Farmer best bet demonstrations for Rhizoctonia management

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DEMO

Searching for answers

Location: Warramboo - Medic and Vetch
Rainfall
Av. Annual: 300 mm
Av. GSR: 204 mm
2013 Total: 329 mm
2013 GSR: 239 mm
Yield
Potential yield: 2.5 t/ha (Yield Prophet 50% probability wheat on 22 July)
Actual: 1.2 - 1.6 t/ha (W)
Paddock History
2012: Vetch or medic
2011: Wheat
2010: Wheat
Soil Type
Calcareous loamy sand over limestone

Location: Warramboo - Fungicide
Rainfall
Av. Annual: 300 mm
Av. GSR: 204 mm
2013 Total: 329 mm
2013 GSR: 239 mm
Yield
Potential yield: 2.5 t/ha (Yield Prophet 50% probability wheat on 22 July)
Actual: 0.95 - 2.2 t/ha (W)
Paddock History
2012: Mace wheat
2011: Medic pasture
2010: Barley
Soil Type
Calcareous loamy sand

Location: Wynarka
Rainfall
Av. Annual: 335 mm
Av. GSR: 238 mm
2013 Total: 289 mm
2013 GSR: 245 mm
Yield
Potential yield: 2.8 t/ha (Yield Prophet 50% probability wheat on 22 August)
Actual: 2.3 - 2.5 t/ha (W)
Paddock History
2012: Kord wheat
2011: Canola
2010: Hindmarsh barley
Soil Type
Brown sandy loam over limestone

Key messages

- **In 2013 the Rhizoctonia best bets demonstrations using rotations were over-sown with cereal and showed break crops which are grass free are the best option to lower Rhizoctonia inoculum levels.**
- **2013 results also demonstrated the interaction between increasing nitrogen levels and Rhizoctonia seminal root infection, both in a vetch and medic rotation, a canola and fallow rotation and the EPARF trial at MAC where 20 kg/ha starter urea induced greater seminal root infection.**
- **The fungicide products for Rhizoctonia suppression have performed slightly better than the controls in grain yield in these 2013 paddock demonstrations.**
- **There were no differences detected in Rhizoctonia infection of seminal or crown roots with applied fungicides in the paddock demonstrations in 2013.**

Why do the demonstration?

After an increase in Rhizoctonia research over the last decade, our understanding of this difficult to manage disease has increased substantially. The aim of the project summarised in this article is to use the latest findings from this Rhizoctonia research to demonstrate the collective value of 'best bet' strategies in broad acre environments of the upper EP in comparison to current farming practices. This SAGIT funded project has been looking at the impact of 2012 break crops on Rhizoctonia inoculum in 2013 and of crop management on disease expression in the 2013 cereal crop. Farmer fungicide strips were also monitored in 2013.

How was it done?

Within the demonstration areas of the paddock four replicated sampling lines were established to measure and collect data. Three sites were monitored – medic and vetch as break crops and banded fungicides at Warramboo, banded fungicides in barley at Wynarka (southern Mallee) and canola and fallow as rotational breaks at Piednippie. Paddock history, PreDictaB disease inoculum levels (RDTS), soil moisture, soil fertility, plant density, Rhizoctonia patch and root score, grain yield and quality were taken from both the 'district practice' part of the paddock and 'Rhizoctonia control'. Each demonstration had treatments located parallel to each other, a minimum of one seeder width and greater than 500 m in length. The sampling lines were established across the treatments.

Kane & Veronica Sampson - Warramboo

Two demonstration sites were located on this property at Warramboo, a rotation demonstration with medic and vetch as break crops and a fungicide demonstration on a second year wheat crop.

Rotation - medic and vetch break crops

In 2012 90 ha of a 96 ha paddock was sown to Blanchefleur vetch at 40 kg/ha with no fertiliser and a section approximately 2 seeder widths wide was left to self-regenerate with medic (mixture of Harbinger and Parabinga) as a comparison of break crops.

Location: Piednippie
Rainfall
Av. Annual: 298 mm
Av. GSR: 243 mm
2013 Total: 273 mm
2013 GSR: 218 mm
Yield
Potential yield: 1.8 t/ha (Yield Prophet 50% probability wheat on 22 July)
Actual: 1.2 - 1.7 t/ha (W)
Paddock History
2012: CL Kord wheat
2011: CL Oasis
2010: Barley
Soil Type
Highly calcareous grey loamy sand

The whole paddock was grass free sprayed twice, 400 ml/ha Targa in early July and 300 ml/ha Select in early August. The paddock was sprayed with 500 ml/ha glysophate in September and 500 ml/ha Paraquat in October.

The paddock was disc chained in March 2013 and received 300 ml/ha Diuron, 1 L/ha trifluralin and 1 L/ha glysophate pre-seeding. The paddock was sown on 12 May with Mace wheat @ 65 kg/ha using fluid fertiliser with 6 units P, 9 units N (dissolved urea) and trace elements (TE) of 1.5 kg/ha each of elemental Mn and Zn. The previous paddock rotation was; 2012 vetch or medic; 2011 wheat; 2010 wheat.

Fungicides

In 2013 Kane included fungicides in a fluid fertiliser but he also applied some strips of the fertiliser without fungicide, so the +/- fungicide strips were monitored for Rhizoctonia disease incidence. The paddock was sown on 8 May with CL Kord wheat @ 65 kg/ha (but due to smaller seed went out at higher rate) using fluid fertiliser with 6 units P, 9 units N (dissolved urea) and trace elements (TE) of 1.5 kg/ha each of elemental Mn and Zn. Urea @ 35 kg/ha was applied in-crop in early July. The previous paddock rotation was; 2012 Mace wheat; 2011 medic pasture; 2010 barley.

Two fungicide treatments were used: Fungicide A and Fungicide B. The control was the fluid fertiliser and TE mix only. One of each fungicide and one control was sown with two seeder widths and approximately a kilometre in length. The strips were located parallel to each other but due to the undulating sandhills and flats moved from a sandhill (Fungicide B), side of sandhill (Control) to a heavier flat (Fungicide A). Four sampling lines within each strip were monitored during the season. Eight 40 m strips were harvested with the small plot harvester for grain yield and quality. A second area was harvested approximately 800 m into the paddock with 8 40 m strips on a flat with more even soil type across the three treatments.

What happened?

The PreDicta B disease inoculum levels were all below detection for most cereal diseases with *Rhizoctonia solani AG8* risk low at 49 and 50 pg DNA/g soil following vetch and medic respectively. *Pratylenchus neglectus* risk was low with 2-3 nematodes/g soil. There were lower soil nitrogen levels in the top 10 cm after vetch compared to medic, and lower available phosphorus, but no differences in soil moisture availability.

Table 1 Initial soil data in March 2013, at Warramboo after medic and vetch break crops

Crop	Soil depth (cm)	Seeding water volumetric (mm)	Estimated mineral N 0 - 60 cm (kg/ha)	Colwell P (mg/kg)	Organic C (%)	EC (dS/m)	pH ($CaCl_2$)	Sulphur (mg/kg)	Harvest water volumetric (mm)
Medic	0 - 10	13	42	21	2.3	0.16	8.1	9.1	4
	10 - 40	49	125	8	1.7	0.25	8.2	8.7	26
Vetch	0 - 10	15	30	17	2.3	0.17	8.0	11.5	8
	10 - 40	53	137	8	1.7	0.24	8.1	9.6	30

Table 2 The effect of 2012 medic and vetch break crops on dry matter, disease and grain yield of wheat at Warramboo, 2013

	Medic	Vetch	*LSD (P=0.05)*
Plant establishment (plants/m^2)	174	152	*ns*
Early dry matter (g/plant)	1.4	1.9	*ns*
Rhizoctonia patch score**	0.95	0.73	*ns*
Rhizoctonia root infection***	1.5	1.1	*ns*
Average number of crown roots	15.6	16.5	*ns*
Rhizoctonia crown roots infection (%)	86.1	56.9	*13.9*
Late dry matter (g/plant)	2.4	2.3	*ns*
Grain yield (t/ha)	1.2	1.6	*0.09*
Grain protein (%)	10.9	10.5	*ns*

** ns = treatments similar, ** number plants affected by Rhizoctonia of 5 selected plants across a row, scored every 2 m, ***plants roots visually scored for Rhizoctonia root damage where 0 = no Rhizoctonia damage and 5=severe Rhizoctonia damage*

Soil nitrogen levels at the start of 2013 were slightly lower in the 0-10 cm soil zone (where Rhizoctonia inoculum is concentrated) after the vetch crop than the medic. The wheat on vetch had lower Rhizoctonia root infection in crown roots. Wheat after vetch yielded greater than after medic, and the vetch treatment also had greater early and late dry matter during the season. The vetch systems also had greater Take-all damage in the wheat following vetch (average 2.7 plants/m^2) in spring than following medic (0.8 plants/m^2). There were no differences in grain quality (grain protein (%), screenings in grain (%), 1000 grain weight (g), test weight (kg/hL)) between the medic or vetch treatments (data not shown).

For the fungicide demonstration site the PreDicta B disease inoculum levels were all below detection for most cereal diseases except for *Rhizoctonia solani AG8:* risk was high at 332 pg DNA/g soil. *Pratylenchus neglectus* risk was low with 10 nematodes/g soil.

Table 3 Initial soil data for Warramboo fungicide demonstration, 2013

Soil depth (cm)	Water volumetric (mm)	Estimated mineral N 0 - 60 cm (kg/ha)	Colwell P (mg/kg)	Organic C (%)	EC (dS/m)	pH ($CaCl_2$)	Sulphur (mg/kg)
0 - 10	11.8	26	22	1.25	0.10	8.1	6.8
10 - 40	38.0	109	7	0.91	0.12	8.2	5.5

Table 4 The effect of banded fungicides on dry matter, disease and grain yield of wheat at Warramboo, 2013

	Control (side of sandhill)	Fungicide A (in flat)	Fungicide B (on sandhill)	*LSD (P=0.05)*
Sandy Rise				
Early dry matter (g/plant)	0.10	0.10	0.08	*ns**
Rhizoctonia patch score**	2.29	1.30	1.33	*0.54*
Rhizoctonia root infection***	2.24	1.98	1.65	*ns*
Average number of crown roots	9.5	10.0	8.2	*0.60*
Rhizoctonia crown roots infection (%)	79.6	78.8	71.6	*ns*
Late dry matter (g/plant)	0.73	0.91	0.56	*ns*
Grain yield (t/ha)	1.78	2.19	1.67	*0.32*
Grain protein (%)	11.8	12.2	11.4	*0.43*
Screenings in grain (%)	6.7	5.7	5.9	*0.81*
1000 grain weight (g)	36.6	35.6	39.8	*2.6*
Test weight (kg/hL)	80.6	75.5	82.0	*1.2*
Heavier Flat				
Grain yield (t/ha)	0.95	0.96	1.21	*0.13*
Grain protein (%)	10.8	11.4	11.0	*ns*
Screenings in grain (%)	9.2	9.3	10.6	*0.67*
1000 grain weight (g)	38.0	38.1	43.9	*2.89*
Test weight (kg/hL)	82.7	81.7	83.2	*0.90*

** ns=all treatments similar, ** number plants affected by Rhizoctonia of 5 selected plants across a row, scored every 2m,*
****plants roots visually scored for Rhizoctonia root damage where 0=no Rhizoctonia damage and 5=severe Rhizoctonia damage*

Due to the undulating sandhills and flats in the Warramboo area the strips on the sandy rise were located parallel to each other but moved from a sandhill (Fungicide B), side of sandhill (Control) to a heavier flat (Fungicide A), and as a result of the change in soil type nitrogen levels may have impacted on the result on this soil type, and the grain yield and protein levels reflect this. Rhizoctonia patch was worse for the control strip than the fungicide treatments (Table 4). Late dry matter, grain yield and grain protein increased from the sandhill down to the flat, where fungicide A performed the best. A second area on a heavy flat with the same heavier soil type across all treatments had lower variation in yield was also harvested and the fungicide B performed best in this area.

Stuart Pope, Wynarka (near Karoonda), southern Mallee

Results - 2012

In 2012 Stuart used fungicides in his fluid fertiliser, one of the fungicide products used was 250 gm/L Flutriafol at a rate of 400 ml/ha. Note: Flutriafol is registered for control of cereal leaf diseases (rusts).

In 2012 the Mallee and Warramboo sites showed large differences in Rhizoctonia crown root infection. Crown roots develop depending on the seasonal conditions and the number of tillers. The Mallee site had 3-4% crown root infection in barley compared to the Warramboo site with 45-83% crown root infection in wheat.

The initial Rhizoctonia inoculum level was much lower at the Mallee site compared to the Warramboo site. Greater infection of the crown roots may have also occurred at the Warramboo site due to plant stress with the seasonal conditions, especially lack of soil moisture from August onwards.

2013 season

This season Stuart used fungicide in his fluid fertiliser, so the demonstration was monitored for any differences in disease incidence and barley yield.

The paddock received a summer spray on 12 February of glyphosate 510 @ 900 ml/ha, amine 625 @ 350 ml/ha and triclopyr @ 70 ml/ha to keep the paddock clean of weeds. Pre-seeding on 7 May it was sprayed with Glyphosate 450 @ 1 L/ha, Amine625 @400 ml/ha, trifluralin @ 1.2 L/ha and paraquat @ 1 L/ha. The paddock was sown with Scope barley @ 55 kg/ha on 25 May with a Morris Concept seeder in a one pass operation. Fertiliser was 28:13 banded below the seed at 75 kg/ha. Five L/ha of a fluid trace element mix was also banded under the seed with 80 g/L of Zn sulphate, 60 g/L of Mn sulphate and flutriafol in the liquid cart. The fungicide A was added in one strip at seeding which was compared to the control (rest of paddock). This paddock was top-dressed in June with 40 kg SOA and then 40 kg urea in July. Herbicides applied post seeding were On Duty@ 40 g/ha, MCPA LVE @ 350 ml and Lontrel @ 150 ml/ha.

The fungicide treatment strip, one seeder width wide, and a control treatment located parallel were monitored during the season. Four 20 m strips were harvested within each treatment, with the small plot harvester for grain yield and quality.

What happened?

Predicta B disease inoculum levels were low for Take-all and *Pratylenchus thornei,* and below detection level for other diseases, except *Rhizoctonia solani AG8* risk was high with 386 pg DNA/g soil and Crown rot was also high with 398 pg DNA/g soil.

The soil type where the demonstration was located was a brown sandy loam with limited rooting depth due to limestone rock.

Table 5 Soil data for the Wynarka paddock demonstration, 2012

Soil depth (cm)	Water volumetric (mm)	Estimated mineral N 0 - 60 cm (kg/ha)	Colwell P (mg/kg)	Organic C (%)	EC (dS/m)	pH ($CaCl_2$)
0 - 10	17.8	32.5	39	1.12	0.07	6.7
10 - 40	40.6	27.3	28	0.72	0.04	6.6

Table 6 The effect of fungicides and trace elements on dry matter, disease and yield of barley at Wynarka (Mallee), 2013

	Control + Trace Element Flutriafol mix	Fungicide A +Trace Element Flutriafol mix
Plant establishment (plants/m^2)	149	168
Early dry matter (g/plant)	1.01	0.99
Rhizoctonia patch score**	1.6	1.6
Rhizoctonia root infection***	2.3	2.8
Average number of crown roots	11.8	11.5
Rhizoctonia crown roots infection (%)	7.4	8.2
Grain yield (t/ha)	2.3	2.5
Grain protein (%)	11.6	12.0

*** number plants affected by Rhizoctonia of 5 selected plants across a row, scored every 2 m.*

****plants roots visually scored for Rhizoctonia root damage where 0=no Rhizoctonia damage and 5=severe Rhizoctonia damage.*

The soil has a lower pH at this Mallee site and nitrogen levels in this paddock are much lower than those measured in paddocks of the demo sites on upper EP. There were no differences in plant growth, Rhizoctonia seminal or crown root scores, grain yield or grain quality between the control and the fungicide treatment at the Mallee site (Table 6, other data not shown).

Dion, Nev and Karen Trezona - Piednippie

A paddock with a pimpernel *(Anagallis arvensis)* weed problem was sown to CL Oasis mustard in 2012 at 3 kg/ha with 60 kg/ha DAP (18:20:0:0) and top-dressed with 35 kg/ha urea in early July. It received a post sowing application of Intervix @ 800 ml/ha, Lontrel @ 90 ml/ha and Targa @ 400 ml/ha. The fallow strip received 400ml of Targa.

In 2013 the paddock was sown with CL Kord wheat @ 55 kg/ha on 27 April with 55 kg/ha of DAP (18:20:0:0). The paddock was sprayed with 800 ml/ha Treflan, 1 L/ha Round Up PowerMax, and 150 ml/ha Ester 680 pre seeding. A post seeding application of 2 L/ha Zn using LVE Agritone liquid was sprayed. The previous paddock history was barley (with high Rhizoctonia damage) in 2011, and wheat (mouse plague resulted in large bare patch causing the pimpernel weed problem and grass issues in this paddock) in 2010.

A fallow strip was marked and monitored during the 2013 season, while in wheat and the canola strip next to this was used as a comparison. Four sampling points were located within each treatment. Eight 20 m strips were harvested with the small plot harvester for grain yield and quality.

What happened?

PreDicta B disease inoculum levels of risk for the canola and fallow areas were all below detection for most cereal diseases. *Rhizoctonia solani AG8* risk was medium with 62 pg DNA/g soil after canola and low (22) after the fallow. Take-all risk was low after the fallow and below detection level after canola.

The soil test data showed a soil pH of 8.1 in a grey calcareous sandy loam with adequate phosphorus levels and high nitrogen levels after canola compared to the fallow (Table 7).

The Rhizoctonia patch score showed greater damage in the canola than the fallow area, and the canola had higher total soil nitrogen levels. The early and late dry matters were greater in the canola than the fallow. Grain yield and grain protein were also higher in the canola than the fallow area. There were no other differences in grain quality (screenings in grain (%), 1000 grain weight (g), test weight (kg/hL)) between the canola or fallow treatments (data not shown).

Table 7 Initial soil data for paddock demonstration, Piednippie 2013

Crop	Soil depth (cm)	Seeding water volumetric (mm)	Total mineral N 0 - 60 cm (kg/ha)	Colwell P (mg/kg)	Organic C (%)	EC (dS/m)	pH ($CaCl_2$)	Sulphur (mg/kg)	Harvest water volumetric (mm)
Canola	0 - 10	14	40.3	34	1.3	0.18	8.1	18.1	11.5
	10 - 40	32	54.6	13	1.0	0.16	8.2	10.7	27.5
Fallow	0 - 10	11	18.2	28	1.4	0.15	8.1	12.3	10.3
	10 - 40	36	19.5	3	0.6	0.12	8.2	7.4	29.5

Table 8 The effect of two break options on wheat dry matter, disease and yield at Piednippie, 2013

	Canola	Fallow/medic	*LSD (P=0.05)*
Early dry matter (g/plant)	1.94	1.25	*0.41*
Rhizoctonia patch score**	0.88	0.65	*0.1*
Rhizoctonia root infection***	1.2	1.0	*ns**
Average number of crown roots	12.7	11.0	*0.96*
Rhizoctonia crown roots infection (%)	75.5	73.6	*ns*
Late dry matter (g/plant)	1.80	1.28	*0.27*
Grain yield (t/ha)	1.70	1.16	*0.06*
Grain protein (%)	11.4	10.3	*0.65*

**ns=all treatments similar.*

***number plants affected by Rhizoctonia of 5 selected plants across a row, scored every 2 m.*

****plants roots visually scored for Rhizoctonia root damage where 0=no Rhizoctonia damage and 5=severe Rhizoctonia damage.*

This paddock performed well this season compared to the farm average, however was not the highest yielding due to some frost damage and better yielding varieties being sown on pasture paddocks.

What does this mean?

In 2013 early seeding conditions with warm soils resulted in ideal crop establishment and little Rhizoctonia disease in early sown crops. However, cold wet conditions on EP in June and July resulted in high Rhizoctonia disease incidence in late sown crops, exacerbated by nitrogen deficiency.

In 2013 the low input vetch break crop at Warramboo was the first monitored on EP as a Rhizoctonia break crop and it performed well compared to the medic, with both break crops having low Rhizoctonia inoculum levels and higher yield being achieved with the vetch rotation. Grass free break crops are currently the best recommended option to lower the Rhizoctonia inoculum level, allowing the following cereal crop to have lower initial disease pressure. However the Rhizoctonia inoculum level will increase during the season and be back to a higher level following one cereal crop.

The demonstration cereal crops following the canola break crops at Piednippie in 2012 and 2013 have continued to show a production benefit (compared to a fallow in 2013) validating previous trial research in this region. The canola break has addressed other issues including weed control, achieved close to potential yield in following cereal crops in both seasons, and increased interest in alternative break crops.

The results from 2013 also demonstrated the interaction between higher nitrogen levels and Rhizoctonia seminal root infection, both in the vetch and medic rotation, the canola and fallow rotation and the EPARF trial at MAC where 20 kg/ha starter urea induced greater seminal root infection.

The fungicide products for Rhizoctonia suppression in paddock demonstrations in 2013 have performed slightly better than the controls in grain yield (0.2 t/ha smallest difference). There were no differences detected in seminal or in crown root infection with the fungicides in the paddock demonstrations in 2013.

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Fungicides are not named in this article as companies are currently seeking registration. These results will be presented in full in the future.