

GRDC National Risk Management Initiative – Nitrogen Use Efficiency in the High rainfall zone

Host: Beech Family (Kendenup).

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Background

The high rain fall zone (HRZ) of Western Australia is a unique environment, where most of the cropping is conducted on sandy soil types with low nutrient and water holding capacities. As a result, there is a significant yield gap between the WA HRZ and those in the eastern states in similar rainfall zones. It has been estimated that potential grain yield for wheat in the high rainfall zone (HRZ) of WA is in the range of 6-12 t/ha and 3-5t/ha for canola. However, average crop yields are below these potentials (except in 2022). On top of this the nitrogen use efficiency in the WA HRZ poses a significant risk and challenge to farmers. The low conversion rate of applied nitrogen to grain yield and grain protein, which is likely the result of losses through high rates of leaching and denitrification, coupled with the inability to bank nutrients in typical WA soils, has led most farmers to be somewhat conservative i.e., not fertilising to meet the yield potential.

In 2023, Stirlings to Coast Farmers will establish a comprehensive long-term small plot trial to examine the impact of crop rotation and grower appetite for nitrogen risk on nitrogen use efficiency, carbon emission efficiency, and profitability. In addition, APSIM models will be utilised to expand upon the field research by utilising the field trial data to model different cropping scenarios and management strategies to broaden the scope of the project.

Methodology/Treatments

Trial Design

The small plot trial will be located in Kendenup and the basic design will be a factorial crop rotation by nitrogen management strategy with full phasing of crop rotations (every crop planted in every year). The trial will contain three crop rotations (with and without legumes) and three nitrogen management, strategies (decile 8, decile 5 and nil nitrogen) within the paddock.

In consultation with local agronomists, a baseline nutrient management plan has been established for the decile

8, decile 5 and Nil nitrogen treatments. In the seasons following 2023, the nutrient management will be adjusted in relation to the carry over soil nitrogen. The number of applications will remain constant, rates will be adjusted only. This will accurately account for the season-on-season variability.

Measurement

The measurements taken throughout the trial will allow for a full nitrogen account to be kept, as nitrogen cycles through the cropping system over the four years of the project. To keep this account, the following metrics will be recorded; soil nitrogen to 100cm pre-seeding and at harvest, plant tissue and harvest residue nitrogen, harvest biomass, harvest index grain removal and grain nitrogen %.

These measurements will allow us to accurately measure the nitrogen use efficiency of each crop rotation system under each nitrogen management strategy, as well as accurately model (with the use of APSIM) these rotations under a range of different climate and management scenarios to establish how to manage nitrogen most profitably and sustainably in the WA HRZ.

Conclusion

This trial is an ambitious undertaking that will allow us to deliver locally relevant and comprehensive information on nitrogen use efficiency for our rainfall zone and our soils. This research will be undertaken in close consultation with local farmers and consultants. We will also be encouraging members to get in touch with us, who are interested in this project and in benchmarking their own nitrogen use efficiency.

Acknowledgments

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