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Managing nitrogen application in uncertain seasons

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Key messages

- Decision support tools such as ‘Select Your Nitrogen’ and ‘CliMate’ can help decision making with in-season nitrogen applications.
- In a decile 1 year there are limited benefits from in season nitrogen applications when yield does not increase with additional nitrogen fertiliser.
- Better economic returns result when both yield and protein are increased in higher decile years.
- It is important to understand production goal and the potential economic return of your nitrogen inputs.

Background

Growers in the Esperance port zone are concerned about decreasing protein levels as their cereal yields increase. Protein is one of the most important quality traits of both wheat and barley in determining that grains end-use (Williams et al 2019). Western Australian wheat has produced the lowest protein in the country in 60% of years since 1999/00 (Williams et al 2019). Similarly barley protein in Western Australia has also been shown to be declining and much of the barley sown has not been meeting protein for malting requirements (Curry et al 2019).

Protein in cereals is known to increase with a good nitrogen supply in the soil at the right time. With more growers in the Esperance port zone opting for continual cropping and with limited legume options there is more reliance on nitrogen fertiliser. Decision making on the rate and timing of nitrogen application is difficult and reactive to seasonal conditions. Decision support tools such as ‘Select Your Nitrogen’ and yield forecasting models such as CliMate App and the DPIRD ‘Potential Yield Tool’ can help (Dept of Ag 2003) (Australian CliMate 2020).

This trial was implemented in order to see, in a given year, how applying different rates in three different locations with varying rainfall and soil type impacted protein levels of wheat and barley. The aim wasto optimise wheat and barley protein by better understanding response to high nitrogen rates in a given season.

Methods

Three farmers were engaged to apply varying rates of nitrogen adjacent to SEPWA cereal variety trials. Two sites were sown to barley and one site sown to wheat. The sites were located in Grass Patch (barley), Neridup (wheat) and Beaumont (barley). Growers at each site applied nitrogen rates to be representative of their growing environment. At each site there were at least three treatments, a high nitrogen rate, control (farmer practice) and a nil (no top up). Each grower’s treatment list and crop

type is outlined in table 1. Growers did not change their nitrogen application at seeding between treatments.

Table 1. Crop type, variety sown and nitrogen treatment at three sites. Treatments were adjusted to suit the growing environment of the trial location. Treatments with * indicate the farmer practice in the year of the trial (2019).

Site	Crop (Variety)	Date sown	Treatment	Nitrogen application		Date N applied
				UAN L/ha	Total kgN/ha	
Grass Patch	Barley (La Trobe)	16/5/19	1	0*	50*	5/8/19
			2	50	71	
			3	100	92	
			4	200	134	
Neridup	Wheat (Scepter)	3/6/19	1	0	32	Split application 5/7/19 & 5/8/19
			2	180*	109*	
			3	360	183	
Beaumont	Barley (Spartacus CL)	3/6/19	1	0*	27*	15/7/19
			2	40	37	
			3	80	48	

Results and discussion

All sites received a decile 1 year for rainfall. The 2019 trial results showed limited benefits to extra nitrogen application from the in-season top-up and this can be attributed to drought and frost conditions, particularly at the Grass Patch and Beaumont site. At the Neridup site the application of the higher N rate resulted in a better grade, however this did not have optimum economic returns. At all sites the less N applied in season in 2019 resulted in the better return on investment (Table 2).

Table 2. Yield, protein, grade, and economic return of the different nitrogen treatments of the 2019 trials results at each site.

	Treatment		Yield T/ha	Protein %	Grade	Gross return $	N cost $	Return net of N cost $	ROI %
	UAN L/ha	Total N Kg/ha							
Grass Patch (La Trobe)	0	50	0.9	14.6	Feed	236	0		
	50	71	0.9	15.3	Feed	234	25	-27	-107
	100	92	1.0	16.0	Feed	256	50	-30	-60
	200	134	0.9	17.3	Feed	248	100	-88	-88
Neridup (Scepter)	0	32	3.7	8.9	ASW1	1061			
	180	107	3.8	11.3	APW	1164	90	13	14
	360	183	3.3	11.7	H2	1065	180	-176	-98
Beaumont (Spartacus)	0	27	1.1	11.2	Malt 1	304			
	40	37	1.5	12.3	Malt 1	428	12.4	112	900
	80	48	1.4	10.9	Malt 1	409	24.8	80	323

In addition to looking at the year that was, this work highlights how using yield modelling tools such as CliMate and nitrogen decision support tools like ‘Select Your Nitrogen’ can help aid in decision making. Using these tools can be beneficial when forecasting for different rainfall decile years and to make well-informed decisions. These modelling tools indicated that yield reached a plateau within the range of nitrogen rates at each site in a decile 1 and 5 year.

Conclusion

Declining protein is still an issue for Esperance growers despite the 2019 season not being conducive to low protein. High nitrogen fertiliser applications to achieve higher protein can be expensive therefore it is important to understand benefits of different rotations and how to better manage nitrogen fertiliser inputs in the future.

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