

CLUBROOT Q & A

DOES ROTATION PREVENT THE SPREAD OF CLUBROOT?

No, crop rotation will not stop the spread of clubroot since this disease travels by soil movement. However, crop rotation DOES slow the buildup of clubroot resting spores, which slows the development of pathotypes virulent on canola and extends the effective durability of clubroot resistant varieties. Protect current clubroot resistance genes and reduce spore numbers by allowing 2-3 year breaks between canola crops on infested soils.

IS CLUBROOT JUST A PROBLEM IN ALBERTA?

No, the disease is more severe in Alberta and growers have increased risk of this disease establishing, but the management strategies recommended for Alberta should also be adhered to in Saskatchewan and Manitoba. Preventing the introduction of this disease is even more important for locations that don't have it; an ounce of prevention is worth a pound of cure.

WHAT IS THE DIFFERENCE BETWEEN A RACE, A STRAIN AND A PATHOTYPE?

These terms are sometimes used interchangeably, but they each have separate meanings, and varying degrees of specificity (as described below):



Strain is a general term used to describe different populations or groups of pathogens that have similar characteristics, particularly with respect to their ability to cause disease on certain hosts.

Pathotype is a more specific term which refers to strains that differ in their ability to infect specific varieties of a host.

Race is the most specific term that describes pathotypes or strains which differ in their impact on specific resistance genes of a host.

As an analogy, if a pathogen was machinery, a strain would be agricultural machinery, a pathotype would be a seeder and a race would be a specific model and make of a seeder.

HOW SHOULD I TIME MY CLUBROOT MANAGEMENT STRATEGIES?

MANAGEMENT STRATEGIES TO IMPLEMENT THROUGHOUT THE YEAR			
WINTER	SPRING	SUMMER	FALL
Submit soil samples for testing			
Variety selection			Variety selection
Control weeds and volunteers			
Spring sanitation			
		Summer sanitation	
			Fall sanitation
Scout and submit plants for testing			

WHEN SHOULD CLUBROOT RESISTANT (CR) VARIETIES BE USED?

- Clubroot resistant (CR) varieties should be used in fields where there is no clubroot present, especially if there are infested fields in the region. Growers cannot be 100% certain the pathogen is not in their field. CR varieties can prevent spore buildup even if it is at undetectable levels.
- CR varieties should be used when there is a low level of clubroot disease present in a field. These varieties can prevent further spore buildup.
- CR varieties should be used when there is a high level of clubroot present. CR varieties allow production of good crops in fields where there is heavy clubroot. However, CR varieties should not be grown continuously or in short rotation, because they may lose their effectiveness or become susceptible within a few canola cycles.

HOW DOES CLUBROOT RESISTANCE WORK WITHIN A CANOLA PLANT?

The root hairs of many resistant varieties can still get infected by the primary zoospores, but further widespread root infection by the secondary zoospores is suppressed. As a consequence, few if any visible symptoms develop in plants with clubroot resistance.

ARE THERE RISKS ASSOCIATED WITH USING CLUBROOT RESISTANCE?

- In non-infested soil, there is no risk since there is no *P. brassicae* present to potentially overcome clubroot resistance.
- In soil with low infestation, the risk is extremely small when spore concentrations are small. Since the *P. brassicae* is present in numbers that are very low, there are not enough individual spores capable of overcoming resistance. Resistance will last a very long time in these conditions.
- In soil with high infestation, yes, there is a risk that *P. brassicae* could overcome the resistance genes in resistant varieties. Therefore resistant varieties need to be used in these conditions in conjunction with other management options to reduce this risk.

WHAT HAPPENED WITH CLUBROOT RESISTANCE IN ALBERTA?

Current CR varieties are highly effective against the predominant pathotypes of *P. brassicae*, and the presence of a clubroot resistance gene in a plant does not lead to a new pathotype of clubroot being formed. Rather, a portion of the billions of spores that are present in heavily infested soil contain a gene that allows the pathotype to overcome or "defeat" the resistance gene.

The more times you plant this variety with this same gene in the same field, the faster you can build up a population of *P. brassicae* spores that can defeat the resistance gene in the plant and cause severe clubroot. This is why being careful about where and how often we grow resistant varieties is critical to extending the effective period of current resistance genetics. It is not that the varieties or genetics have failed, but rather that the pathogen has the ability to adapt.



ALL ABOUT CLUBROOT



FIVE IMPORTANT THINGS TO KNOW ABOUT CLUBROOT

WHAT IS CLUBROOT?

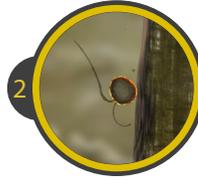
Clubroot is a serious disease of canola and other crops in the family Brassicaceae. Once established, it can lead to swollen, deformed plant roots that restrict water and nutrient uptake, resulting in premature ripening or plant death.

Clubroot is caused by the soil-borne pathogen *Plasmodiophora brassicae*, which shares some characteristics of a fungus, an amoeba and a slime mold, making it challenging to control. Preventing the introduction of the pathogen is critical, however management is possible. We have a good understanding of it, tools to help control it and research that continues to advance both.

1. THE LIFECYCLE



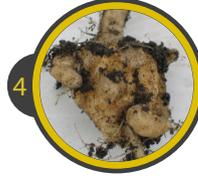
In the spring, resting spores of this pathogen germinate, producing zoospores which swim in free water in the soil and infect susceptible plants through tiny root hairs.



The fungus continues its development in the host organism, and a second generation of zoospores is eventually released, which go on to infect more of the root surface (and require soil moisture to do so).



Infected root tissue is then induced by the pathogen to enlarge cells and increase cell division, restricting effective movement of water and nutrients within the plant and causing the characteristic root swellings.



When the plant root tissue begins to senesce, the pathogen produces millions to billions of new resting spores which are released into the soil upon root decomposition.

2. HOW TO SPOT IT

Scouting fields regularly and carefully is important for effective disease management. Some specifics to keep in mind are:



- Clubroot often shows up in canola fields in distinguishable patches due to premature ripening. (See photo above)
- In fields with no history of clubroot, the diseased patches are most often found at field entrances where equipment carrying infested soil first deposits this soil.
- In fields with a history of this disease, highly infested patches are commonly found in areas with increased moisture, such as low spots or near sloughs.

3. HOW TO DIAGNOSE IT

High soil moisture, warm soil temperatures and acidic soil are all favourable conditions for the pathogen, but the disease can still occur in basic soils. When favourable conditions, a susceptible host and the pathogen are present, the disease occurs. Once the disease is present, the symptoms that result vary by growth stage, resting spore concentration and soil conditions.



Example A: Plants infected in early growth stages in warm, moist soil and high spore concentrations may produce root swellings as early as the 6-leaf stage.



Example B: Infected plants in the late rosette to early podding stage in warm, moist soil and high spore concentrations may show wilting, stunting, yellowing and premature ripening.



Example C: With infections in late growth stages in dry soil conditions and low spore concentrations, above ground symptoms may not be visible but gall swelling may be observed on the roots. Inspection of root tissue for potential gall swelling is required under all conditions.

Even if canola is not being grown, soil samples can be submitted to labs for testing to determine clubroot presence.

4. HOW TO MANAGE IT

i) Prevent spore buildup

- **Utilize resistant varieties when applicable.** See Q & A *When should clubroot resistant (CR) varieties be used?*
- **Carry out suitable crop rotation.** See Q & A *Does rotation prevent the spread of clubroot?*
- **Manage weeds effectively.** Seeded canola isn't the only susceptible plant, volunteer canola and other *Brassica* weeds (such as stinkweed) can harbour clubroot, so control is critical in both canola and especially non-canola years.

ii) Prevent spore movement

- **Use cleaned and treated seed.** Not just canola seed, but any crop seed that is not cleaned and treated may have clubroot spores if harvested from an infested field.
- **Dropping off your dirt = dropping off spores.** Scraping and sweeping off a tractor frame after tilling in a mildly infested field can reduce the spore count on the tractor by over 100 million spores.
- **Limit your soil spreading.** Tillage can spread the clubroot spores from one patch to an entire field very quickly. Zero or reduced till equipment can limit this transmission.

5. HOW TO STAY INFORMED

Get the latest information at clubroot.ca