4. NUTRITION TRIALS

4.1 RELATIONSHIP BETWEEN RESPONSE OF RED WHEAT TO NITROGEN FERTILISER AND DEEP NITROGEN SOIL TEST

Location: Cereal site on Jenkinsons' property, near Glenthompson

Researchers: Design, testing, provide and topdress fertiliser, write-up: John Montgomery, Pivot
Bed-forming, sowing, weed control, harvest: Angela Clough & colleagues, DNRE

Background:
Pivot has been measuring response by red wheat to nitrogen fertiliser on a series of sites with a range of soil nitrogen levels, as measured by the deep nitrogen test. This trial at Glenthompson makes the eighth site in the series. (Note: Another site was also established at Gnarwarre in 2001, but the crop failed, even though it was on raised beds, due to accumulation of water at the bottom of the landscape. We placed the trial there because it was the only spot at Gnarwarre known to have low nitrogen fertility.)

Aim: (over all sites and years): To establish the relationship between response by red wheat to nitrogen fertiliser and deep soil nitrogen test in the high rainfall environment of south west Victoria.

Method:
Design: Treatments were 0, 15, 50, 75 and 100 kg N/ha each replicated 6 times. All 5 nitrogen treatments received 20 kg P/ha. The nil nitrogen treatment was sown with 100 kg/ha of triple super, other treatments being sown with 122 kg/ha of a blend having NPKS 12.6-16.4-0-7. Although it wasn't part of the main design, an extra treatment of nil fertiliser was included to observe response to P. Additional nitrogen for appropriate treatments was top dressed as urea on July 3, after sap testing.

Sowing date: May 22.
Sowing rate & variety:
100 kg/ha of Brennan red wheat.
Harvest date: 25 January, 2002.

Results:

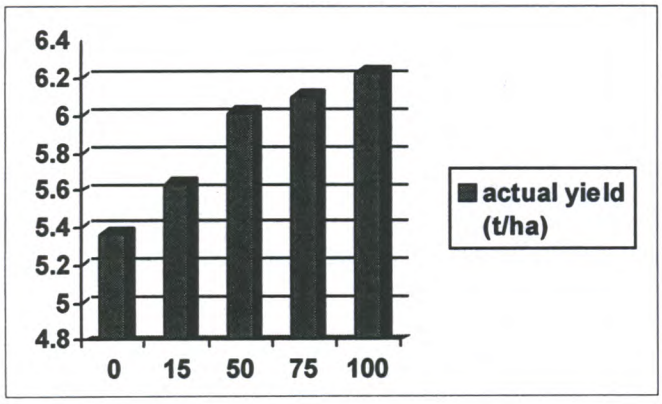
Soil test results: Colwell P 35 mg/kg, KCl sulphur 37 mg/kg, deep N 74 kg/ha.

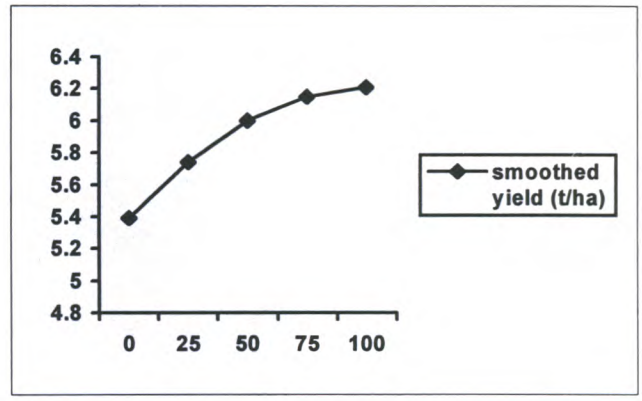
Sap test results: Nil N – 1100, 1200, 1700; Sown with N – 2100, 2100, 2200.

Response to phosphorus:
There was none. (Note: In the first replicate, which members were shown at the field day, the plot sown with triple super yielded 5.36 t grain/ha compared with 4.76 t/ha on the nil fertiliser treatment. However, this trend was reversed in the back replicates, giving no response to phosphorus overall.) As this simple comparison was without nitrogen, lack of nitrogen presumably limited response to phosphorus, at least a small response being expected at a Colwell P of 35 mg/kg.

Response to N:

Rate of nitrogen (kg N/ha)	Actual grain yield (t/ha)	Grain yield "smoothed" by regression analysis (t/ha)
0	5.37	5.39
15	5.63	5.61
50	6.01	6.00
75	6.10	6.15
100	6.23	6.21





The response of grain yield to nitrogen in fertiliser followed the usual curve pattern. Bumps in the curve are due just to experimental error (practical limit on number of replicates). These can be smoothed out by mathematically fitting a curve to the data, which also gives us our statistical analysis.

Statistics:
The relationship between grain yield and nitrogen rate is:

y = 5.389 + 0.0157* N – 0.0000749* N squared

* These co-efficients are significant at the 1% level of probability.

Economics:
Net return from fertiliser used in each of the treatments in the trial was as follows, assuming one kilo of nitrogen costs $0.85 including freight, and one tonne of red wheat returns $195 to the farmer. Note that these are marginal costs and returns, i.e. the values for extra grain yield, cost and return for each line in the table are for the increase above the previous rate, not from zero.

Kg N/ha	Increase in grain yield (t/ha)	Cost of extra nitrogen ($/ha)	Value of extra grain produced ($/ha)	$ back for each $ invested in extra N fertiliser
15	0.22	$12.75	$42.90	$3.36
50	0.39	$29.75	$29.75	$2.56
75	0.15	$21.25	$21.25	$1.36
100	0.06	$21.25	$21.25	$0.55

Conclusion: Optimal rate of nitrogen in fertiliser was approximately 75 kg N/ha.

How this year's results fit with those of previous years:

Fit of this year's result* with those of previous years is shown in the following table.

Deep nitrogen at site (kg N/ha)	Extra grain from N fertiliser (t/ha)
21	0.50
46	0.90
62	0.74
74*	0.82*
75	0.00
80	0.00
98	0.00
148	0.60

This year's site, being responsive to nitrogen, fits with the other responsive sites at the lower end of the range of deep nitrogen test results. However, as the site with the highest deep nitrogen test result recorded a response to nitrogen in another year, more sites are required to further clarify the relationship.