MATCHING NITROGEN MANAGEMENT TO SOILS AND CLIMATE - A STRATEGIC ROLE FOR MODELS

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Declining soil fertility, particularly nitrogen, is an increasing problem in cropping areas of Queensland and northern NSW. Identifying appropriate levels of soil N is made difficult by climatic variability. Cropping-systems models offer a method for handling that variability and matching the potential of a climate with the capability of the soil to produce a crop of wheat (2), and identify minimum levels of soil NO_3-N at planting for producing near optimal yields in most years. Identifying these levels allows for more informed use of fertiliser and legume ley rotations.

MATERIALS AND METHODS

The cropping systems model PERFECT (1) was validated against field data and run to determine optimum levels of soil N at planting for contrasting climates by varying the supply of N. Long-term climate data from the Maranoa (Roma), and from the eastern Darling Downs (Dalby) were used with three levels of N in the soil at planting (40, 80 and non-limited kg $N0_3$-N/ha).

RESULTS AND DISCUSSION

Table 1. Simulated mean wheat yield for a Red cracking clay under two different climates and three different levels of soil nitrogen.

Soil NO_3-N at planting	Yield (t/ha) Maranoa Climate	Yield (t/ha) Darling Downs Climate
40	0.8	1.5
80	1.8	2.8
non-limiting	1.9	3.4

Data in Table 1 show that climate determines the potential yield of wheat, while soil conditions and other factors determine how well that potential is expressed as yield. For example, a soil N level of around 80 kg NO_3-N/ha at planting, or higher, would be close to optimal in the Maranoa. The more favourable climate of the eastern Darling Downs has a higher yield potential and the optimal level of available N is greater than 80 kg/ha. The simulations showed that despite the possibility of greater differences occurring in *good* seasons non-limiting N only produced around 20 t/ha extra over 100 years in the Maranoa. On the eastern Darling Downs the difference was greater, around 35 t/ha extra yield over 100 years.

Hence cropping systems models can be used to identify minimum levels of soil nitrogen that can deliver near optimal yields in most years. Maintaining a level of soil nitrogen that delivers around 80 kg/ha at planting would maximise the chance of producing good yields at Roma. Whereas on the downs a higher level of soil nitrogen would be of benefit. However, the economics of alternative N management strategies would need to be considered in designing farm-specific systems.

REFERENCES

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