IN-SEASON NITROGEN ON WHEAT ON PADDOCK MANAGEMENT ZONES – WEST BUNTINE

Michael Robertson and Kathy Wittwer, CSIRO Precision Agriculture Project

AIM

To evaluate the response of wheat (yield and protein) in different paddock management zones to in-season application of nitrogen fertiliser, using the Yield Prophet system as a guide.

BACKGROUND

Management zones within paddocks differ in yield potential due to soil type characteristics, and hence will respond differently to inputs like fertiliser. At the start of the season the response to inputs like nitrogen fertiliser is uncertain. In-season methods for estimating yield potential and hence demand for N could aid in managing sub-paddock zones by matching fertiliser application to need.

This experiment focused on a well-characterised paddock on Stuart McAlpine's farm where management zones and their soil type basis has been well established. We used the Yield Prophet crop modelling system to follow zones through the season and compared different rates of fertiliser N applied in each zone.

TRIAL DETAILS

Property	Stuart McAlpine, paddock 26
Plot size & replication	At each sampling position wheat yield, biomass, protein, screenings was measured from four 0.5 m^2 quadrats
Soil type	Plots were set up on lines 22, 26 (sand over gravel) and 58 (deep yellow sand) on the eastern side. Plots are set up on line 55 (sand, gravel over red clay) 24 and 28 (shallow gravel) on the western side and in the centre on lines 22 and 24 (sand over gravel).
Sowing date	2nd June 2005. Yield Prophet runs were set up for deep yellow sand, sand over gravel, shallow gravel using starting soil water and N measured 29th June.
Seeding rate	75 kg/ha, Wyalkatchem wheat
Fertiliser (kg/ha)	Basal fertiliser: 90 kg/ha of Macropro+ (9 kg N/ha) applied to entire paddock at seeding. At each sampling position **4 fertiliser treatments** were applied **A** no further topdressing **(total N 9 kgN/ha)** **B** 60 L/ha Flexi_N (25 kg N/ha) at sowing **(total N 34 kgN/ha)** **C** 30 L/ha Flexi_N (12.5 kg N/ha) applied on 2nd Sept 2005 **(total N 21.5 kgN/ha)** **D** 60 L/ha Flexi_N (25 kg N/ha) at sowing, plus 30 L/ha Flexi_N (12.5 kg N/ha) applied on 2nd Sept 2005 **(total N 46.5 kgN/ha).** The late applications of N (treatments C and D) were prompted by Yield Prophet results on 31st August that indicated on average a 0.3 t/ha yield and 1% protein response was likely if an extra 15 kgN/ha were to be applied at that time. The simulations indicated that yield responses were more likely on the better soils, whereas protein responses (+1% on average) were possible on all soil types. Rates of N higher than 15 kg/ha did not produce further increases in yield and protein.
Paddock rotation	2002 (wheat), 2003 (lupin), 2004 (wheat)
Growing Season Rainfall	April to October = 270.4 mm

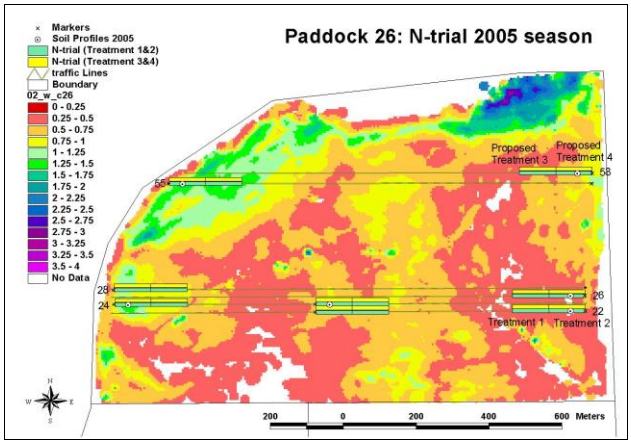

Figure 1: Layout of the sampling locations on paddock 26 at Stuart McAlpine's farm. Also shown is a yield map for 2002 to indicate high and low

RESULTS

Table 1: Yield, quality and gross income of wheat sown at Buntine on 4 soil types within one paddock.

Soil type	N applied (kg/ha)	Yield (t/ha)	Protein (%)	Screenings (%)	Hectolitre Weight (g)	Gross Income $/ha
Deep yellow sand	9	2.20	9.60	1.48	85.12	193
(starting N = 57 kgN/ha)	9 + 12.5	2.60	9.75	1.54	84.37	351
	34	2.70	9.40	2.64	84.72	353
	34 + 12.5	2.94	9.60	1.94	84.50	385
Gravel over red clay	9	2.57	7.70	3.09	82.92	362
(starting N = nm)	9 + 12.5	2.33	9.30	1.66	84.56	300
	34	2.48	7.80	1.05	84.06	312
	34 + 12.5	3.36	10.40	2.07	83.96	464
Sand over gravel	9	2.16	9.38	2.42	82.91	284
(starting N = 62 kgN/ha)	9 + 12.5	2.48	9.40	1.55	83.39	328
	34	2.73	9.98	2.06	82.12	360
	34 + 12.5	2.49	9.60	2.28	82.46	301
Shallow gravel	9	2.43	9.20	1.24	84.88	335
(starting N = 95 kgN/ha)	9 + 12.5	2.15	9.90	1.42		266
	34	3.05	9.40	1.21	84.92	420
	34 + 12.5	2.57	10.15	1.84	83.66	315

Based on EPR for 6/1/05 APN Base Price $188/tonne, $110/ha variable costs (excluding N fertiliser) and $1.3/kgN applied.

COMMENTS

- Yield differences between soil types were less than seen in previous seasons on this paddock. At high N the deep yellow sand and gravel over clay yielded about 3 t/ha while the sand over gravel and shallow gravel yielded around 2.5 t/ha. Lack of difference was probably due to the season ending better than average.
- Yield responded to an extra 25 kg/ha N at sowing on the deep yellow sand, (0.5 t/ha), sand over gravel (0.5 t/ha), and shallow gravel (0.6 t/ha). This is equivalent to 20-30 extra kg grain per extra unit of N

applied. These responses will have been possible due to the good season and the relatively low starting soil N (50-100 kgN/ha) due to the previous year being a cereal. Follow up modeling analysis will attempt to confirm this.

- Yield response to in-season N on deep yellow sand was 0.2-0.4 t/ha for an extra 12.5 kgN/ha (N response of 20-30 kg grain per kg N applied). Similar responses were also recorded for the gravel over clay (0.9 t/ha increase) and sand over gravel (0.2-0.6 t/ha), but not for the shallow gravel where the response to late N was negative. This was probably due to water limiting the response to late N. Follow up modeling analysis will attempt to confirm this.
- Yield responses to late N were in line with average expectations as indicated by Yield Prophet in late August. Responses were greater on the better soils, although the soil type differences were not as large as indicated by Yield Prophet due to the season ending better than average.
- Protein tended to respond only to late N. The rate of N at sowing had no effect. The exception to this was the topdressed treatments on the gravel over clay soil type, which had a 1% higher protein for the 34 vs 9 kg/ha at sowing. Response in protein to late N on the gravel over clay was 1.5-2.6% increase and on the shallow gravel was a 0.7% increase. Screenings did not vary significantly with treatment.
- Protein responses to late N were similar to those that Yield Prophet indicated at the end of August.
- Overall with the better responses to applied N being achieved on the better soils (eg deep yellow sand vs gravel) this experiment has given encouragement to the idea of managing soil types (or management zones) differentially for N. As the response will differ with each season, tools such as Yield Prophet allow one to "play the season" in terms of N application strategies.

ACKNOWLEDGEMENTS

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IN-SEASON NITROGEN ON WHEAT ON PADDOCK MANAGEMENT ZONES – WEST MAYA

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This experiment focused on a well-characterised paddock on Brian McAlpine's farm where management zones and their soil type basis has been well established. We used the Yield Prophet crop modeling system to follow zones through the season and compared different rates of fertiliser N applied in each zone.

TRIAL DETAILS

Property	Brian McAlpine, paddocks Chris and Dayswell
Plot size & replication	At each sampling position wheat yield, biomass, protein, screenings was measured from four 0.5 m^2 quadrats
Soil type	Plots were set up on lines as indicated in Figure 1.
Sowing date	18th May 2005. Yield Prophet runs were set up for good sand, gravel, red clay using starting soil water and N measured before sowing.
Seeding rate	80 kg/ha, Calingiri wheat
Fertiliser (kg/ha)	Basal fertiliser: 100 kg/ha of K-Till extra (10 kgN/ha) applied to entire paddock at seeding.