Clubroot Management and Prevention

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Clubroot: What is it?

- Soil-borne disease caused by the long-lived pathogen *Plasmodiophora brassicae*
- Reduces yield by restricting the plant's ability to obtain water and nutrients from the soil
- Favourable conditions:
  - High soil moisture
  - Warm soil
  - Acidic soil - but can still occur in high pH soil

Host range

Canola

Mustard

Camelina

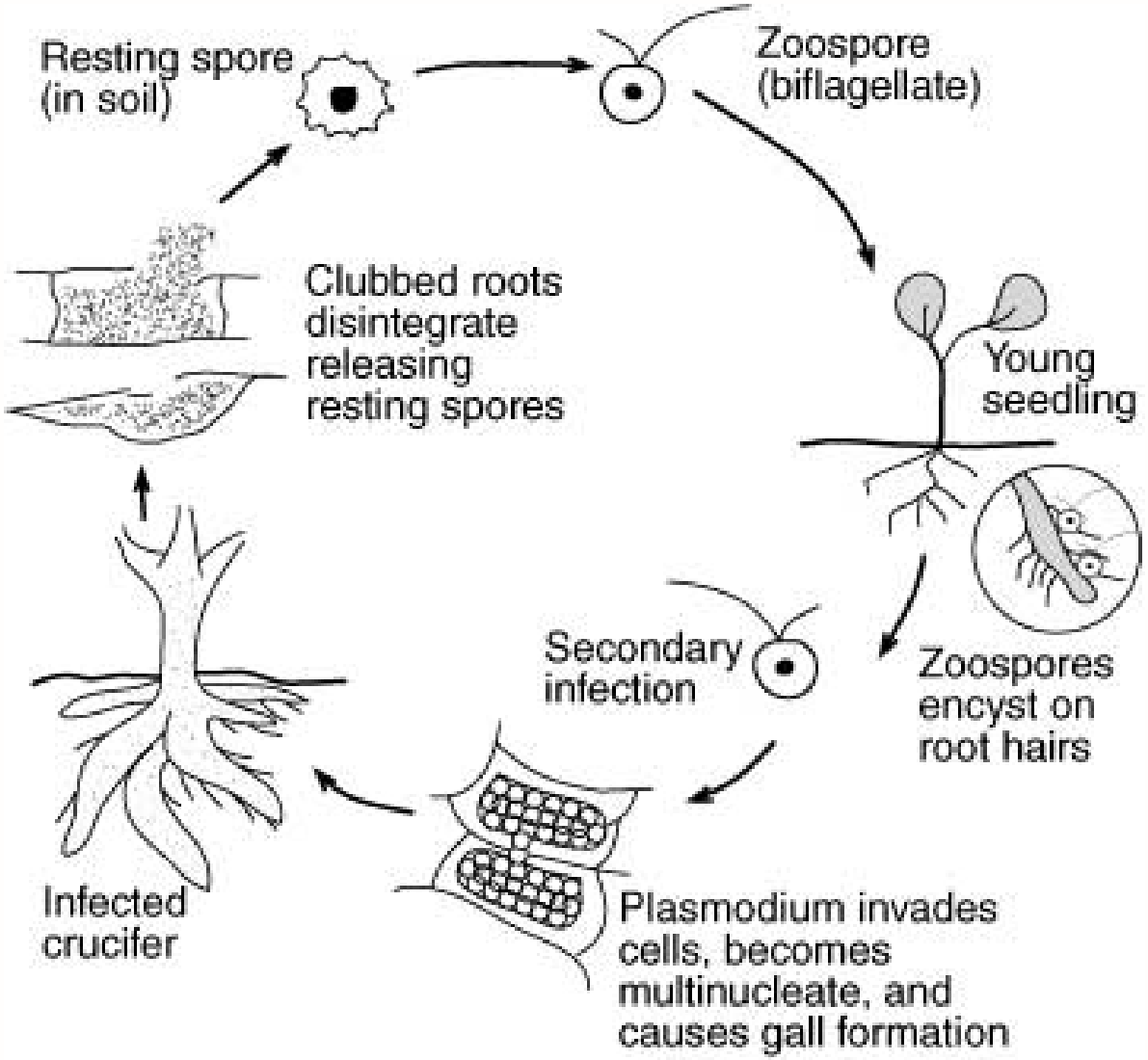
Shepherd's purse

Flixweed or tansy mustard

Wild mustard

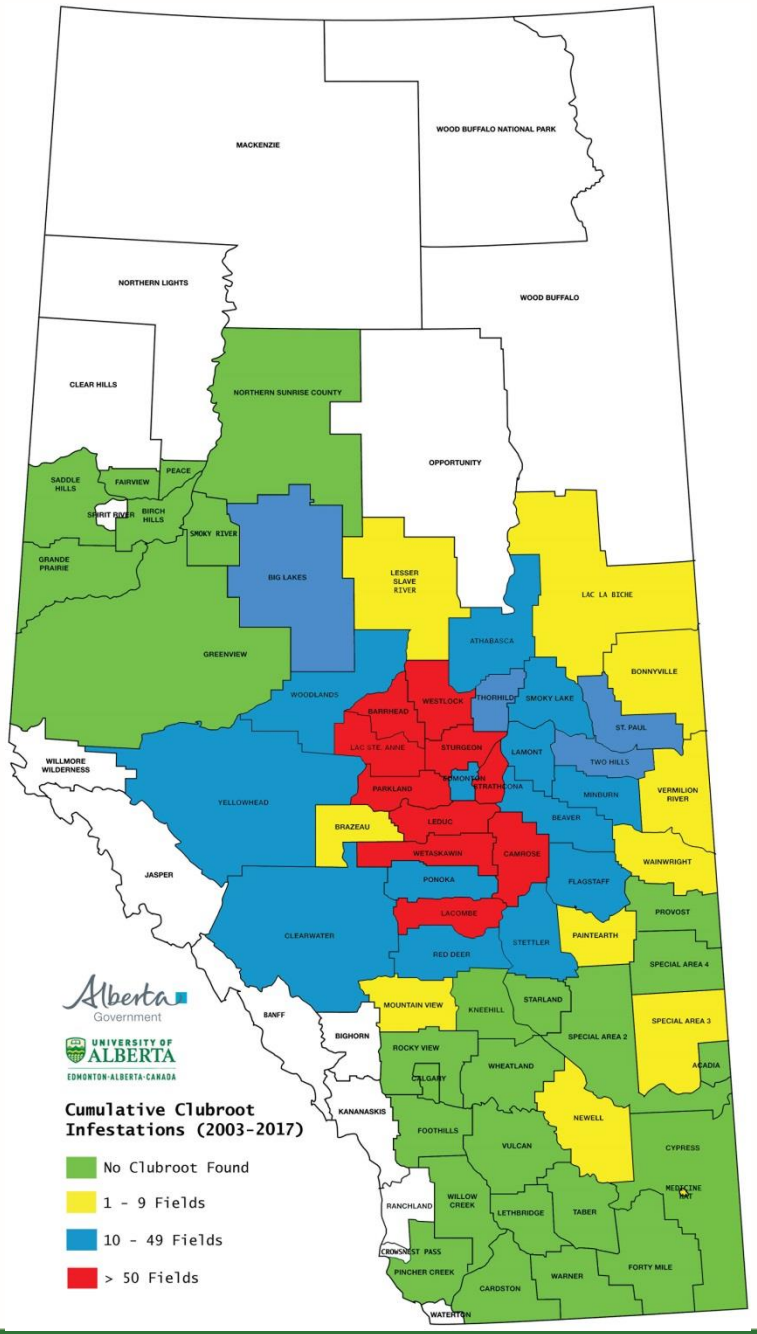
Stinkweed

Clubroot disease cycle



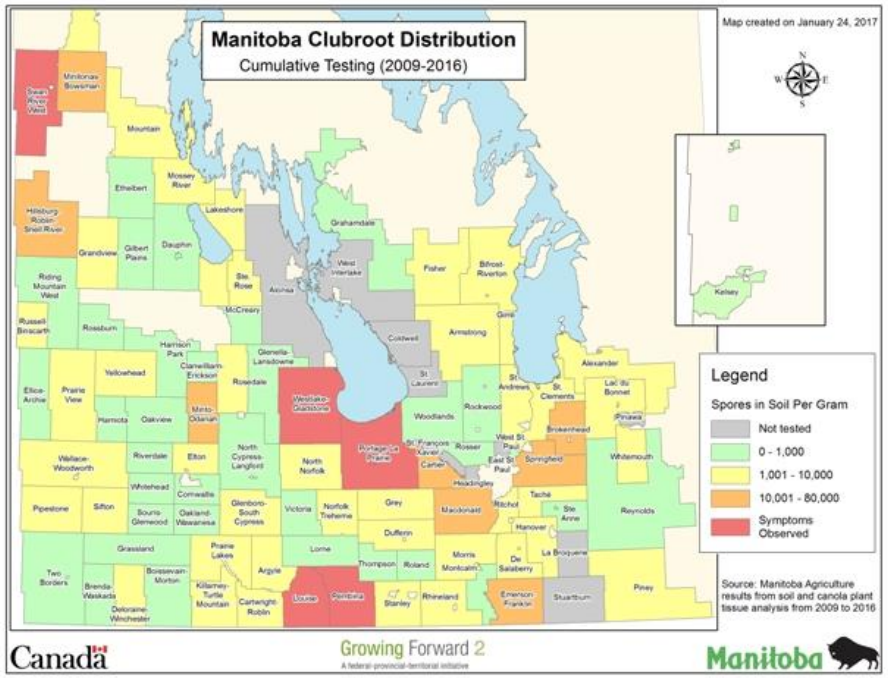
History of clubroot in Alberta

- First identified in canola in 2003
- Confirmed in over 2700 fields
- Pathotypes of the clubroot pathogen that can overcome host plant resistance have been confirmed



Clubroot in Manitoba

- Maps is based on survey results from 2009 – 2016
- 270 individual fields were found positive for clubroot through soil analysis
- 8 fields were confirmed to have symptoms

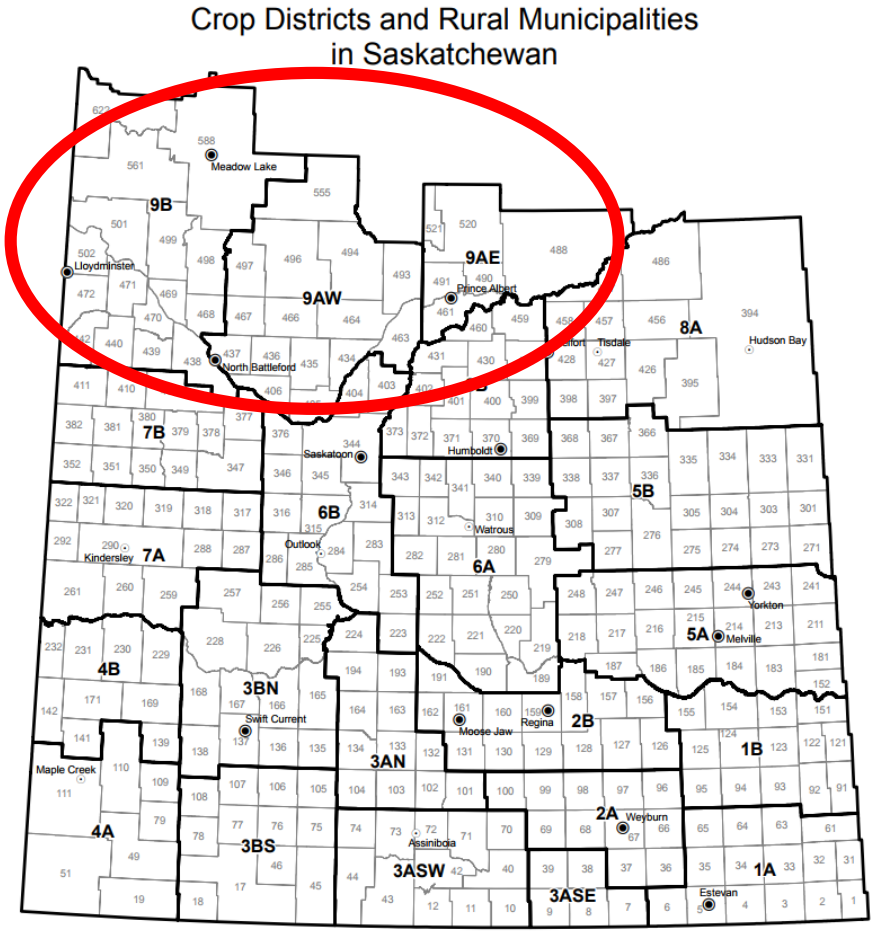


History of clubroot in Saskatchewan

Timeline of Clubroot in Saskatchewan	
Year	**Activities**
2008	One positive field (no symptoms, positive PCR test, positive bioassay)
2009	Declared a pest under *The Pest Control Act* (PCA)
2011	Two fields confirmed positive outside of the Canola Disease Survey
2012	One positive field (no symptoms, positive PCR test, positive bioassay)

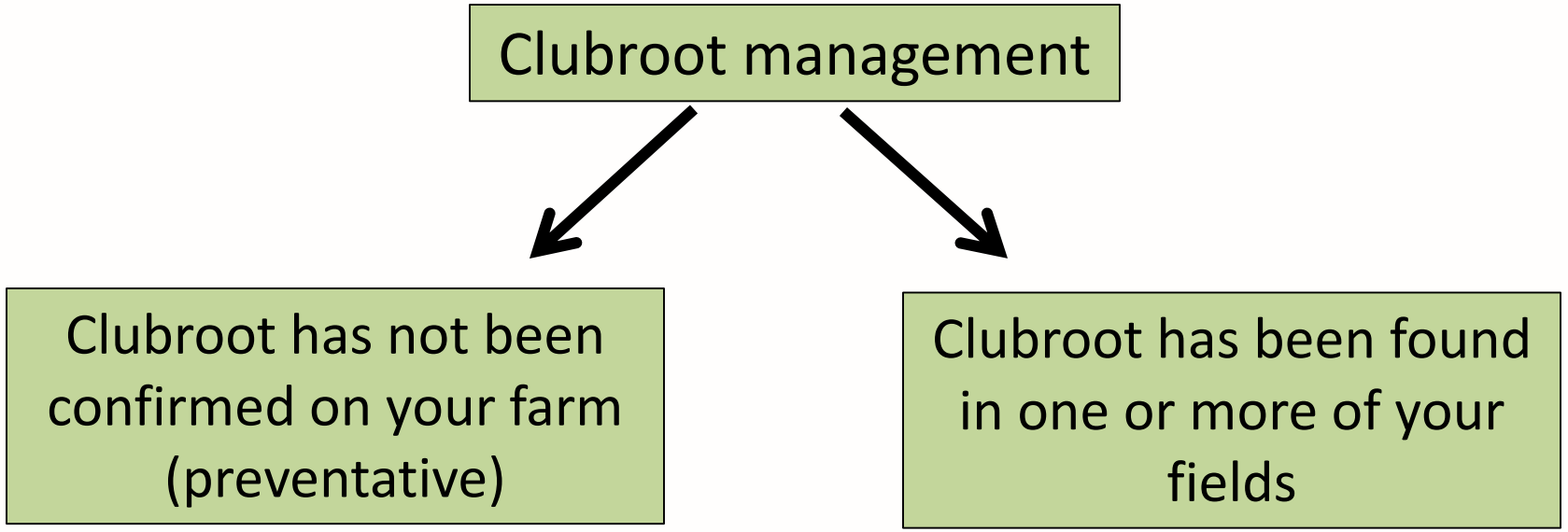
Clubroot in Saskatchewan

- In 2017, clubroot was confirmed in less than 10 commercial canola fields in Crop District 9A and 9B
- Pathotypes 3 and 5



Clubroot management

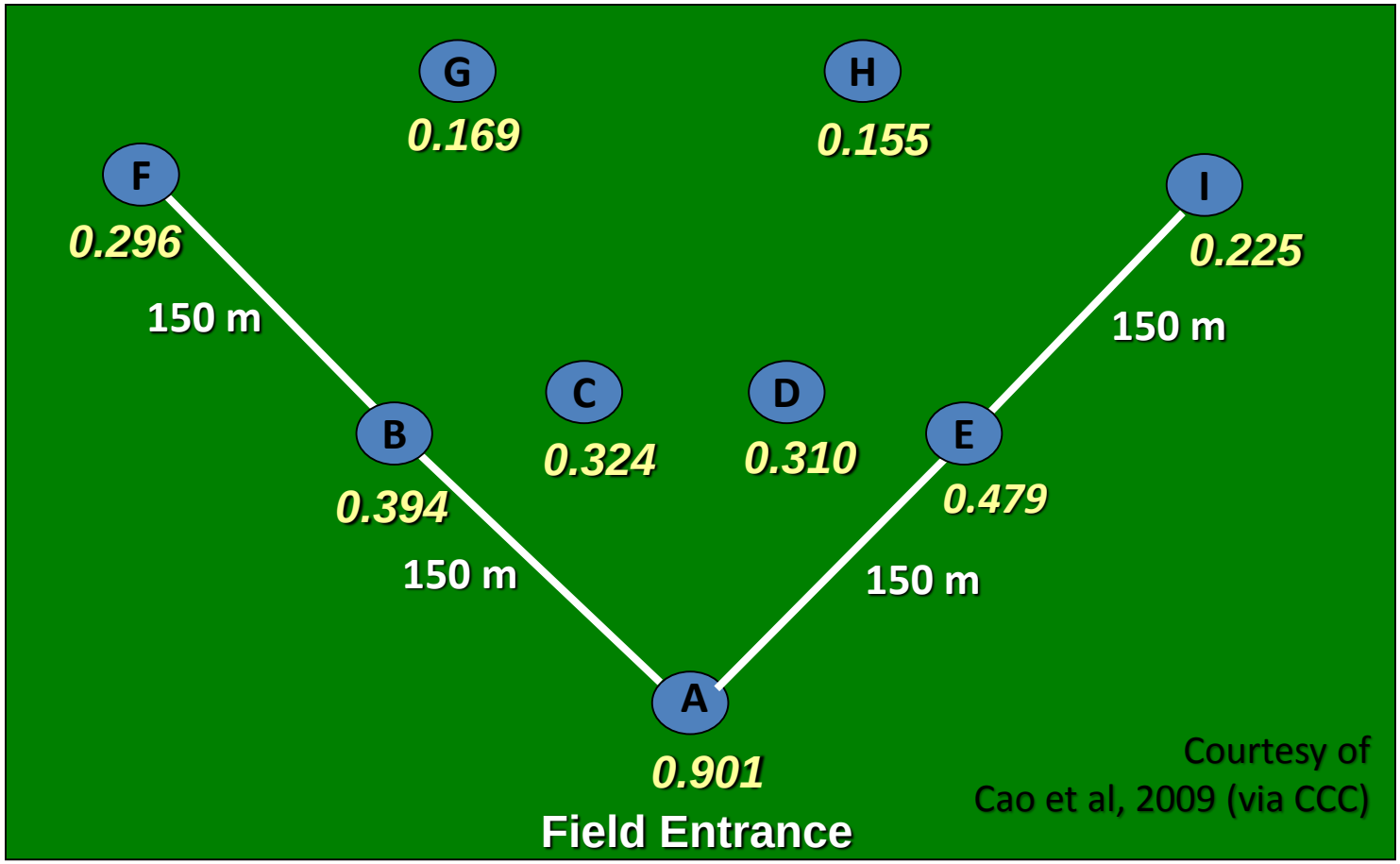
- Clubroot is best managed through a proactive approach



Clubroot prevention: Modes of spread

- Shoes/boots
- Animal traffic
- Earth tag on seed

Clubroot prevention: Modes of spread



Levels of sanitation

1. **Rough clean** – Scraping, brushing or blowing bulk soil and crop debris
2. **Fine cleaning** – Using pressure washing, scrubbing or compressed air to remove remaining residues
3. **Disinfection** – Applying a disinfectant for at least 30 min.

Sanitation on the farm

- The highest level of sanitation is not always practical

- Risk increases when:
  - Clubroot has been confirmed in at least one field on the farm
  - Work is conducted on multiple farms
  - Fields are muddy
  - Equipment is purchased from clubroot infected areas

Movement on equipment

- Work clubroot infected fields last and clean after.
- If possible, avoid working in fields when muddy.
- Remove as much soil as possible before leaving fields.
- Use a higher level of sanitation if working over a large geographic region or between farms.
- Fully sanitize new equipment.

Biosecurity for farm visits

- Park on the side of the road and walk into the field.
- Wear disposable boot covers.
- Sanitize tools between fields.
- Wash vehicle between regions or between farms.
- Higher level of precaution if fields are known to be infected.

Clubroot prevention: Other strategies

- **Minimize soil movement:**
  - Restrict entry of vehicles that have not been properly sanitized.
  - Post multiple “no trespassing” signs.
  - Practice zero/min tillage.
  - Create a separate exit as far as possible from the field entrance.

Early detection

- Scout canola crops regularly (resistant too..)
  - Focus scouting on field entrances, low spots and suspicious patches
- Can also scout for clubroot in non-host crops

Identifying clubroot: Below ground

Early detection

- Soil testing can be used to detect the pathogen at low levels
- Discovery Seed Labs offers this test
  - Contact lab for soil collection protocol
- Soil testing can be used to monitor spore levels over time

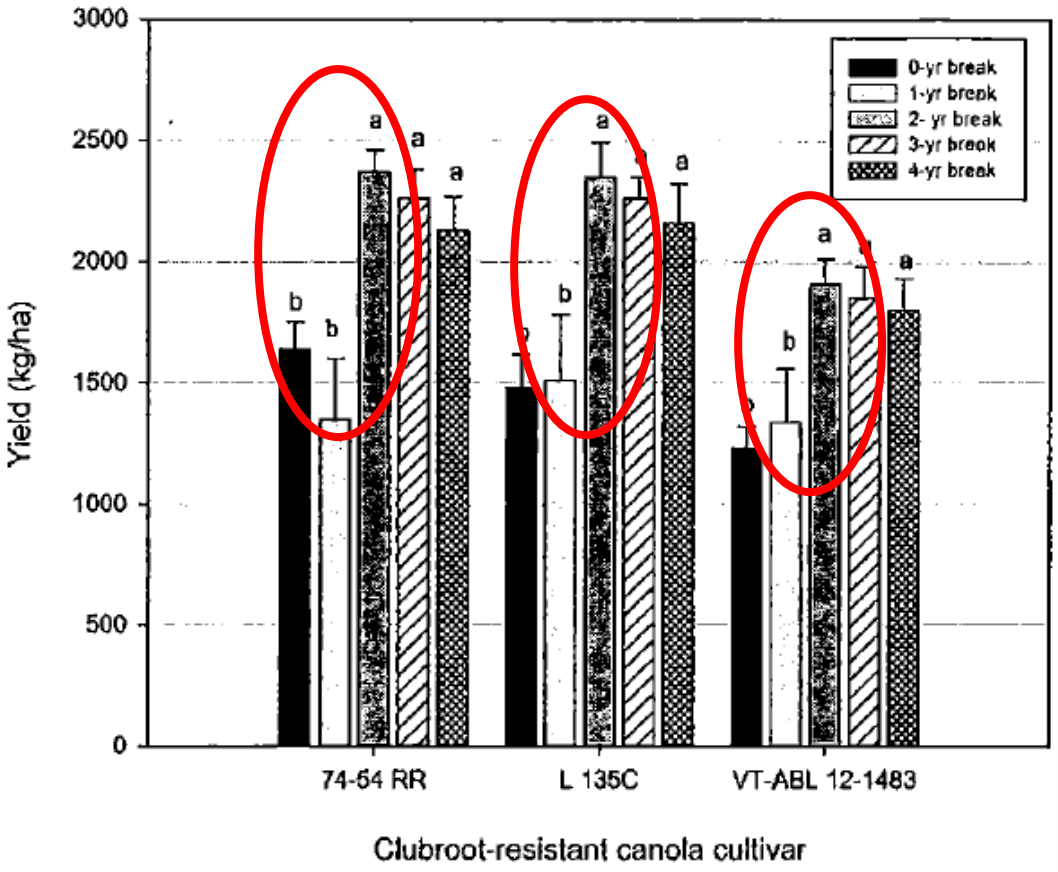

Photo courtesy of Dr. Ron Howard

Crop rotation

- Grow canola in a four year rotation
- Crop rotation will not get rid of the pathogen or prevent introduction but will:
  - Reduce spore levels in the soil
  - Reduce yield losses
  - Reduce the risk of resistance breakdown

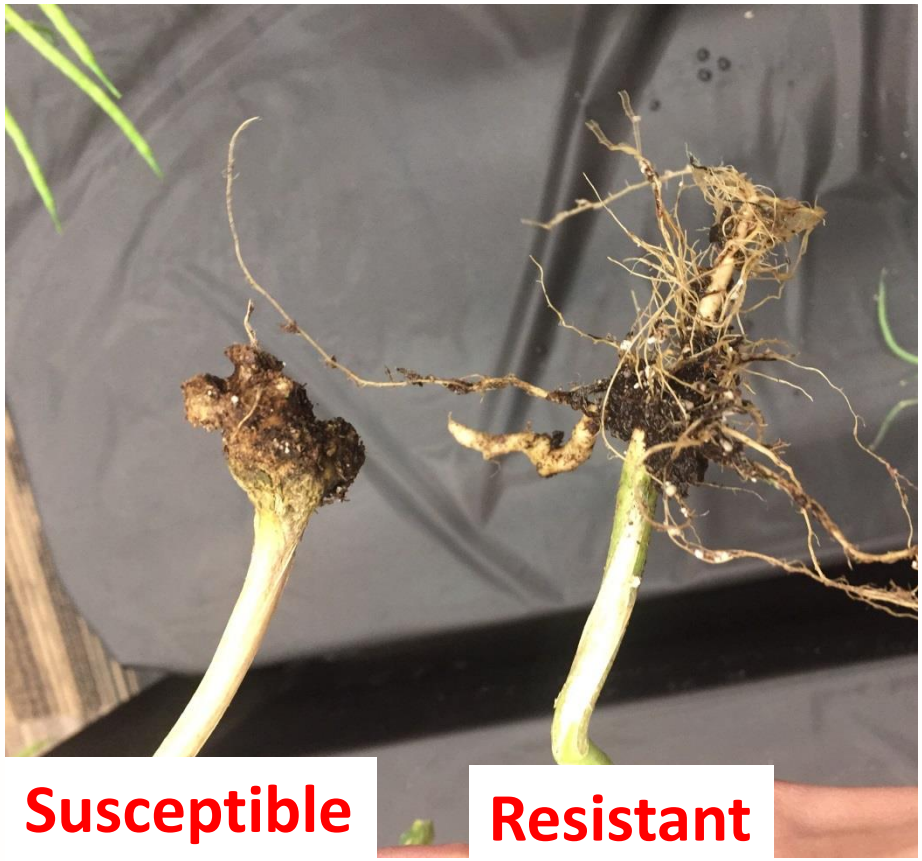
Crop rotation

- Quebec study (Peng et al. 2013)
- A minimum of a 3 year rotation was found to reduce resting spore populations
- A minimum of a 3 year rotation also increased yield of clubroot resistant varieties



Variety selection

- Grow resistant (R) canola varieties
- R varieties are **not immune** to clubroot but highly restrict clubroot symptoms in fields with low to moderate disease pressure
- Should **not** be grown in short rotations



Clubroot patch management

- In many cases clubroot will first be identified in a small region of the field (90% of the time at the field entrance)

Clubroot patch management

- Create a new entrance away from the clubroot infected patch
- Consider seeding the infested area to a perennial grass
- Researchers are investigating other options such as:
  - Liming
  - Solarization

Summary

- In 2017, clubroot was confirmed in commercial canola fields in Saskatchewan.
- Scouting and monitoring is important
- **The earlier that clubroot is identified, the easier it will be to manage and minimize yield losses**

Summary

- Clubroot management should be proactive to:
  - Prevent the spread of clubroot to new areas
  - Keep levels of the pathogen low in areas where it is already present to minimize yield loss
  - Maintain the effectiveness of resistant varieties in Saskatchewan.

Resources:

Clubroot Management Plan

Developed by the Saskatchewan Clubroot Initiative
Revised March 2017

Clubroot Overview

What is clubroot?

Clubroot is a soil-borne disease caused by a microbe, *Plasmodiophora brassicae*. Clubroot affects the roots of cruciferous field crops such as canola, mustard, camelina, oilseed radish, taramira and cruciferous vegetables such as arugula, broccoli, Brussels sprouts, cabbage, cauliflower, Chinese cabbage, kale, kohlrabi, radish, rutabaga and turnip. Cruciferous weeds (e.g. stinkweed, shepherd's purse, wild mustard) can also serve as hosts.

What are the symptoms of clubroot?

Invasion of the interior of host roots alters hormone balance and leads to increased cell division and growth, resulting in clubroot galls. These deformed roots have a reduced ability to absorb water and nutrients leading to stunting, wilting, yellowing, premature ripening and shrivelling of seeds. The cause of these above-ground symptoms can be confirmed by digging up suspect plants to check roots for gall formation. Clubroot affects canola yield and quality to a similar degree as other diseases affecting water and nutrient uptake, and its impact depends on soil conditions and the growth stage of the crop when infection occurs. Early infection of seedlings tends to result in great yield losses. Spore germination in *Plasmodiophora*, infection and disease development are favoured by warm soils, high soil moisture and low soil pH.

Is there surveillance in place for clubroot?

A canola disease survey is conducted annually in the province by a collaboration of plant pathologists, agronomists and crop specialists from the Saskatchewan Ministry of Agriculture, Agriculture and Agri-Food Canada, and private industry. The objective of the canola disease survey is to monitor the presence and severity of common canola diseases, as well as detect the appearance of new diseases such as clubroot.

Where has clubroot been found?

Clubroot affects crucifers worldwide, and was first identified in Europe in the thirteenth century. In Canada, clubroot is primarily established in vegetable growing regions of British Columbia, Quebec, Ontario and the Atlantic provinces. It has also been found in canola in Quebec since 1997. After 45 years of large scale production of canola in western Canada, the disease was reported for the first time in this crop near Edmonton, Alberta. Since then, clubroot has been confirmed in more than 1000 fields Alberta, and was added as a declared pest to Alberta's *Agricultural Pests Act* in 2007.

Clubroot symptoms have not been observed on any of the Saskatchewan canola crops randomly selected for inclusion in the annual canola disease survey (2,063 surveyed from 2008 to 2016). In 2008, 30 soil samples were tested using both DNA diagnostics to detect *Plasmodiophora brassicae* and a bioassay in which canola plants are grown in a sample of the soil and observed for clubroot symptoms after six weeks. One soil sample from west-central Saskatchewan was found to be positive for clubroot using these tests, despite the absence of symptoms in the crop. Clubroot was not detected in any additional soil surveys in 837 fields from 2009 to 2016.

In 2011, clubroot was identified in two canola fields in north-central Saskatchewan in private canola industry research sites. In 2012, one soil sample from west-central Saskatchewan, out of 91 tested across the province, was found to be positive for clubroot using the above tests, despite the absence of symptoms in the crop.

saskatchewan.ca/crops

Government of Saskatchewan