RHIZOCTONIA
FACT SHEET

GRDC
Grains Research & Development Corporation

MARCH 2008

What is *Rhizoctonia* barepatch?

Plants with *Rhizoctonia* have shortened brown 'spear-tipped' roots. PHOTO: SARDI

Patches can vary from just a few plants to large patches, metres across. PHOTO: CSIRO

Cost of *Rhizoctonia* to industry

Yield losses from *Rhizoctonia* are proportional to the total area of the patches and can average up to 50% (Wallwork 2000). It is estimated that *Rhizoctonia* in southern Australia costs $77 million each year in lost production (Roget 2006). *Rhizoctonia* cannot be eliminated but can be suppressed to a level that doesn't cause economic loss.

Rhizoctonia barepatch of cereals is caused by the soil fungus *Rhizoctonia solani*. While mainly a disease of cereals, it can also cause losses in a range of other crops, such as pulses and pastures. *Rhizoctonia* causes crop damage by pruning the root system, which results in water and nutrient stress to the plant.

BASIC BIOLOGY

- Inoculum of *Rhizoctonia* survives on organic matter
- It survives in the top 0-10cm of soil
- It grows as a 'web' of fungal hyphae or filaments through soil
- Inoculum levels increase on the roots of host plants

Why is it still a problem?

Rhizoctonia was traditionally a problem in low-fertility sandy calcareous soils of southern Australia. However, with the increased adoption of conservation tillage, this disease has become much more widespread, as cultivation had provided some control of *Rhizoctonia* by breaking up the network of hyphae in the soil.

Rhizoctonia root rot is difficult to control because:

(i) the fungus has a wide host range, ie, limited rotational controls;
(ii) there are no resistant cultivars; and
(iii) the fungus can grow and survive in the soil on organic residues without a live plant host – this is termed 'saprophytic ability'.

This saprophytic ability is strongly influenced by the soil conditions (soil type, fertility, moisture, temperature, biological activity). This is why the disease can appear 'out of the blue' in some paddocks and why some seasons are much worse than others.

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Key factors controlling the occurrence and severity of *Rhizoctonia* barepatch

1. Level of soil inoculum

The impact of management factors on *Rhizoctonia* inoculum is not fully understood. Until the development of DNA testing it was difficult to measure inoculum in soil. Inoculum levels of *Rhizoctonia* can now be assessed using the PreDicta® B DNA testing service which can detect low (less than 30 standardised DNA units) to high (more than 80 units).

High levels of inoculum indicate potential for increased disease but this measurement by itself can be difficult to interpret, as other factors such as soil suppressive activity may reduce the opportunity for the inoculum to cause disease (root damage).

2. Level of soil suppressive activity

The level of disease-suppressive activity in soil against *Rhizoctonia* is a function of the population, activity and composition of the microbial community. All soils have an inherent level of suppressive activity, but this can be significantly improved by management practices used within a farming system. Suppressive activity can provide complete control of *Rhizoctonia* in some situations and at present provides the best long-term control option.

Carbon from stubble and root residues provides the food to support more suppressive activity, and carbon (C) additions are optimised in intensive and productive cropping systems with full stubble retention. In this type of cropping system, suppressive activity has been shown to increase over a five to eight-year period but the opportunity for improvement will be limited where yields are well below the water-limited yield potential (less than 60% potential yield). Drought, and resulting lack of C input, are likely to reduce suppressive activity.

The level of soil suppressive activity can be assessed experimentally but as yet this is not commercially available.

3. Available mineral nitrogen over the summer/autumn

Recent research in southern Australia has identified that high mineral nitrogen (N) levels in the top 10 centimetres of soil over summer and autumn reduce suppressive activity. High levels of 40 to 60 kilograms of nitrogen per hectare have been shown to switch off suppressive activity.

Intensive cropping with cereals and stubble retention results in very low levels of mineral N over summer as soil microbes temporarily utilise all available N while breaking down the high-carbon stubble residues. These conditions result in soil mineral N levels of less than 10kg/ha and optimise the effectiveness of the suppressive organisms present.

High mineral N levels do not result in a reduction of the underlying suppressive potential of the soil. They just switch off the expression of the suppressive activity in the season following a summer with high mineral N levels. Full suppressive activity can be restored for the next season once mineral N levels are reduced, ie, following a good cereal crop.

There are a range of factors that can result in high mineral N levels over the summer such as legume pastures, green manures and failed cereal crops. Multiple seasons of mineral N build-up can result in severe interruption of suppressive activity and hence major disease.

4. Crop and root vigour

The severity of *Rhizoctonia* can be significantly reduced by avoiding management practices which reduce crop and root vigour and make the crop more susceptible to severe infection. Compacted soils, late sowing into colder soil, inadequate phosphorus (P), zinc (Z) and N nutrition and root pruning by SU (sulfonylurea) herbicides – can all potentially increase the severity of *Rhizoctonia* infection and yield loss caused by the disease.

Control strategies

Reduce inoculum

- Cultivation – break-up of fungal hyphal networks. Cultivation one to two weeks prior to sowing can be very effective
- In seasons with an early break, remove volunteer plant growth as soon as possible, using either cultivation or herbicides

Help roots avoid inoculum through encouraging faster early growth

Rhizoctonia can only attack very young plant roots so anything that increases early root growth can significantly reduce disease

- Adequate nutrition – particularly P, N and zinc (Zn)
- Soil disturbance 50mm below seeding depth in no-till systems – narrow points. Deeper ripping can be advantageous in compacted soils
- Early sowing into warm soils where possible
- Avoidance of SU herbicides – both pre and post-sowing applications and residues from the previous season
- Some seed coatings may increase rate of early root growth and provide some reduction in root damage through suppression of *Rhizoctonia* barepatch

Rotation selection

- Canola and pulse crops are usually less susceptible than cereals
- In cereals, oats are most tolerant followed by triticale, wheat and then barley, which is the most intolerant

Post-sowing nutrition management

- Applications of N to deficient crops can reduce yield loss in poor growth patches by up to 50%

Management and environment impact on *Rhizoctonia* disease

FACTOR	Key factors influencing *Rhizoctonia* disease			Impact of disease
	Inoculum	Suppression	Summer N	
Drought	Unknown	↓	↑	↑
Canola	↓	Unknown	Low to moderate	↓
Grass/Medic pastures	↑	↓	↑	↑
Intensive cereal	↑	↑	Very low	Variable

Longer term control

There is growing evidence that canola can significantly reduce the level of *Rhizoctonia* inoculum and provide a one to two-year control of this disease. Evidence to date has come from low-rainfall, light-textured soils.

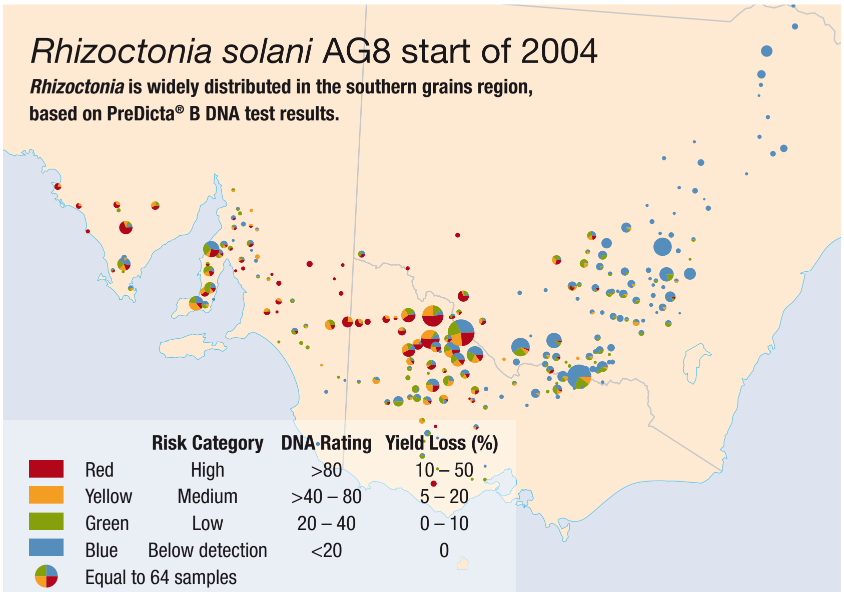
'The N dilemma'

While *Rhizoctonia* can be a serious issue with intensive cereals in conservation cropping systems, this is often not the case. The high stubble loads under these systems support a build-up in soil suppressive activity and very low soil mineral N levels over the summer/autumn period, which significantly enhance the effectiveness of the suppression activity.

However, by sowing time, adequate levels of available soil mineral N are required to allow good early growth of the cereal crop that helps avoid *Rhizoctonia* and other pathogens. In seasons with reasonable summer /autumn rainfall (>100mm) there is an opportunity for sufficient stubble breakdown for some release of N by sowing for crop growth. Fertiliser N can be used to make up any deficiencies.

Where summer/autumn rainfall is low, providing adequate N at seeding can be a problem. Stubble breakdown around seeding can temporarily tie up available N. The microbial demand for N can even tie up added N fertiliser. Under these conditions, which occurred in many parts of southern Australia in 2004 and 2006, *Rhizoctonia* can cause serious problems in the slow-growing N-deficient crop. Options to overcome this problem include:

- higher N fertiliser rates at sowing;
- wider row spacings (more fertiliser per row);
- deeper placement of N to separate the N from the stubble and microbial activity;
- minimising the amount of stubble incorporated at sowing; and
- burning stubbles.



I tried to get it right, but I've still got Rhizo!!

Rhizoctonia is an opportunist that will take advantage of any conditions that suit it. In some years, there are things outside your control that favour disease, such as drought in the previous season, no summer rainfall and late breaks with crops establishing in cold soil.

Farmers in systems which encourage high soil biological activity are in a better position to cope with seasonal impacts on the *Rhizoctonia* threat.

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