Section Editor:
Dr Annie McNeill
University of Adelaide

Disease

Management of soilborne Rhizoctonia disease risk in cereal crops

RESEARCH

Vadakattu Gupta[2], Amanda Cook[1], Alan McKay[3], Nady Harris[2], Daniel Smith[3], Wade Shepperd[1], Ian Richter[1], Kathy Ophel-Keller[3] and David Roget[4]

[1]SARDI, Minnipa Agricultural Centre , [2]CSIRO, Waite, [3]SARDI, Waite, [4]Private Consultant

Searching for answers

Location:
Streaky Bay
J Williams and B Goosay
Streaky Bay Ag Bureau

Rainfall
Av. Annual: 340 mm
Av. GSR: 274 mm
2011 Total: 358 mm
2011 GSR: 235 mm

Yield
Potential: 3.1 t/ha, 2.3 t/ha (C), 8.8 t/ha (pasture)
Actual: 1.7 t/ha (W), 1.45 t/ha (C)

Paddock History
2008-11: Trial treatments
2007: Barley
2006: Wheat
2005: Pasture

Soil
Highly calcareous grey loamy sand

Plot size
60 m x 1.48 x 4 reps

Other Factors
Yellow leaf spot and snails

Key messages

- **Grass free canola and pasture reduce Rhizoctonia inoculum levels and can provide effective control of Rhizoctonia for a following cereal crop.**
- **The cereal yield benefits from previous rotation crops were higher in 2011 compared to 2010 as a result of higher Rhizoctonia inoculum levels at sowing in 2011.**
- **Cereals (and grasses) are the main hosts for Rhizoctonia and result in the rapid build up of inoculum.**
- **Rhizoctonia inoculum is reduced following rainfall after crop maturity but levels can recover during dry periods over summer/ autumn.**
- **Following a wet summer (multiple rainfall events), levels of Rhizoctonia inoculum can be reduced from high risk to low risk.**
- **Rhizoctonia inoculum levels at sowing were significantly lower in cultivation treatments compared to no-till however in the trials to date, the decline in inoculum with cultivation has not been sufficient to provide a yield benefit.**

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 first year of a second round of funding of a national GRDC project 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 the 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. Treatment details for 2011 include; conventional cultivation (22 March - wide sweeps; 12 April - narrow points), strategic cultivation (12 April - narrow points), no-till and with several rotations. The trial was sown on 19 May 2011 into reasonable moisture.

Correll wheat was sown 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 with MAP @ 35 kg/ha. Both the canola and medic had excellent establishment in 2011. The trial area received 1.5 L/ha of glyphosate, 1.5 L/ha of trifluralin and 10 ml/ha Hammer® pre-seeding; on 21 June the trial received 30 ml/ha Karate Zeon® for diamond back moth control. Post sowing 1.5 L/ha of Hoegrass® was used for grass control in all plots and 1.1 L/ha of Amicide 625® in the wheat plots for broadleaf control. The medic plots received Broadstrike® at 25 g/ha.

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

What happened?

Wheat grain yields were significantly higher following rotation crops and fallow in both 2010 and 2011 seasons compared to the continuous wheat (Figure 1). In general, wheat yields in continuous wheat rotations were lower in 2011 compared to 2010 season and the rotation effect was greater in 2011 season. Wheat yield after pasture - no-till were higher in 2010 compared to 2011. The yield reduction from cultivation of pasture could be due to a higher mineral N level measured in the surface soil which may have influenced the suppressive effect of native soil microbial communities.

The effect of crop rotation on Rhizoctonia inoculum levels at sowing were similar in both 2010 and 2011 seasons (Figure 2) and similar results were also observed in the Murray Mallee soils at Waikerie and Karoonda and at Galong in NSW over 3 seasons (2009-2011). Rhizoctonia inoculum levels were lowest immediately after grass free canola, medic pasture and fallow, and highest following cereal. However the reduction in the inoculum level lasts only for one year as inoculum builds up on the following cereal crop. In general, the rotation effect on inoculum was greater than the effect of summer cultivation in continuous wheat rotation (Figure 2). Among the different continuous wheat treatments, no-till and strategic cultivation treatments generally showed highest levels of inoculum and conventional cultivation the lowest (Figure 2). In continuous wheat rotations inoculum levels were higher in 2011 season (average 265 pg DNA/g soil) compared to that in 2010 season (165 pg DNA/g soil) and this reflected in the grain yield differences between seasons (1.44 and 1.80 t/ha during 2011 and 2010 seasons, respectively). The final disease impact on yield is due to a combination of inoculum level, and many other factors including the level of soil microbial activity at seeding, the amount of soil disturbance below seeding depth, N levels at seeding and constraints to root growth (e.g. compaction layers, low temperatures, soil moisture etc.).

Inoculum levels of Rhizoctonia have been significantly lower following cultivation compared to no-till systems. This effect is more pronounced on Eyre Peninsula than in the Mallee or NSW. However the cultivation effect on inoculum in the trials to date has only dropped the disease risk from very high to high and there has been no yield benefit observed.

Research over 3 seasons has confirmed that Rhizoctonia can infect wheat crop roots throughout the growing season but the type of symptoms seen above-ground in the field can vary depending upon the time of infection and the severity of disease. Severe damage during the seedling stage (up to 6-8 weeks after germination) generally results in the characteristic patches.

However, when crops are sown early into warm soils, seminal roots can escape severe Rhizoctonia damage, but as the temperature drops below 10°C, the crown roots and seminal roots can still be infected resulting in above-ground symptoms appearing as a general unevenness of the crop instead of distinct patches. If the damage to crop roots continues throughout the spring, it can result in reductions in plant tiller number and grain yield (Figure 3).

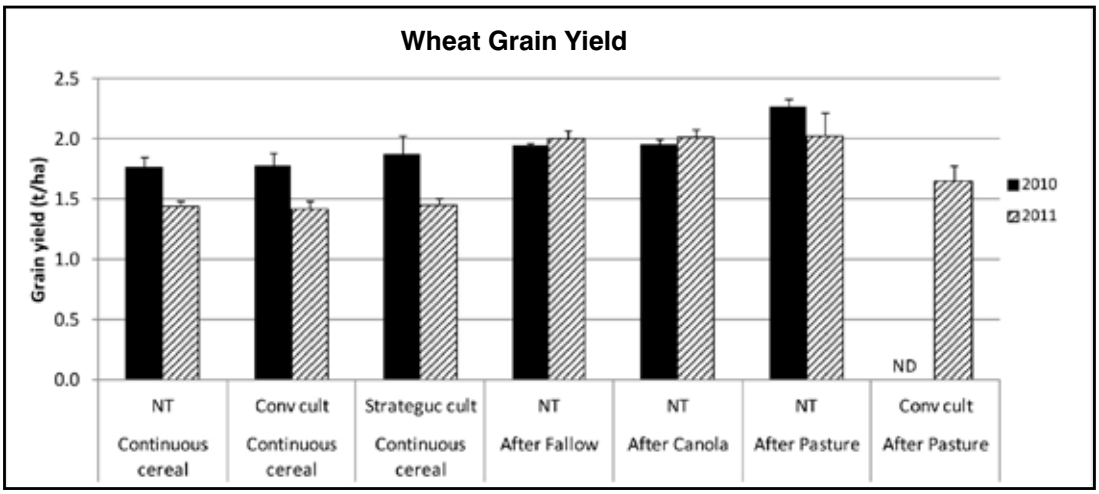

Figure 1 Crop rotation and cultivation effects on wheat grain yield at Streaky Bay during 2010 and 2011 seasons. ND = not determined

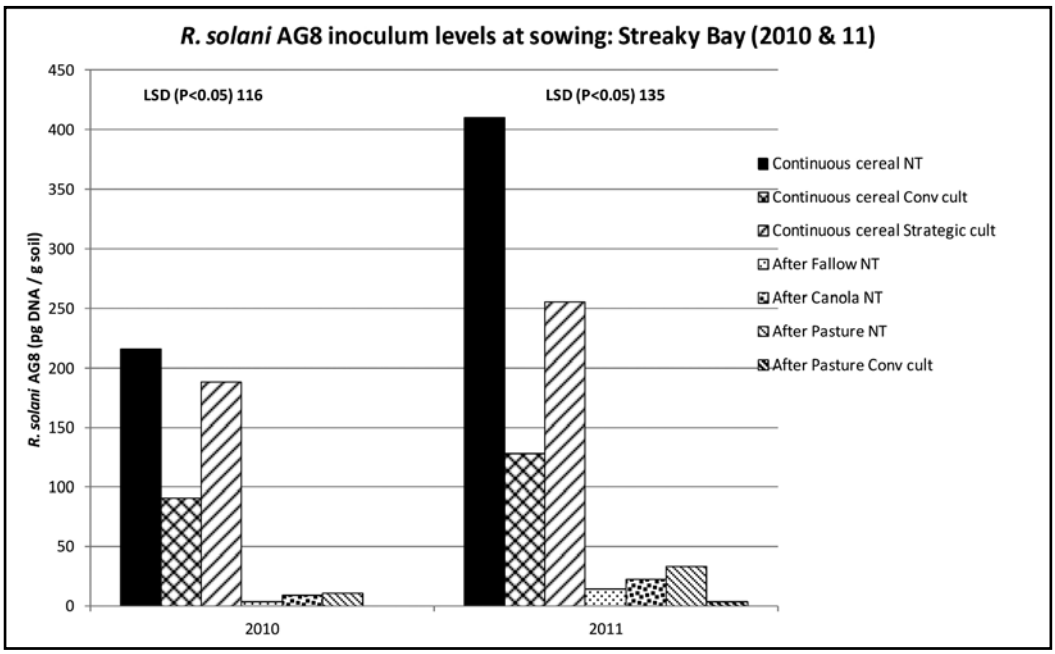

Figure 2 Crop rotation and cultivation effects on the* Rhizoctonia solani AG8 *inoculum levels in soil at sowing of wheat crop during 2010 and 2011

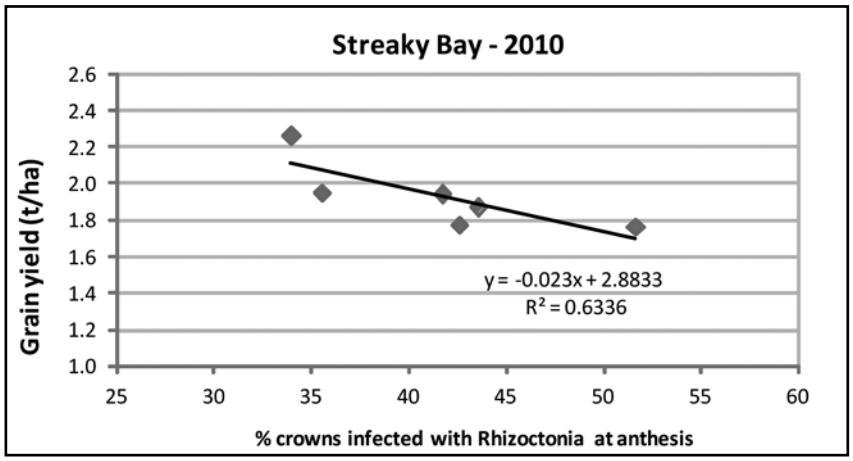

Figure 3 The impact of Rhizoctonia disease incidence on wheat grain yield in 2010

What does this mean?

1. Grass free canola and medic pastures provide a very useful reduction in the Rhizoctonia inoculum level which can result in significant increases in yield. The effect of rotation crops is similar to that after a weed free fallow.
2. Cereals are the key host and inoculum builds up late into the crop season resulting in the rapid build-up of *Rhizoctonia solani AG8* inoculum.
3. Rhizoctonia inoculum levels generally peak at crop maturity and rain post maturity of a crop causes a decline in inoculum, and major rainfall events over summer can reduce inoculum from a high to low risk situation.
4. Multiple significant summer rainfall events that keep soil moist cause Rhizoctonia to decline, but prolonged dry periods that allow the soil to dry out would result in the recovery of inoculum levels.
5. Rhizoctonia damage to crown roots can result in significant loss to wheat grain yield.

Future research will:

- Improve our understanding of the role of summer weeds and other rotation crops.
- Develop more reliable disease prediction based on Rhizoctonia inoculum levels and possibly tests for microbial community structure that affect disease risk.
- Develop techniques to band fungicides to improve disease control (Fungicide project – SARDI).

Acknowledgements

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