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QUALITY REQUIREMENTS AND COTTON BREEDING IN AUSTRALIA

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ABSTRACT

Faster spinning technology increases the physical demands placed on cotton fibres. Stronger lint is required by the processors while other quality characters, grade and yield, must be maintained. The latest CSIRO-bred, local release, SIOKRA, produced by pedigree selection from a 4-way cross, has substantially improved quality and bacterial blight resistance and performs particularly well in cooler, moister environments. Okra leaf shape and smaller bolls are the distinctive morphological features of SIOKRA. These features result in improved insecticide effectiveness and reduced disease incidence.

KEYWORDS

Varietal improvement, bacterial blight resistance, okra leaf.

INTRODUCTION

The Australian cotton industry has expanded dramatically in the last 20 years and produced more than 1 million bales in the 1984/85 season. More than 90% of the crop is exported (mainly to Japan) and with a value of about $A400 million last season, cotton is now Australia's fourth largest agricultural export.

As labour costs for processors (spinners and weavers) have risen new techniques for spinning have been sought and several systems are now replacing the old ring spinning. They all have one thing in common: they use higher spin speeds which put greater stress on the cotton fibres. Fibres with strength below 24 g/tex are unsuitable for the new machines and are becoming increasingly difficult to market.

Until recently, the standard variety in Australia was an import from the USA, Deltapine (DP) 61, which consistently turned in strength values of less than 23.5 g/tex. The only premium quality variety available, Namcala, produces lint of 28 g/tex or more but only yields 90% of DP 61. A new variety, SIOKRA, bred at Narrabri by N.J. Thomson and C. Patrick and planted on 13% of the Australian acreage in the 1985/86 season, partly overcomes this strength deficiency. There are other fibre quality characters which must be maintained in any commercial variety, including fibre length, uniformity of length, elasticity, fineness, and maturity. Certain morphological characters, particularly plant pubescence, size and shape of plant parts, and levels of disease, all lower lint grades. Grade is a subjective measure of colour and the presence of foreign objects in the lint after ginning. SIOKRA is an improved variety in all these respects. Further material is under test from two breeding programmes. This material has superior combinations of quality characters while maintaining yield.

METHODS

SIOKRA was derived from a cross between four parents of American upland cotton (*Gossypium hirsutum* L.). The cross was: (DP 61 × okra leaf nectarless experimental line) BC3 × (Namcala × Tamcot SP37) F1.

Pedigree selection was carried out at the F2, F3, and F4 generations for characters with good to high heritabilities — ginning out-turn, bacterial blight resistance, leaf hairiness, erect stance, and fibre quality. Tamcot SP37 donated a combination of genes for blight resistance (B^2, B^3, and B^7) and the experimental line donated the okra leaf shape gene (L^o) which results in a narrowly lobed leaf with less surface area than normal (L). Smooth leaves (t^3), good harvestability, and high yielding characteristics were derived from DP 61, and high quality characters from Namcala. During the selection process large populations of single plants were artificially inoculated with the bacterial blight pathogen (*Xanthomonas campestis* var. *malvacearum*) using the most virulent race available. There followed early generation (F5) multisite testing throughout the Australian growing area and then large scale commercial testing of populations before release.

RESULTS

SIOKRA has smaller seeds than DP 61 but has vigorous seedling growth. Fruit is set more rapidly which results in it being seven to ten days earlier at harvest. SIOKRA bolls are only 90% of the size of DP 61 (Table 1) and it grows less vegetatively. At maturity its bolls are more storm resistant than those of DP 61. The larger number or smaller bolls of SIOKRA enables the plant to endure periods of adverse climate (cool, wet period) better than Deltapine, SIOKRA retains fruit which would otherwise be shed and is resistant to bacterial blight.

Table 1. Fibre characteristics of two cotton varieties, DP 61, SIOKRA, and new lines being tested.

Material	Strength (g/tex)	Mean boll weight (g)	Fibre length (in.)	Lint yield (bales/acre)
DP 61	23-4	5.0	1.12	2.76
SIOKRA	24.4	4.5	1.12	3.46
Future lines	28.0	4.5	1.19	Being determined

SIOKRA has a high ginning out-turn, averaging about 37% under commercial conditions, which is 2% greater than DP 61 in cool seasons and about 1% in hot seasons. The grade and fibre length of SIOKRA is very similar to DP61 but it has increased fibre strength. Under hot conditions SIOKRA averages 0.2 micronaire units less than Deltapine which means the fibres are finer and produce better yarn. Under cool seasons the fibre is more mature than DP 61, again leading to improved spinning performance. The character combination in SIOKRA results in more mature fibre especially in cool, moist seasons; thus overcoming a long-standing problem associated with growing Deltapine-type cottons under Australian conditions.

DISCUSSION

A new American variety, DP 90, has been introduced which has a better strength (26 g/tex) than SIOKRA, but it is still deficient in other characters. DP 90, like DP 61, is more suited to hot, dry conditions where a full canopy does not cause low light levels to limit photosynthesis in the lower leaves.

SIOKRA is, we believe, the first okra leaf commerical variety that has been accepted by growers for large-scale growing. The leaf shape affords several other advantages. The open canopy allows better penetration of insecticidal sprays and the plant canopy is less humid and therefore less susceptible to boll rot. Strains of SIOKRA with the addition of absence of nectar character are under test in the hope that this will improve insect resistance. Similarly, glabrous (or completely hairless) strains are being evaluated to try and improve lint grade further.

Studies of relative varietal performance against climatic variables, particularly day-degrees, in different seasons and locations, have shown that SIOKRA does better in cooler and wetter Eastern and Southern regions of the Australian growing area (Fig. 1).

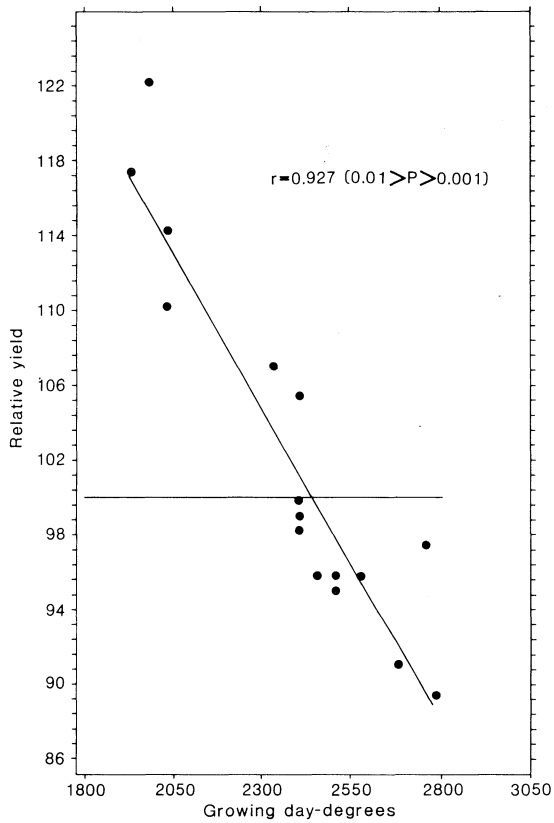

Figure 1. Relative varietal performance of SIOKRA versus DP 90 (its new commercial competitor) against total day-degrees for the growing season at a total of 16 sites in two seasons.

Our current breeding efforts involve the best African and American varieties such as Reba, Albar, and Acala to produce varieties still better adapted to Australian conditions and market requirements. We have new lines under test with fibre quality equal to Namcala and improved plant morphology and good yield.