IMPACT OF RAINFALL VARIABILITY

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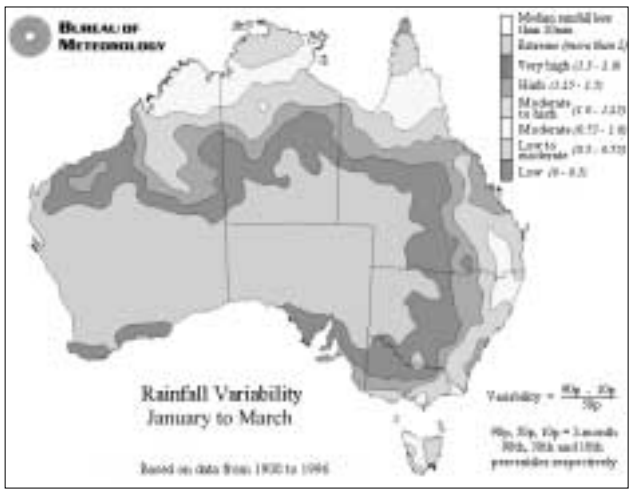
KEY POINTS:

- **Grow strong, deep rooting, indeterminate varieties.**
- **Evaluate variety trials over a number of years for yield, micronaire and fibre length.**
- **Be aware that rainfall and water shortages may impact on fibre quality and yield.**
- **There are many options to manage rainfall variability**

Dryland cotton production is affected by many uncontrollable climatic factors, the number one being rainfall. Australia has predominantly less rainfall than many other countries, making dryland cropping at times, a risky proposition. **Figure 6** illustrates rainfall variability and risk across the cotton growing regions. A majority of dryland crops are grown in areas that have moderate to high variability in rainfall from January to March, which are the most important months in determining both yield and fibre quality of dryland cotton.

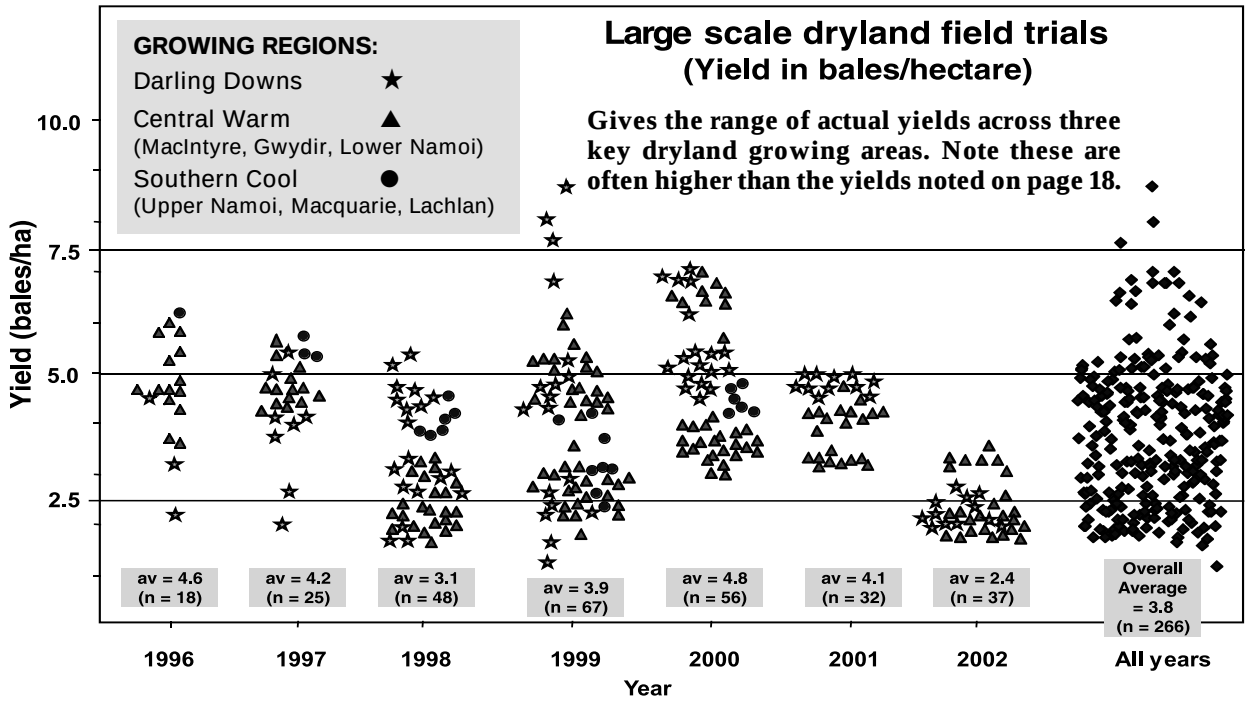
Figure 6: Rainfall variability across Australia. REF: www.bom.gov.au



Unlike many other crops, cotton has a great ability to compensate for drought stress due to its indeterminate growth pattern which allows it to survive dry periods and then to exploit good growing conditions when they occur. In the advent of good rainfall after a previous dry period, the plant will respond by putting on more fruiting positions on the second and third positions on lateral branches and by putting on more main stem nodes.

In dry years, both yield and quality parameters are affected depending on stored soil moisture and in-season rainfall. Because of the variability of rainfall across most cotton growing regions, dryland yields can fluctuate widely. **Figure 7** demonstrates the yield

Figure 7: Yield results for 7 years testing of a range of varieties in large scale dryland field trials, indicates to growers the range of yields that they can expect under varying rainfall conditions.



performance of DPA & CSD varieties over seven years of testing in Deltapine's large scale dryland field trials.

Yield variability follows rainfall variability. In years where rainfall varies across regions like in 1998 and 1999, yields also have a greater range. The very dry year in 2002 resulted in the lowest yields in 7 years of testing.

Dry conditions in January and February not only lead to poorer yields but also can impact on fibre quality.

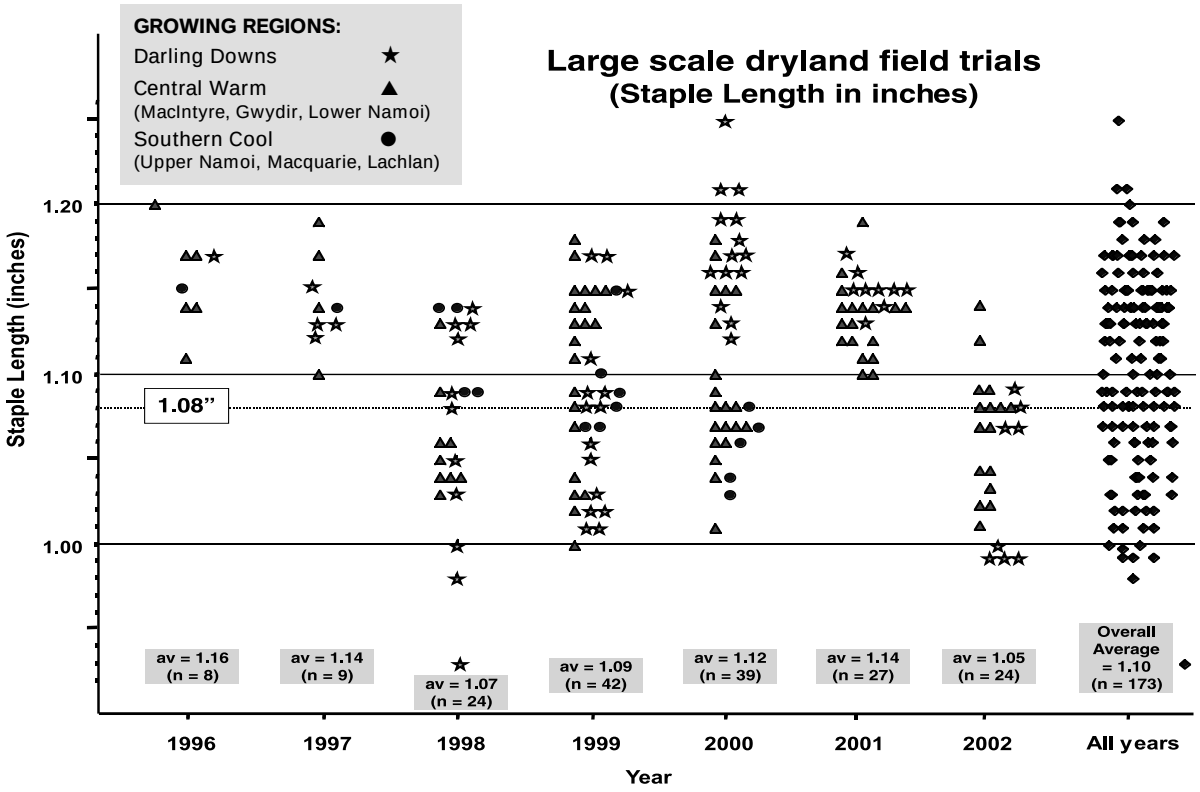
Extremely high or low temperatures during the elongation phase of fibre development (the first 16-20 days), may result in shorter fibre. Fibre length is also decreased by severe water stress and potassium deficiency. Both of these decrease the internal water pressure, thus limiting the expansive force for fibre elongation. **Figure 8** shows the impact of variable rainfall on the fibre length over seven years of Deltapine dryland variety trials.

In the years (1996, 1997, 2000 & 2001) where rainfall was adequate, yield and fibre length were acceptable but in 1999 in a drier season, fibre length averaged 1.09 inches over the 42 entries which is just above penalty range for length. In 1998 the fibre length averaged 1.07 inches over 24 entries and in 2002 the fibre length averaged only 1.05 inches over 24 entries. These figures are in penalty range (<1.08 inches) and would attract discounts. Invariably, the lower yielding years (1998, 1999 & 2002 with 3.1, 3.9 & 2.4 bales / ha, respectively) have a trend towards shorter fibres and hence more length penalties. These years had less rainfall events during peak flowering between January and February across most regions.

With fibre length being reduced due to the impact of reduced summer rainfall, other quality problems can also occur. If good conditions then return, such as a rainfall event in late February, the supply of carbohydrate is reactivated. If rainfall occurs during the second stage of fibre thickening (after fibre length has already been set), the extra cellulose is directed to the fibre cell wall with thicker daily rings of cellulose being set down into the central lumen, resulting in high micronaire.

Water stress often causes high micronaire because boll retention is very sensitive to water stress, but fibre thickening is much less sensitive. Boll retention is reduced when the water stress level drops below -19 bars (afternoon xylem pressure potential); fibre thickening and the elongation are not affected until the severe level of -26 bars is reached. When a plant experiences water stress, it sheds young bolls, leaving the older bolls on the

Figure 8: Fibre length results for 7 years testing of a range of varieties in large scale dryland field trials.



plant with ample carbohydrates to fully thicken the fibre.

The opposite of this can occur when the crop runs out of moisture in the second stage of fibre formation (20-40 days after flowering) when fibres are thickening. Length may not be affected but due to reduced supply of carbohydrate for fibre thickening, the fibres are thinner resulting in low micronaire. **Figure 9** shows the impact of variable rainfall on micronaire over 7 years of Deltapine dryland variety trials.

In 2002 where yields were low and fibre length was short, micronaire shows a trend towards higher than normal results. Consequently some discounts for high micronaire would occur.

Other reasons for high micronaire are varietal and also loss of top positions in the crop which predominantly have lower micronaire than the rest of the plant. These top position bolls can help reduce the overall crop micronaire, once all positions in the crop are averaged.

Other affects on quality due to rainfall variability occur in strength, short fibre index and colour class but occur less frequently and have fewer penalties. The major affects of climate variability are on yield, staple length and micronaire, as previously mentioned.

Generally it is difficult to manage for in-seasonal changes in climate and hence the importance of selecting the right variety with a number of advantages in the dryland system:

- Varieties that have a deep rooting ability that is predominantly strongly indeterminate.
- Varieties that have good water use efficiency.
- Varieties that have yield stability over years.
- Varieties that have a stable micronaire over years.
- Varieties that have longer fibre length.

Figure 9: Micronaire results for 7 years testing of a range of varieties in large scale dryland field trials.