A season without rain: Where’s Noah when you need him!

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By all accounts the summer of 2002–03 was a climatically harsh season. Warmer than average temperatures during September allowed many crops to be sown early, only to be challenged by several belligerent cold shock events.

These warm conditions remained a characteristic of the growing season, with many locations experiencing prolonged periods of above average maximum temperatures. These higher temperatures resulted in high evaporation and transpiration rates — more than normal in most growing regions — with many crops requiring more irrigation water than average to maintain crop growth. This compounded problems when water was also limited.

In this article we compare the weather conditions during the latest cotton growing season at 10 locations in the industry to the long-term averages from climate data recorded from 1957 to now.

The 2002–03 season in review

Figure 1 presents an analysis of cumulative day degrees calculated at the end of each month over the cotton season. We have then graphed the deviation from the long-term average, to determine if conditions were cooler or hotter than the average.

September was at least 40 day degrees above the average at all locations, which set a trend for the remaining season. This was followed with higher than average day degrees in October, with extremely high accumulation during November at most locations except Emerald, Dalby and to a lesser extent Hillston.

December saw the return of closer to normal day degrees across NSW and Queensland, but most southern locations had above average January figures. Overall comparisons for the season show that Dalby and Emerald were the only locations with a similar pattern to the 2001–02 season. All locations experienced a cooler than average March.

Crop growth during early plant development to first square should have been good due to the warmer temperatures earlier in the season. But moisture stress in many fields during October and November was a direct result of high maximum temperatures — between 3°C and 4°C above the long term daily maximum temperature in most regions.

The warmer conditions were ideal for the critical growth period of flowering and boll filling, which reflects in the yields achieved in many valleys where adequate water was available. In fields where irrigations were stretched or delayed, moisture stress and the extreme hot conditions may have negatively affected growth and fibre quality.

Hot temperatures

Higher daily maximum temperatures have the potential to negatively affect plant growth due to an increased rate of transpiration. In response to
this increased water loss, the leaf stomates close
and leaf photosynthesis is reduced — so crop
growth is also reduced. This negative effect on
plant growth should occur at maximum
temperatures of 36°C and above.

Figure 2 shows the frequency of the number of
days during each week of the season that exceeded a maximum temperature of 36°C.

Peak events where temperatures exceeded 36°C included the week beginning December 15 at Hillston, Warren and Bourke, and January 19 at most locations except Goondiwindi and Dalby. These peak weeks match the higher day degree accumulation recorded at the various locations.

March and April daily maximum temperatures were below average in general, resulting in a below average incidence of days exceeding 36°C at all sites.

Cold shocks

When minimum air temperatures fall below 11°C, crop growth and development the following day can be reduced regardless of the maximum temperature reached.

This type of temperature extreme has been given the term ‘cold shock’. The frequency of cold shocks throughout the season was generally close to the long term average (1957–2003) in all locations (Figure 3). But significant cold weeks occurred in the second week of September and first week in October in most areas, with only Emerald recording lower than average cold shocks.

The first week in December brought another shock to most locations south of and including Goondiwindi. The tail end of the season from March onwards, produced an increasing number of cold shocks, although not significantly above the long term average. These late season shocks should not have affected crop growth or fibre development, with many cotton crops maturing earlier than usual due to the warm conditions or moisture stress.

Rainfall

Rainfall (or the lack thereof) was a key characteristic of the 2002–03 cotton season, and one which proved to be critical for irrigation management and final yields. Monthly rainfall totals for September to April compared with the long term average (1957–2003) are presented in Figure 4. All locations recorded below average falls for many months, with January being particularly dry — a month which historically receives the highest monthly average rainfall during the cotton season.

OVERALL ANALYSIS

An overall analysis of the 2002-03 cotton season (Table 1) shows that the seasonal day degree accumulation at all locations was above the long-term average by at least 200 DD. The exceptions were Goondiwindi, Dalby and Moree which were between 140 and 200 DD above average.

This is not surprising considering the heatwave conditions experienced during January and February at many locations in the industry.

FIGURE 4: Monthly rainfall received during the September 2002 to April 2003 period compared with the long-term average (1957–2003)
These adverse weather conditions are reflected in the total number of days above 36°C, with between nine and 26 hot days over the long-term average. The majority of locations had less cold shocks than average for the eight month period, except for Moree.

Accumulated rainfall for the season was down from the average, in common with the majority of eastern Australia, with little or no rainfall during January being a common feature of all locations.

### Climate Analysis Tools

Most people within the Australian cotton industry will be familiar with the Australian Cotton CRC web site and using the SILO day degree calculator (http://www.cotton.crc.org.au/Tools/Weather/). This tool generates up to date day degree calculations and an analysis of historical climatic information, using the latest weather data from the Bureau of Meteorology for any official recording station in eastern Australia.

New functionality will be introduced before the 2003–04 cotton season allowing an analysis of timing for development events to be assessed at any growing location, e.g. time to first flower.

### FURTHER INFORMATION

The information in this article may help growers explain their cotton’s growth and performance during the 2002–03 season. For further information about the impact of cold shocks, frost and hot temperatures please see the March–April 2000 Australian Cotton Grower, “Cool Starts: What is normal?” (Vol 21, No. 2).

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Diff. = Difference between 2002–03 and the long-term average