ASSESMENT OF FIBER QUALITY OF SOME UPLAND COTTON GENOTYPES IN NORTH CENTRAL NIGERIA

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ABSTRACT

This study was conducted to evaluate the fiber quality traits of selected cotton genotypes cultivated in North Central Nigeria, with the aim of identifying superior lines for enhanced textile performance. Key fiber parameters assessed included spinability index, fiber strength, length uniformity, fineness, maturity, and upper half mean length (UHML). Results revealed that **Samcot 11** exhibited the highest spinability index (152.25), length uniformity (86.58%), and fiber strength (29.08 $kNmkg^{-1}$), indicating its potential for high-quality yarn production. **Samcot 10** recorded the highest fiber fineness (4.38), while **Samcot 12** had the lowest fiber maturity value (0.85%). All other genotypes displayed relatively uniform maturity values (0.86%) with no significant differences. However, UHML values across all genotypes were below 21 mm, reflecting generally short fiber lengths. The findings highlight **Samcot 11** as the most promising genotype in terms of overall fiber quality, suitable for further development and utilization in cotton improvement programs in the region.

Keywords: Cotton genotypes, Fiber quality, Spinability index, and Fiber strength

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) usually referred to as the "king of fibres' has global significance in the manufacturing of fibre for the cloth industry, vegetable oil for human consumption and stock for feeding domestic animals (Copur *et al* ,2018). (Kartar and Efe,,2021) Cotton cultivation has significant economic value, and it provides source of income for both medium and large scale farmers, especially in semi-arid regions of the world. Cotton (*Gossypium spp.*) remains one of the most important fiber crops globally, serving as a critical raw material for the textile industry and contributing significantly to the economies of many developing countries, including Nigeria (Odedokun *et al* 2015). The quality of cotton fiber is a key determinant of its market value and processing efficiency, influencing characteristics such as yarn strength, fineness, and uniformity. In Nigeria, cotton production is predominantly carried out by smallholder farmers, with yields and fiber quality varying widely across different regions and genotypes (Endale *et al* 2023).North Central Nigeria presents a unique agro-ecological environment that could influence cotton performance, yet there remains a gap in comprehensive data on the fiber quality traits of locally cultivated and improved genotypes in this region. Assessing the fiber quality of different cotton genotypes under the specific climatic and soil conditions of North Central Nigeria is essential for

guiding breeding programs, improving cotton productivity, and enhancing the competitiveness of Nigerian cotton in global markets.

This study aims to evaluate the fiber quality attributes—such as fiber length, strength, micronaire, and uniformity—of selected cotton genotypes grown in North Central Nigeria. The findings will provide valuable insights into genotype performance, support cultivar selection, and contribute to the development of high-quality cotton varieties suited to the region's growing conditions.

MATERIALS AND METHODS

Description of the Study Area

The study was carried out at the experimental garden; Department of Plant Biology, Federal University of Technology, Minna, Niger State, Nigeria. Geographically, Minna is located in the North Central geopolitical zone of Nigeria, found within latitude 9^0 36 North and longitude 6^0 34 East. It covers a land relative humidity and rainfall of 20-30^{0}C area of 88 square kilometres with an estimated human population of 6.7 million as at 2020. (United nations data,)

Seed source

The cotton genotypes were collected from the Institude of Agricultural Research Ahmadu Bello University Zaria Kaduna State

Experimental Design and Sowing of Seeds

The six genotypes of cotton collected were raised using a complete randomized design (CRD) with five replicates. Five seeds of each genotype were sown at the depth of 1-2cm in an experimental bag of about 20 litre size of bucket.. All other cultural practices including weeding were uniformly adopted throughout the growing period to minimize the environmental variation

Harvest of dried opened boll

The dried boll containing the lint were harvested and seed remved from each of the collected genotypes lint. The possible trash with the dry calyx were removed and the lint weighed using metlar balance Model: MP 600. The samples were further transported to Siverton fiber quality laboratory for further analysis in South Africa.,

Methodology for Determining Fibre Quality

The fibre quality analysis were carried out at Cotton Samples Testing Laboratory Cotton SA, Silverton, South Africa. The cotton lint samples were conditioned for 24 hours in standard atmospheric conditions (Temperature = 20˚C ± 2 and R.H. % = 65% ± 2) before testing. The fibre parameters was determined using High Volume Instrument (HVI 900A). The procedure of testing was adopted as described in America Society for Testing Material (ASTM) Standards (2005).

Data Analysis

The data collected were subjected to analysis of variance (ANOVA) (SAS InstituteInc.2004). Mean separation was done by Least Significant Difference (LSD). The statistical model that

was used for the analysis was based on the linear model for randomized complete block design according to Kaps and Lamberson (2004)

RESULTS AND DISCUSSION

Micronaire is referred to as fineness of the single cell trichome that arise or originate from the seed. The medium (3.00 – 3.90µg/inch) to moderately (4.00 – 4.90µg/inch) fineness in fibre quality obtained in the study is an indication of the quality of the genotype Bakhsh *et al*. (2019) reported that the end product of fibre in cotton is affected by the fineness quality. However, fineness range (3.50 - 4.90) obtained in the study within the ranged value (3.41 – 5.90) reported by Okubazghi *et al*. (2017) but lower than the range value of (4.55 – 5.42) by Chen *et al*. (2018). The slight variation in the ranged of the result could be attributed to variation in the photoperiod and environmental conditions of experimental sites. Variation or increase in mean Micronaire had been attributed to effects of increased temperature during the fibre-thickening period due to quicker crop development arising from increased temperature (Luo *et al.*, 2016).

Fibre maturity, this indicate the degree of cell wall thickness, which is measured in percentage the acceptable range is 80 % and above. According to Luconge (2005), the values recorded in this study lies within the recommended value. The finding of this research is supported with the work of Bourgou *et al.* (2018).Who reported similar value for *Gossypiumbarbadense* it was observed that genotype with this kind of value are diverse.

Fibre strength (g/tex) is a key quality parameter in cotton that has ultimate impact on durability of the fibre during harvesting, ginning and manufacturing of the yarn.The range ofvalues of 24.18 to 27.73 obtained in this study for fibre strength fall within the findings of Sawar *et al.* (2016) who pointed out that fibre strength are more responsive to the growth in the environment. These values were lower than the values of 25.14 – 35.56 earlier reported by Sun *et al.* (2019) and 29.50 to 32.08 by Chen *et al.* (2018). Similarly, the values are slightly lower than the recommended value as measured by high volume instrument. These finding differs greatly with the work of Luconge (2005), and Bhangu *et al.* (2017), perhaps it may be due to differences in the genetic make-up of the genotypes grown under assorted environmental conditions.

Fibre elongation which is a measure of percentage which define strength with which a bundle of fibre incured prior to break. The acceptable ranges of fibre elongation had earlier been reported ranged from 5.20 to 8.00 and above are regarded as high. The values of fibre elongation recorded (5.78 – 6.30) in this study were within the acceptable range. In conformity with this result, Okubazghi *et al.* (2017) reported a range of 4.03 to 6.90. Turley *et al.* (2019) had reported similar acceptable valuesand differ slightly with the findings of Basbag and Gencer (2007) who reported that genotype variation account for differences in fibre elongation.

Uniformity index had been reported to be a vital trait to consider in selection programme of the crop. According to Luo *et al.* (2016), low fibre length uniformity and high short fibre

content are associated with increased manufacturing waste and decreased spinning efficiency during yarn processing. The fibre uniformity index obtained (82.95 – 86.58 %) in this study. These values fall within the range of 76.33 – 86.275 % with an average mean of 81.88 % earlier reported by Okubazghi *et al.* (2017). The slight variation in the minimum value could be ascribed to the variation of daily mean and amplitude temperature as reported by Sawar *et al.* (2016).

Table 2a: Fibre Qualities Composition of Six Nigeria Cotton genotypes

Genotypes	SCI	MIC (µg/inch^{-1})	MAT (%)	UHML (mm)	UI (%)	SF (%)	STR (kNmkg^{-1})
SAMCOT8	131.00±10.22^{b}	4.13±0.04^{ab}	0.86±0.00^{ab}	1.13±0.02^{ab}	84.43±0.86^{b}	6.30±0.53^{b}	26.10±1.78^{ab}
SAMCOT9	129.25±3.94^{ab}	3.96±0.07^{a}	0.86±0.00^{ab}	1.11±0.02^{a}	82.95±0.19^{a}	7.40±0.18^{c}	27.73±0.85^{bc}
SAMCOT10	116.50±4.56^{a}	4.38±0.01^{c}	0.86±0.00^{ab}	1.10±0.02a	83.55±0.66^{a}	6.70±0.14^{b}	24.18±0.17^{a}
SAMCOT11	152.25±2.50^{c}	4.02±0.04^{ab}	0.86±0.00^{ab}	1.19±0.02^{b}	86.58±0.58^{c}	5.03±0.40^{a}	29.08±0.18^{c}
SAMCOT12	121.75±2.56^{ab}	4.05±0.02^{ab}	0.85±0.00^{a}	1.09±0.01^{a}	83.70±0.39^{a}	7.03±0.41^{bc}	25.30±0.21^{ab}
SAMCOT13	125.00±7.49^{ab}	4.09±0.03^{b}	0.86±0.00^{ab}	1.11±0.03^{a}	83.69±0.74^{ab}	6.43±0.32^{b}	26.43±0.95^{abc}

Values are mean ± stand error of mean. Values of genotypes followed by the same letter(s) along the column are not significantly different at P > 0.05

SCI=Spinability index MIC= Micronaire MAT= Maturity UHML= Upper Half Mean Length UI=Uniformity Index SF= Short Fibres STR =Strength

Table 2b: Fibre Qualities Composition of Six Nigeria Cotton genotypes in Minna.

Genotypes	ELG (%)	RD (%)	+B	CGRD	TrCnt	TrAr (%)	TrID
SAMCOT8	5.78±0.10a	75.70±0.57^{d}	9.18±0.24^{b}	34.15±2.32^{b}	20.25±3.15^{b}	0.43±0.09^{ab}	3.50±0.65^{ab}
SAMCOT9	6.15±0.09bc	76.08±0.26^{d}	8.78±0.22^{b}	31.25±0.03^{a}	10.75±0.63^{a}	0.18±0.02^{a}	1.50±0.29^{a}
SAMCOT10	6.05±0.09abc	74.75±0.30^{cd}	9.15±0.06^{b}	31.58±0.21^{a}	27.25±2.46^{bc}	0.47±0.08^{ab}	3.75±0.48^{ab}
SAMCOT11	5.90±0.04ab	74.08±0.54^{bc}	8.65±0.10^{ab}	36.35±2.86^{b}	25.50±3.71^{bc}	0.45±0.10^{ab}	3.75±0.48^{ab}
SAMCOT12	6.30±0.11c	73.00±0.52^{ab}	7.80±0.32^{a}	43.65±2.48^{c}	33.75±1.93^{cd}	0.51±0.09^{b}	3.75±0.48^{ab}
SAMCOT13	6.00±0.08ab	72.30±0.61^{a}	9.18±0.30^{b}	39.43±2.42^{bc}	38.25±2.95^{d}	0.62±0.08^{b}	4.50±0.50^{b}

Values are mean ± stand error of mean. Values of genotypes followed by the same letter(s) along the column are not significantly different at P > 0.05

ELG=Fibre Elongation (%) RD= Brightness b= hunters scale. CGrd=Colour grade code
TrID=Indication of trash particles

0.01 inch in diameter or larger TrAr= The (%) of the sample area occupied by trash.

CONCLUSION

The findings highlight **Samcot 11** as the most promising genotype in terms of overall fiber quality,suitable for further development and utilization in cotton improvement programs in the region
The fibre qualities determined in all the genotypes are in the range of USDA standard and they can be employed in yarn processing and further use in the textile industry.

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REFERENCES

Bakhsh A., Rehman,M., Salman, S., & Ullah, R. (2019). Evaluation of cotton genotypes for seed cotton yield and fibre quality trait under water stress and non stress conditions.*Sarhad Journal of Agriculture*,35(1),161-170.

Basbag, S. & Gencer, O. (2007) Investigation of some yield and fibre quality characterstics of interspecific hybrid Gossypium hirsutum L.x .G.barbadense L. Cotton Hereditas 144, 32-42

Bhangu, D., Wayne Smith, C., & Hague, S. (2017)Performance of the Extra Long Staple Upland, Long Staple Upland,and Extra Strength Upland Fibre Traits in South Texas *Journal of Cotton Science,* 21,190–198.

Bourgou, L., Koulibaly, B., Hema, O.S., Sawadogo, M., Denys-Sanfo, D., Hubert, S.E., Carol-Kelly, B, & . Dever, J.K. (2018). Characterizing Primitive Cotton Acccessions (*Gossypium* Spp.)CollectedIn Burkina Faso To Identify Potential Sources For Fibre Quality EnhancementIn West African Cultivars.*Journal Of Cotton Science* 22,1–11.

Chen, Y., Liu, G., Ma, H., Song, Z., Zhang, C., Zhang, J., (2018). Identification of introgressed alleles conferring high fibre quality derived from *Gossypium barbadense L.* @ in secondary mapping populations of G. hirsutum L. Front. Plant Sci. 9, 1023. doi: 10.3389/fpls.2018.01023

Çopur O, Polat D, Odabaşıoğlu C. (2018) Effect of different sowing dates on cotton (*Gossypium hirsutum* L.) fiber color at double crop growing conditions. Harran *Journal of Agricultural and Food Science.* ;22(1):67–72.

Endale, G. K., Joseph, G Karim, M., Tahani, E.,,Bernard, O., Samson, A. (2023) Sustainable access of quality seeds of genetically engineered crops in Eastern Africa - Case study of Bt Cotton Biotechnology in Agriculture and the Food Chain Volume 14,(1)

Kartal S, Efe L. (2021) Comparison of the fiber characteristics of the some cotton varieties ginned by using sawgin and rollergin. Turkish Journal of Agriculture-Food Science and Technology.:29;9(6): 946-95

Lukonge, E.P. (2005). Characterisation and diallel analysis of commercially planted cotton (*Gossypiumhirsutum* L.). PhD Thesis, University of Free Bloemfontein , South Africa.

Luo, Q., Bange, M., Devoil, P. (2016) Effect of a wheat rotation on cotton production in a changing climate: a simulation study.Climate research vol.70:29-38.

Odedokun, V.O., Ahmed, B., Omolehin,R.A.,& Atala,T.K. (2015). Economic Analysis of Cotton Production among Cotton Farmers in Northern Nigeria: A Case Study of Zamfara State, Nigeria. *Journal of Agriculture & Veterinary Science* 8, 5, 63-70

Okubazghi, K.W.,Li, X.N.,Cai, X.Y. (2017). Genome wide assessment of genetic diversity and fibre quality traits characterisation in gossypium hirsutum races. *Journal of integr. Agric* 16, 2402-2412

Sawar, M. I.,Hussain, A., Iqba, D., Abro, Z. A.,Simair, A. A.,Ansari, K. A.(2016) Impact of climate behavior on cotton fibre traits *International journal Research*. 3, 13, 2348- 6848.

Sun, W., Gao, Z., Wang, J., Huang, Y., Chen, Y., Li, J., (2019). Cotton fibre elongation requires the transcription factor GhMYB212 to regulate sucrose transportation into expanding fibres. New Phytol. 222, 864–881.

Turley,R.B Salliana R. Stetina, N. B, & Molin W.(2019)Comparison of Growth, Yield, and Fibre Quality of the Obsolete SA30 Yellow Leaf with Four Sets of Modern Yellow and Green Leaf Near Isogenic Cotton (Gossypium hirsutum L.) Lines *Journal of Cotton Science 23:253–261*

United States Department of Agriculture. (2019). Cotton sector at a glance. https://www.ers.usda.gov/topics/crops/ cotton-wool/cotton-sector-at-a-glance/

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