Responsive Farming for Soil Type at Wharminda

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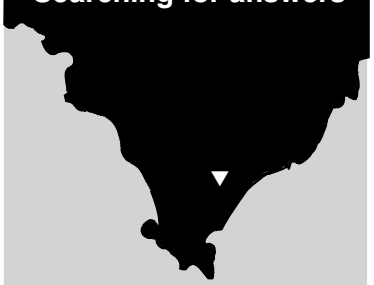
RESEARCH

Searching for answers



Location: Wharminda

Ed Hunt

Wharminda/Arno Bay Ag Bureau

Rainfall
Av. Annual: 322 mm
Av. GSR: 222 mm
2010 Total: 479 mm
2010 GSR: 349 mm

Yield
Potential: 5.7 t/ha (B)

Actual: 3.4 t/ha (poor zone - high input B)

Paddock History
2009: Wheat
2008: Wheat
2007: Wheat

Diseases
Rhizoctonia

Yield limiting factors
Brome, barley and rye grass competition

Key messages

- **In an above average season a high input system was the "best bet".**
- **Variable rate had reduced production but at a lower risk.**

Why do the trial?

It is important that low rainfall farming systems are low risk, flexible and responsive. Paddock inputs need to balance the best agronomic and economic advice with the need to ensure reliable outcomes at low cost. At Wharminda the focus is on managing risk through variable rate technology (VRT) using different inputs over variable soil types. We are also testing the use of Yield Prophet® to match plant available water (PAW) and nutrition with modelling of climatic conditions, knowing that we can have unpredictable finishes to seasons.

The Wharminda soil was chosen as a focus site for the Eyre Peninsula Farming Systems 3 Project (EPFS 3) as the non-wetting sands represent approximately 455,000 ha on EP. These sands present farmers with unique challenges; non-wetting sands that "wet up" slowly and unevenly at the beginning of the growing season which can result in uneven germination and increasing the likelihood of wind erosion. There are also a range of factors common on EP preventing crops from reaching their yield potential including insufficient nutrition, disease, weed competition, delayed sowing dates and restricted access to soil water due to chemical constraints.

Changing inputs according to the production capability of different paddock zones or soil types provides an opportunity to improve profitability for the whole paddock.

How was it done?

A paddock at Ed Hunt's property, Wharminda, was selected and zoned according to soil type - deep sand over clay (poor) representing 20% of the paddock, shallow sand over clay (medium) representing 50% of the paddock and loam (good) representing 30% of the paddock. Soil samples were taken at 4 permanent sampling points for chemical analysis (Table 1).

The paddock was sown with Fleet barley @ 65 kg/ha on 1 June 2010. Three fertiliser treatments of Low 0, Standard 8 and High 16 kg P/ha were applied to the paddock in alternating strips across the paddock. The paddock received standard weed management across all zones.

The measurements taken during the growing season were plant establishment, dry matter at early tillering, anthesis and maturity, soil water content at sowing and harvest, and grain yield and quality. A basic economic analysis was performed to compare a blanket approach of the different fertiliser treatments to tailoring the inputs to match the zone potential using variable rates of fertiliser.

What happened?

Soil chemical analysis prior to seeding showed that mineral N levels were low in all zones, despite a history of good medic based pastures (Table 1). All zones have adequate P levels for this soil type (above 13 mg/kg). Boron, chloride and conductivity are in a restrictive range at 20-40 cm in the medium zone and there are no chemical restraints in the good and poor zones at 0-60 cm.

The was no difference across the zones in terms of plant establishment (data not presented), however the amount of dry matter production was higher in the good zone at early tillering compared to the medium and poor zones (Table 2). In the good zone the medium and high input treatments produced greater early dry matter. There was a yield response to the high input treatment in the good zone, but no response to fertiliser in terms of grain quality.

Table 1 Soil chemical analysis for Wharminda 2010

Zone	Colwell P (mg/kg) 0-10 cm		Total Mineral N (kg/ha) 0-60 cm	
	2009	2010	2009	2010
Good	24	32	149	78
Medium	22	23	82	66
Poor	34	26	125	52

Table 2 Dry matter production, grain yield and grain quality from the 3 paddock zones, 2010

Zones	Inputs	Dry Matter Early Tillering (t/ha)	Dry Matter Anthesis (t/ha)	Grain Yield (t/ha)	Test Weight (kg/hL)	Protein (%)	Gross Margin[1] ($/ha)
Good	High	1.2	4.0	3.4	62.2	10.1	532
	Standard	1.2	3.3	3.1	63.3	9.8	520
	Low	1.1	3.2	3.0	62.5	9.8	395
Medium	High	1.2	3.5	2.7	62.0	9.5	400
	Standard	1.4	3.9	2.3	62.3	9.7	365
	Low	1.1	3.2	2.4	61.3	10.0	414
Poor	High	1.5	4.3	3.4	62.6	10.2	549
	Standard	1.7	4.4	2.5	62.8	9.3	404
	Low	1.1	3.3	2.3	62.9	9.9	532
LSD (P≤0.05)		*0.2*	*1.4*	*0.9*	*NS*	*NS*	
Good		1.4	4.0	2.7	62.7	9.8	
Medium		1.2	3.5	2.5	61.9	9.7	
Poor		1.1	3.5	3.1	62.8	9.9	
LSD (P≤0.05)		*0.1*	*0.8*	*0.5*	*NS*	*NS*	
	High	1.3	3.9	3.2	62.3	9.9	
	Standard	1.4	3.9	2.7	62.8	9.6	
	Low	1.1	3.2	2.5	62.2	9.9	
LSD (P≤0.05)		*0.1*	*0.8*	*0.5*	*NS*	*NS*	

[1] Gross income is of yield x price (with quality adjustments) less seed, fertiliser, chemical and operating costs delivered margin cash pool at 4 January, Pt Lincoln 2011. $150/t used for seed value.

Table 3 Yield Prophet® yield projections at 50% probability with available nutrients, current decile and estimated plant available water at 4 dates on 3 soil zones over the 2010 growing season

Date	Zone	Predicted Yield (t/ha)	Decile ranking	PAW (mm)
10 September	Good	1.0	7	16
	Medium	1.9		27
	Poor	2.1		30
27 September	Good	2.5	9	65
	Medium	3.5		84
	Poor	2.1		51

Yield Prophet® reports were run for the 3 soil zones on 2 dates over the growing season, 10 September and 27 September (Table 3). Projections indicated that the crop in all zones was under moderate N stress by 10 September. The PAW of the 3 zones was calculated by using a combination of the water holding capacity of the different soil types combined with any chemical constraints. The crop did not experience water stress due to good growing season rainfall.

The aim of the variable rate treatments used for the economic analysis was to increase overall profitability by reducing the inputs on the poorer areas of the paddock and increasing inputs in the higher potential areas. This approach keeps the high input on the good zone, standard input on the medium zone and low input on the poor zone. In 2010 the high input blanket approach was the most profitable (Table 4), with the variable rate approach being the next most profitable. The gross margin with a low input blanket approach was slightly more profitable than the standard input.

Table 4 Comparison of the gross income of different sowing regimes vs. variable rates across the whole 60 ha paddock

Treatment	Gross Margin[1] ($/ha)	Gross Margin ($/60 ha) compared to medium input treatment
High Input	425	3,796
Standard Input	363	0
Low Input	385	1,415
Variable Input	407	2,712

What does this mean?

2010 was a decile 9 growing season rainfall at Wharminda, resulting in above average yields across all zones despite the low levels of available N.

Yield Prophet® was run for the first time at the Wharminda Focus Paddock site; the projections underestimated the yields for all zones. This model has not been calibrated for non-wetting sands such as those at Wharminda at this time (pers comm. Anthony Whitbread) and over the next few seasons work will continue on improving the accuracy.

The high input blanket approach was the most profitable in 2010 as this treatment maximised the yields in all zones but at the greatest risk at the start of the season. In contrast to this the low input blanket approach minimised cost and yield. In an above average year such as 2010 some production is forgone by using a variable rate approach, although it may be a good risk management tool in average or below years as the input costs are reduced.

It is intended that these management strategies will be applied to these paddock strips for the next few seasons to track the long term impact of changing inputs, how the different zones respond to different treatments in different seasons, and how the overall economics perform.

Acknowledgements

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