SoilWealth NURTURING CROPS

Integrated Crop Protection PROTECTING CROPS

MAY 2018

CLUBROOT MANAGEMENT IN BRASSICA VEGETABLES

Causal organism: Plasmodiophora brassicae

WHAT IS CLUBROOT?

Clubroot is one of the most potentially devastating soil borne diseases affecting brassica vegetables (e.g. cabbages, cauliflower, broccoli, kale and Brussels sprouts) in Australia. Once plants are infected there are no effective control measures. The pathogen can persist in soil for up to 20 years. It is spread by spores carried by infected seedlings, soil particles and water. This fact sheet details how to identify clubroot as well as some key management strategies to help prevent infection and spread.

Identifying Clubroot

Above Ground
Foliage of plants infected with clubroot may appear wilted; stunted or pale in colour.

Below Ground
Digging up plants infected with clubroot will reveal characteristic stubby swollen roots known as galls. Infected roots have reduced ability for uptake and transport of water and nutrients.

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CLUBROOT MANAGEMENT STRATEGIES

1. Crop and soil management

Soil Amendments

Lime

- Maintaining a soil pH of 7.0 – 7.5 with added lime can reduce the impact of clubroot.
- Reactive lime products (e.g. Quicklime) are often used to raise pH, however the optimum product and amount required will vary between soil types. Seek further advice on rates suitable for soil.
- Apply at least one week prior to transplanting to avoid phytotoxicity[1].

Calcium

- When soil pH is greater than 7 adding soluble calcium salts can reduce clubroot incidence.
- Repeated soil applications of calcium cyanimide can increase soil calcium, pH and beneficial soil microbes, which all help reduce clubroot incidence[3].
- Calcium nitrate has the benefit of also providing a nitrogen source in the form of nitrate which helps protect against clubroot, unlike acidifying ammonium fertilisers[4].
- Banding in rows is an effective and economical application method for calcium products[3].

Boron

- Boron inhibits the infection and development of clubroot and can be applied to the soil in formulation with calcium nitrate fertiliser.
- It can also be applied as boric acid or sodium tetraborate e.g. Granubor. Seek further advice on rates that are suitable for your crop.

Fungicides

- Fungicides will not control established disease however they may provide protectant control.
- The fungicide fluazinam is effective in reducing clubroot infection when applied either as a seedling drench[1] or as a soil drench at transplanting[4,5].

Brassica choice

- Brassica vegetables vary in susceptibility to clubroot (see below) and cultivar choice should be carefully considered in high-risk scenarios.
- Clubroot resistance cultivars should be used as part of an integrated management strategy however repeated planting of resistant cultivars may result in a loss of resistance.

Biocontrol products

- Formulated biocontrol agents (eg. *Bacillus subtilis* and *Gliocladium catenulatum*) applied as a soil drench at transplanting can reduce clubroot infection when disease pressure is low[6].

Soil and irrigation management

- Manage irrigation to prevent over watering.
- Take steps to improve soil structure (e.g. increasing organic matter or adding calcium) to improve drainage and minimise waterlogging.

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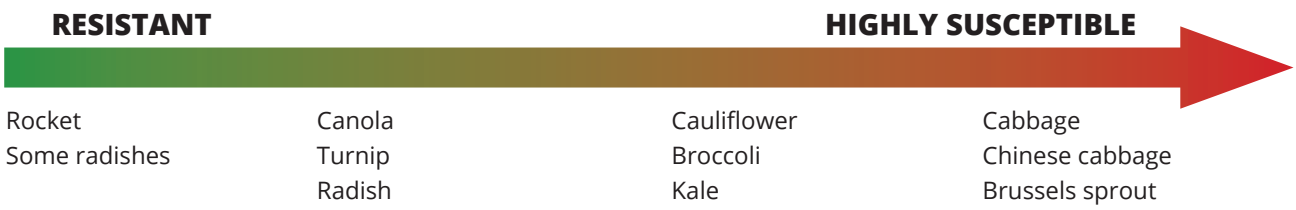
Figure 1. Clubroot susceptibility of brassica vegetables



2. Reduce the disease load in your soil

Rotations

- Rotations of more than 7 years are recommended between brassica crops to reduce resting spore levels.
- When part of an intergated mangement strategy however, a minimum of 2 years between brassica crops may be used.
- Avoid brassica cover crops (eg. Caliente (mustard) or Nemat (rocket).

Clubroot weed hosts

- Control volunteers and weeds which host clubroot such as, Shepherd's purse (*Capsella bursapastoris*) and Wildradish *(Raphanus raphanistrum)* during fallow and non-brassica crop phases.

Fumigation

- Fumigation can be helpful when pathogen load is high. Consideration should be given however to negative impacts on soil health, variable efficacy across different soil types, cost and concerns with user safety.
- Fumigants such as metham sodium and dazomet are effective fumigants for clubroot control[1].

3. Farm biosecurity

Stop soil and plant movement

- Clubroot can only move small distances on its own and spread is mostly through infected seedlings, soil and moving water.
- Follow biosecurity procedures[2] to minimise infected soil and plant movement.
- Quarantine any infected areas/paddocks and reduce surface runoff to stop spore movement.
- If only a small area is infected, dispose of infected plants.
- For small infestations quarantine area, remove plants, roots and attached soil and either burn or dispose of in an industrial landfill.

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INTEGRATED MANAGEMENT STRATEGIES

As disease pressure increases an integrated approach, combining a number of management strategies is required[4], as shown in Figure 2.

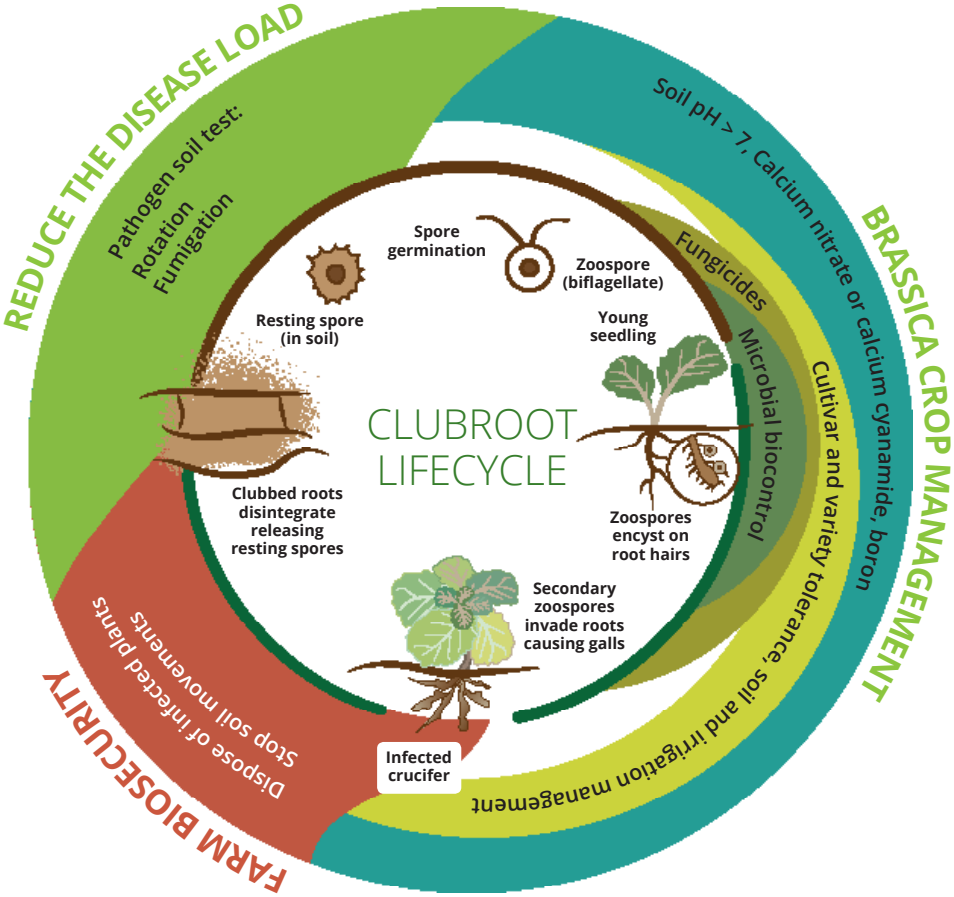

Figure 2. Integrated management options for clubroot management in Brassica vegetables.

Trials conducted in in clubroot-infected soils in Werribee, Victoria showed that integrating soil amendments (calcium nitrate +boron (CaNO3/B), ground-burnt agricultural (GBA) lime) with fungicide (fluazinam) treatment improves marketable yield of cauliflower[1] (See Figure 3).

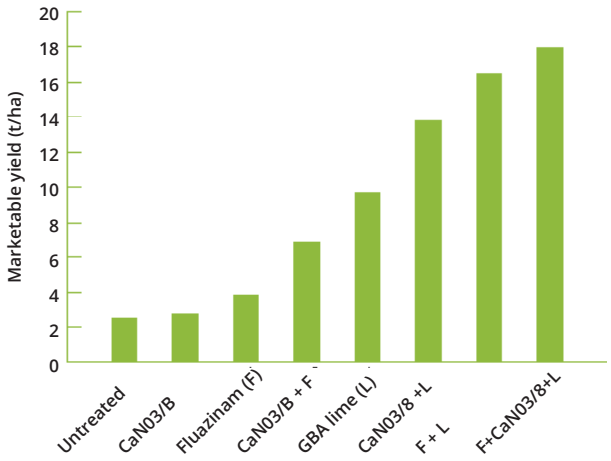

Figure 3. The effect of an integrated approach on marketable yield of cauliflower in a clubroot infected soil[2].

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EVALUATING CLUBROOT RISK

The table below highlights management practices and environmental conditions that either increase or reduce your risk of clubroot infection. This should be used as a guide to help reduce the risk of infection to your crop.

DECREASE CLUBROOT RISK	INCREASE CLUBROOT RISK
Paddock has not grown a brassica crop in the last 7 years or never grown a brassica crop.	Paddock has grown a brassica crop (e.g. cabbage, cauliflower, broccoli, Brussels sprouts) in the past 2 years.
Disease-free seedling.	Choosing a highly susceptible brassica crop e.g. cabbages or Brussels sprout.
Liming soil to maintain pH of 7.0-7.5[1.]	Warm soil temperatures (17-25°c)[5.]
Early application of calcium nitrate and boron[1.]	Poorly drained wet soils and over irrigation.
Applying fungicide seedling or soil drench e.g. fluazinam[1.]	Compacted soils.
Fumigating with metham sodium[1.]	Acidic soils <pH 6
Use of microbial biocontrol agents[6.]	Brassica cover or biofumigation crops.
Raised beds to improve drainage.	Fertilisers containing ammonium fertilisers[4.]

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