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CWFS – Nitrogen Banking Trial 2023 – Progress Summary

Figure 1 - Condobolin N banking trial site at flowering stage.

Background

The Nitrogen (N) banking trial located at the Fettell Centre, Condobolin and managed by Central West Farming Systems (CWFS) has been running since 2022. The aim of the trial is to compare N application rate strategies. Traditionally, growers have under applied N fertiliser causing it to be the biggest factor in not reaching water limited yield potential. However, this is because there is a strong element of risk involved in applying N as it may be lost through different loss pathways or low rainfall conditions could cause high N applied crops to 'hay off' before harvest. Even though these are known risk of applying N fertiliser, they could be still outweighed by the reward of a crop reaching its water limited yield potential. To give growers the confidence to apply higher rates of N, there are strategies that can be

used to calculate application rates which consider the different growing conditions at any location. This means that higher rates could be used without the risk of losing significant amounts of applies N. The long-term project ran at Condobolin, which was continued in 2023, used different strategies to calculate N application rates. These strategies remain in place for each treatment long term so that that profitability of the treatments can be identified over multiple seasons.

Methodology

Soil coring is taken prior to sowing the trial each year to determine the starting level of mineral N in each plot. The trial is sown in small plot replicated design and a standard cropping rotation is followed which means that canola is sown in 2023 into the wheat stubble of 2022. Each treatment represents a different N application rate strategy with N being applied as top-dressed urea during the growing season. The trial is managed as non-limiting which means that all other inputs such as fungicides and insecticides are applied to make sure that nothing else will limit the yield potential of the crop. It is possible to irrigate the site at the Fettell Centre, and given the dry conditions during 2023 at Condobolin, the trial was flood irrigated twice to ensure that a result could still be achieved. Measurements are taken by conducting biomass cuts and grain harvest to measure difference in yield and quality between treatments.

Treatments

The following treatments are used in the trial:

Table 1 - 2023 Treatment list

No.	Treatments	N Rate Applied (kg/ha)
1	Nil control (no N fertiliser applied)	0
2	Grower rate (represents the rate used commercially in surrounding paddock)	45
3	Replacement (calculate the nutrient removal in the previous years crop)	0
4	Low risk seasonally responsive (Yield prophet 75% percentile)	8
5	Medium risk seasonally responsive (Yield prophet 50% percentile)	32
6	High risk seasonally responsive (Yield prophet 25% percentile)	48
7	BOM 3 month forecast (2023 – yield prophet 75% percentile)	16
8	N banking – 25kg < optimum	0
9	N Banking – Profit optimal	0
10	N Banking – Yield optimal (25kg > optimal)	10
11	Rotation – Vetch followed by canola	0
12	Rotation – Wheat followed by vetch	0

Treatments 4 to 7 are using Yield Prophet which is a decision support tool that can identify the probability of a given crop in each location reaching its water limited yield potential. This is achieved by inputting location, rainfall, plant available water estimates and soil mineral N level (from soil test) into the support tool. Based on historical weather data the probability of reaching a water-limited yield can be given. Therefore, the N demand can be calculated in order for the crop to meet this yield target. The different treatments represent different probability levels of reaching a targeted yield. Enough N is applied to reach the demand of the targeted yield.

N Banking treatments are used in treatments 8 to 10. This is a much simpler method than using Yield Prophet as crop demand is not considered. Instead a set target of soil mineral N is set and this remains constant from year to year. Soil testing is conducted each year and the difference between the mineral N target and the test results is applied. The mineral N targets are set using the soil characteristics and annual average rainfall to give an estimate of what the soil mineral N level has the potential to reach.

The rotation treatments use a biological N source rather than applying N as a synthetic fertiliser. In this trial this is achieved by growing a legume crop that is brown manured (terminated before harvest) with the purpose of increasing mineral N level by the plant's natural N fixation. In the trial a legume is grown every second year of the rotation.

Progress Summary

Figure 2 - 2023 sown canola germinating in 2022 wheat stubble

Table 2 - Diary of activities

Date	Action
12/1/23	Fallow spray
31/3/23	Second fallow spray
7/4/23	Pre-sowing knockdown
11/4/23	Pre-sowing soil coring
14/4/23	Pre-Emergent spray and sowing canola and vetch
2/5/23	Emergence counts
29/5/23	Irrigation – 1.42ML/ha
28/6/23	Urea application
1/8/23	Anthesis cuts
16/8/23	Insecticide spray
22/8/23	Irrigation – 1.42ML/ha
29/9/23	Vetch brown manure spray (termination)
16/10/23	Harvest index cuts
27/10/23	Desiccation spray
13/11/23	Machine harvest

The 2023 trial has successfully been completed with full results achievable. The trial site was impacted heavily by flooding in 2022 which meant that no crop was harvested in this season. This has resulted in low N use and the amount of N applied in 2023 was very low across treatments. However, this is not significant as it is a long-term site, and the treatments represent strategies rather than set application rates.

Dry conditions during 2023 meant that the decision was made to irrigate the trial. This was done to ensure that a result was achieved and only a small amount of irrigation was used. This is because growing a fully irrigated crop would not be representative of how winter crops are grown in the region.

All measurements were taken throughout the year including biomass cuts at anthesis and maturity, plant emergence counts and grain harvest where yield and quality are measured. A full written report will be published that includes all the results of the 2023 trial.

Extension

A workshop was held at The Fettell Centre on 16 August 2023 with 30 growers. Newsletter article published in Spring edition of CWFS Newsletter. CWFS website hosts project information.

Workshop at the Fettell Centre, Condobolin 16 August 2023

Figure 3 - Trial site about to be harvested

Report compiled by Hayden Thompson, Thompson Agronomy for Central West Farming Systems (CWFS).

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