

Evaluation of cotton cultivars under dryland and irrigated conditions in South Africa

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ABSTRACT

The RSA currently has enough cotton cultivars to satisfy the textile industry's demand for different types of fiber. Continuous research is being done to improve the genetic composition of cultivars and to overcome current limitations. Both producers and seed companies recognize the importance of cotton cultivars. New cotton cultivars are tested on different soil types in the different climatological zones before the best are released for commercial production. The Institute for Industrial Crops has been conducting the national cotton cultivar trials since 1978. This research bridges the gap between the producer and the industry so that the farmer can have statistically analyzed results against which commercial cultivars can be evaluated and the industry can receive a desirable product. Seventeen cotton cultivar evaluation trials were planted under dryland and irrigated conditions during October and November 2001. Thirteen entries were tested per locality. When the recommendations are made, the following are taken into account: yield, fiber length, fiber strength, micronaire, fiber percentage, adaptability and disease resistance. The results of the 2001/2002 season are presented in this paper.

Introduction

Cotton is cultivated mainly for its fiber, which is used in the spinning, weaving, and knitting industries. The first step in the processing of the cotton picking is taken at the gin, where the fiber, about 36% of the mass, is separated from the seed. The fiber, which is the most important product, consists mainly of cellulose. The cultivars recommended for the different areas are registered for planting in South Africa. In compiling the recommendations the following aspects were taken into consideration: yield, fiber length and strength, micronaire, fiber percentage and adaptability and disease tolerance.

The recommendations were made after these factors had been considered for each area and they include the following information: cultivars with acceptable potential, optimum planting date and optimum plant population. Specialists revise these recommendations during August every year and adapt them for the next season. The ARC-IIC has done cotton cultivar evaluation trials since the 1978/79 season. The importance of cultivars cannot be overemphasized. Cotton needs a long growing season (20 weeks) and specific climatic conditions to produce fiber with good fiber qualities. Specific cultivars perform better in some areas and after years of research, eight cotton-produc-

ing areas were identified, namely:

- Area 1: Lower Orange River (irrigation)
- Area 2: Griqualand West (irrigation)
- Area 3: North-West - Vryburg
- Area 4: North-West-Rustenburg
- Area 5: Limpopo Valley (irrigation)
- Area 6: Loskop, Springbok Flats
- Area 7: Lowveld (irrigation)
- Area 8: KwaZulu-Natal.

The objective of these trials was to evaluate the performance of different cultivars under dryland and irrigated conditions in South Africa.

Experimental procedure

Trial design

A randomized block design with four replications was used to accommodate the 13 cultivars. Each trial locality was given its own trial randomization. The trial randomization differed from year to year. Quantitative data were analyzed as factorial factors. The LSD of Tukey at $p=0.05$ was calculated to compare means.

Plot size and spacing

Each plot consisted of four rows of 9 m. There were four replications. An inter-row spacing of 1 m and an intra-row spacing of 15 cm were used for the irrigation trials and an intra-row spacing of 35 cm was used for the dryland trials. Enough seed was planted to ensure a good plant population, namely 70 kg/ha for irrigation trials and 40 kg/ha for the dryland trials. Seedlings were thinned to one seedling per planting station as soon as the seedlings were strong enough.

Soil and fertilizer

Soil types that are suitable for cotton production were used. Fertilizing was done according to the soil fertility and the yield potential of the area.

Planting date

The designated date for successful production of cotton was used. Cotton must be planted before the 1st of December in South Africa.

Pest control

Effective pest control is of the utmost importance and use of suitable herbicides and insecticides was allowed.

Observations

- Yield (kg ha^{-1})
- First picking % (only at ARC localities)
- Fiber percentage (%)
- Fiber yield (kg ha^{-1})
- Fiber length (mm)
- Uniformity
- Fiber strength (g/tex)
- Elongation (mm)

- Micronaire

Cultivation practices, irrigation, as well as weed, insect and disease control were optimal to ensure the highest possible standard at all the trials.

Cultivars

Thirteen cultivars were planted, namely:

- DeltaOPAL (a conventional cultivar from Delta Pine).
- NuCOTN 35B and NuOPAL.
- DP 5690RR (a Roundup - resistant variety from Delta Pine).
- CS189+, Sicala (two cultivars from Clark Cotton)
- JACEA 15 and JACEA 22 (two lines from the Agricultural Research Council - Institute for Industrial Crops).
- Albacala 72 (an old Acala cultivar from Swaziland).
- SZ 9314, FQ 902, BC 853 and LS 9219 (four cultivars from Quton Cotton in Zimbabwe).

Localities

The trials were planted at five dryland localities, namely Dwaalboom, Makhathini, Rustenburg, Stella and Towoomba, and eight irrigation localities, namely Loskop, Makhathini, Marydale, Rietrivier, Rustenburg, Upington, Vaalharts and Weipe.

Results

The results of only three of the thirteen cultivars evaluated at the irrigation localities, are presented in this paper.

Table 1 shows the results of the cultivar, DeltaOPAL at the eight irrigation localities. Parameters looked at as in all the tables are, yield (kg ha⁻¹), fiber %, fiber yield (kg ha⁻¹), length, strength and micronaire. Norms for the different fiber qualities are as follows:

- Length = > 26.9 - 29+mm
- Strength = > 27 g/tex
- Micronaire = 3.5 - 4.9

Table 1. DeltaOPAL at eight irrigation localities, 2001/2002.

Localities	Yield (kg ha ⁻¹)	GOT	Fiber yield (kg ha ⁻¹)	Length (mm)	Strength (g/tex)	Micronaire
Loskop	4653	37.9	1731	29.1	29.9	3.9
Makhathini	5485	37.3	1402	28.1	31.1	4.0
Marydale	7226	40.0	2841	30.8	32.6	4.6
Rietrivier	3279	41.0	1342	28.2	27.7	4.8
Rustenburg	3212	42.3	1355	29.4	34.1	4.3
Upington	5756	42.7	2451	29.4	34.0	4.1
Vaalharts	6054	43.1	2612	29.5	30.6	4.0
Weipe	8395	41.0	3919	31.0	32.2	4.5
Average	5508	40.7	2207	29.4	31.5	4.3
LSD (0.05)	1851	4.2	1435	1.9	4.8	0.7
CV%	11.7	3.6	22.6	2.3	5.2	5.7

High mean yields of up to 7226 and 8395 kg ha⁻¹ were obtained at Marydale and Weipe. The yields at the other localities were also acceptable. The values for length, strength and micronaire fall within the specified ranges. Table 2 shows the results of the cultivar, NuOPAL, at the eight irrigation localities. High yields were again obtained at Marydale and Weipe. A high fiber percentage of 43.0% was obtained at Rustenburg. The values for length, strength and micronaire fall within the specified ranges. Table 3 shows the results of the cultivar DP5690RR at the eight irrigation localities. High yields were again obtained at Marydale and Weipe. The values for length and strength fall within the specified ranges.

Conclusion

The present range of cultivars can produce good yields, if the cultivation practices are applied effectively. It is necessary that cotton producers plant cultivars that perform best in their area. Cultivar recommendations are given to producers and they can have a great impact on the production potential of a specific area and on the economy of a province.

Spinners need cotton fiber with uniform qualities. Therefore the technical committee, representing the whole cotton industry, recommended only four cultivars for the 2002/2003 season namely, OR3 for the Lower Orange River area and DeltaOPAL, NuOPAL, and DP5690RR for the rest of South Africa.

What will happen in South Africa in the future? In 1998, transgenic varieties constituted 48.6 percent of the cotton crop planted in the United States. More farmers will plant transgenic cotton, because of its advantages. With the first new stacked gene cultivar to be registered within the next year, producers are looking forward to an exciting and successful cotton season.

Table 2. NuOPAL at eight irrigation localities, 2001/2002.

Localities	Seed cotton yield (kg ha ⁻¹)	GOT %	Fiber yield (kg ha ⁻¹)	Length (mm)	Strength (g/tex)	Micronaire
Loskop	4881	37.8	1663	28.9	29.0	3.9
Makhathini	4893	37.3	1519	28.4	30.5	3.8
Marydale	7904	39.7	3077	30.6	31.3	4.4
Rietrivier	3470	41.0	1423	28.3	27.5	4.9
Rustenburg	1996	43.0	854	29.8	36.0	3.9
Upington	6108	42.3	2586	29.6	33.3	4.2
Vaalharts	5852	42.9	2508	29.4	30.0	3.7
Weipe	7366	38.3	3161	31.3	31.7	4.4
Average	5309	40.3	2099	29.5	31.2	4.2
LSD (0.05)	1924	2.9	841.1	1.68	4.7	0.7
CV%	12.6	2.5	13.9	2.0	5.2	6.0

Table 3. DP 5690RR at eight irrigation localities, 2001/2002.

Localities	Seed cotton yield (kg ha ⁻¹)	GOT %	(Fiber yield (kg ha ⁻¹)	Length (mm)	Strength (g/tex)	Micronaire
Loskop	4791	40.6	1791	29.3	27.7	4.1
Makhathini	5284	36.4	1396	28.2	31.2	3.8
Marydale	7999	39.7	3114	30.5	30.9	4.6
Rietrivier	3058	40.7	1244	28.2	28.2	4.7
Rustenburg	2957	41.3	1221	28.5	33.7	4.2
Upington	6021	42.5	2564	29.6	34.1	3.9
Vaalharts	5533	42.9	2372	30.0	28.5	4.0
Weipe	7819	38.0	3254	31.8	32.1	4.4
Average	5433	40.3	2119	29.5	30.8	4.2
LSD (0.05)	1541	2.9	531.5	2.5	2.8	0.7
CV%	9.8	2.5	8.7	2.9	3.1	5.8