

9/83-9/86

1486/DAQSL

H 1986 ✓

COTTON RESEARCH COUNCIL
Final Report

DAQ - 5L Cotton breeding in Queensland

Organization: Queensland Department of Primary Industries

Supervisors: Dr. P.K. Lawrence, Plant Breeder, Biloela Research Station

Operating Staff: Mr. F.D. Page, Senior Entomologist, Entomology Branch, Biloela R.S.
Mr R.M. Noble, Senior Chemist, Ag. Chem. Branch, Indooroopilly
Miss J. Hare, Experimentalist, Biloela Research Station

Period: September '83 - September '86

Allocation: 83/84 \$ 7 800 Cotton Research Council
84/85 \$16 140 Cotton Research Council
85/86 \$15 600 Cotton Research Council

Objectives: To breed cotton cultivars that are adapted particularly to cotton producing areas in Queensland. Specific objectives include the development of cultivars having high yielding ability with yield stability over years, a superior fibre quality (especially fibre strength) and resistance to major insect pests (Heliothis and pink spotted bollworm) and diseases (bacterial blight).

At the time this project commenced, statistical analyses of genotype x environment interaction in the strain and cultivar trials 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.

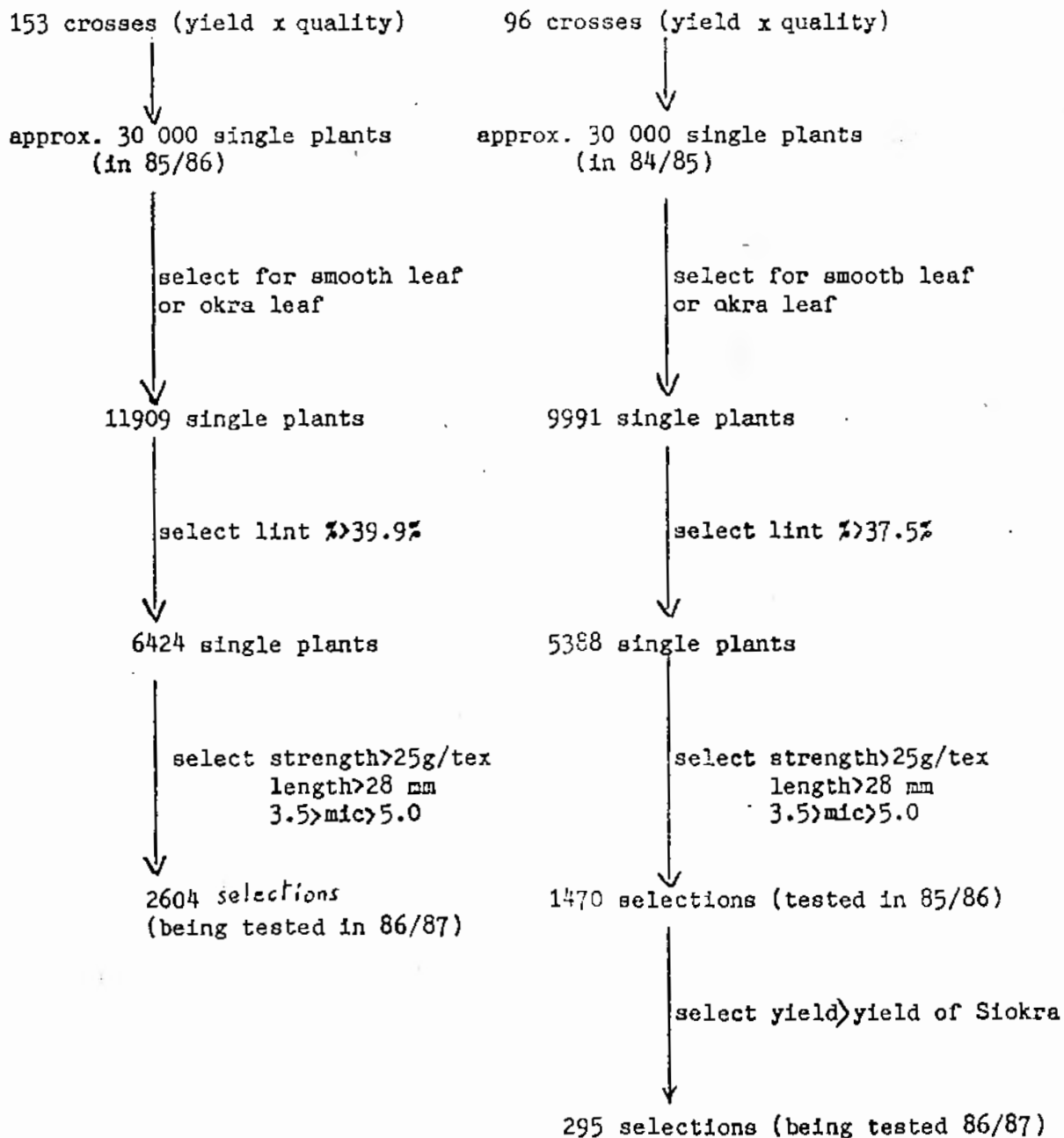
The development of cultivars having resistance to insects is a long term project which will ultimately have wide applicability. The immediate objective is to develop a suitable technique to screen breeding strains for resistance to Heliothis.

Report: Breeding

During the last three years, we have imported 181 genotypes through plant quarantine. They have various characteristics including fibre quality, high tannin, glandless, earliness, pink bollworm resistance, stripper types, Heliothis resistance, and drought tolerance. These genotypes are or will be used as parents in our breeding program.

The high volume instrument for fibre testing located at CSIRO, Geelong, is now enabling us to test large numbers of single plants (5000 - 8000 per year) for fibre quality.

The following diagram illustrates the progress being made to combine yield and fibre quality into one cultivar.



Host plant resistance to Heliothis

During 1972-79, Vince Mungomery (breeder), Peter Twine (entomologist) and Bob Noble (chemist) conducted research into developing Heliothis resistant cultivars. They used high levels of gossypol as their source of resistance and they used two techniques to measure resistance (i) chemical analysis of gossypol content of squares, and (ii) growth rate of Heliothis larvae fed on squares. They were relatively unsuccessful in developing a high yielding, good fibre quality cultivar with some level of Heliothis resistance.

Researchers in the USA (Schuster, Davis, Niles) now suggest that high tannin levels maybe a better source of Heliothis resistance. A number of germplasm strains with high tannin levels have been imported from the USA to be used in our breeding program. However, we require a suitable technique to select breeding strains for resistance to Heliothis. Researchers in the USA (Meredith, Jenkins) have developed a technique to screen breeding strains in the field for resistance to Heliothis, and other researchers (Schuster, Niles, Bird) have developed techniques to screen breeding strains in the glasshouse.

The aim of this aspect of the project is to provide the cotton breeder with a rapid, inexpensive, reliable and meaningful method of screening cotton strains for host plant resistance to Heliothis.

Preliminary studies have been conducted on a number of different methods, including:

- larval weight gain when fed on terminals
- mite resistance screening of cotton seedlings
- yield reduction on unsprayed plots versus sprayed plots
- chemical analyses of tannins and gossypol in squares and terminals.

Some of the methods appear promising but at least two more seasons experiments will be required to refine techniques.

Future Trends: Mr F. Page, Entomology Branch, took over supervision of this project beginning in 85/86.

Host plant resistance to pink spotted bollworm

Mr. Salah Ahmed, a post-graduate student from the University of Queensland, conducted his thesis project on cotton plant resistance to pink spotted bollworm. Experiments were conducted at the Biloela Research Station during 1983/84 and 1984/85 under the joint supervision of Dr. Byth and Dr. Lawrence.

Two groups of genotypes were evaluated (i) 16 isolines comprised of the factorial combinations of four morphological characters, nectariless/nectaries, frego/normal, okra/normal, smooth/hairy; and (ii) 20 genotypes which varied in their gossypol contents. The genotypes were evaluated in a sprayed regime with no insect damage and under a regime with natural infestation of pink spotted bollworm. Genotypes were evaluated for resistance to pink spotted bollworm by three methods; (i) yield reduction under pink spotted bollworm infestation compared to yield under no insect damage; (ii) green boll damage from pink spotted bollworm; (iii) X-ray screening of seed for identifying damaged seed.

Genotype	% Bolls Damaged by pink spotted bollworm in harvests.	% Seed Damage in harvest 4 (X-ray screening)	% Yield reduction	% Gossypol in carpel walls.
HG 69-15	5	4	16	0.7
HG 177-16	9	2	38	
HG 477	9	2	78	0.5
101 H	11	4	21	
VHG 1-96	14	3	2	0.7
HG P-9-13	14	3	42	0.7
PD 8619	15	8	53	0.5
BW73 549	16	3	59	
HG DD SN-3	16	3	55	0.6
Row 177-1	17	4	30	
HG 247-1	18	3	28	0.6
HG 17801 N	19	7	27	
Coker 315	20	6	61	
BW 73 529	20	8	43	
HG NC Sm-16	22	9	40	
Siokra	24	6	42	
M5 94	28	5	17	
Deltapine 61	28	5	28	0.4
MO 63 277	30	6	25	0.5
Empire Red Leaf	46	7	46	0.5
LSD (5%)	6	3	-	0.2

The best methods for screening genotypes for host plant resistance were X-ray screening of seed, and green boll damage. However, these methods were useful only if weekly harvests of seed or bolls were taken and only those harvests with high infestation levels used for selecting genotypes.

The data presented shows there are difference amongst genotypes in resistance to pink spotted bollworm and these differences are partly correlated with gossypol content.

No significant differences for resistance to pink spotted bollworm were detected amongst the 16 morphological isolines.

Future trends: Research on host plant resistance to pink spotted bollworm is not being continued because pink spotted bollworm can be controlled through cultural and insecticide management.