Integrated Management of Clubroot of Crucifers

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Project Funders

- **Agriculture and Food Council of Alberta (50%)**
- **Alberta Canola Producers Commission (25%)**
- **Alberta Crop Industry Development Fund (25%)**

-Current Project End-Date: Sept. 30, 2010

Main Objectives

(1) Develop and assess new and existing clubroot management strategies

(2) Identify and characterize sources of resistance

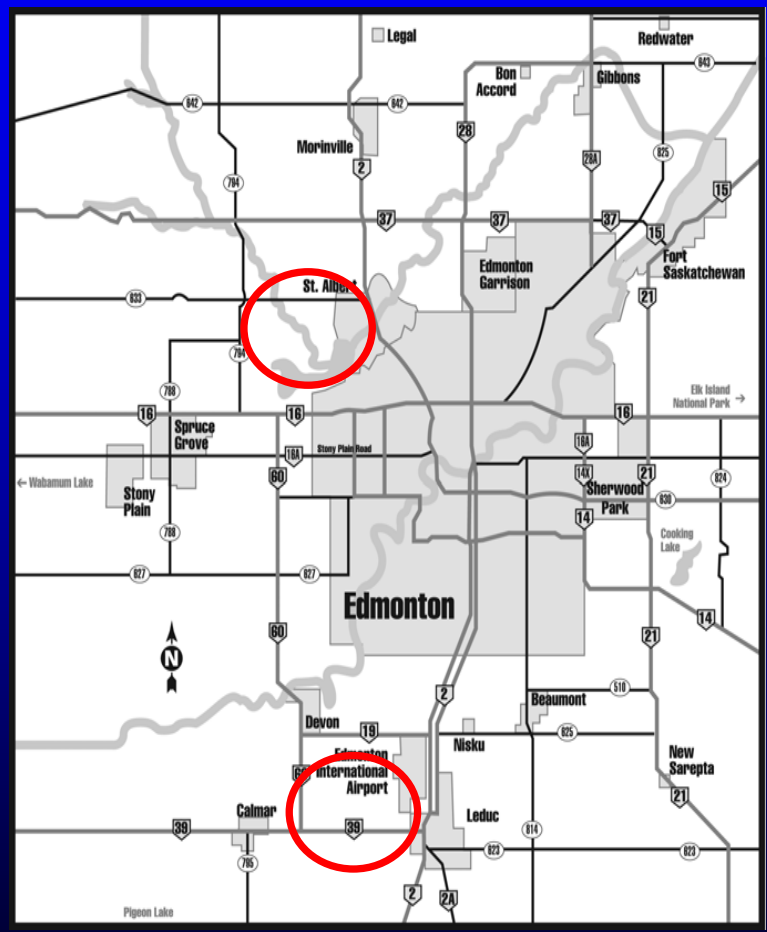
(3) Evaluate diversity in pathogen populations

(4) Monitor clubroot occurrence and spread

Research providing the first information on these topics in Canada (5 years ago, we knew nothing!)

Evaluation of Clubroot Management Strategies

- Determine effects of soil amendments & chemical soil treatments on clubroot severity
- Two locations:
  - Sturgeon County
  - Leduc County
- Experiments established in 2007



Soil Amendments

- Calcium carbonate
  - 2.5, 5.0 & 7.5 t/ha
- Wood ash
  - 2.5, 5.0 & 7.5 t/ha
- Calcium cyanamide
  - 0.5 & 1.0 t/ha

Untreated controls included in both sets of experiments

Chemical Treatments

- Allegro 500F
  - Fluazinam
  - 3.5 & 5.0 L/ha
- Ranman 400 SC
  - Cyazofamid
  - 2.0 & 7.5 L/ha
- Zonix
  - Rhamnolipid biosurfactant
  - 1000 L/ha
- Terraclor 75 WP
  - Pentachlronitrobenzene
  - 45 & 90 kg/ha

Chemical Amendments & Soil Treatments

- Terraclor 75 WP and treatment with high levels of calcium carbonate or wood ash significantly reduced impact of clubroot

Identification of Resistance Sources

- Greenhouse and field screening for sources of resistance
- Screening of lines and accessions
  - U of A Canola Breeding Program & industry
- Contribution to the development of clubroot resistant canola for the Canadian market

I. Falak, Pioneer

Diversity in Pathogen Populations

- Knowledge of pathogenic diversity in *P. brassicae* populations is critical to resistance breeding efforts
- Characterizing populations and single-spore isolates on host differential sets
- Evaluating diversity through molecular techniques
  - Development of molecular markers

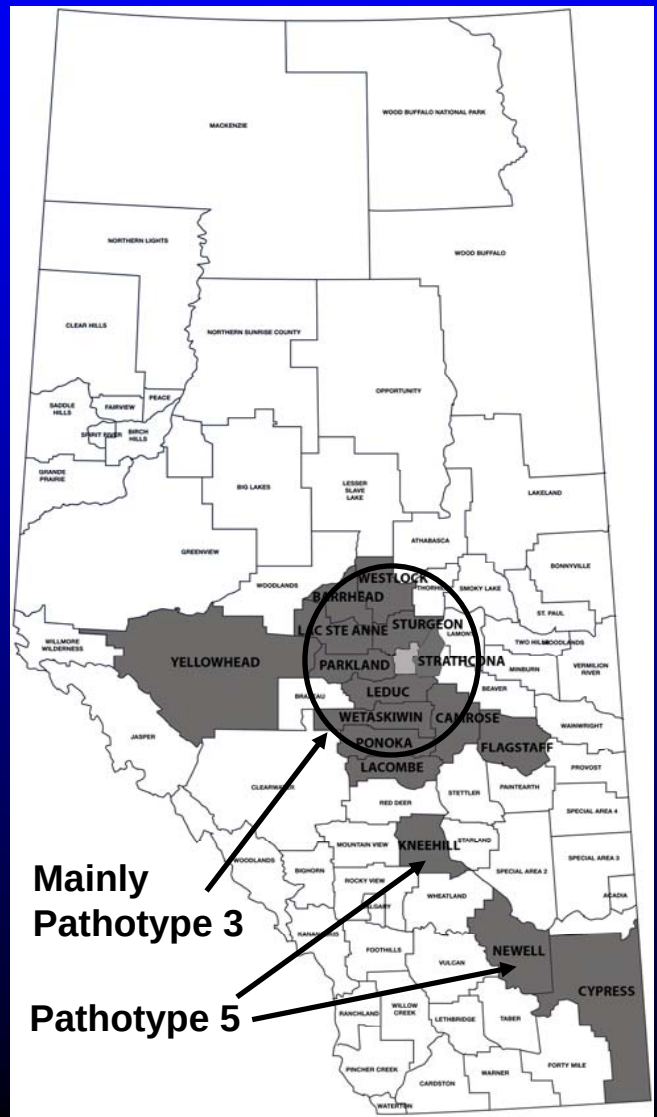
Pathotypes of *P. brassicae*

- **The virulence of *P. brassicae* populations/isoaltes from Alberta (& other parts of Canada) has been evaluated on three differential sets:**
  - **European Clubroot Differential (ECD) set**
  - **Differentials of Williams (1966)**
  - **Differentials of Somé et al. (1996)**

Numerous Pathotypes Identified

- **Central Alberta:**
  - **Pathotype 3 (P_2) accounts for >90% of populations and >70% of single-spore isolates analyzed**
  - **Other pathotypes present but rare (pathotypes 2, 5, 6 & 8)**
- **Southern Alberta:**
  - **Pathotype 5 (P_3) found**
  - **(only two populations analyzed)**

Suggests diversity & potential for evolution of new strains/pathotypes of P. brassicae

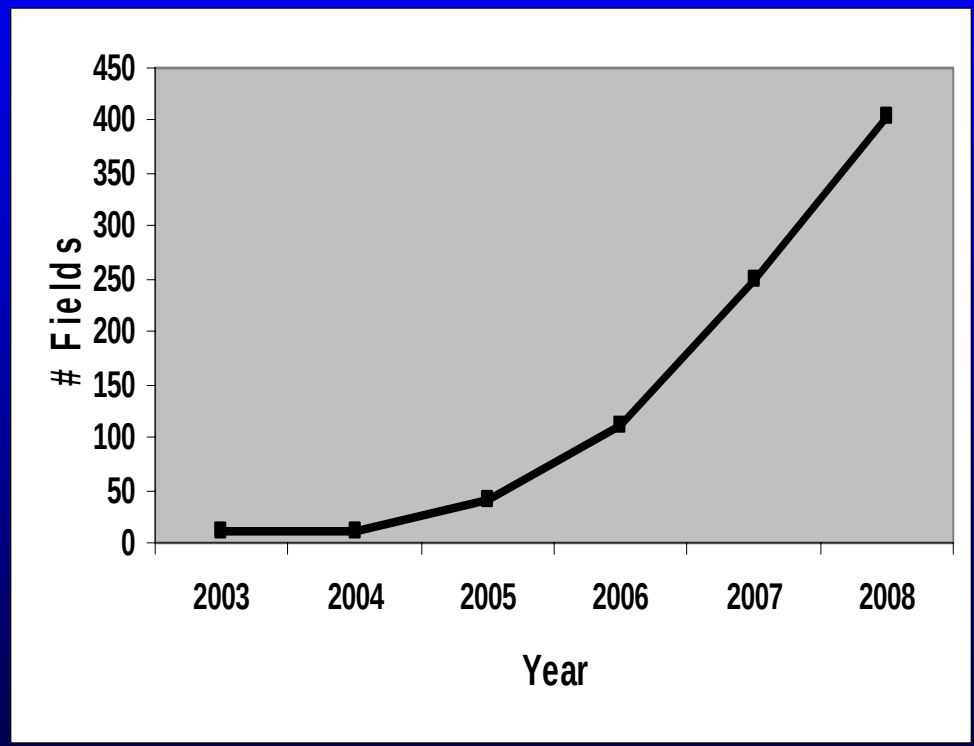


Development of Molecular Markers

- Development of markers to distinguish strains/pathotypes of the pathogen
- Inherent difficulties in working with an obligate parasite
- Promising results with Cleaved Amplified Polymorphic Sequence (CAPS) analysis

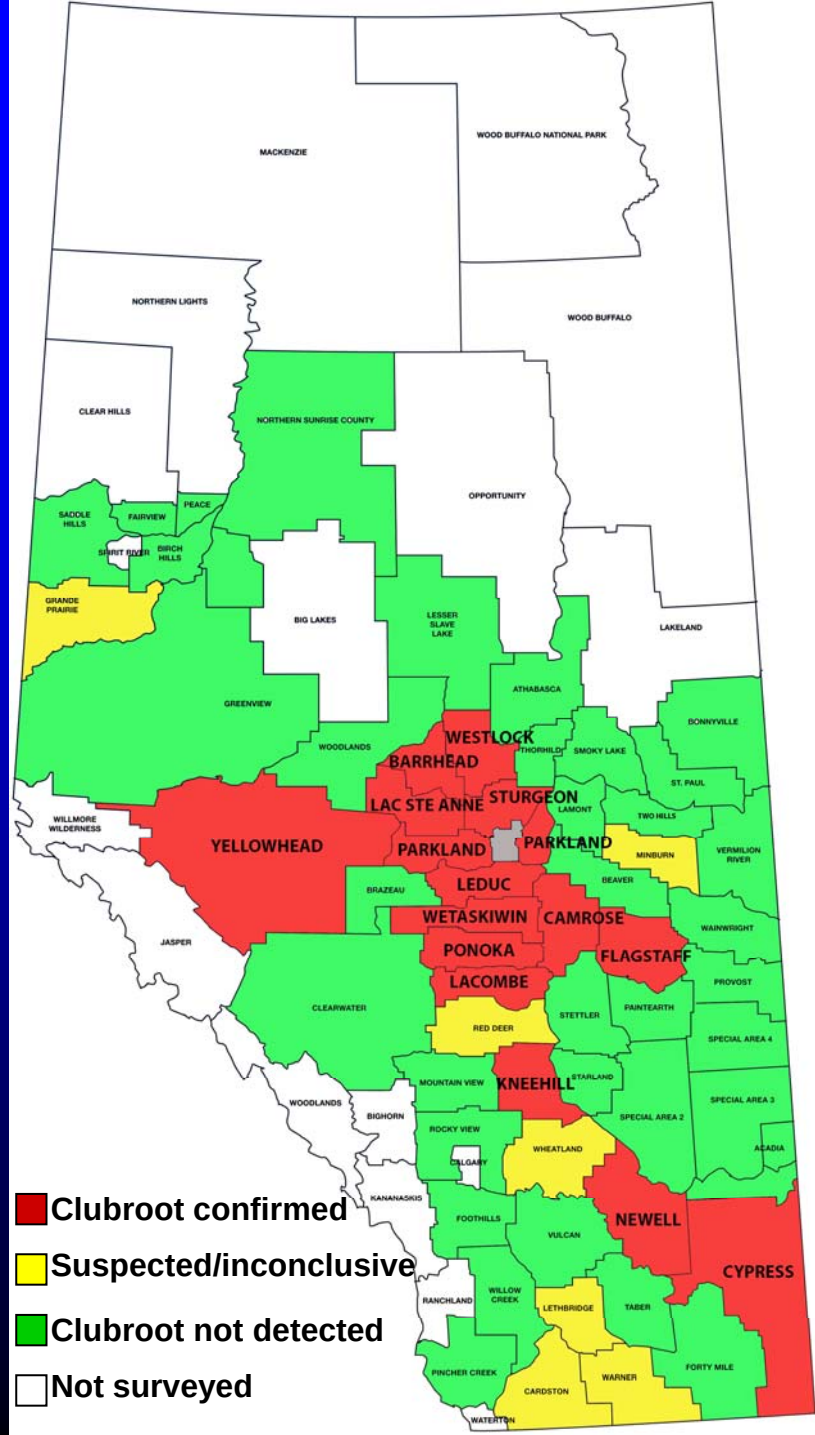
Monitoring Clubroot Occurrence and Spread

- Annual surveys for clubroot conducted by U of A in collaboration with AARD and agricultural fieldmen
- Rapid increase in number of infested fields
  - Yield losses range from trace to 100%



Occurrence in Alberta

- Clubroot confirmed in 405 fields
  - 5685 fields surveyed
  - About 7% clubroot-positive
- 16 municipalities & City of Edmonton
  - Additional cases suspected but not confirmed



Conclusions

- **Promising soil treatments and amendments identified for clubroot control on canola**
  - **Use in conjunction with other tools?**
    - **Seeding date, resistance**
- **Identification of sources of resistance, screening for resistance**
  - **Important for the development of clubroot resistant canola**

Conclusions

- **Pathogenic diversity found in *P. brassicae* populations and single-spore isolates**
  - **Pathotype 3 or P_2 is predominant, but others also occur**
- **Clubroot now established in Alberta**
  - **Appears to be spreading**

- ***This project has served to increase knowledge of clubroot and its management, and represents a strong foundation from which to proceed***