

Clubroot of Canola

Regulatory Concerns

Biology

Identification

Current Situation

Control Strategies

Agricultural Pests Act

What is it?

What responsibilities do I have?

What is the *Agricultural Pests Act*?

Act

Definitions, Responsibilities, Rights



Province of Alberta

AGRICULTURAL PESTS ACT

Revised Statutes of Alberta 2000
Chapter A-8

Current as of November 1, 2010

Regulation

“Operational Guidelines”



Province of Alberta

AGRICULTURAL PESTS ACT

PEST AND NUISANCE CONTROL REGULATION

Alberta Regulation 184/2001

With amendments up to and including Alberta Regulation 101/2011

Purpose of the Act



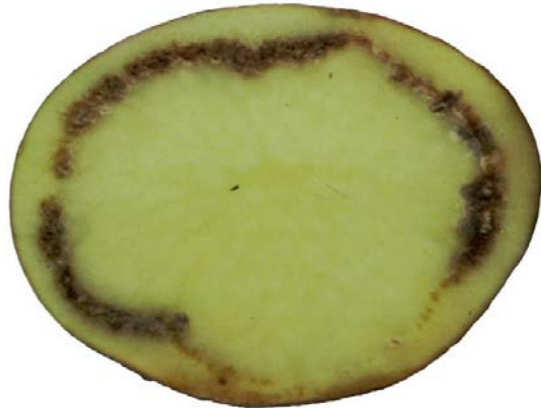
Photo courtesy of Flickr

- To protect agricultural production from the establishment of native and introduced pests
- To prevent the spread of pests

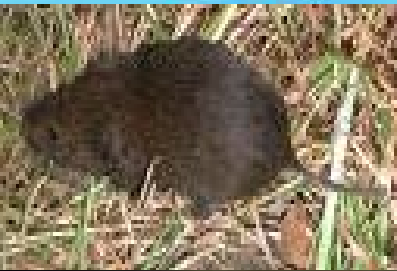
Agricultural Pests Act protects...



Declaration of Pest or Nuisance Pests



Declaration of Pest or Nuisance Nuisances



Everyone has a duty to...

Pest

SHALL prevent establishment of,
control or destroy



Photo credit: Kelly Turkington

Nuisance

MAY prevent establishment of,
control or destroy



Other Duties: Individual



https://www.farmcreditbank.com/images/landscapes/canola_field.jpg

- **Allow inspectors to do their duty**
 - i.e. inspections
- **Comply with notices given**
 - Subject to appeal process
- **Use pest free material for propagation**

Other Duties: Local Authority



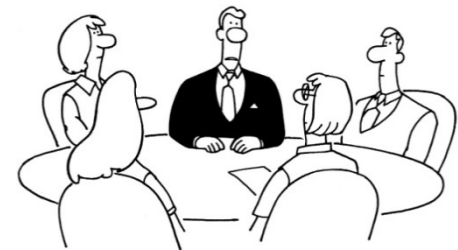
Appoint
Inspectors



Inspection
Enforcement



Set policy & procedure
Bylaws



Establish appeal committees
Handle appeals

Clubroot Biology

History

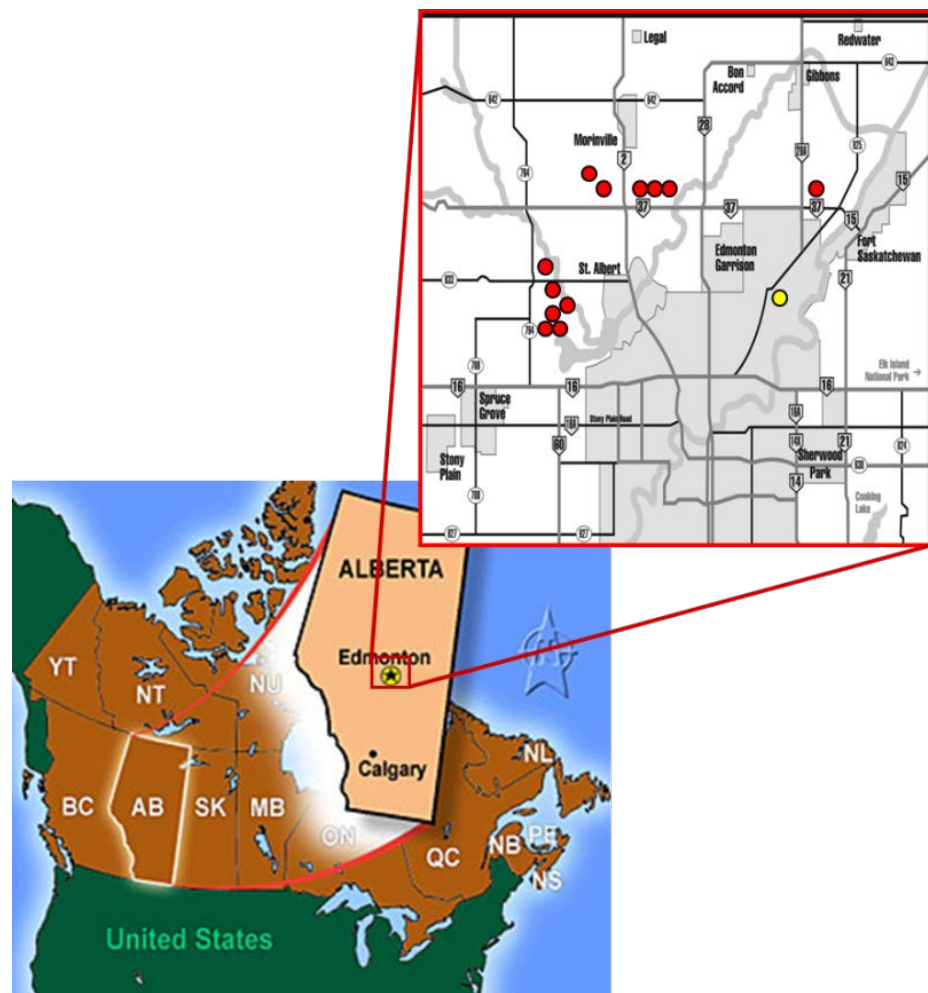
Growing Conditions

Life Cycle

Pathotypes

Clubroot in Canadian Canola

- Historically a problem in cruciferous vegetables in eastern Canada and BC
- On the Prairies, clubroot of canola first found in 2003 (Edmonton region)
- Cause for concern
 - >98% of harvested ha of Canadian canola are grown on the Prairies

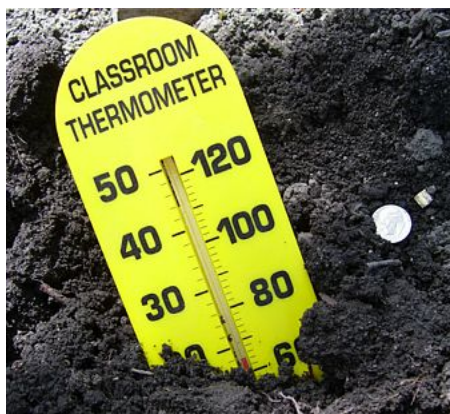


What is Clubroot?



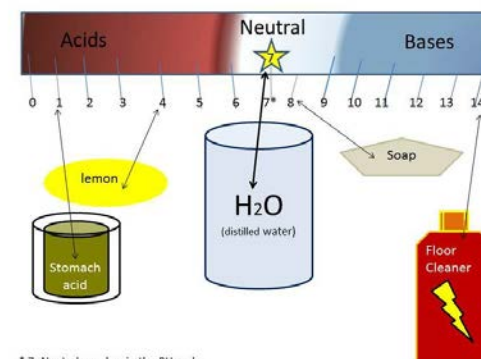
Photo Credit: Kelly Turkington

What conditions are ideal for clubroot development?



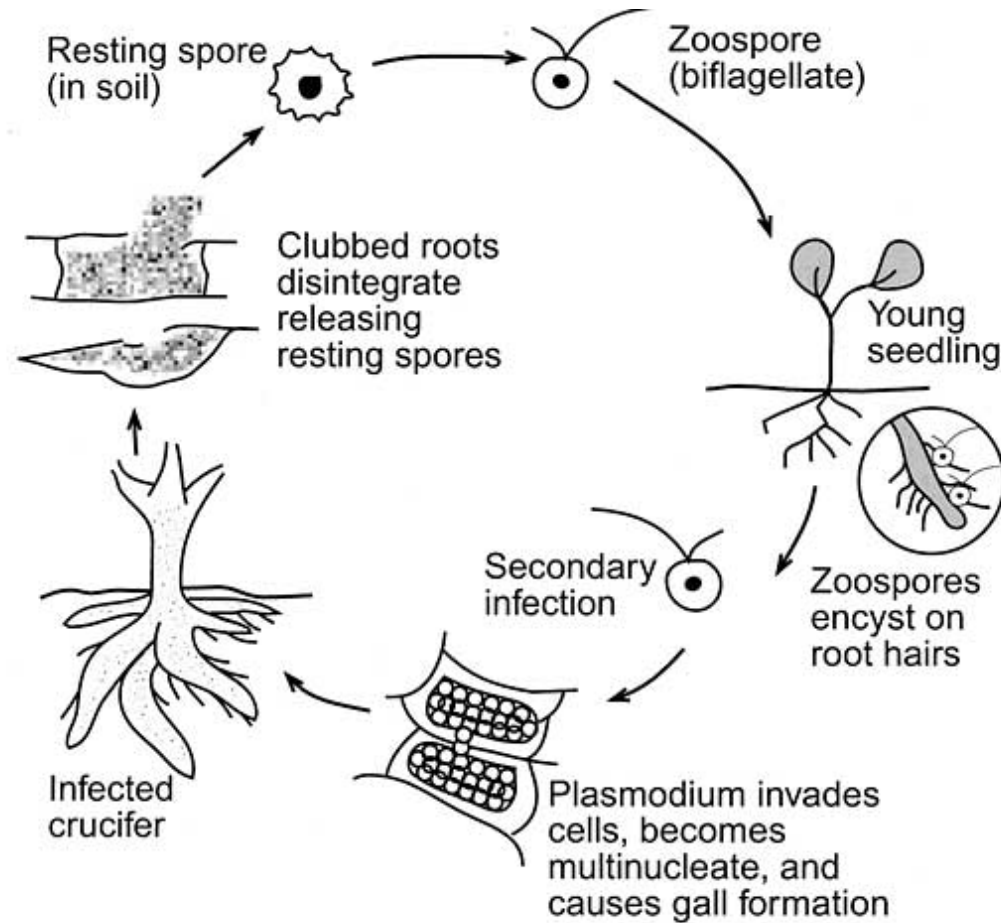
Warm Soil
20-24 Celsius

Wet Soil



Acidic Soils
 $\text{pH} < 7.2$

Clubroot Disease Lifecycle



Source: Ohio State University

Progression of how galls may look...



Initial Infection



Small Galls Expand



Moderate Infection



“Woody” Appearance

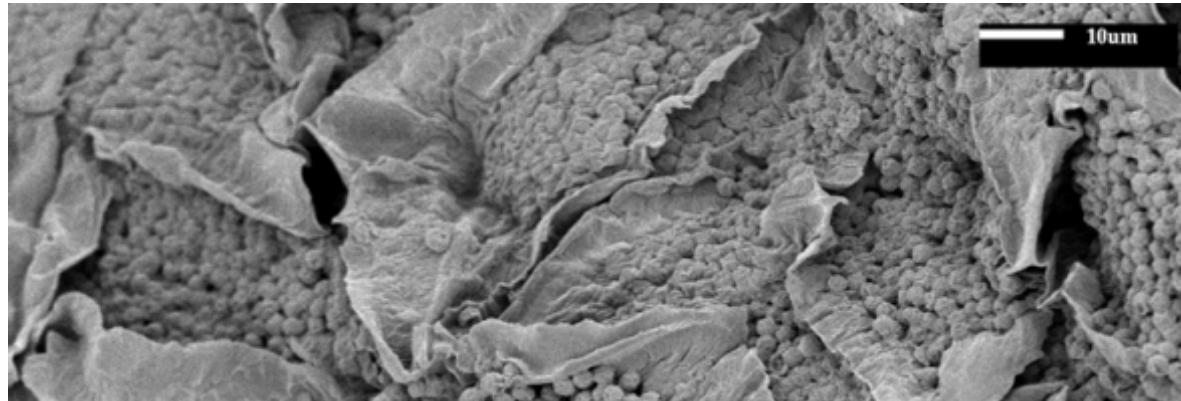


“Peaty” Appearance

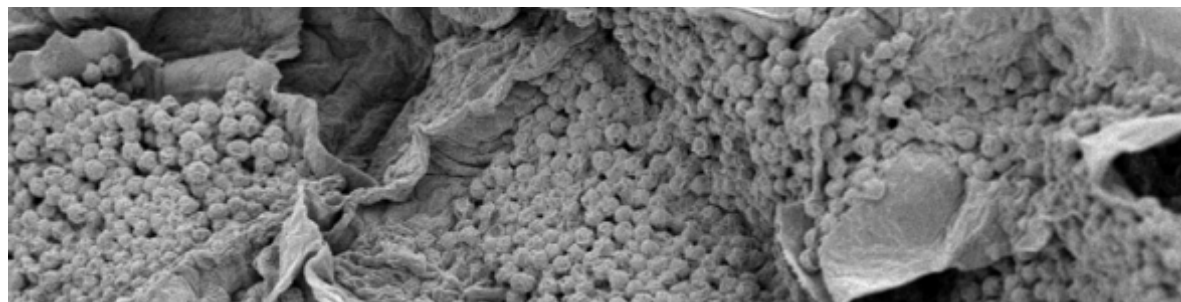


Decayed galls
Whitish Stem

Clubroot Spores



Up to **1 billion** spores in
1 gram of soil
Spores can survive up to
20 years



Studies showed a fairly diverse pathotype composition in Canada

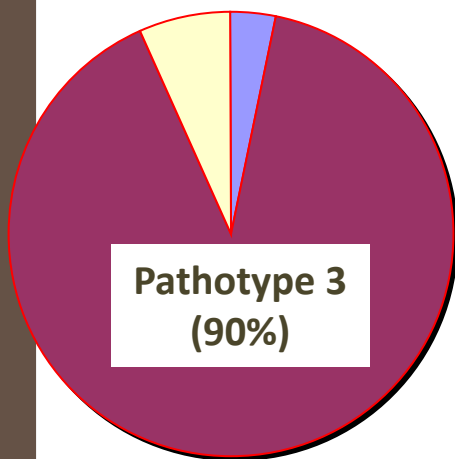
Province	Pathotype(s)		Reference(s)
	Populations	Single-spore isolates	
Alberta	<u>3</u> , 5, 2	<u>3</u> , 8, 2, 6	Strelkov et al., 2006; Strelkov et al., 2007b; Xue et al., 2008; Cao et al., 2009
British Columbia	<u>6</u>	<u>6</u>	Strelkov et al., 2006; Williams, 1966; Xue et al., 2008
Manitoba	5	--	Cao et al., 2009
Nova Scotia	<u>3</u> , 1, 2	--	Hildebrand & Delbridge, 1995
Ontario	<u>6</u>	3, 5, 8	Reyes et al., 1974; Strelkov et al., 2006; Xue et al., 2008; Cao et al., 2009
Quebec	2, 5	--	Williams, 1966; Cao et al., 2009
Saskatchewan	3	--	S.E. Strelkov, unpublished data

Pathotype designations on system of Williams (1966)

Pathotype 3 is Predominant in Alberta

Pathotype 5
(3%)

Pathotype 2
(7%)

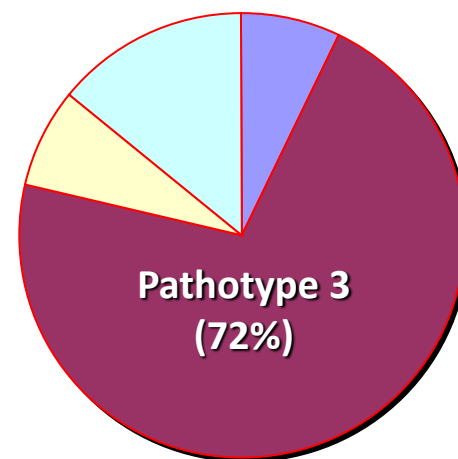


Field Populations

Pathotype 8
(14%)

Pathotype 2
(7%)

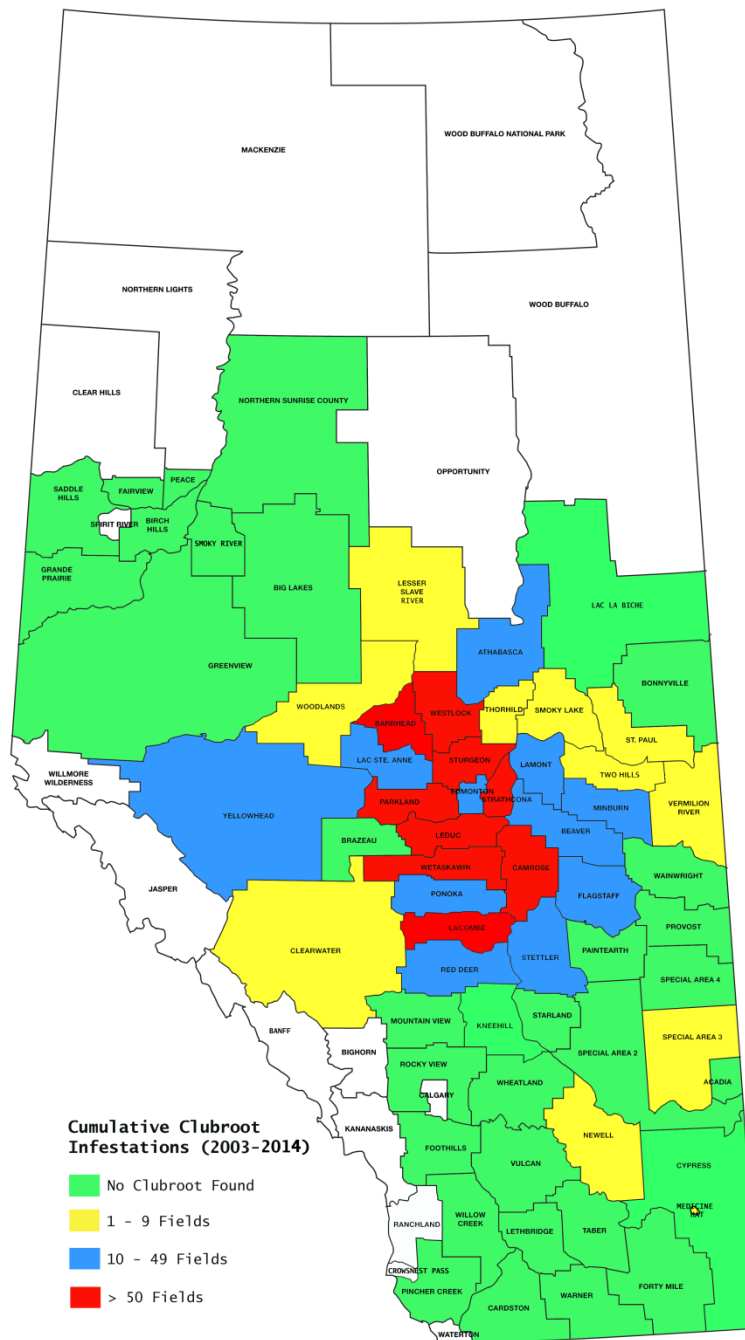
Pathotype 6
(7%)



Single-Spore Isolates

Pathotype 3 (Williams) $\approx$ ECD 16/15/12 $\approx$ P₂ (Somé et al.)

Current Situation



Clubroot Infestations 2003-2014

- 31 municipalities
- 1,868 fields total

Canada

- Few cases identified in Manitoba and Saskatchewan

United States

- First cases identified in North Dakota

Pathotype “5x” Breakdown in Resistance Already?

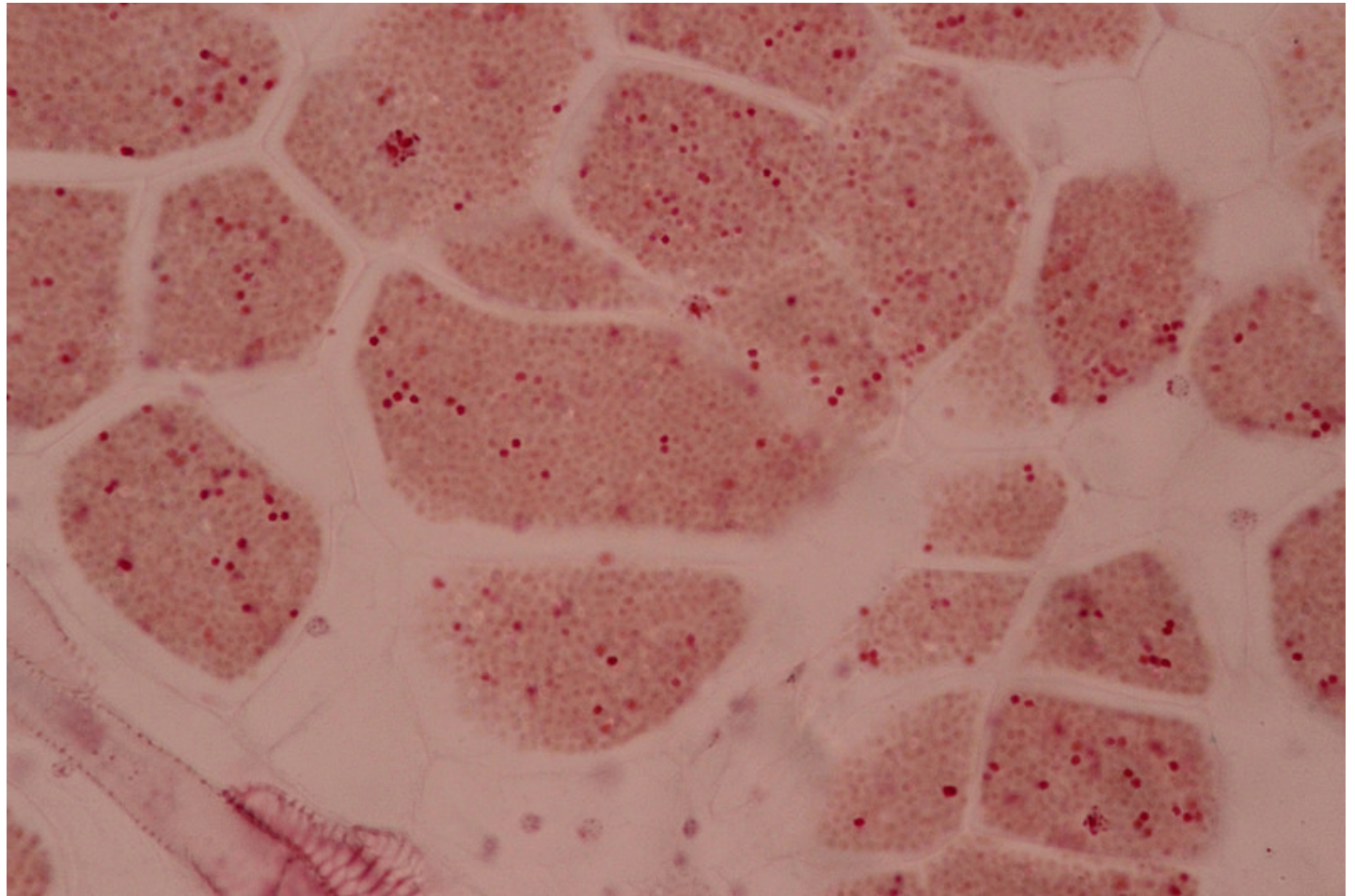


Photo courtesy of Flickr

'Pathotype 5x'

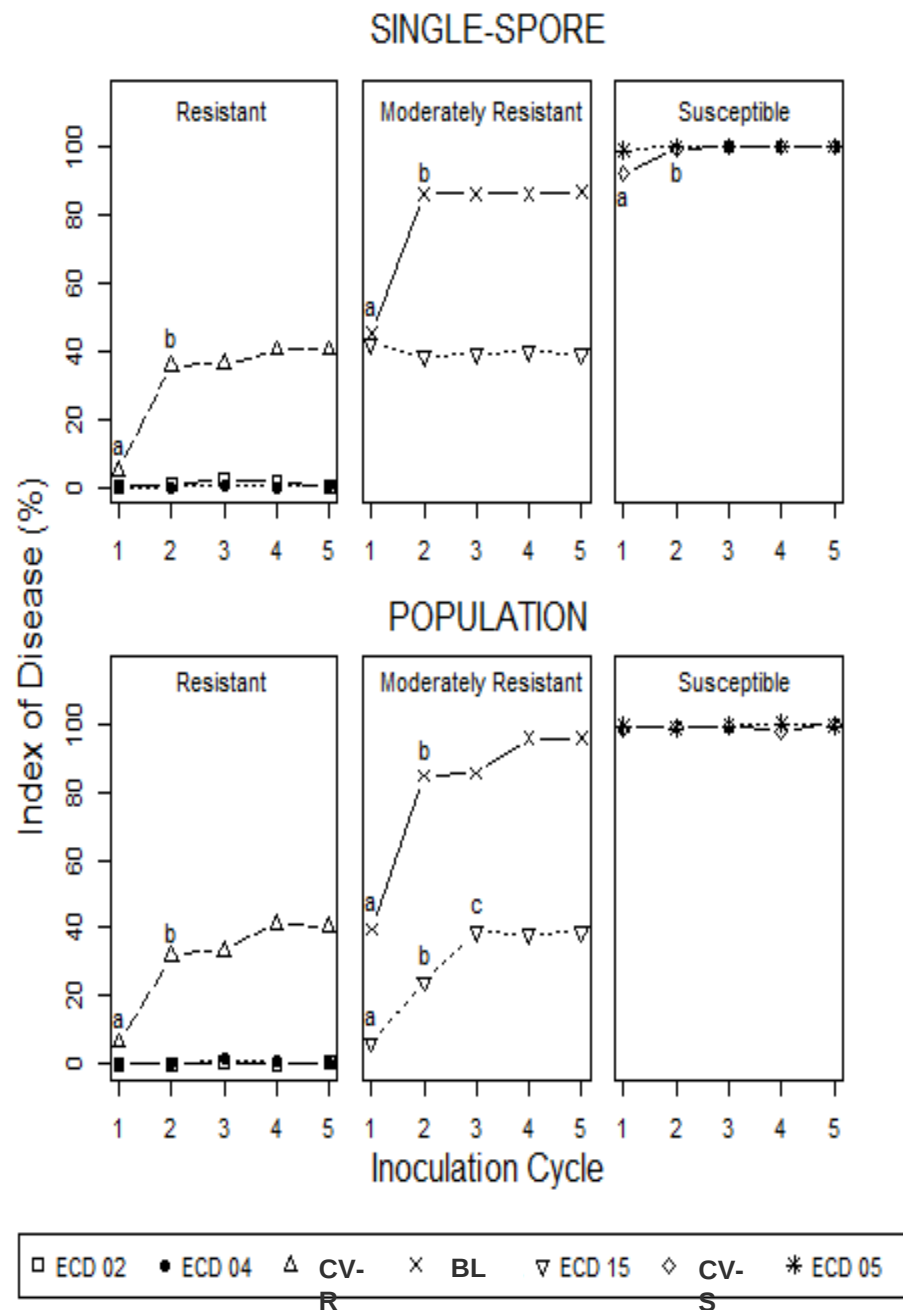
Host variety	Pathotype		
	3	5	5x
Jersey Queen (cabbage)	+	-	-
Badger Shipper (cabbage)	-	-	-
Laurentian (rutabaga)	+	-	-
Wilhemsburger (rutabaga)	-	-	-
Canadian 'clubroot resistant' canola	-	-	+

Pathotype designations as defined on system of Williams (1966)

Pathogen Adaptation to Host Genotypes

Greenhouse studies showed that repeated exposure to a resistance source led to loss in effectiveness of that resistance

Highlighted the need for proper resistance stewardship!

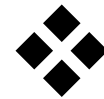


Pathotype Shift: Year 1

Pathotype
3



Pathotype
5



Pathotype
"5x"

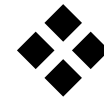


Pathotype Shift: Year 2

Pathotype 3



Pathotype 5



Pathotype "5x"



Pathotype Shift: Year 3

Pathotype 3 😊 😊

Pathotype 5 ❖ ❖

Pathotype
"5x" ☠ ☠ ☠ ☠ ☠

What can I do?

Spread of the Disease
Risk Factors for Spreading Disease
Management Strategies

Spread of Clubroot

Potential Sources of Infested Soil

Farm
Equipment



Vehicles



Boots/Footwear



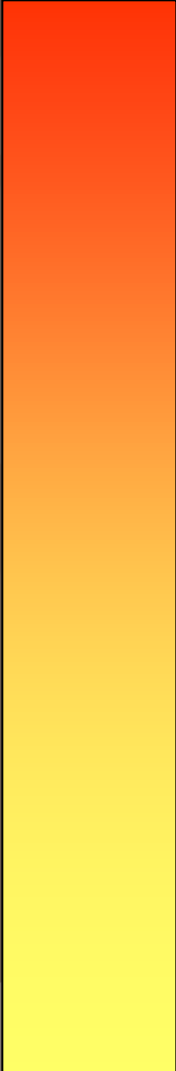
Tools



Storage
Containers



Mechanisms of Spread



Equipment

Large amounts of soil moved, can quickly establish new infections

MITIGATION: equipment cleaning & sanitation

Dust & Water Erosion

Risk not fully assessed, likely contributes to short distance dispersal; risk is function of amount of soil & distance travelled

MITIGATION: minimize erosion processes

Seeds & Tubers

Limited amounts of inoculum, potential for long distance dispersal

MITIGATION: seed cleaning & seed treatments

Scout your fields!



Early Symptoms

Late Rosette – Early Podding
Wilting, Stunting, Yellowing



Source: Stephen Strelkov, U of A

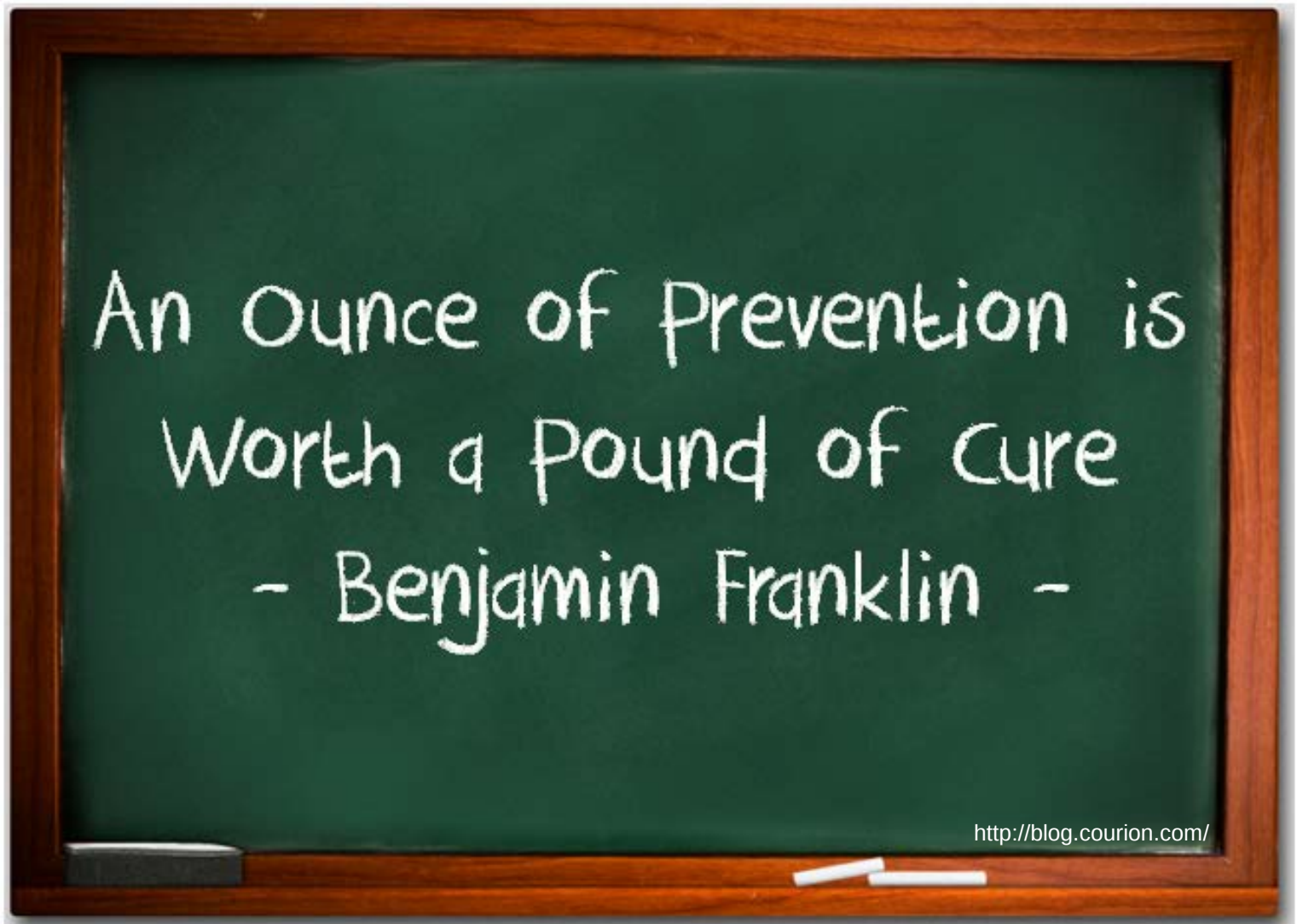


Late Symptoms
Premature Ripening

What if I have a suspect field?

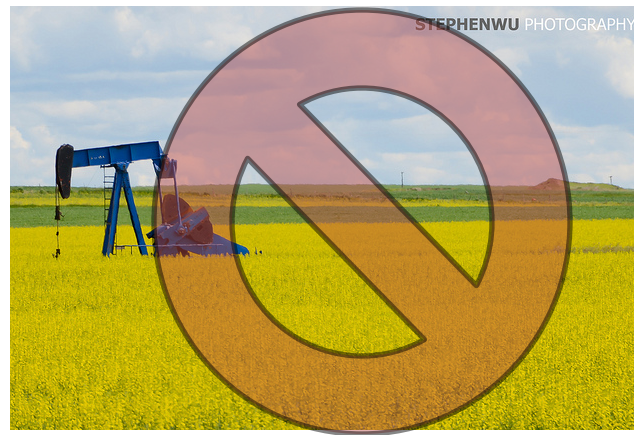


Management Strategies: Prevention

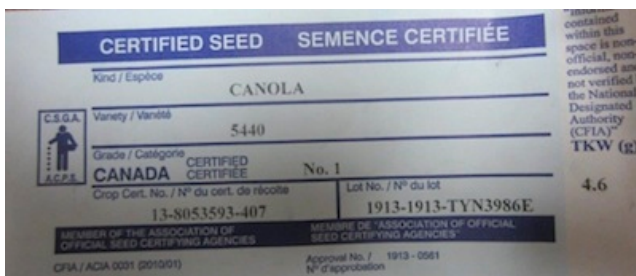




Good Sanitation



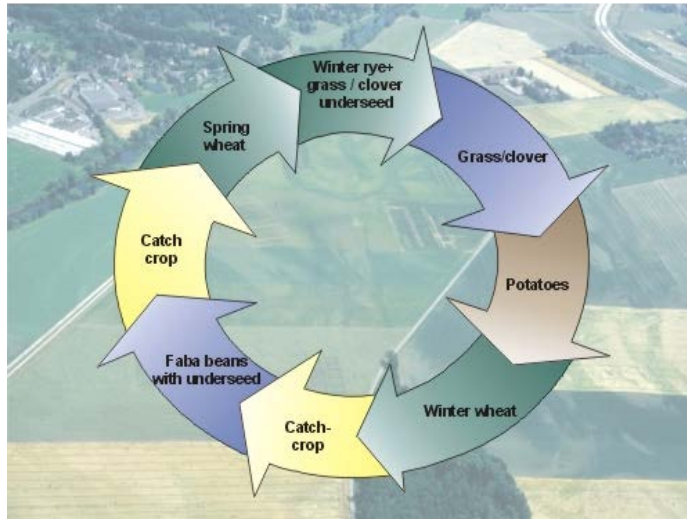
Limit Access



Use Certified Seed



Direct Seeding



Long Crop Rotations
1 in 4 Preferably



Resistant Varieties
Not a “Silver Bullet” though!

Control After Clubroot is Discovered

- Crop rotation may be enforced by a notice under the *Agricultural Pests Act*
- Growers may be required to use a clubroot resistant canola cultivar under a notice
- Control canola volunteers & *Brassica* weeds (i.e. stinkweed)
- Disinfection of equipment in addition to cleaning

Disinfection Protocol



Step 1: Rough Cleaning



Step 2: Fine Cleaning



Step 3: Disinfection

Other Considerations:

- **Choose worksite for decontamination carefully**
 - Low traffic, grassed area near exit is ideal
- **Time – can take up to 6 hours to do properly**
- **Work infested fields last**
- **Don't work fields when wet**
 - Harder to clean mud off the wheels!
- **Post “Do Not Enter” signs on fields with known clubroot on them**
- **Insist operators entering onto fields follow sanitation protocols**

Resources

Clubroot.ca

Clubroot Management Plan – ARD
Canola Council of Canada

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Questions?



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