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Comparative study of the properties of cotton grown in some parts of Nigeria

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ABSTRACT: A study was carried out to investigate the trash content, staple length, fineness and strength of five different varieties of cotton grown in some parts of Nigeria. The cotton fibres from Zaria, Gombe, Katsina, Makurdi, and Abeokuta were collected and their properties (staple length, trash contents, fineness and strength) were analysed using Comb sorter, Woollen Industry Research Association (W.I.R.A) fibre fineness meter, Hollingsworth cotton trash analyser and Pressley fibre strength tester. The results obtained shows that the trash content of Katsina cotton has the highest value, while Abeokuta cotton has the lowest. Based on the staple length, fineness and strength of the fibres, Abeokuta cotton has the highest staple length and fineness while Katsina cotton has the lowest staple length. Also, Abeokuta cotton has the highest strength. Since the quality of cotton yarn is affected mainly by length, fineness and strength of the fibre, therefore, Abeokuta cotton can be spun to give good quality yarn.

Keywords: Nigerian cotton, trash content, staple length, fineness, strength

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INTRODUCTION

Cotton is one of the most important fibres used for textile manufacture in Nigeria (Huson, 2003). However, before cotton can be properly selected and its relative economic value and parallel utilization emphasized, the study of all the important fibre properties and their structures need to be carefully studied (Hamby, 1966; Bernard, 1983).

Cotton is produced in over fifty countries of the world, but the bulk of the world's supply comes from a few major producers. For example, the United States of America being the largest producers in the world. Nigeria however, is considered one of the minor cotton producers (Meredith, 1975; Cassman, *et al.*, 1990).

Commercial cotton production in Nigeria started in the year 1902 by the British Cotton Growers Association with the objective of supplying cotton lint to the Lancashire cotton industry in the United Kingdom (Hamby, 1966). In Nigeria, the association commenced commercial operation in the South around Ibadan and Abeokuta with the idea of plantation production. The introduction of the American upland cotton in 1972 from Uganda however gave a boost to cotton production in Northern Nigeria which has since become a major area of production (Hamby, 1966; El-Mogahzy and Chewing, 2001; Orwell, *et al.*, 2000).

It has been shown that the properties of a textile structure depend majorly on the characteristics of the fibre from which they are made (Hamby, 1966; Hsieh, 2007). Thus, the properties of complex textile system such as yarn, fabric, etc, reflects the characteristics of the individual fibres. Important properties that have great

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influence on the processing behaviour and on the quality of the end products include fibre staple length, fibre fineness, fibre maturity, fibre strength (El-Mogahzy and Chewing, 2001; Azzouz, 2007). Others are tensile properties, moisture content and moisture regain, trash content and response to chemical treatment. Careful measuring and interpreting of these properties give useful parameters for predicting efficiency in terms of processing and end use characteristics of textile products (Hamby, 1966; El-Mogahzy and Gowayed, 1995).

In this assessment, different varieties of cotton produced in some parts of Nigeria were obtained, and their properties such as trash content, staple length, fineness and strength were fully investigated.

MATERIALS AND METHODS

Two out of the five different varieties of cotton grown in some parts of Nigeria (Abeokuta cotton and Makurdi cotton) were obtained from the Institute for Agricultural Research (I.A.R), Ahmadu Bello University, Zaria, Nigeria. The Zaria cotton, Gombe cotton and Katsina cotton were gotten from Olam industries, a ginnery which is a subsidiary of Sunseed Nigeria Ltd.

Analysis of Samples

All the analysis were carried out in a well conditioned laboratory at the Institute for Agricultural Research (I.A.R), Ahmadu Bello University, Zaria, Nigeria, maintaining the required standard testing conditions;

- Relative Humidity=65±2%
- Atmospheric temperature=20±2ºC.

All tests were carried out in accordance with the British Standards Handbook (1995).

Determination of Fibre Trash Content

100g of each of the samples was put into the feed tray and fed to the Hollingsworth cotton trash analyser. It removed the unwanted trash, expelling the cleaned cotton lint out of the machine leaving the trash on the tray in the machine.

The cleaned cotton lint was then weighed, the trash also weighed. The invincible loss was also weighed. All these weighing were then expressed as a percentage of the initial sample weight of 100g.

Thus;

$$\text{Cleaned cotton lint (\%)} = \frac{X-Y}{X} \times 100$$

Where

X = Weight of cotton + Trash content (g)

Y = Weight of Trash content (g)

Five tests were carried out on each of the samples and the mean and coefficient of variation were all determined.

Determination of Fibre Staple Length

The hand stapling method of determining fibre staple length was carried out in preference to the fibro-graph method, because the fibro-graph method gave span length instead of staple length. In the hand stapling method, each of the variety of cotton is ''hand stapled'' using the thumbs and index fingers of both hands. This was done until the cotton fibres were parallelized. A graduated ruler was used to measure the length of the parallelized fibres.

Determination of Fibre Fineness

This was obtained using the Woollen Industry Research Association (W.I.R.A) fibre fineness (calibrated in micronaire). The clean cotton made free from trash and dust was used.

5g of the test specimen was compressed into a cylindrical air flow chamber of the machine. The

air flow was then regulated by the control valve which was opened slowly until the liquid in the monometer touches the lower index mark. The air flow was allowed to flow through the test specimen and it's resistance to air flow was indicated by the position of a float in a tapered glass tube. The flow meter (calibrated in micronaire) gave the fineness reading for the test specimen and the reading was then recorded. The test was repeated four times and average value was calculated. The experiment was repeated for other samples respectively.

Determination of Bundle Strength

This is the same as the tenacity of the fibre, it is a vital attributes of the cotton fibres. It is obtained using the Presley fibre strength tester. Several tufts of the fibres were taken randomly from the bulk of the cotton and prepared it as a parallel ribbon sample from the tuft and then removed the short fibres by the means of a coarse comb provided. About 9g of the sample was weighed using the weighing balanced and transferred to the gauge of the Presley testers, and then placed back into the machine (calibrated in kilogram). When the gauge was placed in the machine, the calibration was read until the fibre breaks. The point at which the fibre breaks is termed as the breaking load. The broken fibres were re-weighed; the error on this machine was noted so as to get accurate result after testing. This was repeated for the other sample. The formula below was used to calculate the strength (tenacity) of each of the sample tested.

$$\text{Strength (g/tex)} = \frac{\text{breaking load X 6.80}}{\text{Sample weighed after breakage}}$$

(Booth, 1968).

RESULTS AND DISCUSSION

The quality of cotton depend on the amount of trash content present and the machine efficiency, since the Katsina cotton has the highest trash content and Abeokuta cotton has the lowest as shown in Table 1, it implies that Katsina cotton possess the lowest quality and Abeokuta cotton possess the highest quality. The same types of machines were used to

Table 1: Fibre Trash Content of the Varieties of Cotton

Cotton Sample	Fibre Trash Content (%)	Standard Deviation	Coefficient of Variation (%)
Zaria	3.03	0.1836	5.24
Gombe	3.14	0.2994	7.13
Katsina	4.30	0.3751	8.45
Makurdi	3.34	0.2588	6.32
Abeokuta	2.89	0.1346	4.09

Table 2: Fibre Staple Content of the Varieties of Cotton

Cotton Sample	Fibre Staple Length (mm)	Standard Deviation	Coefficient of Variation (%)
Zaria	24.48	0.2280	5.98
Gombe	26.00	0.2549	6.11
Katsina	24.30	0.5930	10.76
Makurdi	25.70	0.3278	7.83
Abeokuta	26.30	0.1580	4.97

analyse all the cotton samples. It can be observed in Table 2 that Abeokuta cotton possess the highest staple length. This was closely followed by Gombe cotton, and the least Katsina cotton. Abeokuta cotton having the highest staple length supersedes all other varieties, and this can be used to produce high quality yarns. Katsina cotton being the variety with the shortest staple length, and this can be spun into yarns of less quality. In case of fibre fineness, there are no much differences in the fineness of these cotton varieties. Abeokuta cotton has the highest fineness, while, the Makurdi cotton has the least as shown in Table 3.

It can be seen in Table 4 that the Abeokuta cotton has the highest strength, and Gombe cotton has the lowest.

Table 3: Fibre Fineness Content of the Varieties of Cotton

Cotton Sample	Fibre Fineness (mcg/inch)	Standard Deviation	Coefficient of Variation (%)
Zaria	4.12	0.1247	3.15
Gombe	4.11	0.1782	5.08
Katsina	4.16	0.2351	6.01
Makurdi	3.95	0.1946	5.42
Abeokuta	4.18	0.2134	5.76

Table 4: Fibre Strenght Content of the Varieties of Cotton

Cotton Sample	Fibre Strength (g/tex)	Standard Deviation	Coefficient of Variation (%)
Zaria	22.89	0.2562	6.24
Gombe	19.72	0.1834	5.21
Katsina	21.15	0.1973	5.57
Makurdi	20.40	0.2418	6.05
Abeokuta	23.80	0.1925	5.38

CONCLUSION

It can be concluded that of all the cotton analysed, the Abeokuta cotton has the highest staple length, fineness and strength but lowest trash content making it to be the best choice of variety in producing fine and high quality yarns. Makurdi cotton has the lowest fineness but moderate trash content, staple length and strength. It can be used for the production of coarse yarns.

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