Tests to predict yield response of wheat to topdressed nitrogen

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Various tests of plant N status and other attributes of crops have been used to predict the yield response of wheat to N fertiliser. As discussed in the previous paper, shoot density was the best predictor in a study of 22 commercial crops in the Riverina and Southwest Slopes of NSW. This report is to compare the results of several tests used in predicting N response.

Methods

The tests reported here were made at the DC30 stage of development for 22 wheat crops grown following effective break crops. Two tests were of total N in the above-ground tissue and two were of NO_3-N concentration of fresh youngest expanded blade (YEB) and dry stem base (SB). The NO3-N tests were based on a rapid field-based procedure (1).

Results and discussion

The correlation coefficients in the Table show that shoot density was the best predictor of N-response. Total-N uptake was a worse predictor and the tissue concentrations of total N and NO_3-N were even worse.

	Shoot density	Total N uptake	Total N conc.	Fresh YEB NO_3-N	Dry SB NO_3-N
Units	m^{-2}	$gN\ m^{-2}$	%	$\mu g\ g^{-1}$	$\mu g\ g^{-1}$
Data range	383-976	2.0-6.5	2.8-4.7	32-678	1266-9125
Correlations					
Yield response	-0.90	-0.64	-0.50	-0.29	-0.51
Dry SB NO_3-N	0.45	0.40	0.85	0.91	1.00
Fresh YEB NO_3-N	0.38	0.35	0.74	1.00	
Total N conc.	0.30	0.28	1.00		
Total N uptake	0.77	1.00			
Shoot density	1.00				

Shoot density and total-N uptake predicted yield best because they reflected N-status of the crop over a relatively long period. The likely reason that shoot density was the more successful of these two tests was that crops with many shoots at DC30 subsequently exhausted soil water and hayed off. Crops with high levels of N-uptake at DC30 may have been limited by other factors and did not necessarily exhaust soil water.

The reason that tests of N-concentration alone were not useful predictors was probably because they reflected short-term effects. Furthermore, N in tissue is self-diluting because of its effect on subsequent growth, so that a low N concentration may reflect either low N uptake, or a high uptake diluted by a large biomass. However there may be a role for tests of N concentration associated with counts of shoot density because N concentration responds faster than shoot density to a crop's access to subsoil mineral N.

1. Irving, G.C.J. and Bouma, D. (1986). Comm. Soil Sci. P1. Anal. 17, 1299-1310.