

# Managing Clubroot

**What is Clubroot?** Clubroot is a major soil-borne fungal disease, *Plasmodiophora brassicae* wor., which attacks cruciferous crops and weeds. The disease occurs on turnip, rutabaga, radish, kale, kohlrabi, cabbage, broccoli, cauliflower, brussel sprouts, rape, related Chinese vegetables and weeds in the cruciferae family including shephard's purse, mustards, and penny cress.

The fungus enters the plant through the fine hairs on the roots. Small to large spindle-like swellings develop on the roots of cabbage, cauliflower and broccoli which have fibrous root systems; large outgrowths and misshapen roots occur on turnip, rutabaga and radish. This distortion of the root system inhibits the uptake of water and plant nutrients. Infected plants become stunted, take on a bluish tinge and then turn yellow. Plants begin to wilt on sunny days. As the season progresses these distorted roots are invaded by other soil-borne organisms which breakdown and release spores into the soil. Repeated cropping quickly increases the number of spores.

Cold, moist, acid soil conditions favour the development of the disease. Once soil becomes infested, it will remain for at least seven years. Resting spores can survive in soil indefinitely. These facts should be considered by persons growing these crops. The movement of infested soil to uninfested lands will result in the spread of the disease. The disease can be spread on contaminated machinery, tools, footwear, manure of animals whose feed consists of infected plant material, infected transplants, contaminated seed potatoes, wind and water borne soil, contaminated irrigation water and water on farm roads.

## Control of Clubroot

1. Practice a good crop rotation. To avoid infesting land, do not plant one susceptible crop after another for a period of five to seven years. Susceptible weeds in the land should also be controlled during this time.
2. Infested land should be seeded to a sod crop such as hay or pasture for at least seven years to prevent the movement of soil. The land should be isolated until the sod is well established. Additionally, susceptible weeds should also be controlled.
3. All equipment and tools used on infested land should be washed down and, preferably, steam-cleaned or disinfected to prevent carrying the disease to uninfested fields. Live steam delivered at 690 kPa pressure for 5 minutes is the best method to disinfect equipment. Kem Germ at 30 g/L or Javel products (Javex, Mix-o) at 1 part in 3 parts water, or Cresanol (acetic acid) at 4 parts in 10 parts water are effective disinfecting agents.
4. Cattle-fed infected plant material can pass the viable fungus spores in manure. Do not apply infested manure to land intended to grow cruciferous crops. If possible, apply it to already infested land or spread it on permanent pasture land that will not be used for any susceptible crops and where run-off will not carry the disease to uninfested fields.
5. The clubroot organism thrives in cold, wet soil, therefore wet land should be avoided. Land drainage will help to control the disease.
6. The clubroot organism prefers acid soils. Raising the pH above 7.2 will help to reduce the incidence of the disease. Growers are reminded that at this high a pH some micro nutrients, such as boron, become unavailable to the crop. Boron will have to be applied as a foliar spray in addition to the nutrients supplied in the fertilizer. For the correct rate, time and method of application consult The Vegetable Crops Production Guide for the Atlantic Provinces, publication 1400. When soil pH is raised to this level, the organisms that cause common and powdery scab become more active. Scab can attack crops like turnip, rutabaga, beet and potato. The use of up to 1700 kg/ha (1500 lbs/acre) of hydrated lime as part of the liming material is recommended. This type of lime reacts with the soil quickly and supplies soluble calcium. Remember hydrated lime is caustic and will burn seed and plants. It should be applied to the land six weeks before seeding and transplanting and worked into the soil. Do not apply on seedbeds.
7. Make sure all transplants are free from clubroot. Inspect transplants before they are put in the field.
8. Plant resistant cultivars. The development of clubroot-resistant cultivars is difficult because nine races of the disease have been identified. Fields can have one or more races present. The rutabaga cultivar "York" is resistant to several races, however it is not resistant to all races found in Newfoundland. The cultivar "Kingston" is resistant to all races. There are resistant cultivars of cabbage and broccoli; however, they have poor horticultural characteristics.

9. The fungicides Quintozene (pentochloroaniline) and Terraclor (pentochloronitrobenzene) will give control of clubroot in the field on broccoli, brussel sprouts, cabbage and cauliflower. Read the product label for the proper use of these chemicals.

If you need more information on Clubroot control, please contact your Crop Specialist, area Agricultural Office or the Crop Insurance Representative servicing your area.