MANAGING COTTON GROWTH

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In the majority of cases, growers do not have a problem with excessive vegetative growth in their cotton crops. It is more likely that a field is not growing to potential. Factors which have a big bearing on early season vegetative growth include:

Soil structure/texture. Regardless of the precise detail, growers who make a strong commitment to improving their soil obtain much improved production. This is true for amelioration products such as lime or gypsum; for crop rotation; and for adoption of less aggressive tillage practices.

Temperature. The only real control we have over temperature is sowing date. Fields which have a problem with poor vegetative growth should not be sown too early. Higher temperatures increase internode lengths. Tony Wells has a paper on sowing date effects on yield elsewhere in this booklet.

Irrigation management. Our efficiency and management of water application are very good. Other than water supply, our greatest problems are (a) waterlogging events caused by heavy rain after irrigation, and (b) the requirement to 'flush' a field during early growth - this practice can be damaging to a crop if the weather turns cool. All of these problems are bad luck and the best management is to minimise their impact.

Nutrition management. The best crops have good nutrient status, although instances of poor vegetative growth are not generally due to poor fertility. A separate paper outlines principles for determining optimum N fertilizer rates. There are not widespread instances of mycorrhizal effects reducing early growth, but the closer we look, the more instances are found. David Nehl has an article on mycorrhizae elsewhere in this booklet.

As we continue to crop our soils with high yielding cotton, the issue of nutrient depletion will become more important. In the future, we will be applying more phosphorus and potassium as well as nitrogen. Table 1 summarises critical values and management practices for some important nutrients. Sampling of leaf blades from a cotton crop at early flowering can be one method of monitoring general soil fertility on a farm or field. Growers can build their own database of this type of information to measure fertility trends over a range of seasons. Our survey samples from good crops in the past three seasons has shown the following desirable leaf tissue levels:

N %	P %	K %	Ca %	Mg %	S %	Fe ppm	Mn ppm	Zn ppm	Cu ppm
4.3	0.35	1.5	3.4	0.6	0.9	77	85	26	10

Note that these are not deficiency levels. They are useful for comparison purposes.

Table 1. Nutrient tests, nominal critical values and fertilizer strategies. Critical values are the point where response to that nutrient is expected. No soil test value is given for zinc because that test is not reliable.

Nutrient	Soil test and critical value	Plant test and critical value	Best management strategy
Nitrogen	25 ppm nitrate N as KCl extraction (see other paper).	Petiole nitrate reduction of 32 ppm/daydegree (see other paper)	Pre-sowing band, or combination of pre-sowing and side-dressing.
Phosphorus	10-15 ppm P as bicarbonate extraction.	Blade P content 0.25 %.	Pre-sowing band.
Potassium	100-150 ppm K as ammonium acetate extraction.	Blade K content 1%. Research is required on petiole K patterns.	Pre-sowing band or combination of pre-sowing and foliar. Research is required on 'premature senescence'.
Zinc	*	Blade Zn content 12 ppm.	Pre-sowing incorporated or combination of pre-sowing and foliar.

Plant vigour monitoring

There have been some significant recent improvements in the understanding of managing plant growth in cotton. Dr Tom Kerby of the University of California has implemented some very successful advisory programs for Californian growers to monitor their cotton crops to achieve optimum growth. The general principles of that work are excellent, but not all the precise details are applicable in Australia because of the obvious differences in climate, soils, pests and varieties.

The Californian program specifies regular monitoring of development, crop vigour and fruit retention. The concept of regular monitoring is important for many aspects of cotton management (eg pest levels, water supply, nutrients). An example of the Californian vigour index estimation is shown in Figure 1.

The plot in Figure 1 is often not interpreted correctly. The California standard Acala line is not intended to denote ideal internode lengths. In both California and Australia, the ideal plant size is smaller than this plot - ie the internodes should be shorter. This plot can disregard conditions where a crop is moving from good conditions to bad (line A), or from bad to good (line B). A crop may have short seedling internodes as in line B, then have better conditions where subsequent vegetative growth maybe excessive. Although the crop vigour index may still be 'low', it has a high rate of vegetative growth and could still respond to Pix.

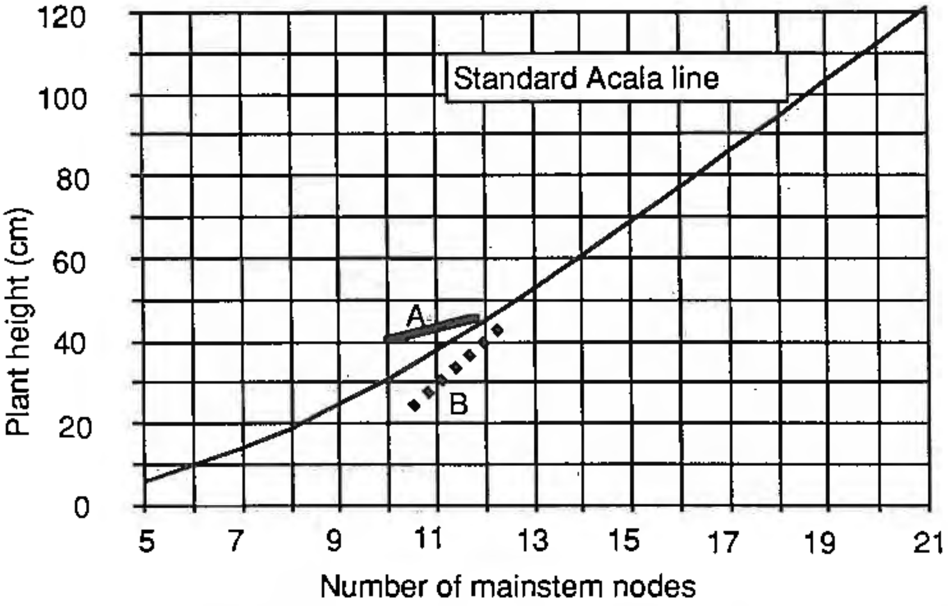

Figure 1. The standard relationship between mainstem nodes and plant height used in California to determine the vigour index of a cotton crop. Lines A and B are described in the text.

This principle of monitoring and managing cotton crop vegetative growth has been examined in our research for the past three years. We have had crops ranging in final plant height from 60 to 160 cm; and yields ranging from 5 to 11 bales/ha. In every experiment, the rate of internode increase in length has been measured prior to applications of Pix. The calculation was as follows:

$$\textbf{Rate of internode increase} = \frac{\textbf{This week's height - Last week's height}}{\textbf{This week's nodes - Last week's nodes}}$$

The results of that study are summarised in Figure 2. They show that internode increases of less than 5.5 cm lead to no response or even negative yield responses to Pix. Note that the Acala line in Figure 1 produces internode increases of more than 8 cm, so California should expect Pix responses - which is generally the case. Since it is usually too late to obtain yield responses to Pix once a crop is already too tall, this procedure allows problem situations to be diagnosed before excessive vegetative growth occurs.

Figure 2 represents a principle that may apply across a wide range of seasons, soil types, sowing dates and varieties. Plants types which are smaller would generally not require Pix, unless they are sown late or are grown on light soil. Siokra 1-4, Siokra S324, Sicala 34, Sicala V1, CS 50 and CS 7S would all fit into the category of having a reduced Pix response. Siokra L22, CS 189 and DP90 are more vigorous and will respond to Pix more often.

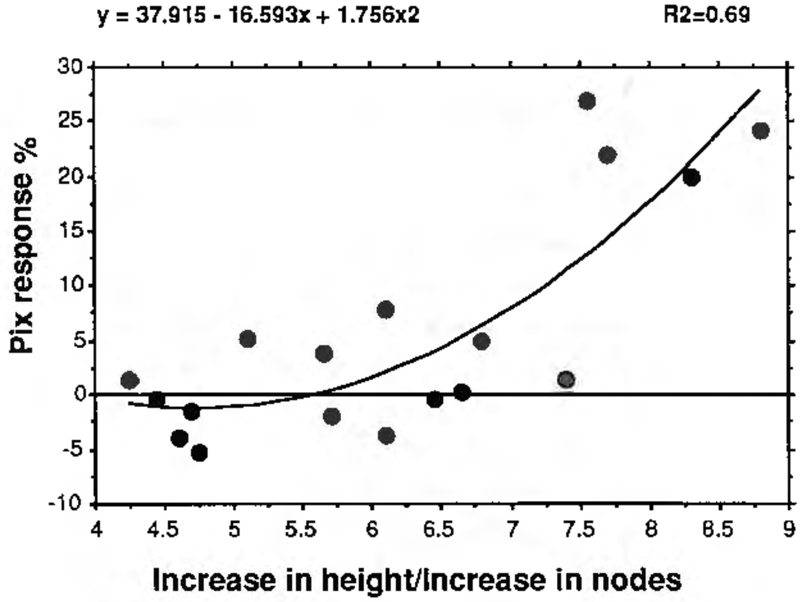

Figure 2. The relationship between rate of plant internode increase at early flowering and the subsequent yield response of that crop to Pix. Pooled data for three seasons and four varieties.

Pix Strategies

There has been much publicity about and some adoption of, multiple Pix applications. Results from overseas as well as locally have clearly shown that strategy is no better than a single application at flowering on standard row spacing. In California, multiple applications are used successfully on 75 cm rows - but only where vegetative growth is excessive.

The results from Figure 2 can be used to make more informed decisions regarding the management of cotton vegetative growth. Table 2 summarises those decisions/actions.

Table 2. Using measurements of plant internode increase at early flowering to make decisions on Pix applications.

Rate of plant internode increase at early flowering stage.	Pix action	Other action/comments
less than 5.5 cm/node	nil	Encourage growth by judicious water and fertilizer management.
5.5 to 6.5 cm/node	200 ml/ha	Do not expect much Pix response.
6.5 to 7.5 cm/node	600 ml/ha	Continue good management.
greater than 7.5 cm/node	750 to 1200 ml/ha	Care should be taken with water and fertilizer management.

Our experiments have shown that most crops and varieties are in the category of growing at less than 6.5 cm/node, so growth encouragement needs as much emphasis as growth regulation. Regular monitoring of plant size is the only way to accurately determine the need to manage crop growth.