USEFULNESS OF RAINFALL RECORDS IN PREDICTING LONG TERM VIABILITY OF RAINGROWN COTTON

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Rainfed cotton has been grown in Central Queensland since the 1920's but the total area has fluctuated in response to variable seasonal conditions as well as changing prices and market trends for cropping options.

Raingrown cotton yield predictions for a range of Queensland locations (Clermont, Emerald, Rolleston, Theodore, Banana, Gatton, St. George) were presented in the May-July issue of the Australian Cotton Grower (Vol. 11, No. 2, pp 52-59). The main features of the yield prediction program were outlined in the Cotton Grower article.

It is suggested that an economic adviser could use the predicted yield probabilities to analyse long term risks and opportunities for rainfed cotton within the economic constraints of particular farming properties.

This paper presents further results generated in the analysis of long term rainfall records from the above sites.

SOWING OPPORTUNITIES (Figure 1)

At all central Queensland locations there is a peak in sowing opportunities in the second half of December. This peak is most pronounced at Rolleston and Theodore.

At Gatton, the greatest chance of sowing conditions is in the first half of December but conditions are also favourable in many years during the second half of December.

At many locations there is a secondary peak in sowing opportunities during the late October period. The bulk of the limited sowing opportunities at St. George occurred during this period.

SOWING DATES - OPTIMUM YIELDS (Figure 2)

As latitude increased the trend was for higher yields at earlier sowing dates. At Clermont and Emerald the most consistent high yields (based on the 50% probabilities) were obtained from the late November-early December sowings. At Rolleston yield levels did not differ greatly over the November-December sowing period. At Theodore late October-early November was the ideal sowing period while at Banana there would be advantages in sowing from late October to late November.

Consistently high yields were obtained from October-early November sowings at Gatton and there was a marked decline in yields from late November onwards.

The sowing opportunity and optimum yield results are for a soil which holds 135 mm of Plant Available Water. Soil water is restored to 80% of capacity by summer fallows between crops. Similar results were obtained for a deeper soil holding 170 mm of Plant Available Water.

By combining the sowing opportunity and optimum yield data it can be concluded that the optimum sowing window for cotton in Central Queensland is late October-late December. It could be argued that other summer crops such as sorghum or sunflower should be considered for January-February sowings. At Gatton, an October-early November sowing window would be preferred.

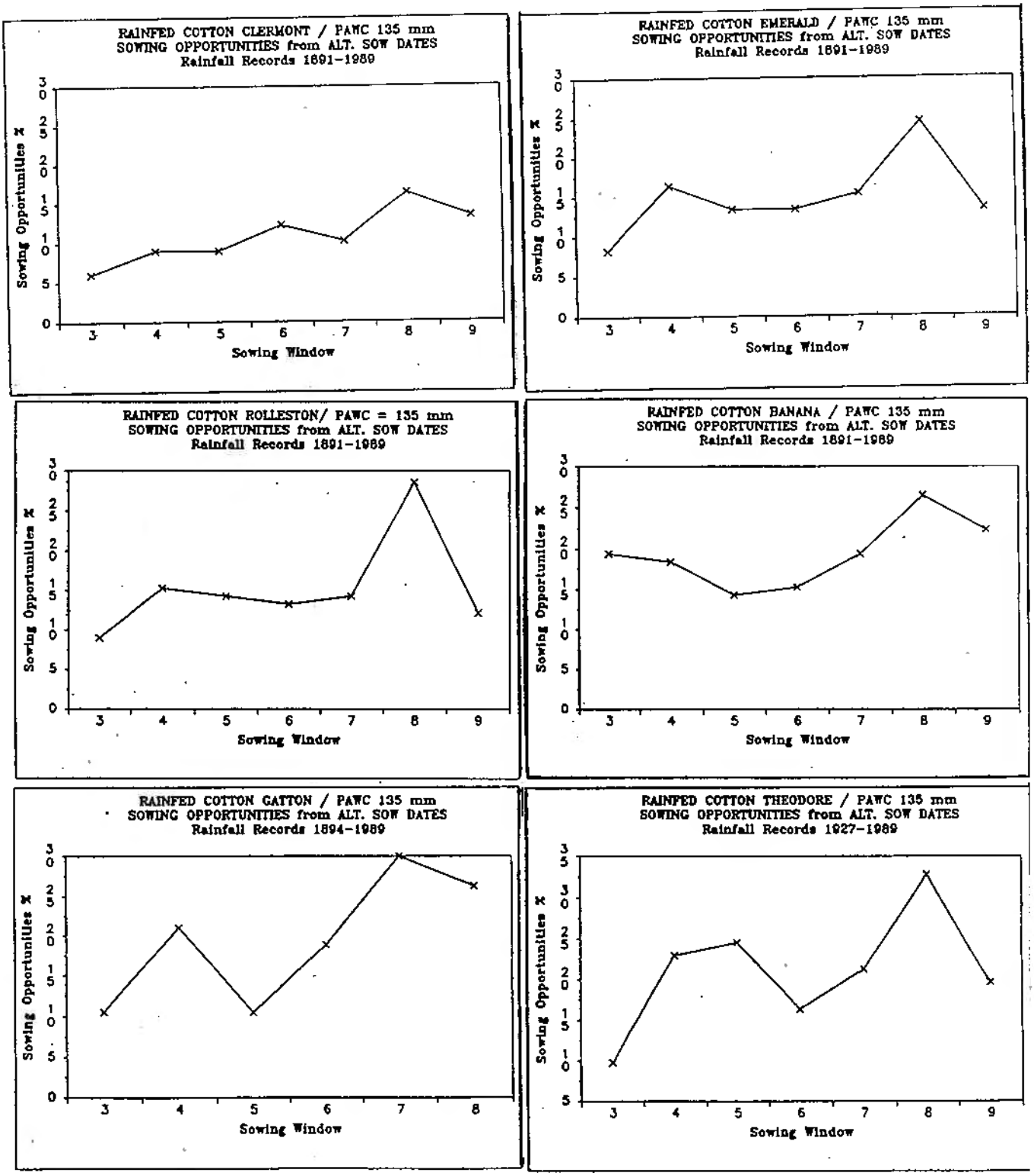

FIGURE 1. Sowing opportunities for different sowing dates.
Sowing windows: 1 (Sept 1-15); 2 (Sept 16-30); 3 (Oct 1-15)
4 (Oct 16-31); 5 (Nov 1-15); 6 (Nov 16-30); 7 (Dec 1-15);
8 (Dec 16-31); 9 (Jan 1-15).

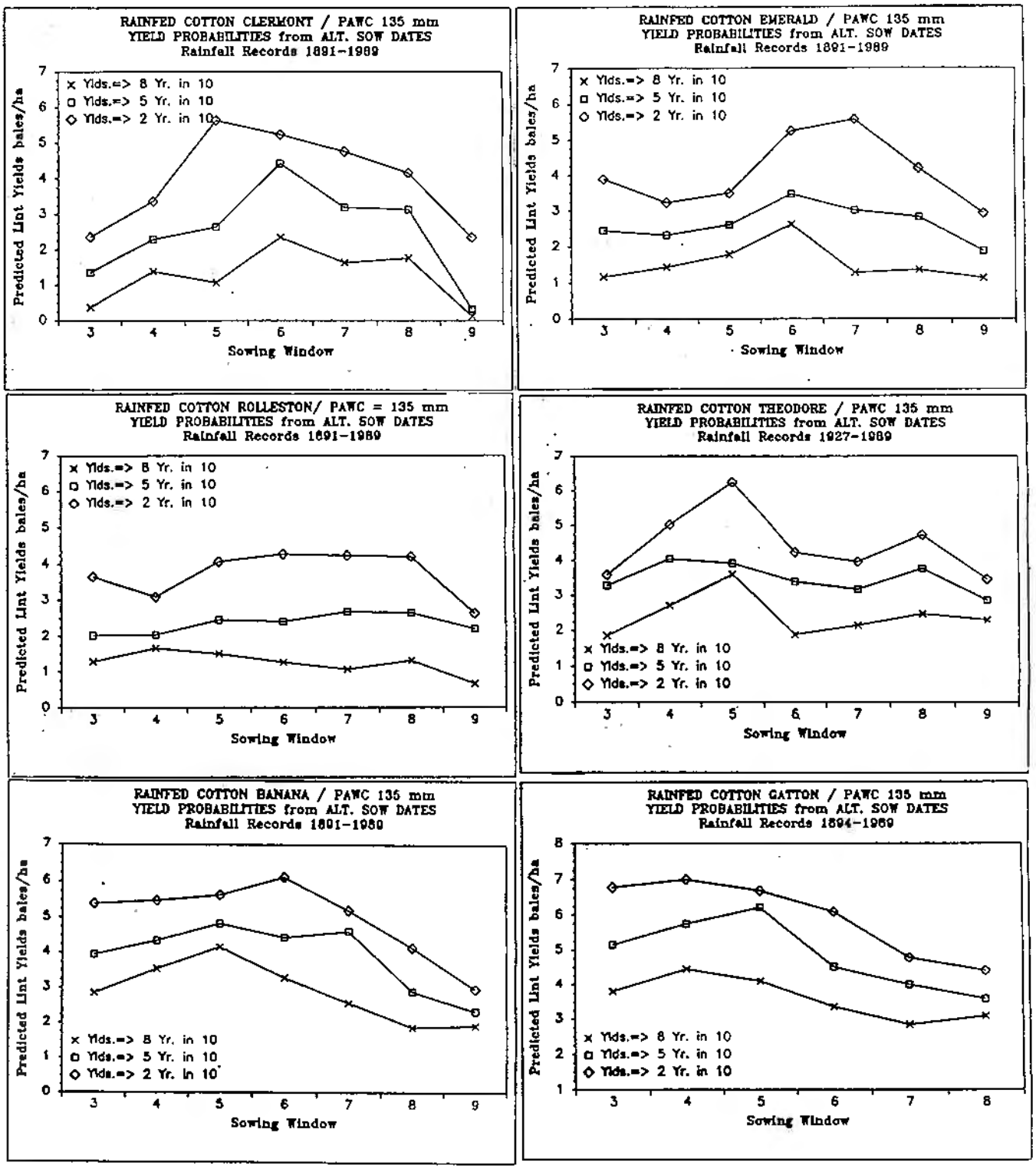

FIGURE 2. Yield probabilities from different sowing dates.
Sowing windows: 1 (Sept 1-15); 2 (Sept 16-30); 3 (Oct 1-15);
4 (Oct 16-31); 5 (Nov 1-15); 6 (Nov 16-30); 7 (Dec 1-15);
8 (Dec 16-31); 9 (Jan 1-15).

RUNOFF (Figure 3)

The program used two methods of predicting rainfall runoff during the period from sowing to maturity.

The Curve Number Method uses a curve number which characterises the infiltration characteristics of the soil. For the heavy clay soils, a Curve Number of 75 was used.

In the second method, rainfall in excess of that required to re-wet the soil profile to full PAWC was estimated as runoff.

The two estimates are shown in Figure 3 for four Central Queensland locations. These data are for a soil with a PAWC of 170 mm and 80% of PAWC available before sowing rains.

In 50 percent of years on the Central Highlands, 2-5% of rain would run off depending on which method of estimation was used. These percentages increased to 5-11% in the Dawson Callide and 12-18% at Gatton. At St. George the percentages were only 1% or less.

At all sites except St. George, the Curve Number method predicted that 30 to 40 percent of the crop rainfall would flow off the paddock in the wettest season, while the second method predicted that 40 to 51 percent of rainfall would run off under these conditions.

The percentages were reduced only slightly if soil water was at 50% of PAWC prior to sowing rains. They did not change significantly on the shallower soil with a PAWC of 135 mm.

The runoff predictions emphasise the importance of contour banks, stubble mulching and other soil erosion control techniques. These techniques are just

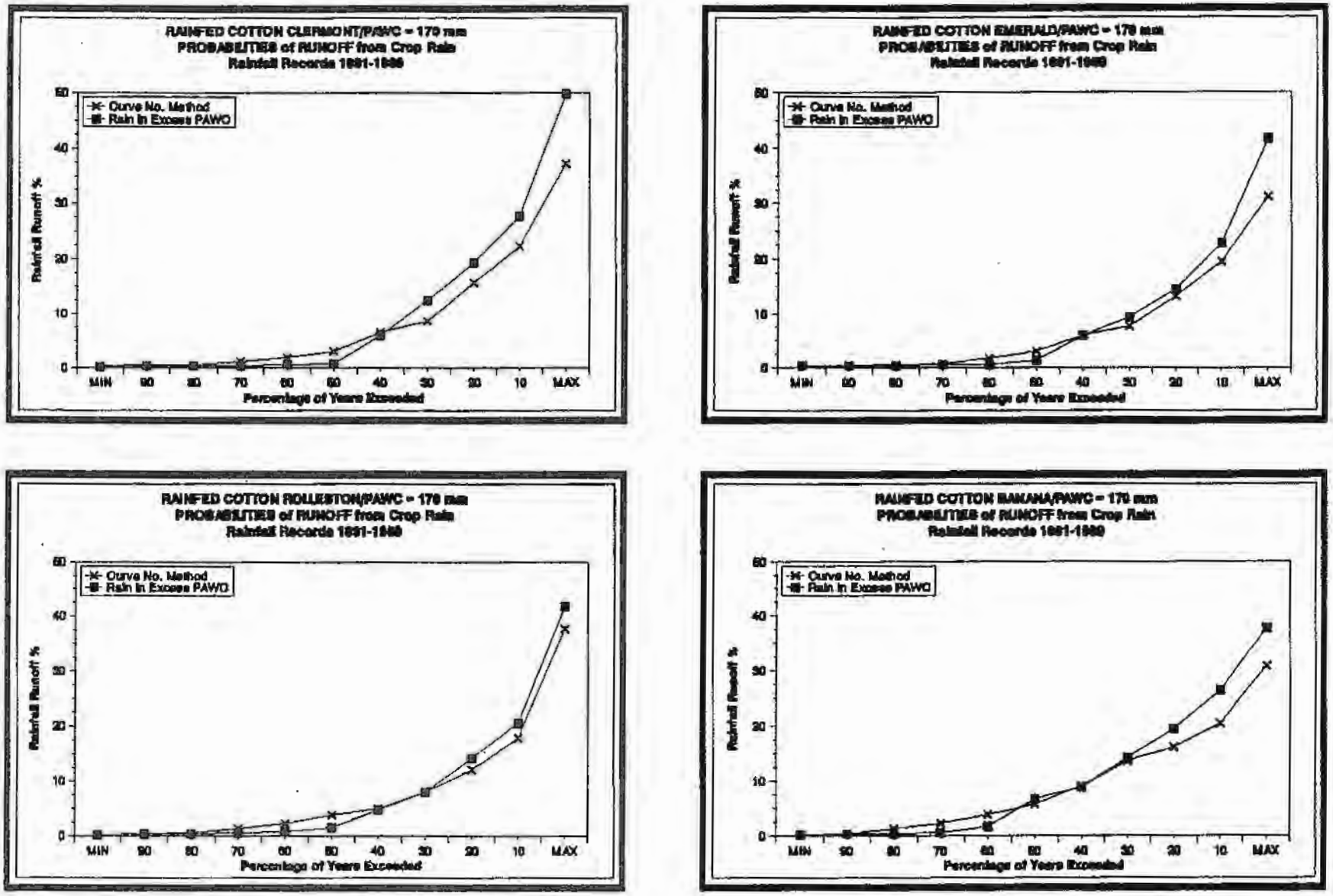

FIGURE 3. Probabilities of percentage runoff from rain falling during the period from sowing to maturity.

as important with cotton as they are with other summer and winter crops. Tied ridges in alternate rows have been used successfully at Biloela not only to reduce runoff but also to increase water infiltration.

CONCLUSIONS

Raingrown cotton would be out of the question at St. George but would be very successful at Gatton particularly if supplementary irrigation were available to achieve optimum sowing dates and to alleviate any critical dry periods.

At all the central Queensland locations, there are opportunities for rainfed cotton but there are also major risks to be considered.

The amount of water stored by the soil (PAWC) has a major influence on the yields achieved. The PAWC is related to the depth of soil and the proportion of clay.

In the Central Highlands-Arcadia Valley area it is predicted that on a soil with a PAWC of 170 mm, yields would be up to 2.5 bales per ha (1 bale per acre) for 50% of the time but over 20% of years yields of 1.3 bales per ha (0.5 bales per acre) or lower would be obtained. The lower yield predictions should be considered by those who find it necessary to purchase strippers and other capital items so as to include raingrown cotton in their farming operations.

The yield probabilities in the Cotton Grower article give trends over 100 years of records but it should be remembered that it is possible for the lower yield expectations to be experienced in two or more consecutive seasons.

On the deeper soils in the Dawson Callide it is predicted that yields of up to 4 bales per ha (1.5 bales per acre) would be obtained in 50% of years but over 20% of seasons yields as low as 2.7 bales/ha (1 bale per acre) would be obtained.

Another way of summarising the predictions in economic terms is to consider the percentage of years in which break even yields would be obtained, if fallowing between cotton crops is practised.

On the deeper soils in the Central Highlands break even yields would be achieved in 62-72 percent of years while on similar soils in the Dawson Callide break even yields would be attained in 86-87 percent of years.

The yield and sowing opportunity predictions should not be considered as absolute. They do provide relative data which should assist farmers in making more rational decisions on the opportunities and risks of including rainfed cotton in their enterprise.

The most important point emerging from these analyses is that in Central Queensland it is not feasible to grow cotton on the same area of soil every season. The land needs to be summer fallowed to ensure adequate subsoil water builds up after the previous cotton crop. Even where fallowing is practised sowing rains may not be received at the optimum sowing time for cotton.

Both these factors mean that other summer and winter crops must be included along with cotton in the whole farm enterprise. Unless contract stripper or row crop harvesters are available this means expensive specialist cotton equipment may not be used to full potential.

Flexibility is the key to successful farming operations in the semi-arid areas of Central Queensland. The primary producer must respond to changing crop and stock prices and weather conditions in making decisions on the blend of grazing and cropping enterprises which suit the particular farm and its economic status.

This analysis has demonstrated the importance of maintaining options for a range of summer and winter crops. There are optimum sowing windows for cotton (late October-late December) and other summer crops such as sorghum (Christmas-mid February) and sunflower (January-February).