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

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AIM

To evaluate the response of wheat (yield and protein) in different paddock management zones to in-season application of nitrogen fertilizer, 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 fertilizer. At the start of the season the response to inputs like nitrogen fertilizer is uncertain. In-season methods for estimating yield potential and hence demand for N could aid in managing sub-paddock zones by matching fertilizer application to need.

Previous work in the GRDC Precision Agriculture project has focused on a well-characterised paddock on Stuart McAlpines farm where management zones and their soil type basis has been well established. We decided to test the transferability of this knowledge to another paddock on the same farm, but that did not have the detailed understanding of soil types. We used the Yield Prophet crop modeling system to follow zones through the season and compared different rates of fertilizer N applied in each zone.

TRIAL DETAILS

Property	Stuart McAlpine, paddocks 20 and 21. These paddocks are mirror images of each other with higher yielding valley soils (perhaps with some salt) and low yielding shallow soils on ridge tops.
Plot size & replication	At each sampling position wheat yield, biomass, protein, screenings was measured from 4 0.5m^2 quadrats at harvest, and crop biomass and N content was measured in the late vegetative period to test for early N responses
Soil type	Plots running E-W were set up on lines covering deep sand soil types in the valley bottom and shallow and medium depth gravels to the north and south on elevated areas.
Sowing date and starting conditions	30/5/06, but did not emerge until late June due to dry conditions. Yield Prophet runs were set up for deep yellow sand, medium gravel, shallow gravel using starting soil water and N measured 10/4/06 at 5 positions in the paddock. More N has mineralised than Stuart expected given that the paddock was wheat after canola. This is not surprising though when thinking about the summer rain, good weed control (paddock has been subsequently burnt). Nitrate-N in top 30cm was about 60 kg/ha and an additional 30 kg/ha for the next 60cm (only applicable to deeper soils). In addition there is 20-30 kg/ha of NH_4-N. In total this was enough to grow a 2 t/ha crop.
Seeding rate	70 kg/ha, Calingiri wheat
Fertiliser (kg/ha)	Given the starting N and limited yield potential of the shallow soils we were proposing to put no extra N (aside from that which goes out with the basal) on the shallow gravel but 60 L/ha of flexi-N on the deep sands in the valley-bottom (except low yielding western end which are medium gravel soils), which have a yield potential of 3 t/ha. The flexi-N areas were interspersed with four 100m strips of zero flexi-N. The flexi-N was designed to give another 0.5 t/ha of yield potential on top of the 2 t/ha at seeding with soil N plus starter and so allowed the flexibility of bailing out of anymore N if the season turns dry. Also, if there is a big leaching event then Yield Prophet was to be used to indicate the possibility of top up N on all areas. 1. Deep sand – 0 kg N/ha as flexi-N at sowing and 0 kg N/ha as follow-up 2. Deep sand – 25 kg N/ha as flexi-N at sowing and 0 kg N/ha as follow-up 3. Shallow gravel – 0 kg N/ha as flexi-N at sowing and 0 kg N/ha as follow-up 4. Shallow gravel – 25 kg N/ha as flexi-N at sowing and 0 kg N/ha as follow-up 5. Shallow gravel – 0 kg N/ha as flexi-N at sowing and 21 kg N/ha as follow-up
Paddock rotation	2005 (canola)
Growing Season Rainfall	April to October = 114mm

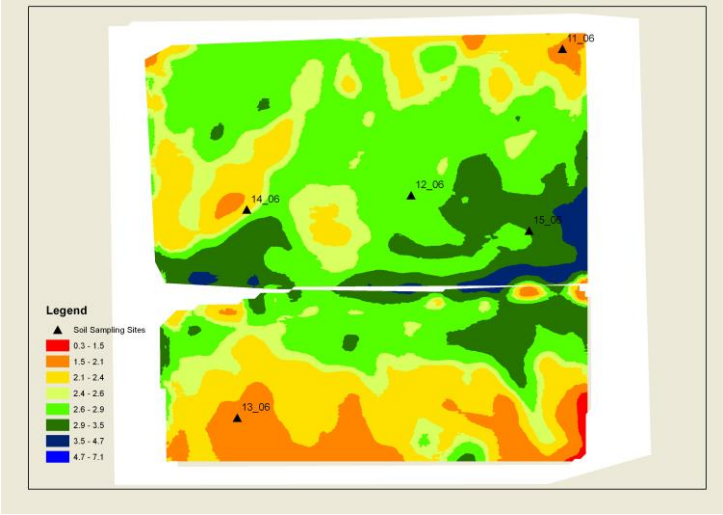

Figure 1: Layout of the sampling locations on paddocks 20 (north) and 21 (south) at Stuart McAlpine's farm. Also shown is a previous yield map to indicate high and low yielding zones.

RESULTS

Table 1: Crop biomass and N% of wheat sampled on 29/8/06. The crop was sown at Buntine on 2 soil types at a range of N fertiliser regimes within one paddock.

Soil type	N applied (kg/ha)	Crop biomass (t/ha)	Biomass N (%)
Deep yellow sand	9 + 0 + 0	0.62	2.44
(starting N = 110 kgN/ha)	9 + 25 + 0	0.82	2.45
Shallow gravel	9 + 0 + 0	0.67	3.20
(starting N = 70 kgN/ha)	9 + 0 + 21	0.53	3.13
	9 + 25 + 0	1.10	2.51

Table 2: Yield, quality and gross income of wheat sown at Buntine on 2 soil types at a range of N fertiliser regimes within one paddock. Sampling conducted 6/11/06.

Soil type	N applied (kg/ha)	Yield (t/ha)	Protein (%)	Harvest index	Screenings (%)	Hectolitre Wt (g)	Gross Income $/ha
Deep yellow sand	9 + 0 + 0	1.07	9.9	0.45	3.4	83	90
	9 + 25 + 0	1.13	12.0	0.43	4.8	81	58
Shallow gravel	9 + 0 + 0	1.10	11.2	0.47	3.7	83	90
	9 + 0 + 21	0.93	11.1	0.45	5.5	79	63
	9 + 25 + 0	1.18	10.3	0.47	2.2	83	58

Based on EPR Base Price $188/tonne, $110/ha variable costs (excluding N fertilizer) and $1.3/kgN applied.

COMMENTS

- There was a small discernable response in early season biomass to N applied at seeding at the sampling on 29th August, but not in N%. This occurred despite high levels of soil N sampled in April and may have been due to better positional availability of fertiliser N relative to soil N under the dry seasonal conditions.
- The early differences in biomass did not translate into differences in grain yield, protein, screenings and hectolitre weight. Nearly all treatments made the noodle wheat window. Header yields also taken at harvest were about 70% of the quadrat yields shown in Table 2, with a similar lack of treatment response.
- Lack of N response meant that treatments with higher rates of N applied had lower gross margin
- Soil type differences were also minimal. This is not surprising given that water storage in the seasonal was minimal and crops would have grown only on available rainfall.
- As early as late July Yield Prophet runs showed median yield expectation ranged from 0.8 to 1.8 t/ha depending on soil type, no response to extra N at sowing and also no response to added N.
- As the prospects for the season deteriorated yield expectation from Yield Prophet also declined. By early September median yield expectation ranged from 0.3 to 1.0 t/ha depending on soil type. Final simulated yield was 0.7-1.0 t/ha, and closely matched the measured in Table 2.

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