

Disease

Effect of deep ripping and fungicide application on rhizoctonia

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Location

Poochera
Gosling Family

Rainfall

Av. Annual: 326 mm
Av. GSR: 247 mm
2022 Total: 550 mm
2022 GSR: 300 mm

Paddock history

2022: Volunteer pasture
2021: Barley
2020: Wheat

Soil type

Grey highly calcareous sandy loam

Soil test

Very high pH and carbonate, poor
P reserves

Plot size

30 m x 2 m x 4 reps

Trial design

RCBD with 4 replicates

Yield limiting factors

Nutrition, hostile subsoil,
rhizoctonia

possibly due to lower foliar disease or by protecting the crown roots from rhizoctonia later in the season.

- **There was a yield improvement of 1 t/ha in barley due to 2020 deep rip plus biochar enriched with nutrients, and deep rip with animal manure.**

Why do the trial?

Rhizoctonia (*Rhizoctonia solani*) remains a significant constraint to barley and wheat production in the low and medium rainfall zones of the Southern and Western regions, especially on calcareous soils of upper Eyre Peninsula (EP). The disease is estimated to be costing Australian growers \$78M annually (Murray and Brennan, 2009).

There are currently no resistant commercial cereal cultivars to rhizoctonia. In the absence of resistant cultivars, rhizoctonia can be reliably managed by crop rotations and fungicide applications. Previous GRDC investments evaluated the efficacy of fungicide control of rhizoctonia, which resulted in the registration of in-furrow and seed-dressing fungicides. However, in the low rainfall zone, economic or practical

reasons limit the use of fungicide applications, and the unique characteristics of calcareous soils render many of the options less effective. Fungicides are effective in most regions but they are an additional cost with variable results so in-furrow fungicide application has not been widely adopted by growers on upper EP.

The aims of this project were to examine innovative management strategies for rhizoctonia control in low and medium rainfall zones, by exploring new actives (chemicals and biologicals) that can reduce rhizoctonia infection, applied either pre-sowing or in-crop, and investigating the potential of different practices (plant fumigants, soil amelioration and deeper sowing with long coleoptile varieties) to reduce the impact of rhizoctonia. The Poochera demonstration trial initiated in 2020 with soil management strategies was used to investigate the effects of soil amelioration and fungicide application at seeding on rhizoctonia.

Key messages

- **Despite no reduction in rhizoctonia disease at eight weeks, the application of Uniform® fungicide at seeding increased barley grain yield by 0.26 t/ha,**

How was it done?

The Calcareous Soils project “Producing more profitable crops on highly calcareous soils by improving early vigour and overcoming soil constraints” was funded for three years by the CRC for High Performance Soils with support by the GRDC. In 2020, a three-year rotational trial on the Gosling family farm at Poochera was initiated and included treatments which showcased some of the major issues facing cropping on highly calcareous sands of the upper EP.

Seven treatments were applied in 2020 to plots 30 m long by 2 seeding passes (4 m) wide in a randomised complete block design. The treatments were:

- Control - typical management strategy for the district
- Anti-rhizoctonia - high rates of MAP and SOA, fungicides (Vibrance® and Uniform®) and trace elements at seeding
- Fertiliser toxicity - high rate of DAP with the seed
- Deep ripping + inclusion plates (IP) (Deep Rip)
- Deep rip + IP with animal manure (Deep Rip AM)
- Deep rip + IP with biochar enriched with nutrients (Deep Rip Biochar).

Deep ripping treatments were imposed to 40 cm pre-sowing in early May 2020 using a Yeoman's plough on 64 cm spacings with inclusion plates. The animal manure (Neutrog pellets at 10 t/ha) and nutrient enriched biochar (at 1.5 t/ha) were applied in bands on the soil surface to align with the ripper tines to aid incorporation in the following ripping pass.

The basal fertiliser package was 25 kg DAP/ha with the seed and 50 kg DAP/ha plus 36 kg urea/ha banded under the seed rows for all treatments except Anti-rhizoctonia and Fertiliser toxicity.

The fertiliser toxicity treatment received a package of fertilisers at seeding to reduce germination and establishment; 75 kg DAP/ha plus 36 kg urea/ha with the seed.

The anti-rhizoctonia treatment received 45 kg MAP/ha plus 4 kg SOA/ha with the seed and 68 kg MAP/ha plus 137 kg SOA/ha banded under the seed rows. Seed was treated with Vibrance® at 360 mL/100 kg seed and Uniform® was added to the trace element mix banded 3 cm under the seed rows at 300 mL/ha.

In 2020, the trial was treated with knockdown and soil-active herbicides immediately prior to seeding and subsequent weeds controlled with an Intervix® application mid-season. Spartacus CL barley was seeded in all plots at 60 kg/ha with a DBS seeder using ribbon seeding boots on 19 May 2020. All plots received banded liquid trace elements at seeding of 2 kg Zn, 3 kg Mn and 1 kg Cu/ha as sulphates, except for the anti-rhizoctonia treatment which received a double rate.

In 2021, the trial was sown to Scepter wheat @ 60 kg/ha with 50 kg/ha DAP as a basal on 5 June.

In 2022, the fungicide Uniform® (active ingredients, azoxystrobin & mefenoxam) was applied to one of the seeding passes in each plot. Uniform® was applied at 400 mL/ha with 85 L/ha of water as a split application (on top of the seed rows and banded under the seed rows).

The trial was treated with a knockdown and soil-active herbicides immediately prior to seeding and subsequent weeds controlled with Intervix® mid-season. The trial was sown with a DBS seeder using ribbon seeding boots on 13 May 2022 into good moisture conditions with DAP @ 50 kg/ha and Maximus CL barley @ 60 kg/ha to all plots.

Crop establishment, crop growth and grain yield were monitored during the season. At eight weeks plant roots were scored for seminal rhizoctonia infection, crown root infection and general root health. Rhizoctonia infection was assessed using a standard rhizoctonia root score (0-10) of seminal and crown roots developed by the project team with SAGI-West in project DJP1907-002RMX.

Data from quantitative assessments were analysed using an ANOVA split-plot model with three replicates sown in a single range using GENSTAT. The main plots were the seven 2020 treatments, and the sub-plots were the two 2022 fungicide treatments.

What happened?

The 2022 season was very good with stored soil moisture due to February rains and early seeding at the end of April. Minnipa (35 km from the trial site) had a decile 9 growing season with stored subsoil moisture from summer rains in late 2021 and February 2022.

There were no differences in crop establishment between treatments in 2022 with an average establishment of 89 plants/m².

There was no effect of Uniform® fungicide application on early plant dry matter compared to the control.

Treatments imposed in 2020 continued to impact on crop growth in 2022. The mean of the deep ripping with Deep AM, and Deep ripping with Deep biochar increased early and late dry matter compared to district practice (control) (Figure 1). While there was no difference in early or late dry matter of barley in the deep rip, anti-rhizoctonia treatment or fertiliser toxicity compared to the control (Figure 1).

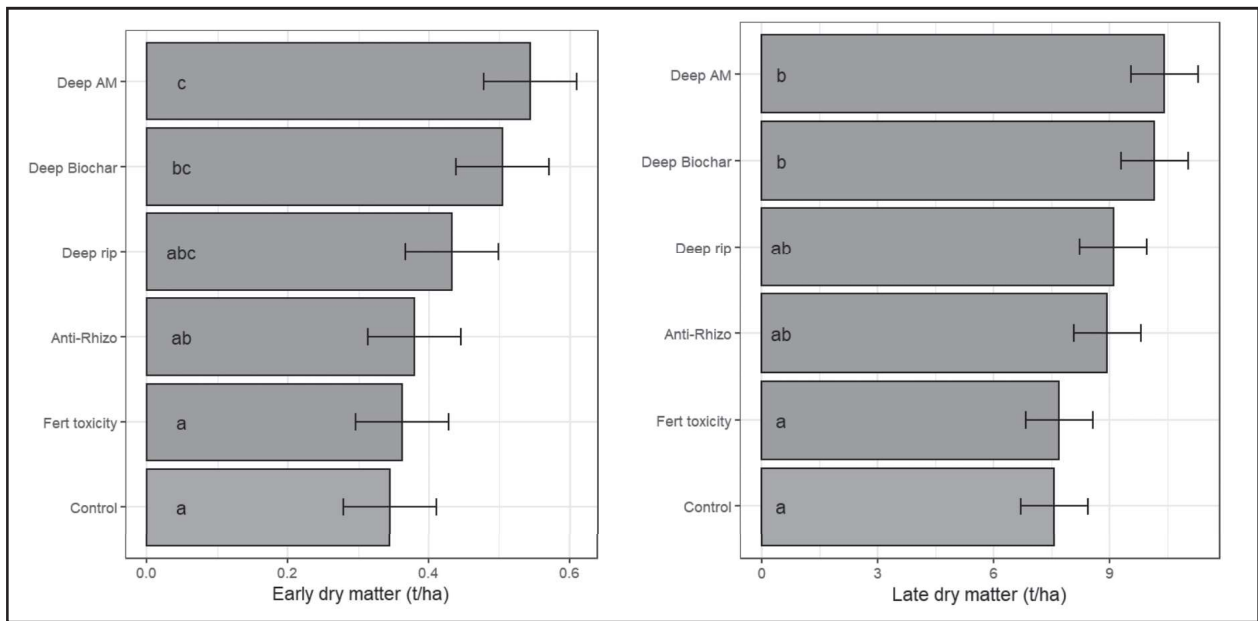


Figure 1. Mean early and late dry matter of barley (t/ha) in the Poochera rhizoctonia management trial, 2022. Bars in each graph are the treatment LSD ($P = 0.05$).

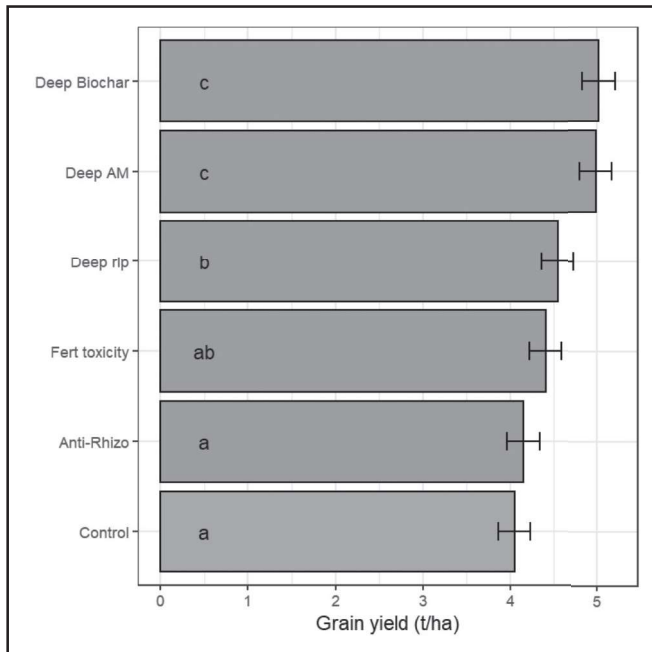


Figure 2. Grain yield of barley (t/ha) in the Poochera Rhizoctonia management trial 2022. Bars are the treatment LSD ($P = 0.05$).

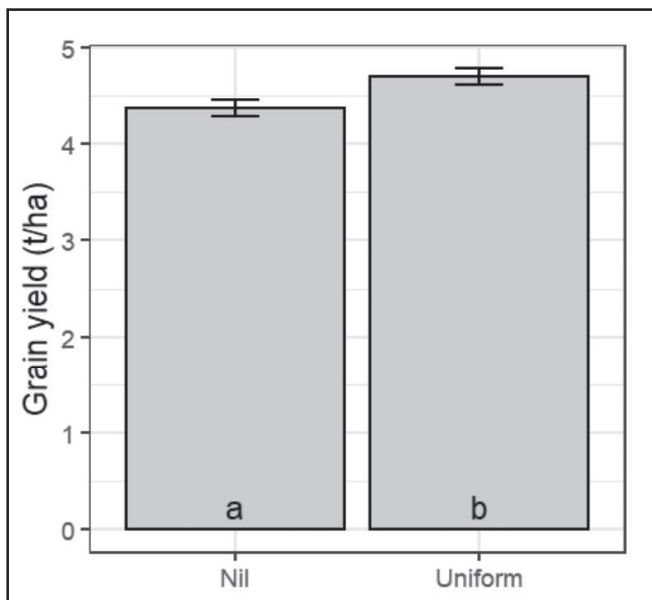


Figure 3. Grain yield of barley (t/ha) in the Poochera Rhizoctonia management trial 2022. Bars are the treatment LSD ($P = 0.05$).

There were no differences in rhizoctonia infection eight weeks after seeding despite crop growth appearing different between treatments (data not shown). However, Deep Biochar and Deep AM had lower visual rhizoctonia disease scores compared to the Control at the time of root sampling (data not shown).

Grain yield followed a similar trend to plant growth during the season with Deep Biochar and Deep AM yielding 1 t/ha better than the control and deep rip alone having higher yields than the control (Figure 2).

The application of Uniform® fungicide in furrow at seeding in a split fluid application increased grain yield by 0.26 t/ha compared to the Nil (control) (Figure 3) but did not change disease ratings (data not shown).

What does this mean?

For the third season the management treatments of Deep rip plus biochar enriched with nutrients (Deep Biochar), and Deep rip AM with animal manure pellets imposed at the beginning of 2020 performed better than the district practice control. The yield improvement was 1 t/ha in barley in the 2022 season in an above average rainfall season.

There were no differences due to the 2020 management treatments or fungicide application for rhizoctonia root infection of the seminal roots, the number of crown roots and crown root infection or general root health. Despite no differences being detected with root scoring, the use of Uniform® fungicide applied as a liquid stream with a split application increased grain yield by 0.26 t/ha in 2022. Previous studies on fungicides for rhizoctonia control show yield variation between seasons which may depend on spring rainfall (McKay, A., *et al.*). The benefit of the fungicide may have been a reduction in foliar leaf disease or the protection of the crown roots in the season; later than the eight weeks when roots were sampled. This would need to be confirmed in future trials to assess the level of foliar disease. The 2022 season was in a Decile 9 rainfall year with cool mild grain filling conditions and Uniform® showed a benefit of fungicide application which has not always been detected in previous upper EP research with earlier and drier finishes to the seasons.

Using break crops in the rotation such as canola or legumes and eliminating grass weeds to lower rhizoctonia inoculum levels before a cereal crop are still good management options.

The ‘Epidemiology and management of rhizoctonia in low and medium rainfall zones’ research has two more seasons with a new trial to examine innovative management strategies for rhizoctonia such as deep ripping and the use of long coleoptile varieties to be established in 2023. The research project also aims to better understand the seasonal triggers driving increased disease expression of rhizoctonia and a better understanding of the spatial variability (within and between paddocks). This research will be undertaken by CSIRO at Buckleboo in 2023.

Acknowledgements

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