VARIABLE RATE APPLICATIONS OF NUTRIENTS

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AIM

To determine the effects of Variable Rate Technology (VRT) through variable nutrient management across high, medium and low performing soil types, and also the effects of seeding rate across these soil types.

BACKGROUND

This trial is an on-farm demonstration for the Liebe Group's GRDC funded adoption project '**Growers critically analysing new technologies for improved farming systems**'. The site was selected by the farmer as it was a large paddock with even variation of soil types across the paddock, which defined the zones trialed. The zones include Good soil (1) which is a shallow loam over gravel, Poor Soil which is a very shallow sand over gravel, Medium Soil which is a deeper loam over sand and Good Soil (2) which is a heavy clay over sand.

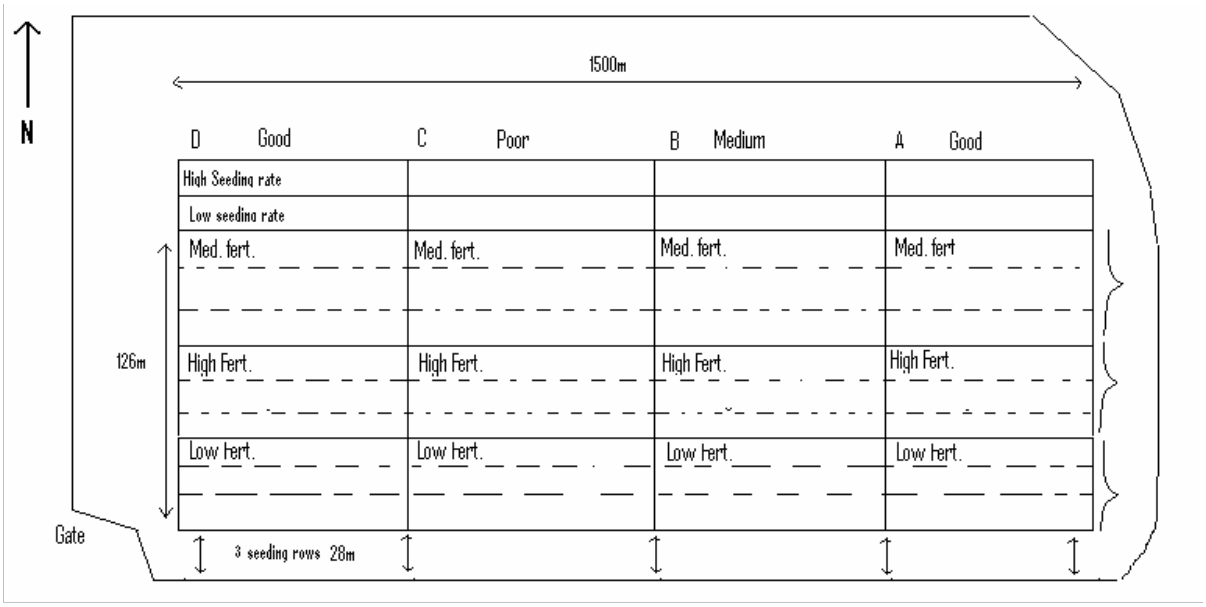
VRT is a precision agriculture management strategy which utilises variable rates of inputs to 'better match' soil variability to agronomy. The benefits of VRT applied in collaboration with other precision agriculture technologies have been evaluated by Robertson *et al.* (2007). VRT is however, a seemingly controversial subject in current agricultural systems.

The trial aims to test how adjusting fertiliser levels to match yield potential as determined by soil type affects the final yield and gross margin of a wheat crop.

TRIAL DETAILS

Property	Lance and Robyn Kennedy, Miling
Plot size & replication	375m x 13m x 3 replicates
Soil types	As above
Sowing date	16/6/07
Seeding rate	High 85 kg/ha, Medium 65 kg/ha, Low 45 kg/ha, Bonnie Rock @ 10 inch spacing
Fertiliser (kg/ha)	Compound Potassium and Phosphorus granular fertiliser rates: High 80 kg/ha, medium 60 kg/ha and low 0 kg/ha. UAN liquid fertiliser rates: High 50-60 kg/ha, medium 40 kg/ha and low 10-20 kg/ha
Paddock rotation	2002-2007 = Wheat
Herbicides	16/6/07: 2.3 L/ha Duet 16/6/07: 10 g/ha Glean PSPE: 700 mL/ha Roundup Powermax PSPE: 250 mL/ha Ester POST: 600 mL/ha MCPA LVE
Growing Season Rainfall	127mm

TRIAL DESIGN



NB. From left to right, 'Good' represents good soil type (1, shallow loam over gravel), Poor represents poor soil (very shallow sand over gravel), Medium represents medium soil (deeper loam over sand) and Good represents Good Soil (2 is heavy clay over sand). Each treatment is 375m long and has 3 replicates (indicated by the staggered lines within each box).

RESULTS

Results obtained from this demonstration represent how variable rate can influence a crop in a below average season. Adjusting fertiliser levels to yield potential as determined by soil type affects the final yield and gross margin of a wheat crop, this influence has been evaluated through the following results.

The highest yielding treatment was the deep loam over sand (medium soil) with applications of fertiliser at 60 kg/ha compound fertiliser and 40 kg/ha UAN liquid fertiliser (medium application) (Figure 1 and Table 1). This same treatment also obtained the highest gross margin of all treatments (Table 1). Low fertiliser on the shallow gravel over sand (poor soil) was the lowest yielding (Figure 1). However, the high fertiliser on the poor soil obtained the lowest gross margin (Table 1).

The high fertiliser application obtained the lowest gross margin of all treatments (Table 1).

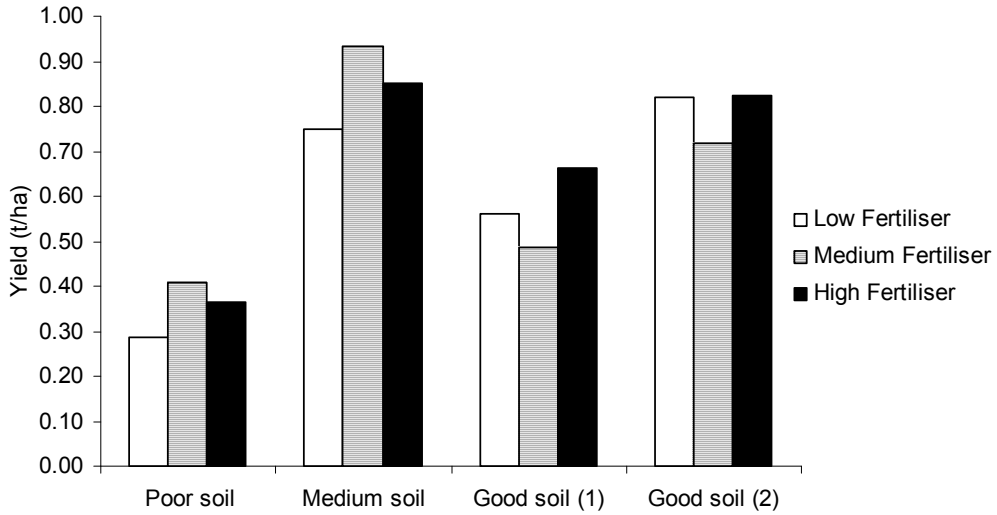


Figure 1: Yield comparisons between high, low and medium fertiliser rates for good, poor and medium soil types examined within the demonstration trial (LSD 5% 0.0757).

Table 1: Yield, quality and gross margins for Bonnie Rock wheat sown on 16/6/2007 for variable fertiliser rate across variable soil types.

Soil Type	Fertiliser	Yield (t/ha)	Protein (%)	Screenings (%)	Hectolitre (g)	Gross Return ($/ha)	Variable Costs ($/ha)	Gross Margin
Good soil (1)	Low Fertiliser	0.56f	11.5	3.30	402.1	237.73	153.96	83.77
Good soil (1)	Medium Fertiliser	0.49g	14.4	6.54	400.1	205.58	191.68	13.9
Good soil (1)	High Fertiliser	0.66e	12.9	5.05	403.8	280.45	253.8	26.65
Poor soil	Low Fertiliser	0.29i	11.0	9.64	393.0	120.56	153.96	-33.4
Poor soil	Medium Fertiliser	0.41h	11.2	7.12	402.8	171.74	191.68	-19.94
Poor soil	High Fertiliser	0.36h	11.3	8.70	384.7	153.55	253.8	-100.25
Medium soil	Low Fertiliser	0.75d	11.5	4.27	414.0	315.98	153.96	162.02
Medium soil	Medium Fertiliser	0.93a	11.7	3.23	408.0	394.24	191.68	202.56
Medium soil	High Fertiliser	0.85b	12.4	7.41	404.8	359.13	253.8	105.33
Good soil (2)	Low Fertiliser	0.82bc	13.0	3.72	408.5	347.28	153.96	193.32
Good soil (2)	Medium Fertiliser	0.72de	12.4	7.72	403.7	303.29	191.68	111.61
Good soil (2)	High Fertiliser	0.82bc	14.3	5.38	403.2	348.55	253.8	94.75
LSD (5%)	0.0757							
LSD (5%) Fertiliser	0.0378							
LSD (5%) Soil Type	0.0437							

Means followed by same letter do not significantly differ.
Based on EPR for 27/12/2007 APW Base Price $423/tonne

Assuming all soil types within the paddock occupy 25% of the area for the paddock, by applying the 'best package' (highest gross margin) to each soil type versus just applying a medium rate of fertiliser to the whole paddock, the gross margin would be $38/ha more than applying a medium fertiliser rate across the whole paddock. In addition, applying a low fertiliser rate to the poor soil, medium rate to the medium soil and high rate to the two good soils versus just applying a medium rate of fertiliser to the whole paddock results in a gross margin of $4.4/ha less than only applying the medium fertiliser rate (Table 1).

The results comparing seeding rates (Table 2) show only slight differences. These treatments were implemented without replicates as representations of potential results for the growers own interest. The low seeding rate obtained the highest yield, however this is most likely related to the limited plant available water applicable to the season. Gross margins were much greater for the low seeding rate in comparison to the medium and high seeding rates.

Table 2: Yield, quality and gross margins for Bonnie Rock wheat sown on 16/6/2007 for variable seeding rates across all soil types.

Seeding Rate	Soil Type	Yield (t/ha)	Protein (%)	Screenings (%)	Hectolitre (g)	Gross Return ($/ha)	Variable Costs ($/ha)	Gross Margin
High	Good (1)&(2), Medium, Low	0.75	11.9	5.33	400.9	368.16	153.13	215.03
Medium	Good (1)&(2), Medium, Low	0.64	12.4	5.63	403.6	316.827	229.53	87.30
Low	Good (1)&(2), Medium, Low	0.89	11.8	4.47	411.2	268.71	191.33	77.38

Based on EPR for 27/12/2007 APW Base Price $423/tonne

COMMENTS

An analysis of the soils PAWC needs to be conducted to determine yield potential of the soils types analysed to draw meaningful conclusions from these results.

There are no solutions to ameliorate shallow soils and it is not economically viable to do so. It is therefore important to manage these zones accordingly to obtain the best possible gross margin on these particular zones. In this case it was applications of medium fertiliser rates applied to the poor soil types which achieved the greatest gross margins.

There are trends or small increases in profit that suggest that zone management may have merits, however the 2007 season may have prevented the treatments applied in this demonstration from achieving their full response.

ACKNOWLEDGEMENTS

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