Soilborne pathogen identification and management strategies for winter cereals

Host: Hunt family (Woogenellup).

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KEY MESSAGES:

- The low pathogenic load at the site over the two years of the project meant visible plant symptoms were minimal.
- PREDICTA® B is critical to identifying the risk posed by soil pathogens.
- There are very few treatments available for soil pathogens. Informed decision making on appropriate rotations is the best tool for minimising yield loss.

Background

Soilborne pathogens and disease pose a significant risk to crop production in the southern region of WA. It has been estimated that soilborne diseases cost Australian grain growers over $370 million each year. In Western Australia, rotations are already tight and there is limited non-host crop options. On top of this, soilborne diseases are often hard to detect in the field as their symptoms mirror those of common nutrient and environmental stressors. To further complicate identification, many of the observable crop symptoms can be similar between different pathogens and plant parasitic nematodes. Seasonal conditions can also either exacerbate or suppress the in-crop symptoms of soilborne diseases.

The main diseases detected in the Western Australian grain growing region are rhizoctonia root rot, crown rot, root lesion nematodes (RLN), and an increased risk of cereal cyst nematode (CCN) and take-all.

Methodology/Treatments

As part of an investment from the GRDC, Stirlings to Coast Farmers established a trial site in Woogenellup, in a paddock which the farmer suspected had soilborne pathogen issues. This site was monitored over two growing seasons, with the aim to provide opportunities for growers and agronomists to learn about the pathogens, their diseases, diagnosis, and management options.

In 2021, the treatment plots were seeded with various crop types (barley x 2, wheat and vetch) or left as fallow. In this year, one of the barley treatments were sown with Uniform (the other not) and the wheat was also sown with Uniform.

The two treated plots for 2021 focused on rhizoctonia management, where Uniform was applied at 300ml on the fertiliser.

In 2022, the whole site was seeded with wheat (no Uniform).

Table 1: Live plant assessment of disease in 2022 for each treatment over-sown in year two with wheat, Woogenellup.

2021 Treatment (over-sown with wheat in 2022)	Rhizoctonia solani	Crown Rot	Nematodes
Wheat Untreated	Not detected	Not detected	
Barley Untreated	Not detected	Not detected	860 per gram of root
Vetch	Not detected	Not detected	1947 per gram of root
Wheat Treated	Not detected	Not detected	
Barley Treated	Not detected	Not detected	

Results and Discussion

Pathogenic load – PREDICTA ® B and live plant sampling

The baseline pathogen load at the start of the 2021 season was measured via PREDICTA® B. The results for the trial area had low risk of rhizoctonia (1.24 log(pg DNA/g soil)) and crown rot (0.97 log(pg DNA/g soil)). No root lesion nematodes were detected at the site in 2021. By the end of the 2021 season there had been no change in the pathogenic load within the soil. It was suspected that the extremely wet season in 2021 limited pathogen activity, and that a greater differential would be observed in 2022 when the plots were over sown with wheat.

In 2022, there were slight changes in the loading of the soilborne pathogens, however, each pathogen load was classified as low. The results were also inconclusive as to whether the 2021 Uniform treatment or the vetch break crop reduced the presence of rhizoctonia.

Live plant sampling

The 2022 live plant samples showed minimal pathogen presence, which reinforces the lack of visible symptoms seen in the paddock (Table 1). The two above average rainfall seasons, particularly early in the plant's growth stages, likely suppressed pathogenic activity leading to very low infection rates.

Conclusion

Although the host farmer suspected that there had been a presence of soilborne disease in the paddock, the pre-season PREDICTA® B samples revealed minimal pathogens within the treatment areas. This trial highlights the difficulty in measuring and identifying soil pathogens in the field. While it is critical that farmers can visually identify soilborne pathogens, environmental conditions can often supress the symptoms, complicating the issue. For example, in the last two seasons there was above average rainfall, particularly in the early part of the growing season. Increased rainfall reduces the visible symptoms of many soil pathogens that impact root growth, as ample water is available within the reduced root area. Also, when early season infection occurs, it is unlikely that symptoms will be visible without removing plants and inspecting roots, as bare patches from diseases such as Take-All are yet to be visible.

The fact that soil pathogens can co-exist also makes identification incredibly difficult without testing plants or at the very least removing suspect plants and examining the roots. The workshops held as part of this project and run by DPIRD pathologists, allowed farmers to learn how to identify root symptoms, where they suspected pathogens might exist. However, pre-season PREDICTA® B testing is the only way to be certain of soil pathogen activity within a paddock. These tests are critical in identifying the risk of soilborne pathogens, which can allow farmers to make rotational decisions to prevent yield loss.

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