Responsive farming for soil type at Mudamuckla

RESEARCH

Cathy Paterson[1], Roy Latta[1], Therese McBeath[2], Wade Shepperd[1] and Ian Richter[1]
[1]SARDI, Minnipa Agricultural Centre, [2]CSIRO Ecosystem Sciences, Waite

Location: Mudamuckla Muddy/Nunji/Wirrulla Ag Bureau

Rainfall
Av. Annual: 291 mm
Av. GSR: 219 mm
2011 Total: 348 mm
2011 GSR: 220 mm

Yield
Potential: 2.8 t/ha (W)
Actual: 2.1 t/ha

Paddock History
2010: Canola
2009: Wheat
2008: Wheat
2006: Self sown barley

Soil Test
Outlined in article

Diseases
Rhizoctonia

Plot Size
Paddock trial, sowing widths 18 m

Yield Limiting Factors
Rhizoctonia
Dry spell in spring

Environmental Impacts

Soil Health
Soil nutrients: Needs to be monitored

Resource Efficiency
Energy/fuel use: Standard
Greenhouse gas emissions (CO_2,NO_2, Methane): Standard

Social Practice
Time (hrs): Standard
Clash with other farming operations: Standard
Labour requirements: Standard

Economic
Infrastructure/operating inputs: VRT technology
Cost of adoption risk: Low if improving returns

Key messages

- **Wheat yields in the poor, medium and good zones in response to low, medium and high inputs respectively did not differ significantly in 2011.**
- **Over a 3 year wheat-canola-wheat rotation there has been no measured production benefit from applying 6 kg/ha of P on the good soil type as opposed to nil P on a shallow constrained soil.**

Why do the trial?

It is important that our 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 Mudamuckla, one of three focus paddocks in the current farming systems project, the emphasis is on managing risk through tailoring inputs to the different production zones potential by using variable rate technology.

Changing inputs according to the production capability of different paddock zones or soil types may provide an opportunity to improve gross margins for the whole paddock.

How was it done?

Paddock 8 at Mudabie Farm was segregated into zones of good (grey calcareous sandy loam), medium (sandier hills) and poor (magnesia flats) production zones in 2009 using 5 years of yield maps and an elevation map (EPFS Summary 2009, pp 97-103). The area represented by these zones are summarised in Table 1.

The paddock was sown to Mace wheat on 14 May 2011 using variable rate technology (VRT) to apply the different seed and fertiliser rates following 29 mm of rain for the month. The seeding and fertiliser rates are summarised in Table 1. Four permanent sampling points in each of the good, medium and poor zones were established in 2009 enabling soil chemical analysis, plant establishment, dry matter at anthesis, soil water measurements (sowing and harvest) and grain yield to be monitored.

What happened?

Pre-seeding Colwell P levels tended to be lower in the good zone as compared to the other zones. There was more total mineral N measured in the poor zone than the good or medium zones (Table 2). The 2008 analysis of the depth to chemical plant root constraints is shown in Table 2.

Plant establishment was lower in the poor zone than the medium and good zones, reflecting the lower seeding rate, however grain yields were similar and with good grain quality in all 3 zones (Table 3).

Table 1 Paddock zone areas and seed and fertiliser inputs

Paddock zone	Paddock area (%)	Input strategy	Seed rate (kg/ha)	Phos. acid (P kg/ha)
Good	40	High	50	6
Medium	45	Medium	50	4
Poor	15	Low	35	0

Table 2 Soil chemical analysis for Mudamuckla in 2011

Zone	Colwell P 0-10 cm (mg/kg)	Total Mineral N 0-60 cm (kg/ha)	*Depth to B > 15 mg/kg (cm)	*Depth to Cl > 1000 mg/kg (cm)
Good	37	88	n/a	n/a
Medium	43	79	n/a	n/a
Poor	41	142	60	40

** 2009 data*

Table 3 Wheat establishment, grain yield and quality and calculated gross income from the 3 paddock zones at Mudamuckla, 2011

Zones	Wheat (plants/m^2)	Yield (t/ha)	Protein (%)	Screenings (%)	Test weight (kg/hL)	Gross income[1] ($/ha)
Good	133	2.1	11.8	0.8	76.8	460
Medium	130	1.9	12.0	0.9	76.3	419
Poor	96	1.8	12.1	1.0	76.6	431
LSD (P < 5%)	*13*	*ns*	*ns*	*0.1*	*ns*	

[1] Gross income is yield x price of H2 less seed and fertiliser costs delivered cash on 1 December 2011, Pt Lincoln. $350/t used for seed value.

What does this mean?

Three years of study at this site (2009-11) has shown no measured loss in production from deleting P inputs into the shallow constrained soils. Near average (200 mm) growing season rainfall, in all 3 seasons, coupled with high total soil N and Colwell P figures has given confidence in the option to reduce inputs in line with soil chemical assessments. The more constrained the soil the greater the opportunity to reduce inputs, as in 2011 where Colwell P and total nitrogen figures have remained high in the poor zone (having had no P applied over the study period) and trended lower on the good zone in line with wheat grain yields trending higher on those soils with 6 kg/ha of P applied annually. However there is no measure of the impact of putting 6 kg of P on the good soil as opposed to nil P or no comparison of the nil and 6 kg of P on the poor zone.

The benefits of variable rate sowing at Mudabie will continue to be investigated for at least the 2012 season.

Acknowledgements

We acknowledge the funding from GRDC project UA00107 for this work. Thanks to Peter Kuhlmann for the opportunity to use this paddock as part of EPFS 3, Andre Eylward and Paulus Viljone for sowing the paddock and all their help during the year.