

# Developing strategies for nutrition management

By Chris Dowling, Nutrient Management Services

The recent stepwise increase in cotton yield has implications for crop nutrition, soil fertility and nutrient use efficiency.

Achievable paddock yields now frequently overreach the science and yields upon which our current crop nutrition practices are based. Managing high yield cotton has often been done with a lack of verifiable evidence-based strategies and more based on seasonal tactics.

In the current atmosphere of high yield expectations, increasing nutrient prices and varying cotton prices, continuation of the 'increasing nutrient addition' approach poses risks both to the stability of production and the environment.

Increasing rates of nutrients applied must be done in a considered and balanced approach so that nutrient use efficiency keeps pace with increasing yield. A large divergence in this relationship can be an early symptom

of increased environmental risk and reduced profitability (Figure 1).

Over-fertilisation chasing yield has a smaller economic impact when yields are high and prices strong but is more problematic when either yields or prices decline.

And the closer we push cotton to its physiological limits without clearly defined strategies, the more risk of increasing yield volatility, nutrient use inefficiency and resource rundown.

## MANAGEMENT STRATEGIES FOR HIGH YIELD CROPS

A major challenge facing production of high yield is developing a workable strategy that looks after the current crop as well as the potential of future crops. In developing a management program for cotton nutrition it

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is important that there is a clear process of reviewing soil capability and ensuring the strategy and tactics are manageable and appropriate.

A soil fertility management strategy is a longer-term plan that defines nutrients and soil properties that are of concern, their priority for management and how they are to be managed.

### Proactive versus reactive strategies

A good example of a proactive strategy is the cotton industry's insect resistance management strategy. A reactive strategy, on the other hand, is like driving while looking in the rear view mirror

We need to get on the front foot and manage to a well considered strategic plan. And we need in-crop tools that enable this forward looking management.

A strategy should be developed for important manageable nutrients and other soil chemical parameters. And a strategy performance-monitoring plan should be used — using test-strips and on-farm replicated experiments.

### STRATEGY OPTIONS

Not all strategies are appropriate for all nutrients and situations.

#### Soil rundown

This simply uses the soil capital reserves. It may be used where nutrients are in large excess compared to the rate of removal.

#### Nutrient replacement

This strategy is generally used for immobile nutrients such as P, K and Zn. For a 10 bale per hectare cotton crop, the nutrients removed include 130 kg per hectare N; 24 kg per hectare P, 37 kg per hectare K and 10 kg per hectare S.

There should be caution using this strategy on soil where the available nutrient concentration is less than

the 'critical level', in which case, yields may not be optimised

#### Maintenance

This is also generally used for immobile nutrients such as P, K and Zn. This strategy calls for the replacement of all nutrients subject to all nutrient loss processes, including those 'lost' in the crop.

#### Nutrient budget

This is generally used for mobile nutrients such as nitrogen. The budget takes account of all demand and supply factors for the nutrient. In the case of N, they would include plant uptake, leaching, denitrification and mineralisation.

#### Replacement plus buildup

This strategy could be used in situations where the soil nutrient concentration is below the 'critical value' and the aim is to replace nutrients removed and build soil toward critical value over a defined period of time. It is generally for immobile nutrients.

#### Economic optimisation model

An economic optimisation model determines the increase in gross margin from the increased application of a nutrient. Nutrients would be applied as long as they had a positive impact on the gross margin.

### TRENDS IN COTTON NUTRIENT MANAGEMENT

Nutrient management of high yield irrigated cotton in recent years has evolved on a 'trial and error' basis for the most part. Generally there has been a greater focus on a more balanced nutrient program with more frequent inclusion of phosphorus and potassium — and in some areas use of sulfur and a range of trace elements. Rates of addition of P and K are generally related to nutrient removal calculated from yield.

But some of the nitrogen fertiliser rates being reported in the quest for the high yields are disturbing. It is widely recognized the nitrogen is a key component in high yielding crops but it is also the nutrient that is most prone to overuse. It is vital that N efficiency is maintained at the highest possible level to avoid crop management problems associated with end of the season high N and possible offsite environmental issues.

Areas of management that may increase N efficiency include:

- Decrease losses by control of water — reduce deep drainage and denitrification (waterlogging hours).
- Reduce the period of exposure of high soil supply and lower crop demand by using split applications.
- Improve soil physical properties where possible.
- Know your soil N supply in the root zone before adding fertiliser N.
- Ensure that other nutrients are not limiting.
- If water running N and recirculating water, know what N rate is applied in the water.

The author will present a detailed analysis of future trends in nutrition management at The Australian Cotton Conference.

**FIGURE 1: Effect of N rate, lint yield and crop price on relative profitability in irrigated cotton**

