Development of agronomic and varietal options for dry season cotton production in NW Australia.

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Summary.

High yields (> 11 b/ha) were achieved with varieties adapted to hot arid growing conditions. However, fibre lengths were lower than for the same variety grown in southern Australia; cool nights early in fibre development were thought to be the cause. Screening for varieties that can produce longer fibre is continuing. March - April sowing dates produced the highest yields. Progress was made in determining nitrogen fertiliser rates and plant densities. Integrating results from agronomic research with pest management research and developing recommendations for the use of growth regulators are future priorities.

Introduction.

In 1994, after a 20 year lapse, cotton research was recommenced in the Ord River Irrigation Area. This research coincided with trial work in other areas of NW Australia; namely, the West Kimberley, the Fitzroy River and at Katherine (NT). The results from the 1994 season have been summarised by Geoff Strickland and Greg Constable in the September-October edition of *The Australian Cotton Grower* entitled 'Cotton on the Ord Again' and is recommended reading. The encouraging results from 1994 led to an expanded collaborative program between CSIRO and Agriculture WA in 1995.

A new philosophy for growing cotton is being evaluated in NW Australia. This involves switching from the wet (summer) to the dry (winter) season to avoid peaks of insect abundance and to minimise difficulties imposed by the wet season. Genetically engineered varieties combined with resistance management strategies are central to the new production system. Seed of these varieties was not available in 1994 and 1995 so 'conventional' varieties were sown. Two broad series of experiments to cover (1) aspects of agronomy and varietal performance and (2) pest management options are being conducted. In this paper we describe progress with the former series of experiments.

1. The effect of sowing date on yield and fibre quality.

Dry season production will necessitate sowing sufficiently early to permit a dry harvest and allow time for stubble destruction and soil preparation. Based on seasonal heat units, by sowing in late March to April, end of season operations will occur from mid September through to the end of October, before the wet season. Sowing date studies have confirmed these dates and shown that due to high temperatures in September and October (35 - 42° C) the rate of boll opening is very rapid (Table 1).

Table 1: Rate of boll opening

Sowing Date	First Open Boll	60% Bolls Open	90% Bolls Open	First open to 90% open (days)
March 29	August 27	September 13	September 20	24
April 24	September 13	October 3	October 9	26
May 18	October 2	October 9	October 15	13
June 9	October 14	October 26	November 2	18

The effect of sowing date on yield was similar in 1994 and 1995; yields peaked at March and April sowing dates and fell when sowing was in May or June (Fig. 1). Fibre length was the quality parameter most affected by the dry season. Fibre length was reduced particularly at March and April sowing dates (Table 2). Cool night temperatures during fibre elongation (June and July) are thought to be the cause. Sowing date had a similar effect on fibre strength which ranged from 27 g/tex at a May/June sowing date to 25 g/tex in March/April. Micronaire was not affected by sowing date and was in the acceptable range of 3.6 to 4.9.

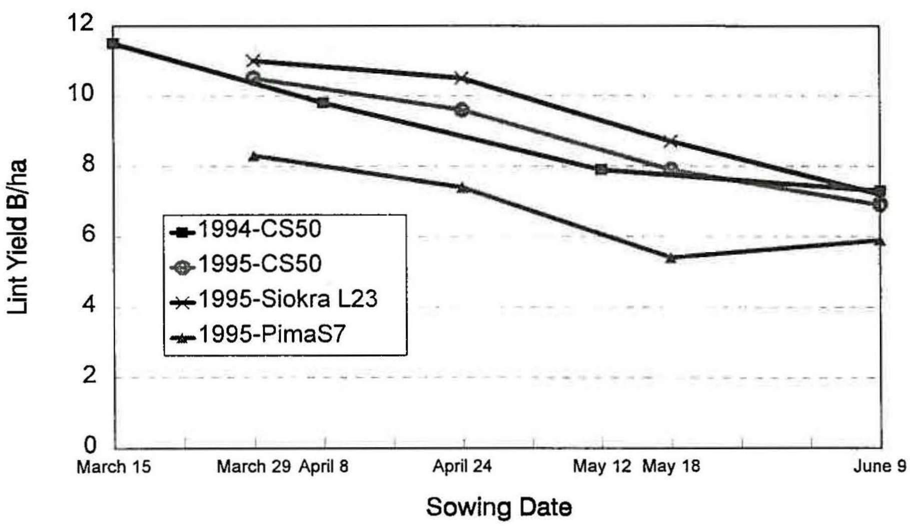

Fig 1. The effect of sowing date on lint yield in the Ord River Irrigation Area.

Table 2: The effect of sowing date on fibre length (inches). Cotton was machine picked and lint separated in a small gin. It should be noted that the values obtained from commercial scale harvesting and ginning may be lower than the discount length of 1.05".

Sowing Date	CS50		Siokra 1-4	Siokra L23
	1994	1995	1994	1995
March 15, 29	1.10	1.09	1.08	1.09
April 8, 24	1.09	1.07	1.09	1.09
May 12, 18	1.22	1.10	1.15	1.16
June 9, 10	1.13	1.10	1.11	1.12

2. Varieties.

Eleven varieties were screened in 1994. CS50, Siokra L23 and DP90 yielded at least 11 bales / ha. The expanded trial in 1995 included varieties not tested in 1994 plus 14 experimental lines from CSIRO. Yields in 1995 were similar to 1994 although the ranking of varieties changed. Siokra L23 was the only variety to yield at least 10.5 b/ha in both seasons. Sicala 34 and DP5690, not trialed in 1994, yielded > 11 b/ha (Table 3). Two experimental lines produced good yields and fibre quality compared to commercial varieties. For all varieties fibre length was on average 0.1" shorter than for the same variety grown in NSW and harvested and ginned in the same manner. A variety with a longer fibre is a priority for NW Australia. In 1996 we have included experimental lines known to produce extra long fibres when grown in NSW. In addition, 'Ingard®' varieties are being trialed for the first time in 1996.

Table 3: Machine picked yield, fibre length and strength. Sown April 20, 1995.

Variety / Line	Yield (bales/ha)	Fibre length (inches)	Fibre Strength (g/tex)
88208-214	11.4	1.12	28.7
Sicala 34	11.4	1.10	26.6
DP5690	11.1	1.10	25.6
Siokra L23	10.5	1.10	27.4
Sicot 189	10.3	1.12	27.1
Siokra L22	9.9	1.10	24.7
DP90	9.7	1.09	25.8
Sicala V2	9.7	1.08	26.3
CS50	9.6	1.09	24.8
88201-343	9.5	1.12	27.1
Siokra 1-4	9.2	1.08	24.8
LSD 0.05	1.49	0.0299	2.0

In 1995 eight *Gossypium barbadense* (Pima) lines were also trialed. At March and April sowing's yields were 7 - 8 b/ha (Fig 1). Fibre length was reduced by 0.14" compared with NSW. Two lines were significantly longer than Pima S7, however no line exceeded 1.31 inches. Generally the Pima types were easy to grow, being less attractive to Heliothis and not as prone to rank growth than the upland cottons.

3. Managing early growth.

Sowing in March/April means that seedling cotton is growing in much higher temperatures than in southern Australia. Rank growth occurred in March sown cotton in 1995. The growth regulator mepiquat chloride (Pix) was evaluated for the management of excess vegetative growth and increasing earliness. We compared the established rules (temperate Australia) governing the rate and timing of mepiquat chloride (MC) applications. Emphasis was place on early (squaring) application as we anticipated that excessive vegetative growth would reflect the high temperatures early in the life of the crop.

Some results are shown in Table 4. Early growth was rapid with plants > 60 cm at first squaring. MC reduced plant height and the number of nodes. The extent of these reductions was proportional the total amount of MC applied. Yields were not increased using MC; indeed a high rate of MC at squaring reduced yield. It is possible that insect damage in flowering which removed flowers on lower nodes was not compensated for in treatments receiving MC. This was because there were fewer nodes in these treatments from which compensation could occur. It is clear that further research is required to establish rules for MC application in NW Australia. Ingard® varieties should minimise the problem of early fruit loss by Heliothis in future trials.

Table 4: The effect of Pix® on lint yield, plant height and node number. Sown 29 March 1995.

Treatment	Lint Yield (b/ha)		Maximum Height (cm)		Maximum Nodes	
	Siokra l23	CS50	Siokra L23	CS50	Siokra L23	CS50
No Pix	11.0	10.3	173	162	25.0	22.3
Multiple low rate*	10.4	10.5	155	134	24.4	21.7
Rate of internode increase**	8.8	9.2	136	116	22.8	20.9
500ml/ha at flowering	10.9	10.6	158	149	23.9	21.8
Lsd	1.04		8.92		0.83	
CV	7.16		4.8		2.87	

* 250 ml/ ha at first square, first flower, and 2 weeks after first flower.
** 2 applications; 250 ml /ha and 1000 ml/ha during early and late squaring.

4. Optimum nitrogen fertiliser rate and plant density.

Progress was made in determining the optimum nitrogen fertiliser rate and plant density for dry season cotton. Yield peaked with 225 kg/ha of N (Fig. 2). It should be noted that the response to nitrogen fertiliser will be affected by paddock history and rainfall during the previous wet season. Our aim is to be able to predict N fertiliser requirement from soil tests made prior to sowing.

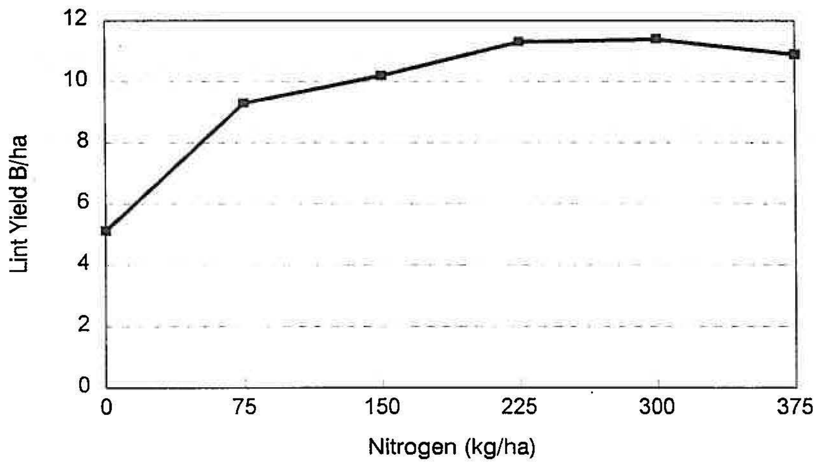

Fig. 2. The effect of nitrogen fertiliser on lint yield. CS50 sown 24 April 1995, N as urea banded 20cm below and 5 cm to side of seed prior to sowing.

The response to plant density was similar to cotton growing areas in Australia and USA. About 9 plants per m per 0.9m wide row (100,000 /ha) appears optimal. Accordingly we have reduced plant densities from 12 per m of row in 1994 and 1995 to 9 per m of row in 1996.

Conclusions and Future Research

* High yields have been achieved with existing varieties and progress has been made in identifying optimum sowing dates, nitrogen fertiliser rates and plant densities.

* Future research priorities include (i) identifying varieties that produce longer fibre in the dry season (ii) detailed recommendations for the use of growth regulators (iii) integrating outcomes of agronomic research with pest management research (iv) sustainable rotation systems (v) model analysis of management scenarios using Ozcot.