

Disease

Effect of deep ripping and fungicide application on rhizoctonia

Amanda Cook^{1,2}, Nigel Wilhelm^{1,2}, Daniel Hubreli³, Karyn Reeves³, Ian Richter¹, Craig Standley¹ and Marina Mudge¹

¹SARDI; ²The University of Adelaide; ³DPIRD, Western Australia



- **Rhizoctonia infection on field pea roots was reduced by deep ripping undertaken 3 years previously, but amendments incorporated with the ripping had no further impact on rhizoctonia.**
- **Uniform® fungicide in furrow at seeding did not reduce rhizoctonia in the 2023 crop but did in 2022 in a decile 9 season.**
- **Despite using peat inoculant at seeding, nodulation for N fixation was poor.**

Why do the trial?

Rhizoctonia (*Rhizoctonia solani*) remains a significant constraint to crop 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. Previous GRDC investments evaluated the efficacy of fungicidal 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 are 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 different soil management strategies used to investigate the effects of soil amelioration and fungicide application at seeding on rhizoctonia.

Key messages

- **Kastar peas performed poorly in a decile 2 season at Poochera with an average yield of only 0.26 t/ha.**

How was it done?

“Producing more profitable crops on highly calcareous soils by improving early vigour and overcoming soil constraints” was a project funded for three years by the CRC for High Performance Soils with support by the GRDC. In 2020, a three-year rotational trial 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). The biochar product is now referred to as Carbon Coated Mineral (CCM).

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 CCM (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 in 2020 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, Spartacus CL barley was seeded in all plots at 60 kg/ha with a DBS seeder using ribbon seeding boots on 19 May. 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®, at 400 mL/ha with 85 L/ha of water, was applied as a split application (on top of the seed rows and banded under the seed rows) to one of the seeding passes in each plot. The trial was sown with a DBS seeder using ribbon seeding boots on 13 May into good moisture conditions with DAP @ 50 kg/ha and Maximus CL barley @ 60 kg/ha to all plots.

In 2023, the trial was sown with a DBS seeder using ribbon seeding boots on 16 May into a drier seed bed with MAP @ 50 kg/ha and Kastar peas (IMI herbicide tolerant) @ 100 kg/ha to all plots. The fungicide Uniform® was re-applied in the same way and to the same seeding passes used in 2022. The trial was treated with a knockdown and soil-active herbicides immediately before seeding.

Crop establishment and grain yield were assessed in 2023. In addition, at eight weeks after seeding, plant roots were scored for number of nodules, root score and rhizoctonia infection. Rhizoctonia infection was assessed using a score (0-10) developed by the project team. The ratings are: 0=no disease, 2-3=<25% roots damaged, 4-5=25-50% roots damaged, 6-7=50-75% roots damaged, 8-9>75% roots damaged, 10=all roots highly diseased and truncated.

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 fungicide treatments.

What happened?

The 2023 season on upper Eyre Peninsula was poor despite stored summer soil moisture from November 2022 rainfall events. Minnipa (35 km from the trial site) had a decile 2 growing season (April to October), and a decile 4 season for total rainfall in 2023.

Kastar pea establishment was similar across all treatments and averaged 48 plants/m².

Uniform® fungicide did not reduce rhizoctonia infection on pea roots eight weeks after seeding in 2023. However, there were differences in root disease scores between the 2020 management and deep ripping treatments.

Rhizoctonia infection was higher in the Control and Fertiliser toxicity treatments than in the Deep - CCM, Deep AM and the Deep rip only treatments (Figure 1). Anti-Rhizoctonia, which was only applied in 2020, had similar disease to the Control, Fertiliser toxicity and Deep rip treatments.

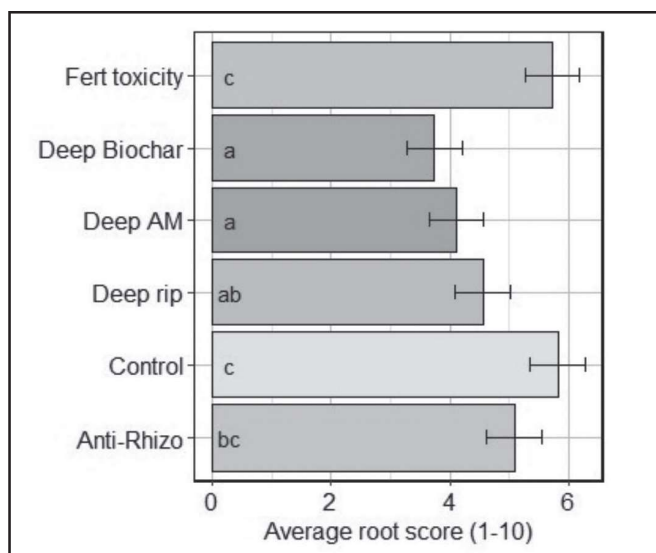


Figure 1. Average Rhizoctonia score on field pea roots in the Poochera rhizoctonia management trial with 2020 applied management treatments (0= no Rhizoctonia infection and 10= roots highly diseased and truncated), 2023. The letters within the graph represent the LSD of treatments which are significantly different at LSD ($P=0.05$).

Table 1. Average Grain yield (t/ha) of Kastar peas in the Poochera rhizoctonia management trial, 2023.

2020 Treatment	Nil	Uniform
Anti-Rhizo	0.32	0.31
Deep Biochar	0.29	0.27
Deep rip	0.28	0.28
Control	0.24	0.24
Fert toxicity	0.21	0.29
Deep AM	0.18	0.19
LSD ($P=0.05$)	ns	ns

Nodulation for N fixation was very poor despite being inoculated with peat, with an average of only one nodule per plant.

Just prior to harvest in October, the Deep CCM treatment appeared to have better and more even crop growth than the other treatments (data not shown).

Grain yield of Kastar peas in 2023 was similar across all treatments, averaging only 0.26 t/ha across the whole trial (Table 1).

What does this mean?

The 2023 season was very dry (decile 2) and Kastar peas performed poorly with an average yield of only 0.26 t/ha. Despite being inoculated at seeding with peat inoculant, nodulation for N fixation was poor with one nodule per plant.

Despite management treatments being imposed three years previously, they still had some effect on rhizoctonia infection on field peas in 2023. All treatments deep ripped in 2020 had lower rhizoctonia infection than the Control but the incorporation of organic amendments with ripping in 2020 had no further effect on rhizoctonia in 2023. Uniform[®] fungicide in furrow at seeding did reduce rhizoctonia in the 2022 barley crop in a decile 9 season.

Uniform[®] fungicide applied as a split application at seeding did not reduce rhizoctonia infection on pea roots in the dry season of 2023. However, in 2022, in a decile 9 rainfall year with cool mild grain filling conditions, despite having no reduction in rhizoctonia disease at eight weeks, the application of Uniform[®] fungicide

at seeding increased barley grain yield by 0.26 t/ha (EPFS Summary 2022, p.165). This was possibly due to lower foliar disease or by protecting the crown roots from rhizoctonia later in the season. The lack of benefit from Uniform on rhizoctonia has been common 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 any other strategies to reduce grass weeds, are still the “go to” management options so that rhizoctonia inoculum levels are low prior to the cereal crop.

The ‘Epidemiology and management of rhizoctonia in low and medium rainfall zones’ research has one more season to run. In 2024, crop performance and rhizoctonia infection will be monitored in a trial which was established in 2023 and is examining innovative

management strategies for rhizoctonia such as deep ripping with and without amendments and the use of long coleoptile varieties. 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.

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