Better prediction and management of Rhizoctonia disease risk in cereals

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Take home messages:

- Higher frequency of below average rainfall in recent years resulted in higher inoculum levels before sowing.
- Crop rotation does affect inoculum levels i.e. levels were lowest immediately after canola compared to that after wheat.
- Inoculum levels were reduced over summer and based on experience at other drier sites this may be associated with summer rainfall events.
- The incidence and severity of Rhizoctonia bare patch disease in cereals depend on the amount of pathogen inoculum, soil microbial community activity and crop/root vigour.

Introduction

Rhizoctonia bare patch is a disease of seedlings caused by *Rhizoctonia solani* Kühn AG-8. It decreases root length resulting in reduced plant growth and yield losses. Recent estimates indicate that it causes significant losses in wheat, $59 million pa across southern Australia (Murray and Brennan, 2009). Although this disease is considered more of a problem in lower rainfall regions (<350mm) and in lighter soils it occurs in NSW and across the entire Australian wheat belt. The adoption of minimum tillage practices has resulted in an increase in Rhizoctonia in wider agricultural environments. This fungus grows on soil organic matter and produces a hyphal network in the surface soil.

While previous research has found the risk of yield loss can be reduced by management practices that increase seedling vigour, it remains a difficult disease to predict and control. Currently there are no effective chemical or biological control measures and limited or no plant genetic resistance against Rhizoctonia disease.

The incidence of Rhizoctonia bare patch has increased in recent years due to increased cereal crops in rotation, the higher frequency of drought years and in particular below average rainfall in spring and summer. This has resulted in higher inoculum levels before sowing (See Figure 1). The overall lower level of microbial activity for long periods during and following the drought favour the growth of *R. solani* fungi.

The incidence and severity of Rhizoctonia bare patch depends on the amount of Rhizoctonia inoculum, composition and activity of the soil biology community (inherent suppressive activity), available soil N levels over summer and at seeding and constraints to root growth. The complex relationship makes this a difficult disease to predict and manage. We used recent developments in DNA-based (inoculum and communities) and biochemical (catabolic diversity) techniques to better measure and link the various factors to disease incidence.

The GRDC funded project CSE00048 aims to develop better prediction and management options based on a better understanding of the changes in inoculum levels especially over summer and its interaction with soil microbial community and crop.

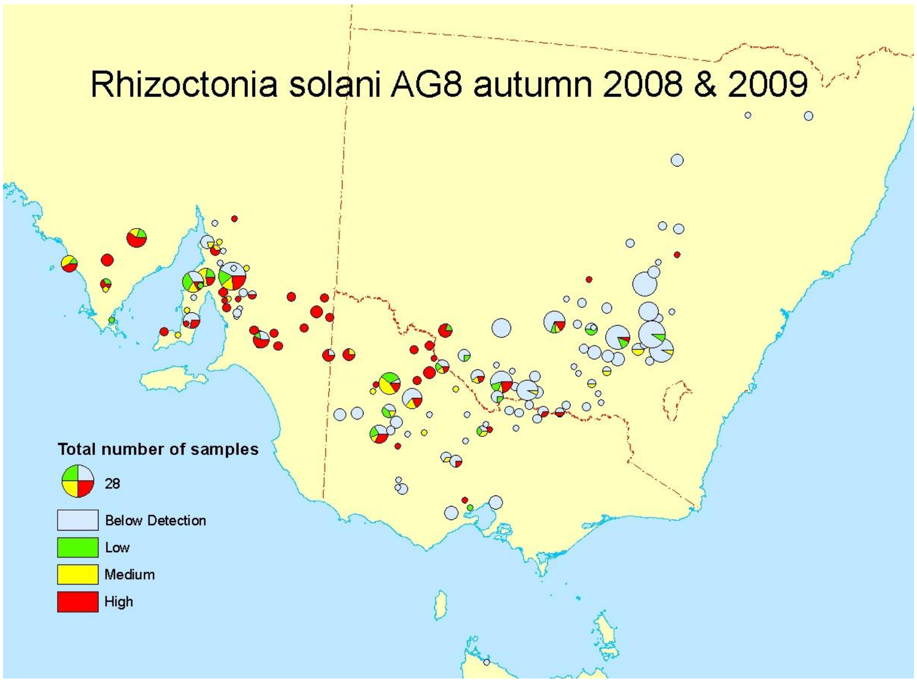

Figure 1. Distribution of Rhizoctonia solani AG8 before sowing in 2008 & 2009 (PreDicta B sample results).

Results and Discussion

Inoculum and disease development:

NSW - *R.solani* AG8 DNA concentrations during summer

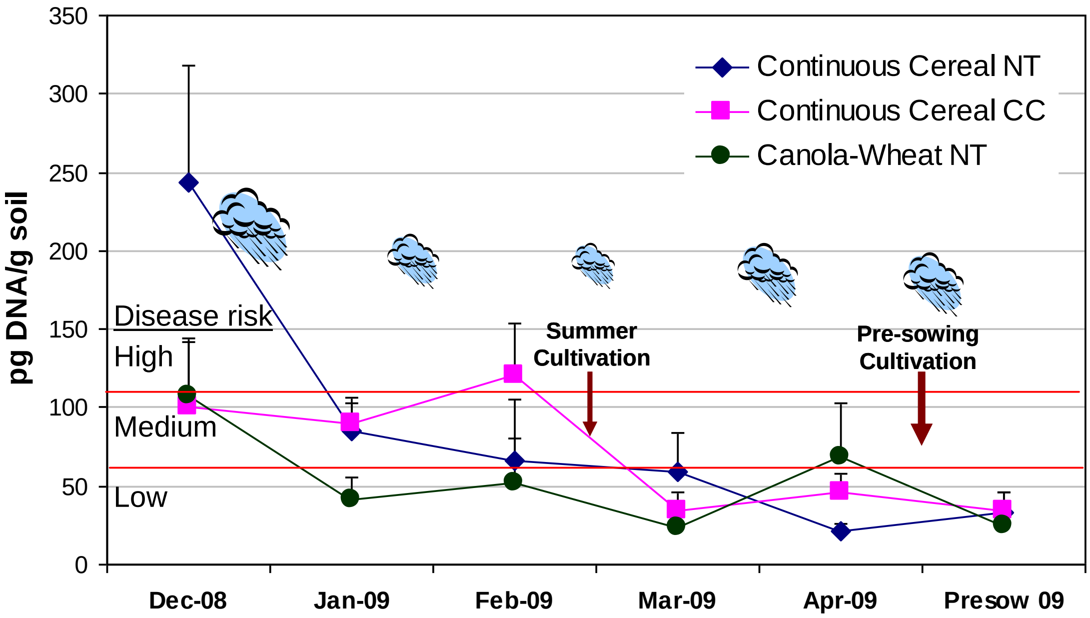

Figure 2. Changes in the amount of *Rhizoctonia solani* AG8 DNA in the surface soil under different rotation and tillage treatments during summer 2009 at Galong, NSW. Clouds denote rainfall.

In a field trial at Galong, NSW on a Red Brown Earth soil, DNA based assays revealed that:

- Rotation does affect Rhizoctonia inoculum levels.
    - Levels were lowest after canola compared to that following wheat crop
- Inoculum levels were substantially reduced by multiple summer rainfall events. In other field trials in SA where there were less summer rainfall events, Rhizoctonia inoculum levels recovered in the dry periods
    - The reduction in inoculum over summer was also observed in grower paddocks.
    - This has very important implications in relation to timing of soil sampling and interpretation of DNA assessments.
- Plant assessments showed that Rhizoctonia damage was slightly higher under continuous cereals compared to cereal / canola rotations but there was no consistent impact of rhizoctonia damage on yield.

Seedling assessments revealed that in addition to the damage to seminal roots, crown roots were also severely affected, especially in no-till systems. This is probably due to the seminal roots escaping the disease through rapid root growth through warm soil while crown roots emerged into cold soil with the re-establishment of hyphal network following soil disturbance at seeding.

Evaluations of seed treatments such as Dividend® were unable to show a significant reduction in Rhizoctonia damage in wheat, however yield responses were observed in NSW possibly due to the control of *Pythium* damage.

Implications:
An improved understanding of the factors influencing rhizoctonia inoculum levels will assist growers and advisers better utilise diagnostic information to select options and requirements for improved management of Rhizoctonia disease. The multiple interactions that can affect rhizoctonia disease impact suggest that improvement to natural biological disease suppression may be the best option to control soilborne diseases such as Rhizoctonia bare patch.

Factors likely to reduce the risk of yield loss caused by Rhizoctonia disease:
- Control summer weeds to stop build-up of inoculum
- Encourage early seedling vigour, sow early
- Cultivate deep sow shallow (avoid disc seeders)
- Canola can help reduce inoculum for the following wheat crop
- Barley and wheat are most intolerant crops
- Minimise N deficiency at seeding, especially in intensive cereal rotations.

Further reading:
GRDC Factsheet March 2008
http://www.grdc.com.au/uploads/documents/GRDC_FS_rhizo.pdf

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