Photo: K. Turkington

Alberta **Clubroot** Management Plan

Developed by:

Alberta Clubroot Management Committee

Revised February 2008

Alberta

AGDEX 140/638-2

Clubroot Overview

What is it?

Clubroot, caused by *Plasmodiophora brassicae,* is a serious disease of canola, mustard and other crops in the cabbage family. Cole crops such as broccoli, brussels sprouts, cabbage, cauliflower, Chinese cabbage, kale, kohlrabi, radish, rutabaga and turnip are also susceptible to clubroot.

Where did it come from?

Clubroot was found in a few Alberta cole crops in the past and was first detected in canola near Edmonton in 2003. This find was the first report of clubroot on canola in Canada. How and when the disease was first introduced into Alberta is unknown.

Why has it spread?

Clubroot can only spread through resting spores in the soil or in canola plant material containing galls. Resting spores are most likely to spread via contaminated soil carried from field to field by equipment. Tillage equipment represents the greatest risk of spreading the disease as soil is frequently carried on shovels and discs from field to field.

Why is it of concern?

Resting spores are extremely long lived, surviving in soil for up to 20 years. The resting spore longevity is a key factor contributing to the seriousness of the disease, especially under tight canola rotations. Research indicates that infestations nearing 100 per cent of plants affected cause about 50 to 80 per cent yield loss, while infestations of 10 to 20 per cent lead to 5 to 10 per cent yield loss. Severe field infestations in Alberta have caused total yield loss (not worth combining) in a few cases. Also, canola quality (oil content) is often reduced. However, clubroot is not a phytosanitary issue for trade.

What is being done about it?

In spring 2007, clubroot was added as a declared pest to Alberta's *Agricultural Pests Act*. The *Agricultural Pests Act* is the legislative authority for enforcement of control measures for declared pests in Alberta. Researchers from the University of Alberta and Alberta Agriculture and Food have begun research projects on clubroot in Alberta. Public and private breeding programs have started to develop clubroot resistant lines for western Canadian germplasm.

What is the current state of clubroot in Alberta?

By the end of 2007, clubroot was present in 10 municipalities around Edmonton and one county in southern Alberta. However, the disease has the potential to spread to most of the traditional canola growing areas of western Canada.

Background

Clubroot is a serious soil-borne disease of cruciferous crops (canola and cabbage family) worldwide and was first identified in Europe in the thirteenth century. This disease is a major problem in cole crops (cruciferous vegetables like cabbage) in some areas of British Columbia, Quebec and Ontario. There have been two previous reports of clubroot in cole crops in Alberta. Thus, clubroot is not a new disease in Canada or Alberta.

In 2003, clubroot was confirmed in several canola fields near Edmonton, which was the first report on canola in western Canada. Clubroot has spread to 11 municipalities in Alberta, including one in southern Alberta, but is found primarily in Edmonton and surrounding counties of Sturgeon, Parkland, Leduc and Strathcona.

Clubroot can affect broccoli, brussels sprouts, cabbage, cauliflower, Chinese cabbage, kale, kohlrabi, radish, rutabaga and turnip. Canola/rapeseed and mustard are also susceptible to this disease. There are several non-cruciferous weak hosts, but they are considered to be a very low risk for disease develpment and carryover.

Symptoms will vary depending on the growth stage of the crop when infection occurs. Early infection at the seedling stage can result in wilting, stunting and yellowing symptoms by the late rosette to early podding stage.

Infection that occurs at later stages may not show plant wilting, stunting or yellowing, but infected plants will ripen prematurely, and seeds will shrivel. Thus yield and quality (oil content) are reduced. Symptoms may be confused with drought, nutrient deficiency or other diseases, so suspect plants should be pulled from the soil to check for gall formation on roots.

Swedish researchers found that infestations nearing 100 per cent of plants affected caused about 50 to 80 per cent yield loss, while infestations of 10 to 20 per cent led to 5 to 10 per cent yield loss. These levels are similar to sclerotinia stem rot infection in canola where a general rule of thumb is that yield loss is half of the percentage of infected stems. This comparison is a reasonable one since both diseases restrict the flow of water and nutrients to developing seeds.

In severe cases of field infestations in Alberta, total canola crop losses have been experienced (not worth combining). Clubroot is not presently a phytosanitary trade issue.

There are no economic measures for controlling clubroot infestations in canola or mustard. In contrast, there is some genetic resistance and fungicides are available for cole crops. Public and private breeding programs have started breeding for clubroot resistance for Canadian canola germplasm.

Objective

Minimize the spread and build-up of clubroot in canola, mustard and market garden fields in Alberta.

Regulatory Status

Alberta's *Agricultural Pests Act* is the legislative authority for enforcement of control measures for declared pests in Alberta. Clubroot was added as a declared pest to the *Agricultural Pests Act* in April 2007. The Minister of Alberta Agriculture and Food is responsible for this Act. However, enforcement is the responsibility of the municipality. Agricultural Fieldmen are responsible for enforcing pest control measures in their municipality.

Pest inspectors may be appointed by the local municipality or by the Minister of Agriculture and Food. Agricultural Fieldmen are pest inspectors under the *Agricultural Pests Act*. Pest inspectors have the power to enter land at a reasonable hour, without permission, to inspect for pests and to collect samples.

The owner or occupant of land has the responsibility of taking measures to prevent the establishment of any pest on land, property and livestock and to control or destroy all pests on the land or property.

Control measures for clubroot are specified in this management plan. It is important to understand that these control measures represent an acceptable standard that is to be applied in all municipalities across the province. Municipalities can enhance the standard within their own jurisdictions.

Factors in the Spread of Clubroot in Alberta

Resting spores are most likely to spread from field to field via contaminated soil on equipment. Tillage equipment represents the greatest risk of spreading the disease as soil is frequently carried on shovels, discs and other openers. Clubroot surveys in Alberta have found that almost all new infestations begin near the field access, which indicates that contaminated equipment is the predominant spread mechanism. Other methods of spread could include movement of soil with water or wind, soil attached to seed (earth-tag) and soil on hay, straw or greenfeed.

Resting spores are extremely long lived, with a half-life of about four years, but surviving in soil for up to 20 years. The longevity of the resting spores is a key factor contributing to the seriousness of the disease, especially under tight canola rotations.

Growers, custom operators and all land users (including oil and gas industry, recreationalists, etc.) need to be vigilant and diligent in removing potentially contaminated soil from equipment prior to leaving fields, to prevent the introduction of clubroot to clean fields because no economically viable options currently exist to control infestations in canola.

Management Plan Rationale

The most desirable approach to managing clubroot in Alberta is through a proactive program designed to prevent the spread of this pathogen in the province. The program will include both a management and a communication plan. The long-term goal of this management plan is to prevent the establishment and minimize the spread of clubroot in Alberta.

Best Management Practices

1. Use long rotation breaks between canola crops. Although crop rotation will not prevent the introduction of clubroot to clean fields, it will restrict disease development within the field and probably avert a severe infestation of clubroot and other diseases such as blackleg. Canola growers in high risk situations (confirmed clubroot in the area) should follow traditional canola rotation recommendations (one canola crop every four years). Under very light infestations, a three-year rotation break from canola will keep the clubroot level very low. Under moderate to high infestations, the rotation break needs to be five years or more to reduce clubroot to low levels.

2. Volunteer canola and cruciferous weeds must be controlled on infested fields to prevent more than three weeks of growth to avoid the production of new resting spores.
3. Practice good sanitation to restrict the movement of potentially contaminated soil (this approach will also help reduce the spread of other diseases, insects and weed seeds). The resting spores are most likely to spread via contaminated soil. Moderate to high infestations will leave high spore concentrations in soil on field machinery – thus sanitation is very important in these situations. All producers should follow the practice of cleaning soil and crop debris from field equipment before transport from all fields. Cleaning equipment involves knocking or scraping off soil lumps and sweeping off loose soil.
    - For risk averse producers or for fields with heavy infestations, additional cleaning steps will slightly decrease the risk of spread, but these steps involve considerably more work and expense:
        - After removal of soil lumps, wash equipment with a power washer, preferably with hot water or steam.
        - Finish by misting equipment with weak disinfectant (1 - 2% active ingredient bleach solution). The use of a disinfectant without first removing soil is not recommended as soil inactivates most disinfectants.
        - Seed an area to grass near the field exit to clean off equipment more effectively.
4. Use direct seeding and other soil conservation practices to reduce erosion. Resting spores can also readily move in soil transported by wind or water erosion. Reducing the amount of tillage on any given field will reduce the spread of the organism within the field and to other fields.
5. Minimize traffic to and from fields.
6. In situations where fields are lightly infested only near the current access, create a new exit at another distant edge of the field if possible.
7. Scout canola fields regularly and carefully. Identify causes of wilting, stunting, yellowing and premature ripening – do not assume anything!
8. Avoid the use of straw, hay or greenfeed, silage and manure from infested or suspicious areas. Clubroot spores may survive through the digestive tracts of livestock.
9. Avoid common untreated seed (including canola, cereals and pulses). Earth-tag on seed from infested fields could introduce resting spores to clean fields. The effect of current seed treatment fungicides on resting spore viability on seed needs research.

The risk of spreading clubroot through contaminated seed or plant material is much less than through transporting contaminated soil on field equipment.

Responsibilities

Alberta Agriculture and Food (AF)

- Pest Management Branch (PMB) of AF will do the following:
  - co-ordinate the Alberta Clubroot Management Plan
  - provide regulatory consultation and training
  - prepare and provide technical information on clubroot control recommendations to inspectors and others in the field
  - assist in educating the agriculture industry, oil industry and general public about clubroot and the threat it represents to Alberta
  - inform other industry sectors such as the agricultural retail industry, environmental companies, custom applicators and landscaping companies about equipment cleaning requirements to reduce spread within the municipalities
  - develop a communication plan to inform all stakeholders about the threat of clubroot

Agricultural Service Boards (ASB)

- Provide support and resources to the Agricultural Fieldmen in carrying out their duties.
- Agricultural Fieldmen will do the following:
  - actively survey for clubroot if canola or mustard is grown in their municipality
  - provide recommendations and information to farmers on clubroot prevention and management
  - enforce control measures as necessary to meet the objectives of the Alberta Clubroot Management Plan
  - maintain records of infestations and provide information on infested land locations to potential land renters, landowners, oil and gas companies and other parties with a financial interest, under provisions of the *Agricultural Pests Act* and the Pest and Nuisance Control Regulation (section 10).
  - assist in educating the Alberta agriculture industry about clubroot and the threat it represents to Alberta

Landowners/Occupants

- take measures such as sanitation and rotation to prevent the establishment of clubroot on their land and to minimize the spread of clubroot to other land or property
- observe and practice all management practices to meet the objectives of the Alberta Clubroot Management Plan

Agricultural Retail Industry (pesticides, fertilizer, equipment, etc.)

- take measures such as equipment cleaning to prevent the establishment of clubroot and to minimize the spread of clubroot to other land and property
- assist in educating the Alberta agriculture industry about clubroot and the threat it represents to Alberta

Custom Equipment Operators

- take measures such as equipment cleaning to prevent the establishment and to minimize the spread of clubroot on the land and property
- assist in educating the Alberta agriculture industry about clubroot and the threat it represents to Alberta

Oilfield, Gas and Other Companies (operating on agricultural land)

- take measures such as equipment cleaning to prevent the establishment and to minimize the spread of clubroot on the land and property
- assist in educating Alberta's oil, gas and other related industries about clubroot and the threat it represents to agriculture in Alberta

Clubroot Management Committee

- provide a forum to represent the interests and views of the Alberta agriculture industry and oil and gas industries in Alberta and western Canada regarding the management of clubroot
- recommend management strategies for clubroot for inclusion in the Alberta Clubroot Management Plan
- assist in educating the agriculture, oil and gas industries in western Canada about clubroot and the threat it represents to canola and cole crop production
- evaluate and revise the Alberta Clubroot Management Plan as required

Suggested References

Clubroot Disease of Canola and Mustard factsheet, Agdex 140/638-1, Alberta Agriculture and Food

Clubroot of Crucifers Control Strategies, Agriculture and Agri-Food Canada, Horticulture

Clubroot Management Committee Contact List

Murray Hartman (chair)
Oilseed Specialist
Alberta Agriculture and Rural Development
murray.hartman@gov.ab.ca

Allan Macaulay (co-chair)
Pest Management Branch
Alberta Agriculture and Rural Development
allan.macaulay@gov.ab.ca

Darrel Armstrong
Canola Commercial Seed Manager
Pioneer Hi-Bred Production Ltd.
darrel.armstrong@pioneer.com

Clarence Assenheimer
Director, Region 5
Alberta Canola Producers Commission
classenheimer@yahoo.ca

Don Christensen
Director, Northern Region
Alberta Farm Fresh Producers Association
dlchrist@mcsnet.ca

Patrick Delaney
Vice President
Petroleum Services Association of Canada
pdelaney@psac.ca

Emile deMilliano
Viterra
emile.demilliano@viterra.ca

Jeff Enerson
Health and Safety Analyst
Petroleum Services Association of Canada
jenerson@psac.ca

Clifford Goerz
Councillor, Division 3
Parkland County
cgoerz@parklandcounty.com

Bruce Greenfield
Science Advisor
Energy Resources Conservation Board
bruce.greenfield@ercb.ca

Ron Howard
Plant Pathology Research Scientist
Alberta Agriculture and Rural Development
ron.howard@gov.ab.ca

Brent Hoyland
Agricultural Fieldman
Flagstaff County ASB
bhoyland@flagstaff.ab.ca

Sheau-Fang Hwang
Plant Pathology Research Scientist
Alberta Agriculture and Rural Development
sheau-fang.hwang@gov.ab.ca

Chad Jarvis
Cargill
Chad_jarvis@cargill.com

Mary Lupwayi
Agricultural Fieldman|
Grande Prairie County
mlupwayi@countygp.ab.ca

John Mayko
Senior Agronomy Specialist
Canola Council of Canada
maykoj@canola-council.org

continued on next page

Clubroot Management Committee Contact List

Doug Moisey
Agronomy Specialist
Canola Council of Canada
moiseyd@canola-council.org

Gary Sargent
Manager, Resource Access
Canadian Association of Petroleum Producers
gary.sargent@capp.ca

Steve Strelkov
Assistant Professor
University of Alberta
stephen.strelkov@ualberta.ca

Lee Taylor
Quicksilver Resources Canada Inc.
LTaylor@qrinc.ca

Ward Toma
General Manager
Alberta Canola Producers Commission
Ward.toma@canola.ab.ca

Aimee Wonsik
Assistant Agricultural Fieldman
Wainwright County ASB
asb@mdwainwright.ca

Contact list updated July 2008