Sorghum and nitrogen in 2008

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If this season's early sorghum sowing prevented you applying pre-plant nitrogen, the challenge now is about assessing the potential impact of nitrogen supply options on grain yield.

Recent changes in fertiliser prices and crop values increase the difficulty of making profitable crop nutrition decisions. Wise fertilising decisions need to consider potential financial gains in addition to the impact on the soil's nutrient balance. With fertiliser prices for nitrogen at $1.60 to $2 per kilogram and sorghum crop values at $200 to $250 per tonne, there is still reasonable scope to profit from judicious and targeted fertiliser nitrogen use.

As an example, 2007 sorghum grain yield responses to nitrogen supply at Incitec Pivot's 'Colonsay' long-term experiment can be used to assess the impact of shifting fertiliser nitrogen and grain yield prices on the optimum nitrogen input.

What the experiment told us

Low nitrogen supplies restricted grain yields to about 4.2 tonnes per hectare. As the supply of available nitrogen increased, yields responded and peaked at 5.2 tonnes per hectare. The amount of grain produced per kilogram of crop-available nitrogen levelled out (Figure 1) as water availability became more yield limiting.

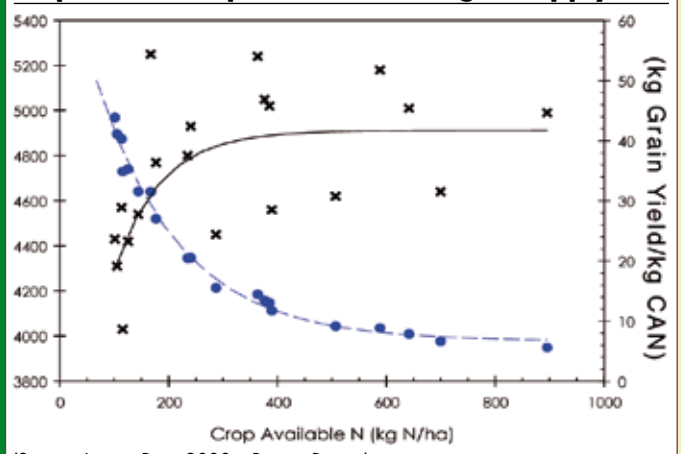
Six scenarios were chosen to highlight the interaction between grain price, fertiliser cost and economic return (Table 1).

In the Table 'Starting crop available N' is representative of soil mineral nitrogen plus an estimate of seasonal nitrogen mineralisation. A value of 50 kg per hectare would be typical of a three to six month fallow in a soil of low to moderate organic carbon percentage. Values of 100–125 kg per hectare would be typical of a 12–18 month fallow for soils with a low to moderate organic carbon percentage.

The 'Target crop available N' defines likely economic outcomes from increasing nitrogen supply from the 'Starting' amount to the 'Target' supply where yield hits a plateau at about five tonnes per hectare.

The first scenario in Table 1 (crop price $250 per tonne and nitrogen price $2 per kg) shows that with a yield potential of five tonnes per hectare, by increasing the crop available nitrogen from 50 kg per hectare to 150 kg, the net return would have been $305 per hectare.

FIGURE 1: Crop yield and agronomic efficiency response to crop available nitrogen supply



(Source: Incitec Pivot 2008 – Project Report)

The key to good nitrogen management in sorghum is to know what amount of N is available at sowing.

Conversely, by not recognising the deficit early enough, up to $305 per hectare may be lost. Increasing the rate beyond 150 kg per hectare without an increase in yield, decreases the net return.

This means the economic optimum crop nitrogen availability was about 150 kg per hectare.

By varying the nitrogen price and the grain value, Table 1 (see opposite) indicates the impact on both the net return and the optimum crop available nitrogen. For each 'Starting crop available N' the highest return is highlighted in bold. Decreasing grain value by 20 per cent or increasing the nitrogen price by 25 per cent lowered the optimum crop available nitrogen. Increasing the grain value or decreasing the nitrogen price tended to push the optimum crop-available nitrogen and returns higher.

Know your starting nitrogen

The key to effective nitrogen management is having accurate and reliable information about your starting crop nitrogen availability. The most direct way to secure this is with a well-constructed and executed soil sampling program.

For nitrogen decisions, soil sampling within three to four weeks post sowing is an option as the proportion of nitrogen taken up compared to the total demand is unlikely to significantly affect the estimate of total season demand.

Where there is a history of phosphorus or zinc response, plant tissue analysis may enable growers to check that yields are not restricted by growth-limiting supplies of other nutrients.

In the current climate, taking the 'nutrient balance approach' (put back what you remove) without reference to background nitrogen in the soil may not be as forgiving as in the past. This is because the application of nitrogen beyond optimum crop-available nitrogen may more quickly produce negative returns.

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