

H 88 ✓

Cotton Research Council**FINAL REPORT*****DAQ 30L Breeding cotton cultivars adapted to management
for sustainable yields*****ORGANISATION:** Queensland Department of Primary Industries**SUPERVISOR:** Dr Peter Lawrence (1986/87)
Dr Mal Hunter (1987/88)**PERIOD:** 1986/87 and 1987/88**FUNDS:** \$19,000 (1986/87)
\$19,000 (1987/88)**OBJECTIVE:** To breed cotton cultivars for high yield under optimum conditions, but which also produce high yields in poorer environments.**SUMMARY:** Advanced breeding selections initially selected at Biloela outyielded CSIRO selections initially selected at Narrabri. In contrast, the Biloela selections were low yielders when tested in New South Wales (NSW). The highest yielding lines on the Darling Downs were those selections which were initially selected on the Downs.**BACKGROUND**

Fifteen to twenty years ago, statistical analyses of genotype-environment interaction indicated that different cultivars were required for central Queensland, Darling Downs and NSW cotton growing areas. The production of such cultivars will more likely be achieved through a local breeding effort.

The objective of this cotton breeding program is to breed cultivars which are adapted to central Queensland environments. Specific objectives include the development of cultivars having high yield, with stability of yield over years, different environments, and different crop inputs; a superior fibre quality (especially high fibre strength); bacterial blight resistance; and resistance to heliothis and pinkspotted bollworm (obtained by selecting for okra leaf, smooth leaf, frego bract and nectarilessness).

METHODOLOGY

During the past three years, we have imported 181 genotypes through plant quarantine. They have various characteristics including high strength, high tannin, glandlessness, earliness, pink bollworm resistance, stripper types, heliothis resistance, semi-dwarf, non branching, bacterial blight resistance, various boll types, and drought tolerance. These genotypes are being used as parents in our breeding program.

The high volume instrument for fibre testing located at CSIRO Geelong is enabling us to evaluate 15 000 samples per year for fibre quality (before HVI we tested 500 samples per annum). The planting, picking and ginning equipment at Biloela is enabling us to evaluate 4000 genotypes per year for yield, at 2-3 locations for some genotypes.

Screening for resistance to bacterial blight commenced in 1986/87 but we were relatively unsuccessful in achieving a high inoculation rate across plots. Bacterial blight resistance screening was not continued in 1987/88 because of the unavailability of a cotton breeder to supervise the work.

Early generation yield trials were evaluated under conditions where nitrogen fertiliser was applied at 66% of the recommended rate, and irrigation was applied at 130% of the recommended water deficit. This was our strategy for selecting genotypes that produced high yields under growing conditions that will probably be used commercially in 10-15 years when inputs become more costly.

A modified pedigree approach has been followed using F_2 derived lines for evaluation. Crosses have involved 2, 3, 4 or 8 parents. F_2 single plants have been selected for morphological characters such as leaf shape or leaf hairiness, lint % and fibre quality. Selection intensity for morphological characters was 50-75%, 50% for lint %, while fibre quality was selected at an intensity of 60-70%.

Seed cotton yield on F_3 lines was measured on single rows evaluated in a grid plot design. These were F_2 -derived lines in the F_3 . Lint yield was calculated using the lint % of the F_2 single plant modified by a heritability factor of 0.33.

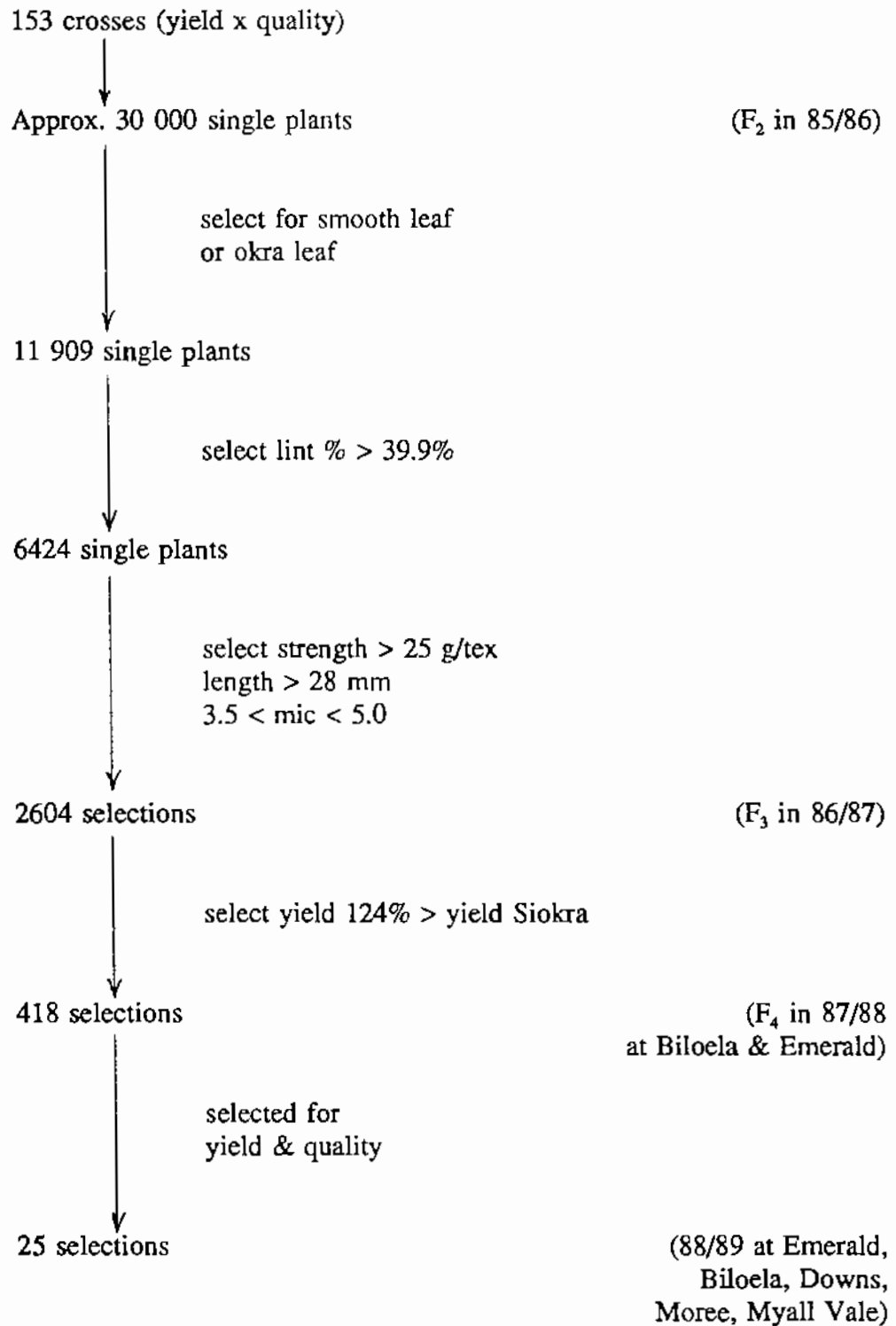
RESULTS

1987/88 Queensland Preliminary Strain Trial

In 1986/87 2604 F_3 selections were evaluated for yield at Biloela. Of these, 418 lines had a yield 124% or greater than the Siokra check (see diagram for selection history). These lines were tested in replicate trials at Biloela and Emerald in 1987/88.

In this trial 25 lines were selected as being superior in yield and fibre quality to the Siokra and Deltapine 90 checks (refer to table for detailed results). These lines would be tested in five locations in Queensland and NSW in 1988/89.

Selection history of 87/88 Queensland Preliminary Strain Trial



1987/89 Preliminary Strain Trial

Genotype	Lint yield (kg/ha)		Length	Strength	Micro	1988/89 Test Sites
	Biloela	Emerald				
PD2164/SJC1 -103	2128	2750	1.17	27.0	4.0	all
1235Comp -40	2410	2403	1.20	29.4	4.3	all
Sic1/PD2164 -2	2327	2462	1.14	24.3	4.6	
PD2164/SJC1 -101	2258	2484	1.18	30.4	4.7	all
PD2164/SJC1 -75	2107	2622	1.19	30.2	4.3	all
Comp12345678 -149	2167	2493	1.18	24.3	4.7	
DP90/HYC7659 -62	2470	2174	1.16	24.6	5.1	
1235Comp -57	2528	2078	1.16	27.1	4.6	all
Sic2/DP90//Siok -23	2203	2397	1.19	25.6	4.5	all
PD2164/SJC1 -95	2011	2582	1.17	27.9	4.0	all
PD2164/SJC1 -63	2213	2374	1.19	27.2	4.1	all
Sic1/PD2164 -10	2297	2290	1.15	26.4	5.2	
PD113/DP90 -134	2306	2249	1.17	25.9	4.7	
PD2164/SJC1 -33	2121	2420	1.21	27.0	4.4	all
PD2164/SJC1 -89	2234	2304	1.20	28.1	4.3	all
DP90/Siokra -17	2147	2372	1.16	26.5	4.5	all
DP90/HYC7659 -36	2212	2293	1.15	26.1	4.4	
PD113/DP90 -2	2261	2215	1.17	25.4	5.0	
DP90/HYC7659 -56	2371	2103	1.13	25.5	4.2	
PD111/N98308 -1	2322	2145	1.19	27.0	4.4	all
PD2164/SJC1 -41	1957	2509	1.19	28.3	4.0	all
Sic2/DP90//KNX8912 -60	2160	2289	1.16	25.8	4.7	
Ac1517/439H -36	2255	2188	1.16	25.4	4.5	
Ac1517/DP90 -22	2287	2150	1.19	25.2	4.9	
Sic1/PD2164 -29	2242	2192	1.18	25.2	4.8	
Sic2/DP90//Siokra -9	2089	2339	1.22	26.2	4.7	all
PD2164/SJC1 -6	1904	2522	1.19	29.4	4.1	all
N91830/Cok315 -12	2233	2193	1.21	26.3	4.4	all
NM838/Sic1//NM838 -162	2258	2158	1.18	25.9	4.2	
Sic1/PD2164 -18	2387	2028	1.18	24.9	4.8	
DP90/Siokra -21	2221	2188	1.15	25.2	4.8	
Siok/KNX2019*2 -59	2147	2256	1.19	26.9	4.5	all
Siok/N98308 -117	2045	2354	1.23	27.9	4.3	all
Sic2/DP90//Siokra -14	2053	2335	1.22	27.2	4.4	all
Sic1/PD2164 -53	2324	2062	1.16	26.6	4.7	
1327Comp-10	2102	2284	1.10	24.9	4.6	
DP90/Siok -50	1908	2477	1.17	26.1	4.3	all
Sic2/DP90//KNX0063 -3	2064	2319	1.21	25.3	4.3	
Cok315/DP90 -55	2037	2340	1.18	26.2	4.8	all
Sic2/DP90//KNX8912 -22	2123	2248	1.19	24.7	4.7	
PD2164/SJC1 -51	1932	2427	1.19	28.4	4.0	all
KNX2019/DP90//PD4381 -33	2320	2032	1.17	25.2	4.6	
Ac1517/439H -28	2412	1930	1.20	25.4	4.5	
Sic2/DP90//KNX8912 -54	2129	2196	1.17	25.3	4.2	
Deltapine 90	2152	2168	1.15	28.2	4.9	
Siokra	1916	2056	1.17	25.1	4.6	
average	1955	1940	1.17	26.4	4.4	
CV (%)	8	10	2.2	4.9	6.0	
LSD 5%	246	289	0	2.0	0.4	
LSD 1%	324	380	0.1	2.6	0.5	

1987/88 Queensland Advanced Strain Trial

In 1985/86 1470 F₃ lines were tested for yield at Biloela in a single replicate grid plot trial. Of these, 295 lines had a yield greater than the Siokra check (see figure for selection history) and these 295 lines were evaluated at Biloela and Darling Downs in a two replicate trial in 1986/87.

Based on yield and fibre strength relative to the Siokra and Deltapine 90 checks, 35 lines were selected for further testing at Biloela and Emerald, 11 lines were selected for further testing on the Darling Downs, and 17 lines were selected for further testing throughout Queensland and NSW. Results from these trials are presented in the following tables.

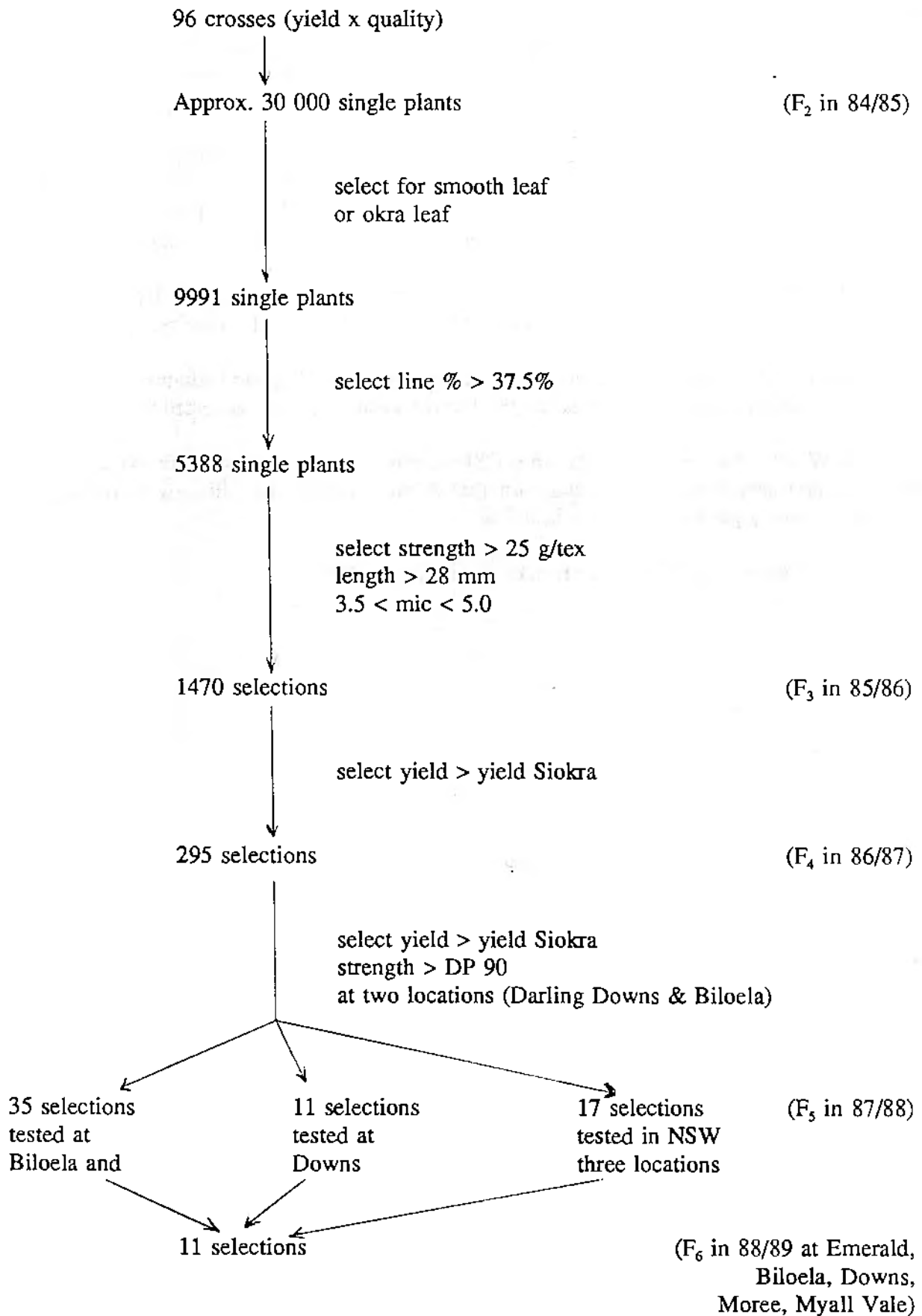
At Biloela and Emerald a few lines were superior to the commercial checks. These lines all had been selected in the previous generation at Biloela and not on the Downs.

On the Darling Downs, all 11 selections were superior to the Siokra and Deltapine 90 checks. All these selections had been selected on the Downs in the previous generation.

In the NSW locations the best lines were CSIRO selections. The best of the Queensland selections had previously been selected on the Downs. Selections which were originally selected at Biloela performed poorly in NSW.

A total on 11 lines were chosen for further testing in 1988/89.

Selection history of 87/88 Queensland Advanced Strain Trial



1987/88 Advanced Strain Trial in Biloela and Emerald

Genotype	Yield	1986/87 Selection Site	1988/89 Test Sites
St825/Siok -37	2119	Bi,DD	all
439H/DP90 -16	2111	Bi	all
439H/DP90 -41	2005	Bi	all
St825/Siok -27	2003	Bi	all
DP90	1977	check	
DP90/Sic 2 -20	1945	Bi,DD	all
KNX2019/DP90//Siok -61	1938	Bi	all
439H/DP90 -15	1936	Bi	
Sic 2/DP90//KNX0063 -18	1927	Bi	
Sicala	1918	check	
Sic 2/DP90//Nam -31	1916	Bi	
DP90/Sic 2 -14	1909	Bi	
DP70/DP90 -9	1891	Bi	
Siokra 215	1881	check	
Siok/DP90 -30	1876	Bi	
C315/KNX2019 -15	1872	Bi	
Siokra	1780	check	
Ac1517BR/Siok -51	1723	Bi,DD	all
CV (%)	10		

1987/88 Advanced Strain Trial at Darling Downs

Genotype	Yield	1986/87 Selection Site	1988/89 Test Sites
St825/Siok -45	704	DD	all
DP90/KNX0063 -54	656	DD	
KNX2019/DP90 -6	655	DD	all
C3131/Siok -33	633	DD	
Siok/McNair 220 -26	624	DD	
Ac1517BR/Siok -51	604	Bi,DD	all
St825/Siok -37	565	Bi,DD	all
DP90/Sic 2 -90	526	Bi,DD	all
KNX2019/DP90//N98275 -43	521	DD	all
DP55/N98249 -36	515	DD	
Sic 2/DP90//NM866 -23	514	DD	all
DP90	511	check	
Siokra	455	check	
Sicala	448	check	
Sicala 215	421	check	
CV (%)	10		

1987/88 Queensland Advanced Strain Trial in NSW

Genotype	Yield	Length	Strength	Micro	1986/87 Selection Site	1988/89 Test Sites
82268-263	2107	1.15	25.2	4.1	NSW	
83229-135	1997	1.14	25.5	3.9	NSW	
83203-156	1983	1.10	26.7	4.4	NSW	
St825/Siok -45	1813	1.20	26.0	3.9	DD	all
KNX2019/DP90 -6	1780	1.16	26.5	4.0	DD	all
St825/Siok -37	1709	1.19	26.5	3.9	Bi DD	all
DP55/N98249 -36	1671	1.17	26.1	4.2	DD	
DP70/DP90 -9	1641	1.15	26.8	3.9	Bi	
DP90/KNX0063 -54	1597	1.19	25.5	3.8	DD	
DP90/Sic 2 -20	1560	1.21	27.1	3.7	Bi DD	all
Ac1517/Siok -51	1531	1.18	27.0	3.5	Bi DD	all
KNX2019/Nam -41	1518	1.16	28.1	3.4	Bi	
C3131/Siok -33	1491	1.14	25.8	4.1	DD	
KNX2019/DP90//Ac1517 -2	1491	1.14	27.5	3.7	Bi	
KNX2019/DP90//N98275 -43	1486	1.21	27.4	3.6	DD	all
DP70/DP90 -67	1474	1.16	27.1	3.8	Bi	
Siok/McNair 220 -26	1459	1.18	26.3	3.5	DD	
Sic 2/DP90//NM866 -23	1412	1.17	27.8	3.9	DD	all
Sic 2/DP90//KNX2019 -65	1389	1.18	29.5	3.6	Bi	
Nam 830/C315 -29	1271	1.22	29.9	3.5	Bi	
Siokra 215	1870	1.19	27.3	3.7	check	
Sicala	1732	1.18	27.0	4.0	check	
Siokra	1683	1.20	26.2	3.6	check	
Deltapine 90	1621	1.18	26.5	4.0	check	
CV (%)		2.9	5.7	6.4		

1988/89 Queensland Advanced Strain Trial

Thirty-six selections from the 1987/88 Preliminary and Advanced Strain Trials were tested at five locations (Emerald, Biloela, Downs, Moree, Darling Downs) in 1988/89. This trial was part of the Project DAQ28.

Results of the trial are listed in the following tables.

The best selections at Emerald were slightly higher yielding than Deltapine 90 and were significantly better than Siokra and Sicala. The best Queensland selections were originally selected at Biloela.

On the Darling Downs the best line (83055-33) originated from CSIRO. This line was previously selected in CSIRO trials conducted on the Downs by QDPI. Quite a few Queensland selections were superior to the Siokra and Sicala checks. The best Queensland selections were originally selected on the Downs.

In NSW, the best selections were from CSIRO. The Queensland selections were relatively poor yielders.

Overall, three lines were chosen for further testing in NSW and Queensland in 1989/90 and eight lines were chosen for further testing in central Queensland in 1989/90.

1988/89 Queensland Advanced Strain Trial

Genotype	Yield			Length	Strength	Micro	1989/90 Test Sites
	Em	DD	NSW				
DP90/Siok-17	2200	990	2407	1.13	26.1	4.0	all
PD2164/SJC1-33	2183	1239	2038	1.16	27.9	3.7	all
439H/DP90-41	2143	1084	2356	1.15	26.2	4.0	
Cok315/DP90-55	2121	824	2280	1.15	25.6	3.8	
1235Comp-57	2117	946	2275	1.13	26.7	3.9	
Deltapine 90	2110	1305	2125	1.13	27.7	3.8	
PD2164/SJC1-89	2110	1146	1977	1.19	27.8	3.4	CQ
PD2164/SJC1-51	2105	1176	2169	1.18	28.4	3.5	CQ
St825/Siok-45	2100	1528	2217	1.15	25.6	4.1	
PD2164/SJC1-103	2089	1451	2110	1.13	27.7	3.6	CQ
PD2164/SJC1-95	2075	1343	2189	1.16	27.2	3.6	CQ
1235Comp-40	2074	1377	2258	1.14	27.8	3.6	CQ
439H/DP90-16	2072	1449	2135	1.15	28.2	3.6	
PD2164/SJC1-101	2072	1026	2372	1.14	26.7	3.8	CQ
PD2164/SJC1-6	1983	1351	2077	1.18	29.6	3.6	CQ
PD2164/SJC1-75	1966	1401	2108	1.15	29.3	3.8	CQ
DP90/Siok-36	1953	1088	2341	1.15	26.1	3.9	
Siokra 2-2	1909	1012	2578	1.20	27.9	3.9	
Sic2/DP90//Siok-9	1844	1058	2331	1.20	25.8	3.9	
Siok/N98308-117	1815	1582	2262	1.20	26.2	3.7	all
Namcala	1743	1256	1911	1.14	31.5	3.5	
Siokra 1-4	1737	695	2437	1.17	27.6	3.9	
83055-33	1734	1672	2378	1.13	29.3	4.1	
Sicala 3-2	1708	978	2291	1.16	27.9	4.1	
Sic2/DP90//Siok-23	1656	1332	2366	1.19	25.8	3.8	
LSD (5%)	252	175					

Yield Ranking for 1988/89 Queensland Advanced Strain Trial

	Em	DD	NSW
DP90/Siok-17	1	32	3
PD2164/SJC1-33	2	18	37
439H/DP90-41	3	27	4
Cok315/DP90-55	4	40	12
1235Comp-57	5	35	13
Deltapine 90	6	14	28
PD2164/SJC1-89	7	22	41
PD2164/SJC1-51	8	21	26
St825/Siok-45	9	3	19
PD2164/SJC1-103	11	4	31
PD2164/SJC1-95	13	9	24
1235Comp-40	14	7	17
439H/DP90-16	15	30	5
PD2164/SJC1-101	16	5	27
PD2164/SJC1-6	19	8	34
PD2164/SJC1-75	20	6	32
DP90/Siok-36	23	26	8
Siokra 2-2	27	31	1
Sic2/DP90//Siok-9	31	28	10
Siok/N98308-117	32	2	15
Namcala	35	17	42
Siokra 1-4	36	42	2
83055-33	37	1	4
Sicala 3-2	38	33	11
Sic2/DP90//Siok-23	39	11	6

CONCLUSIONS

The genotype-environment analyses conducted under project DAQ20 indicated there was very little genotype-environment interaction over the NSW and Queensland cotton growing regions. This analysis was conducted using advanced breeding selections from CSIRO.

This project evaluated advanced breeding lines developed by QDPI and initially selected at Biloela. The results clearly indicate there is some genotype-environment interaction between the NSW, Darling Downs and central Queensland cotton growing regions.

Separate breeding programs are probably not required for central Queensland and the Darling Downs. However, to make further progress in breeding new cultivars, early generation testing must be carried out at each of these three regions and selections made for each region. After the initial selection for morphological characters and fibre quality at Narrabri, all early generation breeding lines must be tested in all three regions.

