

A GUIDE TO THE PREVENTION AND MANAGEMENT OF CLUBROOT IN VEGETABLE BRASSICA CROPS



A PUBLICATION OF THE NATIONAL CLUBROOT PROJECT

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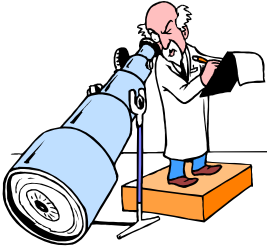


A business of the
Department of
Natural Resources
and Environment



Keeping Clubroot Out

Look out for the following sources of contamination:



- Dirty machinery and equipment
- Dams receiving run off from infected paddocks
- Grazing livestock
- Contract or shared equipment, labour, machinery

On farm

HYGIENE

Good farm hygiene is your responsibility and your right.

- Clearly signpost limited access areas.
- Restrict access to the property if necessary.
- Require visitors to report to reception, the farmhouse or provide a mobile number for them to call before entering the property.
- Insist on the cleanliness of shared bins, trays and other equipment being returned to your property.
- Make your hygiene concerns known to visitors.

PLEASE RESPECT
OUR FARM HYGIENE
NO UNAUTHORISED
VEHICLES PAST
THIS POINT

In the nursery

Monitor and restrict access to the nursery

- Restrict vehicle access.
- Have separate pick-up and loading areas.
- Concrete thoroughfares.
- Limit access to screen houses.
- Supply foot baths at the entrance to all work areas.
- Supply wash down facilities (high pressure)

Maintain a rigorous hygiene program

Equipment which leaves the nursery and is later returned for reuse represents one of your greatest hygiene risks.

- If possible, pull and pack transplants into waxed boxes to avoid sending trays onto farms.
- Request that trays, pallets or delivery racks which are sent to farms are kept off the ground and cleaned before being returned.
- Wash all traces of soil off reused trays (preferably with a high pressure wash), disinfect or steam sterilise (at least 60°C for 30 mins) trays before reuse. Note: Plastic trays are easier to clean and disinfect than polystyrene.

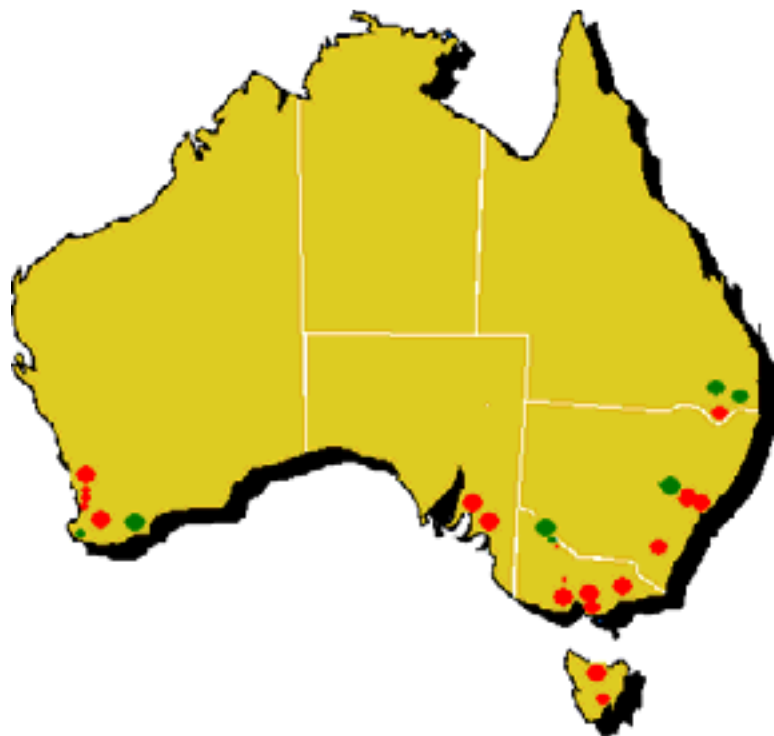
ATTENTION !
CLUB ROOT PROPERTY
DO NOT GO PAST THIS POINT
WITHOUT FARMERS PERMISSION
*Report to house
before entering property*
LEGAL ACTION MAY BE TAKEN

Clubroot Thrives in:

Warm
Moist
Acid soils

Make every effort to create an environment that is hostile to clubroot by improving drainage (grading paddocks or bedforming) and increasing soil pH to 7.0-7.5 by application of lime.

Clubroot in Australia



- Production regions with clubroot
- Clubroot free production regions



Quick checklist

See “Keeping clubroot out”

NO

Have you ever seen clubroot on your property?

YES

Is the area affected small?
(less than 20 m²; one or two sites only)

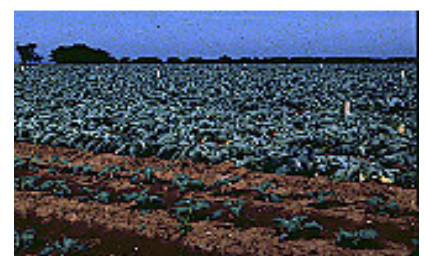
YES

See “Cleaning up spot infections”

NO

Large area or many spot infections

See “Management Decisions” and
“Management Actions”



Cleaning up spot infections

Quarantine the area.

- Peg or preferably fence the area off at a distance of at least three meters from the outer edge of the clubroot infected plants.

Remove all plants from within this area.

- Carefully dig up the plants and bag the roots. Do not shake soil free from the roots.
- Take the plants well away from cropping areas. Burn or dispose of into an industrial waste tip.

Disinfest the site.

- Disinfest the site using a suitable fumigant (eg. dazomet granules (Basamid®)).
- Read and follow the label instructions carefully, as these products can be extremely dangerous if used incorrectly.
- Apply the fumigant to moist (but not wet) soils. Following application, seal the soil surface either by rolling or laying plastic over the site and apply light irrigation.
- Fumigation is best done by a registered fumigation contractor. In most states, permits or licences are required for many fumigants.

Prevent movement of soil from this site to other parts of the farm.

- Take washing equipment and disinfectant to the site as boots, machinery and equipment used will be contaminated. Clean and disinfect these before leaving the site.
- Do not let stock or machinery through the site for as long as is possible (preferably 5 years). Working these soils could spread clubroot to the rest of the property.

Manage the rest of the property to minimise the likelihood of developing clubroot.

- Rotate using non brassica crops.
- Test soil pH and if necessary, adjust pH of responsive soils to 7.0-7.5 by application of lime.
- Improve drainage by raising bed heights or laser grading low lying areas.
- Do not over water.
- Purchase good quality seedlings from a reputable source.
- Keep soil calcium and boron high in the first 3 weeks after transplanting

(If using calcium cyanamide remember to apply it at least 10 days before transplanting, incorporate immediately and thoroughly irrigate to initiate the decomposition process.)

Calcium nitrate fertilisers are highly soluble and most effective if applied within the first three weeks of planting. Apply at planting and follow up with at least one low rate side dressing.)

- Avoid over use of nitrogenous fertilisers.

Disinfectant program

Many of the commercial disinfectant solutions have been found to be ineffective against clubroot. High pressure washing is currently the most effective means of decontaminating equipment. Provided all traces of soil have been removed, clubroot contamination is likely to be negligible. For extra insurance, apply a commercial disinfectant solution at the recommended label rate after washing.

Most disinfectant solutions are more effective when applied in the absence of soil and organic matter contamination.

Long term dips should be replaced regularly to ensure they remain effective.



Application issues

Limes and liming

Fine, calcium oxide (hot lime, quick lime, Ground Burnt Agricultural GBA lime) limes have a pH of 12, react rapidly in the soil and should be applied 7 days before planting. These limes are the most effective at increasing soil pH.

Coarser, calcium carbonates (aglime) limes have a pH of 7 and react more slowly. These limes should be applied at least 3 months before planting. All limes should be spread and incorporated immediately. Followed by light irrigation. Do not leave lime on the soil surface or water in.



Calcium cyanamide (Perlka®)

To avoid crop damage, calcium cyanamide should be incorporated into the soil and irrigated at least 7-10 days before planting.

Calcium nitrate

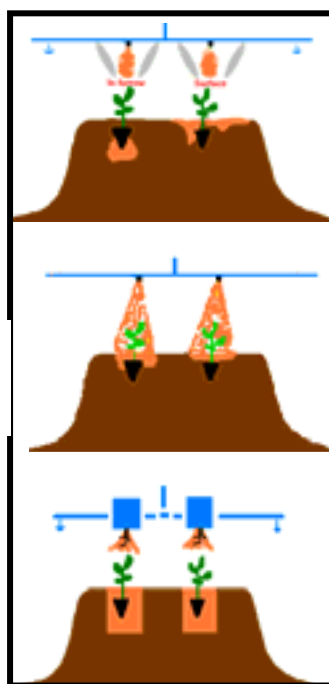
Calcium nitrate products are highly soluble and most effective if applied within the first three weeks of planting. Apply at planting and follow up with at least one low rate side dressing.

Strategic application

Strategic application describes a method developed to incorporate products evenly around the root zone where protection is needed.

This method of application provides a more reliable pattern of distribution than the traditional transplant drench or post transplanting spray. Strategic application is the most effective method of applying the fungicide, Shirlan®.

Strategic application can reduce the cost of application of several other products, such as Perlka®, as less than one third of the broadcast area is treated.



Transplant Drench (100 ml/plant)

- ✓ Greater volume of fungicide can be delivered per plant
- ✓ Transplanting and treatment can be done simultaneously.
- ✗ Can be phytotoxic if transplant placed directly on treated area (eg in furrow application).
- ✗ Treatment may not reach target area due to surface run off along presswheel tracks.

Post Transplanting Spray

- ✓ Ease of application.
- ✓ Can use or adapt existing machinery.
- ✗ Poor infiltration and distribution in heavy soils.

Strategic Application

- ✓ Even distribution of fungicide around transplant root zone.
- ✓ No phytotoxicity or run off.
- ✓ Suitable for application of liquids and granules.
- ✓ Treatment and planting can now be done in a single tractor pass.

For further information

For further information please contact:

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Management decisions

The questions below have been designed to assist you to decide on a management strategy that best suits your situation. The questions are in order of importance so an answer which falls into the high risk category (red box) for question 1 or 2 is more important than the same answer to question 10. Please work through the questions, using them to estimate your overall risk and required management action (below).

		LOW	MEDIUM	HIGH
1	Severity of last observed clubroot infection.	Mild	Moderate	Severe
2	Time since last observed clubroot infection.	More than 7 years	2-5 years	0-2 years
3	Intended sowing time (for brassicas)	May-Aug	March/April and Sept/Oct	Nov-Feb
4	Have brassica weeds been observed on the site since last infection (including wild radish, mustards, shephard's purse)?	Never	Infrequently	Often
5	Intended crop	Non - brassica!!	Broccoli, Brussels sprouts, cabbage, Other Asian veg brassica	Cauliflower, Chinese cabbage
6	Soil pH	7-8	6-7	Less than 6
7	Source of planting material	Cell grown transplants - reputable nursery	Seed bed on farm	Direct seeded onto site
8	Variety	Tolerant/resistant	Susceptible	Highly susceptible
9	Drainage	Excellent	Fair	Poor
10	Soil type	Sand	Loam	Clay

Management Action

Low risk

Be rigorous about farm hygiene (see section "Keeping Clubroot Out").

Lime responsive soils to pH 7.0-7.5.

Improve drainage (if necessary) by laser grading low lying areas or raising bed heights.

Monitor for symptom development. Look for stunted or wilting plants, particularly in low lying or wet areas of the paddock. Remove and check roots for galls. Treat any spot infections (see "Cleaning up Spot Infections") **immediately**.

Medium risk

Where possible practice a 3 yr crop rotation to prevent build up of clubroot in the soil, maintain all crops free of brassica weeds.

Lime responsive soils to pH 7.0-7.5. Maintain high soil calcium in the first 3 weeks after planting.

Improve drainage (if necessary) by laser grading low lying areas or raising bed heights.

Use a tolerant/resistant variety where available.

High risk

Avoid summer plantings.

Do not crop Chinese cabbage.

Practice a 3 yr crop rotation, maintain rotation crops free of all brassica weeds.

Lime responsive soils to pH 7.0-7.5.

If a crop must be grown:

Apply a preventative chemical treatment, fumigate the site or incorporate Shirlan 3L/ha into bands along the transplant rows immediately before planting.

Maintain high soil calcium in the first 3 weeks after planting.