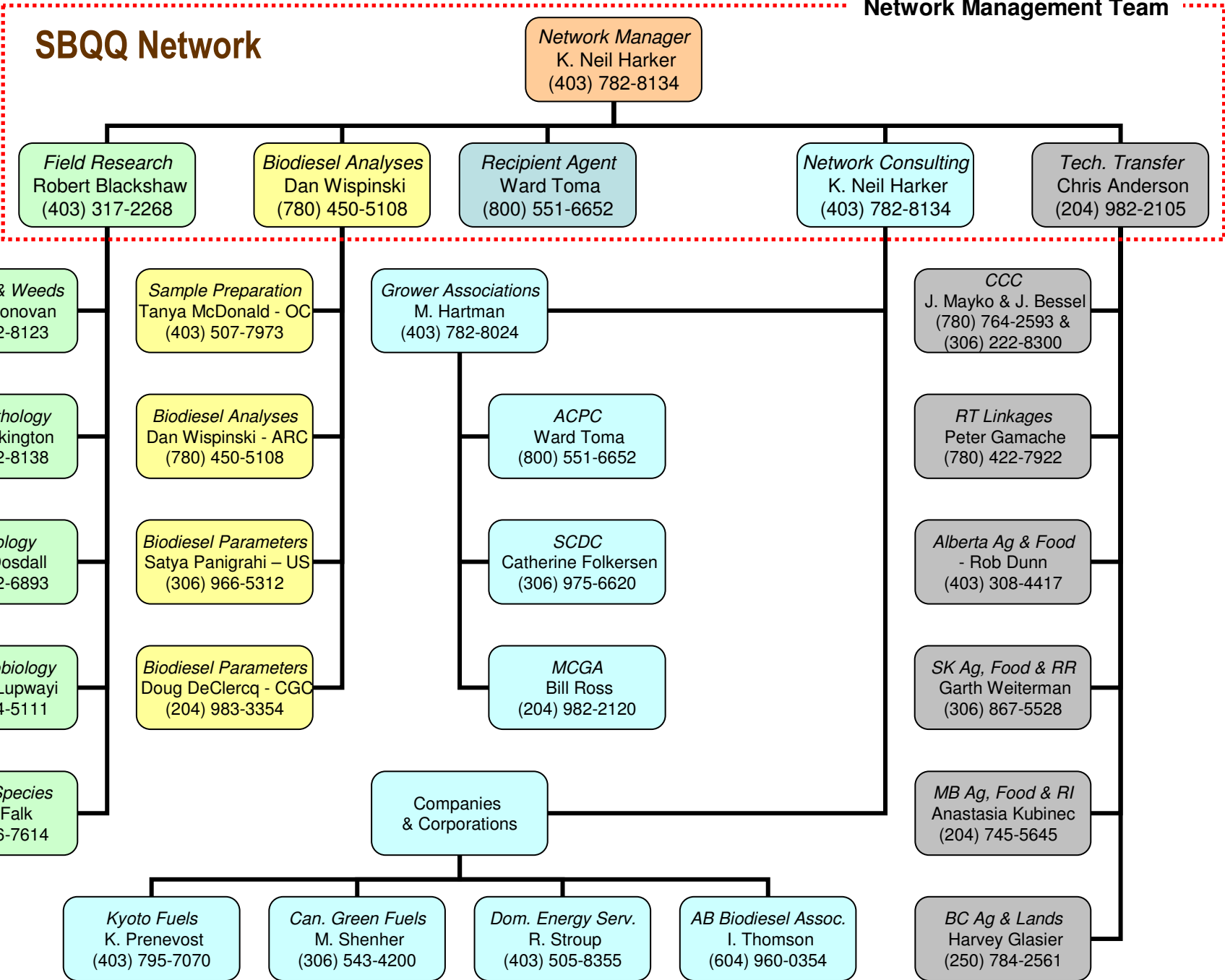


Flea beetles – Lacombe 2008



Key Questions...

1. What are the agronomic and economic implications of growing canola more frequently in rotations?
2. What are the agronomic risks of continuously grown canola if cultivars are rotated over years or grown in mixtures with other cultivars?
3. Will higher than normal input levels (seed, fertilizer, pesticides) substantially increase canola yields and profitability?
4. Are there western Canada oilseed species other than canola that would be suitable as a biodiesel feedstock?
5. How is canola food-oil quality and biodiesel quality affected by agronomic management, soil type, and environmental conditions?



Hypothesis...

- Environment (sites and years) and Agronomics (rotations, fertilizer, disease, insects & weeds) will influence:

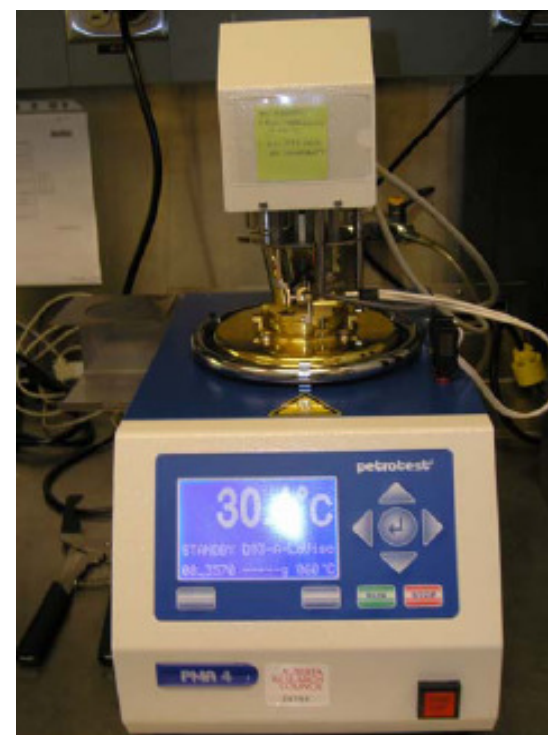
- **Canola Oil Food Quality**

- Fatty acid profiles

- **Biodiesel Quality Parameters**

- Acid number
- Phosphorous content
- Cold soak (fuel filter blocking potential)
- Free & total glycerin
- Na⁺, K⁺, Ca⁺⁺, Mg⁺⁺ metal ions
- Oxidation stability
- Kinematic viscosity
- Cloud point
- Cetane

Funding:
ABIP
PCARP
ACIDF



Auto Flashpoint determination

Experiment 1 – Test #85

- All Phases Rotation Study
- Key Questions 1, 2, 5, 6
- Locations (5): Lacombe, Lethbridge, Scott, Melfort, Swift Current
- 2008 – 2013
- 2 HR Canolas: Continuous vs. 1-in-2, vs. 1-in-3, vs. 1-in-3 diverse
- 13 Treatments

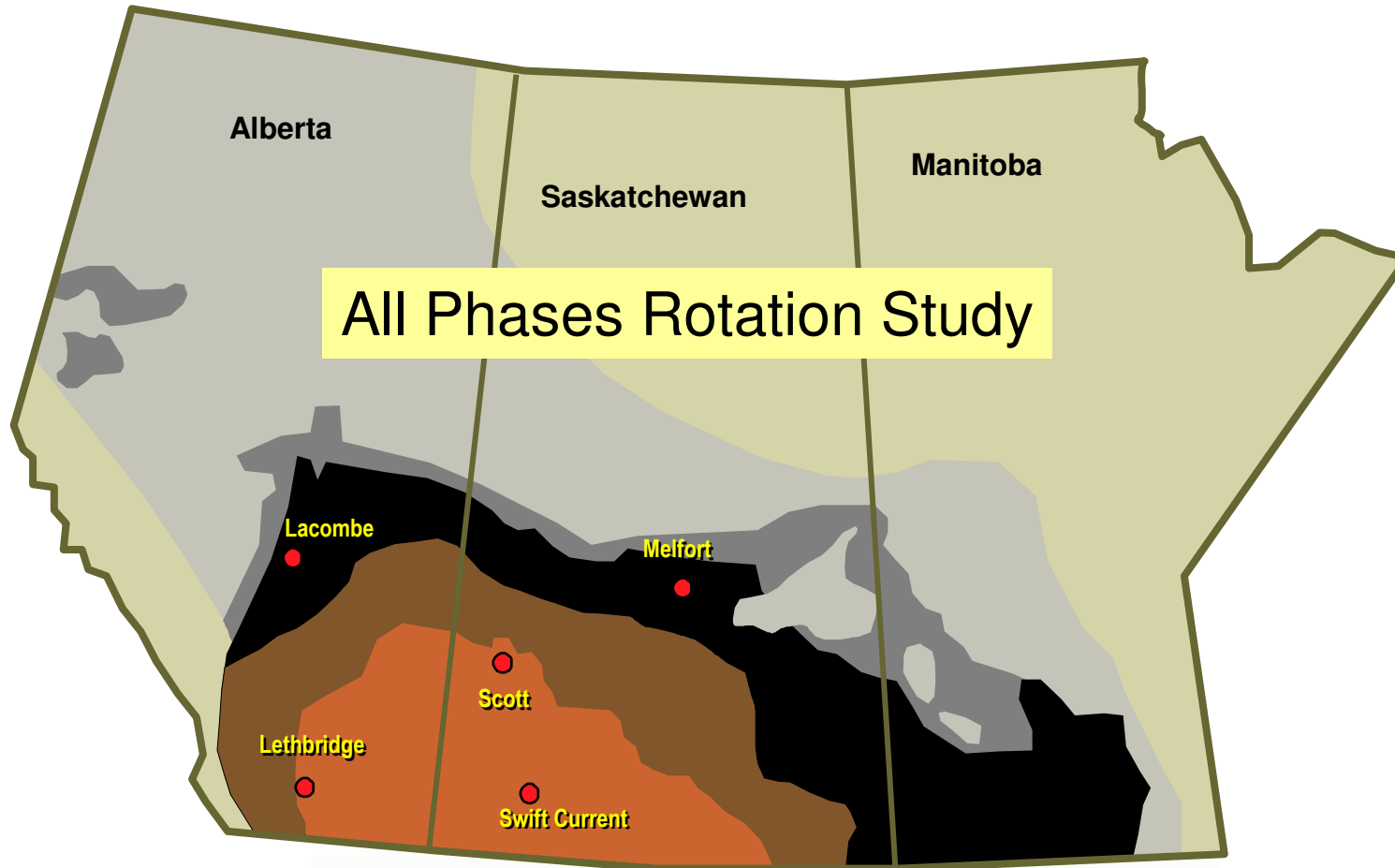


Cold Soak: ppt. above cloud point

Experiment 1 - Treatments

<u>Treatments:</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>
1.	LL	LL	LL	LL	LL	LL
2.	RR	RR	RR	RR	RR	RR
3.	LL	W	LL	W	LL	W
4.	W	LL	W	LL	W	LL
5.	RR	W	RR	W	RR	W
6.	W	RR	W	RR	W	RR
7.	LL	P	B	LL	P	B
8.	P	B	LL	P	B	LL
9.	B	LL	P	B	LL	P
10.	RR	P	B	RR	P	B
11.	P	B	RR	P	B	RR
12.	B	RR	P	B	RR	P
13.	L	W	LL	P	B	RR

Red = Biodiesel analyses



All Phases Rotation Study

Alberta

Saskatchewan

Manitoba

Lacombe

Melfort

Lethbridge

Scott

Swift Current

Soil types:



Gray



Dark Gray



Black



Dark Brown



Brown

Disease Risks...





Experiment 2 – Test #86

- Risk Mitigation Strategies in High Frequency Canola Rotations
- Key Questions 1, 2, 5, 6
- Locations (5): Lacombe, Beaverlodge, Edmonton, Melfort, Brandon
- 2008 - 2010
- 3 HR Canolas: Cultivar types within HR system vs. rotating HR systems vs. HR mixes vs. diverse or stacked rotations
- 14 Treatments

Experiment 2 - Treatments

Treatment	2008	2009	2010
1.	RR1	RR2	RR3
2.	LL1	LL2	RR3
3.	CF1	CF2	RR3
4.	RR1	LL1	RR3
5.	RR1	CF1	RR3
6.	LL1	RR1	RR3
7.	LL1	CF1	RR3
8.	RR1-2	RR1-2	RR3
9.	LL1-2	LL1-2	RR3
10.	RR1-2	CF1-2	RR3
11.	W1	LL1	RR3
12.	P	W1	RR3
13.	W1	W1	RR3
14.	Wes	Wes	RR3



Risk Mitigation Strategies

Soil types:



Gray



Dark Gray



Black



Dark Brown



Brown

Weed Risks...



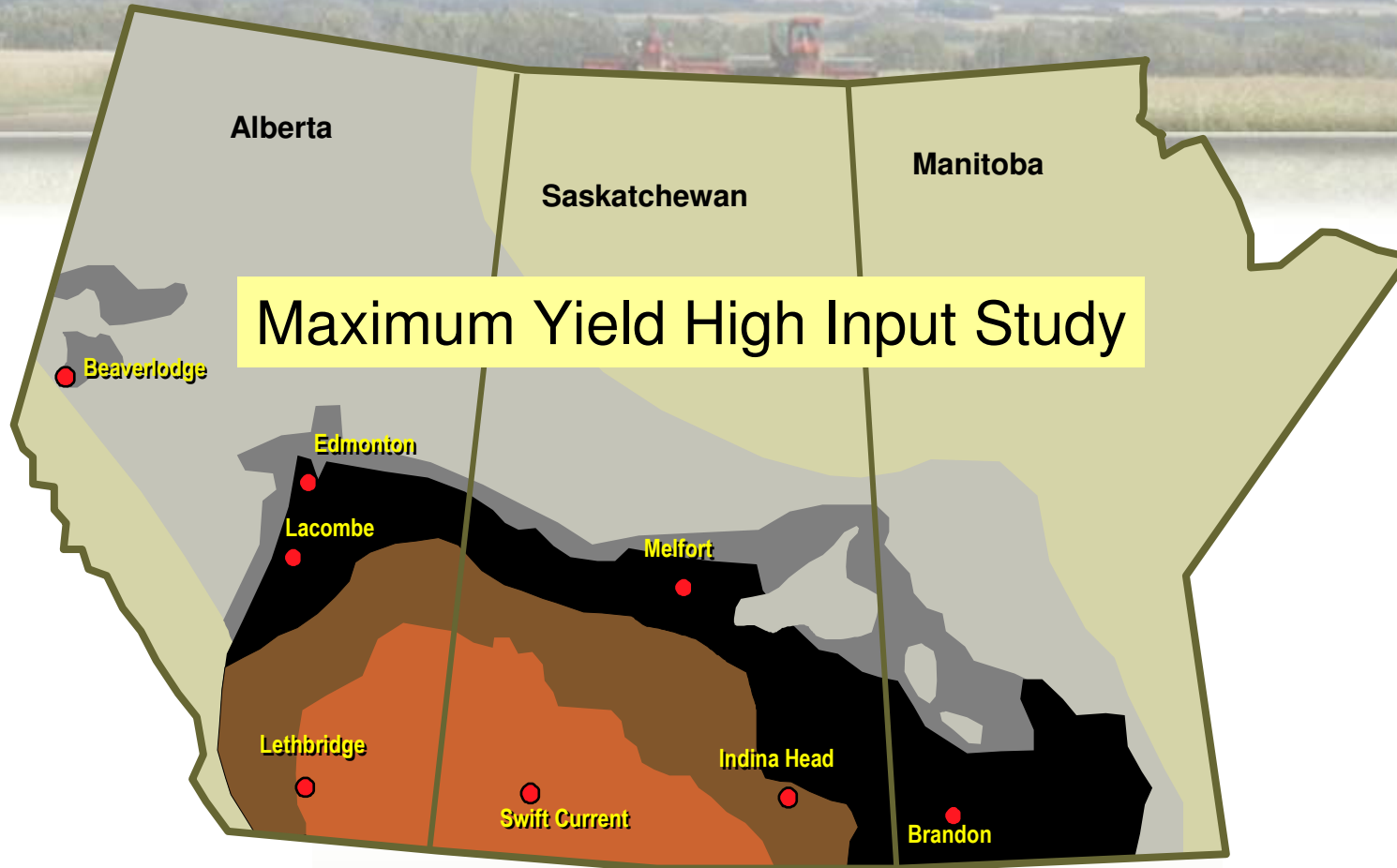


Experiment 3 – Test #87

- Maximum Yield High Input Study
- Key Questions 3, 5, 6
- Locations (8): Lacombe, Beaverlodge, Lethbridge, Edmonton, Indian Head, Swift Current, Melfort, Brandon
- 2008 - 2010
- 100% Fertilizer rate (NPKS) – target yields of 70 bu/ac
- 150% Fertilizer rate = 150% N + 100% PKS
- Herbicides and Insecticides applied to all plots as needed at recommended rates - at least 1 treatment, additional treatments as required
- Fungicide package - at least 1 treatment for sclerotinia, additional fungicides as required
- 15 Treatments

Experiment 3 - Treatments

Treatments:	2008	2009	2010
1. 75 seeds - 100% Fertilizer	LL1	W1	RR1
2. 75 seeds - 100% Fertilizer + Fungicide	LL1	W1	RR1
3. 75 seeds - 100% Fertilizer (50-50 ESN) + Fungicide	LL1	W1	RR1
4. 75 seeds - 150% N Fertilizer	LL1	W1	RR1
5. 75 seeds - 150% N Fertilizer + Fungicide	LL1	W1	RR1
6. 75 seeds - 150% N Fertilizer (50-50 ESN) + Fungicide	LL1	W1	RR1
7. 150 seeds - 100% Fertilizer	LL1	W1	RR1
8. 150 seeds - 100% Fertilizer + Fungicide	LL1	W1	RR1
9. 150 seeds - 100% Fertilizer (50-50 ESN) + Fungicide	LL1	W1	RR1
10. 150 seeds - 150% N Fertilizer	LL1	W1	RR1
11. 150 seeds - 150% N Fertilizer + Fungicide	LL1	W1	RR1
12. 150 seeds - 150% N Fertilizer (50-50 ESN) + Fungicide	LL1	W1	RR1
13. 75 seeds - 150% N Fertilizer (50-50 ESN) + Fungicide	RR1	LL1	RR1
14. 150 seeds - 150% N Fertilizer (50-50 ESN) + Fungicide	RR1	LL1	RR1
15. 150 seeds - 150% N Fertilizer + Fungicide	Wes	Wes	RR1



Soil types:




Experiment 4 – Test #88

- Alternative Species Biodiesel Potential
- Key Questions 4, 5, 6
- Locations (5): Lethbridge
Swift Current, Scott, Indian Head,
Morden
- 2008 & 2009
- Determine oil and biodiesel
quantity and quality
- 10 Treatments



Mass Spec. – SGs, saturated MGs, etc.

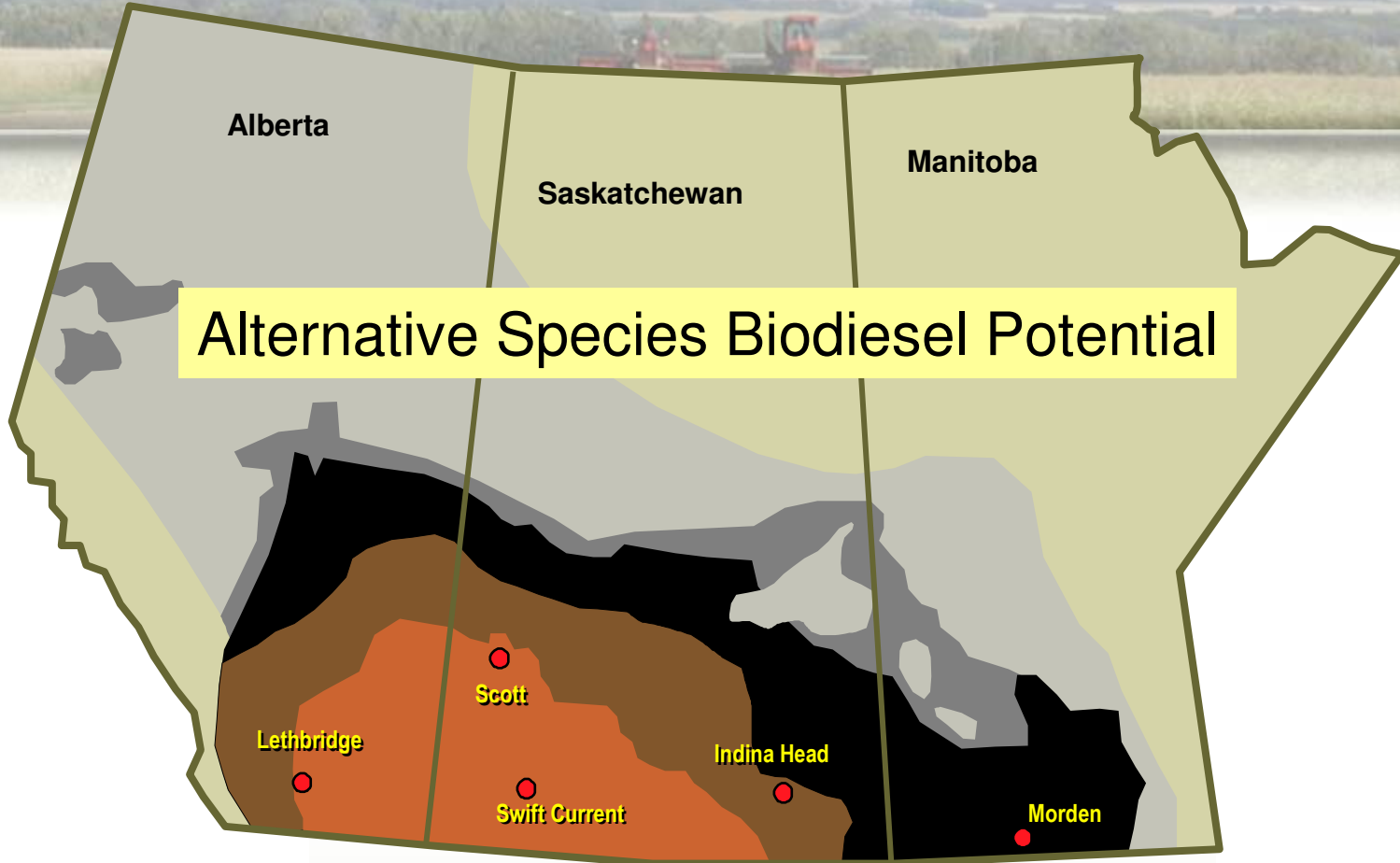


Experiment 4 - Treatments

Crop species treatments:

1. Argentine Canola LL hybrid 5440 (*Brassica napus*)
2. Polish Canola synthetic (*B. rapa*)
3. Camelina (*Camelina sativa*)
4. Ethiopian mustard (*B. carinata*)
5. Yellow mustard (*Sinapis alba*) Andante
6. Canola quality Juncea (*B. juncea*)
7. Oriental mustard (*B. juncea*) Cutlass
8. Flax (*Linum usitatissimum*) CDC Bethune
9. Soybean (*Glycine max*) – variety 1
10. Soybean (*Glycine max*) – variety 2

Biodiesel analyses – all 10 trts – in year 1 and 2



Alternative Species Biodiesel Potential

Soil types:

- | | | | |
|---|-----------|---|------------|
|  | Gray |  | Dark Brown |
|  | Dark Gray |  | Brown |
|  | Black | | |

Cetane Engine





Summary

- 2008 was the 1st year in the field
- Agronomic data collected at all sites
- Oil profile and biodiesel analyses underway
- Two more years of data collection (5 more – Expt. #1)

Acknowledgements...



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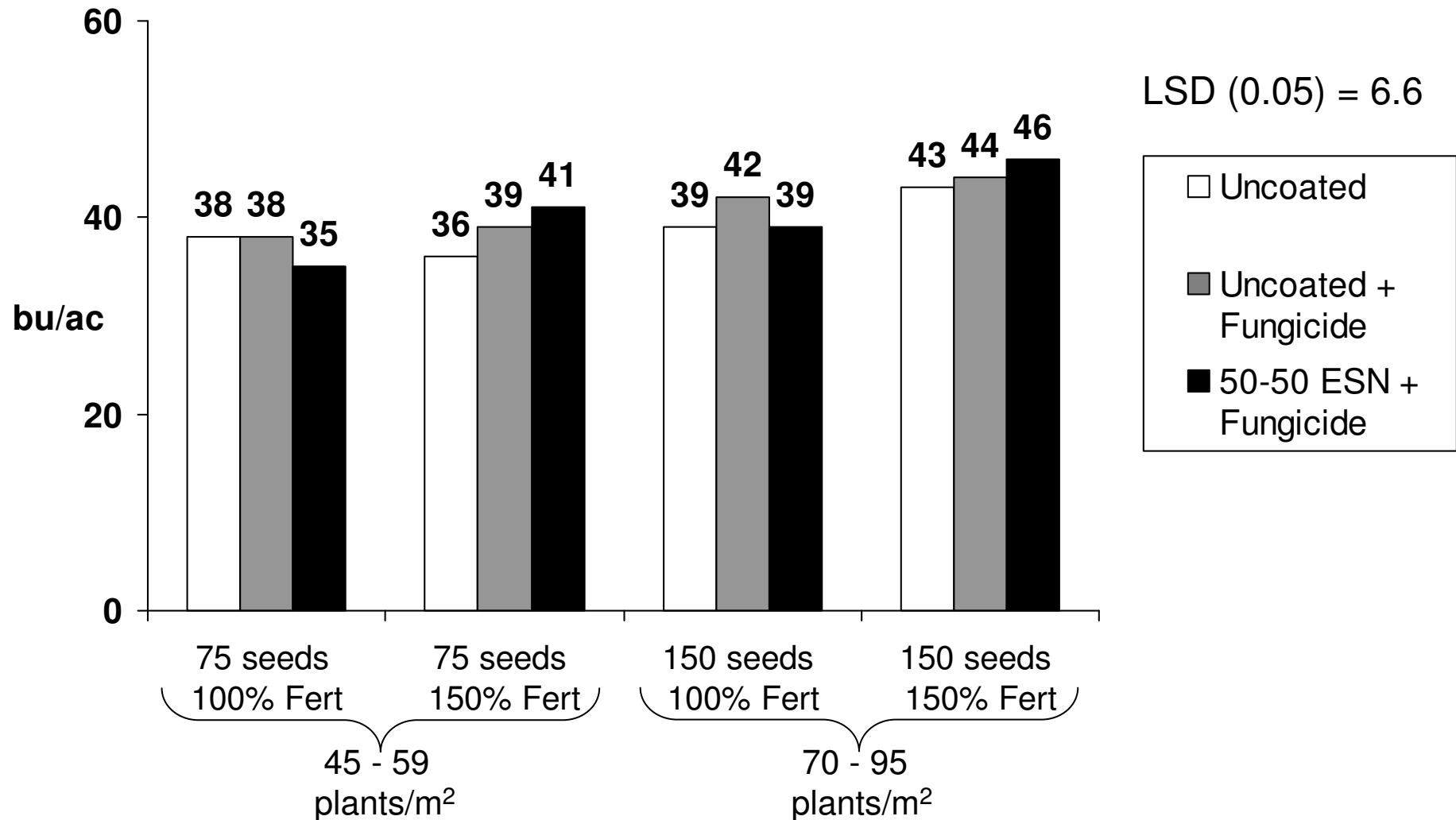
ABIP





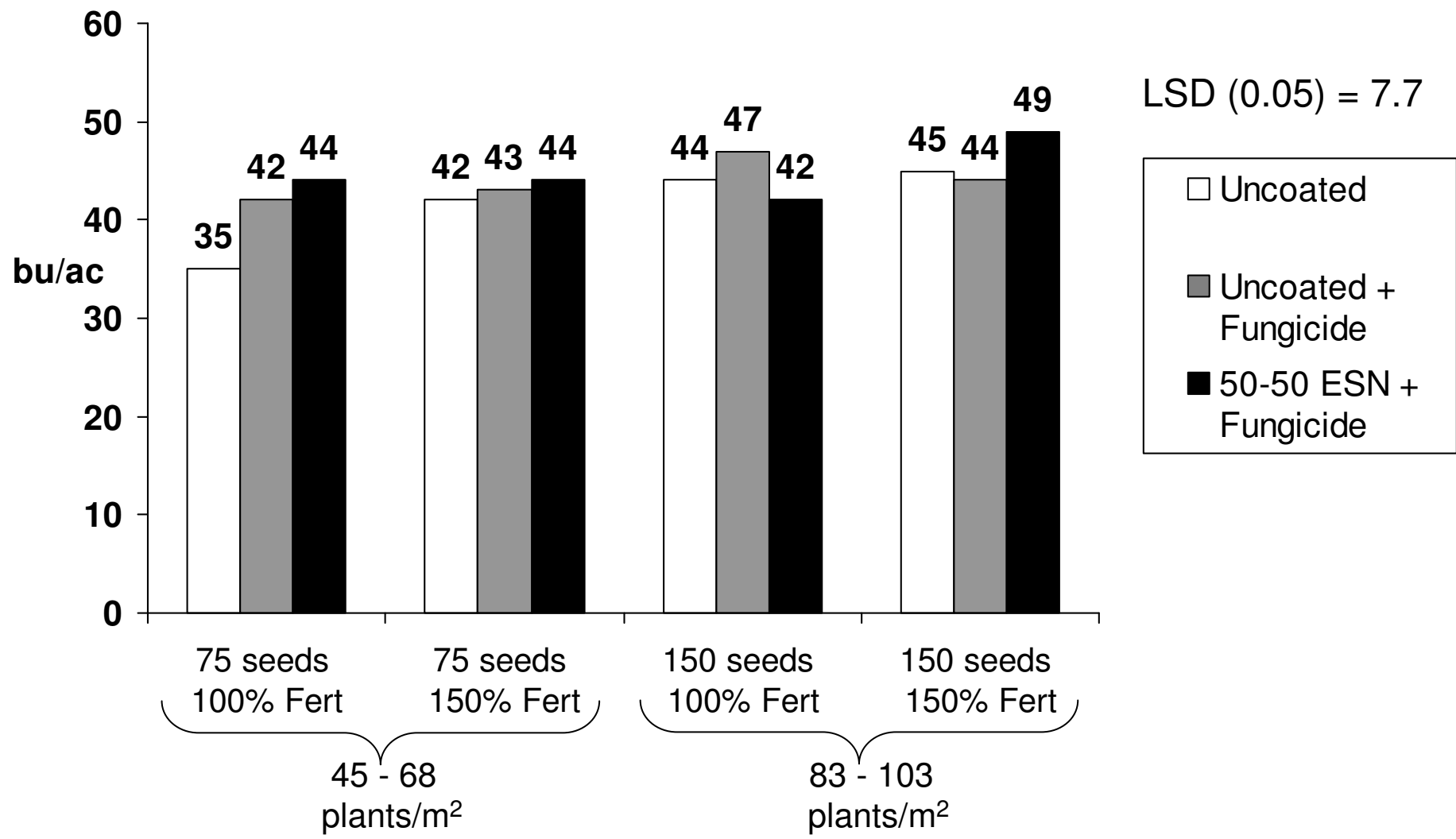
LL Canola – Brandon 2008

Grain Yield – bu/ac



LL Canola – Beaverlodge 2008

Grain Yield – bu/ac



Other Canola – Indian Head 2008

Grain Yield – bu/ac

