**Predicting the yield response of wheat to topdressed nitrogen**

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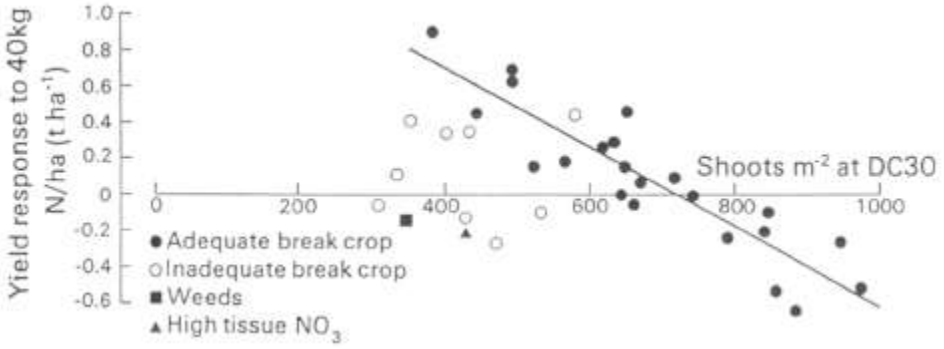
Nitrogen responses of wheat are notoriously variable in south eastern Australia, both between seasons and between fields within a season. Between-season variability can be reduced if the decision to apply N is delayed until crop and seasonal conditions can be assessed, several months after sowing. Variability of between-field responses would be reduced if the responsiveness of individual crops could be predicted at the same time.

**Methods**

During 1987 40kgN ha-1 as urea was topdressed at DC30 (start of stem elongation) on 32 farm crops lying along a 300 km transect across the Riverina and Southwest Slopes of NSW. Crops were chosen to represent a range of previous cropping intensities; 22 followed an effective break crop (oats or a broadleaf crop with good control of weeds known to be hosts of wheat diseases) within the previous two years. A range of possible predictors of N reponse were tested, including field history, soil tests, soil-incubation tests, shoot density and the tissue tests described in the accompanying paper.

**Results and discussion**

Because of the dry spring in the region (mid September - mid October rainfall was in the lowest quartile of long-term records) yield responses to N were small and variable: from +900 kg ha$^{-1}$ to -640 kg ha $^{1}$, with a mean of +75 kg ha$^{-1}$. For the 22 crops following effective break crops (see Fig.), the best predictor of N response was shoot density at DC30 ($R^2$-0.81), irrespective of plant density (which ranged from 58 to 152 m$^{2)}$.




For the nine crops which had not followed break crops, the responses were generally small and were unrelated to shoot density or to any other parameter measured. The responses of two other crops were less than expected. One of these crops was constrained by weeds and the other, which had a high level of tissue $NO_3$ at DC30 (dry stem-base $NO_3$ - 6200 ?gN g $^{1}$), was grown in topsoil with a low level of mineral N but subsoil with a high level. The positive responses to N were associated with increased tiller survival and spike density. The yield decreases, associated with lower harvest index, smaller grains and increased grain protein, were classic examples of haying-off.

The results suggest that N-responsive crops in this environment are likely to be those growing after a recent break-crop, with shoot density less than 500-600 m 2 at DC30 and with a low tissue-NO3 concentration, as discussed in the following paper.