

# Understanding Bollgard II nutrition

By Ian Rochester<sup>1</sup>, Greg Constable<sup>1</sup>, Chris Dowling<sup>2,3</sup> Cotton Catchment Communities CRC

There has been much discussion about the nutrition of Bollgard II crops since the introduction of the technology. Some believe that Bollgard II crops require more fertiliser to achieve the higher yields that have been achieved in the past two years, but this has not been substantiated.

It is logical that higher yields (whether from Bollgard II or conventional varieties) may increase the total nutrient demand and timing of uptake by the crops. But it is unlikely that there would be a difference between the two where the fruiting pattern and yield are the same.

There is little evidence to support the belief that high fruit retention creates a greater demand for nutrients and that demand needs to be sustained over a shorter period of development. This implies that Bollgard II crops may need to take up nutrients at a much greater rate during boll fill than conventional cotton.

The production of fruit creates a demand for uptake of nutrients. It is important to remember that a high proportion of the nutrients taken up are eventually translocated into the bolls (mostly into the seeds).

As the bolls fill, there is an enormous drain on the plants' nutrient reserves and the plants' ability to take up nutrients may not meet the demand. In some situations, deficiency symptoms may appear as nutrients are drained from the leaves (such as in the premature senescence syndrome). This normally only occurs in very high yielding crops.



The experimental site that yielded 13 bales per hectare growing Sicot 289BR.

In-crop nutrient applications and strategies that ensure adequate nutrient availability during early crop development can increase the quantities of plant nutrients available at boll filling and may possibly help to avoid nutrient deficiency symptoms appearing. Research is continuing on that topic.

## BALANCE NEEDED

But a good balance between crop size and boll load is an important criterion to achieve optimum yield. Agronomic management (other than nutrition) is important in this regard.

Understandably, growers want to avoid crop nutrient stress and aim to provide their crops with sufficient nutrients to attain the maximum yield possible. So it is important that regular soil testing is carried out in each field to indicate whether soil fertility is being maintained or is adequate for high cotton yields. Plant analysis will provide further information to fine-tune crop nutrition.

In practical terms, Bollgard II should be treated the same as any high-yielding conventional cotton cultivar. Nutrient demand will be higher for any crop carrying a high boll load or with high boll retention.

Selecting the most fertile, well-drained fields that are better able to meet the

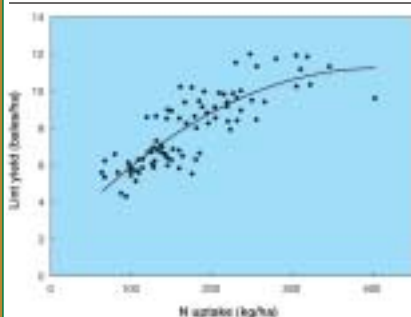
demand for nutrients will help to attain high yields. Similarly, applying good sensible agronomic practices (such as irrigation) will optimise yield, improve the expression of the Bt proteins and help improve nutrient-use efficiency.

One of the hottest topics in producing high yield cotton (12 plus bales per hectare) during the 2004–05 season was the rates of N applied — ranging from 250 to over 400 kg per hectare. Adding to the confusion about N rate is the fact that rarely is the background soil supply included in the amount of N available to the crops when N management is discussed.

It may be the case that the same total supply of N was available in both cases — with one having a high soil N with low N fertiliser applied and the other having low starting soil N and high fertiliser N applied. Once again, this points to the need to get a good fix on soil nutrient availability prior to sowing and monitoring in-crop so the fertiliser programs can be tailored for maximum effectiveness and minimum risk.

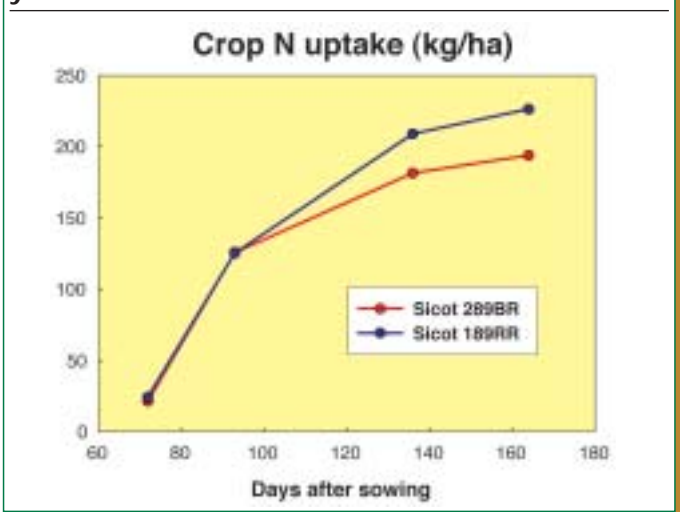
Figure 1 indicates that lint yield is closely related to crop N nutrition. This data was collected over the past seven years from N fertiliser response studies where N fertiliser was applied at rates from zero to 260 kg N per hectare.

**FIGURE 1: Relationship between crop N uptake and lint yield derived from several years of N fertiliser rate experiments**



Lint yield is optimised at 300 kg N per hectare crop uptake, which is normally achieved with moderate application rates N fertiliser (200–250 kg N per hectare)

**FIGURE 2: The Bollgard II crop took up 14 per cent less N than the conventional crop later in the season, despite producing 23 per cent higher lint yield at the ACRI site**



Importantly, no more than 200 kg N per hectare was required to achieve the maximum yield, even though initial soil N was low. The low yielding points represent experimental plots that received insufficient N fertiliser.

The highest yields were gained from legume-based rotation systems with little or no N fertiliser applied.

Adding more N fertiliser may increase the crop N uptake, but not increase lint yield. In these experiments, yields have increased over time mainly because of careful nutrient monitoring and better scheduling of crop irrigations, not because of greater nutrient inputs.

### Experiments with Bollgard II

In 2004–05, two experiments were set up at ACRI, Narrabri and on a nearby field where Bollgard II and conventional cotton cultivars could be compared. The cultivars Sicot 289BR and Sicot 189RR were sown side-by-side — two strips of each cultivar were assessed at each site.

Both fields were sown into fallowed soil following wheat crops. N was applied as anhydrous ammonia at 150 kg N per hectare, six weeks before planting.

Nutrient uptake was similar between the cultivars, despite the Bollgard II out yielding the conventional crops because of better insect control during flowering. Gin out-turn and fibre quality were identical.

At the nearby site, uptake of other nutrients was identical between the two cultivars, whereas at the ACRI site, N and P uptake was significantly lower in the Bollgard II crop.

As the Bollgard II crops produced greater yields while requiring

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similar or less amounts of nutrients, it is clear there has been a greater efficiency of nutrient use by the Bollgard II crops.

Higher yields in any circumstance result in greater quantities of nutrients being exported from fields in seed cotton and this may deplete soil fertility in the long term.

Replacement of nutrients removed is a sensible policy to adopt, particularly for those that have been in good supply and may be running down (for example, P and K) or where those nutrients are not in luxuriant supply. NUTRIpak and NutriLOGIC are being updated to provide detailed information on nutrient replacement, using data from high yielding crops.

### Conclusions from these experiments

- Bollgard II crops used nutrients more efficiently than conventional crops;
- Applying greater quantities of nutrient will not necessarily produce greater lint yields because crop nutrient-use efficiency is as important as nutrient uptake;
- Good agronomy involves understanding soil nutrient status so an appropriate fertiliser program can be designed for each field; and,
- Improving crop management (especially avoiding waterlogging and crop water stress) will help improve nutrient-use efficiency.

1 CSIRO Plant Industry, Narrabri.

2 Nutrient Management Systems, Brisbane.

3 Incitec Pivot Ltd.

**TABLE 1: Results from two Bollgard II nutrition sites**

	ACRI site		Nearby site	
	Sicot 289BR	Sicot 189RR	Sicot 289BR	Sicot 189RR
Crop DM (t/ha)	14.7	16.6	10.4	10.3
Crop N uptake (kg/ha)	194	226	244	248
Crop P uptake (kg/ha)	19	29	28	27
Crop K uptake (kg/ha)	234	224	193	184
Bolls/m	185	200	144	145
Lint yield (b/ha)	13.1	10.7	10.1	8.3