



# Clubroot: a Galling Disease

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## What is Clubroot?

Clubroot is one of the most destructive diseases of brassicas globally. Although it was detected in Australia as early as the 1890s, *Plasmodiophora brassicae*, the pathogen that produces clubroot, caused widespread loss during the 1980s and 1990s due to increasing brassica production and use of transplants. Clubroot now affects more than 70% of brassica properties in Victoria, Australia.

Clubroot is caused by a soil-borne organism that forms bulbous galls on the roots (Figure 1), which constrain uptake of nutrients and water and can cause considerable yield loss.

Severe infection can cause stunting, poor quality crops and even plant death before harvest.



Figure 1: A root system with clubroot galls

## Why is clubroot a problem?

After it is established, clubroot is almost impossible to eradicate and very difficult to control. In addition, viable spores can remain in the soil for up to 20 years.

Therefore, prevention measures are ideal to avoid contamination, including clean soil, water, seeds and

seedlings (i.e. nursery stock) and site selection that considers paddock history.

## How do I know if I have clubroot?

Clubroot causes plants to yellow, wilt and stunt (Figure 2). If you suspect you have clubroot infestation, the first step is to dig up some roots – the characteristic knobbly growths are usually clearly visible (see Figure 1).



Figure 2: Yellowed and wilted leaves caused by clubroot

## Key messages

- Clubroot is a destructive disease and nearly impossible to eliminate
- New research outcomes will indicate the significance of disease load detected
- Prevention is ideal, but management options are available
- An integrated management approach may include liming, high-calcium fertilisers, proper drainage and good crop hygiene
- Chemical control is not very effective
- Genetically resistant hybrids may become increasingly available.

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Next, you can get soil, water or nursery stock tested. Samples can be sent to various companies for testing and turnaround may vary from a few days to several weeks.

However, detecting the presence of clubroot is only the first step. The South Australian Research and Development Institute (SARDI) is currently undertaking research to define how disease load (measured as DNA level) can predict yield loss and inform planting and management decisions.

## Checking for clubroot:

1. Dig up some roots
2. Lab-test soil, water or nursery stock for presence or absence of clubroot
3. **Know Before You Sow:** SARDI is researching the relevance of clubroot level for management in brassicas.

## What can I do about clubroot?

Once the disease is present, there are a variety of management options available. Table 1 lists common management approaches for clubroot.

**Table 1: Recommended approaches for clubroot control in vegetable production**

GOAL	APPROACH	DETAILS
Prevent	Clean stock	Only accept clean seedlings in new trays/boxes from an accredited nursery.
Reduce spread	Restrict movement	Minimise equipment, livestock, water and people around your production areas.
	Meticulous hygiene	Always thoroughly clean farm equipment after working in a field suspected of having clubroot.
	Weed control	Remove weed hosts such as shepherd's purse and mustard.
	Test spore load	Do not plant susceptible varieties in infested soils with more than 1000 spores per gram of soil.
	Water management	Prevent overwatering and ensure each block receives clean water rather than run-off from nearby infested blocks.
	Improve soil drainage	Warm, acid soils with standing water favour rapid growth of the clubroot pathogen.
Reduce impact	Choose more resistant varieties	For example, rocket, radish, turnip and radish are less susceptible to the disease, and genetically resistant varieties are available.
	Bacterial biocontrol agents	Introduce <i>Bacillus subtilis</i> or <i>Gliocladium catenulatum</i> .
	Vary crop rotation	Include non-brassicac crops in your crop rotation to minimise disease carryover.
	Site preparation	Before planting, make sure plants and roots from the previous crop have been removed and areas that were infection 'hot spots' in the previous crop are treated.
	Soil modification	Before planting a susceptible crop increase soil pH to 7.0–7.5 by adding lime; during early production, add calcium and boron, which can reduce gall formation.
	Fumigation	Strategic use of fungicides (e.g. banded incorporation at planting) or fumigating (e.g. metham sodium and dazomet) as a last resort when the pathogen load is high.

## What are the costs?

The major costs of the disease are yield loss, hygiene measures to stop spread, restricted rotation options and management costs, such as addition of lime, calcium or boron.

Although clubroot management can be very costly, the risks and costs can compound if the disease is not managed.

## What does the future of clubroot management look like?

Available in the near future, SARDI's diagnostic tool specific for soil-borne diseases in Australian brassica crops will arm growers with a valuable new way to assess risk before planting.

Another promising management option for the future is bred or genetically engineered clubroot-resistant cultivars.

For example, Syngenta's TopRes™, a trait that provides intermediate resistance to most 'races' of clubroot, is currently available in a selection of cabbage, cauliflower and Brussels sprout varieties, such as clubroot-resistant hybrid cauliflower Highfield F1. Early trial work is currently being conducted in broccoli and new hybrids with TopRes™ resistance are expected to be available in the near future.

Although highly adaptable clubroot pathogens may challenge resistant varieties quite quickly, researchers worldwide continue to work on new lineages.

## Further Information

For further information on clubroot in horticulture, the following resources may be of interest:

- [Fact Sheet: Clubroot in Brassica Vegetables](#)
- [HAL Report: Total Crop Management of Clubroot in Brassica Vegetables \(2003\)](#)
- [A guide to the prevention and management of clubroot in vegetable brassica crops](#)
- National Clubroot Project fact sheets:
  - [Integrated Control of Clubroot - Introduction](#)
  - [Design the nursery to minimise your clubroot risk.](#)
  - [Clubroot Prevention - Farm Hygiene](#)
  - [Managing New and Isolated Outbreaks](#)
  - [Keep seeds, water and soil free of contamination.](#)
  - [Monitor for clubroot in the nursery.](#)
  - [Chemical Control of Clubroot](#)
  - [Strategic Application](#)
  - [Strategic Application - Machinery Design](#)