Department of Agriculture and Food
GOVERNMENT OF WESTERN AUSTRALIA

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It's a mystery: why is there disease present in cereal roots in the absence of pathogen DNA in the soil?

Background and Methods

Cereal paddocks with high incidence of symptoms of *Rhizoctonia solani,* but from which no soil DNA was detected over 3 years, were identified in WA. An intensive soil and plant survey was conducted at 2 barley sites where *Rhizoctonia* DNA was not detected with PreDictaB (problem paddocks) and 1 oat site (Broken Hill paddock) with high levels of Rhizoctonia root symptoms and detectable soil DNA. During the 2014 growing season, each of the 3 paddocks were assessed at monthly intervals to identify changes in pest and disease incidence and severity for both *Rhizoctonia* and root lesion nematode (RLN, *Pratylenchus neglectus*). Between June and October, a series of transect assessments were conducted for soil on and off the cropping row, and cereal plants. A 25 cm core was also taken at each transect and the sample divided into five 5cm sections to determine if the presence of *Rhizoctonia* and RLN changed with soil depth.

Monthly paddock sampling strategy

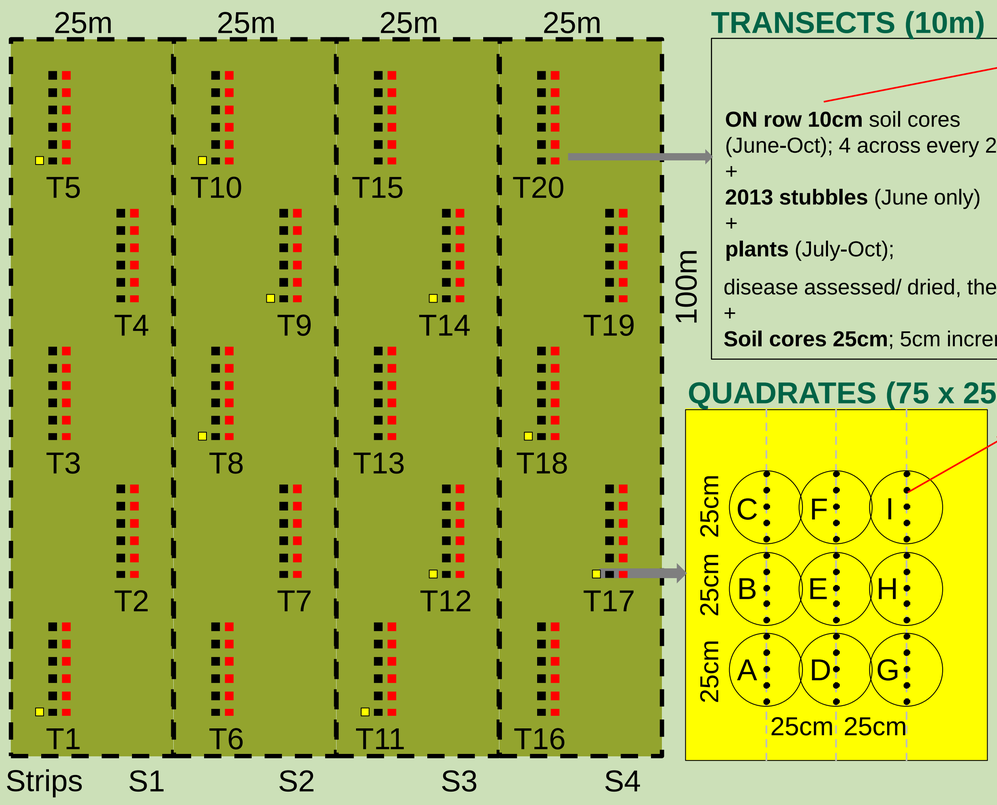


Fig. 1. Soil and plant samples collected from 3 paddocks across 20 transects (T1-T20) during June-Oct, 2014. Overall disease severity, including *R. solani* and root lesion nematodes (RLN), was assessed July onwards. Roots were then dried and DNA extracted for *R. solani* and *P. neglectus*.

How does disease change on roots?

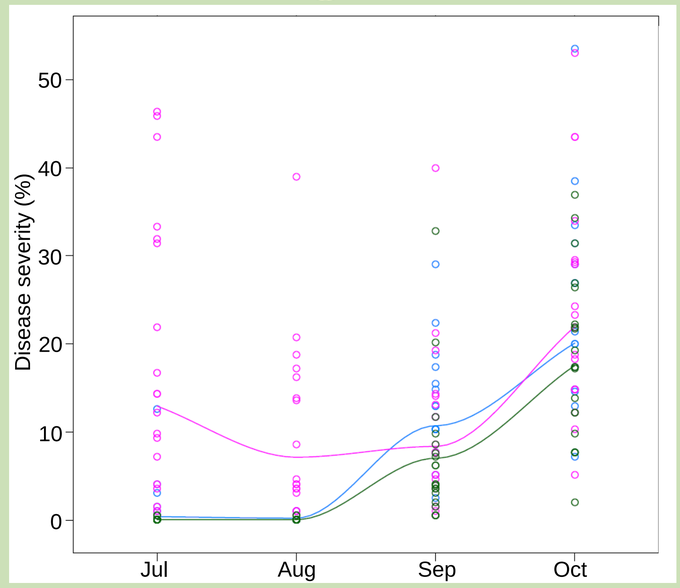


Fig. 3. Disease severity on cereal roots collected from Broken Hill - oats (-), Als Flat - barley (-) and Double G - barley (-). Score includes all root diseases.

How do soil DNA and numbers change?

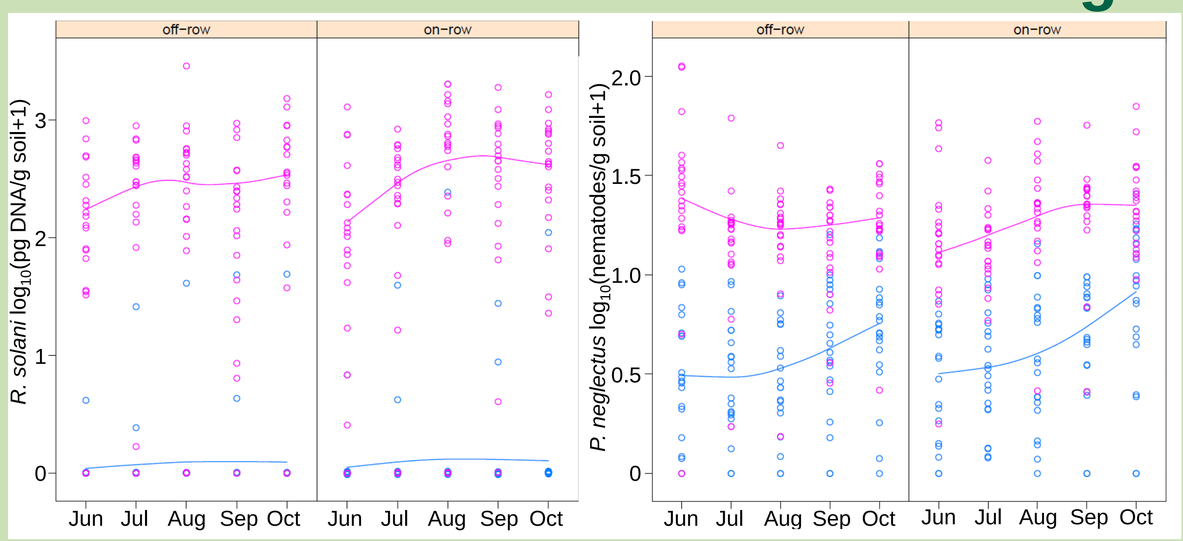


Fig. 4. *R. solani* DNA levels and *P. neglectus* numbers in soil from Broken Hill (-) and Als Flat (-) collected on and off the current crop row. *R. solani* was consistently found at Als Flat in 1 transect only. Very limited *R. solani* and *P. neglectus* at Double G.

Where are they in the soil profile?

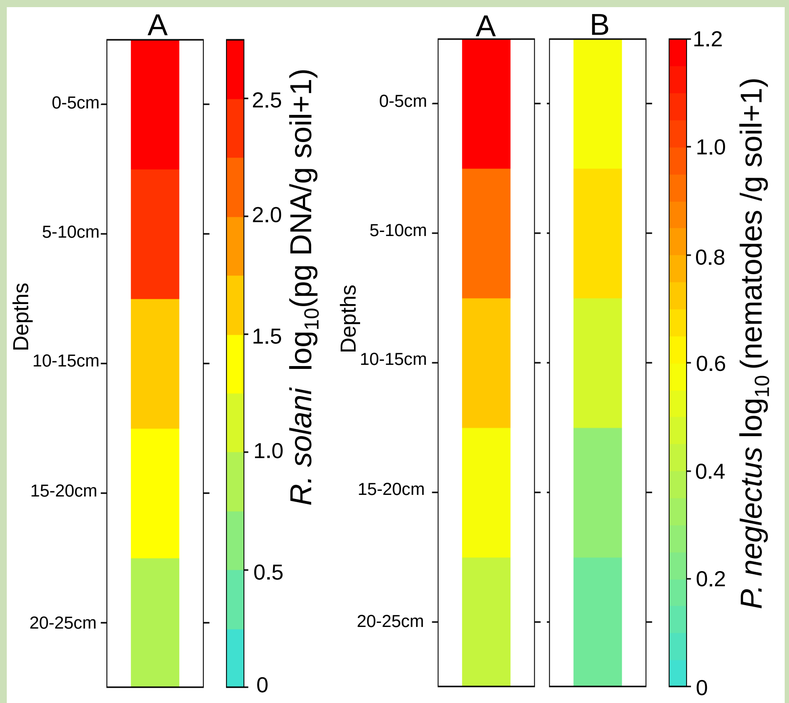
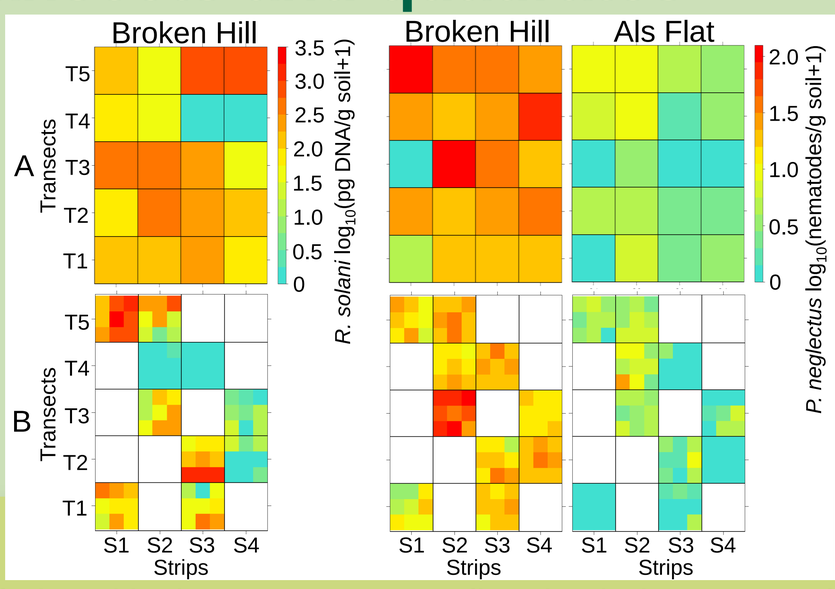


Fig. 2. Soil cores of 5cm from Broken Hill (A) and Als Flat (B) for *R. solani* DNA and *P. neglectus* numbers. Note: Double G had limited *R. solani* and *P. neglectus,* and Als Flat had limited *R. solani* except at 1 transect.

Variation among transects and quadrates

Fig. 5. Soil DNA levels for *R. solani* and nematode numbers for *P. neglectus* from Broken Hill and Als Flat for transects (A) and quadrates (B; refer to Fig. 1 yellow square for layout) collected on the 2013 stubble row in June 2014; white squares not sampled. Note: Double G had limited *R. solani* and *P. neglectus,* and Als Flat had limited *R. solani* except at 1 transect.



Conclusion

- Both *R. solani* and *P. neglectus* are mainly found in the top 10cm; sampling depth does not explain lack of detection in soil in previous years.
- Little disease observed on roots. Disease and soil DNA in the current year did not explain the high levels of *R. solani* incidence found in previous years at Als Flat and Double G.
- Soil transects exemplify the patchy nature of *R. solani* and *P. neglectus* in paddocks. Some *R. solani* DNA detected in both problem paddocks, but only in 1 or 2 transects.
- Large variation within quadrates supports collection of a few samples from a small area to get a representative composite sample from across the paddock for *R. solani* and *P. neglectus* detection.

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