Establishing Sustainable P Rates on Varying Soil Types

RESEARCH

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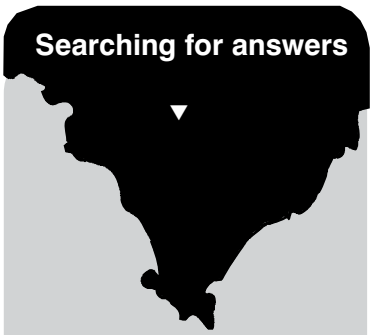

Location: Minnipa Ag Centre
Rainfall
Av. Annual: 325mm
Av. GSR: 242mm
2009 Total: 421mm
2009 GSR: 333mm
Yield
Potential: 5.2 t/ha (W)
Actual: 4.6 t/ha (W) (20kg/ha P - low P zone)
Paddock History
2008: Wheat
2007: Wheat
Soil Type
Red sandy loam
Soil test
Organic C%: 0.96-0.99
Phosphorus: 25-35 mg/kg
Diseases
Low levels Rhizoctonia
Plot size
1.4 m x 9 m x 4 reps
Yield Limiting Factors
Nil
Environmental Impacts
Soil Health
Soil structure: Stable
Disease levels: Low – medium Rhizo, low Crown Rot
Tillage type: No-till
Compaction risk: Low
Perennial or annual plants: Annual
Grazing Pressure: Low
Water Use
Runoff potential: Low
Resource Efficiency
Energy/fuel use: Standard
Greenhouse gas emissions (CO_2, NO_2, methane): Cropping and livestock
Social/Practice
Time (hrs): No extra
Clash with other farming operations: Standard practice
Labour requirements: Standard practice
Economic
Infrastructure/operating inputs: High input system has higher input costs
Cost of adoption risk: Medium

Key messages

- **Applying 20 kg/ha of phosphorus (P) increased grain yield and protein content above a replacement P rate, however there was little economic benefit from the extra P on either a deep or a shallow constrained soil in 2009.**

Why do the trial?

Comparing the crop response to applied P rates interacting with soil production potential is important supporting information for the application of variable rate technology. The long term production and economic outcomes from applying P at nil, replacement, average and twice average rates on soils with varying production constraints is an important part of the input decision making process.

How was it done?

A four year trial was established in Paddock North 1 Minnipa Ag Centre in 2009. The trial aims to measure comparative wheat yields in response to varying P applications on 2 soil types. One on a deep, sandy loam soil type (Colwell P, 25 mg/kg) and the second on a shallow sandy loam over clay, lower in the landscape (Colwell P 35 mg/kg).

There were 3 fertiliser treatments applied plus no fertiliser with Wyalkatchem wheat sown at 60 kg/ha. The trial was sown onto the high 2008 VRT treatment. This means it received 10 kg/ha of P and was sown at 60 kg/ha of wheat in 2008. Plots were 9 m x 1.4 m and replicated 4 times.

Table 1 shows P rates applied as DAP with 18 kg/ha of N added to all treatments (adjusted with urea as required). Measurements presented include dry matter at tillering, grain yield and quality. Estimates of gross margins were made. All plots received standard weed management.

Changes in residual soil P for each treatment will be measured over the 4 year period of trial along with the comparative crop performance

What happened?

Table 2 shows early biomass production, grain yield and quality from the 2 soil types in 2009. Screenings were ≤1% and test weights >84 kg/hL for all treatments (data not presented). Biomass production, grain yield and protein contents were either similar or higher for both soil types in response to 20 kg/ha of P applied compared to the nil and replacement P treatments. However the 20 kg/ha of P applied had only a minor advantage in estimated gross margins over the replacement P treatment and a disadvantage over the nil treatment on the deeper soil type.

What does this mean?

The Colwell P levels measured at the commencement of the study suggested that the soil P may be sufficient for the first year of this trial. This almost proved to be the case with some production and economic benefit from P applied on the shallow soil type compared to the nil treatment.

On the deep soil type the incidence of Rhizoctonia reduced yields to the point where the nil treatment provided the highest estimated gross margin through achieving a similar yield to all other treatments. Residual P levels were found to be adequate for the yields achieved.

Table 1 Phosphorus and nitrogen (kg/ha) applied in 2009

Shallow sandy loam over clay Yielded 0.39 t/ha in 2008	P (kg/ha)	DAP (kg/ha)	N supplied (kg/ha)	Urea needed (kg/ha)
0 kg P	0	0	0	39
Replacement P	1.2	6	1	37
10 kg P	10	50	9	20
20 kg P	20	100	18	0
Deep sandy loam Yielded 0.65 t/ha in 2008	**P/ha**	**DAP (kg/ha)**	**N supplied (kg/ha)**	**Urea needed (kg/ha)**
0 kg P	0	0	0	39
Replacement P	2	10	2	35
10 kg P	10	50	9	20
20 kg P	20	100	18	0

Table 2 Crop performance in P replacement trial, 2009

kg/ha applied	Dry Matter (t/ha)	Yield (t/ha)	Protein (%)	Gross income* ($/ha)
Shallow soil				
0	1.7	3.9	10.5	827
Replacement P	1.7	4.3	10.5	910
10	2.2	4.4	10.6	906
20	2.4	4.6	10.9	920
LSD (P≤0.05)	*ns*	*0.4*	*0.2*	
Deep soil				
0	0.7	2.9	10.5	604
Replacement P	0.6	2.7	10.5	552
10	0.9	2.8	10.6	549
20	1.0	3.1	10.9	585
LSD (P≤0.05)	*0.3*	*0.3*	*0.3*	

**Gross income is yield x price of APW less seed and fertiliser costs delivered to cash pool on 2 December 2009, Port Lincoln. $350/t used for seed value*

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