On-farm soybean variety evaluation for suitability to organic and transition to organic production in southern Manitoba

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Introduction

Background:

- Manitoba is the most significant soybean producer in western Canada.
- Despite competitive prices, *organic* soybean production remains stagnant and dismal.
- Two challenges facing organic growers are lack of varietal choice and performance data under organic production
- Conventionally bred varieties may not be appropriate under organic conditions

Objective: Evaluate and identify non-GM soybean varieties suited to organic production systems

Fig. 1 Organic soybeans grown in 2014 at St-Pierre-Jolys

Results

Data Averages Across All Sites 2014 & 2015

In order of earliest maturity to latest

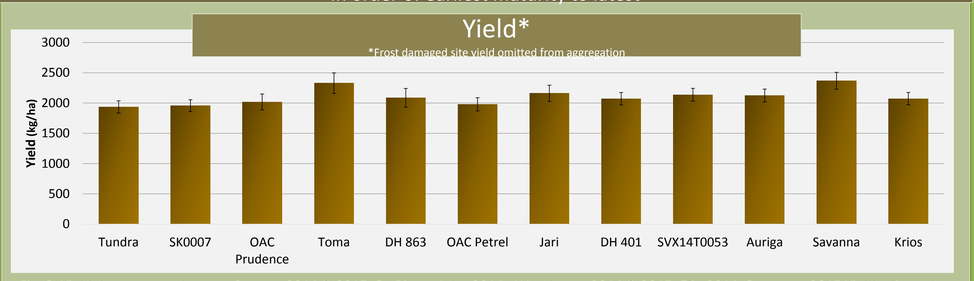

Fig. 3. Yield data averaged across Carman 2014 & 2015, St. Pierre-Jolys 2014 , Woodmore 2014 & 2015, Elie 2014. Somerset 2015 Yield adjusted to 13.5% moisture

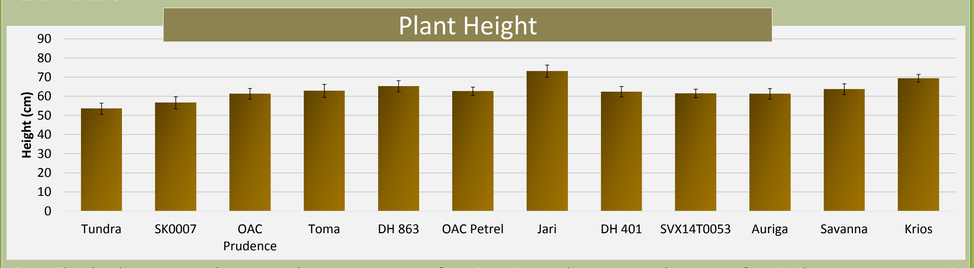

Fig. 4. Plant height at maturity data averaged across Carman 2014 & 2015, St. Pierre-Jolys 2014 , Woodmore 2014 & 2015, Elie 2014. Somerset 2015.

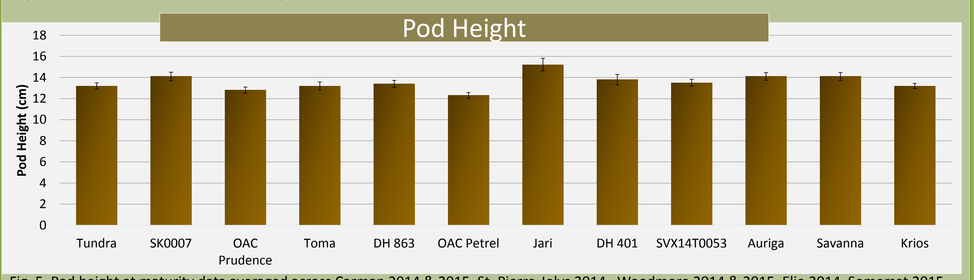

Fig. 5. Pod height at maturity data averaged across Carman 2014 & 2015, St. Pierre-Jolys 2014 , Woodmore 2014 & 2015, Elie 2014. Somerset 2015.

- Organic yields observed were comparable to conventional yields (figure 3)
- Estimated yields ranged from 1935 kg/ha (Tundra) to 2367 kg/ha (Savanna)
- Later maturing varieties outperformed early maturing varieties
- All varieties at Somerset and Swan Lake 2014 suffered yield loss and quality downgrades due to hard frost damage on September 12 2014
- Differences between plant and pod heights were observed amongst varieties; Jari outperforming most varieties, respectively (figures 4 and 5)

Yield Stability

Relationship between Variety Mean Yield and Site Mean Yield

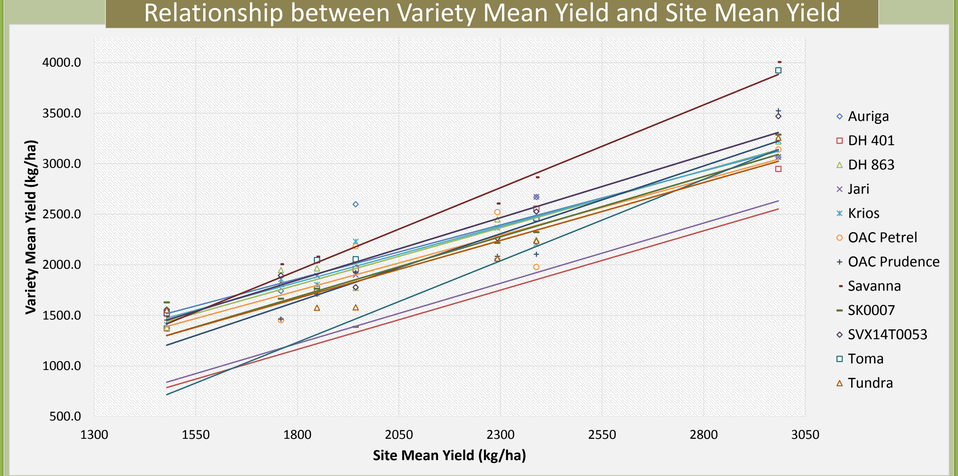

Fig. 6. Relative variety stability across all sites for Carman 2014 & 2015, St. Pierre-Jolys 2014 , Woodmore 2014 & 2015, Elie 2014. Somerset 2015.

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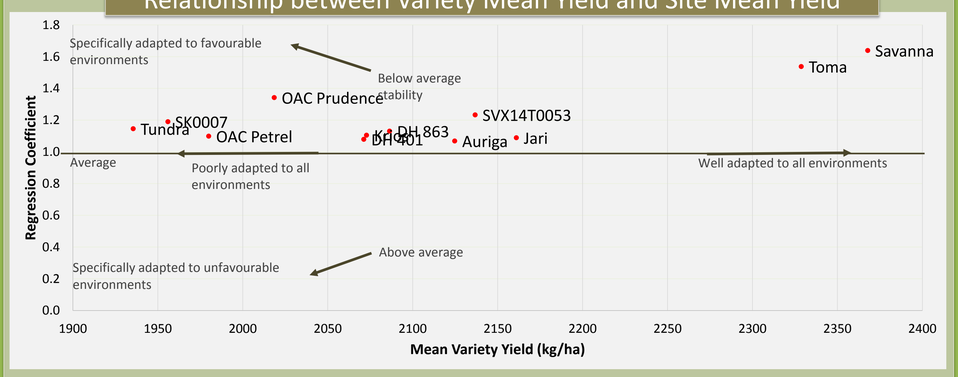

Fig. 7. Relative variety stability for Carman 2014 & 2015, St. Pierre-Jolys 2014 , Woodmore 2014 & 2015, Elie 2014. Somerset 2015.

- Savanna and Toma exhibited the highest yield and good stability across all sites, followed by SVX14T0053 (figure 6)
- All varieties exhibited adaptation responses to favourable conditions according to Wilkinson and Finlay (1963) varietal stability interpretation (figure 7)

Methods

- 10-12 varieties (table 1) were seeded at the Ian Morisson Research Station in Carman, and 5 organic farms in across southern Manitoba
- RCBD with four replicates at each site
- Varieties were seeded between May 21 and June 3, 2014 & 2015
- Plots received pre-emergence harrow, and inter-row cultivation four weeks after seeding
- Varieties were harvested at maturity

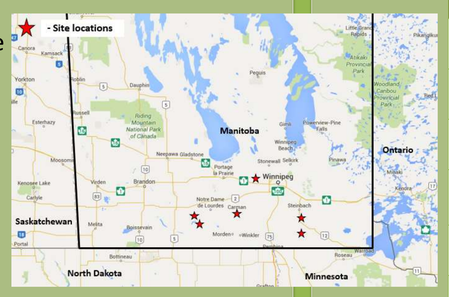

Fig. 2. Locations of testing sites across southern Manitoba. The red star indicates the site location. (Google Maps, 2015)

Measurements:

- Soil nutrient status (table 2)
- Plant Height at V3 and maturity
- Biomass (crop and weeds) at R1 and R5
- First pod height
- Yield

Table 1. Varieties evaluated, source, and company heat units (CHU)

Variety	Source	CHU
Tundra	Semences Prograin, Quebec	2350
SK0007	SK Foods, North Dakota	2375
OAC Prudence	Robert Wiens, Domain, Manitoba	2450
Toma	Semences Prograin, Quebec	2500
DH 863	Sevita International, Ontario	2500
OAC Petrel	SG Ceresco, Quebec	2520
Jari	Elite Le Coop, Quebec	2550
DH 401	Sevita International, Ontario	2550
SVX14T0053	Sevita International, Ontario	2625
Auriga	Elite Le Coop, Quebec	2625
Savanna	Homestead Organics, Ontario	2650
Krios	Elite Le Coop, Quebec	2675

Site Descriptions

Table 2. Soil nutrient status of six farms in Southern Manitoba at the 0-60cm soil depth increment.

Location	Nitrate-N[X] (kg/ha)	Olsen-P (ppm)	Potassium (ppm)	Sulfur[X] (kg/ha)	Zinc (ppm)	Copper (ppm)	OM[Y] (%)	pH
Carman 2014 Texture: Loamy sand	58.2	10	125	20.2	1.1	0.69	2.4	5.5
St-Pierre-Jolys 2014 Texture: Light clay	56	5	328.5	188.2	0.62	2.6	4.7	8
Woodmore 2014 Texture: Sandy loam	40.9	3.5	61.5	37	2.4	0.38	1.65	8.1
Elie (transition) 2014 Texture: Clay loam	56	42	436	380	2.98	2.37	7.9	7.8
Somerset 2014 Texture: Clay loam	77.3	7	391	47	1.46	0.42	5.4	7.7
Swan Lake 2014 Texture: Clay loam	108.6	46	408	123.2	2.75		4.5	7.2
Carman 2015 Texture: Loamy sand	42	12	197	30	1.61	0.63	3.2	6.4
Woodmore 2015 Texture: Sandy loam	90	62	62	34	0.38	.29	2.2	8
Somerset 2015 Texture: Clay loam	92	20	414	34	2.43	0.49	5.6	6.3

[X]Nitrogen and sulfur determined for 0-15cm and 15cm-60cm soil depths. Data shown is from total 0-60cm soil depth increment.
[Y]Organic Matter

Variety Recommendations

- **SK0007** has the potential to be useful for organic growers due to early season competitiveness, early maturity, and increased pod height
- **Jari** is a good option for growers with higher heat units for its high yield potential, increased plant height, and good pod height

Future Research

- Identify traits for soybean varieties to compete with weeds through tolerance vs. suppression, increasing weed competitiveness
- Detect differences between varieties and nutrient accumulation in organically managed soils
- Potential intercropping or relay cropping opportunities for organic growers in Manitoba
- Creates baseline data for a potential short-season organic soybean breeding program

Acknowledgments

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Finlay, K. W., & Wilkinson, G. N. (1963). The analysis of adaptation in a plant-breeding programme. *Australian Journal of Agricultural Resources*, (14), 742–754.