Grain yield, nitrogen uptake and sustainable wheat production: are varieties equal?

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N-fertilizer is used in increasing amounts on wheat *(Triticum aestivurn)* in south-eastern Australia but there is little information on the variability in N response between varieties. Extensive field trials in the past (Taylor *et al.* 1978; Angus *et al.* 1989) have assumed the differences to be negligible. The objectives of this study were to determine the extent of variation among six Australian wheats in yield, yield components, grain protein, N uptake and water use in response to N-fertilizer applied at sowing in a field trial at Pucawan, NSW.

Methods

The site was a red-brown earth in which a 2.5 tonne ha^{-l} weed-free canola *(Brassica napus)* crop had been harvested in the previous year. The varieties given in Table 1 were chosen for their diverse genetic background and similarity of anthesis date and sown in a 6 replicate experiment on 19 June 1991 with 21 kg P ha^{-l} in the form of Bayleton double superphosphate. Sowing rate for each variety was adjusted for seed size which established a seedling density of 127+4m2.

Results and discussion Table 1. Responses of six wheat varieties to applied N.

Prophylactic site management resulted in no visible root or foliar disease. Results show that applied N and variety both affected grain yield and yield components with a significant interaction between the two. Contrary to expectations varieties differed in anthesis date by up to 7 days and these differences account for most of the variation in yield. Without supplementary N there was a positive relationship between grain yield and anthesis date, yield increasing by 68?29 kg/ha/day but with N at sowing, grain yield decreased by 49?29 kg/ha/day. Janz with N used 32 mm more water than Kulin without N. Janz had the highest above ground N uptake without N while Dollarbird was highest with N. The soft wheat Corella had the lowest grain protein without N and Janz had the highest with N due to the relatively large reduction in kernel weight. While anthesis date explains most of the variation between varieties, differences exist in the uptake of soil-derived and supplemental N, the partitioning of N within the plant and the ability to convert biomass to grain yield. Varieties which can extract more soil N and water slow acidification rates due to leaching thereby improving sustainability and maintaining grain protein.

References

1. Angus, J.F., van Herwaarden, A.F. and Fischer, R.A. 1989. Proc. 5th Australian Agronomy Conf.,Perth. p. 550.

2. Taylor, A.C., Storrier, R.R. and Gilmour, A.R. 1978. Aust. J. Exp. Agric. Anim. Husb. 18, I 18- 22.

Variety	Anthesis date	N rate (kg/ha^{-1})	Grain yield (t/ha^{-1})	HI	Kernel wt. (mg)	Grain protein (%)	N uptake (g/m^2)	ET (mm)
Comet	10.10.91	0	3.55	0.40	38.9	7.1	5.6	310
		80	4.37	0.40	35.6	9.0	8.2	315
Corella	18.10.91	0	3.32	0.41	34.6	6.9	5.0	n.a.
		80	4.06	0.42	31.5	8.8	7.3	n.a.
Dollarbird	18.10.91	0	3.75	0.42	35.9	7.6	6.0	n.a.
		80	4.42	0.41	31.1	10.1	9.1	n.a.
Janz	20.10.91	0	3.79	0.42	33.9	7.6	6.4	303
		80	4.06	0.41	28.2	10.7	8.9	329
Kulin	13.10.91	0	3.27	0.44	37.2	7.3	5.0	297
		80	4.45	0.43	34.8	9.0	8.1	311
Vulcan	18.10.91	0	3.70	0.43	32.8	7.4	5.8	n.a.
		80	4.39	0.43	29.0	9.5	8.5	n.a.
s.e.d.			0.08	0.005	0.6	0.2	0.2	5

n.a., not available.