Determining the nitrogen requirement of crops: 1 wheat

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Eastern Australian wheat farmers have traditionally been reluctant to apply N fertilizer to dryland crops. In recent years intensive cropping and declining soil fertility have resulted in decreased wheat yield and quality. Consequently there is growing interest in applying N fertilizer at sowing or as a topdressing on winter sown wheat. In order to optimise N fertilizer use, a simple field test is required to enable growers to identify N responsive wheat crops during early growth. This paper describes a field test, based on Merkoquant nitrate test strips, which determines the N status of wheat by monitoring basal stem sap nitrate levels.

Methods

Several on farm sites were established in 1987 and 1988, using rates of N ranging from 0 to 120 kg N/ha applied to 2 x 30 m plots at sowing, early tillering and first node stage. Sap nitrate levels were measured in the field several times between two leaf and second node stage using the rapid sap nitrate test described in Paper 136, Proc. 5th Agronomy Conference.

Results and discussion

Stem sap nitrate levels in wheat plants decline steadily with crop age irrespective of the amount of N fertilizer applied. In all cases, plants from low yielding sites had lower sap nitrate levels than plants from high yielding sites at equivalent growth stages. The decrease in sap nitrate was paralleled by a decrease in total N (%N) in whole plants. There was a strong correlation (R = 0.85) between stem sap nitrate levels measured in the field and %N measured in the laboratory. Grain yields were generally lower and more variable in 1988 than in 1987. Of the 18 sites studied, economic N responses were obtained at 12 sites. When data from all responsive sites was analysed there was a strong linear correlation (R^2 = 0.75) between grain yield and sap nitrate levels up to mid tillering. Beyond this growth stage the correlation was poor. The correlation between sap nitrate and grain protein was poor when data from all sites was pooled but improved when data from individual sites was analysed and was strongest at the second node stage (R^2 = 0.62). The following sap nitrate values are the critical levels found in this study, values below these indicate N responsive crops, the lower the value the stronger the observed yield response to topdressed N.

Growth stage	2-3 leaf	Early tillering	First node
Sap nitrate (mg kg^{-1})	2500	2000	800

These results indicate that this rapid field test has great potential to identify nitrogen deficient crops and improve nitrogen fertilizer management of winter sown wheat crops.