

Germinating ideas

By CSD Extension and Development Team

With around 150,000 hectares of cotton planted this season, summer has finally broken through with a burst of warm and stormy

conditions. Many crops are scheduled for or have received their first irrigation. As the demands of the crop begin to increase, the challenge for growers now is

to identify the most limiting factors in their system and take early actions to minimise any potential impact on crop performance. This edition of Germinating Ideas will discuss some of these management considerations.

Monitoring vegetative growth

The cotton plant is fairly predictable in the way it develops, especially in relation to temperature. This is tracked using day degrees (DD) and in theory, a new node will develop every 42 day degrees, or approximately three days.

The crop commonly enters a period of rapid growth with the onset of hotter weather over the Christmas and New Year period. Maintaining the right balance in vegetative and reproductive growth during the flowering period is an important factor in determining final yield and fibre quality.

Crops producing less vigorous growth may be suffering from some form of plant stress such as moisture stress, heat wave or waterlogged conditions. This would be highlighted where the nodal growth has slowed and a decrease in nodes above white flower (NAWF) observed.

Avoiding excessive vegetative growth under favourable conditions is just as important. Big yields come from high fruit loads with the right plant architecture developed to support boll fill – not necessarily tall crops. Rank growth can cause problems because self-shading may reduce fruit retention, producing a late crop harvest with increased potential for disease.

Many growers and consultants now consider the best way to monitor plant vigour is to use the Vegetative Growth Rate (VGR) method.

By measuring the crop height and number of nodes on two occasions, about four to seven days apart, the rate of internode increase during that period can be determined. As a rule of thumb, a VGR greater than 5.5 cm per node would indi-

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FIGURE 1: A high Vegetative Growth Rate scenario where the crop is tracking above the upper limit

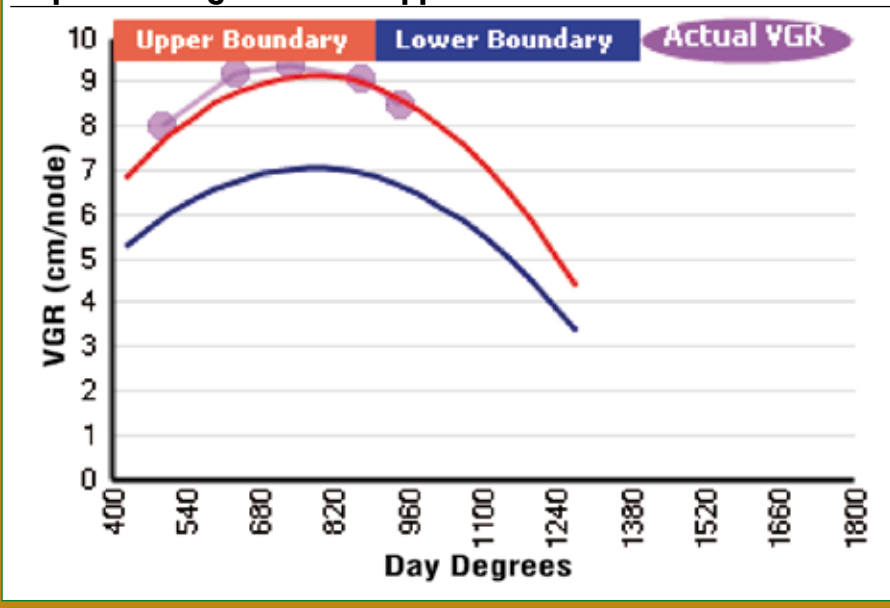
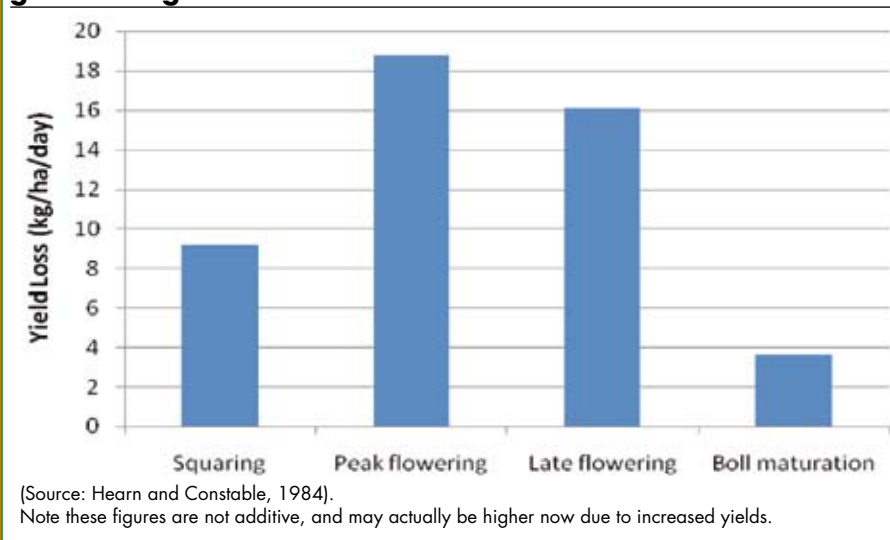


FIGURE 2: The impact of one day's water stress varies with growth stage



cate that the application of a plant growth regulator should be considered.

This information is now incorporated in the Crop Development Tool on the Cotton CRC website. The VGR is plotted against day degrees accumulated for the crop during the flowering period. The aim is maintain the crop's VGR between the upper and lower limits. Warmer regions and more fertile soils will tend to have higher VGR.

An application of Pix should be considered if the VGR is above the upper limit, as is the case in the scenario shown in Figure 1. Where the crop is tracking below the lower limit, the management of the crop may need to be adjusted to promote plant growth.

AVOIDING MOISTURE STRESS

As crops settle into an irrigation pattern through December and into January, the water demands of the plant are increasing rapidly with the onset of the critical flowering and boll filling growth stages. Cotton plants are very sensitive to moisture stress from early flowering – this is a critical time in determining yield.

Moisture stress during periods of highest demand will generally result in the greatest impact on yield. The effect of one day's stress at peak flowering may be double that for a stress early or late stressing the flowering period (Table 1). The impact of any one stress event will be increased if followed by further stresses

The impact of water stress at different growth stages will differ between technologies. CSIRO research conducted over the past few seasons has shown that yields of

Bollgard II crops were more sensitive to stress during the flowering and boll filling period up to cut-out. Conventional crops, while still sensitive to a stress at first flower, tended to be impacted more by stresses later in the season – post cut-out.

These differences can be explained by the higher fruit load and lower level of tipping out in Bollgard II. It is not unusual for first position fruit retention to be over 80 to 90 per cent at first flower. Moisture stress through the critical flowering and boll fill period in these high retention crops can impact on the final yield and quality in the following ways.

Early cut-out

Once the crop starts flowering there is competition for resources between looking after the fruit already set and producing new nodes, branches and squares. Under ideal growing conditions a crop should commence flowering at about eight nodes above white flower (NAWF). A crop's NAWF will always decline to a point where it cuts out at four NAWF and hopefully enough fruit has been set to produce a high yield.

When a crop comes under moisture stress the node development will slow in favour of fruit already set. The crop's NAWF will decrease rapidly and squares at the top of the plant will be shed. Early cut-out produces a small plant without sufficient nodes to produce a good yield. Within season length constraints, always aim to prolong the period from flowering to cut-out to maximise yield.

Fruit shed

The cotton plant will physiologically shed fruit if the supply of carbohydrates

in the plant is not sufficient to meet the demands of the total fruit load developing at that time. Crops will naturally shed fruit late in the season when the plants cut-out, or at any stage when a stress limits the carbohydrate supply.

Fruit is predominantly shed as small squares, flowers or two to three day old bolls but shedding can occur in bolls up to 10 to 14 days old. This will require the plant to compensate by producing bolls higher up the plant, thereby delaying maturity, or otherwise a yield loss will occur. Regular monitoring of NAWF and fruiting numbers is useful for detecting subtle changes in crop growth and being ready to react to seasonal conditions.

Short fibre

Elongation of fibres in a boll occurs in the first 18 to 24 days after flowering (Figure 3). A water stress event that occurs during this period will slow fibre elongation and shorten the staple length in affected bolls.

As bolls produced at this point in the season are major contributors to final yield, it only takes small changes in conditions to result in large changes in final staple length.

Crop monitoring techniques, when used in conjunction with water monitoring systems, can assist greatly in scheduling subsequent irrigations. The Crop Development Tool helps to incorporate both nodal and fruit development information so that any faster than ideal changes in plant growth are identified early. This allows growers to be ready to respond to different scenarios and ensure that crop growth is ultimately being converted into boll production.

FIGURE 3: The fibre development process relative to days after flowering

