

How do I manage soil-borne root diseases in sub-clover pastures?

The issue: Soil-borne root diseases impact the productivity and persistence of sub-clover pastures across southern Australia.

The impact: Less than optimal pasture production limits animal growth rates and wastes inputs, including nutrients and water.

The opportunity: Managing root disease through a range of practical interventions could significantly boost pasture production and persistence.

There are four main pathogens of concern relating to root diseases: **Pythium, Phytophthora, Aphanomyces and Rhizoctonia.**

MLA-funded research has highlighted a range of practical options to minimise the impact and boost the productivity of sub-clover pastures.

While no silver bullet was identified, management practices, such as an adequate fertiliser program, rotational grazing, cultivation, and in some situations, fungicide seed treatments when reseeded support rapid root growth through the soil profile, are most likely to lower widespread incidence of the disease.

In the longer term, field trials have confirmed that identifying resistant and field-tolerant sub-clover varieties has the potential to boost productivity up to five-fold from current levels. Identification of sub-clover varieties with field tolerance to soil-borne pathogen complex remains an urgent priority for research.

How do I know if my sub-clover is affected?

Symptoms of root disease can appear as:

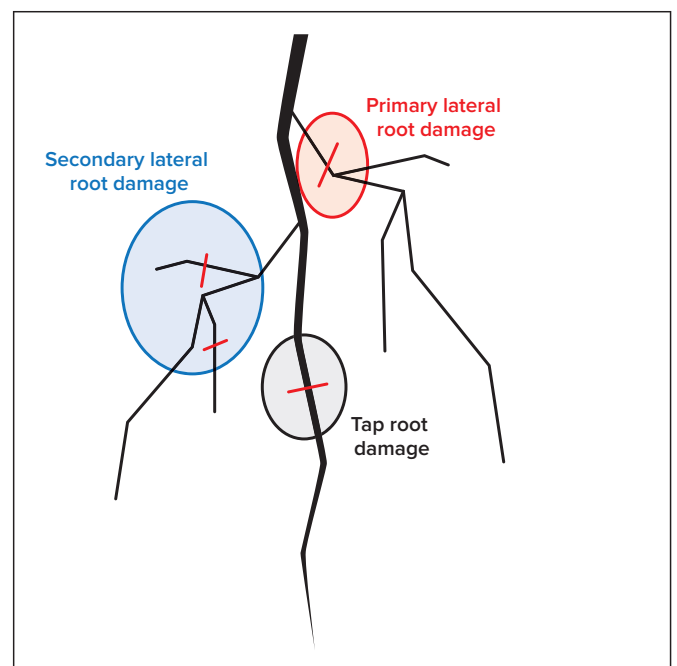
- stunted plants
- poor or patchy germination
- sudden die-off for no apparent reason
- little or no presence of sub-clovers.

Soil moisture, type, temperature and nutrition determine disease severity and impact depending on the prevailing pathogens. Sub-clovers are most susceptible to root disease during autumn and winter. While the disease also occurs in spring, plants are generally healthier and actively growing so the impact may be lower.

Access to rapid diagnosis through the PREDICTA® B test from SARDI is now available. PREDICTA® B results can help establish the main pathogens present and support strategic management decisions.

Pathogens are expressed under different environmental conditions (e.g. Phytophthora is favoured by warm, wet soils, Rhizoctonia is favoured by cold conditions and dry soils).

Figure 1. Types of root damage



Taking control

The most cost-effective on-farm management approaches developed from the research include:

- cultivating soil to reduce pathogens and subsequent root disease impact on productivity for several years
- ensuring adequate soil and plant nutrition through strategic fertiliser management, to enable better root and shoot growth even when disease is severe
- choosing field-tolerant varieties which perform well locally
- sowing a mixture of sub-clovers as an insurance policy
- using rotational grazing which allows more plant growth and, in turn, improves root development, even where disease is severe.

The paddock test

A three-year MLA Producer Research Site project by the MacKillop Farm Management Group Inc in SA determined the best disease control was provided by good pasture establishment practices including:

- best practice weed control prior to sowing
- cultivating an even seed bed
- applying Apron® fungicide as a seed dressing
- choosing varieties which are either new and bred with tolerance, or varieties long grown in the region and, thereby, with good field tolerance to disease.

On trial

SA-based Barossa Improved Grazing Group ran a three-year MLA Producer Research Site project to evaluate strategies to reduce root disease impact and improve sub-clover winter productivity. Treatments included fungicides, inoculants and fertilisers. It found:

- no response in dry matter production in Clare and Trikkala varieties following application of registered fungicides
- no response in dry matter production or root nodulation from the application of inoculant when regenerating pastures
- significant response in dry matter production in winter/early spring (from 28 to 112%) to the application of phosphorous fertilisers at sites with marginal soil phosphorus levels.

The findings also suggest Clare and Trikkala can continue to perform well even if root disease is present.



How do I manage this on my farm?

Management option	Considerations
Resistant and field-tolerant varieties	<p>Opportunities: Long-term success will rely on identifying resistant and field-tolerant sub-clover varieties, which is likely to boost productivity up to five-fold.</p> <p>Keys to success: In the interim, select varieties known to perform well in your region until data on resistance levels in newer varieties becomes available.</p> <p>Cautionary warning: The Pasture Trial Network currently does not incorporate disease screening.</p>
Soil nutrition	<p>Opportunities: Focusing on pasture health first and foremost is the best approach — healthy plants best tolerate disease.</p> <p>Keys to success: Carry out regular soil tests and address nutritional deficiencies with fertiliser to optimise growth.</p> <p>Cautionary warning: Apply fertiliser as test strips to identify a potential deficiency.</p>
Rotational grazing	<p>Opportunities: Rotational grazing offers potential to significantly increase sub-clover productivity during the autumn feed-gap period.</p> <p>Keys to success: Allow affected pastures to recover from grazing pressure to decrease root disease incidence and increase nodulation.</p>
Cultivation	<p>Opportunities: Cultivation can deliver significant productivity increases for up to four years by breaking up pathogen hyphae (which is produced by soil-borne pathogens), reducing the pathogen's ability to cause root disease and increasing the opportunity for faster root growth and better legume root nodulation.</p> <p>Keys to success: Carry out shallow cultivation prior to pasture germination (up to 10cm) following break-of-season rain. Avoid cultivating after germination to maximise seedling survival.</p> <p>Cautionary warning: Cultivation is not a realistic option in established permanent pasture systems unless undertaking pasture renovation and/or resowing. Disc seeders do not provide sufficient disturbance to impact on disease.</p>
Fungicide seed treatment or sprays	<p>Opportunities: Variable success depending on season and location.</p> <p>Keys to success: Try test strips before embarking on paddock-scale application.</p> <p>Cautionary warning: Root diseases can appear as a 'mix' of two to four pathogens, which makes fungicide management difficult as the fungicides registered for sub-clovers do not impact all four diseases. Fungicides need to be targeted to individual and different soil borne pathogen populations as they occur on individual farms.</p>

Other limitations

Disease is only one factor that can limit sub-clover productivity and persistence.

In other MLA research, a national survey of sub-clover pastures found poor root nodulation to be closely associated with root disease, and the more severe the root disease the poorer the nodulation. Reducing root disease will proportionally increase nodulation. While effective nodulation and nitrogen fixation promotes optimal pasture growth, there is little effective nodulation where root disease is severe. Understanding what is happening below ground supports strategic soil management decisions and optimises opportunities for both managing root disease and fostering the proliferation and efficiency of rhizobia in legume pastures.



Good nodulation

What is PREDICTA® B?

PREDICTA® B determines the amount of pathogen DNA present in soil samples. The findings can be applied to pasture and crop management.

Test results are reported in two ways:

1. **Disease risk categories:** the risk of yield loss associated with a particular level of pathogen DNA has been determined and is displayed using a graphic to indicate a 'low', 'medium' or 'high' disease risk.
2. **Population density:** category for 'tests under evaluation' as the relationship between yield loss and pathogen level has not been determined. Population density categories enables new tests to be reported to growers faster as developing disease risk categories can take several years.

Results can be used to rank levels of inoculum in different paddocks, monitor changes in inoculum during different phases of the cropping sequence and confirm disease diagnosis.

Samples should be collected with the support of an accredited agronomist who will receive and interpret the test results. That agronomist will consult with you to develop a specific management strategy appropriate for the farming system.

Results also help formulate a map of soil-borne diseases, available on the PREDICTA® B website, which can help inform paddock management decisions.

More information

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- Visit the [Barossa Improved Grazing Group](#) and [Mackillop Farm Management Group](#) websites to investigate their findings.
- For more information on soil fertility go to mla.com.au/research-and-development/reports/2017/managing-soil-borne-root-disease-in-sub-clover-pastures/
- For more information on the PREDICTA® B soil test go to: pir.sa.gov.au/research/services/molecular_diagnostics/predicta_b

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