# Better Prediction and Management of Rhizoctonia Disease in Cereals

RESEARCH

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**Searching for answers**

**Location:** Streaky Bay
J Williams & B Goosay
Streaky Bay Ag Bureau

**Rainfall**
Av. Annual: 340 mm
Av. GSR: 274 mm
2010 Total: 358 mm
2010 GSR: 294 mm

**Yield**
Potential: 3.7 t/ha (W), 2.8 t/ha (C), 10.8 t/ha (Pasture)
Actual: 2.3 t/ha (W), 0.9 t/ha (C)

**Paddock history**
2007: Barley
2006: Wheat
2005: Pasture

**Soil**
Highly calcareous grey loamy sand

**Plot size**
60 m x 1.48 m

**Other factors**
Mice damage meant cereal plots were resown.

## Key messages

- **Inoculum can change dramatically throughout the year.**
    - Inoculum build-up continues throughout crop growth until maturity.
    - Rain post maturity of a crop causes a decline in inoculum.
    - Major rainfall events over summer can substantially reduce inoculum.
    - Long dry periods over summer can allow inoculum build up.
- **Inoculum is concentrated near the surface of field soils (top 5 cm).**
- **Cereals are the key host for rapid build-up of *Rhizoctonia solani* AG8 inoculum.**
    - Inoculum after canola and other non-cereal break crops is lower than before these crops.
    - Break crops have similar impacts on inoculum as fallow.
    - Lower inoculum levels after break crops are maintained through to the end of the following summer.
    - Crop impacts on inoculum only last for one year, e.g. one year of wheat will take low levels following canola to high and vice versa.
- **Soil microbial assessments have been strongly associated with changes in Rhizoctonia infection, especially seasonal and site differences.**
- **The importance of Rhizoctonia infection on crown roots in modern cropping systems may have been underestimated.**

## Why do the trial?

Rhizoctonia continues to be an important but complex disease in the southern agricultural region, especially on upper Eyre Peninsula. This is the final year of a national project funded by GRDC to improve long term control of Rhizoctonia by increasing the understanding of the interactions between disease inoculum and natural soil suppressive activity and to improve the prediction and management of disease.

## How was it done?

A trial was established at Streaky Bay in 2008. Rhizoctonia disease and inoculum levels are being compared between three different tillage systems; conventional cultivation (5 May - wide sweeps; 26 May - narrow points), strategic cultivation (26 May - narrow points), no-till and with several rotations. The trial was sown again on 7 June 2010 into reasonable moisture but mice damage resulted in the cereal plots being sprayed out and resown on 29 June. These plots were also harrowed to remove the furrows and make it harder for mice to find the grain.

Correll wheat was sown in 2010 at 70 kg/ha with DAP @ 60 kg/ha and urea @ 35 kg/ha. Cobbler canola was sown @ 5 kg/ha with MAP @ 150 kg/ha, and urea @ 70 kg/ha was broadcast shortly after germination. Herald medic was sown @ 2.5 kg/ha ha with MAP at 35 kg/ha. Both the canola and medic had excellent establishment in 2010. The trial area received 1.5 L/ha of Roundup®, 1 L/ha of Treflan® and 80 mL/ha Hammer® pre seeding; 0.9 L/ha of Lorsban® post sowing and 500 mL/ha of Astound® and 400 g/ha of Achieve® later in the season. The canola plots also received 1.5 L/ha of atrazine and 200 mL/ha of Lontrel®.

Sampling included soil characterisation, soil moisture, pathogen DNA levels, root disease infection, dry matter, microbial activity, soil microbial populations and grain yield.

## What happened?

In 2010 the highest grain yield occurred after pasture despite Rhizoctonia inoculum at seeding being lower after fallow, canola and pasture. This indicates nitrogen may have been a limiting factor in 2010, rather than just the impact of disease on grain yield (Figure 1).

Crop rotation impacts on Rhizoctonia inoculum levels showed similar patterns for the 2009 and 2010 seasons. Rhizoctonia inoculum levels were lowest immediately after canola, medic pasture and fallow, and the highest following cereal.

This lowered inoculum level was found to be only a one year effect. For example, inoculum levels following wheat after rotation crops returned to original levels (Figure 1).

Tillage impacts on Rhizoctonia showed similar patterns for the 2009 and 2010 seasons, with no till and strategic cultivation having the highest levels and conventional cultivation the lowest (Figure 2).

The amount of Rhizoctonia inoculum at seeding was correlated with amount of disease in the following wheat crop although the overall seminal roots disease levels were lower in 2010 (root score average 1.7) compared to 2009 (root score average 3.0). Seminal roots may escape some of the disease by rapidly growing through warm soil early in the season, while crown roots will develop in cold soils with re-established rhizoctonia hyphal networks in place. The role of crown roots infection in modern cropping systems may be underestimated and may not result in classic bare patches early in the crop but may cause more damage later. Crown root infection was lower in 2010 compared to 2009 (Figure 3).

In 2009 disease patch incidence in crop was negatively correlated with grain yield. A yield loss of 0.25 t/ha occurred with every 10% increase in area of patch incidence (Figure 4).

Other research from this project (data not presented) has shown that soil microbial activities have been strongly associated with changes in Rhizoctonia infection, especially with seasonal and site differences.

Catabolic diversity (of the microbial population present) and suppression potential in pot assays can be used as tools to identify activity which affects disease expression, and catabolic diversity correlates well with pot suppressiveness. Fungal diversity has also been shown to be influenced by management more than bacterial diversity.

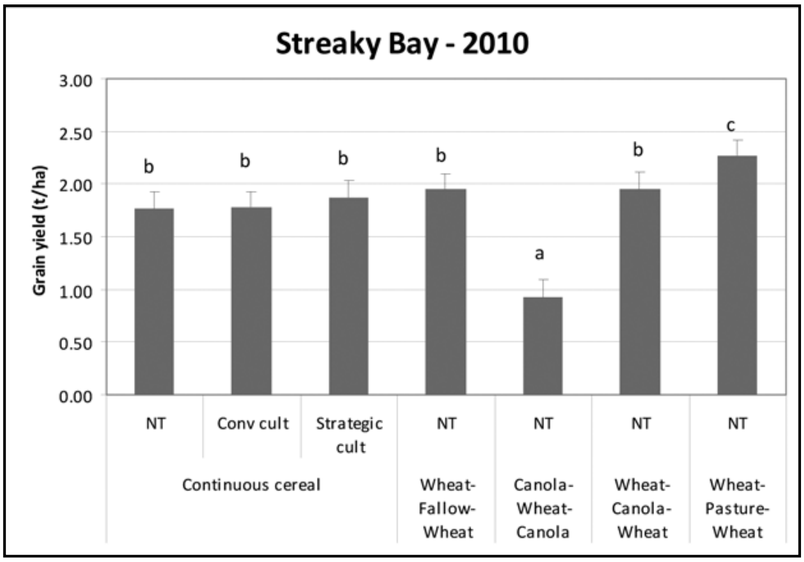


*Figure 1 The effect of crop rotation and cultivation on grain yield, Streaky Bay 2010*

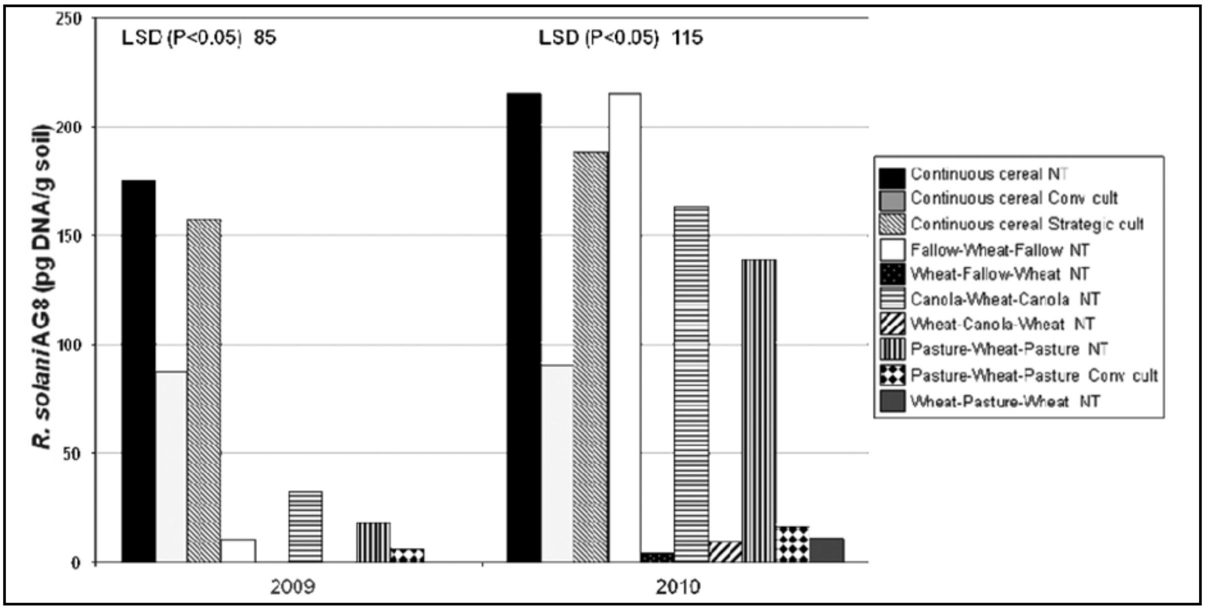


*Figure 2 The effect of crop rotation on Rhizoctonia solani AG8 inoculation level in soil (pg DNA/g soil), 2009 and 2010*

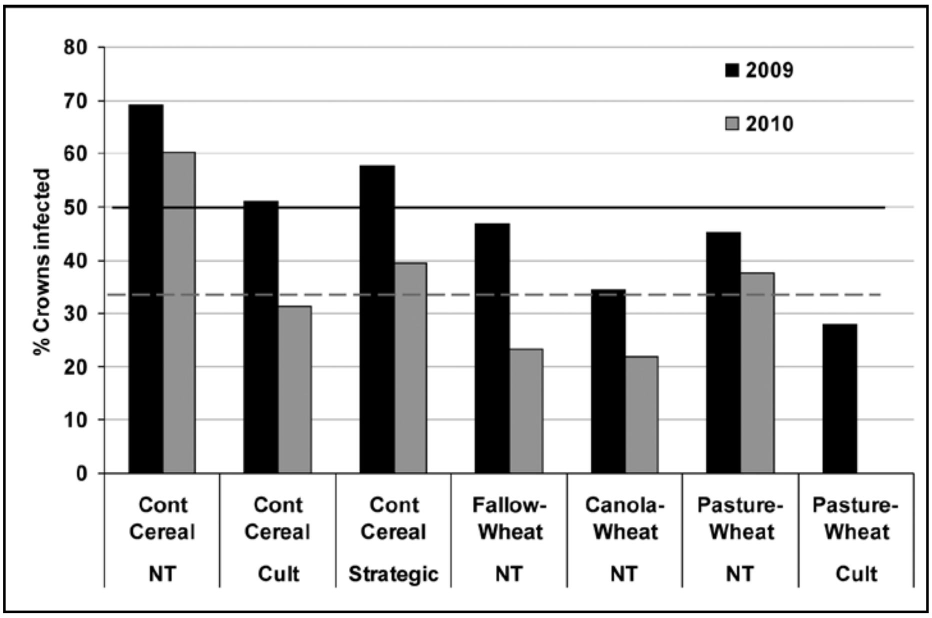


***Figure 3 Incidence of Rhizoctonia crown root infection in 2009 and 2010. Average disease levels are indicated by solid (2009) and dashed (2010) lines.***

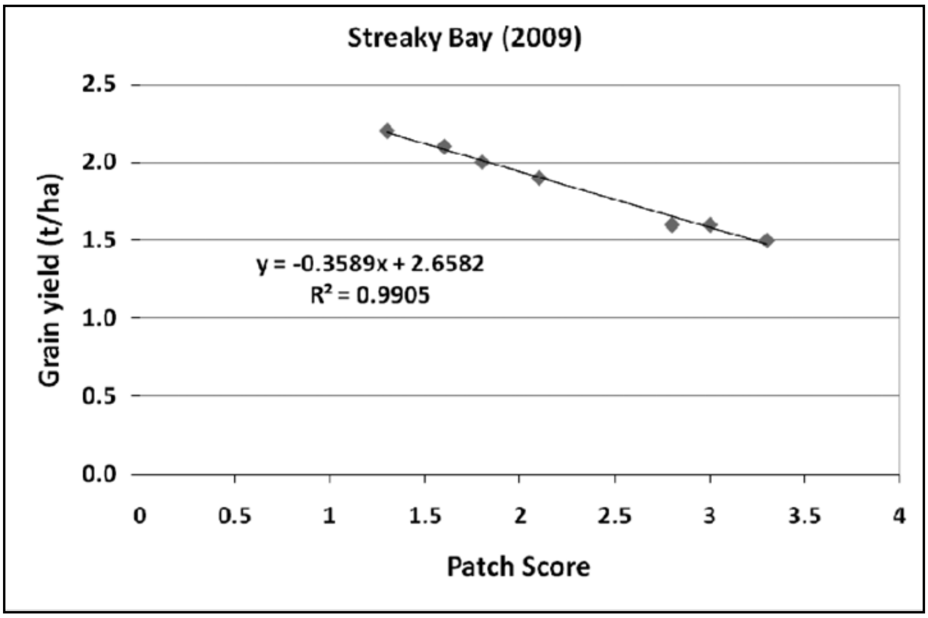


***Figure 4 The impact of Rhizoctonia patch incidence on grain yield in 2009***

## What does this mean?

- Cereals are the key host involved in the rapid build-up of *Rhizoctonia solani* AG8 inoculum. Canola and other non-cereal break crops can lower inoculum similar to a fallow. Lower inoculum levels after break crops and fallow are maintained throughout the following summer. However these crop impacts last for one year only, e.g. one year of wheat will take low levels following canola to high and vice versa.
- Changes in the Rhizoctonia inoculum, both in-crop and during the non-crop period, are far more dynamic than previously believed. Rhizoctonia inoculum build-up continues through to maturity in a crop especially in the 0-5 cm zone. Long dry periods over summer can allow inoculum build up.
- Rain post maturity of a crop causes a decline in inoculum, and major rainfall events over summer can substantially reduce inoculum.
- The role of Rhizoctonia crown root infection in modern cropping systems may be underestimated.


## Acknowledgements

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