What in the soil is going on with prairie field pea production?

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With input from Sherrilyn Phelps (SPG) and

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University of Saskatchewan

Crop Development Centre

Government of Saskatchewan
Ministry of Agriculture

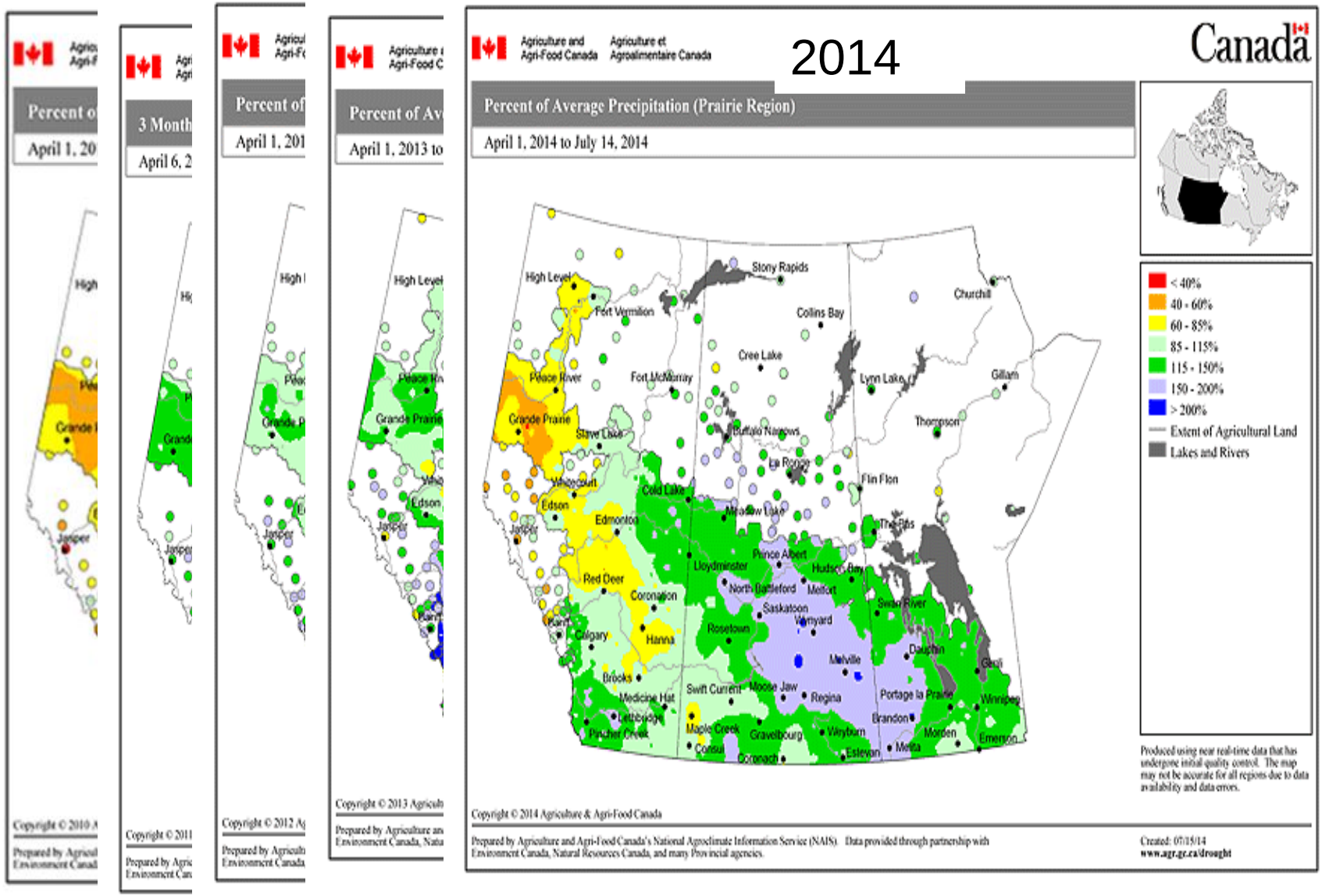
Saskatchewan pulse Growers

Prevalence of root rot

- 2009: 38% of 144 pea fields
- 2010: 29% of 112 pea fields
- 2012: First definite confirmation of *Aphanomyces*
- 2013: *Aphanomyces* confirmed in 11 municipalities

Dokken-Bouchard, Armstrong-Cho and colleagues, published in the Canadian Plant Disease Survey

Weather patterns



Peas do not like wet feet

….but some soil pathogens really love it

Root rot pathogens

- Root rots usually caused by a combination of species

  $\Rightarrow$ **root rot complex**

- Soil samples analyzed to date always revealed
  - *Fusarium* spp.
  - in many cases *Aphanomyces euteiches*
  - sometimes *Rhizoctonia* and *Pythium*

Root rot pathogens

- Species with a wider host range
  - *Fusarium* spp. (e.g. *solani, avenaceum, acuminatum, graminearum*)
  - *Rhizoctonia solani*
  - *Pythium* spp.
- Relatively host-specific species:
  - *Fusarium oxysporum* f.sp. *pisi* or f. sp. *lentis*
  - *Aphanomyces euteiches*

- True fungi
  - *Fusarium* spp.
  - *Rhizoctonia solani*
- Fungus-like organisms
  - *Pythium* spp.
  - *Aphanomyces euteiches*

Seed treatments

- True fungi and fungus-like organisms are controlled by different actives
- Protection for approximately 3 weeks
- Protection of the seed, not an extended root system
- No effective pea seed treatment against *Aphanomyces*

PRODUCTS	Page	CROPS							DISEASES							
		Beans	Chickpea	Fababean	Lentil	Lupin	Pea	Soybean	Damping-off caused by *Rhizoctonia solani*	Seed and Seedling Rots / Blights**	Pythium Seed Rot and Damping Off	Seed-borne ascochyta (chickpea, lentil, pea)	Seed-borne *Botrytis spp.*	Seed-borne anthracnose (beans)	Seed-borne Phomopsis (soybean)	White mould (Sclerotinia)
Agrox FL	404	X	X		X		X	X		•						
Allegiance FL	435	X	X		X①		X	X			②					
Apron Advance / Apron Maxx RTA / Apron Maxx RFC	405	X	X	X	X	X	X	X⑥		•	•	•		•	②	
Belmont 2.7 FS	435	X	X		X[1]		X	X			②					
Crown	407				X					•		③				
Cruiser 5FS†	408	X	X		X		X	X								
Cruiser Maxx Beans†	409	X						X		•	•			•	②	
Cruiser Maxx Pulses†	409		X		X		X			•	•	•				
Cruiser Maxx Vibrance Beans†	409							X	•	•	•				②	
EverGol Energy	419	X	X		X		X	X	•	•	•	*			•	
Heads Up Plant Protectant	424	X						X	•							•
Stress Shield 600	451	X	X	X	X		X	X								
Thiram 75WP	452	X	X				X	X		•	•					
Trilex AL	453	X	X		X		X	X		•	•	•*			•	
Trilex EverGol	454	X	X		X①		X			•	•	•*	•		•	
Vibrance Maxx RTA Vibrance Maxx RFC	459		X		X		X			•	•	•	•			
Vitaflo 280 / Vitaflo 220 / Vitaflo SP / Vitaflo	464	X	X		X***		X***	X		•	•	④			•	

Symptoms

Patches of pea plants with

- —stunting
- —yellowing
- —poor root growth
- —Little or no nodulation
- —browning of root area

The most frequent pathogens: *Fusarium*

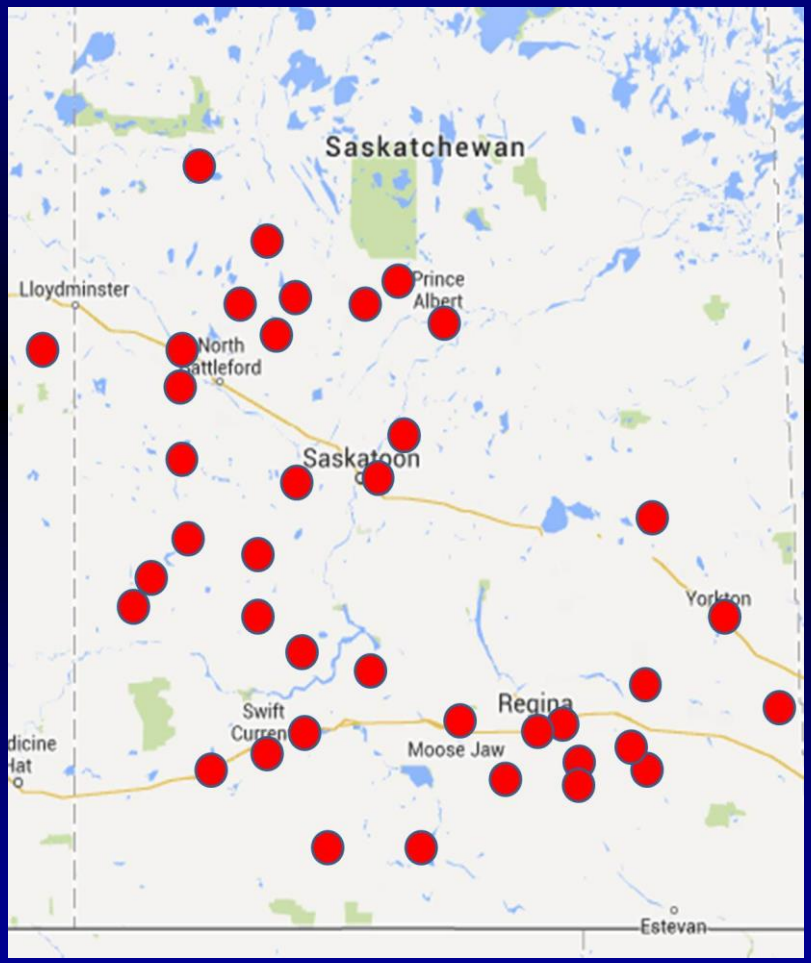
The increasingly more common pathogen: *Aphanomyces euteiches*

Infected roots with caramel brown discolouration

Healthy cream coloured roots

Aphanomyces euteiches

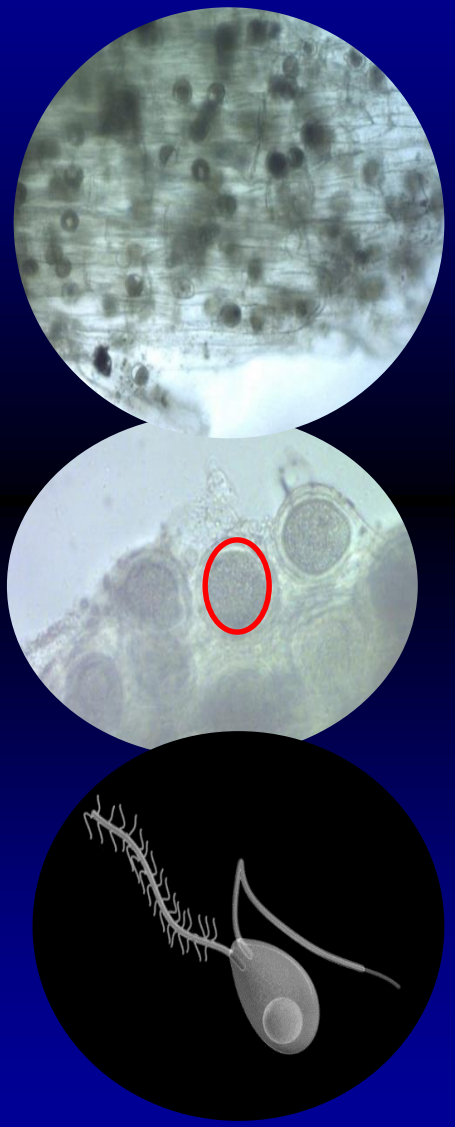
- First confirmed report in SK in 2012
- Widespread identification in soil and plant roots across SK in 2014
- Has likely been present for a long time
- Recent conducive conditions for build-up of pathogen



Data from CDC, Discovery Seed Lab, Sask Ministry Diagnostic Lab

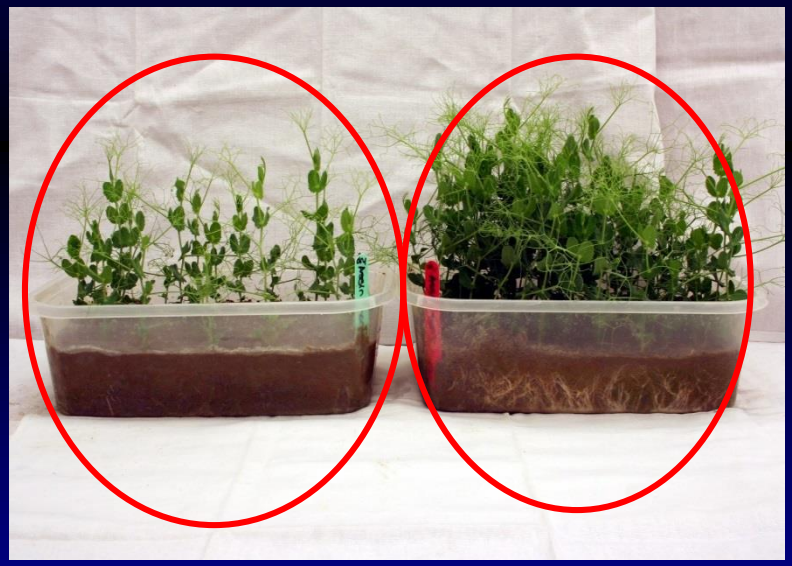
Aphanomyces euteiches

- Belongs to the ‘water moulds’ like *Pythium*
- Survival of oospores in the soil without a host for up to 20 years
- Is mobile (zoospores) and can move with the water
- No effective chemical controls to date

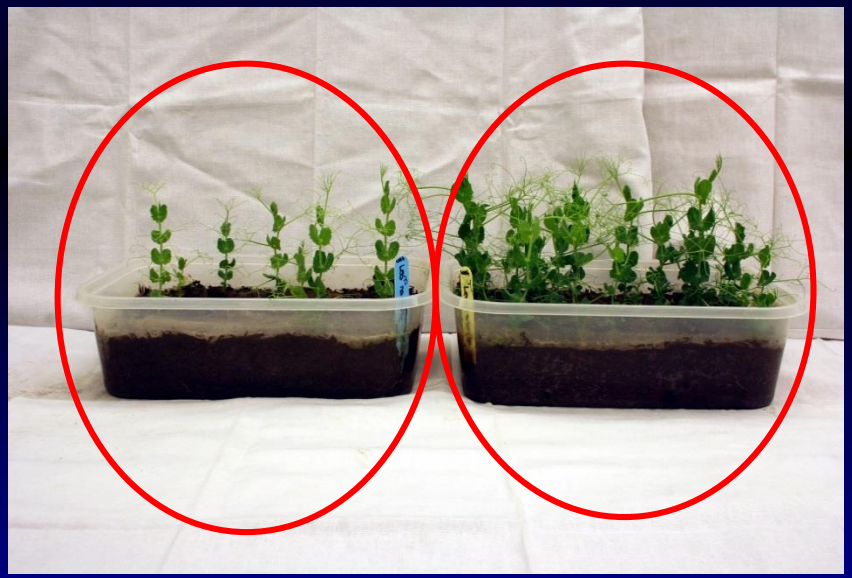


Effect of water-logging on aphanomyces root rot severity

Normal watering
Non sterile vs sterile field soil



Water-logged
Non sterile vs sterile field soil



Undergraduate student thesis project 2013: Matthew Tetreault

Contributing factors to root rot increase

Reduces risk	Increases risk
Dry, well-drained soils	Wet, water-logged soils
No soil compaction	Soil compaction
Diverse, long rotations	Tight rotations
Balanced nutrient supplies including spring N	Nutrient deficiencies

Soil compaction

- Soil type
  - Higher clay content more susceptible to compaction
- Traffic on the soil
  - Weight of machinery
  - Soil wetness
- Rooting depth of crops
  - Deep-rooting crops can counteract compaction (to some degree)

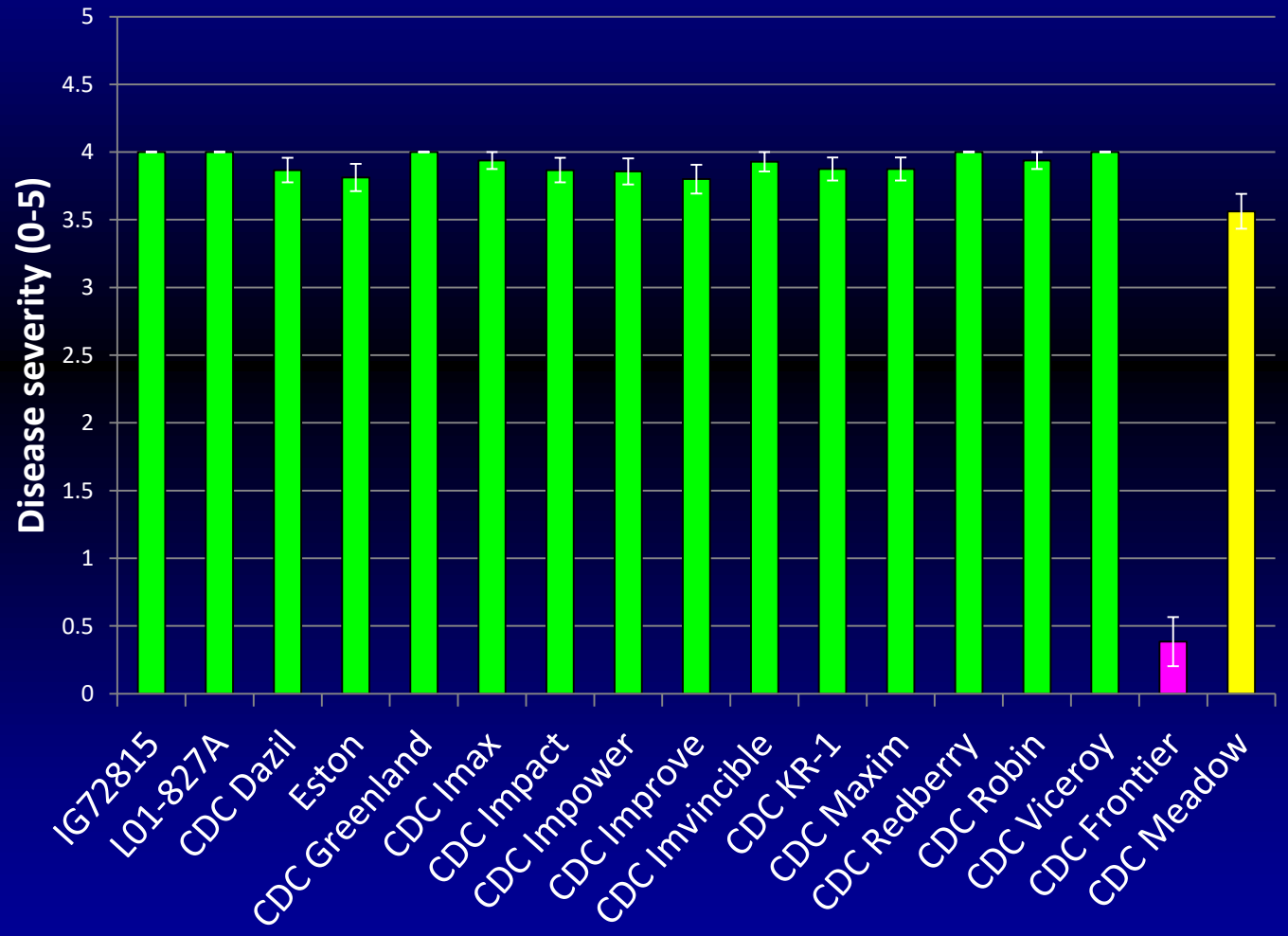
Rotation

- Generally 4-year rotations
- In case of *Aphanomyces* 6- to 8-year rotations away from a susceptible host

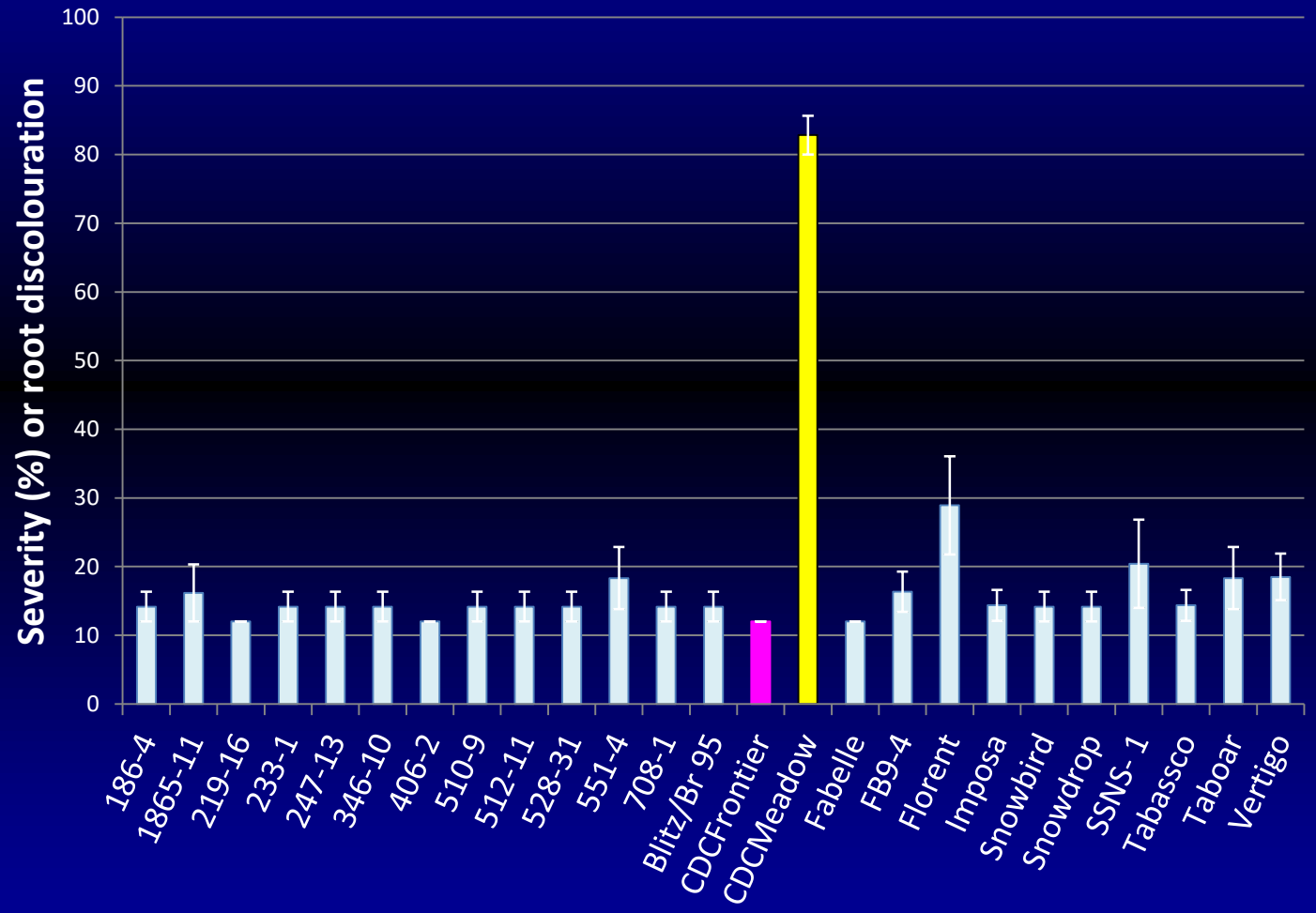
Crop selection

- All pulse crops susceptible to *Fusarium*, *Pythium*, *Rhizoctonia*
- **Pea, lentil and possibly many alfalfa varieties** are also susceptible to aphanomyces root rot
- Soybean, fababean and chickpeas have good partial resistance to aphanomyces root rot

Varietal differences in resistance: Lentil

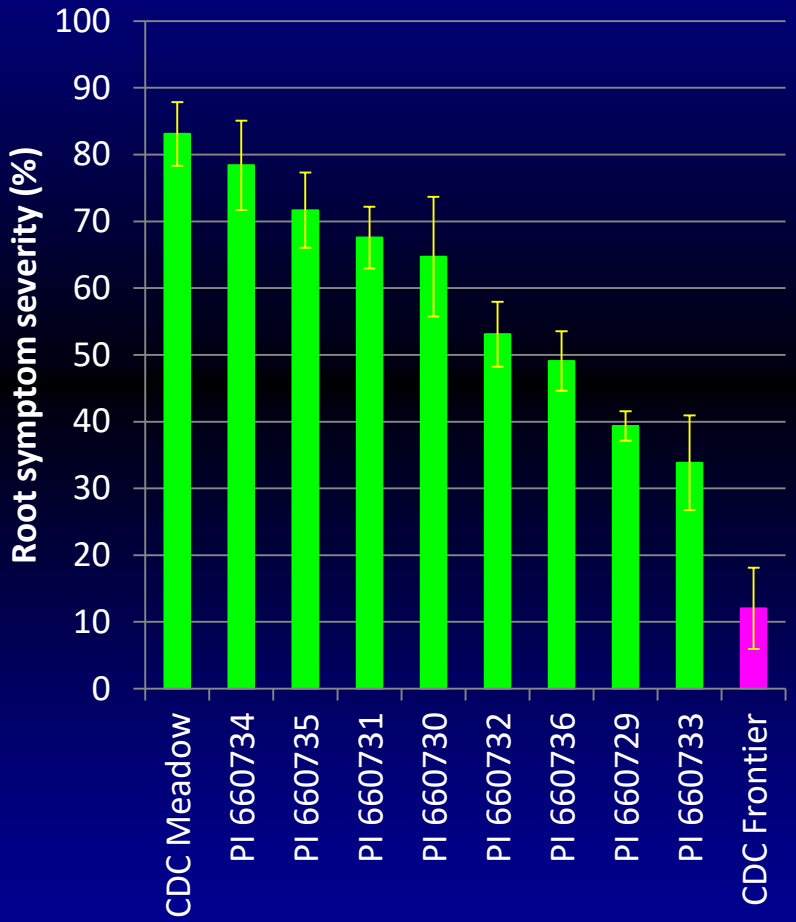


Alternative pulse crop: Faba bean



Resistance in pea to aphanomyces root rot

- Extensive screening in pea in France and USA
- USDA lines received by CDC
- French selection currently not available



Resistance in lentil to aphanomyces root rot

- Moderate resistance in interspecifc lentil germplasm (score of 3)
- Iranian germplasm at USDA

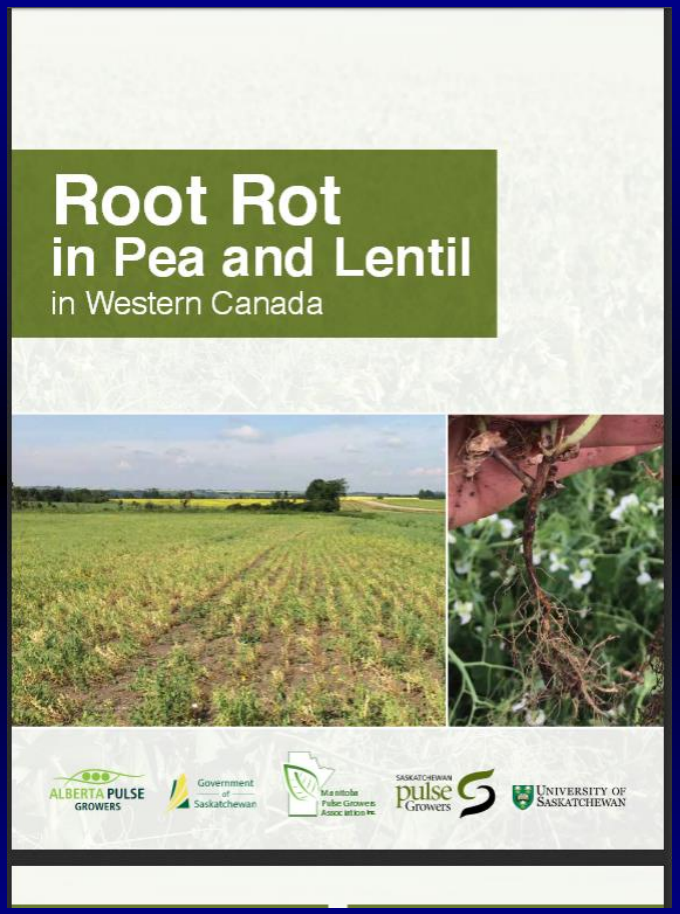
Parents/Lines	Disease reactions	Parents/Lines	Disease reactions
P-LR26 -Eston	5	P-LR59 -Eston	5
P-IG 72815	**3**	P-L01827 A	**3**
LR26-12	7	LR59-4	**3**
LR26-19	7	LR59-10	**3**
LR26-20	5	LR59-14	9
LR26-183	9	LR59-23	5
LR26-187	5	LR59-27	5
LR26-216	3	LR59-29	5
LR26-220	5	LR59-55	5
LR26-240	5	LR59-62	7
LR26-241	9	LR59-76	5
LR26-253	**3**	LR59-81	5
LR26-274	9	LR59-86	7
LR26-281	7	LR59-90	5
LR26-290	5	LR59-126	5
LR26-293	9	LR59-127	9
LR26-300	7	LR59-133	7

Strategies for 2015

Choices	Options for Reducing Risk of Root Rots
Field Choice	• Lighter textured soils (sandier) with good drainage • Out of peas/lentils for at least three years (four year rotation) and maybe up to six years if *Aphanomyces* positively identified • Manage or avoid compacted fields or areas
Soil Testing and Fertility	• Apply nutrients as needed • Starter nitrogen if soils <15 lbs/acre available nitrogen in top 12 inches • Phosphorous if seeding early into cool soils • Other nutrients only if deficient • Know the safe rates of nutrients that can be safely seed placed
Seed Testing	• Plant good quality seed • Apply seed treatments as warranted for seed borne disease or if planting early into cool soils (see next table)
Seeding Decisions	• Use appropriate inoculant and good application methods • Choose more resistant crops - fababean, chickpea, and soybean (only for *Aphanomyces* root rot) • Minimize seed damage and watch airspeed of seeder • Seed into warm moist soil – the quicker the emergence the more vigorous the seedlings
After Seeding	• Monitor crop for signs of stress • Follow herbicide labels - increased injury can occur when plants are stressed

- Rotation: minimum of 4-6 year pea/lentil rotations
- Field selection: lighter soil, good drainage
- Soil fertility: 15 lbs/acre available N
- Seed quality: high germ & quality
- Seed treatments

More information on SPG website



http://www.saskpulse.com/uploads/content/141104_Root_Rot_Brochure_web.pdf

Diagnostic Labs

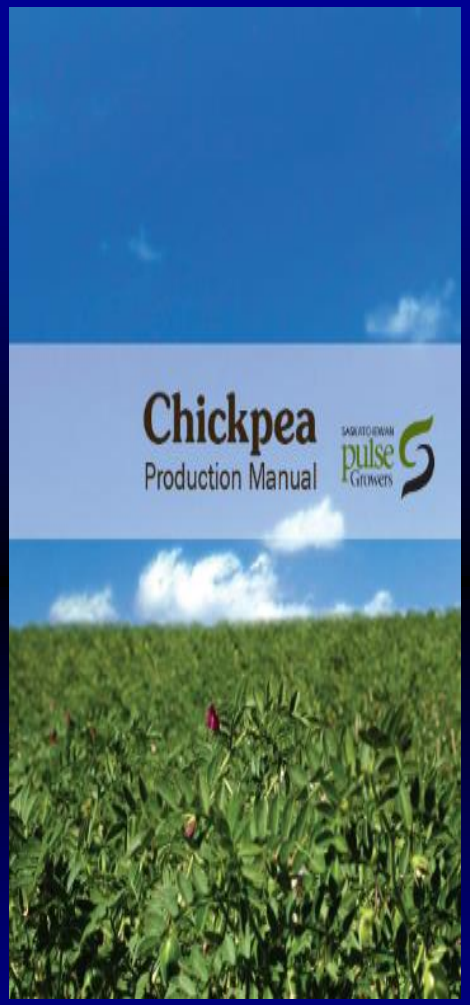
Lab	Location	Web address
Discovery Seed Lab	Saskatoon	www.seedtesting.com
BDS Labs	Qu'Appelle	www.bdslabs.com
20/20 Seed Labs	Nisku	www.2020seedlabs.ca
Crop Protection Lab	Regina	www.agriculture.gov.sk.ca/Crop_Protection_Lab

Tests available for roots and/or soil:

- Microscopy
- Baiting soil with a susceptible plant species
- Molecular testing of plant and soil samples

Individual labs may differ in testing methods and sample requirements. Please check with lab prior to sending samples

Alternative pulse crops: Chickpea



www.saskpulse.com
www.agr.gov.sk.ca/chickpea-ascochyta

Alternative pulse crops: Faba bean

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FABA BEAN

Faba Bean

June 2013

Introduction

The faba bean (*Vicia faba minor*) is an ancient small-seeded relative of the Chinese broadbean (*V faba major*). The oldest seeds of *Vicia faba* were found in Jericho and dated at 6250 BC. The crop is grown in the Mediterranean region where it is a common food. In Europe the faba bean is grown primarily as a livestock feed. Britain, where both winter and spring types are grown, is the largest European producer of faba bean. Commercial production of faba bean in Western Canada first occurred in 1972 and since then the area under production has fluctuated.

Faba bean grows upright, ranging from one to 1.5 meters tall. It is an annual legume with one or more strong, hollow, erect stems. Faba bean has a strong tap root, compound leaves and large, white flowers with dark purple markings. A flower cluster may produce one to four pods. The pods are large (up to 10 cm long and one to two cm wide) and green, turning dark at maturity; from brown to black. Three to four oblong/oval seeds (Figure 1) are contained within each pod. Flowering occurs in 45-60 days and faba bean requires 110-130 days to mature. The bushel weight of faba bean is 60 pounds.

(Figure 1) Faba bean seed Source: Saskatchewan Agriculture

(Figure 2) Chinese broadbean seedlings Source: Saskatchewan Agriculture

Chinese Broadbean

Chinese broadbean (*Vicia faba major*) is produced in China, Europe, the Middle East, North Africa and South America. It can also be found growing in many vegetable gardens in Canada (Figure 2). It has a 1000 seed weight of 850 grams and is rarely contracted for growing in Saskatchewan. Chinese broadbean is significantly earlier maturing than most current faba bean varieties and is equal in yield to the faba bean variety Outlook. A major cost of production for Chinese broadbean is seed. The seeding rate required is 325 kg/ha (289 lb./ac.) and a specialized seed drill is required to accommodate the large irregular-shaped seed.

Markets

World production, export and import data is not compiled for faba bean. Data for dry broadbean, which includes faba bean and Chinese broadbean, is reported by the Food and Agriculture Organization of the United Nations. The Chinese broadbean is consumed mainly as a vegetable. World production of dry broadbean ranged from 4.9 to 5.1 million tonnes from 2007-2011 with China producing (almost exclusively Chinese broadbean) almost half. The major dry broadbean producing countries are shown in Figure 3.

http://www.agriculture.gov.sk.ca/crops/Faba_Bean

Alternative pulse crops: Soybean

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BEAN

Soybean Production in Saskatchewan

History

The cultivated soybean, *Glycine max L.*, is a domesticated soybean grown in many parts of the world. It is a member of the subgenus, *Soja*. Soybean is thought to have been domesticated in China, then spread into Europe around the 17th century and North America in the 1800s. Soybean has become a dominant crop in world oilseed trade. Many foods have been developed from soybean in Asia. Soybean flour and protein fractions are being used in European and North American diets as well.

Figure 1. Soybean in vegetative state. Photo credit: Alberta Pulse Growers, John Walker.

Field Selection

Soybeans have adapted to a wide range of soil types in south eastern Saskatchewan. Ideally, they are grown on loamy soils and may also perform well on clay soils if conditions are favourable for rapid seedling emergence. Soybean is sensitive to drought, so sandy soils are not usually conducive to satisfactory performance.

Soybean is a warm season crop requiring sufficient heat to perform well and mature in a timely fashion. Soybean varieties in Saskatchewan need between 2325 and 2450 corn heat units. This limits production of soybean to areas receiving sufficient heat.

See the Saskatchewan Ministry of Agriculture, Saskatchewan Corn Heat Units Map: http://www.agriculture.gov.sk.ca/Default.aspx?DN=c62b9cc0-955c-4099-9064-928369ffb44d

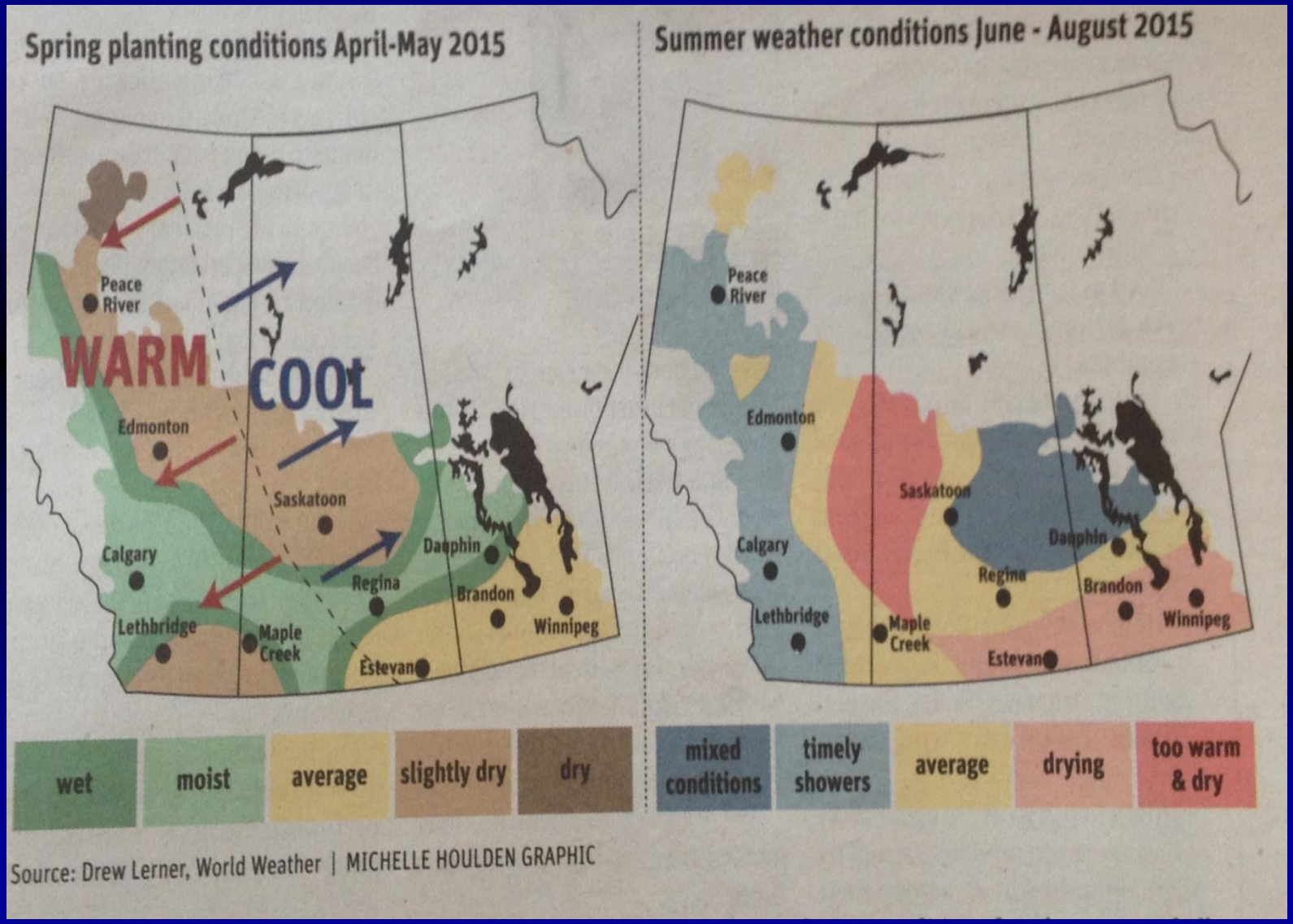
Figure 2. Field of Soybeans.

Variety Information

Recommended varieties of soybean are listed in the most current Saskatchewan Ministry of Agriculture publication, "Varieties of Grain Crops". These varieties are limited to either Roundup Ready 1 or Genuity Roundup Ready 2 Yield (GENRR2Y) types. A complete list of commercial varieties can be found in the most current issue of "Seed Manitoba" (www.seedmb.ca).

www.agriculture.gov.sk.ca

Forecast for 2015: Western Producer January 29



A successful 2015!

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