VARIETIES - THE DRYLAND NEEDS

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Over the past 5 seasons, dryland cotton has contributed no more than 5 % of the total Australian production, but despite such a relatively small contribution, it seems to have maintained a much higher profile in industry debate over the same period. The reason for this appears to be asscociated not so much with the current level of production, but with what it may become. There is clearly scope for any future expansion of the cotton industry in Australia to involve a larger proportion of dryland to irrigated production than currently exists.

Many within the industry have acknowledged the progress being made in the local breeding program which has been primarily aimed at developing improved varieties for irrigated production. These varieties, as well as a selection of US irrigated and dryland varieties, have also been tested under dryland conditions at 1-3 sites per season throughout the last decade. This paper is based on the assumption that, provided the economics of cotton production remain favourable, there will be a considerable expansion of dryland cotton over the next decade. It is also assumed that there will be an associated increase in both the level of interest in dryland research and the level of dryland research funding. Consequently, additional funding might become available for the investigation of dryland varieties. In order for these funds to be wisely allocated, there is a need for further industry debate. This paper is aimed at presenting some aspects of this debate and seeks to answer the following questions:

* Are the dryland industry's needs being met by the spin-offs from the current breeding program?
* Given the success of the irrigated breeding program, is there a need to duplicate it to cater for the dryland cotton industry of the future?

To answer the first question it is necessary to define what the present day dryland industry's main needs are in a variety and then review the dryland varietal trial results to see if they have identified varieties that comply with these needs. In defining the dryland cotton industry's requirements for a variety, it needs to be realized that a variety is only a relatively small part of the risk management process that all dryland growers must consider before planting. A variety, no matter how

good, will only compensate for poor agronomic or entomological management to a limited degree. Growers must understand that the major limitation to productivity under dryland conditions is water availability and the management thereof.

While drought tolerance is one of the most important requirements of a dryland variety in Australia, it should not be at the expense of performance in seasons of above average rainfall. Depending on planting rainfall, a dryland crop can be planted over a 2 to 2.5 month period in Northern NSW and Southern Queensland and a 3 to 3.5 month period in central Queensland. Consequently, an ideal dryland variety needs to be versatile in its response to season length as well as moisture availability. Dryland crops are harvested either with spindle pickers or strippers. For spindle picking, the lint needs to be relatively well exposed in the open boll and staple length should remain above 11/32" or losses are quite high. For stripper harvest, the nature of the open boll and staple length are not as important, but stripping requires a relatively compact plant that is easlier to defoliate or dessicate. There are also certain characteristics that may be of more importance to southern Queensland and northern NSW growers than to central Queensland growers, e.g. ability to recover from hail damage and tolerance to *Verticillium* wilt. Obviously it would be difficult to breed or uncover a variety that was the best performer in all of these characteristics, therefore, the dryland industry appears to need either a good all-round performing variety that is the best compromise between the most desirable characteristics or it needs a selection of varieties each with good overall performance, but each with particular strengths among the major desirable characterictics. Which of these choices would be of most benefit to the dryland industry?

For the past two seasons the dominant varietal choices for the dryland industry have been the same as for the irrigated industry, with Siokra 1-4 and Deltapine 90 (DP 90) being the main selections. While Siokra 1-4 dominates dryland plantings on the Darling Downs, DP 90 dominates in NSW and central Queensland. However, growers in all areas have shown that they will choose between these varieties on the basis of their relative strengths and weaknesses. For example, many dryland growers in central Queensland will select Siokra 1-4 over DP 90 for late planting, while growers on the southern Darling Downs will choose DP 90 if *Verticillium* wilt is anticipated to be a problem in a certain field.

Since the 1981/82 season dryland sites have been included in the Australian Cotton Cultivar Trial (ACCT) program. For the purposes of this paper dryland ACCT

from the two main testing areas, Narrabri and central Queensland have been reviewed. The 1983/84 season was selected as the starting point for this review because it saw the first introduction of DP 90 and Siokra 1-1. These varieties have been kept in all trials since that time and serve as benchmarks for the performance of the other varieties tested against them. A total of 116 varieties have been tested over this period with between 25 and 42 varieties tested in each area each season. As well as the ACCT, which are replicated small plot trials, there have also been a number of larger plot Cotton Seed Distributors trials conducted to test the most promising varieties on a "commercial" scale. Table 1 summarizes the number of trials in which a selection of varieties, discussed in this paper, have been included. For the purposes of the following discussion, DP 90 is used as the standard against which the other varieties are compared. In Table 1, the number of trials in which each variety has yielded more than DP 90 have also been included.

Table 1. The total number of trials and number of times selected varieties have out-yielded DP90.

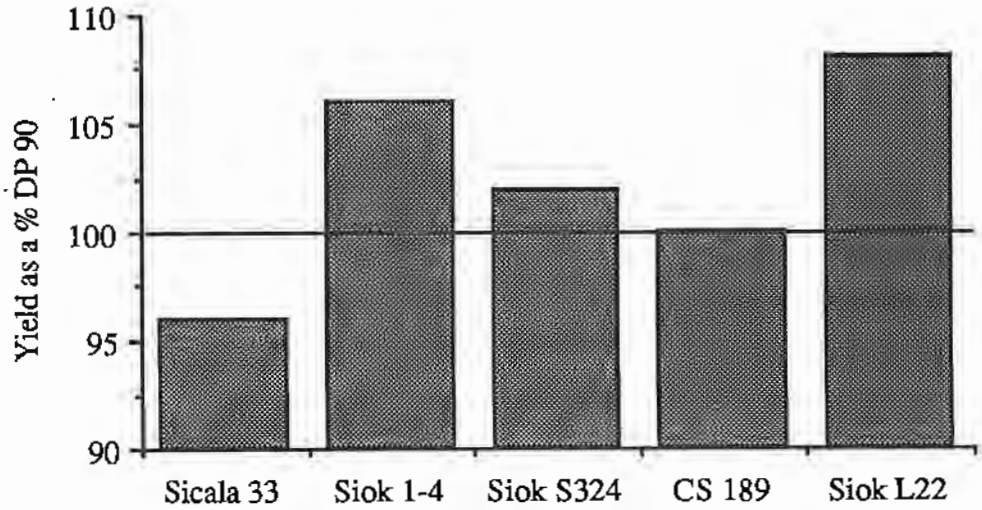
Variety	Small Plot Trials *		Large Plot Trials †	
	No	Yield > DP90	No	Yield > DP90
Siokra 1-1	12	6	2	1
Siokra 1-2	4	2	4	1
Sicala 3-1	10	1	-	-
McNair 235	10	5	-	-
Tamcot CAMD-E	8	0	-	-
Sicala 33	5	0	3	1
Siokra 1-4	5	3	4	2
Siokra S324	5	3	1	1
Siokra L22	5	5	1	1
CS 189	5	3	1	1

* Small plot trials 1983/84 - 89/90 † Large plot trials 1986/87 - 89/90

Figure 1 compares the combined small plot dryland trial yields, relative to DP 90, of five of the most promising current irrigated varieties. Of these, only Sicala 33 has failed to show any yield advantage over DP 90, but if the sellers of Australian cotton are able to obtain a premium for Sicala 33 as a superior quality fibre then some account of high quality may need to be taken in future trials. Siokra 1-4 has been a commercially available variety for two seasons and has met good acceptance with dryland growers. Siokra L22 and CS 189 have been commercially released for the 1990/91 season and Siokra S324 is being released on a limited basis.

Siokra S324 is one of the better performing earlier maturing varieties while CS 189 is one of the first bacterial blight resistant, normal leaf varieties to show similar yield, quality and season length characteristics to DP 90 under dryland conditions. The long season Siokra L22 has clearly shown over the last three seasons that it is a very promising variety for both irrigated and dryland production.

Figure 1. Dryland yields of current varieties (% DP 90) - ACCT



Over the last three seasons Siokra L22 has out-yielded DP 90 in all dryland trials and, as shown in figures 2 and 3, is the first variety to have done so in both NSW and central Queensland (C.Q.) trials. It also appears from figures 2 and 3 that DP 90 has performed better, relative to most other varieties in the NSW trials compared to the C.Q. trials. Between 1984/85 and 1988/89, DP 90 ranked between 1 and 5 in the NSW trials, but ranked between 11 and 28 in the C.Q. trials.

In the very dry 1989/90 trial in NSW, DP 90 was ranked 26 out of 42 varieties with a similar yield to the 1985/86 season when it ranked 2 out of 40. By contrast, the 1988/89 dryland trial in C.Q. was late planted and subject to a very wet season - in this trial DP 90 was ranked 28 out of 42. A number of the varieties that performed better than DP 90 under both long, dry and short, wet seasons were common to both trials. These results indicate that the dryland screening program is starting to identify varieties which are more versatile than the traditionally strong performers like DP 90. It is also significant that most of these varieties are locally bred.

Figure 2. Dryland yields of current varieties (% DP 90)
NSW vs C. Q.

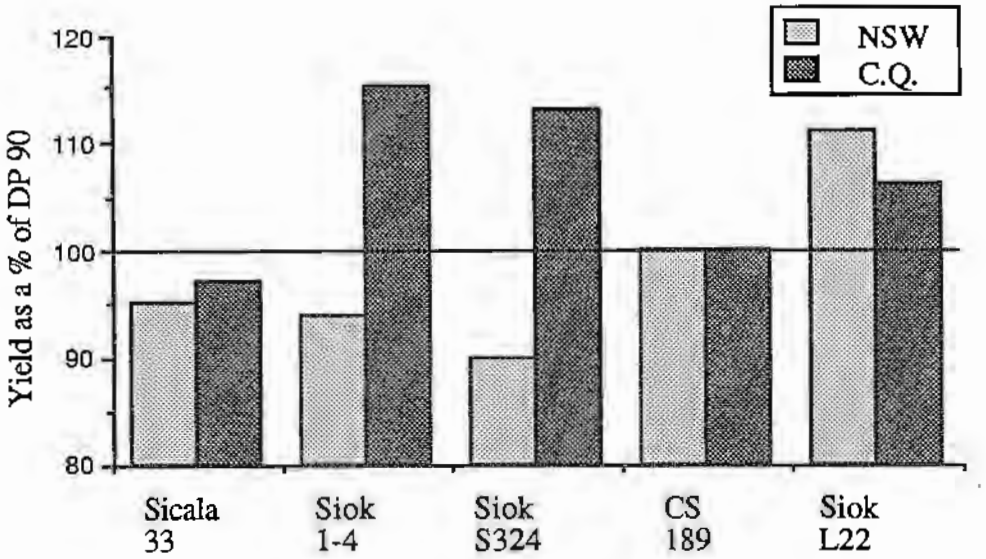


Figure 3. Dryland yields of past varieties (% DP 90)
NSW vs C.Q.

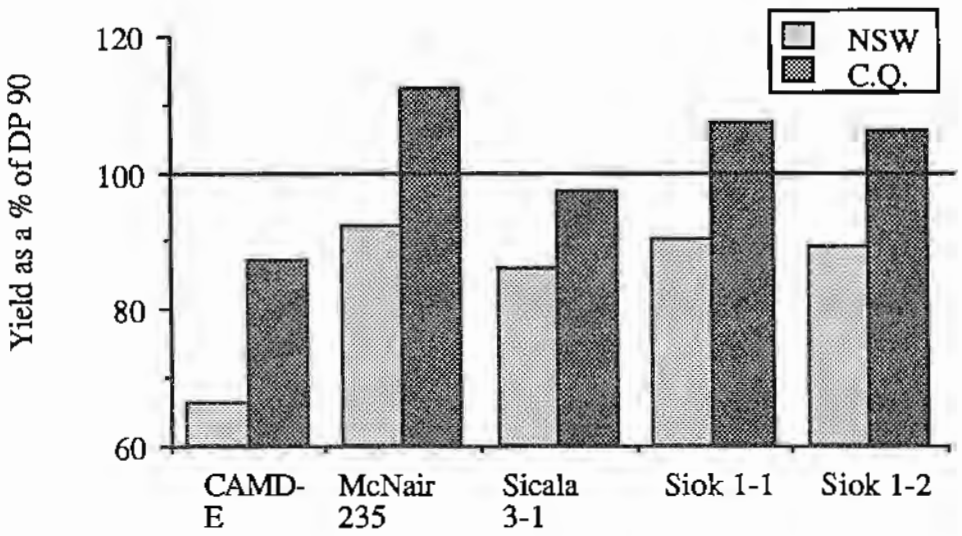
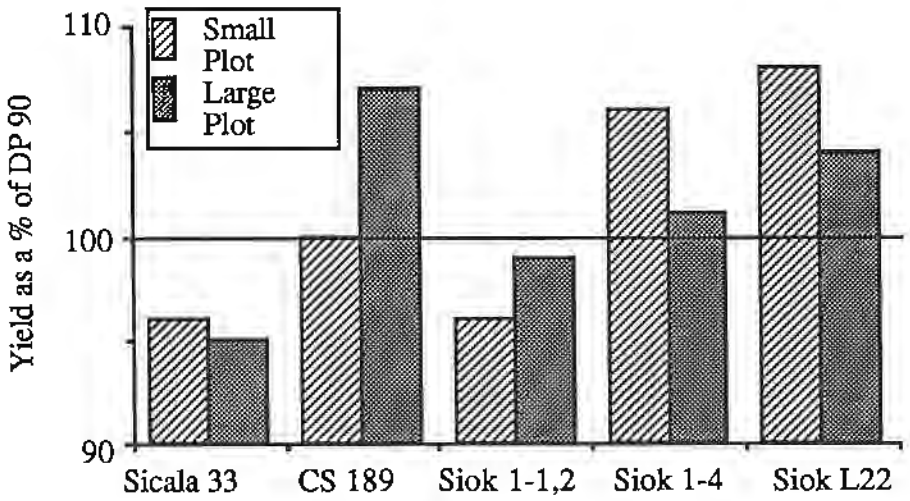


Figure 4 shows a comparison of the dryland yields (% DP 90) for a number of varieties in both small and large plot trials. In general, the trends shown in the small plot trials are reflected in the large plot results.

Figure 4. Dryland yields (% DP 90) - small vs large plot trials



It is clear that progress is being made with the current approach to dryland varietal selection even though this is a relatively simple screening program. Because the majority of lines screened have been out of the irrigated breeding program, it is probably not surprising that the the best performers from that program have also tended to be the best ones under dryland conditions.

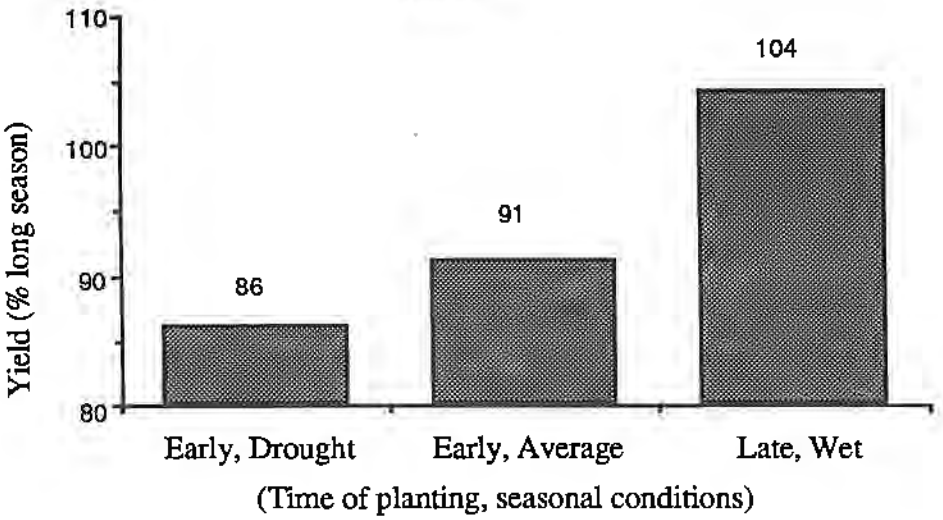
Despite the apparent success of the dryland program some criticism remains. It is argued there is a need for a broader based dryland varietal program that either includes the testing of more overseas (particularly US) dryland material or involves the expansion to a separate local breeding program for dryland varieties. The suggestion to include more US material centres on the adoption of earlier maturing (short season) varieties as part of the movement towards earliness management in the predominantly dryland production areas of the US cotton belt.

In response to this criticism, it should be noted that a selection of short season US varieties has always been included in the dryland ACCT. Two have been included in figure 3 - the Texan stripper type Tamcot CAMD-E, and McNair 235, a dryland variety from the high rainfall eastern portion of the US cotton belt. Tamcot and other stripper types tested have always yielded well below the level of DP 90 and Siokra lines. McNair 235, on the other hand, did perform well over a number of seasons, particularly in Queensland. It was rejected as a commercial prospect because of its low strength and shorter staple which would have discounted returns sufficiently to have negated any yield advantage. As in Australia, cotton breeding programs in the US are concentrating on both yield and quality, therefore, the

policy of including several of the better US dryland varieties in the ACCT will continue.

The call for the development or introduction of short season dryland varieties in Australia has also been advocated stongly at times. It is argued that short season varieties should be more efficient than long season varieties when moisture is limiting. Short season varieties should also be cheaper to grow by reducing the length of exposure to pests. Trial results over the last three seasons, however, indicate that it is the longer season varieties that respond better to below average rainfall. Figure 5 shows the yield performance of a selection of short season varieties (6 per season between 1987/88 and 1989/90) expressed as a percentage of a selection of long/normal season varieties (5-6 per season) and categorized according to planting time (early, late) and seasonal conditions (average, wet, drought).

Figure 5. Yield of short season lines as a % of long season lines



The shorter season varieties appear to respond more to season length than to moisture stress. Nevertheless, Siokra S324 and some of the more advanced varieties from the CSIRO short season breeding program have yielded well under a range of dryland conditions. The commercial release of Siokra S324 and CS 6S this year will give growers in all of the main dryland areas more options than they have had before. The potential value of these varieties for late planting or in areas where season length is short is obvious. If growing these varieties was also associated with reduced costs, it would would be an enormous boost for the sustainability and growth of the dryland industry.

CONCLUSIONS

In 1990 and 1991, dryland growers will have the option to choose from the largest range of varieties ever available to them: DP 90, Siokra 1-4, Siokra L22, Siokra S324, Sicala 33, CS 189 and CS 6S. In these they have gained varieties which are versatile and high yielding over a range of seasonal conditions and districts (Siokras 1-4 and L22, CS 189 and DP 90), extra high quality (Sicala 33) and greater suitability for late planting (Siokras 1-4 and S324 and CS 6S). They have gained these varieties at minimal cost to the industry as a spinoff from the irrigated breeding programs. Irrigated growers in areas where water allocations are limited can also gain from the dryland screening program through its identification of the better performing varieties under moisture stress conditions.

The dryland industry is, arguably, being well served by the current approach of screening varieties under dryland conditions. There is no good reason to expand this into a separate breeding program since all the evidence points to the best irrigation variety being the highest yielding under dryland conditions. Nevertheless, the needs of the industry will have to be kept under review particularly if significant expansion or alterations to management practices occurs. Some of the concerns of dryland producers over varieties could be met by an expansion of the current program to include the following:

* more varieties and sites by region and planting date
* a selection of more recent US (or other) dryland lines
* harvest preparation for and harvestability comparison of pickers vs strippers
* correlations of seasonal or regional interactions
* marketability of different yield and quality combinations
* analyses of growing costs vs yield and quality

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