2.1.1 Interaction of Nitrogen management with disease management in winter wheat.

Location and Trial: Inverleigh Main Research site Project No. SFS00015

Funding Organisation: Grains Research and Development Corporation

Researchers: Nick Poole, Foundation for Arable Research, New Zealand and Lou Ferrier, Southern Farming Systems.

Authors: Nick Poole and Lou Ferrier

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Summary:
The later maturing feed wheat Mackellar was significantly lower yield than the earlier AH category variety Chara, with mean yields of 2.35 and 2.52 t/ha respectively. Much of this difference was due to the poor performance of Mackellar under the seedbed nitrogen application, since when compared at the later nitrogen timing alone, the mean yields were 2.55 and 2.60t/ha for Mackellar and Chara respectively. Fertilising with upfront nitrogen had less detrimental effect on yield with an early maturing variety with lower tillering capacity than it did with later maturing wheat (Mackellar) that had a longer tillering window.

As was the case with barley sown in the same rotation position (1st cereal after canola), there was a no disease development in the trial, so it was not possible to examine the interaction between nitrogen strategy and fungicide treatment. As a consequence of these drier conditions, there was no response to fungicide application in either variety and therefore no increase in margin from the use of these products.

The later nitrogen timing at stem elongation produced significantly higher yields than the same quantity of N applied in the seedbed. This effect did interact with variety, since the early maturing variety Chara did not show such a great advantage to later nitrogen application as shown with later variety Mackellar. With hindsight, using a nitrogen rate of 100kg/ha N was excessive considering the subsequent drought, so much of the effect of nitrogen timing in the trial maybe related to which timing was least detrimental, considering the overall rate that was applied.

In previous seasons protein levels have usually been higher with stem elongation nitrogen, however this season (probably due to the yield dilution effect) protein levels were lower than the corresponding seedbed N treatments.

With so few significant yield differences it can be concluded that optimum gross margins were produced by those crops untreated with fungicides and fertilised with later nitrogen at GS30-31. With quality specification at AH standard, Chara was clearly more profitable than Mackellar feed wheat on the basis of its yield advantage (though this was not as apparent with the later nitrogen timing) and a price premium.

Background & Objectives: To quantify how "upfront" nitrogen application versus application at stem elongation (GS 30-31) influences the need for disease control in varieties of differing disease resistance.
Wheat crop canopies that are fertilised with later nitrogen tend to produce smaller crop canopies, this work has been set to examine whether this influences the need for a fungicide strategy or the timing of disease control relative to earlier fertilised crops.

Growing Season Rainfall (Apr – Nov): 235 mm (compared to 350 mm in 2005)
Soil Nutrition: Silty Loam, pH 5.8, Nitrate Nitrogen 30 mg/kg
Sowing Date: 24th May 2006
Sowing Rate: 200 plants/m^2
Harvest Date: 13th December 2006
Seed Treatment: Hombre

Methodology: The trial was sown into 2005 canola stubble and comprised of two cultivars, four fungicide management programs and two nitrogen regimes (based on 100 kg/ha N total applied 46% N urea granules) replicated four times. Varieties sown were Chara rated moderately susceptible - susceptible to stripe rust and Mackellar rated resistant. MacKellar has been noted to be susceptible to leaf rust over the last two seasons.

Fertiliser Treatment:
All plots were treated with 150kg/ha MAP at sowing. Nitrogen regime based on 100kg/ha N total N applied.

Trt No.	Seedbed	GS 30-31	GS 37-39
1	50kg/ha N	50kg/ha	---
2	---	50kg/ha	50kg/ha

Fungicide Treatment:

Trt. No.	Seeding GS00	GS 37-39 (flag leaf)
1	Untreated	---
2	Impact 400ml/ha in furrow	---
3	Impact 400ml/ha in furrow	Opus 250ml/ha
4	---	Opus 250ml/ha

Weed Control: Pre emergent – Spray Seed @ 2L/ha and Trifluralin @ 1.2L/ha, Post Sowing Pre emergent spray – Dual Gold @ 250mls/ha and Diuron @ 500 ms/ha, Post emergence – Axial @ 300mls/ha and Tigrex @ 750 mls/ha.

Results:
i) Disease assessment

There was no disease development in this season's trial, due to the exceptionally dry conditions during the spring. Therefore unlike 2005 when stripe rust was a key disease in this trial, no response was recorded from the use of fungicide

ii) Crop Structure & Yield

There was a pronounced effect of variety on tiller numbers recorded at GS31-33, with the later maturing wheat Mackellar having approximately 50% more tillers at this growth stage relative to the earlier variety Chara.

Mean tiller number/m^2 Chara 205 tillers/m^2 Mackellar 284 tillers/m^2

The assessment taken from those plots with no fungicide application revealed little difference in tiller number due to nitrogen treatment.

Influence of variety
With no disease and very dry finish to the season, yields were considerably reduced on last season, the earlier variety Chara significantly out yielded Mackellar by 0.17t/ha, with mean yields of 2.52 and 2.35 t/ha respectively.

Mean yield:	2006	Chara 2.52 t/ha	MacKellar 2.35 t/ha	LSD - 0.12t/ha
	2005	Chara 3.47 t/ha	MacKellar 5.02 t/ha	LSD - 0.18t/ha

The yield range of Chara was 2.39 – 2.69 t/ha, whilst with MacKellar it was 2.09 – 2.66 t/ha.

Influence of nitrogen timing
Overall, averaging the yields of both varieties there was a significant difference (p=<0.001) between seedbed nitrogen (50/50 split at sowing/GS31) and later applied nitrogen (50/50 split at GS31/GS39), in favour of the later split dose.

Mean yield (mean of varieties): Early N 2.29 t/ha Late N 2.58 t/ha

There was an interaction that was just on the boundary of significance between nitrogen timing and cultivar since the trend for later nitrogen to be superior was stronger with MacKellar than Chara (figure 2).

Influence of fungicide strategy

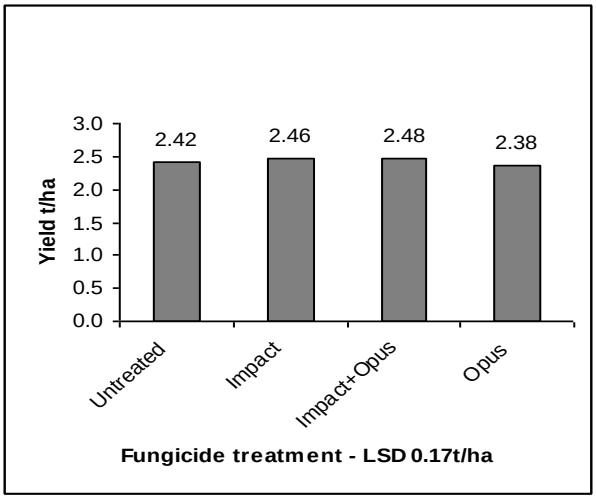

Figure 1. Influence of fungicide treatment on yield t/ha (mean of 2 varieties Chara & MacKellar).

There was no response to fungicide when data from both varieties were averaged together (figure 1). The same was also the case when individual varieties were analysed (figure 2).

Interaction between nitrogen timing and fungicide strategy

There was no interaction between nitrogen timing and fungicide strategy, though there was a trend for the yield difference due nitrogen timing to be greater with Mackellar than it was for Chara.

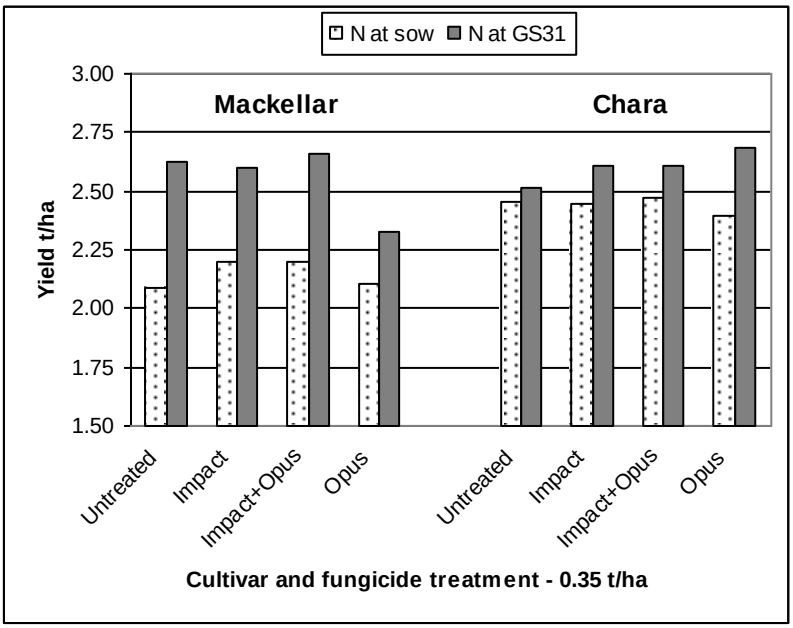

Figure 2: Influence of fungicide treatment, nitrogen timing and cultivar on yield t/ha – SFS Inverleigh 2006

iii) Quality and Margin after fungicide cost $/ha

The principal differences in quality assessments were due to the cultivar rather than fungicide or nitrogen treatment; however % protein of the grain was influenced by nitrogen timing (Table 3). In previous years protein content has been increased by delaying the nitrogen application until GS30-31; however in 2006 the reverse was the case. This effect could be purely due to the yield dilution since the later N treatments were significantly higher yielding, though reduced nitrogen uptake of the later nitrogen timing cannot be ruled out as an explanation of the lower protein levels.

Though there were few effects of treatment on screenings, there was a significant difference in screening levels between the two varieties; the earlier maturing variety had screenings no greater than 5.8%, whilst none of the treatments for the later maturing variety MacKellar produced screenings under 10%.

Table 3. Influence of cultivar, nitrogen timing and fungicide on yield (t/ha) and quality (% Protein, % screenings & test weight T.W. kg/hl)

Cultivar	Fungicide	N trt	Yield t/ha	Protein %	TGW g	Scr. %	Test wt kg/ha
MacKellar	Untreated	early	2.09	14.0	29.4	10.9	78.7
		late	2.63	13.4	30.0	10.6	79.6
	Impact	early	2.20	13.9	28.1	11.0	78.8
		late	2.60	13.4	27.9	12.1	78.7
	Impact + Opus	early	2.20	14.1	29.0	10.5	78.6
		late	2.66	13.4	27.7	12.5	79.0
	Opus	early	2.10	14.1	28.9	11.6	78.1
		late	2.32	13.8	27.3	12.2	78.1
Chara	Untreated	early	2.46	14.7	30.2	5.3	79.6
		late	2.52	14.4	31.5	5.8	79.1
	Impact	early	2.45	14.4	30.9	5.4	79.4
		late	2.61	14.5	28.9	5.8	79.9
	Impact + Opus	early	2.47	14.7	30.3	5.2	79.2
		late	2.61	14.2	30.0	5.5	79.6
	Opus	early	2.39	14.7	30.6	5.0	79.3
		late	2.69	14.3	31.2	5.0	80.3
LSD							
Cultivar			0.12**	0.20***	0.51***	0.69***	0.4***
Fungicide			0.17 ns	0.28 ns	0.71 ns	0.98 ns	0.5 ns
N timing			0.12***	0.20***	0.51 ns	0.69 ns	0.4 ns
Cultivar/Fungicide interaction			0.24 ns	0.39 ns	1.01 ns	1.38 ns	0.8 ns
Cultivar/N timing interaction			0.17*	0.28 ns	0.71 ns	0.98 ns	0.5 ns
Fungicide/N timing interaction			0.24 ns	0.39 ns	1.01 ns	1.38 ns	0.8 ns
Cultivar/Fungicide/N timing interaction			0.35 ns	0.55 ns	1.43 ns	1.95 ns	1.1 ns

*** Highly Significant, * Significant & ns Not significant

Notes: Impact 0.4 in furrow based on $20/ha, Opus 250 ml/ha GS39 costed at $15/ha.
Wheeling damage from foliar sprays based on 2.5% yield loss with $7.50/ha application cost for foliar sprays.
Chara grain price based on AH $164/tonne adjusted for % screenings
Mackellar grain price based on feed $ 140/tonne.

With the susceptible variety Chara the optimum margins were generated by nitrogen split between seedbed and GS31 (the early N timing) and Impact in furrow followed by Opus at GS39, however this was only $7/ha superior to the same N treatment with Opus alone.
With Mackellar the later N split (50/50 split between GS31 & GS39) combined with Opus at GS39 produced the optimum margin.

Conclusions

With so few significant yield differences it can be concluded that optimum gross margins were produced by those crops untreated with fungicides and fertilised with

later nitrogen at GS30-31. With quality specification up to AH standard, Chara was clearly more profitable than Mackellar feed wheat on the basis of its yield advantage (though this was not as apparent with the later nitrogen timing) and a price premium.

Since there was no disease in the trial it was not possible to conclude how nitrogen timing influences optimum fungicide strategy, however the trial did illustrate that early stem elongation nitrogen may have a less detrimental effect on yield when the nitrogen rate selected was excessive for the growing season rainfall.