Nutrition requirements for high yielding crops

Cotton growers may soon need to place more emphasis on post-emergent fertiliser applications to meet higher peak nutrient demands and maximise productivity, as crop yield potentials continue to rise.

Yields across the industry are creeping up, with averages for the Australian crop a full half a bale per hectare higher between 2000–01 and 2003–04 compared with the previous four years.

The rise has been even more pronounced for many irrigated cotton growers thanks to the introduction of genetic modification, such as Bollgard II, to most varieties and the availability of new water management technology.

Where crops are pushing 12.5 bales per hectare, Chris Dowling, agronomist with Nutrient Management Systems, is encouraging growers and agronomists to carefully review their fertiliser strategies.

"If you look at it logically, you can see that to produce more cotton, the crop will need to take up and remove greater amounts of nutrient," he said. "But the time to grow and reach flowering is similar."

This is leading to higher peak nutrient demands during the critical boll filling period.

"What that means for best management nutrient use is not clear at this stage, but it appears that growers may need to increase nutrient inputs or increase the number of fertiliser applications through the season, or both," he said.

He said one of the biggest challenges facing growers chasing higher yields was in maintaining nutrient efficiency.

While a blow out in nutrient efficiency (higher rates per unit of yield increase) may not severely increase production risk or jeopardise profitability, he said it could put pressure on the surrounding environment, as higher concentrations of unused nutrients move to more sensitive, non target areas.

"With top-end yields on whole fields now approaching 15 bales per hectare, we're also in largely uncharted territory from a nutrient research point of view," he said.

But Chris said targeted soil analysis, plant tissue analysis and nutrient budgeting would help keep growers and agronomists on track until targeted research could identify superior nutrient products, rates, placements and timings that suit higher yield potentials without increasing environmental exposure.

Changes to Incitec Pivot's cotton fertiliser range are already being made to reflect the expected greater demand for nitrogen, phosphorus and potassium in cotton, particularly with the introduction of liquid fertilisers for top-up foliar and water run applications.

Higher yields are leading to a re-think of fertiliser management.

Nitrogen

Cotton uses more nitrogen than any other nutrient in the soil. Traditionally, two thirds to all of a crop's estimated nitrogen requirement is applied at sowing, with the remainder applied in side-dress or water run applications.

Peak requirement for nitrogen occurs around peak flowering, when the plant has its maximum leaf area and maximum root mass.

Cameron Clarke, Incitec Pivot's Market Manager — Cotton, said the nitrogen fertiliser options for cotton growers included urea, Green Urea, Big N (anhydrous ammonia) Easy N (urea ammonium nitrate solution) and Easy U Sol (urea solution).

He said growers could use either granular urea or Big N for pre-plant applications. Post planting, he said growers could use urea, Big N, Easy N or Easy U Sol to supply nitrogen during peaks in demand.

"Easy N can be used in foliar sprays, suppling up to

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10 kg per hectare of nitrogen to top up nutrient supply or address periods of stress," he said.

"Another new fertiliser available this season is Green Urea, which is a urea fertiliser treated with an additive that limits volatilisation losses."

This additive, Agrotain, inhibits the activity of urease enzymes. Two Green Urea products are available — Green Urea 7 and Green Urea 14 — designed to limit volatilisation losses from urea for up to seven or 14 days.

Phosphorus

Phosphorus is required in relatively large quantities early in the life of the crop.

Cameron said Granulock Starter Z or Granulock Cotton Sustain could be used to supply the majority of the crop's phosphorus requirement.

He added that water injected Easy NP, Liquifert P or Liquifert Emerald could be used as a 'pop-up' at sowing to assist with early seedling vigour, particularly when early growing conditions may be cold.

"Cotton growers may also find it worthwhile to consider Easy PK for foliar application to address early senescence initiated by waterlogging or where top up applications are needed," he said.

Research conducted by PhD student, Ivan McLeod, in the late 1990s suggested that low availability of phosphorus during the recovery phase of waterlogging played a role in triggering early senescence, along with the already recognised potassium deficiency.

Potassium

The increasing requirement for potassium in higher yielding cotton led Incitec Pivot to add a Granulock starter fertiliser with potassium to its range.

Granulock Cotton Sustain contains 5% N, 10% P, 21% K and 1%Zn, a ratio carefully matched to removal rates (30 kg per hectare replaces the P and K removed by about one bale of raw cotton).

Cameron said some additional potassium may still be required in crop, depending on boll load and seasonal conditions.

The increases in peak daily nutrient demand pose a major challenge to managing cotton nutrition as yields increase.

"Foliar sprays of Easy PK or Liquifert K Nitrate are ideal at and after the peak requirement for potassium, as the root system is starting to close down," he said.

More information on cotton nutrition and Incitec Pivot's range of fertilisers is available from Incitec Pivot on 1800 333 197 or www.incitecpivot.com.au

TABLE 1: Estimated nutrient requirements in cotton

	7.5 bales/ha	12.5 bales/ha	Increase
Uptake (kg/ha)			
N	230	320	39%
P	45	60	33%
K	170	225	32%
Removal (kg/ha)			
N	90	150	66%
P	20	35	75%
K	35	60	71%
Peak demand (kg/ha/day)			
N	3.5	4.8	37%
P	0.8	1	25%
K	3	4	33%