

Does cultivation reduce soil-borne diseases?

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Key messages

- The monitoring undertaken showed no evidence for significant reduction of soil borne disease by ripping and cultivation.
- The spatial variability of soil borne diseases dictates that careful site selection, small plots, multiple replications and intensive sampling is required to obtain meaningful results.

Background to the activity

There are many questions about soil renovation including influence on weed and disease control, particularly soil borne diseases.

There is limited evidence that cultivation may reduce the impact of RLN on susceptible crops, cultivation is known to reduce early infection of *Rhizoctonia solani* AG8 and the effect on Take-all and Crown Rot is variable.

Regional Research Agronomy staff used the opportunity of Ripper Gauge sites at Salmon Gums and Kendenup to assess the influence of soil renovation treatments on soil borne diseases.

Activity objectives

To investigate the effect of deeper cultivation (30-40cm depth) on the incidence of soil borne diseases including RLN (*P. neglectus*), crown rot (*Fusarium species*) and the level of *Rhizoctonia* bare patch (*Rhizoctonia solani* AG8).

The purpose of the Ripper Gauge demonstrations was to compare several types of ripping and soil mixing machines in one location to determine their suitability for ameliorating various constraints in a range of soil types.

Methods

Two sites were chosen; (i) 11km SE from Salmon Gums (-33.04019 S, 121.73817 E) with 20cm sandy duplex soil, and (ii) 20km WNW from Kendenup (-34.42566 S, 117.41863 E) with low to moderate non-wetting loamy forest gravel soil.

The Salmon Gums site was ripped prior to sowing in autumn 2018 with the DPIRD research “Lil Ripper”. Treatments were no cultivation, ripping to 30cm and ripping to 54cm on strips wide enough for header yield mapping over 1000m long.

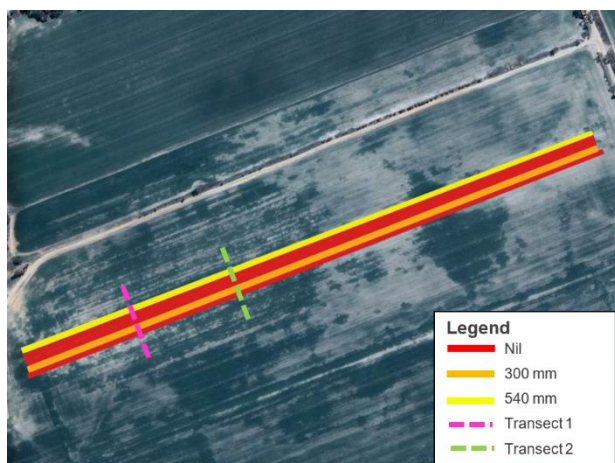


Image 1 – Satellite image of the Salmon Gums ripper gauge site showing layout of treatments and position of sampling and scoring transects.

The Kendenup site was established prior to seeding in 2019 comprising strips (200m long 12m wide) of the Horsch Tiger MT, Plozza Plough and a shallow offset disc implement, along with uncultivated strips.

Results: Salmon Gums

PreDicta B samples collected on 12 June 2019 (Figure 1) indicated high risk of crown rot. All other soilborne diseases had low or below detection limit risk rating. Across all treatments there was no significant difference in PreDicta B values of crown rot (Table 2). There was a slight increase (but not significant) in crown rot values in the nil rip strip in both transects with an average of 3.16 log pgDNA/g soil compared to the two deep ripped strips (Table 2).

Table 1. Crown rot population density (log pgDNA/g soil) results from PreDicta B sampling along two transects on 12/6/2019 at the Salmon Gums ‘Ripper Gauge’ demonstration site.

Treatment	Transect 1	Transect 2	Average of both transects
540mm	3.02	2.63	2.83
300mm	3.07	1.66	2.37
NIL	3.16	3.17	3.16

Plots were monitored during grain ripening with no significant decrease in white head incidence in deep ripped plots (table 2).

Table 2. Number of white heads per square metre in each of the trial strips along two transects on 11/10/2019 at the Salmon Gums ‘Ripper Gauge’ demonstration site.

Treatment	Transect 1	Transect 2	Average of both transects
540mm	17	0	8
300mm	3	7	5
NIL	8	8	8

Results: Kendenup

Pre-cultivation PREDICTA B testing revealed average levels of 15 nematodes (*P. neglectus*) per gram of soil. *P. quasitereoides* was not detected. The test also returned a low risk of yield loss from *Rhizoctonia* bare patch (0.76 log(pg DNA/g soil)).

RLN

RLN populations increased significantly over the season under barley, a susceptible host, as seen in Figure 1 ($p < 0.001$). Average numbers in June (all samples) were 4 nematodes/g soil, increasing to 18 nematodes/g soil by January. Post-harvest data indicated that cultivation did not significantly reduce end of season nematode levels ($p = 0.307$).

Rhizoctonia

Rhizoctonia levels were highly variable across the site. In June most samples had undetectable levels of Rhizoctonia, however levels increased over the season ($p < 0.001$) from 0.2 to 1.7. No significant differences were found in relation to cultivation ($p = 0.683$).

Root health

Scores of Rhizoctonia symptoms were not statistically different between treatments (crown roots $p = 0.394$, seminal roots $p = 0.639$). However symptoms of RLN were statistically different between treatments. Root lesions and root stunting was scored significantly more severe in roots collected from uncultivated soil than those collected from cultivated soil (lesions $p = 0.004$, stunting $p = 0.016$).

Yield

Uncultivated strips yielded on average 5.45t/ha and cultivated strips yielded 5.22t/ha. These yields were not statistically different ($p = 0.649$). No quality parameters differed significantly in terms of cultivation treatment (data not presented).



Image 2. Barley roots collected from the trial site were affected by *Rhizoctonia* and root lesion nematodes (*Pratylenchus neglectus*)

Conclusions and discussion

Salmon Gums - These results did not indicate that cultivation reduced the incidence nor yield loss from soil borne diseases. June PreDicta B results and October whitehead counts showed no significant differences among treatments. While grain yields showed a small trend to increased yield with deep ripping there were no significant differences among treatments. This result is likely in the second season as SBDs build up and re-establish during a growing season. Very large reductions of inoculum are required for any differences to be evident in the second season.

Kendenup - The RLN population and Rhizoctonia levels increased significantly over the season under barley. Barley is a host to both pathogens. The PreDicta B data did not reveal any significant difference in RLN or Rhizoctonia levels in response to cultivation. Some root health symptom scores pertaining to RLN damage were significantly higher in roots from uncultivated soil. Despite this, there was no significant difference in barley yield or grain quality in relation to cultivation. Soil cultivation to 30-40cm did not appear to reduce soil borne diseases nor increase barley grain yield at the Kendenup site.

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