Soybean Agronomy for the Canadian Prairies

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IHARF Soil and Crop Management Seminar
Southey, SK - February 5, 2014

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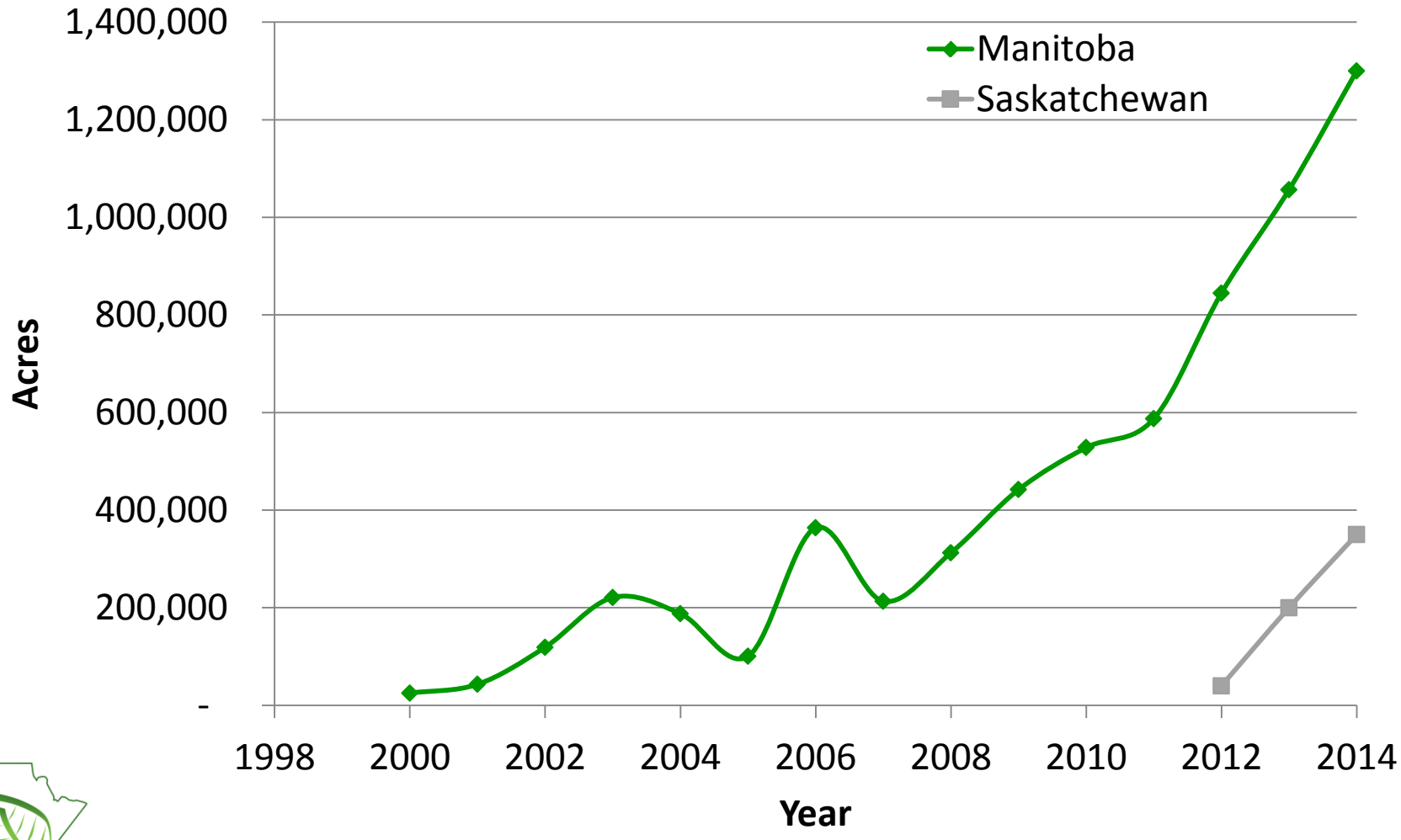
Soybean acres on Prairies



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The Soybean Plant

Glycine max.

- Warm season
- Broadleaf
- Legume
- Indeterminate
- Branches

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Outline

- Crop Rotation and Field Selection
- Fertility
- Seeding rate and row spacing
- Volunteer canola
- Insects and Diseases
- Seasonal Water Use
- Lessons from Manitoba

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The Bean Report

Your source for soybean and pulse crop agronomy and research.

Crop Rotation

- Before soybean = cereal

Previous Crop		Crop Planted						
	Soybean	HRS	Barley	Oat	Canola	Flax	Sunflower	Corn
Soybean	95	106	106	105	98	100	92	103
HRS	103	85	98	101	104	104	101	100
Barley	100	89	84	93	100	96	97	99
Oat	99	90	86	82	92	95	100	93
Canola	101	102	103	104	85	88	95	95
Flax	96	98	110	97	104	73	98	74
Sunflower	99	99	102	96	82	NSD	88	99
Grain Corn	107	100	101	106	104	NSD	112	87

Source: Manitoba Agricultural Services Corporation – 2007-2012

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Crop Rotation

- What do canola and soybean have in common?
  - Sclerotinia
  - Roundup Ready = volunteers
  - Root rots

Pathogen	Optimal Environment	Alternate Hosts
Pythium spp.	Cold (10-15°C) Wet soil	Wide host range including **pulses, cereals, canola, alfalfa**
Rhizoctonia solani	Warm (20-27°C) Moist to wet soil	Wide host range including **pulses, cereals, canola, alfalfa**
Fusarium spp.	Warm (20-27°C) Dry to moist soil	Wide host range including **pulses, cereals, canola, alfalfa**
Phytophthora sojae	Warm (20-27°C) Wet soil	none

Source: Holly Derksen, MAFRD

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Crop Rotation

- After soybean = flax, oats, barley, wheat

Previous Crop		Crop Planted						
	Soybean	HRS	Barley	Oat	Canola	Flax	Sunflower	Corn
Soybean	**95**	**106**	**106**	**105**	**98**	**100**	**92**	**103**
HRS	103	85	98	101	104	104	101	100
Barley	100	89	84	93	100	96	97	99
Oat	99	90	86	82	92	95	100	93
Canola	101	102	103	104	85	88	95	95
Flax	96	98	110	97	104	73	98	74
Sunflower	99	99	102	96	82	NSD	88	99
Grain Corn	107	100	101	106	104	NSD	112	87

Source: Manitoba Agricultural Services Corporation – 2007-2012

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Field Selection – Soil factors

- Nitrate levels – low < 50 lbs
- Phosphorus – medium to high >10 ppm
- Salinity and Carbonates
- Tolerance to salinity

Barley

Wheat

Canola

Flax

Soybean

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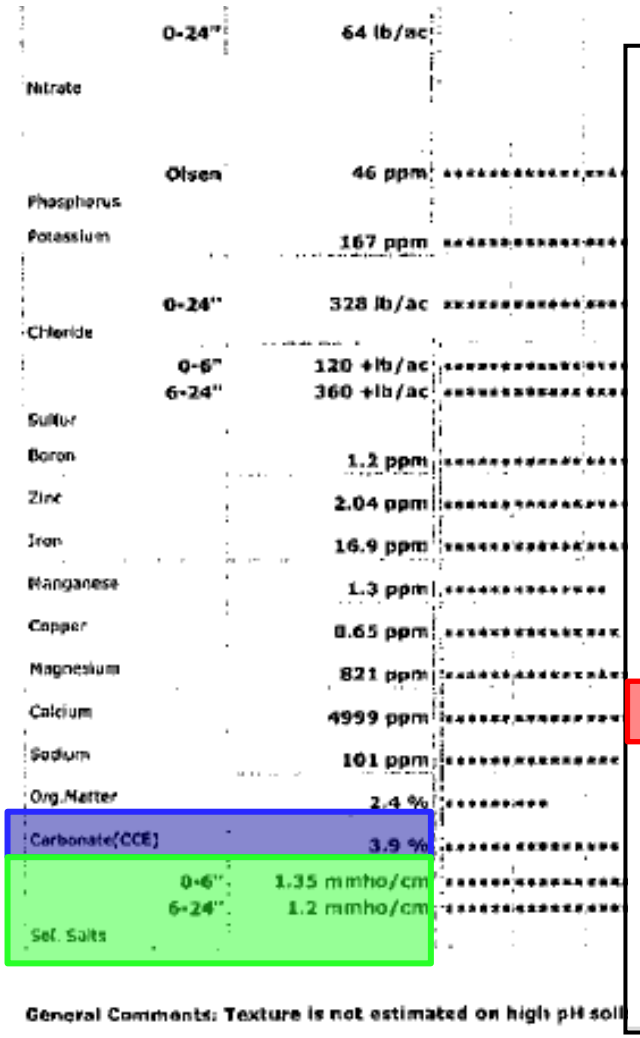
Assess Risk of Iron Deficiency Chlorosis (IDC)



Date Sampled 10/24/2013

Nitrate	0-24"	64 lb/ac
Phosphorus	Olsen	46 ppm
Potassium		167 ppm
Chloride	0-24"	328 lb/ac
Sulfur	0-6"	120 +lb/ac
	6-24"	360 +lb/ac
Boron		1.2 ppm
Zinc		2.04 ppm
Iron		16.9 ppm
Manganese		1.3 ppm
Copper		0.65 ppm
Magnesium		821 ppm
Calcium		4999 ppm
Sodium		101 ppm
Org.Matter		2.4 %
Carbonate(CCE)		3.9 %
Sol. Salts	0-6"	1.35 mmho/cm
	6-24"	1.2 mmho/cm

General Comments: Texture is not estimated on high pH soil

RISK OF IRON CHLOROSIS IN SOYBEANS

BASED ON CARBONATE AND SALT LEVEL

Carbonate Level Percent(%)	Soluble Salts mmhos/cm	Risk of Iron Chlorosis
0-2.5%	<0.5	Low
0-2.5%	0.51-1.0	Moderate
0-2.5%	>1.0	High
2.6-5.0%	0-.25	Low
2.6-5.0%	.26-.50	Moderate
2.6-5.0%	.51-1.0	High
2.6-5.0%	>1.0	Very High
>5.0%	0-.25	Moderate
>5.0%	.26-.50	High
>5.0%	.51-1.0	Very High
>5.0%	>1.0	Extreme

Source: AgVise

Varieties differ in their tolerance to IDC

VARIETY DESCRIPTIONS

Manitoba Variety Zone	Company Heat Unit	Maturity Grouping	Variety	[1]Type	Relative Days to Maturity[2] + / - of Check Average	2013	2012	Yield % Check	Site Years Tested	Hilum Colour	Relative Seeds/ lb	Lodging[3] Clay	Loam	IDC[4] Rating (1– 5)	Grouping	Notes[5]
	2300	00.1	P001T34R	RR1	-10	-12	-8	75	11	BR	2935	1.0	1.0	2.0	ST	–
	2300	000	NSC Moosomin RR2Y	R2Y	-8	-8	–	82	6	BR	3209	1.0	1.2	2.5	S	–
	2325	000	Pekko R2	R2Y	-5	-5	-5	96	16	BL	2389	1.0	1.3	2.1	ST	–
Short Season Zone	2325	00.1	NSC Reston RR2Y	R2Y	-5	-5	-4	101	12	BL	2653	1.2	2.3	2.9	S	1k
	2325	00.1	23-10RY	R2Y	-4	-4	-4	96	18	BL	3128	1.1	1.4	1.8	ST	1c
	2400	00.7	S007-Y4	R2Y	-4	-4	–	104	6	IY	2441	1.0	1.7	2.0	ST	1k
	2450	00.2	Bishop R2	R2Y	-4	-4	-3	94	17	IY	2987	1.3	2.3	2.8	S	–
	2350	00.2	NSC Anola RR2Y	R2Y	-3	-4	-1	102	16	BL	2930	1.1	2.0	1.8	ST	1c
	2425	00.4	TH 32004R2Y	R2Y	-3	-4	-1	105	18	BL	3400	1.4	2.2	1.7	ST	1c
			Experimental Lines that have been supported for registration in Canada													
			PH12005	R2Y	-5	-5	–	85	85	IY	2936	1.0	1.5	2.1	ST	–
			FLZ612A4	R2Y	-3	-3	–	100	6	BL	2965	1.2	2.0	1.7	T	–
			EXP00313R2	R2Y	-3	-3	–	99	6	BL	2550	1.3	2.0	1.8	ST	SCN
			LS002R24N	R2Y	-2	-2	–	101	6	BL	2500	1.6	2.3	1.9	ST	–
	2375	00.2	LS 002R23	R2Y	-2	-2	-1	102	12	BL	2719	1.1	1.5	1.9	ST	–
	2450	00.7	S00-B7	R2Y	-2	-4	0	93	11	BL	2377	2.1	2.5	2.3	S	1a
	2400	00.3	TH 33003R2Y	R2Y	-1	-2	0	101	15	BR	3200	1.4	2.3	1.7	ST	1c
	2475	00.6	Chadburn R2	R2Y	-1	-1	-1	100	19	BL	3086	1.0	1.5	1.7	T	–
	2375	00.3	McLeod R2	R2Y	-1	-2	0	104	12	BL	2473	1.1	1.3	1.7	T	–
	2350	00.3	Vito R2	R2Y	-1	-1	-1	96	16	GR	3160	1.5	2.3	1.7	ST	1k
	2375	00.4	NSC Libau RR2Y	R2Y	-1	0	-1	100	18	BL	2800	1.0	1.6	1.8	ST	1c
	2375	00.4	NSC Tilston RR2Y	R2Y	0	-1	1	101	16	BL	2965	1.1	2.4	1.9	ST	–
Mid Season Zone	2425	00.5	NSC Elie RR2Y	R2Y	0	-1	1	104	19	BL	2673	1.0	1.8	2.3	ST	1k
	2425	00.4	004R21	R2Y	0	0	0	100	22	BL	3153	1.0	1.9	1.6	T	1a
	2425	00.5	24-10RY	R2Y	0	0	0	104	22	IB	2645	1.0	1.8	2.2	ST	1k
	2425	00.6	900Y61	RR1	1	-1	2	96	18	BR	2608	1.0	1.5	1.6	T	1c
	2450	00.7	900Y71	RR1	1	1	1	98	18	IY	2935	1.0	1.9	1.7	T	1c
	2450	00.5	Gray R2	R2Y	1	0	1	101	12	BL	3300	1.0	1.5	2.0	ST	1c
	2425	00.8	Sampsa R2	R2Y	1	0	1	106	14	IB	2092	1.0	1.3	2.0	ST	1c
	2425	00.3	LS 003R22	R2Y	1	1	0	101	18	BL	2827	1.1	2.1	1.8	ST	–
	2450	00.6	HS 006RYS24	R2Y	1	1	1	103	17	BL	2900	1.1	2.1	1.7	T	SCN
	2500	00.8	Beurling R2	R2Y	1	0	2	94	17	BL	3220	2.4	3.1	2.1	ST	–
			Experimental Lines that have been supported for registration in Canada													
			NSC Gladstone RR2Y	R2Y	-1	-1	–	99	6	BL	2620	1.1	2.8	1.8	ST	–
			TH 33005R2Y	R2Y	-1	-2	1	113	12	BL	2500	1.1	1.8	1.8	ST	1c,1k
			S00-N6	R2Y	0	0	–	99	6	BL	3006	1.1	2.6	2.5	S	–
			TH 34006R2Y	R2Y	0	0	–	106	6	BL	2800	1.1	2.0	2.3	S	–
			SC2380 R2	R2Y	1	1	–	98	6	BL	2830	1.2	3.0	2.0	ST	1c
			CFS 12.302R2	R2Y	-1	-2	0	104	11	BL	2142	1.1	2.3	NT	NT	–

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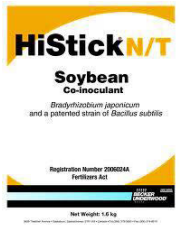
Soybean Fertility - **Nitrogen**

- Inoculant required:
  - Liquid
  - Peat
  - Granular
- Most popular = Liquid + Granular or Liquid + Peat
- It's not a matter of *which* inoculant you use,
- But that you use one!
- If using a seed treatment, make sure they are compatible



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Soybean Fertility - **Phosphorus**

1. Soybeans require, take up and remove large amounts of P
   - Remove 0.8-1.1 lbs P_2O_5 / bu
2. Sensitive to seed placed P
   - Stand reduction
3. Respond differently to applied P
   - More efficient at extracting soil P than fertilizer P

Table 2. Seed-placed fertilizer effect on soybean emergence relative to the check. Preliminary data from 2013 soybean studies in Manitoba (G. Bardella). Soybeans seeded in 9-inch rows.

	% Soybean Emergence		
Rate of MAP 11-52-0	Melita	Arborg	Beausejour
lb P_2O_5/ac	*Souris loamy sand*	*Eyala clay*	*Osborne clay*
0	100	100	100
20	64	92	103
40	65	87	106
80	29	73	103

(Heard, Grant and Flaten 2013)

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Soybean Fertility - **Phosphorus**

4. Yields are greater on soils with healthy P reserves
5. Fertilization strategies
   - Guidelines are not clear-cut
   - Balance P removals within your rotation
   - Probability of profitable crop response to applied P is medium to low when soil test P is > 10 ppm

Table 3. Soybean yield response to applied phosphorus on low and high P soils (Gyles Randall, University of Minnesota).

Applied P	Soybean Yield (bu/ac)	
lb P_2O_5/ac	Low P Soil	High P Soil
0	34.5	49.1
25/20*	35.9	49.4
50/40*	38.7	48.9

* The higher rate was applied to the low P soil, the lower rate to the high P soil. Fertilizer was applied to the previous corn crop.

(Heard, Grant and Flaten 2013)

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Soybean Fertility - **Potassium**

1. Soybeans require, take up and remove a lot of K
   - 1.2 lbs K_2O / bu removed with seed (Heard, 2005)
2. Fields risk factors
   - Sandy soils
   - High frequency of soybean, alfalfa, corn
   - Drought can induce deficiency
3. Critical soil test level is <u>150-200 lbs/ac</u>
4. Scout in August when uptake rate can exceed 4 lbs/day

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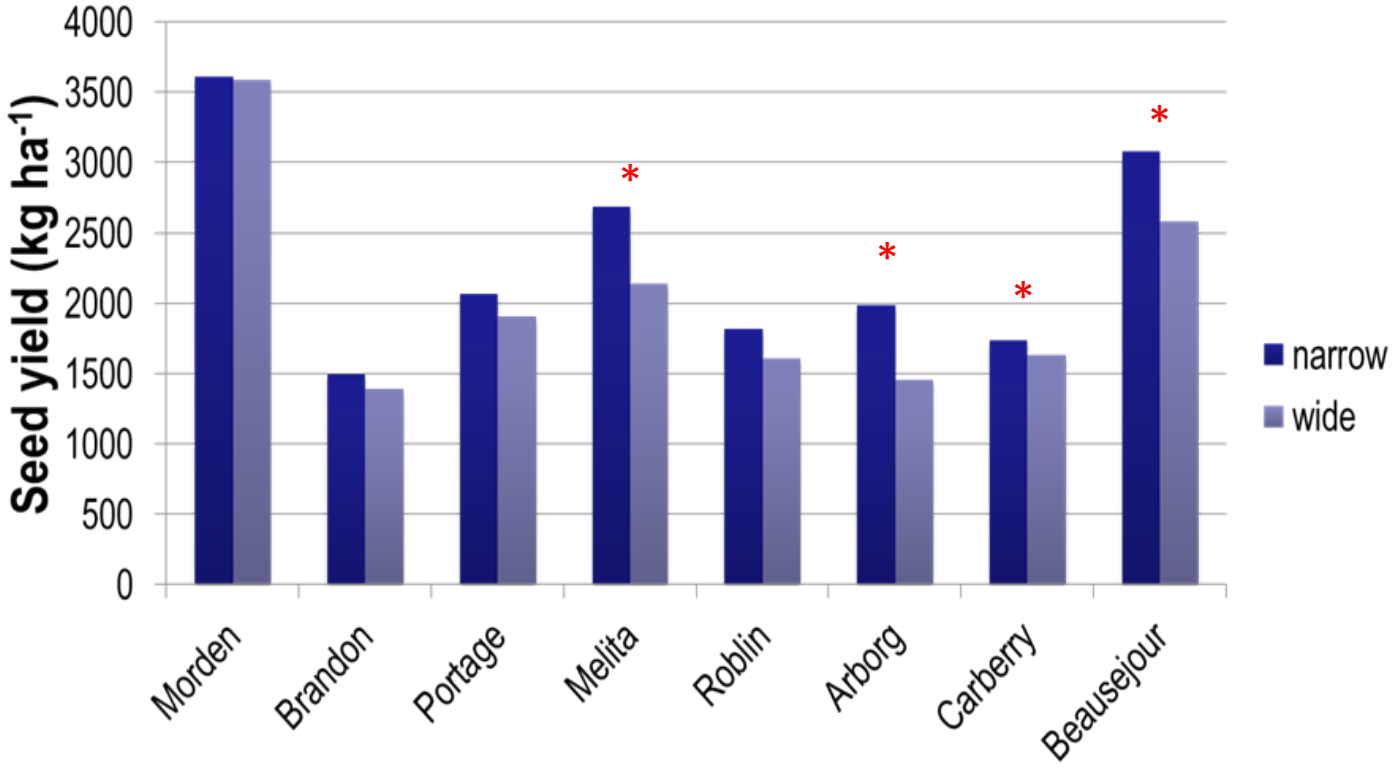
Row Spacing

- In Manitoba, 68% of soybeans are solid seeded
  - 20% - 30 inch rows
  - 8% - 15 inch rows
  - 5% - 20 inch rows w. drill
- #1 factor should be equipment availability
- YIELD?

Narrow rows have higher yield potential



(Preliminary results from Mohr et al. 2012)

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Pros and Cons

	DRILL	PLANTER
Seeding rate/cost		✓ Lower
Emergence		✓ i.e. soils prone to crusting
Canopy closure	✓ Faster	
Weed competition	✓ Good	
Disease risk		✓ Lower
Yield potential	✓ Higher	Can be similar i.e. long season areas

- Economics are similar between seeders and planters
- Use what you have available
- Ideal = narrow rows + precision of planter i.e. 15”

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Seeding Rate

Row Spacing	Seeding Rate
Solid	**200-210,000 seeds/ac**
15”	175-185,000 seeds/ac
30”	160-170,000 seeds/ac

- Target plant stand is **<u>150,000 plants/ac</u>** (NDSU)
- Seed survival is low
  - 1st trifoliate 71%
  - Pre-harvest 62% (Tone Ag 2012-2013)
    - Germination
    - Seed cracks
    - Root rots/seedling diseases
    - Weed competition, intraspecific competition

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100% of yield at 120-160,000 plants/ac

(Guelph, Purdue)

140,000 plants/ac vs. 180,000 plants/ac

Assess your plant population
Aim for 150,000 plants/ac or 3.5 plants/sq ft

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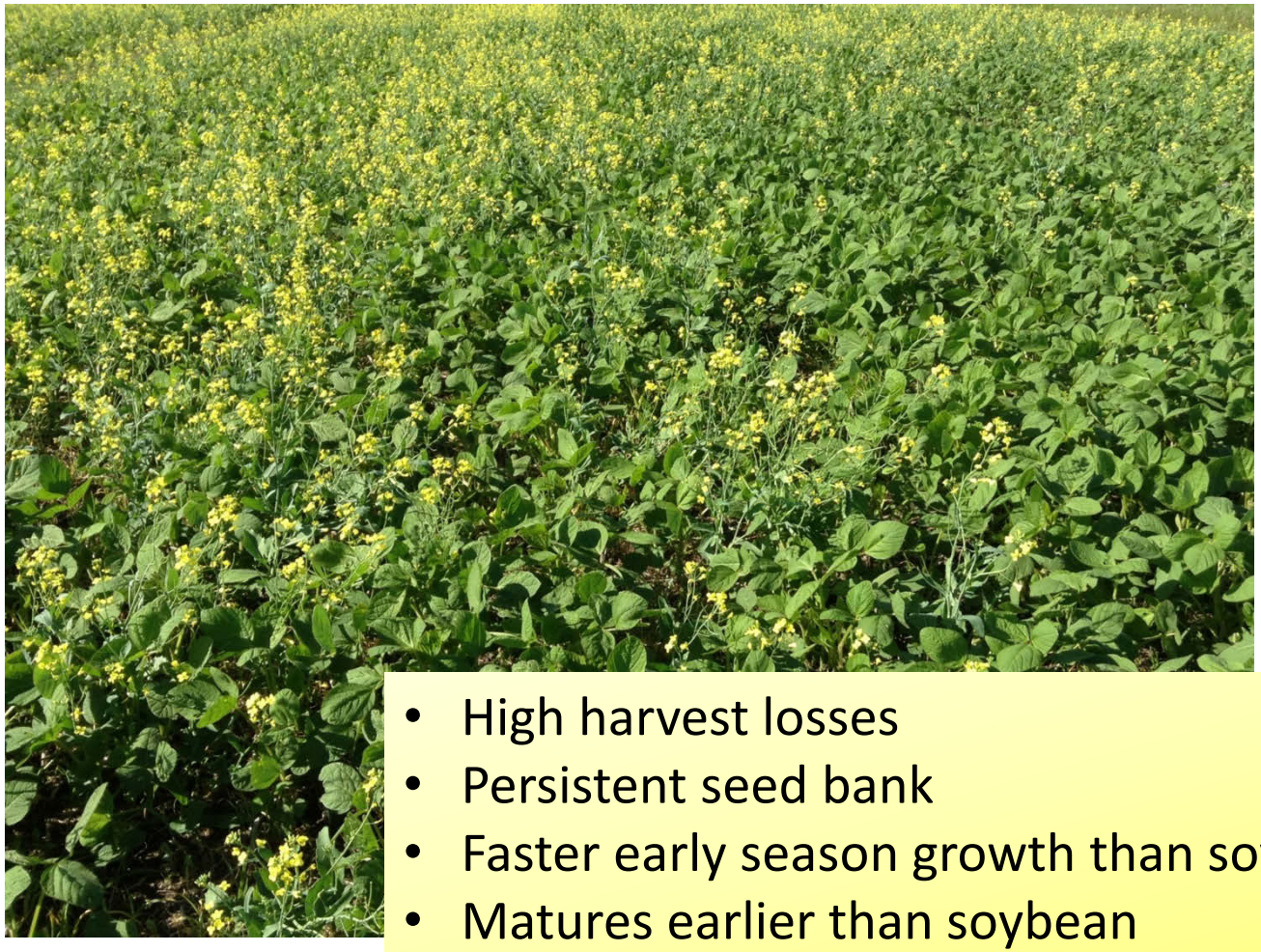
Volunteer RR Canola #1 Weed



- High harvest losses
- Persistent seed bank
- Faster early season growth than soybean
- Matures earlier than soybean

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Herbicide Options

PRE SEED	Notes
CleanStart	• Group 9 + 14, vol canola 1-3 lf stage
Express SG*	• Group 2, vol canola up to 6 inches
Heat*	• Group 14, vol canola up to 8 lf

* must be mixed with glyphosate

IN CROP	Notes
Basagran Forte	• Group 6, do not tank mix with glyphosate
Odyssey	• Group 2, be aware of re-cropping restrictions
Pursuit	• Group 2, be aware of re-cropping restrictions
Viper ADV	• Group 2 + 6, do not mix with glyphosate

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HEAT powered by KIXOR herbicide

Basagran Forté herbicide

ODYSSEY

VIPER ADV HERBICIDE

EARLY fall harrow stimulates germination

(Geddes and Gulden, 2013)

Narrow rows are better for weed competition

(Gregoire and Gulden, 2013)

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Soybean Insects

Source: John Gavloski, MAFRD

Source: John Gavloski, MAFRD

Source: John Gavloski, MAFRD

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Soybean Insects

Source: John Gavloski, MAFRD

2012

Source: John Gavloski, MAFRD

2008, 2011

Source: John Gavloski, MAFRD

2010, 2013

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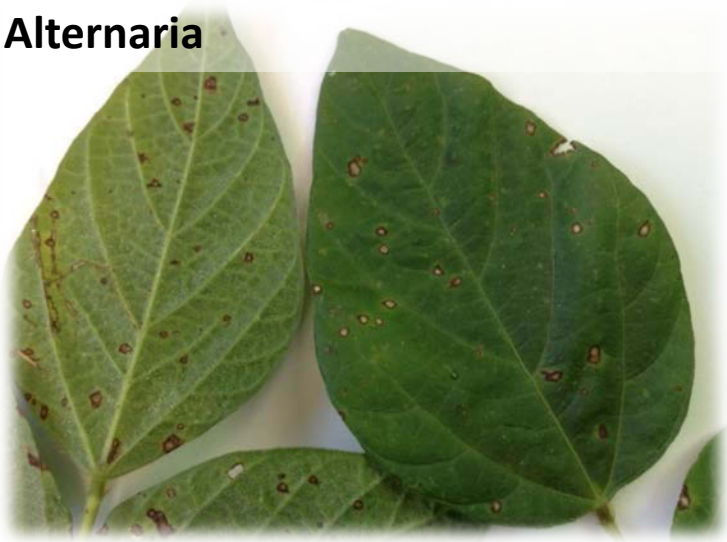
Soybean Leaf Diseases

Septoria

Bacterial Blight

Downy Mildew

Alternaria



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Is a fungicide application warranted?

In Northern growing regions, there is rarely significant disease pressure

Fungicide applications are not warranted

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White Mold of Soybean

Sclerotinia sclerotiorum

- Same pathogen that affects canola, sunflower etc.
- Soybeans are not like canola
  - Naturally more tolerant
- Highest levels observed in 2013
  - 40% of soybean fields surveyed in Aug/Sept had white mold
  - Majority at <10% incidence
- How is it affecting yield?

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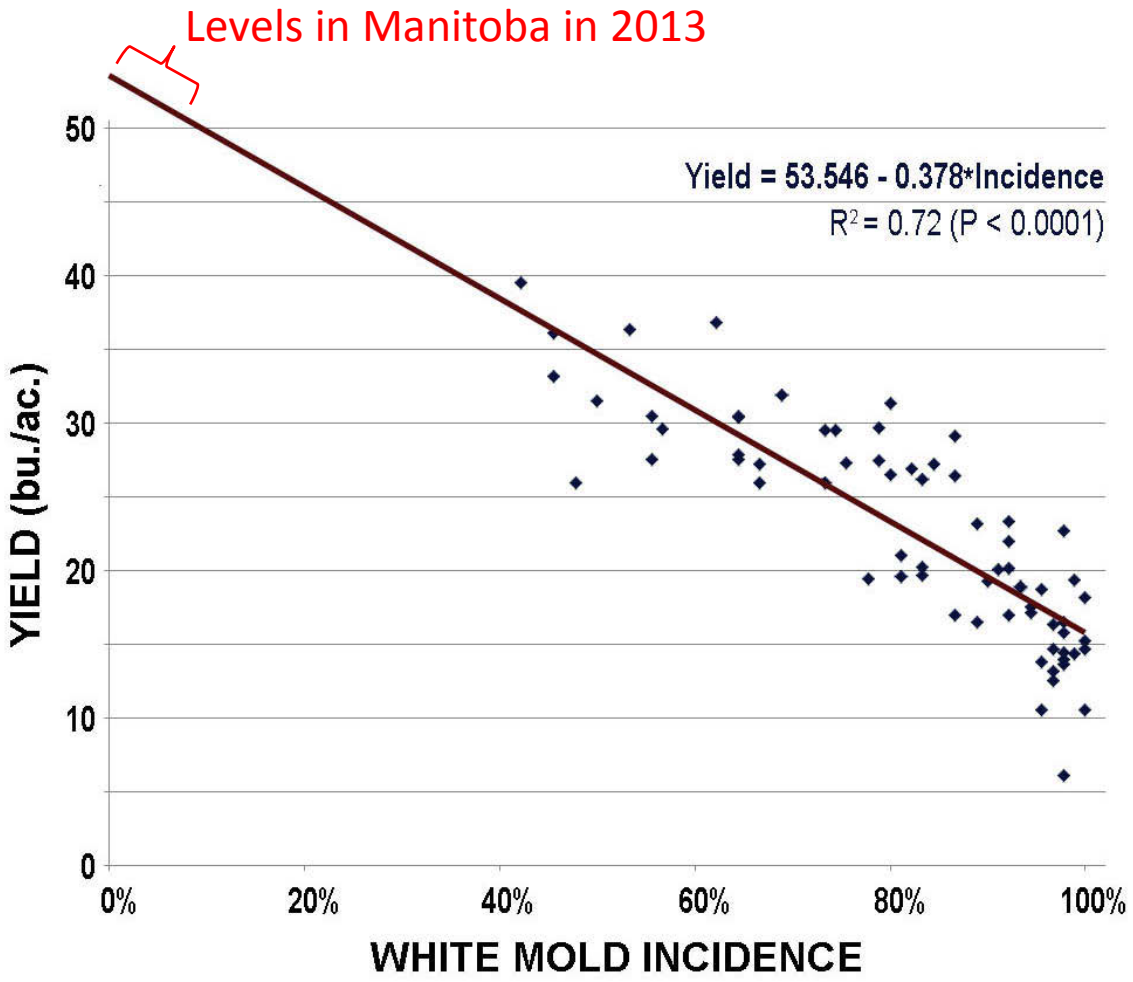
3.2 - 5.0 bu yield loss with 10% white mold



(Michael Wunsch, NDSU)

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Soybeans use more water

TABLE 3. Mean seasonal water use, growing season length, and daily water use rates of crops studied in 1977 and 1978 crop water use comparisons in eastern North Dakota[1]

Crop	Seasonal Water use inches	Days from emergence to maturity	Daily water use rate inches/day	Water use efficiency lb/a inch H_2O used
dry edible bean	10.2a[3]	71	0.14ab	218.7
spring wheat	11.9b	74	0.16c	128.1
barley	12.6b	86	0.15b	222.1
flax	13.7bc	102	0.13a	41.5
sunflower	14.9c	110	0.14a	119.7
corn	16.3d	113	0.14b	307.3
soybean	16.9d	131	0.13a	139.2
sugarbeet	20.4e	140	0.15b	1.0

[1]Average across years and locations for each crop.
[2]English tons raw beets/a/in H_2O; equal to 0.1 tons extractable sugar/a/in H_2O.
[3]Values in the same column followed by the same letter(s) do not differ significantly at the 10% probability level, according to Duncan's Multiple Range Test.

(Bauder and Ennen, 1978)

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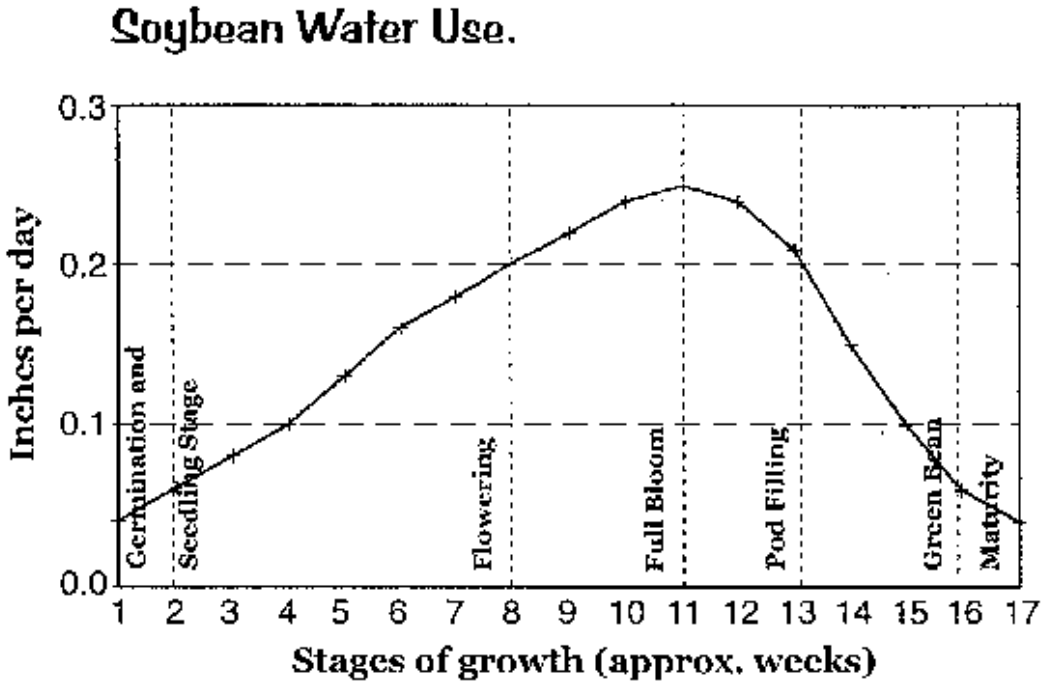
Water use is highest in August

25 mm = 2.5 bu soybeans (Lindsey and Thomison 2012)



Climatological Aspects of Irrigation Design Criteria in Mississippi
MAFES Technical Bulletin 138

Monthly Precipitation (mm)			
	Wynard	Regina	Brandon
M	49	53	50
J	75	75	74
J	67	64	76
A	**50**	**43**	**69**
Total	241	235	269

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1 inch of rain in August

Lessons from Manitoba

- Variety selection is key
  - Look at days to maturity, choose earliest variety
- Soybeans are not a “no-input” crop
  - Monitor soil nutrients
- Few insect or disease concerns... so far
  - Fungicides not warranted
- White mold often looks worse than it is
- Volunteer RR canola an important weed
  - Cultural and herbicide options

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Lessons from Manitoba

- Good fit for wet conditions
- Break in wheat-canola rotations
- Limitations – moisture, cool temperatures
- Harvest equipment is important
  - Flex > Rigid headers
- Research underway for Canadian zero till systems
  - Residue management
  - Effects of cool, wet soil in spring

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The Bean Report

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September 23, 2013

This week....

- Soybean harvest underway
- Pulse crop variety market share
- Fall frost update
  - NEW Soybean School West
- Soybean harvest checklist
  - Visual guide to harvest losses
  - Minimize compaction

In Every Issue.... Crop Conditions

Soybean harvest got underway last week but has been interrupted by periodic rainfall and it looks like it will be on hold this week in many parts of the province as thunderstorms roll through. A killing **frost** swept across parts of the province on the mornings of Sept 16 and 21, although some parts of Western Manitoba remain unaffected.

Thank you

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