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Some Properties of Various Cotton Cultivars Grown in South Africa from 1977 to 1979

by

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SOME PROPERTIES OF VARIOUS COTTON CULTIVARS GROWN IN SOUTH AFRICA FROM 1977 TO 1979

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ABSTRACT

The physical properties of more than 2 000 cotton samples, covering three seasons, various cultivars and different production areas, have been measured and averaged to provide typical values for the different cultivars. Frequency distribution curves have been used to illustrate variations in fibre properties within each of six cultivars. The inter-relationship between different fibre properties, with particular emphasis on that between micronaire and maturity within a cultivar, have been determined. Contrary to popular belief, fibre perimeter and standard fineness, derived from airflow measurements of fineness and maturity, have been found to be not constant for a particular cultivar. Aspects related to method and time of harvesting have also been covered to a limited extent.

INTRODUCTION

Cotton production in South Africa and Swaziland has increased very rapidly over the past decade, rising from 76 260 bales (15,25x10^6 kg) in 1971 to 325 071 bales (65,01x10^6kg) in 1980 (see Fig 1)[1]. At that stage, cotton production virtually equalled its local consumption and it was only necessary to import a small percentage of speciality cottons at the extreme ends of the quality range (long/fine and short/coarse) representing types that were not produced locally. Drought and economic factors, however, have led to a very sharp drop in production during the past three years but it is expected that production will eventually rise to exceed the record crop of 1980. At present, about 58% of the combined South African and Swaziland crop is produced in the Transvaal (mainly Northern and Eastern Transvaal), about 17% in the Cape Province, about 13% in Natal and about 12% in Swaziland[1]. Approximately 44% of the cotton is machine picked and some 36% of the crop is irrigated[1]. The breakdown of production by cultivar for the period 1977 to 1982 is shown in Table I.

There is little published information on the fibre physical characteristics of the various cotton cultivars grown locally. In 1974 Van Heerden and Cronje[2] published data on the strength and micronaire of various cultivars grown in different parts of South Africa while in 1980 Hunter *et al*[3,4] published typical values for the different classes of cotton produced during the period 1977 to 1979. Subsequently[5–7], the correlation between fibre and yarn properties was reported for certain of these cottons. The authors did not, however, evaluate

TABLE I

APPROXIMATE DISTRIBUTION OF COTTON CROP BY CULTIVAR[1]

	PERCENTAGE OF TOTAL ANNUAL PRODUCTION					
CULTIVAR	1977	1978	1979	1980	1981	1982
Acala	51	60	42	42	52	51
Albacala	4,5	5	10	9	13	13
Deltapine	17	12	21	22	10	10
Albar	14	9	6	6	8,5	9
Acala SJ 1	10	10	16	15	8	7
Clarcot Coker	0,1	1	2,2	3	4	5
CS2	3	1	2	2	4	4
Alma	0,4	2	0,8	1	0,5	—
Other	—	—	—	—	—	1

fibre properties in terms of cultivar. In view of the fact that such recent information is not only lacking but would be useful, it was decided to re-analyse the information compiled on the 1977 to 1979 cotton crops, placing specific emphasis on cultivar. Some attention was also given to certain other aspects, such as the interrelationship between certain of the fibre properties and the effect of the method and time of harvesting on fibre properties.

EXPERIMENTAL

Representative bale samples of cotton lint are drawn for the Department of Agriculture Cotton Grader and from these, 500g sub-samples were forwarded to SAWTRI for the 1977, 1978 and 1979 cotton crops for various fibre tests. Samples of lint were passed through a Shirley trash analyser and were then tested for micronaire, fineness and maturity on a IIC-Shirley Fineness/Maturity tester. Other than for 1979, both zero-gauge (Pressley) and 3,2 mm (1/8″) gauge bundle tenacity tests were carried out on a Stelometer using sliver prepared on a miniature card. All the Stelometer results (i.e. zero- and 3,2 mm gauge) were corrected to the Pressley values by using USDA standard samples prepared in the same way. Fibre length characteristics were determined on a digital Fibrograph (330) following standard procedures. Some 2 400 cottons were tested and the results grouped and averaged by cultivar for each of the three years, as well as for the three years combined (see Table II).

RESULTS AND DISCUSSION

Average values and distribution

In Table II the average values, ranges and standard deviations are given for each of 10 cultivars for the three years, separately as well as combined. These values, particularly those pertaining to the combined results, can be considered as fairly typical of the properties of the different cultivars. The distribution of values is shown in Figs 2 to 10 for certain of the fibre properties for the six most common cultivars. These frequency distribution histograms provide useful additional reference information about the fibre properties of the cultivars in terms of their ranges and distributions. The relatively wide spread of values is a characteristic of most of the distribution curves, particularly where a large number of samples were tested.

If the assumption is made that, for a particular cultivar, the line is genetically pure and stable, then the variations reflected in Table II and Figs 2 to 10 illustrate the influence of environmental, harvesting and ginning conditions, plus experimental or random variation. Clearly, therefore, environmental, harvesting and ginning conditions have a very significant effect on fibre properties and, consequently, on the final commercial quality of a particular cultivar. These wide differences of values frequently mask genetic differences although the latter are still evident, particularly, when considering average values as in Table II.

Figs 9 and 10 are particularly interesting in that they indicate that fibre perimeter and standard fineness (Hs) for a particular cultivar are not, as is generally assumed, genetically determined and constant irrespective of any environmental or other external influences. This aspect will be referred to again when the relationship between micronaire and maturity is discussed.

Without providing detailed supporting data, the following general trends emerged from the fibre test results.

The Acala cottons tended to be the longest, followed by Albacala and then Albar. Deltapine tended to be both weaker and coarser than the other cultivars, while the Acalas tended to be stronger and finer. Deltapine also had a lower length uniformity than the other cottons.

As previously reported[3], the cotton crop of 1979 was generally superior to those of the previous two years. Thus, the 1979 cottons tended to be longer and stronger and exhibited a greater degree of uniformity in most fibre properties. The 1979 cottons tended to be coarser (micronaire) but more uniform than in 1977 and 1978. It is interesting to note that these results are reflected in the class compositions of the national commercial crop of those three years.

Differences in fibre properties due to locality were largely masked by cultivar differences and the wide distribution of values.

With respect to the method of harvesting (i.e. whether hand-picked or machine-picked) and time of harvesting (i.e. early, middle or late) information

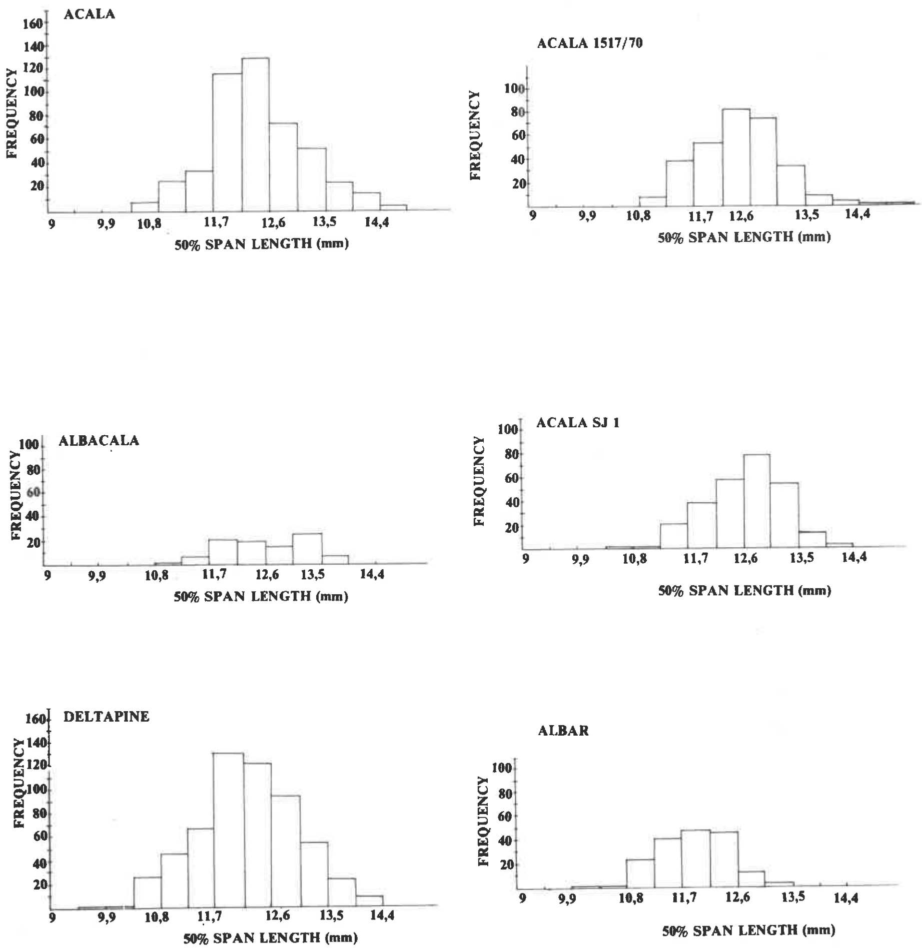

Fig. 3 – Frequency distribution diagrams for 50% span length. (Data for 1977, 1978 and 1979 pooled)

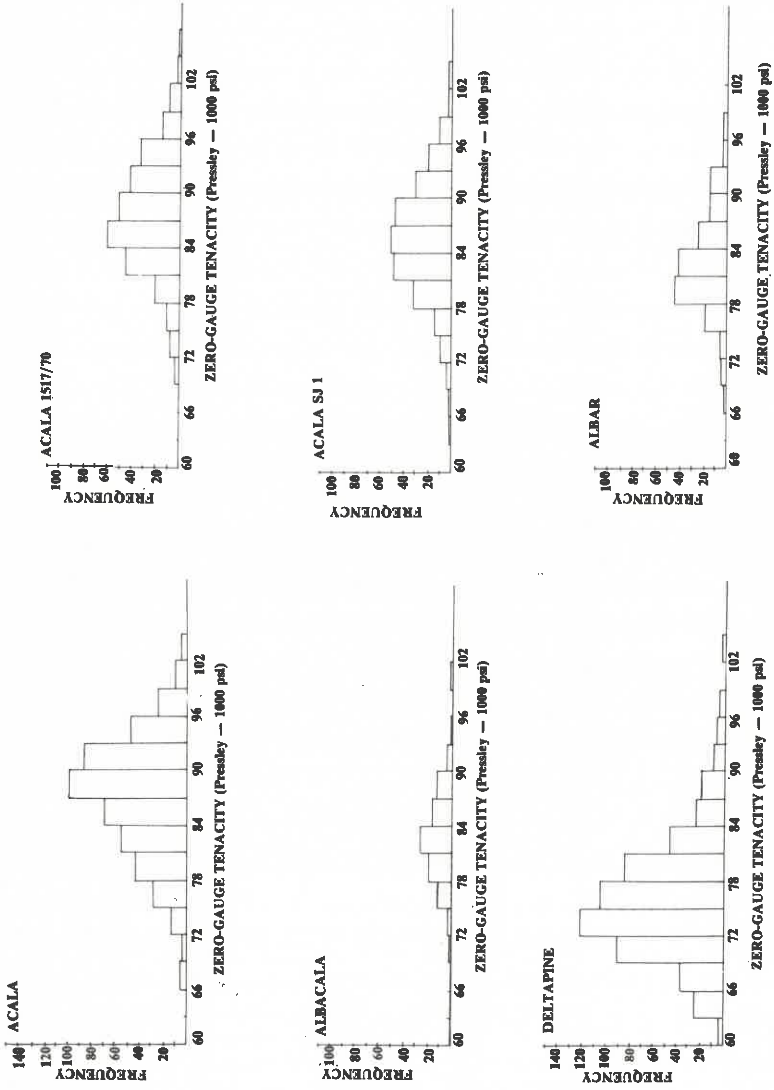

Fig. 4 – Frequency distribution diagrams for zero-gauge tenacity (Data for 1977, 1978 and 1979 pooled)

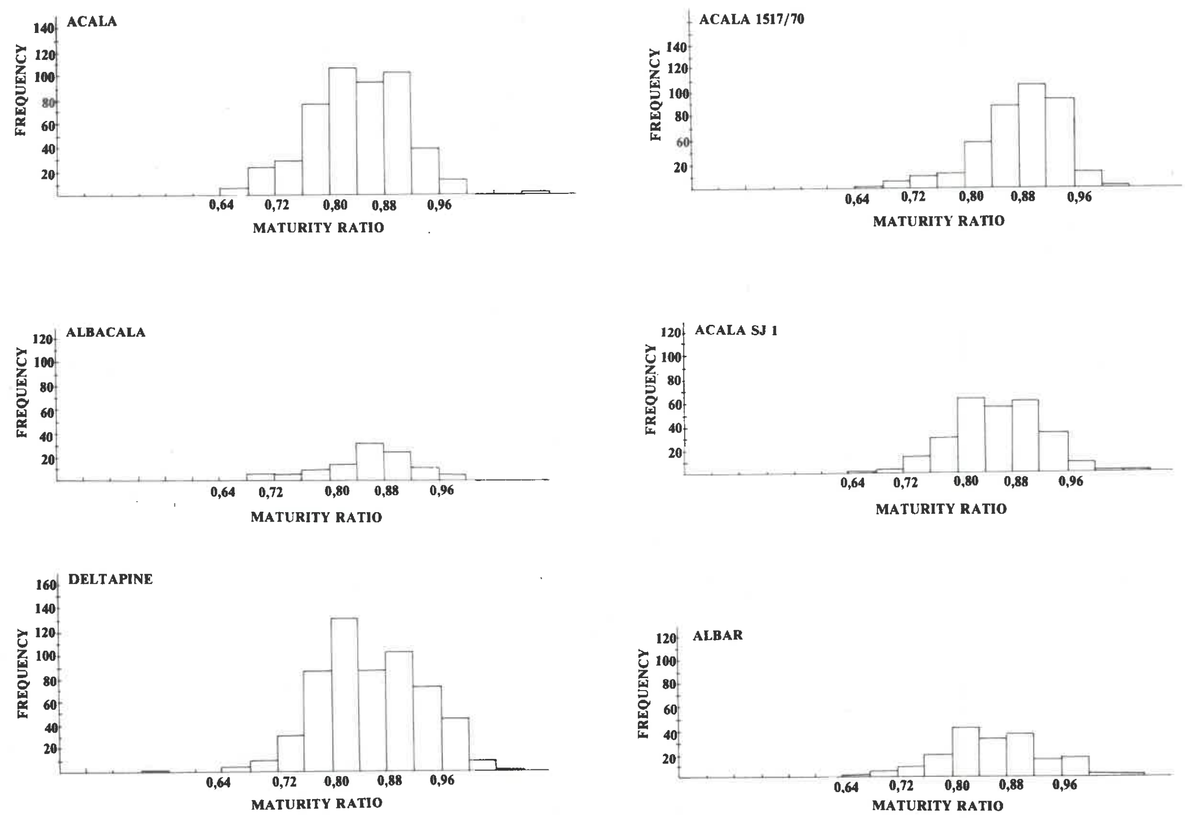

Fig. 7 – Frequency distribution diagrams for maturity ratio (Data for 1977, 1978 and 1979 pooled)

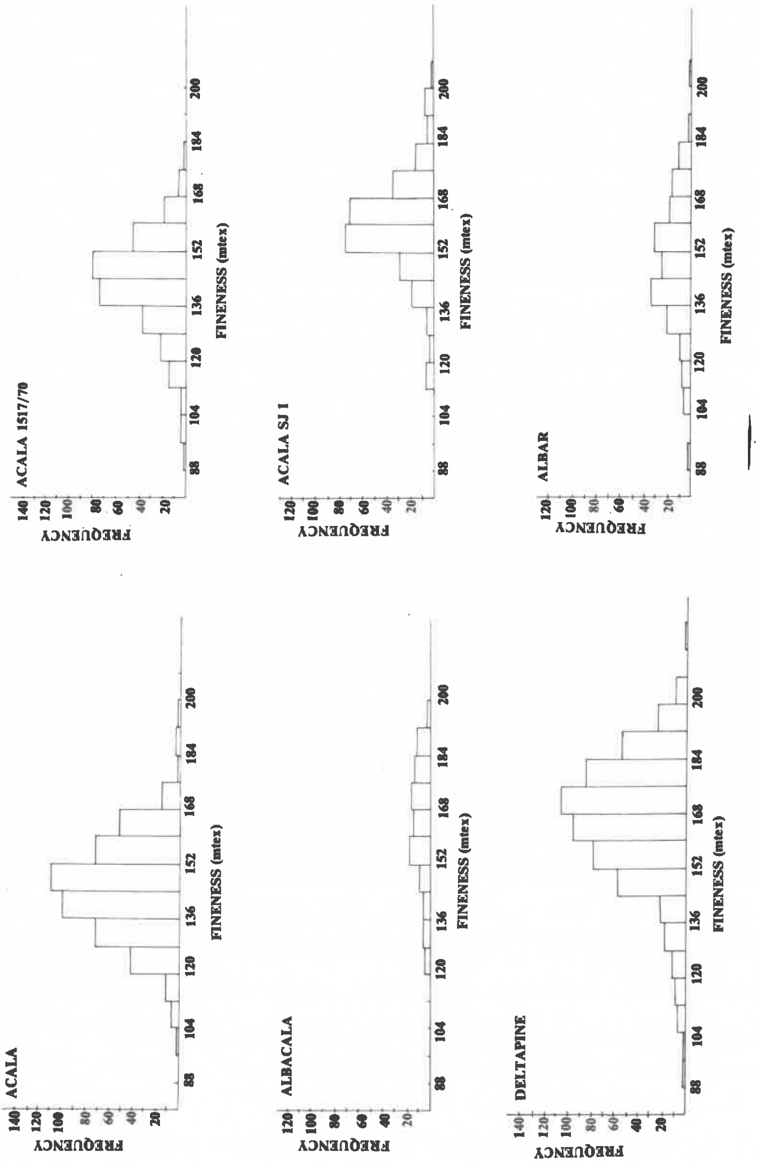

Fig. 8 – Frequency distribution diagrams for fineness (Data for 1977, 1978 and 1979 pooled)

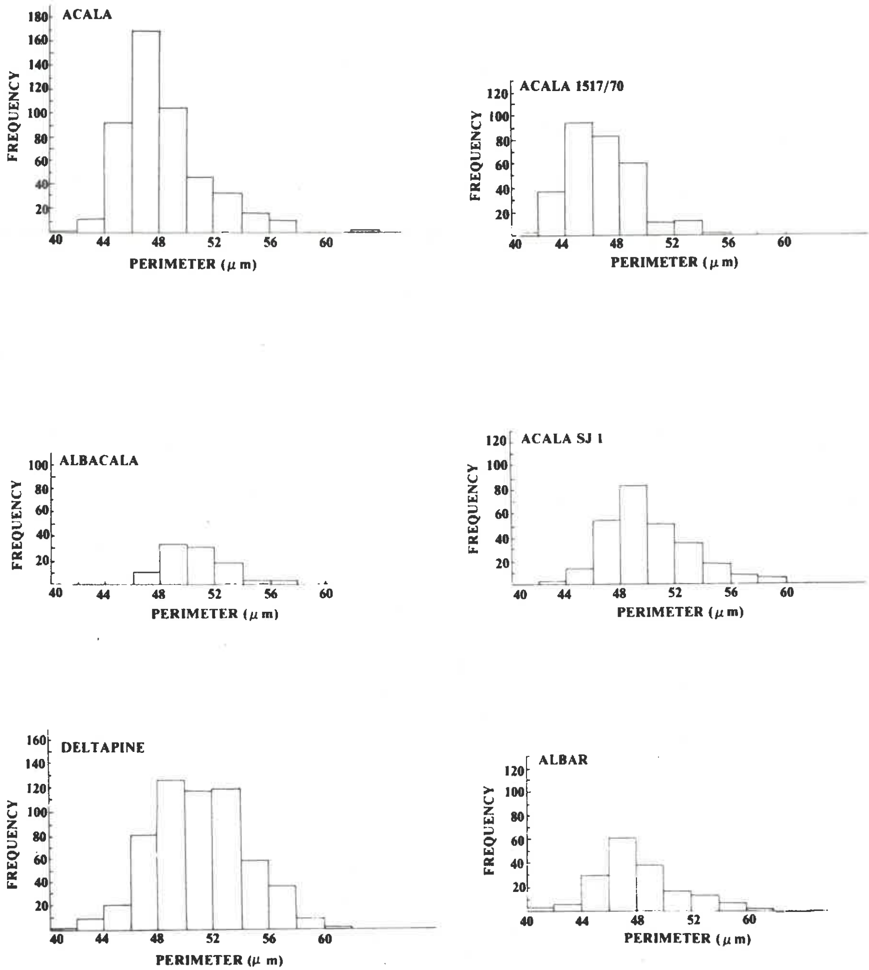

Fig. 9 – Frequency distribution diagrams for calculated perimeter (Data for 1977, 1978 and 1979 pooled)

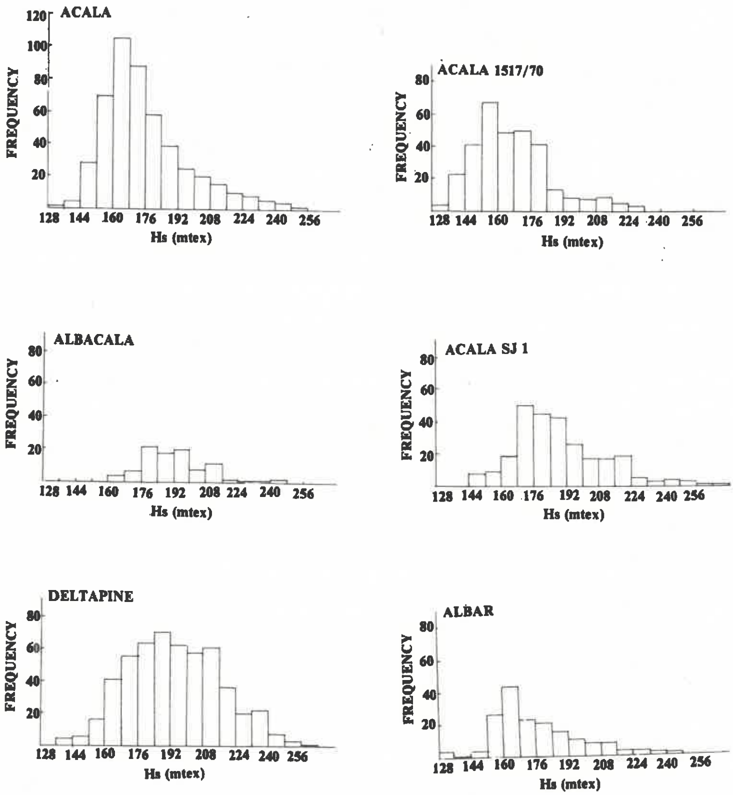

*Fig. 10 – Frequency distribution diagrams for calculated standard fineness (Hs)**. Data for 1977, 1978 and 1979 pooled.

**Hs* = measured fineness ÷ maturity

on the 1977 crop only was available. Although most differences were small, the hand-picked cottons, in general, tended to be longer ($\simeq$ 0,5 mm), coarser, stronger and less trashy (by 15%) than the machine-picked cottons, with the differences, if anything, more marked for the early season. Furthermore, the cottons harvested earlier in the season tended to be longer ($\simeq$ 0,6 mm), stronger and possibly coarser and more mature than those harvested later in the season.

Interrelationship between fibre properties

Table III gives the correlation coefficients between the various fibre properties for the combined 1977 and 1978 results. The 1979 results were excluded because no 3,2 mm-gauge tenacity values were available for that year. Table III shows that micronaire and fineness were the most highly correlated ($r = 0{,}89$), followed by the two span length values ($r = 0{,}72$) and the two tenacity values ($r = 0{,}67$). None of these correlations, however, was sufficiently high to allow the one variable to be predicted accurately from the other, particularly for such a diverse range of cottons. Table III illustrates the well known trends for longer cottons to be stronger and for a higher micronaire to be associated with a higher maturity. There was also a trend for a better length uniformity ratio to be associated with a greater 50% span length, which is to be expected, and with coarser cottons.

The question now arises whether such correlations can be improved by grouping the data according to cultivar, locality and season. If it can be established that, once such a sub-division has been made, micronaire can be used as a reliable guide to maturity, then this would greatly simplify and reduce the cost of this particular aspect of cotton fibre testing.

Linear and quadratic regression analyses were carried out for maturity ratio vs micronaire, using the data separated according to cultivar, locality and season (see Table IV). The results are given in Table V in those cases where ten or more results were available and it can be seen that, although maturity and micronaire were correlated as expected, none of the correlation coefficients was sufficiently and consistently high to allow maturity to be predicted accurately from micronaire. It remains to be seen whether this objective can be achieved if further constraints and limitations are imposed on the nature of the grouping and the range of the samples.

To illustrate the general correlation between micronaire and maturity, the results for the Acala, Albacala, Deltapine and Albar cultivars have been plotted without distinguishing between growing localities and season (see Figs 11 to 14), and the linear regression lines have been superimposed. If, in fact, fibre perimeter (p) and standard fineness (H_s) are fairly constant within a cultivar, as is often assumed, then a far better correlation than that obtained here should exist between maturity and micronaire. This supports the earlier comments on the relatively large variations in perimeter and standard fineness values. The

TABLE III

CORRELATION* BETWEEN FIBRE PROPERTIES**

	3,2 mm-gauge Tenacity	Zero-gauge Tenacity	Micro-naire	Fine-ness	Maturity Ratio	2,5% Span Length	50% Span Length	Uniform-ity Ratio
3,2 mm-gauge tenacity	1	0,67	-0,01	-0,1	0,18	0,65	0,54	0,02
Zero-gauge tenacity		1	-0,16	-0,25	0,11	0,52	0,34	-0,11
Micronaire			1	0,89	0,58	-0,06	0,31	0,54
Fineness				1	0,19	-0,15	0,21	0,50
Maturity					1	0,13	0,31	0,31
2,5% Span Length						1	0,72	-0,09
50% Span Length							1	0,60
Uniformity Ratio								1

* All values greater than 0,08 (ignoring the sign) are significant at the 99% level

** Based upon 1819 test results from 1977 and 1978 cottons

TABLE IV

NUMBER OF COTTON LOTS TESTED FOR EACH OF THE SIX SELECTED CULTIVARS AND REGIONS

Cultivar	Loskop/ Marble Hall	Louis Trichardt	Upington/ Orange River	Lowveld	Natal	Vaalhartz	TOTAL
1977							
Acala	158	0	1	0	0	180	339
Acala 1517/70	0	0	0	0	0	0	0
Deltapine	110	1	5	43	44	0	203
Albar	46	1	0	0	0	0	47
Albacala	0	0	0	2	5	0	7
SJ 1	0	1	28	0	1	0	30
TOTAL	314	3	34	45	50	180	626
1978							
Acala	63	1	0	0	0	0	64
Acala 1517/70	0	2	0	0	0	82	84
Deltapine	37	82	0	0	34	0	153
Albar	14	0	0	0	0	0	14
Albacala	0	0	0	0	37	3	40
SJ 1	9	7	0	0	0	0	16
TOTAL	123	92	0	0	71	85	371
1979							
Acala	16	16	0	6	0	0	38
Acala 1517/70	6	2	0	20	0	0	28
Deltapine	13	5	0	40	0	0	58
Albar	2	2	0	5	0	0	9
Albacala	1	0	0	0	11	0	12
SJ 1	11	5	15	19	3	0	53
TOTAL	49	30	15	90	14	0	198
OVERALL TOTAL	486	125	49	135	135	265	1 195

TABLE V

CORRELATION COEFFICIENT (r) BETWEEN MATURITY RATIO AND MICRONAIRE WITHIN A SPECIFIC CULTIVAR, REGION AND SEASON

CULTIVAR/REGION	1977		1978		1979	
	n	r	n	r	n	r
ACALA						
Loskop/Marble Hall/ Groblersdal	158	0,37	63	0,74	16	0,81
Louis Trichardt	—	—	—	—	16	0,38
Vaalhartz	180	0,72	—	—	—	—
ACALA 1517/70						
Lowveld	—	—	—	—	20	0,87
Vaalhartz	—	—	82	0,78	—	—
DELTAPINE						
Loskop/Marble Hall/ Groblersdal	80	0,56	37	0,56	13	0,54
Louis Trichardt	—	—	82	0,55	—	—
Lowveld	43	0,50	—	—	40	0,73
Natal	44	0,79	34	0,88	17	0,49
ALBAR						
Loskop/Marble Hall/ Groblersdal	46	0,45	14	0,64	—	—
ALBACALA						
Natal	—	—	37	0,47	11	0,86
SJ 1						
Loskop/Marble Hall/ Groblersdal	—	—	22	0,82	11	0,97
Upington/Orange River	28	0,41	96	0,56	15	0,76
Lowveld	—	—	—	—	19	0,71

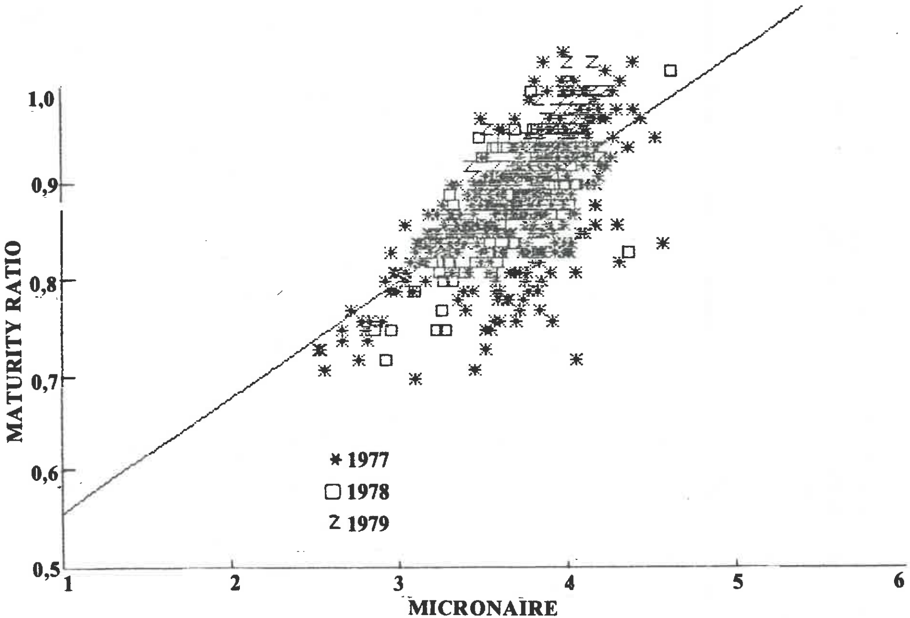

Fig. 11 – The relationship between maturity ratio and micronaire for Acala cotton

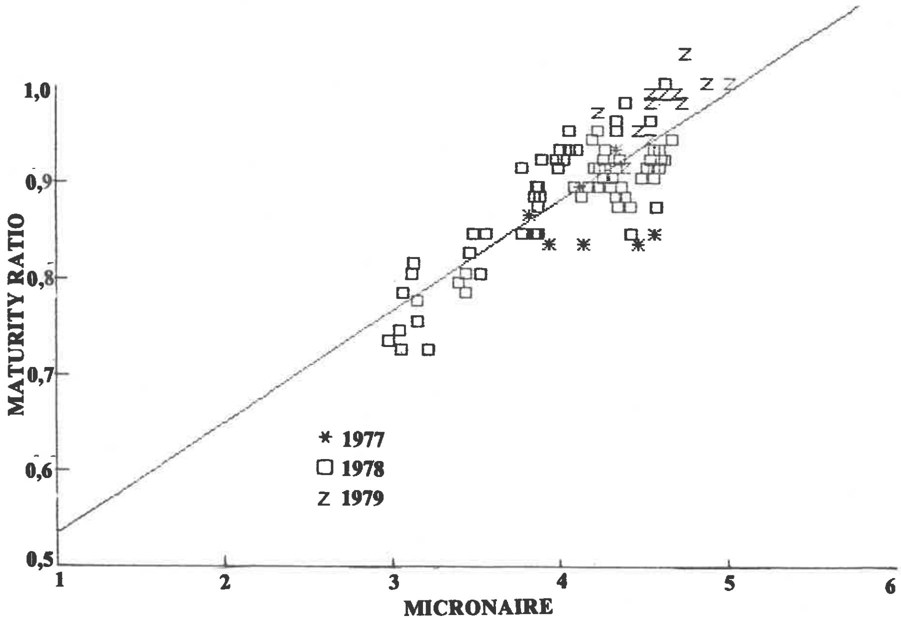

Fig. 12 – The relationship between maturity ratio and micronaire for Albacala cotton

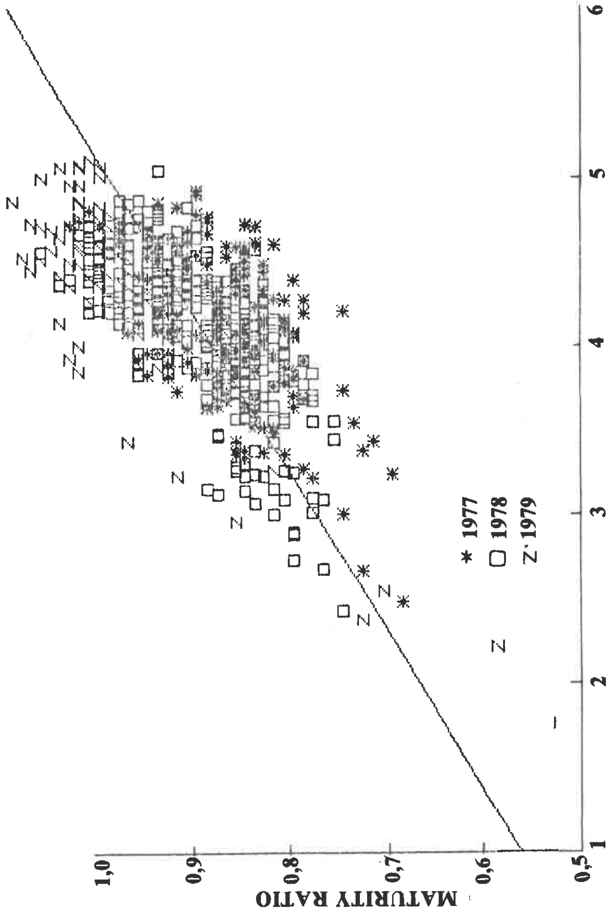

Fig. 13 – The relationship between maturity ratio and micronaire for Deltapine cotton.

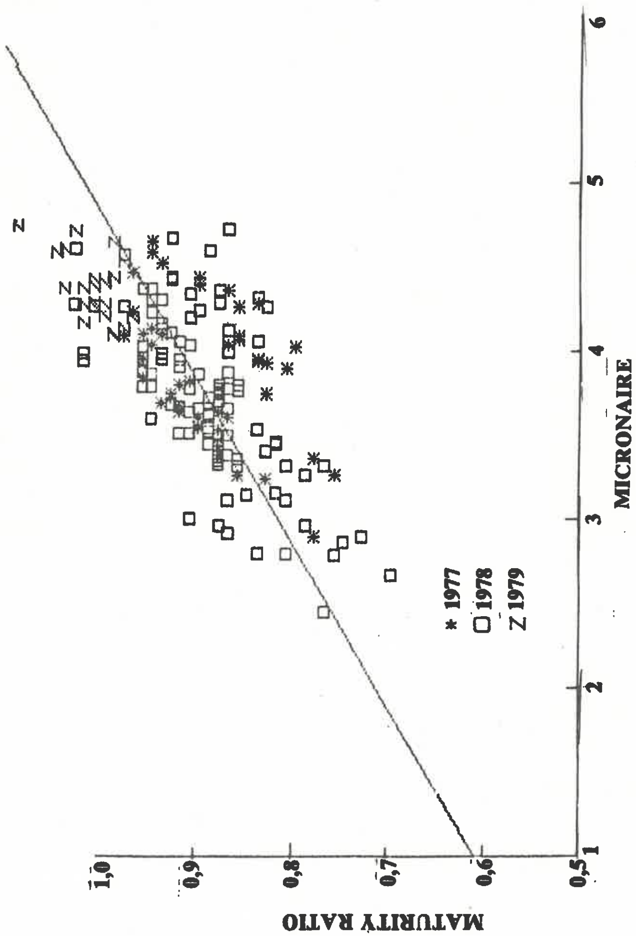

Fig. 14 – The relationship between maturity ratio and micronaire for Albar cotton.

inherent assumption in arriving at these conclusions is that the airflow method of measurement employed is both consistent and accurate.

Regression analyses were also carried out on the 1977 and 1978 fibre data separately and combined, including all the available results, to determine the interrelationship between the zero-gauge and 3,2 mm gauge tenacities and their dependence upon other fibre properties. It was found that the various air-flow measures of fibre cross-sectional dimensions (i.e. micronaire, fineness and maturity) showed very little correlation with fibre bundle tenacity (i.e. zero gauge or 3,2 mm gauge). If anything, more mature fibres were slightly stronger, and so were finer fibres provided maturity remained constant. The best correlation found was with 3,2 mm gauge tenacity as a function of zero-gauge tenacity together with either the 2,5% span length ($r \simeq 0{,}76$; $n \simeq 1500$) or 50% span length ($r \simeq 0{,}75$; $n \simeq 1500$). Clearly, therefore, no general empirical relationships emerged which enable one fibre property to be predicted accurately from any other property or combination of properties. By restricting the data, for example, to a particular cultivar and growing area and season, it may be possible to improve the correlations but it still seems unlikely that even then accurate predictions will be possible.

The most significant regression equation for the 1977 and 1978 results combined is:

$$S_1 = 0{,}26\ So^{0.47}\ Mic^{0,073}\ L^{0,81}$$

$n = 1526$; $r = 0{,}762$

where S_1 = 3,2 mm gauge tenacity (cN/tex)

So = zero-gauge tenacity (cN/tex)

Mic = micronaire

and L = 2,5% span length (mm)

SUMMARY AND CONCLUSIONS

Various fibre properties of more than 2 000 samples of cotton lint grown in South Africa from 1977 to 1979, and representing various cultivars and growing areas, have been measured. Average values have been calculated for the fibre length, strength and fineness characteristics of each of 10 cultivars, and these can be regarded as fairly typical. In addition, frequency distribution histograms have been presented for the fibre properties of the six most common cultivars. These figures illustrate the variation which can occur in the fibre characteristics of a particular cultivar when assessed over different growing seasons and localities. One factor which emerged from the distribution of fibre perimeter and standard fineness (H_S), both derived from the airflow-measured fineness values, is that both parameters vary quite widely for a particular cultivar and they cannot, therefore, be assumed to be genetically determined and constant irrespective of growing conditions. This was confirmed by regression analysis of airflow-measured maturity against micronaire, within a cultivar, locality and season, which showed that the correlation between maturity and micronaire was not as high as would be expected from the hypothesis of constant fibre perimeter and standard fibre fineness within a cultivar. This aspect justifies further investigation.

Environmental, harvesting and ginning effects often overshadowed genetic (i.e. cultivar) effects. The interrelationships between various fibre properties, separately and combined, were investigated and it was found that none of the correlations was sufficiently high to allow one fibre property to be accurately predicted from another fibre property or properties when such a wide range of cottons is covered.

As is well known, micronaire was correlated ($r \simeq 0{,}89$) with fineness, 2,5% span length with 50% span length ($r \simeq 0{,}72$) and zero-gauge tenacity with 3,2 mm-gauge tenacity ($r \simeq 0{,}67$). Similarly, the longer cottons tended to be stronger and higher micronaire values tended to be associated with greater maturity.

The Acala cottons tended to be the longest, followed by Albacala and then Albar. Deltapine tended to be both weaker and coarser than the other cultivars, while the Acalas tended to be stronger and finer. Deltapine also had a lower length uniformity than the other cottons.

As previously reported, the cotton crop of 1979 generally was superior to those of the previous two years. Thus, the 1979 cottons tended to be longer and stronger and exhibited a greater degree of uniformity in most fibre properties. The 1979 cottons were also coarser (micronaire) but distinctly more uniform than in 1977 or 1978. It is interesting to note that these results are reflected in the class compositions of the national commercial crop of those three years.

With respect to the method of harvesting (i.e. whether hand-picked or machine-picked) and time of harvesting (i.e. early, middle or late season) information on the 1977 crop only was available. Although most differences were small, the hand-picked cottons, in general, tended to be longer, coarser, stronger and less trashy than machine-picked cottons, with the differences, if anything, more marked during the early season. Furthermore, the cottons harvested earlier in the season tended to be longer, stronger and possibly coarser and more mature than those harvested later in the season.

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Table II (continued)

Cultivar	No. of Samples (n)	2,5% Span Length (mm)			Micronaire			Maturity Ratio			Fineness (mtex)			Zero Gauge Tenacity-Pressley (1000 psi)			3.2 mm Gauge Tenacity (cN/tex)		
		Range	Mean	Standard Deviation	Range	Mean	Standard Deviation	Range	Mean	Standard Deviation	Range	Mean	Standard Deviation	Range	Mean	Standard Deviation	Range	Mean	Standard Deviation
1979																			
Acala	56	25,6-31,2	28,2	0,8	3,4-4,2	3,9	0,2	0,89-1,02	0,95	0,03	133-170	152	8	82,4-102,0	92,9	4,3	—	—	—
Acala 1517/70	71	26,7-32,5	29,8	1,4	2,2-4,4	3,9	0,2	0,77-1,03	0,95	0,04	114-178	151	8	81,4-113,3	98,3	6,2	—	—	—
Cape Acala	16	29,5-31,2	30,3	0,7	3,6-4,0	3,8	0,1	0,87-0,98	0,93	0,03	144-158	151	4	91,7-102,0	96,2	3,5	—	—	—
Alma	9	27,0-29,4	27,9	0,8	3,4-3,8	3,6	0,2	0,85-0,92	0,89	0,04	138-151	145	5	84,5- 95,8	89,8	3,7	—	—	—
Deltapine	83	24,5-32,1	27,7	1,4	2,2-5,1	4,3	0,6	0,58-1,08	0,97	0,07	102-203	170	20	74,2-110,2	89,2	7,6	—	—	—
Albar	26	24,4-29,0	27,3	1,0	3,9-4,7	4,3	0,2	0,85-1,08	1,00	0,05	151-183	165	8	86,5-104,2	94,3	4,1	—	—	—
Albacala	12	26,3-28,1	27,2	0,6	4,2-5,0	4,6	0,2	0,91-1,03	0,98	0,04	163-197	182	8	87,6-107,1	94,1	5,6	—	—	—
Clarcot Coker	24	26,3-31,1	29,1	1,1	3,1-4,6	4,1	0,3	0,81-1,01	0,95	0,04	130-180	165	12	80,3-102,2	88,3	5,6	—	—	—
Clarcot CS 2	28	25,9-30,4	28,2	1,0	2,2-4,8	4,1	0,6	0,59-1,06	0,94	0,08	112-188	165	17	83,4-104,0	92,5	4,7	—	—	—
Acala SJ 1	58	26,4-30,7	28,3	1,3	3,7-5,1	4,2	0,2	0,94-1,08	0,95	0,04	152-189	168	7	85,5-106,9	94,8	5,2	—	—	—
AVERAGE	383**		28,4			4,1			0,96			161,5			93,3			—	
1977-1978-1979																			
Acala	483	25,0-31,9	28,4	1,2	2,2-4,6	3,6	0,4	0,69-1,12	0,88	0,07	110-204	153	15	65,9-110,2	92,7	7,0	17,3-34,7	26,3	2,4
Acala 1517/70	303	25,5-32,5	28,7	1,3	2,2-4,6	3,7	0,4	0,70-1,04	0,91	0,06	101-184	149	14	75,2-113,3	92,7	6,4	20,3-29,9	26,0	1,5
Cape Acala	157	27,1-31,2	29,2	0,8	2,5-4,2	3,6	0,3	0,63-0,98	0,86	0,07	109-182	150	13	79,3-107,1	93,3	4,7	24,0-30,5	27,1	1,4
Alma	20	26,5-29,4	27,8	0,8	3,1-3,9	3,7	0,3	0,81-0,97	0,88	0,04	131-163	149	9	82,4- 95,8	88,8	3,3	22,6-26,4	24,4	1,2
Deltapine	575	24,0-32,1	27,0	1,0	2,2-5,1	4,1	0,5	0,58-1,08	0,89	0,07	102-227	173	19	67,0-110,2	81,6	6,6	19,0-28,3	23,4	1,7
Albar	176	24,4-29,0	26,9	0,7	2,4-4,7	3,8	0,5	0,69-1,08	0,90	0,07	102-209	157	19	74,2-105,1	88,2	5,6	20,9-28,3	24,7	1,6
Albacala	97	25,9-29,2	27,7	0,6	3,0-5,0	4,1	0,5	0,72-1,03	0,89	0,07	131-206	171	17	76,2-107,1	88,2	4,7	21,8-27,9	24,9	1,4
Clarcot Coker	31	26,3-31,1	28,8	1,1	3,1-4,6	4,1	0,3	0,81-1,01	0,93	0,05	130-187	167	12	74,2-102,0	86,1	6,6	23,3-25,5	24,2	0,8
Clarcot CS 2	84	24,4-30,4	27,4	1,0	2,2-5,0	4,0	0,5	0,59-1,06	0,87	0,08	112-230	171	18	73,1-105,1	87,6	7,2	20,0-26,6	23,4	1,5
Acala SJ 1	236	26,4-30,7	28,3	0,9	3,0-5,1	4,0	0,3	0,68-1,08	0,90	0,06	124-212	169	13	73,1-110,2	91,9	6,4	20,1-30,8	26,5	1,9
AVERAGE	2 162**		27,9			3,9			0,89			161,3			88,8			25,2	

**TOTAL

TABLE II

AVERAGE VALUES FOR CERTAIN FIBRE PROPERTIES FOR VARIOUS COTTON CULTIVARS

Cultivar	No. of Samples (n)	2,5% Span Length (mm)			Micronaire			Maturity Ratio			Fineness (mtex)			Zero Gauge Tenacity-Pressley (1000 psi)			3,2 mm Gauge Tenacity (cN/tex)		
		Range	Mean	Standard Deviation	Range	Mean	Standard Deviation	Range	Mean	Standard Deviation	Range	Mean	Standard Deviation	Range	Mean	Standard Deviation	Range	Mean	Standard Deviation
1977																			
Acala	339	25,0-31,9	28,6	1,3	2,2-4,5	3,6	0,4	0,69-1,12	0,87	0,07	110-204	153	16	65,9-110,2	94,1	6,8	17,3-34,7	26,6	2,4
Acala 1517/70	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cape Acala	33	27,5-30,9	29,3	0,6	2,8-4,1	3,6	0,3	0,63-0,98	0,83	0,09	131-168	153	8	82,4-107,1	93,1	5,6	24,6-30,3	27,9	1,3
Alma	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Deltapine	173	24,0-28,6	26,4	0,8	2,5-4,9	4,1	0,5	0,68-1,02	0,86	0,06	115-227	177	21	67,0-103,0	81,8	6,4	19,0-28,3	23,6	1,9
Albar	47	25,7-28,7	27,0	0,5	2,9-4,6	3,8	0,4	0,75-0,97	0,88	0,06	126-191	160	18	74,2-105,1	88,8	7,0	20,9-27,4	24,5	1,6
Albacala	7	25,9-27,5	26,6	0,6	3,8-4,5	4,2	0,3	0,83-0,93	0,86	0,04	161-206	182	17	79,3- 96,8	90,0	5,4	21,8-26,6	24,1	1,5
Clarcot Coker	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Clarcot CS2	43	24,4-28,9	27,0	0,8	3,3-5,0	3,9	0,4	0,70-0,90	0,82	0,05	141-230	174	20	69,0-105,1	85,9	7,2	20,0-26,6	23,4	1,6
Acala SJ 1	30	26,7-30,2	28,9	0,6	3,5-4,6	4,2	0,3	0,73-1,02	0,88	0,07	149-207	181	17	72,1-110,2	95,0	7,8	22,6-30,8	27,6	2,3
AVERAGE	672**		27,5			3,8			0,86			162,6			90,0			25,6	
1978																			
Acala	88	25,1-29,3	27,6	0,8	2,8-4,6	3,6	0,4	0,71-1,01	0,87	0,06	126-197	151	12	72,1-103,0	86,9	6,0	21,1-28,1	25,0	1,8
Acala 1517/70	232	25,5-31,0	28,3	1,0	2,3-4,6	3,7	0,4	0,70-1,04	0,90	0,06	101-184	149	15	75,2-106,9	91,1	5,6	22,3-29,9	26,0	1,5
Cape Acala	108	27,1-30,6	29,0	0,8	2,5-4,2	3,6	0,3	0,71-0,95	0,86	0,06	109-182	149	15	79,3-100,9	92,9	4,5	24,0-30,5	26,9	1,4
Alma	11	26,5-28,8	27,7	0,8	3,1-3,9	3,7	0,3	0,81-0,97	0,88	0,04	131-163	152	10	82,4- 92,7	87,8	2,9	22,6-26,4	24,4	1,2
Deltapine	319	24,4-29,8	27,2	0,8	2,4-5,0	4,1	0,4	0,74-1,05	0,89	0,06	104-213	172	17	67,0- 92,7	79,3	4,7	19,5-27,4	23,3	1,6
Albar	103	25,2-28,5	26,8	0,7	2,4-4,7	3,7	0,5	0,69-1,02	0,88	0,06	102-209	153	21	75,2- 97,9	86,3	3,9	20,9-28,3	24,8	1,6
Albacala	78	26,7-29,2	27,9	0,4	3,0-4,6	4,0	0,5	0,72-1,00	0,88	0,06	131-198	168	17	76,2- 96,8	87,1	3,9	21,8-27,9	25,0	1,4
Clarcot Coker	7	26,7-28,5	27,8	0,6	3,8-4,5	4,1	0,2	0,83--0,94	0,88	0,05	166-187	174	8	74,2- 84,5	78,5	4,1	23,3-25,5	24,2	0,8
Clarcot CS 2	13	26,2-28,4	27,2	0,6	3,8-4,3	4,0	0,2	0,81--0,88	0,86	0,03	162-191	172	10	73,1- 93,7	82,0	5,4	20,7-24,7	23,5	1,1
Acala SJ 1	148	26,4-30,3	28,1	0,6	3,0-4,5	3,9	0,3	0,68-1,02	0,88	0,05	124-212	167	13	73,1-104,0	90,0	5,8	20,1-29,7	26,2	1,7
AVERAGE	1 107**		27,8			3,9			0,88			160,4			86,5			25,0	