Tackling fusarium root rot of lentil with novel strategies – harvest report

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Key findings

- Root rots are common in lentil and often reduce yield.
- Fusarium avenaceum is a key fungal pathogen causing root rot, reducing germination and infecting plant roots.
- A field trial at Hart in 2025 demonstrated that F. avenaceum inoculum reduced lentil yield by up to 48%. Use of a seed treatment produced yields equivalent to the uninoculated control.

Introduction

Key cereal soilborne diseases such as crown rot, Rhizoctonia root rot and root lesion nematode are estimated to cost Australian grain growers more than $500 million per annum in direct yield losses. These diseases are quite well known by growers and agronomists, and often are identified where they have a clear impact on a crop. Pulses and canola are also impacted by soilborne diseases but unlike cereals, these diseases are less well known by industry, and impacts may go unnoticed or be misdiagnosed. Globally, several diseases are considered major constraints to pulse production, including root rots caused by various *Fusarium* species.

Previous surveys (2019-2020) of poor performing pulse crops across Australia have demonstrated that root diseases are common, and further work has led to the identification of key soilborne pathogens likely reducing pulse yields. *Fusarium avenaceum*, *Rhizoctonia solani* AG8, and *Didymella pinodella* are commonly found in soil/root DNA tests through the Mid North, as well as in other Australian growing regions. These pathogens have long been known to affect pasture legumes such as medic and clover, but their effect on lentil yield is not well established. Around 20% of poor performing pulse root samples were found to have *F. avenaceum* present. This means that some paddocks, but not all, will benefit from knowing the inoculum level present, and making a management plan. Seed treatments can be a cost-effective means of protecting crops against diseases that affect emerging and young plants. As the Mid North of SA is a key pulse production region, Hart is an ideal location to conduct pulse disease research relevant to a large number of growers. This experiment at Hart tested the effectiveness of three fungicide seed treatments in managing Fusarium root rot caused by *Fusarium avenaceum* at nil, low and medium inoculum levels in lentils.

Methodology

Plots of lentil cv. PBA Hallmark XT⨀ were sown at a target density of 120 plants/m^2 on June 27. The field experiment comprised three fungicide seed treatments as well as an untreated control, sown into three *F. avenaceum* inoculum densities. Inoculum was produced on sterile millet grain in the laboratory before being dried, then sown with the seed during normal sowing operations. Inoculum was applied either as nil (control), low (1 g inoculum/linear metre crop row) or medium (3 g/lm). Inoculum densities were based on previous research undertaken by the research team. The experiment was set out in a randomised complete block design with three replicates of each treatment. Not all possible combinations of seed treatment and inoculation were included due to space constraints.

Table 1. *Treatments applied to lentil at Hart, 2025.*

ID	Treatment	Inoc level	Seed treatment
1	Control untreated	nil	nil
2	Med untreated	med	nil
3	Control ST1	nil	ST1
4	Low ST1	low	ST1
5	Med ST1	med	ST1
6	Control ST2 (PPT)	nil	ST2
7	Low ST2 (PPT)	low	ST2
8	Med ST2 (PPT)	med	ST2
9	Control ST3	nil	ST3
10	Med ST3	med	ST3

Seed treatments were selected with input from crop protection companies, and chosen because their active ingredients are considered likely to have effect on the pathogen, and also because they are available in Australia, meaning they have potential to be registered if found to be sufficiently effective. One seed treatment (ST2, PPT/Evershield) is currently registered, and the two others are not registered for this use at this time.

Measurements taken throughout the year were emergence, plant and root weight at early flowering, root disease and nodulation assessment at early flowering, and yield. Statistical analysis was completed using a 1-way ANOVA in Genstat.

Results and discussion

Statistical analysis showed that there were significant effects of treatments on emergence, plant and root weight, root disease, nodulation and yield (Table 2).

The medium density of *F. avenaceum* inoculation reduced establishment by approximately 60% (Figure 1). However, all seed treatments were effective at both the low and medium inoculum densities, and had similar emergence to the non-inoculated control. This shows that the seed treatments were able to protect the lentils in the critical early stage of emergence.

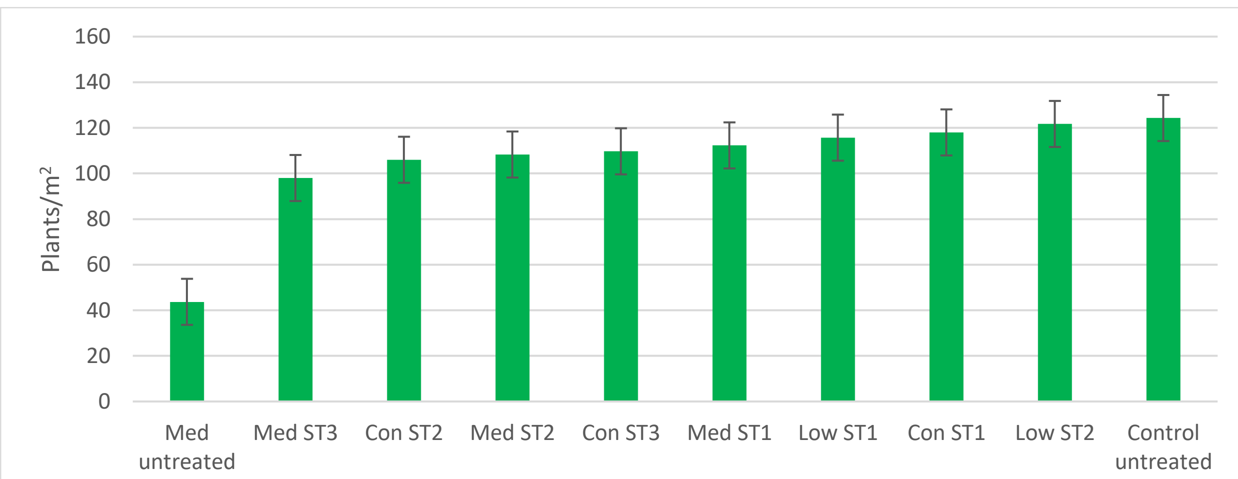

Figure 1: Emergence of lentils with different rates of fungal infection and/or fungicides.

Plant and root weight (results not shown) were similar in all treatments except the inoculated control. Due to the low plant numbers and less competition for resources in the inoculated control, the remaining plants and root systems were larger than the other treatments. This did not compensate for the lower plant numbers in harvested yield.

Root disease ratings were significantly higher in the inoculated plots with no seed treatment (Figure 2). Seed treatment resulted in root disease ratings being similar to the healthy control.

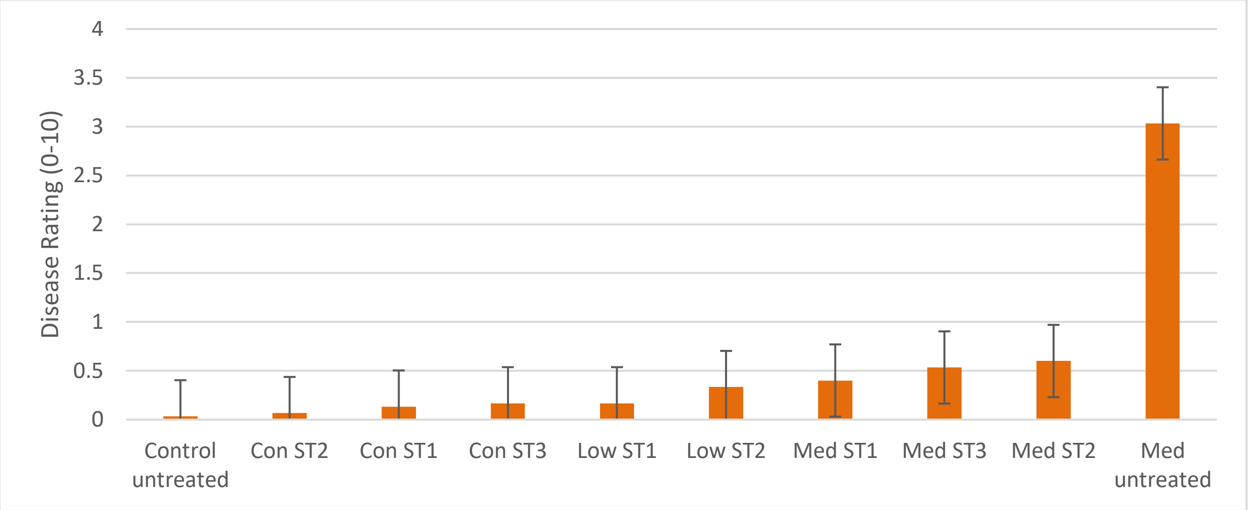

Figure 2: Disease rating (0-10) of lentil roots with different levels of F. avenaceum and seed treatment at Hart in 2025.

Nodulation of the roots was assessed. The inoculated control had less rhizobium nodules than the healthy control and the treated inoculated plots.

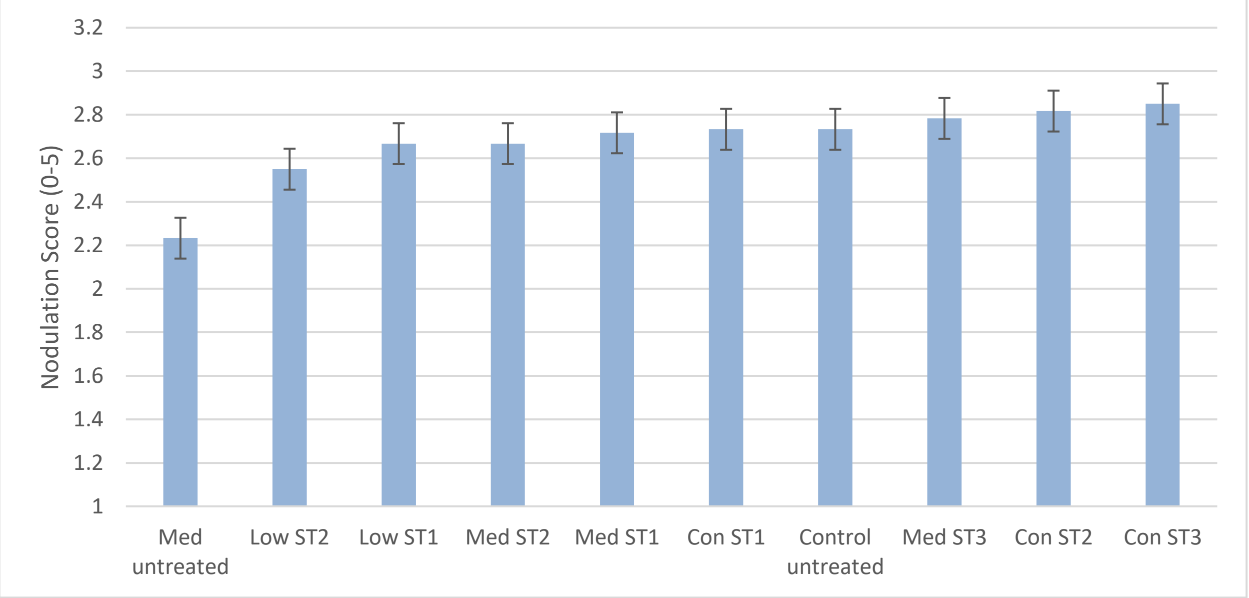

Figure 3: Lentil root nodulation scores (0-5) for lentil roots at Hart 2025.

Yield was significantly lower in the inoculated control plot, at 52% of the untreated control (Figure 4). This was due to the low number of plants in the inoculated control plot. Although these plants had grown larger, they were unable to compensate for the loss of numbers when it came to grain yield.

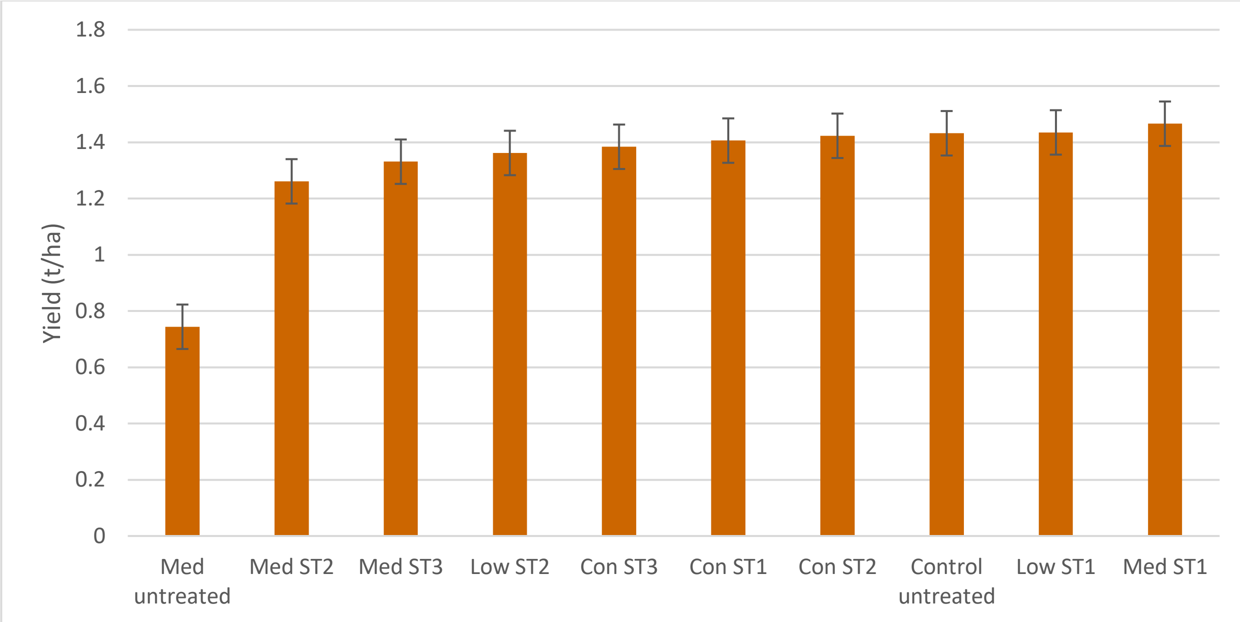

Figure 4: Lentil yield with F. avenaceum and seed treatment at Hart 2025.

Table 2: Results of measurements of lentil trial at Hart, 2025, comparing seed treatment effects on plots with and without F. avenaceum infection. Different letters indicate a significant effect at an alpha level of 0.05. Shaded values indicate significant best performing treatments.

Measurement **Treatment**	**Emergence (p/m^2)**	**Root disease (0=none, 10 =max)**	**Nodulation (0=none, 5 = max)**	**Yield (t/ha)**
Control untreated	124^{c}	0.03^{a}	2.73^{bc}	1.43^{c}
Med untreated	44^{a}	3.03^{b}	2.23^{a}	0.74^{a}
Control ST1	118^{bc}	0.13^{a}	2.73^{bc}	1.41^{bc}
Low ST1	116^{bc}	0.17^{a}	2.67^{bc}	1.44^{c}
Med ST1	112^{bc}	0.4^{a}	2.71^{bc}	1.47^{c}
Control ST2	106^{bc}	0.07^{a}	2.81^{c}	1.42^{bc}
Low ST2	122^{c}	0.33^{a}	2.55^{b}	1.36^{bc}
Med ST2	108^{bc}	0.6^{a}	2.67^{bc}	1.26^{b}
Control ST3	110^{bc}	0.17^{a}	2.85^{c}	1.38^{bc}
Med ST3	98^{b}	0.53^{a}	2.78^{c}	1.33^{bc}
LSD	**21.7**	**0.79**	**0.2**	**0.165**
Significance	**<0.001**	**<0.001**	**<0.001**	**<0.001**

Conclusions

Seed treatment with a fungicide in inoculated plots resulted in improved emergence, root disease scores, rhizobium nodulation and yields when compared to inoculated plots with no seed treatment. Inoculated plots with seed treatment were mostly very similar to plots with no inoculation, showing that seed treatment can be an effective means of protecting against *F. avenaceum* during crop establishment.