Soilborne Pathogen Identification and Management Strategies for Winter Cereals Project – Southern Dirt

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Key Messages

- Chemical fallow is an effective tool for reduction of a range of soilborne disease constraints including Take-all, *Rhizoctonia* bare patch and root lesion nematodes.
- Wheat is a susceptible crop for root lesion nematodes (RLN) commonly found in WA broadacre cropping but there are variety differences that can help manage levels (see 2023 WA Crop Sowing Guide)
- Seasonal conditions influenced the presence and absence of pathogens in the trial. This site was waterlogged from August to September 2022. The trial was designed to reduce the impact of the diseases take-all and root lesion nematodes (*Pratylenchus* spp.) that were present in the paddock.
- It is important to remember that PREDICTA® B is a risk-based decision tool for growers. Impacts of soilborne pathogens and nematode pests in a crop is determined by the susceptibility of the host crop, environmental conditions such as rainfall and soil type as well as nutrient inputs like trace elements and nitrogen.

Aim

This project aims to provide growers with knowledge and experience in diagnosing soilborne pathogens from symptom expression on plant roots. It will provide them with knowledge of management of these pathogens and demonstrate some management options in field situations and deliver extension activities nationally.

Background

Despite the significance of the issue, diagnosing soilborne pathogens can be difficult. Currently, the presence or absence of soilborne pathogens can be ascertained through diagnostic services (e.g. PREDICTA® B, and DDLS), through the observation of root symptoms, and to a lesser extent, above-ground crop symptoms. Unfortunately, it has become apparent that growers frequently rely on above-ground crop symptoms to diagnose crop diseases.

Above-ground symptoms for soilborne disease diagnosis can be problematic and incorrect for several reasons. Firstly, several of the observable crop symptoms can be similar between different pathogens and plant parasitic nematodes and even other crop issues such as nutrient deficiency. Secondly, some in-crop symptoms of soilborne diseases can be affected by seasonal conditions. For example, last year's higher rainfall reduced the visual symptoms (patches) in the field. Another example, *Rhizoctonia solani* crown root infection can be more prevalent with early sowing but is more difficult for growers to diagnose as there is no typical bare-patch and variation between a crown root infected crop and a healthy crop is not as easily discernible early in the season. Thirdly, some pathogens co-exist and impact cereals in a complex interaction that may increase the complexity of visual identification above and below crop. Reliance on a single method of identification increases the likelihood of incorrect management strategies being implemented, and a holistic approach to identification with all available tools is ideal.

Soilborne disease management differs according to which soilborne disease and/or nematode pests are present, it is reliant on correct identification of the causal pathogen. Grower and advisors need to have the knowledge and experience to be able to achieve this.

The purpose of this investment is to extend to growers and advisors the different methods for correctly identifying soilborne pathogens.

Technical issues resulted in the final 2021 trial not being finalised. A new demonstration site was established in 2022. This report summarises the 2022 results.

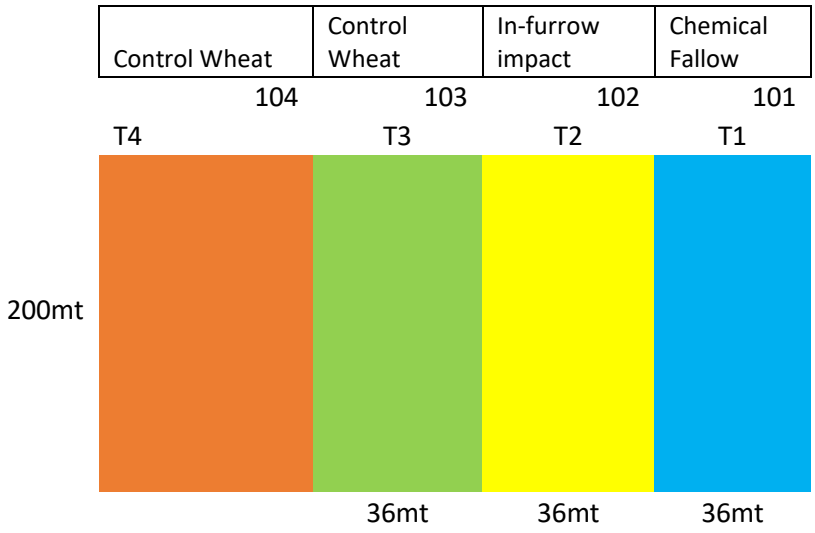
Table 1: Field Trial Details and treatments

Trial Location **Plot size & replication**	Lynford Farms, Williams 36m x 200m x 1 replication
Paddock rotation	2018: Canola, 2019: Oaten Hay, 2020: Canola, 2021: Bannister Oats
Sowing date	22/6/2022
Sowing rate	100 kg/ha Scepter Wheat
Fertiliser	20/6/2022: 40 L/ha FlexiN 100 AMF Custom Blend NPK 16/8/2022:105 kg/ha Urea 16/9/2022: 30 L/ha Flexi N 3 L/ha Calx 1.5 L/ha Tracer Cu 3 L/ha CS Multi Tracer
Herbicides, Insecticides & Fungicides	12/4/2022: 1 L/a Glyphosate 540, 0.5 L/ha SOA (adjuvant) 15/6/2022: 2 L/ha Trifluralin, 2 L/ha Glyphosate 540, 0.5 SOA (adjuvant), 100 L/ha Oxyfluorfen; 118 Sakura; 48.7 Calisto 20/6/2022: 0.26 L/ha Evergol Energy 4/8/2022: 1 L/ha Colt, 100 L/ha Le-Mat 16/9/2022: 800 ml/ha Estercide Xtra 680
Growing Season Rainfall - Darkan	349 mm (April – Oct.) Annual rainfall 2022 – 380 mm Ave Annual Rainfall (10yr) – 459.7mm

Table 2: Treatments

	Crop	Treatment
1	Chemical Fallow	Chemical Fallow
2	Wheat Scepter	In-furrow Impact
3	Wheat Scepter	Control - Wheat
4	Wheat Scepter	Control - wheat

Trial Layout at Williams site for the Soil pathogen project



Results and Discussion

The treatments planned for this site focused on control of take-all caused by the pathogen *Gaeumannomyces graminis* (Gg) and root lesion nematode pests (RLN; *Pratylenchus spp.*) which were detected in the PREDICTA® B sampling at the start of the season (table 4). Treatment 4 was originally planned as a break crop (lupins) however seasonal conditions precluded the seeding of lupins at the time.

In season plant root assessment (at GS30) for soilborne disease pathogens 2022 (Table 2)

There were no plant samples from the chemical fallow treatment. The pathogen *Rhizoctonia solani* was not detected in the roots of plants sampled from the "Impact in-furrow" treatment. However*, Rhizoctonia solani* was detected in the wheat control plots.

Table 2. Live plant assessment of disease for 2022 Southern DIRT trial in Williams.

Treatments	**Live plant results 2022**		
	Rhizoctonia solani	*Fusarium* spp.	*Pratylenchus neglectus* per g of root
Chemical Fallow	-	-	-
In furrow Impact	Not Detected	Detected	6,072
Control Wheat	Detected	Detected	8,037
Control Wheat	Detected	Detected	5,345

It was too early in the season, for the pathogen Gg to be isolated from the plant roots. However, the pathogen that causes crown rot (*Fusarium pseudograminearum*) was detected in all the treatments.

Wheat is a susceptible crop for root lesion nematodes (RLN) commonly found in WA broadacre cropping but there are variety differences that can help manage levels (see 2023 WA Crop Sowing Guide). The number of root lesion nematodes (*Pratylenchus neglectus)* detected from live plant samples across the treatments ranged from moderate (5,345) to high (8,037). The wheat variety sown in 2022 (Scepter) is rated susceptible so this rise in levels could be expected. A moderate number of root lesion nematodes detected at this time of year in the crop has the potential to cause economic yield loss at the end of the season.

End of Season

Comparing the PREDICTA® B results from the beginning of the 2022 season to the end of the season, shows an increase in the amount of DNA detected in the soil samples across all treatments except in the chemical fallow. Weed free chemical fallow is an effective management tool for a range of soilborne disease and nematode pest issues so the drops in take-all and RLN DNA was anticipated (Table 4). For example, for Take-all, the most effective method of reducing take-all is to remove grasses including a chemical fallow, grass-free pasture or 'break' crop. The chemical fallow treatment did contain some grasses (it was not bare earth) so the RLN species *P. neglectus* was able to multiply but it does indicate how well it did reducing pathogen DNA levels in the soil overall.

The yields shown in Table 3 are not significantly different between the treatments.

Table 3. Grain yields of treatments in Williams in 2022.

Treatments	**Yield t/ha 2022**
Chemical Fallow	0
In furrow Impact	5.89
Control Wheat	5.9
Control Wheat	6.2

Table 4. Baseline PREDICTA® B testing at the start of the trial sown in 2022 and at the end of season. PREDICTA® B risk categories indicate the potential for developing disease in the following season (in parenthesis for each result).

Treatments	**Pathogens detected from initial PREDICTA® B tests (pg DNA/g sample)**				**Pathogens detected from final PREDICTA® B tests (pg DNA/g sample) [1] December 2022.**			
	Rhizoctonia solani	*Take-all (wheat + oat strains)*	*Pratylenchus neglectus* Nematodes/g soil	*Pratylenchus quasitereoides* Nematodes/g soil	*Rhizoctonia solani*	*Take-all (wheat + oat strains)*	*Pratylenchus neglectus* Nematodes/g soil	*Pratylenchus quasitereoides* Nematodes/g soil
Chemical Fallow	0 (BDL)	555 (High)	5	32	0 (BDL)	3.6; 0-8 (BDL - Low)	9.3; 6-14 (Low to medium)	5.6; 4-7 (low)
In furrow Impact	0 (BDL)	23 (Low)	5	13	23.6; 0-71 (BDL - Medium)	343; 10-865 (Low - High)	28.6; 26-30 (Low to high)	12; 10-14 (medium)
Control Wheat	0 (BDL)	41 (Medium)	5	11	0 (BDL)	291; 3-475 (BDL - High)	21.6; 3-36 (Low to high)	7; 4-11 (Low to medium)
Control Wheat	0 (BDL)	1273 (High)	9	5	0 (BDL)	880; 67-1460 (Medium - High)	19; 10-32 (Low to high)	5.3 2-7 (Low)

[1] Three samples were taken at end of season; the average and the range are presented.

[2] Below detection limit

Acknowledgements

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