start 7/91 cease 6/94.

Cotton Research and Development Corporation[1]

PROJECT TITLE:

National facility for assessment of cotton fibre quality.

PROJECT NO:	**CSP35C**
RESEARCH ORGANISATION:	**CSIRO**
PRINCIPAL RESEARCHER:	Dr. G.A. Constable CSIRO Cotton Research Unit PO Box 59 NARRABRI NSW 2390 Phone: 067 991500 Fax: (067) 931186
SUPERVISOR:	As above.

SUMMARY

This project supports the maintenance of fibre testing facilities at the Australian Cotton Research Institute. The major activities are associated with the cotton breeding program with close to 20,000 samples being processed each year in the three months after harvest. This procedure enables early generation testing of fibre properties where inferior types can be culled from further testing.

Varieties developed from this program have enabled the Australian cotton crop to improve fibre quality properties by up to 30% in the past ten years.

It is recommended that this testing method be retained, with upgrading of the equipment in 1996.

[1] Final report to CRDC; January 1995

INTRODUCTION

Industry significance

The value of the Australian crop directly relates to its quality, and the efficacy of the breeding programs concerned with upgrading quality are largely dependent on having the ability to rapidly screen large numbers of selections. The fortunes of the industry are heavily dependent on this facility being kept at a high pitch of efficiency, hence the re-equipping that has been done. The significance and importance of the facility is demonstrated by the progressive improvement in quality of recent CSIRO commercial releases. The incorporation of the fibre maturity tester into the HVI testing program now allows due attention to be paid to this important component of fibre quality. The spinning industry has signalled that increasingly in the future they will require fine, but mature cotton, and this equipment gives the Australian breeding program the tool necessary to do this.

The importance of determining fibre quality for cotton breeding

Besides yield, the major consideration affecting the return of cotton producers is quality. However, unlike yield, where simply 'more' is better, quality is not so easily defined nor is it so simply measured.

Whereas yield basically only requires measuring two components - the yield of seed cotton and the ginning out-turn, a number of assessments including fibre length, uniformity, strength, extension, fineness and maturity are needed to even roughly assess a cotton's suitability for manufacture. Different qualities then command different prices so that for a certain weight of cotton returns may differ widely.

What this means to research is that not only yield but also quality must be considered in judging the worth of a treatment - whether this be an agronomic, entomological or varietal variable. It is not simply good enough to conclude that such and such a treatment has given a certain yield advantage, hence return, since accompanying quality changes could negate the advantage.

The major consequence of this fact for breeding programs is the need for extensive quality monitoring as early as possible and as often as possible (since quality itself varies between environments) to decide the merit of genotypes as they progress through the breeding process.

The ability to rapidly evaluate quality means that we can commence screening genotypes for quality from the earliest generation (F2) and all subsequent generations to ensure they continue to meet our standards. This ability to quality-screen throughout the breeding cycle has allowed us to increase the efficiency of our breeding in that land, crop and staff inputs are not being 'wasted' on growing sub standard material. By this means we are now raising the quality levels of our material considerably and this is being reflected in our commercial releases and in those varieties acceptance on the market. It is vital that we retain this testing capability so that the industry can be supplied with the best possible cultivars to compete on the world markets.

Some years ago the fibre quality facility we transferred from Geelong, Victoria, to Narrabri Agricultural Research Station, and at the same time re-equipped with new HVI (High Volume Instrumentation) Spinlab 900 Series. We also purchased the newly manufactured Shirley FMT 3 - Fineness/Maturity Tester. This action was undertaken to improve the efficacy of fibre testing and, by the provision of the FMT 3, to extend the measures made on the cotton fibre.

The transfer of the testing from Geelong to Narrabri has been very successful, enabling us to do all our samples in time to use the data in deciding on our next season's selections, while also enabling us to process more samples. The new series Spinlab equipment has proved far more reliable and robust than the previous model.

Objectives:

1. To provide fibre quality assessments for Australian cotton breeding programs and of commercial cultivars before release.

2. To provide fibre quality assessments for agronomic and cotton management programs carried out by Australian cotton research bodies.

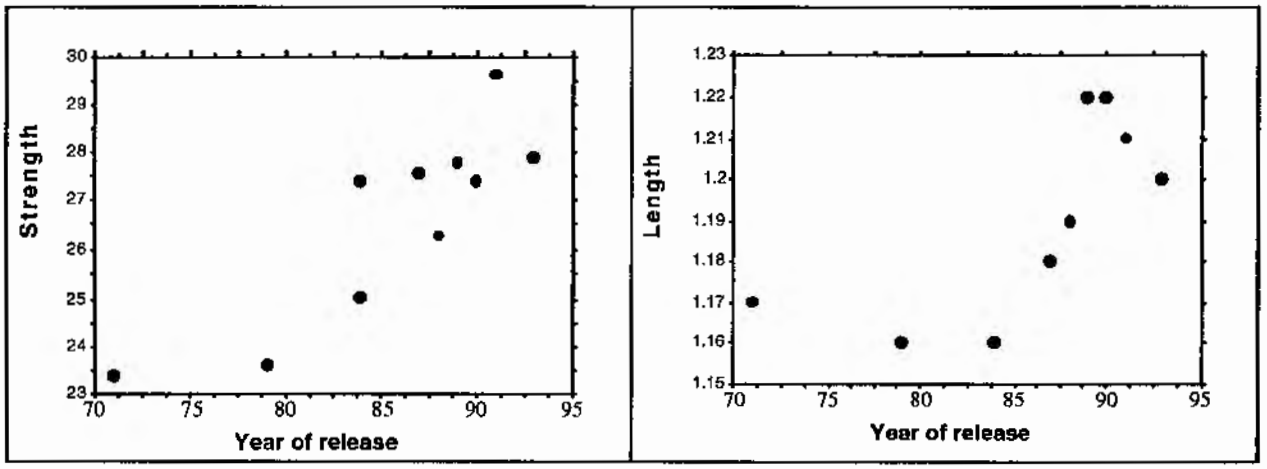
RESULTS

This project is part of an on-going program breeding Australian cotton varieties.

Improvements in local varieties.

Figure 1 shows the improvements in fibre length and fibre strength in the past decade with the release of better quality varieties. The fibre properties have increased 20-30% over that time. These characteristics have enabled easy selling on the export market.

Figure 1. Improvements in fibre properties with new varieties in the past 15 years.



New lines coming through the program are continuing the improvement. Line 114, a potential replacement for Siokra S324, has longer, stronger, more mature and finer fibres (Table 1). Siokra V-15 has much stronger fibre than Siokra 1-4.

Table 1. Fibre properties of new lines compared with their predecessor. New lines are identified in **bold** type.

Line	Gin %	Len (inch)	Unif	Str (g/tex)	Ext (%)	Mic	Mat R	Mat (%)	Fin
Siokra S324	40.0	1.17	84.4	26.9	6.0	3.9	0.93	83	154
89013-114	**39.9**	**1.20**	**84.4**	**28.9**	**5.3**	**3.9**	**0.95**	**84**	**153**
Siokra 1-4	39.2	1.21	83.7	28.1	6.4	3.7	0.91	81	146
Siokra V-15	**38.4**	**1.21**	**84.5**	**29.8**	**5.6**	**3.7**	**0.92**	**82**	**144**

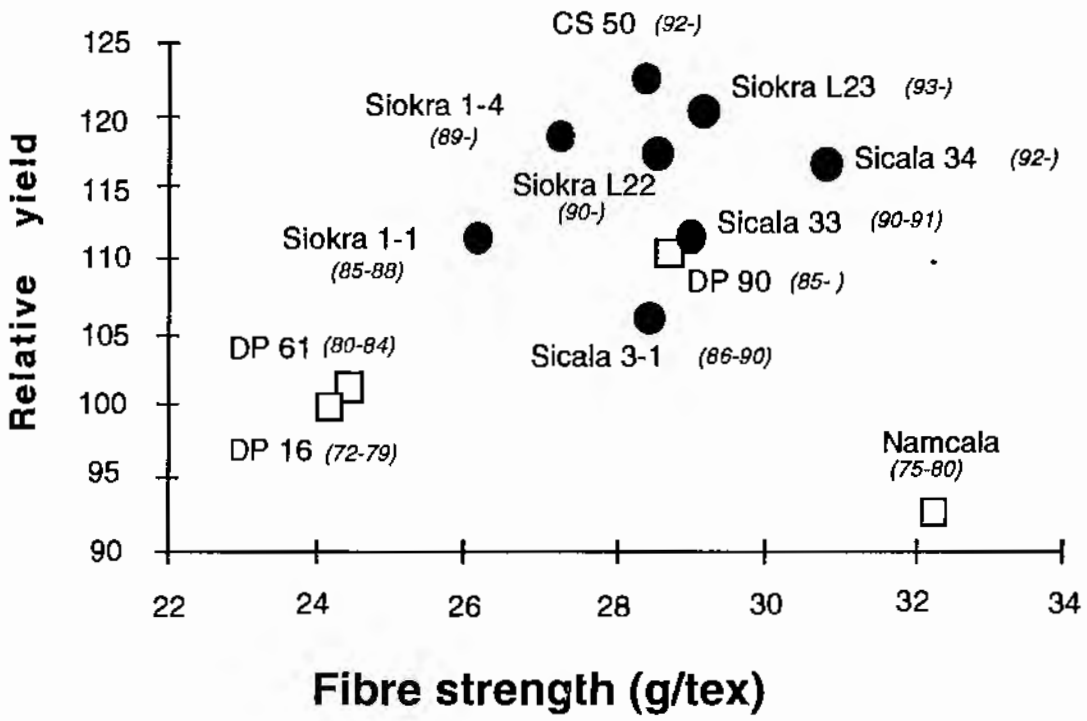
The combination of fibre properties is also very important. The value of Sicala 34 was recognised in the recent study by Schlafhorst in Germany. Table 2 shows the yield advantage of local high quality varieties compared with overseas lines. Of particular note is the poor yield adaptability of Californian Acalas to Australian conditions. Japanese buyers have already recognised the good fibre properties of CSIRO varieties compared with Californian Acalas.

Table 2. Means of fourteen high quality varieties in 1992/93 and 1993/94; ranked for yield.

	Origin	Yield	Gin%	Len	UR	Str	Ext	Mic	MR	Fin
SICALA V2	Aust	2675.	41.8	1.20	85.7	29.0	5.9	4.1	0.93	162.
SICALA 34	Aust	2597.	39.6	1.21	84.6	30.1	5.8	3.9	0.96	151.
SIOKRA L23	Aust	2469.	41.9	1.21	85.1	28.2	6.3	3.9	0.88	162.
DP90	AZ	2362.	40.3	1.17	85.0	27.6	6.6	4.0	0.88	168.
NAMCALA	AZ	2125.	37.3	1.20	85.3	31.1	5.6	3.5	0.89	142.
SIPREME	Aust	1985.	34.2	1.27	86.4	33.7	6.3	3.7	0.93	144.
ACALA 1517-91	AZ	1943.	40.3	1.18	85.3	29.5	6.0	3.9	0.86	166.
ACALA ROYALE	CA	1789.	41.4	1.18	86.3	28.9	6.6	3.8	0.93	148.
ACALA SJ-2	CA	1788.	38.0	1.20	85.4	28.1	6.1	3.8	0.85	165.
ACALA C37	CA	1617.	38.7	1.19	85.7	31.0	6.4	3.8	0.91	150.
GN88	Zimb	1616.	34.0	1.25	86.1	31.5	5.8	3.9	0.91	159.
ACALA PREMA	CA	1588.	37.8	1.19	86.0	32.0	6.6	3.7	0.90	148.
ACALA SJ-4	CA	1584.	39.5	1.16	85.9	29.4	6.3	3.9	0.94	153.
ACALA MAXXA	CA	1473.	41.4	1.20	85.8	29.7	6.3	3.5	0.84	149.
S.E.		92.5	0.38	0.01	0.39	0.55	0.2	0.08	0.017	3.0

These improvements have been combined with increased yield (Figure 2). Of particular note is the strength improvement within variety types: the progression from Siokra 1-1 to Siokra 1-4; from Siokra L22 to Siokra L23 and from Sicala 3-1 to Sicala 33 to Sicala 34 are very significant in their processing suitability.

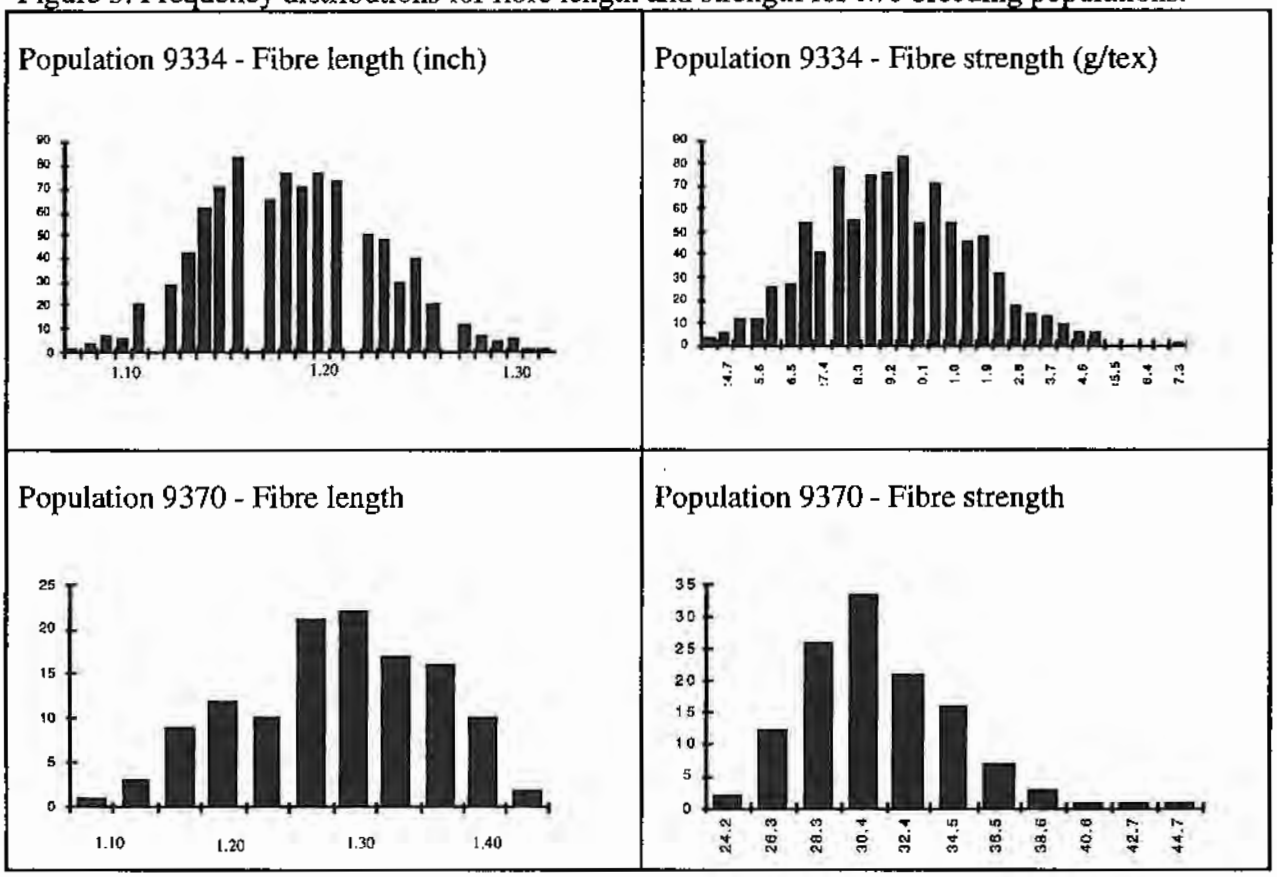
Figure 2. Improvements in both fibre strength and yield with CSIRO varieties. Values in brackets are year of release of a variety.



New material

Frequency distributions of fibre length and fibre strength from two breeding populations are shown in Figure 3. These data clearly demonstrate the amount of material with high fibre length and fibre strength. Population 9334 are progeny rows of high quality lines, while population 9370 are single plant selections of a *G. hirsutum* x *G. barbadense* cross. Note the proportion of those populations greater than 1.2 inches fibre length and greater than 30 g/tex fibre strength.

Figure 3. Frequency distributions for fibre length and strength for two breeding populations.

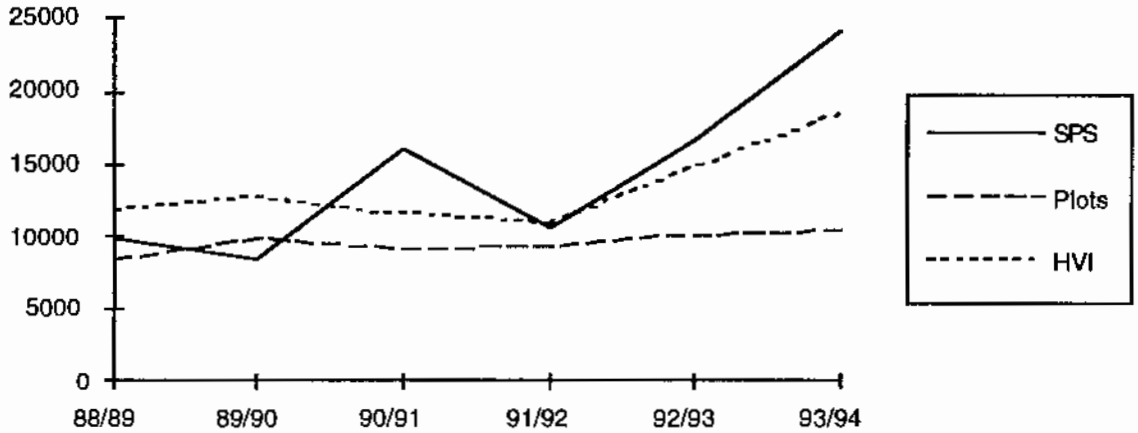


Scale and maintenance

Modifications and maintenance to the HVI line over the three years have improved the reliability of the equipment. The changes include humidity control and dust extraction, which together have improved reliability and working conditions.

Figure 4 shows the number of fibre testing samples processed in the breeding program in the past seasons. These numbers are processed in three months after harvest and enable lines of superior fibre quality to be identified and prepared for sowing by the following September.

Figure 4. Details of the size of the cotton breeding program at Narrabri in the past six years (SPS = single plant selections; Plots = field plots machine harvested; HVI = fibre testing by High Volume Instrument).



The performance of our HVI line in comparative testing, both local and international, has been satisfying. Table 3 indicates our HVI line has excellent results in both International and National standardisation schemes. We are confident our values from HVI tests, and the differences between improved types over controls are real and reproducible.

Table 3. Comparison of CSIRO HVI line with other laboratories.

a. Bremen test round (mean of 18 samples)

	CSIRO	MEAN	difference
MATURITY %	76.97	79.80	-2.66
MATURITY R	0.86	0.90	-0.04
FINENESS	160.24	157.65	2.44
MICRONAIRE (HVI)	3.80	3.88	-0.08
MICRONAIRE (FMT)	3.88	3.87	0.01
STRENGTH	25.76	26.01	-0.25
ELONGATION	6.20	6.42	-0.22
LENGTH (mm)	31.39	31.34	0.05
UNIFORMITY	82.28	82.31	-0.03

b. Cotton Classers Association of Australia test round 1994 (mean of 8 samples)

	CSIRO	MEAN	difference
MICRONAIRE	4.07	4.05	0.02
STRENGTH	28.63	30.18	-1.55
LENGTH (in)	1.16	1.15	0.01
UNIFORMITY	82.03	82.52	-0.48

DISCUSSION

The results presented above clearly demonstrate the success of the breeding program in improving fibre quality in new local varieties. The results also justify the approach taken - ie. having a HVI line on site for evaluating fibre properties in the early stages of the breeding program has been a significant advance on using a remote testing facility.

RECOMMENDATIONS

We propose to continue with the present approach. New material in the program, particularly the Bt breeding lines need a special breeding effort to ensure our fibre quality standards are not compromised. That aim will require large numbers of lines.

The current CRDC project with fibre quality has shown the importance of fibre colour and dye ability. Other aspects such as uniformity and extension have been mentioned by spinners. These aspects fibre quality will require the present HVI line to be replaced within two years. That was the basis of our application for upgrading the HVI line in 1996.

It is essential that the HVI line is on site at Narrabri. We must be able to HVI test, acid delint seed for preparation in time for September sowing. Any other option would delay the process by one year. The testing is flexible, we can work overtime or have two shifts at harvest if necessary. In addition priorities can be determined or changed on a daily basis. Our technicians have interest and ownership of fibre quality results which overcomes the boredom problem which existed at Geelong.

COMMUNICATION

Results from the plant breeding program are rapidly available to growers and consultants from the written and personal involvement by CSIRO and CSD.

APPENDIX 1

BUDGET

Item	1991/92	1992/93	1993/94
STAFF Salaries Other costs Payroll tax Worker's insurance Super. contrib.			
TOTAL STAFF COSTS			
TRAVEL	5,000	4,980	
TOTAL TRAVEL	9,960	4,980	
OPERATING			
1. Electronic Engineer	3,500	3,500	3,500
2. Casual labour	11,100	11,100	11,100
3. Maintenance	5,000	5,000	5,000
4. Electricity	4,250	4,250	4,250
5. Consumables	7,000	7,000	7,000
6. Insurance	700	700	700
TOTAL OPERATING	31,550	31,550	31,550
CAPITAL			
TOTAL CAPITAL			
TOTAL REQUESTED	36,550	36,530	31,550

Funds for this and other projects for the project supervisors	Requested in this proposal	Provided by own institutions		Provided or requested from other sources	
	$	$	Source	$	Source
This project	41,510	21,983	CSIRO		
Other projects		197,847	CSIRO		